Ministry of Environment and Urbanization

National Implementation Plan of Persistent Organic Pollutants (POPs) Management in Turkey

Annexes

August 2014

Table of Contents

Table of Contents 1

Annex I: Persistent Organic Pollutants........ 2

Annex II: Country Profile........ 10

General Information 10

Annex III: Legal Legal Framework on POPs........ 12

International Agreements and Legislation........ 12

National Legislation 13

Annex IV: Actual results of Turkish national POPs inventory 26

Annex V: Stockpiling, Wastes and Contaminated Sites – results of inventory........ 31

Annex VI: Current Programs and Results on Monitoring of POPs Emissions and Effects on Human Health and Environment........ 37

Annex VII: Overview of technical infrastructure for POPs assessment, measurement, analysis, alternatives and prevention measures, management, research and development - linkage to international programs and projects 50

Annex VIII: Accredited Laboratories that can carry out POPs analysis 62

Annex IX: List of Stakeholders........ 66

Annex X: GAP analysis 67

Annex XI: SWOT Analysis of POPs management in Turkey........ 109

Annex XII: Preliminary inventory of banned flame retardants in Turkey…………………

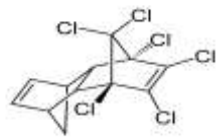
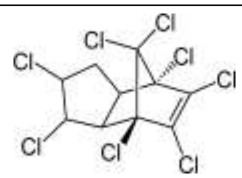
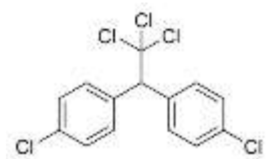
Annex XIII: Initial inventory of PFOS for the implementing of EU persistent organic pollutants regulation in Turkey…………………………………………

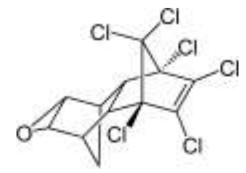
Annex XIV: Report on POPs contaminated site inventory in Turkey………

Annex I: Persistent Organic Pollutants

POPs areas of use, CAS numbers and chemical structures are shown below.

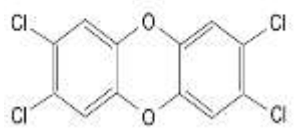
POPs Chemicals' CAS no, areas of use and chemical structures

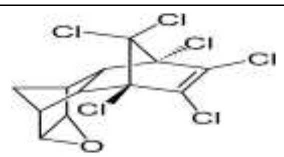
Aldrin		
A pesticide applied to soil for killing termites, crickets, worms, generally for insect control.	CAS No: 30-9-00-2	
It can easily be metabolized into dieldrin in plants and animals. As a result, it is very difficult to find aldrin residues in foods and animals, if so in very small quantities. It is bound to the soil particles firmly. Due to its high volatility, it disappears in soil. Because of its persistency and hydrophobic property, aldrin and especially its transformed products become bio-concentrated. Aldrin is toxic to humans. The lethal dose of aldrin for an adult is estimated as 5 g (83 mg/kg body weight). It was observed that liver and gallbladder cancer rate increased in the professionals who were exposed to aldrin. Only evidence for aldrin causing cancer is based on animal tests. Therefore, IARC (International Agency for Research on Cancer) does not classify aldrin as human carcinogen.		
Chlordane		
An insecticide is widely applied in controlling termites and protecting agricultural products from other insects	CAS No:57-74-9	
Chlordane is a wide spectrum contact insecticide. It is semivolatile, so it can be present in the atmosphere. It can be bound to sediments in the water easily and become bioconcentrated in the fat tissues of organisms. When the chlordane exposed persons were checked up, it has been detected that significant changes had been occurred in their immune system. IARC categorizes chlordane as a possible human carcinogen (2B group: Possible human carcinogen). Average half-life in soil is 1 year.		
DDT		
Most known POPs type, used during World War 2 to protect soldiers and civillians from malaria, typhoid like diseases spreaded from insects. They are still used in some places to avoid malaria from mosquitos	CAS No:50-29-3	
In the post war era DDT use on agricultural products and vector combat continued. Because of the belief of its harmful effects on nature, especially on wild birds, most of the developed countries banned DDT in the beginning of 1970‟s. Due to its semi-volatile characteristic, it can be present in atmosphere. It can easily accumulate in the fat tissue of all living organisms; it was even detected in mother‟s milk. DDT and its related products are very durable in nature, even after 10 - 15 years from its application more than 50 % of them remain in the soil. Although there is not enough evidence of DDT being carcinogenic, IARC classified it as a possible human carcinogen based on the results of the animal tests.		
Dieldrin		

<table>
<tr><td>Used for insects and termites damaging textile plants and also used to control insect related diseases and applied to pests in some farmlands</td><td>60-57-1</td><td></td></tr>
<tr><td colspan="3">Used principally to control insects and textile pests, dieldrin has also been used to control insect-borne diseases and insects living in agricultural soils. Due to its harmful effects on nature and human health, many countries banned dieldrin. It vanishes due to its high volatility in soil. It becomes bio-concentrated because of its persistency and hydrophobic properties

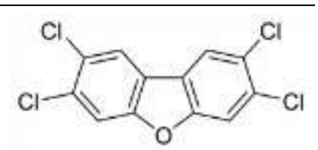
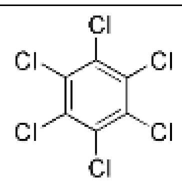
Relative increase of liver and gallbladder cancer were observed at workers contacting aldrin, endrin and dieldrin in factories. IARC did not classify dieldrin as a possible human carcinogen as there was no relevant evidence of both human and animal tests.

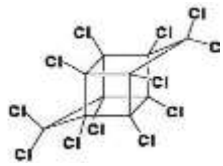
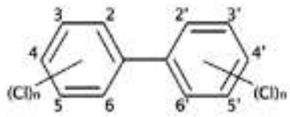
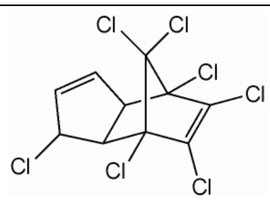
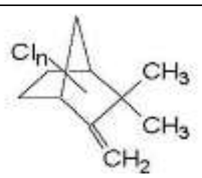
Dieldrin has a half-life of 5 years in warm soil. Dieldrin residues were found in air, soil, fish, bird, mammals, human, and mother’s milk</td></tr>
<tr><td colspan="3">Dioxins (polychlorinated dibenzo-p-dioxins)</td></tr>
<tr><td>These chemicals are produced unintentionally due to incomplete combustion, as well during the manufacture of pesticides and other chlorinated substances. They are emitted mostly from the burning of hospital waste, municipal waste, and hazardous waste, and also from automobile emissions, peat, coal, and wood. There are 75 different congeners, of which seven are considered to be of concern.

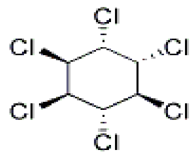
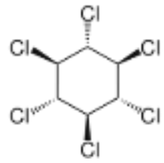
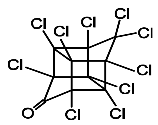
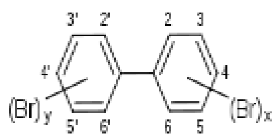
Dioxins have been associated with a number of adverse effects in humans, including immune and enzyme disorders and chloracne, and they are classified as possible human carcinogens.</td><td>various</td><td></td></tr>
<tr><td colspan="3">Among these, PCDDs and PCDFs (also collectively referred to as PCDDs/Fs) have never been used as commercial products, nor were intentionally manufactured for any reason other than laboratory purposes. PCBs, HCB and PeCBz are also unintentionally formed, usually from the same sources that produce PCDDs/Fs. However, unlike PCDDs/Fs, they have also been manufactured and used for specific purposes, their intentional production and use being by far higher than the unintentional formation and release.

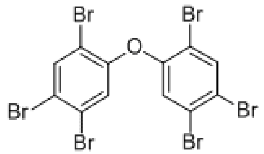
PCDDs/Fs releases are accompanied by releases of other unintentional POPs, which can be minimized or eliminated by the same measures that are used to address PCDDs/Fs releases. When a comprehensive inventory of PCDDs/Fs is elaborated, it allows to identify priority sources, set measures and develop action plans to minimize releases of all unintentional POPs.</td></tr>
<tr><td colspan="3">Endrin</td></tr>
<tr><td>It is an insecticide sprayed to the leaves of cotton and grain. Used to control rats, microtus and small rodents.</td><td>72-20-8</td><td></td></tr>
<tr><td colspan="3">Endrin is an organochlorine insecticide that used to control rodents such as mice and voles. Animals can metabolize endrin, so it does not accumulate in their fatty tissue to the extent that structurally similar chemicals do. It can reach up to atmosphere because of their volatile character and can be washed away from soil to the surface waters.

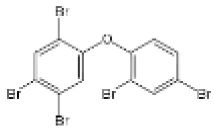
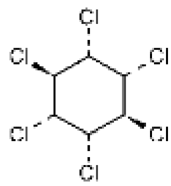
Statistically a significant raise is seen in liver and gall bladder cancer on the workers of factories producing aldrin, endrin and dieldrin. IARC didn’t classified dieldrin as carcinogen because lack of proof on human kind, and having limited data on experimental animals.

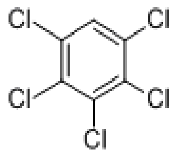
Endrin can persist in the soil for up to 12 years and highly toxic to fish.</td></tr>
<tr><td colspan="3">Furans (polychlorinated dibenzofurans)</td></tr>
<tr><td>These substances are produced mostly same as dioxins and produced unintentionally while producing PCB and similarly as dioxins are associated with a number of adverse effects.</td><td>Various</td><td></td></tr>
<tr><td colspan="3">The basic characteristics is presented under Dioxins</td></tr>
<tr><td colspan="3">Hexachlorobenzene (HCB)</td></tr>
<tr><td>First introduced in 1945 to treat seeds, HCB kills fungi that affect food crops. It was widely used to control wheat bunt. It was produced as industrial chemical and also was/is a byproduct of the manufacture of certain industrial chemicals, combustion processes and exists as an impurity in several pesticide formulations.</td><td>118-74-1</td><td></td></tr>
</table>

It is highly soluble in fat and can be transferred through breast milk. Low dose of HCB can cause reproductive system malfunction.		
Mirex		
This insecticide is used mainly to combat fire ants, and it has been used against other types of ants and termites. It has also been used as a fire retardant in plastics, rubber, and electrical goods.	2385-85-5	
Mirex is considered to be one of the most stable and persistent pesticides, which half-live in soils of up to 10 years. Mirex is relatively volatile with potential long-range transport. There is evidence of its potential for endocrine disruption and possibly carcinogenic risk to humans.		
Polychlorinated biphenyls (PCBs)		
These compounds are used in industry as heat exchange fluids, in electric transformers and capacitors, in hydralulic systems and as additives in paint, carbonless copy paper, and plastics. Of the 209 individual congeners of PCBs, 13 exhibit a dioxin-like toxicity.	Various	
PCBs are the general name given to a group of chlorinated aromatic compounds which are the polychlorinated biphenyls. As, there are 10 places that chlorine atom can occupy in a biphenyl structure, it has 209 different congeners depending on the chlorine atoms situated in PCB structure. As chemical stability and flame retardancy properties and high dielectric constant are high PCBs are mainly and widely used in electrical and electronic equipments, additives in lubricants used in hydraulic machines and other applications for operational safety and maintenance. PCBs are used as dielectric fluid in transformers and capacitors, heat transfer fluid in industries. Moreover, they are also used in carbonless copy paper, insulating materials and plastics. PCBs are highly dangerous in nature due to its stable structure and persistent properties and are subjected to long range transportation. Also, like other POPs compounds PCBs tend to accumulate in fatty tissues of organisms. Other than direct production, PCBs may also be produced as a by-product in PVC manufacturing, pesticide production or waste incineration process. Moreover, when the optimum conditions for incineration are not reached, i.e. retarded combustion PCDDs and PCDFs are released.		
Heptachlor		
Primarily used to kill soil insects and termites, heptachlor has also been used more widely to kill cotton insects, grasshoppers, other crop pests, and malaria-carrying mosquitoes.	CAS No. 72-20-8	
Heptachlor is a non-systemic, effecting through digestive system and by contact. It has a very high volatility, so it can be found in the atmosphere. It can be bound to sediments in the water easily and become bioconcentrated in the fat tissues of living organisms. Heptachlor is metabolized to heptachlor epoxide in animals and this substance can be stored in animal fat tissues. It was determined that gall bladder cancer cases increase significantly in workers of heptachlor producing factories. Although there were no fatal cases for liver and gallbladder cancer, fatal cerebrovascular diseases (brain vessel diseases) were frequently observed. IARC classified Heptachlor as a possible human carcinogen.		
Toxaphene		
This insecticide a non-systemic and contact effective insecticide, used on cotton, cereal grains, fruits, nuts, and vegetables. It has also been used to control ticks and mites in livestock.	8001-35-2	
It becomes bioconcentrated in aquatic organisms. It can be carried through the atmosphere. High frequency chromosome aberration was observed on eight female workers, who had been working on a Toxaphene applied field with		

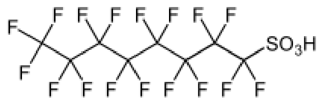
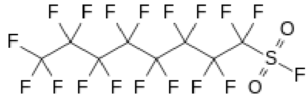
2 kg ha^{-1} dosage compared with control group. IARC classified Toxaphene as possible human carcinogen. Its half-life in soil can vary from 100 days to 12 years depending on the soil type and climate.		
Alfa-hexachlorocyclohexane		
Alpha-HCH was produced as ballast isomer during the producton of Lindane, many years was use together with other HCH isomers and technical mixture.	319-84-6	
Although the intentional use of alpha-HCH as an insecticide was phased out years ago, this chemical is still produced as unintentional by-product of lindane. For each ton of lindane produced, around 6-10 tons of the other isomers including alpha- and beta-HCH are created. α- HCH is classified as potentially carcinogenic to humans and adversely affects wildlife and human health in contaminated regions.		
Beta-hexachlorocyclohexane		
Although the intentional use of beta-HCH as an insecticide was phased out years ago, this chemical is still produced as unintentional by-product of lindane.	319-85-7	
For each ton of lindane produced, around 6-10 tons of the other isomers including alpha- and beta-HCH are created. Large stockpiles of alpha- and beta-HCH are therefore present in the environment. Beta-HCH is highly persistent in water in colder regions and may bioaccumulate and biomagnify in biota and arctic food webs. This chemical is subject to long-range transport, is classified as potentially carcinogenic to humans and adversely affects wildlife and human health in contaminated regions.		
Chlordecone		
Chlordecone is a synthetic chlorinated organic compound, which was mainly used as an agricultural pesticide. It is no longer produced.	36355-01-8	
Chlordecone is a synthetic chlorinated organic compound, which has mainly been used as an agricultural pesticide. It is closely related chemically to mirex. According to available data, chlordecone can be considered to be highly persistent in the environment. Chlordecone is not expected to hydrolyse or biodegrade in aquatic environments, nor in soil. Direct photodegradation is not significant. Chlordecone does not volatilise to any significant extent. With BCF-values in algae up to 6,000, in invertebrates up to 21,600 and in fish up to 60,200 and documented examples of biomagnification, chlordecone is considered to have a high potential for bioaccumulation and biomagnification. Concerning the potential for causing adverse effects, there is a convincing set of data. Chlordecone is readily absorbed into the body and accumulates following prolonged exposure. It is both acutely and chronically toxic, producing neurotoxicity, immunotoxicity, reproductive, musculoskeletal and liver toxicity. The International Agency for Research on Cancer has classified chlordecone as a possible human carcinogen (IARC group 2B). Moreover, chlordecone is very toxic to aquatic organisms, most sensitive group being the invertebrates.		
Hexabromobiphenyl (HBB)		
Hexabromobiphenyl is an industrial chemical that has been used as a flame retardantIt is no longer produced or used.	36355-01-8	
Hexabromobiphenyl (HBB) is a member of polybrominated biphenyls (PBBs) which are generally referred as Brominated Flame Retardants (BFRs) and generally used in 3 groups of products. These are ABS thermoplasticizers generally used in house appliances, sealants and Polyurethane (PUR) foams used in automobile dashboards. Like many countries in the world HBB is not used for a long while since it has been banned for a long time and has many alternatives.		
Commercial OctaBDE		

<table>
<tr><td>Commercial mixture of octaBDE is mainly used as a flame retardant in electrical and electronic equipment.</td><td>Various</td><td></td></tr>
<tr><td colspan="3">PBDEs represent one of the sub-groups of brominated flame retardants. PBDEs possess similar characteristics to PCBs[1]. When PBDEs are incinerated, they have a high risk in formation of polybrominated dibenzo-p-dioxins and dibenzofurans (PBDDs/Fs), having similar effects as PCDDs/Fs.

PBDEs have PBT (persistent, bioaccumulative, toxic) properties and they can be found everywhere in the surrounding environment – in soil, water, sewage, in tissues of fish, birds, seals, whales and polar bears, in human blood, as well as in mother's milk. PBDEs concentrations in the environment are steeply rising.</td></tr>
<tr><td colspan="3">Commercial PentaBDE</td></tr>
<tr><td>Mainly used as a flame retardant in Polyurethane foams which have many applications in such as automotive sector, furnitures, etc.</td><td>Various.</td><td></td></tr>
<tr><td colspan="3">The pentabromodiphenylether (PeBDE) commercial product is a mixture of primarily tetra- through hexaBDE congeners (plus trace amounts of triBDE and 0-1% heptaBDE). The ratio of the PBDE-congeners in commercial PeBDE mixtures is different in different regions of the world.
PeBDE is released into the environment during the manufacture of the commercial PeBDE mixture, the manufacture of products, during their use and after they have been discarded as waste. The releases are to air, water and soil. The major part of the releases ends up in soil. The distribution between the environmental compartments is: soil>>>water>air. The main part of PeBDE in the environment is bound to particles; only a small amount is transported in its gaseous phase or diluted in water.
Due to PeBDEs high persistency in air, the main route for long-range transport is through the atmosphere. PeBDE is widespread in the global environment and in humans. Vulnerable ecosystems and species are affected, among them several endangered species. The potential for the toxic effects in wild life and mammals is evident. The exposure to humans is through food, use of products and indoor air and dust. PeBDE transfers from mothers to embryos and lactating infants. Vulnerable groups can be pregnant women, embryos and infants.</td></tr>
<tr><td colspan="3">Lindane</td></tr>
<tr><td>Lindane has been used as a broad-spectrum insecticide for seed and soil treatment, foliar applications, tree and wood treatment and against ectoparasites in both veterinary and human applications. The production of lindane has decreased rapidly in the last few years and only few countries are still known to produce lindane.</td><td>58-89-9</td><td></td></tr>
<tr><td colspan="3">Lindane is effecting through digestive system, respiratory system and by contact. It is in a colourless and crystalline structure. It is mostly used for soil and seed dressing. It is a wide spectrum insecticide used in animal ecoparacites, soil endemic insects, public health diseases, and predators. It is used in various crops (controlled pests: aphids, coleopterous larvas, millepedes, dipteras, lepidopteras, arthropodas and thrips), warehouses, public health applications (roaches, common flies, mosquitos, flies and flea control) and seed applications (it can also be used with fungicides in seed applications).

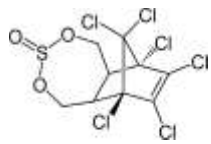
Lindane has a persistent, with high potential to bioconcentration. Their toxic effects are proven on developmental and immune system by the experiments on animals and aquatic organisms.</td></tr>
<tr><td colspan="3">Pentachlorobenzene</td></tr>
<tr><td>PeCB was used in PCB products, in dyestuff carriers, as a fungicide, a flame retardant and as a chemical intermediate e.g. previously for the production of quintozene. PeCB might still be used as an intermediate. PeCB is also produced unintentionally during combustion, thermal and industrial processes. It also present as impurities in products such as solvents or pesticides.</td><td>608-93-5</td><td></td></tr>
<tr><td colspan="3">The substance is persistent in the environment and is bioaccumulative. The small spatial variability across the Northern Hemisphere indicates that pentachlorobenzene has a very long atmospheric residence time, which allows it to become widely distributed in the global hemisphere. There are monitoring data from remote areas, backed up by modelling results that suggest that pentachlorobenzene can be transported over great distances. Pentachlorobenzene is moderately toxic to humans, but is very toxic to aquatic organisms. Present concentrations in remote areas are well below estimated critical body burdens.</td></tr>
</table>

[1] PCB has also been used as flame retardant but to a minor extent

PFOS and its salts and PFOSF		
PFOS is both intentionally produced and an unintended degradation product of related anthropogenic chemicals. The current intentional use of PFOS is widespread and includes: electric and electronic parts, firefighting foam, photo imaging, hydraulic fluids and textiles. PFOS is still produced in several countries.	Various	 

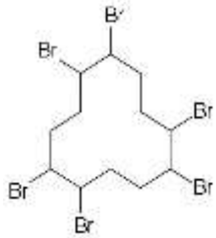
PFOS is produced synthetically from PFOSF, and PFOS can be derived from its salts when dissolved. The term "PFOS-related substances" is used for all substances that contain one or more PFOS groups (defined as C8F17SO2) and that can, or are assumed to, be degraded to PFOS in the environment. These PFOS-related substances are restricted through the listing of PFOSF, the basic material for their manufacture, and the listing of PFOS in Stockholm Convention (SCS, 2012a).

PFOS and PFOS-related substances are known with their high surface activeness and they have been added to Stockholm Convention Annex B because they meet the POP criteria of the Convention. PFOS and PFOS-related substances have an extensive usage area which is limited by the Convention, permits to intended purposes and special exemptions (SCS, 2012a).

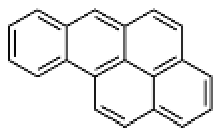
Technical endosulfan and its related isomers		
Widely used to control insects as an insecticide. It was being used since 2009 on grains, fruits, vegetables, forest products and in greenhouses until it is banned.	959-98-8 33213-65-9	

According to the risk profile on endosulfan is persistent in the atmosphere, sediments and water. Endosulfan bioaccumulates and has the potential for long-range transport. It has been detected in air, sediments, water and in living organisms in remote areas, such as the Arctic, that are areas where endosulfan never been used.

Endosulfan is toxic to humans and has been shown to have adverse effects on a wide range of aquatic and terrestrial organisms. Exposure to endosulfan has been linked to congenital physical disorders, mental retardations and deaths in farm workers and villagers in developing countries in Africa, Asia and Latin America. Endosulfan sulfate shows toxicity similar to that of endosulfan.

Hexabromocyclododecane (HBCD, HBCDD)		
Frequently used as brominated flame retardants in materials for insulation (expandable and extruded polystyrene), in polymers of electric and electronic parts, a texitile coating agent		

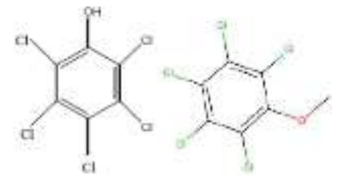
HBCD appear as white, non-volatile and odourless solids, insoluble in water but soluble in organic solvents, is very persistent in the environment. Degradation in the environment seems to be insignificant, and levels are mostly increasing. HBCD is for instance still present in sediment after 15-40 years. HBCD is lipophilic and bioaccumulative, the log K_{OW} of 5.6 for HBCD is in the upper range for bioaccumulation, and it is comparable with that of DDT. Biomagnifies and concentrates in natural food chains.

Polycyclic aromatic hydrocarbons (PAHs)		
PAHs are a group of compounds consisting of two or more fused aromatic rings. Most of these are formed during incomplete combustion of organic material and the composition of PAHs mixture varies with the source(s) and also due to selective weathering effects in the environment. Some of them are produced.	Various	

Persistence of the PAHs varies with their molecular weight. The low molecular weight PAHs are most easily degraded. The reported half-lives of naphthalene, anthracene and benzo(e)pyrene in sediment are 9.43 and 83 hours, respectively, whereas for higher molecular weight PAHs, their half-lives are up to several years in soils/sediments. The BCFs in aquatic organisms frequently range between 100 – 2 000 and it increases with increasing molecular size. Due to their wide distribution, the environmental pollution by PAHs has aroused global concern.

The acute toxicity of low PAHs is moderate, whereas the higher PAHs exhibit higher toxicity. The critical effect of many PAHs in mammals is their carcinogenic potential. The metabolic action of these substances produces intermediates that bind covalently with cellular DNA. IARC has classified benz[*a*]anthracene, benzo[*a*]pyrene, and dibenzo[*ah*]anthracene as probable carcinogenic to humans. Benzo[*b*]fluoranthene and indeno-[123-*cd*]pyrene were classified as possible carcinogens to humans.

Pentachlorophenol and pentachloroanisol

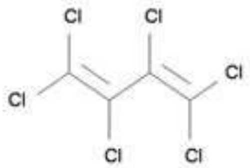
It is used as insecticide (termiticide), fungicide, non-selective contact herbicide (defoliant) and, particularly as wood preservative. It is also used in anti-fouling paints and other materials (e.g. textiles, inks, paints, disinfectants and cleaners) as inhibitor of fermentation. Technical PCP contains trace amounts of PCDDs and PCDFs.	87-86-5	

The rate of photodecomposition increases with pH ($t_{1/2}$ 100 hr at pH 3.3 and 3.5 hr at pH 7.3). Complete decomposition in soil suspensions takes >72 days. Although enriched through the food chain, it is rapidly eliminated after discontinuing the exposure ($t_{1/2}$ = 10-24 h for fish).

It has been proved to be acutely toxic to aquatic organisms and have certain effects on human health, at the time that exhibits off-flavour effects at very low concentrations. PCP is an aromatic hydrocarbon of the chlorophenol family and was first introduced for use as wood preservative in the 1930's. Since its introduction, PCP has had a variety of other applications (biocide, pesticide, disinfectant, defoliant, anti-sapstain agent, anti-microbial agent and used in the production of pentachlorophenyl laurate). The salt sodium pentachlorophenate (Na-PCP) was used for similar purposes as PCP and readily dissociates to PCP. The ester pentachlorophenyl laurate (PCPL) was used in textiles. PCP is produced by reacting chlorine with phenol at high temperatures in the presence of a catalyst. Contaminants including hexachlorobenzene, dioxins and furans are produced in the manufacturing process. Pentachlorobenzene is also suspected to be present. These compounds are inherently toxic, as well as environmentally persistent and their presence may increase the ecological risk associated with the use ofPCP.

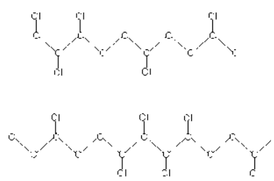
PCA is not used as a commercial chemical or pesticide and is not released directly into the environment. It can be produced through the transformation of PCP. PCA may result from the degradation of structurally related chlorinated hydrocarbons, such as PCP, hexachlorobenzene (HCB), lindane (HCH), and pentachlorobenzene (PCNB).

Hexachlorobutadiene

Hexachlorobutadiene (HCBD) is a halogenated aliphatic hydrocarbon mainly generated as a by-product in the manufacturing of chlorinated hydrocarbons. HCBD has experienced a variety of uses, spanning from an intermediate in chemical production to transformer, hydraulic or heat transfer liquid to a viticulture pesticide. Its use and production have ceased in the UN-ECE countries but information about ongoing application outside the UN-ECE is not currently available. The substance is still unintentionally released by industry, including during waste management.	87-68-3	

Based on the available evidence, HCBD is persistent, bioaccumulative and very toxic to aquatic organisms and toxic to birds. The comparison of effect data with monitoring data of marine sea water, freshwater as well as marine or freshwater sediments, indicates that the risk of significant adverse effects of HCBD to aquatic and sediment dwelling organisms is low but it cannot be excluded. Indeed, the level of uncertainty in identifying long-term risk according to the traditional risk assessment approach cannot be estimated with sufficient accuracy. In addition it should also to be taken into consideration that Arctic animals and top predators are exposed to a mixture of heavy metals and persistent organic substances.

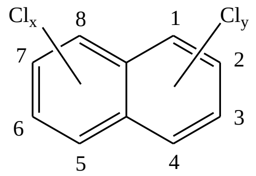
Short chain chlorinated paraffins

Polychlorinated alkanes ($C_xH_{(2x-y+2)}Cl_y$), in the case of SCCPs alkanes with C_{10-13}. They are manufactured by chlorination of liquid n-alkanes or paraffin wax and contain from 30 to 70% chlorine. The products are often divided in three groups depending on chain length: short chain (C_{10} – C_{13}), medium (C_{14} – C_{17}) and long (C_{18} – C_{30}) chain lengths**.**	85535-84-8	

The largest application of CPs is as a plasticizer, where only MCCPs are used generally in conjunction with primary plasticizers such as certain phthalates in flexible PVC. The chlorinated paraffins also impart a number of technical benefits, of which the most significant is the enhancement of flame retardant properties and extreme pressure lubrication.

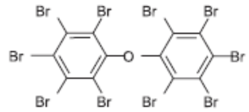
CPs may be released into the environment from improperly disposed metal-working fluids or polymers containing chlorinated paraffins. Loss of chlorinated paraffins by leaching from paints and coatings may also contribute to environmental contamination. Short chain CPs with less than 50 % chlorine content seem to be degraded under aerobic conditions. CPs are bioaccumulated and both uptake and elimination are faster for the substances with low chlorine content.

The acute toxicity of CPs in mammals is low with reported oral LD_{50} values ranging from 4 - 50 g kg^{-1} bw, although in repeated dose experiments, effects on the liver have been seen at doses of 10 – 100 mg kg^{-1} $bw.day^{-1}$. Short-chain and mid-chain grades have been shown, in laboratory tests, to show toxic effects on fish and other forms of aquatic life after long-term exposure. The NOEC identified in the EU risk assessment for the most sensitive aquatic species tested was 5 µg l^{-1}.

Polychlorinated naphthalenes		
Chlorinated naphthalenes (CNs) are halogenated organic compounds. CNs are divided into eight homologue groups, based on the number of chlorine atoms in the molecule. These homologue groups are referred to using the prefixes mono- to octa- (e.g. mono-CNs, di-CNs, etc). Physical-chemical properties vary considerably due to the degree of chlorine substitution. Tri- to octa-CNs are very lipophilic and their water solubility and vapour pressure decrease with the degree of chlorination.		 x + y = 1~8

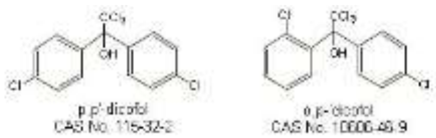
CNs had various uses similar to PCBs, which gradually replaced CNs in many applications. Characteristic functions of CN formulations were electric insulation, flame retardation and biocidal protection of goods. Until known global production virtually stopped in many countries, having drastically decreased already by the late 1970s, some 150–400 kilotons had been produced worldwide.

While the commercial CN manufacture in the UNECE region has drastically declined since their large-volume production in the first half of the 20th century, the major current source of CNs is probably waste incineration. Releases from former uses of CNs or as impurities of technical PCB contained in landfills or old appliances are plausible but difficult to assess.

Decabromodiphenyl ether		
Commercially available decabromodiphenyl ether (c-decaBDE) is a synthetic chemical product consisting of decabromodiphenyl ether (BDE-209, ≥90%), with small amounts of nonabromodiphenyl ether and octabromodiphenyl ether. C-decaBDE has been under investigation for its potential health and environmental impacts for more than a decade but is still extensively used in many global regions. C-decaBDE is used as an additive flame retardant. It has a variety of applications including in plastics/ polymers/composites, textiles, adhesives, sealants, coating and inks. C-decaBDE containing plastics are used in housings of computers and TVs, wires and cables, pipes and carpets. It is used in commercial textiles, mainly for public buildings and transport, and in textiles for domestic furniture in countries with stringent fire safety regulations.		

BDE-209 is widespread and is one of the most dominant PBDEs in the global environment. When detected it is typically found along with other PBDEs originating from other commercial PBDE formulations or from debromination of c-decaBDE. Monitoring data show high concentrations of BDE-209 in sediments and soil as well as in biota worldwide. Levels are generally highest in the urban regions, near waste water discharges and in areas around electronic waste and recycling plants. In air, BDE-209 binds to particles that protect the chemical from photolytic degradation and it can be transported over long distances. The estimated atmospheric half-life is 94 days, but can exceed 200 days. Hence BDE-209 is also detected in environmental and biological samples from remote regions. BDE-209 has long been thought to have limited bioavailability because of its large size that constrains its ability to pass cell membranes via passive diffusion. However, biomonitoring data shows that BDE-209 is bioavailable and is taken up by humans and other organisms. BDE-209 has been found in a variety of different organisms and biological matrices including human blood serum, cord blood, placenta, fetus, breast milk and in milk of lactating cows.

Debromination of BDE-209 in environmental matrices and biota to more persistent, toxic and bioaccumulative PBDEs such as already listed POP-BDEs is considered to be of high concern in a number of assessments of BDE-209. Several PBDE congeners that are not part of any commercial mixture have been identified and are considered to provide evidence for debromination of BDE-209. In addition c-decaBDE can be a source for environmental releases of toxic dioxins and furans and possibly also hexabromobenzene. Due to debromination of c-decaBDE and past releases of commercial penta- and octabromodiphenyl ether organisms are typically co-exposed to a multitude of PBDEs.

Dicofol		
Dicofol is an organochlorine pesticide that is chemically related to DDT. The substance is a miticidal pesticide and acaricide used in many countries around the world on a wide variety of fruit, vegetables, ornamental and field crops.	115-32-2	

The evaluation of existing information indicated that there is reason of concern, due to clear evidence that dicofol does meet the criterion for bioaccumulation due to its BCF > 5 000, its potential for long-range environmental transport, and its very high toxicity to aquatic organism in addition to other health hazards including a potential endocrine disrupting property with reprotoxic effects have been identified. Furthermore concerns are caused by some evidence for dicofol contamination in remote sites, persistency of dicofol in acidic waters and suggested persistence of the major metabolites in water, soil and sediment.

In addition, dicofol can contain DDT depending on the manufacturing method.

References

Documents of the Stockholm Convention and CRLTAP

Annex II: Country Profile

General Information

Turkey or Republic of Turkey in official name is a country, located in both in Europe and Asia and its capital is Ankara. Country's land is located in Anatolia peninsula and Thrace which is an extension of Balkan Peninsula. Country is surrounded from 3 sides by Mediterranean, Black Sea, Aegean Sea and Sea of Marmara which is between Black Sea and Aegean Sea. Neighboring countries are; Greece, Bulgaria, Georgia, Armenia, Azerbaijan (Republic of Nakhchivan autarchic), Iran, Iraq and Syria.

Governmental and Executive structure

Turkey is a democratic, secular, centralist and constitutional republic. Parliamentary representation democracy is implemented in Republic of Turkey. President of Republic is the president of the country and elected with the direct selections in seven year periods. Separation of powers principle is adopted. Turkey is governed by Prime Minister and Council of Ministers holding the executive power; Turkish Grand National Assembly holding the legislative prerogative and Courts holding the jurisdiction. Turkish Grand National Assembly consists of 550 parliamentarian and they are elected in 4 year-periods.

Demography

Population is 75 627 384 by year 2012. Latest census show that the 77.3% of the population lives in provinces and counties. 20 province has a population over 1 million and 20 province has a population between 500 000 and 1 million. Only 2 provinces' population is under 100 000. Most populated 5 provinces of Turkey are Istanbul (13 million), Ankara (5 million), Izmir (4 million), Bursa (3 million) and Adana (2 million).

There are significant differences between geological regions in population and population density. Physical factors (climate properties, geographical formations, soil characteristics) and human factors (industrialization, agriculture, underground resources, tourism, transportation) effects cause these differences. Maximum population rate is at Marmara Region and the minimum ratio is at East Anatolian Region. Approximate lifetime for men is 71 and 75 for women.

Economy

Turkey placed 16th in gross domestic product (purchasing power parity) and 17th in gross domestic product (nominal). Important sectors of Turkey are banking, construction, major appliances, electronics, textile, petroleum refining, petrochemical products, food, mining, iron-steel, machine industry, tourism and automotive.

Geography

Turkey is located in 36 and 42 degrees Northern Latitudes and 26-45 Eastern Longitudes and shaped like a rectangle. There is a 75 minutes of time difference between east and west sides and it is 1 600 km wide. It has a 783 562 km² projection area and it has the 37th biggest projection area in the world. It is surrounded by three seas; Aegean Sea on west, Black Sea in north and Mediterranean in south. It has Marmara Sea at northeast side.

Turkey is a Eurasian country which has lands on two continents. 97. 5% of its land located in Asia, named Anatolia. The remaining 3% is located in Europe and it is called as East Thrace or Rumelia side. Dardanelles and Bosphorus separate European and Asian lands and links Black Sea and Aegean with Marmara Sea. Bozcaada and Gokceada, are two islands of many that Turkey have in Aegean.

Turkey has its Bulgarian and Greek borders at East Thrace. Neighboring Georgia at northeast; Armenia, Azerbaijan and Iran at east, Iraq and Syria at southeast. Average elevation of the country is 1 132 meters. North Anatolian Mountains lined up in north and Taurus Mountains lined up at south, southeast and east sides of Turkey. The elevation level mostly increases from west to east therefore; the highest elevation level is at the east side of Turkey. The Mountain Ararat within the boundaries of Agri is the highest mountain of the country. The biggest natural lake is Lake Van. The rivers Fırat, Dicle, Aras and Kura rise from Turkey but flow through borders to other countries. Biggest river rising from Turkey and flows to our borders is Kızılırmak.

Turkey is separated to seven geographical regions. These regions are Mediterranean, East Anatolia, Aegean, Southeastern Anatolia, Central Anatolia, Black sea and Marmara regions. Black Sea region lies up through North Anatolia and one-sixth of the total surface area.

Turkey is placed on several fault lines and has several dormant volcanos. Many earthquakes occurred in history which are 1939 Erzincan Earthquake, 1943 Tosya-ladik Earthquake, 1999 Golcuk Earthquake causing loss of many lives.

Climate

Three climate types could be observed in Turkey. In Aegean and Mediterranean shores has the Mediterranean climate characterized by hot and dry in summer, warm and rainy in winter. In Black Sea shores, Black Sea climate, which has a temperate climate and is rainy in every season, are observed. Natural vegetation is forest. Black Sea shores are the only region which is rainy during all year in Turkey and receives 2 000 - 2 500 mm rain per year.

In Marmara shores located between Aegean and Black Sea, transition climate could be observed. Mediterranean climate is observed in South Shores, Black Sea climate in North Shores and Continental Climate is observed in northwest of Marmara Sea. Snowfall could only be seen a few days in Marmara and Black Sea regions and it only lasts for a few days. Mountains are parallel to the shores and prevent the temperate weather to reach to the middle.

Continental Climate is observed in Central Anatolia, Southeast Anatolia and East Anatolia. In the continental climate temperature differences during day and night is high; hot and dry in summer, cold and snowy during winter. Severe weather conditions could be observed in Eastern sides of Turkey. In East Anatolia temperatures can decrease down to -30°C and -40°C (−22 °F to −40 °F) and snow is present at least 120 days in a year. Average temperature in west is 1°C (34 °F). However, it is hot and dry in summer. All across the country usually the dryest months are July and August as the temperature can get over 30 °C (86 °F) during the day, and the rainiest month is May.

Annex III: Legal Framework on POPs

As a Party to the Stockholm Convention, there are a number regulations and legislations adopted and implemented on POPs in order to comply with the convention's liabilities. The list of the regulations and its related statements are demonstrated in **Tables AIII/1-4.**

Legal framework

There are several international agreements, EU regulations and national legislations providing the legal basis to the management of POPs. Some of them directly address the issues related to POPs management while others are related to the chemicals and waste management policy of Turkey. However, none of these legislations covers the management of POPs as a whole. The specifics of the legal framework are discussed under international and national categories in the following sections.

International Agreements and Legislation

Stockholm Convention is the international treaty governing the management of POPs. In addition to this, Basel Convention and Rotterdam Convention are multilateral environmental agreements related to the management of hazardous substances. Basel Convention was adopted in 1989 and governs the disposal and transboundary movement of hazardous wastes. Rotterdam Convention was adopted in 1998 and governs prior informed consent procedure for the international trade of certain hazardous chemicals and pesticides. Some provisions of the Stockholm Convention on management of POPs wastes are related to the provisions of Basel Convention. Turkey is a party to the Basel Convention since 1994. On the other hand, Turkey signed the Rotterdam Convention in 1998 but still not a party to the Convention.

Apart from these multilateral environmental agreements, there are a number of EU regulations on POPs. In the EU accession process, Turkey has to harmonize those regulations related to POPs that were not already adopted. All EU regulations relevant to POPs are listed in **Table AIII/1:**

Table AIII/1: EU regulations related with POPs

Regulation	Number & Date	Scope	Related Turkish Regulations
Industrial Emissions Directive	2010/75/EU 24.11.2010	Preventing, reducing and eliminating pollution with an integrated approach	-
Council Directive on the Disposal of Polychlorinated Biphenyls and Polychlorinated Terphenyls	96/59/EC 16.09.1996	Disposal of polychlorinated biphenyls and polychlorinated terphenyls	By-law on the Control of Polychlorinated Biphenyls and Polychlorinated Terphenyls
Regulation on Export and Import of Dangerous Chemicals	689/2008 17.06.2008	Control of export and import of certain dangerous chemicals	By-law on the Inventory and Control of Chemicals
Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)	1907/2006 18.12.2006	Regulating the registration, restriction and certification of the chemicals	By-law on Inventory and Control of Chemicals, By-law on Classification, Packaging and Labeling of Dangerous Substances and Preparations
Council Regulation on Persistent	850/2004/EC	Providing legal basis for the control	-

Regulation	Number & Date	Scope	Related Turkish Regulations
Organic Pollutants and Amending Directive 79/117/EEC	29.04.2004	of production, use and placing on the market of POPs listed in the Convention and Aarhus Protocol and minimization of the releases of these pollutants to the environment	

National Legislation

There are numerous national legislations regarding management of chemicals and wastes, production of pesticides, control of import of products. These legislative instruments were listed based on their relevance to management of POPs and provisions of the Stockholm Convention and grouped according to their aim and scope in the following tables **AIII/2-6**. For by-laws and notifications, date and number indicates the date and number of the Official Gazette in which the regulation was published.

Table AIII/2: National legislations on chemicals management

Environmental Law	
Date and Number	11.08.1983/2872
Implementing Institution	Council of Ministers (Ministry of Environment and Urbanization)
Relevance with the POPs management	Article 2 of the law provides the definition hazardous waste. Article 13 of the law sets principles for the manufacturing, use, storage, transportation, import and export of hazardous chemicals and management of hazardous wastes by referring to the related regulations. Moreover, it is stated that Ministry of Economy can prohibit or restrict the import of certain chemicals, products and wastes by consulting the Ministry of Environment and Urbanization. The law appoints administrative fines for the case of violation of the provisions.
Relevant EU Regulation or International Agreement	-
Law on the Approval of Ratification of the Stockholm Convention	
Date and Number	02.04.2009/5871
Implementing Institution	Council of Ministers (Ministry of Environment and Urbanization)
Relevance with the POPs management	The law states that the ratification of Stockholm Convention by Turkey was approved.
Relevant EU Regulation or International Agreement	Stockholm Convention
By-law on Control of PCB and PCTs	
Date and Number	27.12.2007 /26739
Implementing Institution	Ministry of Environment and Urbanization/ Directorate General of Environmental Management/Department of Waste Management
Relevance with the POPs management	Setting methods and principles of disposal of PCB containing equipments and prohibits the production and import of PCBs
Relevant EU Regulation or International Agreement	96/59/EC (Directive on Disposal of PCBs and PCTs)
By-law on Inventory and Control of Chemicals	
Date and Number	26.12.2008/27092

Implementing Institution	Ministry of Environment and Urbanization/ Directorate General of Environmental Management/Department of Chemicals Management
Relevance with the POPs management	Gathering and presentation of data on production and import of chemicals and control of the associated risk caused by chemicals
Relevant EU Regulation or International Agreement	1907/2006 (REACH)
By-law on Classification, Packaging and Labeling of Dangerous Substances and Preparations	
Date and Number	26.12.2008/27092
Implementing Institution	Ministry of Environment and Urbanization/ Directorate General of Environmental Management/Department of Chemicals Management
Relevance with the POPs management	Management and control of classification, packaging and labeling of hazardous substances on the market with the aim of ensuring the protection of environment and human health and establishment of "Chemicals Advisory Board" to follow up the implementation of the by-law
Relevant EU Regulation or International Agreement	67/548/EEC (CLP), 2006/121, 1907/2006 (REACH)
By-law on Compilation and Distribution of Safety Data Sheets for Hazardous Substances and Preparations	
Date and Number	26.12.2008/27092
Implementing Institution	Ministry of Environment and Urbanization/ Directorate General of Environmental Management/Department of Chemicals Management
Relevance with the POPs management	Principles of compilation and distribution of material safety data sheets to protect the environment and human health
Relevant EU Regulation or International Agreement	1907/2006 (REACH)
By-law on Restriction of Manufacturing, Placing on the Market and Use of Certain Hazardous Substances, Preparations and Articles	
Date and Number	26.12.2008/27092
Implementing Institution	Ministry of Environment and Urbanization/ Directorate General of Environmental Management/Department of Chemicals Management
Relevance with the POPs management	Restricts and prohibits the production, use and placing on the market of PCBs and PBBs
Relevant EU Regulation or International Agreement	1907/2006 (REACH)
By-law on Cosmetics	
Date and Number	23.05.2005/25823
Implementing Institution	Ministry of Health/ Medicine and Medical Devices Institution
Relevance with the POPs management	The article 7 of the regulation prohibits the use of α-HCH in cosmetic products.
Relevant EU Regulation or International Agreement	76/768/EEC (Directive on Cosmetic Products), 96/335/EC (Commission Decision of establishing an inventory and a common nomenclature of ingredients employed in cosmetic products)
Notification on Auditing of Import of Chemicals that are Controlled for Environmental Protection	
Date and Number	31.12.2013/28868

Implementing Institution	Ministry of Economy/ Directorate General of Product Safety and Inspection
Relevance with the POPs management	The import of chemicals listed in Annex II of the notification including PCBs and PBBs is banned.
Relevant EU Regulation or International Agreement	-
By-law on the Prevention and Reduction of the Effects of Major Industrial Accidents	
Date and Number	30.12.2013/28867
Implementing Institution	Ministry of Labor and Social Security/ Directorate General of Occupational Health and Safety Ministry of Environment and Urbanization/ Directorate General of Environmental Impact Assessment, License and Inspection
Relevance with the POPs management	Methods and principles concerning the necessary measures to ensure the efficient and continual prevention of the major industrial accidents in the facilities in which PCDD/Fs can be formed as by-products of processes
Relevant EU Regulation or International Agreement	96/82/EC (Seveso II Directive)

Table AIII/3: National legislations on management of pesticides

Law on Veterinary Services, Plant Health, Food and Feed	
Date and Number	11.06.2012/5996
Implementing Institution	Council of Ministers (Ministry of Food, Agriculture and Livestock)
Relevance with the POPs management	Sets forth the principles of production, import, use, packaging, labeling, transport, storage, certified or non-certified sale, certification, control and supply of pesticides and provides the legal basis for the relevant by-laws
Relevant EU Regulation or International Agreement	-
By-law on Control of Pesticides	
Date and Number	20.05.2011/27939
Implementing Institution	Ministry of Food, Agriculture and Livestock/ Directorate General of Food and Control/ Department of Pesticides
Relevance with the POPs management	Article 36 of the by-law states that the production, import and sale of the pesticides whose certificates are invalidated is ceased out. The prohibition and phasing out of the pesticides which have been listed or will be listed by the Stockholm Convention as POP is fulfilled in the scope of this by-law.
Relevant EU Regulation or International Agreement	-
By-law on the Certification of Pesticides	
Date and Number	25.03.2011/27885
Implementing Institution	Ministry of Food, Agriculture and Livestock/ Directorate General of Food and Control/ Department of Pesticides
Relevance with the POPs management	Article 22 of the regulation states that the certificates of the pesticides which have been prohibited by the international organizations/institutions are cancelled

	out by the Ministry of Food, Agriculture and Livestock and this is the first step in the prohibition process of the pesticides listed by the Convention as POP.
Relevant EU Regulation or International Agreement	-
By-law on Sale and Storage of Pesticides	
Date and Number	10.03.2011/27870
Implementing Institution	Ministry of Food, Agriculture and Livestock/ Directorate General of Food and Control/ Department of Pesticides
Relevance with the POPs management	Prohibiting the sale of POP pesticides due to the provisions of Article 15
Relevant EU Regulation or International Agreement	-

Table AIII/1: National legislation on management of POPs wastes

By-law on Control of Hazardous Wastes	
Date and Number	14.03.2005/25755
Implementing Institution	Ministry of Environment and Urbanization/ Directorate General of Environmental Management/Department of Waste Management
Relevance with the POPs management	Ensuring the environmentally soundly management of hazardous wastes (including wastes contaminated with PCB, PCDD/Fs) by minimizing at source and preventing the adverse effects on human health and environment of wastes
Relevant EU Regulation or International Agreement	Basel Convention 91/689/EEC (Council Directive on Hazardous Wastes)
By-law on Control of Waste Oils	
Date and Number	30.07.2008/26952
Implementing Institution	Ministry of Environment and Urbanization/ Directorate General of Environmental Management/Department of Waste Management
Relevance with the POPs management	Limiting the PCB content of the waste oils, prevention of the incineration of PCB containing oils and ensuring the environmentally soundly disposal of PCB containing waste oils
Relevant EU Regulation or International Agreement	2008/98/EC (Waste Framework Directive), 75/439/EC (Directive on Disposal of Waste Oils)
By-Law on Control of Waste Electrical and Electronic Equipments	
Date and Number	22.05.2012/28300
Implementing Institution	Ministry of Environment and Urbanization/ Directorate General of Environmental Management/Department of Waste Management
Relevance with the POPs management	Determines the principles of disposal of waste electrical and electronic equipments containing PCBs, PBBs and PBDEs and prohibits the production and import of electrical and electronic equipments containing PBBs and PBDEs
Relevant EU Regulation or International Agreement	2002/95/EC (Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipments), 2002/96/EC (Directive on Waste Electrical and Electronic Equipments)

By-law on the General Principles of Waste Management	
Date and Number	05.07.2008/26927
Implementing Institution	Ministry of Environment and Urbanization/ Directorate General of Environmental Management/Department of Waste Management
Relevance with the POPs management	Determines the general principles of management of wastes from cradle to grave
Relevant EU Regulation or International Agreement	2008/98/EC (Waste Framework Directive)
By-law on Landfill of Wastes	
Date and Number	26.03.2010/27533
Implementing Institution	Ministry of Environment and Urbanization/ Directorate General of Environmental Management/Department of Waste Management
Relevance with the POPs management	Sets down the rules for the storage of wastes contaminated with PCBs
Relevant EU Regulation or International Agreement	1999/31/EC (Landfill of Waste)
By-law on the Incineration of Wastes	
Date and Number	06.10.2010/27721
Implementing Institution	Ministry of Environment and Urbanization/ Directorate General of Environmental Management/Department of Waste Management
Relevance with the POPs management	Sets out the principles of incineration of some wastes like PCBs and hazardous wastes
Relevant EU Regulation or International Agreement	2000/76/EC (Incineration of Waste)

Table AIII/2: National legislations setting the discharge and ambient quality standards for POPs

Turkish Food Codex By-law on Contaminants	
Date and Number	29.12.2011/28157
Implementing Institution	Ministry of Food, Agriculture and Livestock/ Directorate General of Food and Control
Relevance with the POPs management	Determining the allowable limit values for PCDD/Fs and dioxin like PCBs in foodstuffs
Relevant EU Regulation or International Agreement	1881/2006/EC (Directive on Setting Maximum Levels for Certain Contaminants in Foodstuffs)
By-law on Control of Pollution Caused by Dangerous Substances in Aquatic Environment	
Date and Number	26.11.2005/26005
Implementing Institution	Ministry of Environment and Urbanization/ Directorate General of Environmental Management/Department of Water and Soil Management
Relevance with the POPs management	Determination of discharge and water quality standards for certain POPs (DDT, hexachlorocyclohexane, aldrin, dieldrin, endrin, hexachlorobenzene, endosulfan) and aiming the control the discharges of these pollutants
Relevant EU Regulation or International Agreement	76/464/EEC (Directive on Water Pollution by Discharges of Certain Dangerous Substances)

By-law on Control of Soil Pollution and Sites Contaminated by Point Sources	
Date and Number	08.06.2010/27605
Implementing Institution	Ministry of Environment and Urbanization/ Directorate General of Environmental Management/Department of Water and Soil Management
Relevance with the POPs management	Determines the methods and principles of detection of the sites contaminated or potentially contaminated by POPs and remediation and monitoring of these sites in line with the sustainable development goals, defines generic limit values for certain POPs in soil (aldrin, DDT, dieldrin, endosulfan, endrin, α-HCH, β-HCH, lindane, hexachlorobenzene, heptachlor, pentachlorobenzene, PCB, toxaphene, PCDD)
Relevant EU Regulation or International Agreement	-
By-Law on Surface Water Quality Management	
Date and Number	30.11.2012/28483
Implementing Institution	Ministry of Forestry and Water Affairs/ Directorate General of Water Management/ Department of Water Quality Management
Relevance with the POPs management	Determining the limit values in water (environmental quality standards) for POPs by 2015 and reveals the vitality of monitoring of POPs in water and sediment
Relevant EU Regulation or International Agreement	2000/60/EC (Water Framework Directive), 2008/105/EC (Environmental Quality Standards Directive)
By-law on Control of Air Pollution Arising from Industrial Facilities	
Date and Number	03.07.2009/27277
Implementing Institution	Ministry of Environment and Urbanization/ Directorate General of Environmental Management/Department of Air Management and Climate Change
Relevance with the POPs management	Control the emissions of POPs from industrial facilities, sets down restrictions and limit values for emissions of PCDD/Fs and PCBs
Relevant EU Regulation or International Agreement	2010/75/EU (Integrated Pollution Prevention and Control Directive)

Table AIII/7: Turkish Legislations in accordance with Stockholm Convention's Legal Liabilities

Evaluation of the current status of Turkey in terms of compliance with the requirements of the Convention

Requirements of the Stockholm Convention

Article	No	Requirement		Responsible Institution	Fulfillment	Related Legislation	Gaps
3	**1.a**	Prohibit and/or take the legal and administrative measures necessary to eliminate	**i.** production and use of the chemicals listed in Annex A	MEU (industrial chemicals) MH (industrial chemicals)	Prohibition of the manufacture and use of PCBs and hexabromobiphenyl Prohibition of the production of electrical and electronic equipments containing hexabromobiphenyl and PBDEs (with some exceptions) Prohibition of the production of PCBs Prohibition of the use of α-HCH in cosmetic products	By-law on Restriction of Manufacturing, Placing on the Market and Use of Certain Hazardous Substances, Preparations and Articles By-law on Control of Waste Electrical and Electronic Equipments By-law on Control of PCBs and PCTs By-law on Cosmetics	Production and industrial use of PBDEs, hexachlorobenzene and hexabromocyclododecane are not prohibited by legal instruments.
				MFAL (pesticides)	Elimination of use of pesticides in Annex A	By-law on the Certification of Pesticides By-law on Sale and Storage of Pesticides By-law on Control of Pesticides	Although the regulations state that the certificates of the pesticides which have been banned by the international agreements/organizations are invalidated, the mechanism of prohibition of the production is not specified. In what frequency the prohibited pesticides list is revised?

Article	No	Requirement		Responsible Institution	Fulfillment	Related Legislation	Gaps
			ii. import and export of the chemicals listed in Annex A	MEU (industrial chemicals) ME (industrial chemicals)	Prohibition of the import of PCBs Prohibition of the import and export of wastes containing POPs Prohibition of the import of electrical and electronic equipments containing hexabromobiphenyl and PBDEs in (with some exceptions) Prohibition of the import of PCBs and hexabromobiphenyl	By-law on Control of PCBs and PCTs By-law on Control of Hazardous Wastes By-law on Control of Waste Electrical and Electronic Equipments Notification on Auditing of Import of Chemicals that are Controlled for Environmental Protection	The import and export of PBDEs and hexabromocyclododecane as pure chemicals are not prohibited by the legislations. There is no regulation controlling the export of Annex A industrial chemicals. However, the export of wastes containing these chemicals is prohibited. The only legal instrument on the export of products is "Regulation on Export". The regulation states that the export of products whose export is subject to prior consent due to the international agreements is controlled.
				MFAL (pesticides)	Elimination of the import of pesticides in Annex A	By-law on Control of Pesticides	The export of POP pesticides is not regulated.
3	**1.b**	Restrict the production and use of the chemicals listed in Annex B		MEU	-	-	The production and use of PFOS are not regulated.
				MFAL	Elimination of the production and use of DDT	By-law on the Certification of Pesticides By-law on Control of Pesticides	-

Article	No	Requirement		Responsible Institution	Fulfillment	Related Legislation	Gaps
3	**2.a**	Take the necessary measures to ensure that a chemical listed in Annex A or Annex B is imported only	i. for the purpose of environmentally sound disposal ii. for a use or purpose which is permitted for that Party under Annex A or Annex B	MEU MFAL	Prohibition of the import of wastes containing POPs unless they can be used as raw materials in the production processes Prohibition of the import of PCBs Prohibition of the import of POP pesticides	By-law on Control of Hazardous Wastes By-law on Control of PCBs and PCTs By-law on Control of Pesticides	Although the import of POPs containing wastes is regulated, there is no regulatory instrument covering the import of POPs other than PCBs as pure chemicals or products.
3	**2.b**	Take measures to ensure that a chemical listed in Annex A or B for which production or use specific exemptions and/or acceptable purpose are in effect is exported only	i. for the purpose of environmentally sound disposal **ii.** to a party which is permitted to use that chemical **iii.** to a nonparty state by ensuring the environmental protection	MEU MFAL	Ensuring that the wastes containing POPs are export only for the purpose of environmentally soundly disposal	By-law on Control of Hazardous Wastes	The export of POPs as pure chemicals or products is not regulated.
3	**2.c**	Take measures to ensure that a chemical listed in Annex A for which production or use specific exemptions are no longer in effect for any party is not exported from it except for the purpose of environmentally soundly disposal		MEU MFAL	Ensuring that the wastes containing POPs are export only for the purpose of environmentally soundly disposal	By-law on Control of Hazardous Wastes	The export of POPs as pure chemicals or products is not regulated.
3	**3&4**	Take measures to regulate the production and use of new industrial chemicals/pesticides which exhibit the characteristics of persistent organic pollutants		MEU MFAL	The production of new pesticides is controlled.	By-law on Certification of Pesticides	The production of new industrial chemicals is not controlled by legal instruments.

Article	No	Requirement	Responsible Institution	Fulfillment	Related Legislation	Gaps
						The information required for the process of certification of pesticides does not cover the physicochemical properties, bioaccumulation potential and ecotoxicological data. The list must be revised.
5	**a**	Develop an action plan to identify, characterize and address the release of Annex C chemicals including; **i.** evaluation of the current and projected releases; source inventory and release estimates **ii.** evaluation of the effectiveness of the existing legislation **iii.** strategies to meet the obligations of the Convention **iv.** awareness raising activities **v.** periodic review of the activities **vi.** a schedule for the implementation of the action plan	MEU	-	-	There is no action plan in Turkey regarding the control of emissions of Annex C chemicals. On the other hand, the emissions of PCDD/F emissions from industrial facilities are restricted by By-law on Control of Air Pollution Arising from Industrial Facilities.
5	**b**	Promote the application of available, feasible and practical measures to reduce the releases	MEU	-	-	There is no action or plan to promote the application of measures.
5	**c**	Promote the development and use of substitute materials to prevent the formation of Annex C chemicals	MEU	-	-	There is no action or plan to promote the application of measures.
5	**d, e**	Promote the use of best available techniques and best environmental practices to control and eliminate the production and releases of Annex C chemicals	MEU	-	-	There is no action or plan to promote the application of measures.

Article	No	Requirement		Responsible Institution	Fulfillment	Related Legislation	Gaps
6	1.a	Develop appropriate strategies for identifying	**i.** stockpiles containing Annex A/B chemicals	MEU MFAL	-	By-law on General Principles of Waste Management By-law on Control of PCBs and PCTs	Although some of the stockpiles have been controlled and a project has been initiated on the control of POPs stockpiles and emissions, there isn't strategy or plan developed to identify the stockpiles.
			ii. products and articles in use and wastes containing Annex A/B/C chemicals	MEU MFAL	-	By-law on Control of PCBs and PCTs By-law on the General Principles of Waste Management	By-law on Control of PCBs and PCTs states provisions on the inventory of PCB containing equipments and wastes. The ministry developed an inventory system for PCBs. However, the system is not in use currently. On the other hand, By-law on the General Principles of Waste Management requires the identification of characteristics of the wastes which are given in the Annex III A of the by-law. But, these requirements are not adequate to determine whether a waste contains POPs or not. There is not a comprehensive strategy or plan or legislation allowing the identification of POPs containing products and wastes.
6	1.b	Identification of the stockpiles of Annex A/B chemicals		MEU MFAL	Some of the old stockpiles have been identified. There is an ongoing project on the identification and disposal of stockpiles.	-	The activities are not conducted according to a plan or strategy. Individual projects or studies are conducted.
6	1.c	Manage stockpiles in an environmentally soundly manner		MEU	The old stockpiles have been disposed in environmentally soundly manner.	-	There is no legislation covering the disposal of POPs stockpiles.
6	1.d	Take measures to ensure that POPs containing	**i.** handled, collected, transported and stored in	MEU	The principles are stated by the By-law on Control of Hazardous Wastes	By-law on General Principles of Waste	The hazardous waste categories given in the Annex III A of By-law on Control of Hazardous Wastes does not

Article	No	Requirement		Responsible Institution	Fulfillment	Related Legislation	Gaps
		wastes are	an environmentally soundly manner		for the control of hazardous wastes not specifically for all POPs, only PCBs, PCDD/Fs are included.	Management By-law on Control of Hazardous Wastes	include all the POPs. Therefore, the Annex III A of the by-law should be updated.
			ii. disposed appropriately or environmentally soundly considering the international regulations on hazardous waste management				
			iii. not permitted to be disposed of in such a way that can be resulted in the recovery, reuse, recycling and reclamation of the POPs				
			iv. not transported across international boundaries without considering the international rules and regulations				
6	**1.e**	Endeavour to develop appropriate strategies to identify the contaminated sites		MEU	By-law on Control of Soil Pollution and Sites Contaminated by Point Sources sets forth the principles of identification of the contaminated sites and "Contaminated Sites Information System" has been developed accordingly.	By-law on Control of Soil Pollution and Sites Contaminated by Point Sources	"Contaminated Sites Information System" is not in use and there is not a system to identify contaminated sites and no control mechanism has been developed.
7	**1**	Develop, update an review a national implementation plan in line with the provisions of the Convention		MEU	First national implementation plan has been submitted to the secretariat in 2011 and the second NIP will be submitted this year.	-	-
7	**3**	Integrate national implementation plans in sustainable development strategies of the company		MEU	-	-	Turkey does not have a chemicals management policy and the activities listed in the NIP have not been taken

Article	No	Requirement	Responsible Institution	Fulfillment	Related Legislation	Gaps
						into account when determining the development strategies.
9	**1**	Undertake information exchange on reduction/elimination of the production, use and release of POPs and alternatives of POPs	MEU	-	-	Turkey does not have specific information on the elimination/reduction of production, use and releases of POPs since the scientific studies and governmental efforts are limited.
10	**1**	Enhance the awareness of public and decision makers on POPs issue	MEU	-	-	There is no awareness enhancing activity.
10	**5**	Develop mechanisms to collect information on estimates of annual quantities of POPs like pollutant release and transfer registers	MEU MSIT	-	-	Turkey does not have a PRTR system.
11	**1**	Encourage research, development and monitoring activities on POPs	All related governmental institutions	Although they are not specific to POPs, Turkish Scientific and Technical Research Council provides support to research activities.		The actions required to implement the Convention are not included in the national programs.
15	**1**	Report to the Conference of Parties on the measures taken to implement the Convention and the effectiveness of these measures	MEU MH	-	-	There is no reporting mechanism regarding the implementation of the Convention.
15	**2**	Provide statistical data to the secretariat on the production, import, export of POPs	MEU	-	-	There is not a permanent inventory system to collect data on the production, use, import and export of POPs.
16	**2**	Conduct monitoring studies to obtain meaningful data for evaluating the effectiveness of the Convention	MEU MH MFWA	-	-	The monitoring studies conducted in Turkey are not representative and organized. Most of them are limited to specific places and the duration of monitoring is not sufficient. Turkey has to develop a comprehensive monitoring plan and be a part of global or regional monitoring activities conducted by international organizations.

Annex IV: Actual results of Turkish national POPs inventory

Table AIV/1: Current PCB Containing Equipment Number and Weight (UNIDO, 2014)

Category/Use	$N_{equipment}$	$Weight_{equipment}$ (tons)
Transformer	177	912
Capacitor	2 782	138
Contaminated equipment	31	30
Other uses*	-	Not known

* Hydraulic, lubricant, plastic, sealant, printing ink

Table AIV/2: Recalculation of c-PentaBDE present in the transport sector to the listed POP-PBDEs for the relevant life cycle stages (Corresponding to table 5- 1 in the PBDE inventory guidance (Stockholm Convention Secretariat, 2012, UNIDO, 2014**)**

(in kg)	Distribution homologues c-PentaBDE	POP-PBDEs in vehicles currently in use in inventory year (2012) (kg)	POP-PBDEs imported* in vehicles in the inventory year (2012) (kg)	POP-PBDEs in end-of-life vehicles in the inventory year (2012) (kg)	POP-PBDEs recycled from transport sector (2012) (kg)	POP-PBDEs disposed off in the past from the transport sector (1990-2012) (kg)
Inventoried c-PentaBDE		59 012	40 956	303 118	21 897	199 636
TetraBDE	32%	18 884	13 106	96 998	7 007	63 884
PentaBDE	56%	33 047	22 935	169 746	12 262	111 796
HexaBDE	9%	5 311	3 686	27 281	1 971	17 967
HeptaBDE	0.5%	295	205	1 516	110	998

* Note that the imported vehicles are also included in the inventory of “current transport” and that these two categories are not summed up

Table AIV/3: HexaBDE and heptaBDE present in EEE, WEEE and in polymers in recycling from CRT computer monitors (kg) (UNIDO, 2014)

Homologues	Distribution homologues c-OctaBDE	POP-PBDEs in imported CRT for inventory year 2013	POP-PBDEs in stocks for inventory year 2013	POP-PBDEs entering the waste stream 2013	POP-PBDEs in recycled polymers for inventory year 2013*
Inventoried c-OctaBDE		Σc-OctaBDE 390 733	Σc-OctaBDE 168 016	Σc-OctaBDE 42 981	80 378
HexaBDE	11%	42 981	18 482	4 728	8 842
HeptaBDE	43%	168 015	72 247	18 482	34 563
OctaBDE	35%	136 757	58 806	15 043	28 132

* based on End-of-Life model estimation value between 1970-2005

Table AIV/4: Imported ABS to Turkey (UNIDO, 2014)

Year	ABS Imported (tonnes)*	Year	ABS Imported (tonnes)*
1970	0	2002	31 826
1980	0	2003	38 319
1990	0	2004	50 688
1993	0	2005	53 900
1994	0	2006	58 996
1995	0	2007	66 279
1996	36 412	2008	63 800
1997	99 104	2009	64 119
1998	31 895	2010	84 433
1999	29 455	2011	87 319
2000	33 556	2012	86 951
2001	24 609	2013	56 023

*Ministry of Customs and Trade Database

Table AIV/5: The amount of PFOS used in the country by taking the difference between the import and export amounts for the 2923.90.00.90.19 HS Coded chemical (UNIDO, 2014)

Years	2008	2009	2010	2011	2012
Difference between the import and export amount (used in the country) (ton)	937	809	804	717	966

Table AIV/6: Import and export amounts of specific HS codes for 2011 (UNIDO, 2014)

HS CODES	ACTIVITY	AMOUNT (kg)	RESIDUAL (kg)
3402	Import	195 046 909	-32 592 769
	Export	227 639 678	
3703	Import	2 178 995	2 105 989
	Export	73 006	
2904 10	Import	2 613 438	2 534 245
	Export	79 193	
2904 90	Import	1 458 204	1 359 886
	Export	98 318	
3208 90	Import	33 253 559	2 416 092
	Export	30 837 467	
3707 90	Import	4 486 922	3 576 213
	Export	910 709	
3809 91	Import	17 314 587	3 879 088
	Export	13 435 499	

3810 10	Import	5 473 050	4 658 936
	Export	814 114	
3824 90	Import	217 665 476	137 583 190
	Export	80 082 286	
2710 19 83 0000	Import	3 628 318	-10 104 496
	Export	13 732 814	
3808 91 20 0019	Import	13 041	-92 367
	Export	105 408	
3808 91 90 0019	Import	5 460 167	414 988
	Export	5 045 179	
3813 00 00 0017	Import	4 003 285	3 707 777
	Export	295 508	
8424 10 00 0000	Import	1 485 120	788 793
	Export	696 327	

Table AIV/7: Values related priority sectors for 2011 (UNIDO, 2014)

SECTOR	Production Amount (kg)	Import Amount (kg)	Export Amount (kg)	Amount Remaining in Country (kg)
Metal Plating	*	*	*	*
Textile[1]	3 150 000 000	2 496 270 605	1 171 090 392	4 475 180 213
Apparel[1]	2 930 000 000	55 082 092	358 776 236	2 626 305 856
Synthetic Carpet[2]	748 800 000	20 000 000	504 127 000	264 673 000
Paper-Carton[3]	2 827 326 000	2 705 867 000	326 988 000	5 206 205 000
Aviation Hydraulic Fluids[4]	0	5 444 239	1 094 361	4 349 878

1: *http://www.immib.org.tr/tr/birliklerimiz-istanbul-demir-ve-demirdisi-metaller-ihr-birligi-istanbul-demir-ve-demirdisi-metaller-ihr-birligi.html;* ***2:*** *(MSITT, 2012), Mınistry of Economics Database;* ***3:*** *(MET, 2012) (MSITT, 2013);* ***4:*** *(PPIF, 2011) 5: The Data taken from Ministry of Customs and Trade does not directly indicate Aviation Hydraulics. Hydraulic breake fluids and petroleum-based oils or bitumen mineral datas are used in inventory. *: *:Data can not be collected.*

Table AIV/8: Approximate PFOS amount for prior sectors for 2011 (UNIDO, 2014)

SECTOR	Remaining Product amount in country (kg)	PFOS amount per product (low – high) (mg PFOS kg^{-1} product)[1]	Approximate PFOS amounts remaining in country (ton PFOS)		
			Scenario[2]	**Low Value**	**High Value**
Textile	4 475 180 213	500 – 5 000	**0.001%**	0.022	0.224
			0.01%	0.224	2.238
			0.1%	2.238	22.376
			1%	22.376	223.759
			10%	223.759	2 237.590
Apparel	2 626 305 856	500 – 5 000	**0.001%**	0.013	0.131
			0.01%	0.131	1.313
			0.1%	1.313	13.132
			1%	13.132	131.315
			10%	131.315	1 313.153

Synthetic Carpet	264 673 000	500 – 5 000	**0.001%**	0.001	0.013
			0.01%	0.013	0.132
			0.1%	0.132	1.323
			1%	1.323	13.234
			10%	13.234	132.337
Paper-Cardboard	5 206 205 000	500 – 5 000	**0.001%**	0.026	0.260
			0.01%	0.260	2.603
			0.1%	2.603	26.031
			1%	26.031	260.310
			10%	260.310	2 603.103
Aviation Hydraulic Fluids	4 349 878	500 – 1 000	**0.001%**	0.000	0.000
			0.01%	0.000	0.000
			0.1%	0.002	0.004
			1%	0.022	0.043
			10%	0.217	0.435
TOTAL			**0.001%**	***0.063***	***0.629***
			0.01%	***0.629***	***6.287***
			0.1%	***6.288***	***62.866***
			1%	***62.884***	***628.662***
			10%	***628.836***	***6 286.617***

1: *SCS (2012a).* ***2:*** *It does not seem possible to determine the amount of PFOS and derivatives in products. These Scenarios show the possible PFOS amount in percentage*

Table AIV/9: 2012 uPOPs inventory of Turkey (UNIDO, 2014)

Group	**Source Category**	**Annual Release (g TEQy^{-1})**				
		Air	**Water**	**Land**	**Product**	**Residue**
1	Waste Incineration	0.0	NA	NA	NA	2.8
2	Ferrous and Non-Ferrous Metal Production	156.2	0.1	NA	NA	567.4
3	Heat and Power Generation	60.5	ND	NA	NA	31.2
4	Production of Mineral Products	11.2	NA	NA	0.2	2.7
5	Transportation	2.6	NA	NA	NA	NA
6	Open Burning Processes	78.4	ND	76.8	NA	NA
7	Production of Chemicals and Consumer Goods	0.3	7.5	ND	87.4	15.3
8	Miscellaneous	NA	NA	NA	NA	0.1
9	Disposal	NA	6.1	NA	1.6	193.2
10	Identification of Potential Hot-Spots	NA	NA	NA	13.7	NA
1-10	**Total**	**309.1**	**13.7**	**76.8**	**102.9**	**812.7**
	Grand Total	**1 315**				

Table AIV/10: 2010 uPOPs inventory of Turkey (revised) (UNIDO, 2014)

Group	**Source Category**	**Annual Release (g TEQ y^{-1})**				
		Air	**Water**	**Land**	**Product**	**Residue**
1	Waste Incineration	62.8	0.0	0.0	0.0	1.3
2	Ferrous and Non-Ferrous Metal Production	624.7	0.0	0.0	0.0	675.4
3	Heat and Power Generation	59	0.0	0.0	0.0	13

4	Production of Mineral Products	10	0.0	0.0	0.3	0.1
5	Transportation	21.5	0.0	0.0	0.0	0.0
6	Open Burning Processes	151	0.0	96	0.0	0.0
7	Production of Chemicals and Consumer Goods	0.0	5.3	0.0	72.5	23.3
8	Miscellaneous	0.0	0.0	0.0	0.0	0.1
9	Disposal	0.0	6.5	0.0	2.2	180
10	Identification of Potential Hot-Spots	0.0	0.0	0.0	0.0	0.0
1-10	**Total**	**929**	**11.8**	**96**	**75**	**893.2**
	Grand Total	**2005**				

Table AIV/11: The magnitude of unintentional PCB emissions from various industries based on measurements or emission factors in Turkey (UNIDO, 2014)

Industry	**Release to air (kg yr^{-1})**	**Reference**
Iron and steel	89 - 2 800	Odabaşı et. al., 2009
Steel production	579.3	Kuzu et. al., 2009
Copper production	306.7	Kuzu et. al., 2009
Coal combustion	22.03	Kuzu et. al., 2009
Zinc production	9.00	Kuzu et. al., 2009
Pig iron production	3.00	Kuzu et. al., 2009
Medical waste incineration	0.18	Kuzu et. al., 2009
Cement production	0.06	Kuzu et. al., 2009

References:

Kuzu, S.L., et al., *Estimation of atmospheric PCB releases from industrial facilities in Turkey*. Atmos. Pollut. Res. 2013, **4**(4): 420-426.

Ministry of Customs and Trade Database

Odabasi, M., Bayram, A., Elbir, T., Seyfioglu, R., Dumanoglu, Y., Bozlaker, A., Demircioglu, H., Altıok, H., Yatkın, S., Cetin, B. *Electric Arc Furnaces for Steel-Making: Hot Spots for Persistent Organic Pollutants,* Environ. Sci. Technol., 2009, **43**: 5205-5211

Stockholm Convention Secretariat, 2012 Guidance for the inventory of polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention on Persistent Organic Pollutants. (Draft)

UNIDO, 2014. The draft of the National implementation plan of the Stockholm Convention on POPs.

Annex V: Stockpiling, Wastes and Contaminated Sites – results of inventory

Pesticides

There is no other known POPs stockpile other than one HCH stockpile located in Kocaeli. As long as pesticides were banned and restricted in Turkey, necessary measures were taken and use of pesticides like aldrin, dieldrin, heptachlor, DDT, chlordane, toxaphen have been restricted, since 1980s. Soil treatment by using aldrin and heptachlor was banned, but seed treatments were permitted. Use of DDT on vegetable and fruit trees was restricted, while use against olive moth, while the trees are in the flowering period and against prodenia in cotton were allowed. In those years, there was no decision against the use of HCH. However, as a result of using agricultural chemicals, HCH residues on plants and DDT on straws were found and so a warning has been issued to take necessary measures in 1985.

Approximately, 2 700 tons of HCHs (hexachlocyclohexane or γ-HCH) and DDT in barrels were stored in Derince, Kocaeli. These chemicals, which is in a white powder form was preserved in 50 kg nylon bags and barrels to be used for agricultural protection. In 1985, the General Directorate of Protection and Control of Ministry of Agriculture and Rural Affairs, according to the (Law for Agricultural Protection, Law no. 6968) forced this product to be stored in storage house. In 2006, Ministry of Environment and Urbanization has decided to dispose of 2 700 tons of HCH inside Merkim Industrial Products Inc.'s depots stored inside bags and barrels because of the risk that the stockpile posed both to human health and the environment. In order to dispose of the stockpile, Kocaeli Chamber of Industry has signed an agreement with Merkim Inc. as responsible parts in 24.11.2006 in coordination with MoEU.

As stated in the agreement, Kocaeli Chamber of Industry is both the director and coordinator of the funds and donations and Merkim Industrial Products Inc. would assist the process whereas the industrialists and İZAYDAŞ Inc. were responsible from the technical consultation. As a result of former studies, it is found to be appropriate to dispose HCH in Germany with an agreement signed between German AVG corporation and Kocaeli Chamber of Industry in 03.04.2007. However, because of the encountered problems only 500 tons of the stockpiles were been able to sent and disposed.

Hence, Turkey has submitted a project request to GEF on this issue to dispose these stockpiles. This project is aimed to start on 2014 would expected to be proceeded for 3 years.

PCBs

Apart from the updated stocks given in Section 2.3.1.3 and information on PCB contaminated sites in the first NIP of Turkey, fairly little data is present on the status of PCB pollution. According to the former inventory studies a fairly large portion of PCB containing equipments has been disposed off. As stated in the initial NIP 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 between the years 1997 and 2007. There has been no systematic monitoring of PCBs in waste products in Turkey. Recently, in a project on management of domestic/urban wastewater treatment sludges, levels of PCBs were measured in 28 different plant sludges. None of the treatment sludges exceeded the limit of 800 ng g^{-1} dry weight stated in the Turkish regulatotion for use of sludge in agriculture.

On the other hand, the amounts of waste containing PCBs are inventoried in the Environmental Information System (EIS). Stocks or wastes containing PCBs were recorded into the system under the group of "PCB inventory". In 2009, the amount of PCB-laden equipment or waste registered to system was approximately 129 tons. While waste oils including PCBs, constitutes 81% of this amount, 19% resulted from PCB-laden transformers or capacitors. There is a sharp increase in the amount of transformers or capacitors containing PCBs in 2010, namely, 89% of 555 tons (Özyürek et, al., 2012). In 2011, 450 tons of PCBs were registered and 52% of this amount was PCB containing waste oil and 48% was from PCB-laden transformers or capacitors. These data clearly indicate that there is still need for detailed information on the type and characteristic of wastes including PCBs. The efficacy of Environmental Information System (EIS) portal should be improved for more reliable data inventory and this is in progress for better management of PCBs. PCB Inventory Programme was prepared to be added to EIS portal.

PBDEs

Figure 4 shows waste management practices applied in Turkey between the years 1994-2004 (TURKSTAT). Based on these practices landfills and dumpsites that are scattered all over the country may be potentially contaminated with POP-PBDEs. Further research is required to identify all the sectors involved, manufacturing locations and locations of storage, wastes being disposed, biosolids application, methods of waste disposal or treatment, and waste disposal locations.

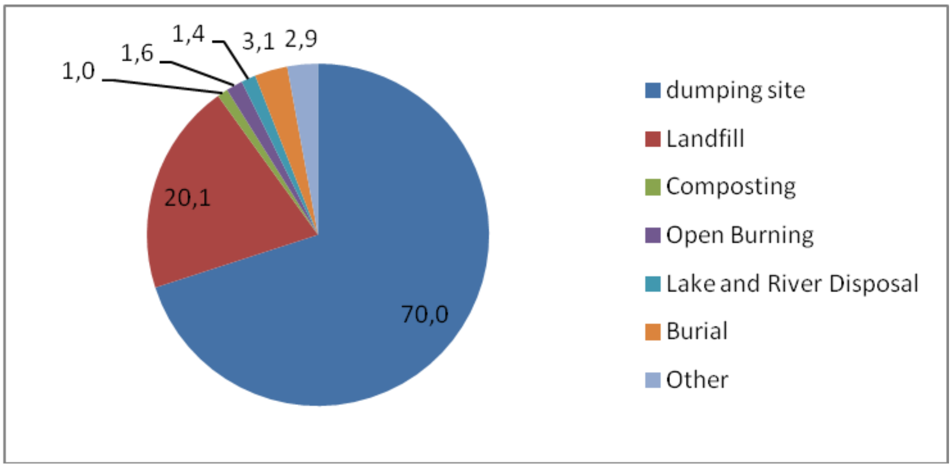


Figure 1: Average Waste Management Practices in Turkey between 1994 and 2004 (TURKSTAT)

POP-PBDEs are precursors of brominated dibenzofurans (PBDFs) and dibenzo-p-dioxins (PBDDs) (WHO 1998; UNEP 2010b, Shaw et al. 2010). They are largely formed during primitive recycling of e-waste and non-BAT incineration or other thermal treatment of POP-PBDEs-containing materials (UNEP, 2010b; Weber and Kuch 2003; Ebert and Bahadir 2003). Recently the WHO TEF expert panel concluded that PBDDs, PBDFs, and some dioxin-like biphenyls (dl-PBBs) may contribute significantly in daily human background exposure to the total dioxin toxic equivalencies (TEQs) (Van den Berg et al. 2013). Therefore the locations of these activities should also be identified and assessed.

PFOS

There are no data available on PFOS wastes, stockpiles and PFOS contaminated sites. However, further assessment on uncontrolled dump sites, sites that may be contaminated with PFOS containing products and petroleum refinery sites is required for future predictions.

uPOPs

The procedure for contaminated sites and hotspots includes three steps:

I. Identifying historical activities that could have caused contamination and identifying the potentially contaminated sites;
II. Assessing these sites for the likely magnitude of the contamination and ranking by their exposure risk;
III. Assessing the degree of contamination of the most significant sites by detailed analysis.

Since there is very limited or possibly no information both on the historical activities that could have caused PCDDs/Fs contamination and on the contamination levels in various environments (including air, soil, water or sediments) in Turkey, inventory of contaminated sites and hotspots include only the estimations and assessments based on these limited information. Since the identification and inventory of polluted sites is merely a first step to manage related risks and for final cleanup and rehabilitation, further studies are necessary to assess the pollution levels and related health risks in these “possibly polluted” sites, while the existence of some unknown sites and hotspots (due to some illegal dumps or unknown sources) should also be considered and addressed.

Chlor-alkali production in Turkey started firstly in Körfez District of Kocaeli in 1960s in two plants (one private and one public enterprise). Then, the second complex of public institution including chlor-alkali production started to operate in the end of 1970s in Aliağa, İzmir. After privatization process of the public enterprise, all the plants including ethylene, polyethylene, chlor-alkali, VCM and PVC production plants placed in Körfez complex were closed in the beginning of 1990s. At the present, chlor-alkali production is made primarily in Aliağa, Körfez, Yalova, Çerkezköy (Tekirdağ) and Kırıkhan (Hatay) by three companies. Although the production was based on mercury-cell technology until 1990s, this system was replaced by membrane-cell technology (with titanium electrode) after that in all the plants. Therefore, Körfez and Aliağa may be defined as “possibly contaminated sites” with respect to historical activities related o chlor-alkali production.

Production of forest products has a long history (more than 100 years) in Turkey. According to the statistics of 2011, there are about 10 000 facilities on timber production in Turkey, producing 6.2 million m^3 timber. Although the timber production is among the important sectors of Turkish economy, the use of modern technology is not common and production is made by old technology with low-capacity machineries generally. Timber production facilities are concentrated Kocaeli, Bursa, Mersin, Adana, Kütahya and Sakarya. However, there is no data on the use of PCP in timber industry in the past. The study of Karademir et al. (2013) on the PCDDs/Fs levels of the Izmit Bay sediments (in Kocaeli) suggests that the PCDDs/Fs pollution may be linked to the use of PCP and other wood preservatives in the past. Therefore, further studies are necessary to evaluate the PCDDs/Fs contamination related to timber manufacture and treatment facilities.

There is no data on the production of chloranil, PCP and certain dyes in Turkey. The historic import of these chemicals in not known but can be expected. Currently some pigments containing POPs are exported in different amounts. The sludges originated from production and wastewater treatment in these industries are disposed by incineration in recent years, but waste dump areas in the past for such sludges should be investigated as well as areas where such sludges have possibly been applied on agricultural soils.

Pulp and paper production started in 1936 in Turkey (SEKA, with a capacity of 10 000 tonnes), and it has been one of the important industrial sectors since that time, showing a continuous increase in its total production capacity. Pulp and paper plants were located different areas of Turkey, including Izmit, Afyon, Dalaman, Aksu, Çaycuma, Balıkesir and Kastamonu. Although elemental chlorine was replaced by ClO_2 in bleaching process in pulp and paper industry in recent years, a considerable amount of the pulp and paper sludge have been produced in the bleaching process using elemental chlorine in the past. However, there is no reliable information on the fate of these sludges with respect to amount and contents and to their management in the past, and therefore further studies are required for a concrete assessment.

There are three waste incinerators (two hazardous waste incinerators in Izmit, Kocaeli and Aliaga, İzmir, and one medical waste incinerator in Kemerburgaz, Istanbul) in Turkey. The oldest incinerator is IZAYDAS in Kocaeli, which started to operate in 1997. In general, the 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. On the other hand, the studies investigating the contamination status in the vicinity of these incinerators are limited and therefore, more studies on the uPOP levels in soils, sediments, and local animal products as the indicators of contamination status should be conducted in the incinerator areas for a concrete assessment. As an example, PCDDs/Fs levels measured in local animal products in Kocaeli showed some high results (Aslan et al., 2010), but their relationship with the incinerator emissions is not proven. There is no study for the contamination levels in the neighborhood of the incinerators in Aliağa and Kemerburgaz.

Since the metal industry is the primary sector for uPOP inventory in Turkey (responsible for about 60 % of total uPOP releases), contaminated sites related to primary and/or secondary metal production should be assessed in details. The results of the inventory shows that especially iron ore sintering and iron and steel production processes are important sources of PCDDs/Fs releases to air.

Since contaminated Dioxin and PCB contaminated sites around metal industries result often from historic releases also areas around secondary copper, aluminum and zinc facilities should be assessed.

The map of steel producers in Turkey is given in **Fig. 2.** As shown in the **Fig. 2**, steel plants are concentrated in four regions, i.e., west part of Black Sea region, Marmara Region, İzmir and İskenderun-Osmaniye Region. Although there is no study specially focused on the PCDDs/Fs levels in the vicinity of metal plants, but it is highly possible that the contaminated sites due to the PCDDs/Fs releases of these important PCDDs/Fs sources exist in Turkey. The study of Aslan et al. (2010) gives high PCDDs/Fs levels in the animal products collected from Dilovası, Kocaeli where two iron and steel plants are placed. Therefore, contamination status in the neighborhood of these plants, especially integrated plants with high capacities and iron ore sintering processes in Ereğli, Karabük and İskenderun should be investigated and defined in details.

Figure 2: Steel Map of Turkey

High levels of PCDDs/Fs contamination may result from the fires were chlorinated aromatic compounds such as PCB transformer fires or fires of pesticide stocks or other organochlorine stockpiles are burned. Since these materials are generally the products of chemistry sector, accidental fires especially in the chemical plants should be concerned. According to the Chemistry Sector Report of the Ministry of Science, Technology and Industry, chemistry plants producing petroleum products, chemicals of detergent and soap, pharmaceutics, and dye chemicals are generally located in the three large industrial cities of Marmara Region, i.e., İstanbul, Kocaeli and Sakarya. Therefore, fires in the chemistry plants in this region should be investigated with respect to uPOPs contamination. Although there are a number of factory fires which were observed in the chemistry plants in recent years, contamination from these fires have not been investigated in details.

A few studies were conducted to determine the PCDDs/Fs levels in the sediments in Turkey. The study of Okay et al. (2009) shows that PCDDs/Fs levels in İstanbul Strait are below the sediment quality guideline and safe values set by the European Community (20 ng TEQ per kg dry weight), while the study of Karademir et al. (2013) on the sediments of Izmit Bay indicates that PCDDs/Fs levels are higher (between 0.45 and 255 ng WHO2005-TEQ kg^{-1} dry weight). Pollution mapping shows that PCDDs/Fs levels in the central section of Izmit Bay are much higher than those in the eastern and the western sections. The study has shown that the sediments especially collected from the northern part of the central section showed very high PCDDs/Fs concentrations. A review of the congener profiles reveal three different congener profiles dominated by OCDF, 1,2,3,4,6,7,8-HpCDF, and OCDD, suggesting different sources. The dominance of OCDF in the sediment samples taken from the central section was attributed to the former production of vinyl chloride monomer (and relate EDC production) in the area, while that of 1,2,3,4,6,7,8-HpCDF was attributed to the (previously unknown) use of a chlorophenol-based fungicide in the region. The OCDD dominated group was explained by the use of pentachlorophenol. The results indicate that historic industrial discharges are the main contributor to the PCDDs/Fs pollution in the sediments. Since VCM/EDC production processes are defined as a PCDDs/Fs source for wastewaters, similar sediment studies should be conducted in Aliağa Bay also. On the other hand, there are no dredging activities of these contaminated sediments.

The production of kaolinic and ball clay is an important sector in Turkey. According to the MTA (Mineral Research & Exploration General Directorate), total reserves of ceramic (ball) and kaolinic clays in Turkey are about 75 million and 100 million tonnes. The mining facilities for these clays are concentrated in the areas of İstanbul (Şile, Kemerburgaz), Balıkesir (Düvertepe, Gönen), Bursa (Mustafakemalpaşa), Eskişehir (Mihalıççık), Çanakkale (Çan), Kütahya (Emet), Nevşehir (Avanos) and Bilecik (Söğüt). There is no information on the use of these clays for human consumption and/or as animal feed additive in Turkey. However, presence of some attempts to use these clays in some agricultural applications (e.g., the use of kaolin in olive trees against olive fruit fly (*Bactrocera oleae* Gmelin (Dip..Tephritidae)) shows the necessity for further studies related to the use of kaolin and ball clay and the contamination levels of these clays and related sites.

References:

Aslan, S. Korucu, M. K., Karademir, A., Durmusoglu, E. *Levels of PCDD/Fs in Local and Non-Local Food Samples Collected from a Highly Polluted Area in Turkey*. Chemosphere 2010. **80** (1): p. 1213-19.

Karademir, A., Ergül, H. A., Telli, B., Kılavuz, S. A., Terzi, M. *Evaluation of PCDD/F Pollution in Surface Sediments of Izmit Bay*. Environ. Sci. Pollut. Res. 2013: p. 1-9.

Okay, O. S, Karacık, B., Başak, S., Henkelmann, B., Bernhöft, S., Schramm, K.-W. *PCB and PCDD/F in Sediments and Mussels of the Istanbul Strait (Turkey).* Chemosphere 2009. **76** (2): p. 159-66.

Özyürek, N., N. Sevingel, and K. Kurusakız, *PCB yönetimi konusunda Türkiye'deki mevcut durum.* Katı Atık ve Çevre, 2012. **85**: p. 21-29.

Shaw, S. D., Blum, A., Weber, R., Kannan, K., Rich, D., Lucas, D., Koshland, C. P, Dobraca, D, Hanson, S, Birnbaum, L. S., 2010. Rev. Environ. Hlth. **25**(4): p. 261-305.

TURKSTAT (TÜİK), Türkiye İstatistik Kurumu, www.tuik.gov.tr

UNEP, 2010. Technical review of the implications of recycling commercial Penta and Octabromodiphenyl ethers. Annexes. Stockholm Convention document for 6th POP Reviewing Committee meeting (UNEP/POPS/POPRC.6/INF/6) Geneva 11-15. October 2010

Van den Berg, M, Denison, M. S., Birnbaum, L. S., DeVito, M. J., Fiedler, H., Falandysz, J., Rose, M., Schrenk, D., Safe, S., Tohyama, C., Tritscher, A., Tysklind, M., Peterson, R. E., 2013. *Review Polybrominated Dibenzo-p-Dioxins, Dibenzofurans, and Biphenyls: Inclusion in the Toxicity Equivalency Factor Concept for Dioxin-Like Compounds.* Toxicol. Sci. **133**: p. 197–208.

Weber, R., Kuch, B., 2003. *Relevance of BFRs and thermal conditions on the formation pathways of brominated and brominated-chlorinated dibenzodioxins and dibenzofurans.* Environ. Intern. **29**: p. 699-710.

World Health Organization (WHO), 1998. Polybrominated dibenzo-p-dioxins and dibenzofurans. *Environ Health Criteria* **205** [Geneva].

Annex VI: Current Programs and Results on Monitoring of POPs Emissions and Effects on Human Health and Environment

The First Long Term Monitoring Study in Turkey

There is no systematic monitoring program on the determination of releases, health risks and emission statements of POPs in Turkey. On the other hand, a study has been initiated under the global passive air monitoring network (MONET) project with the cooperation of Department of Environmental Engineering (Middle East Technical University) and Research Center for Toxic Compounds in the environment (RECETOX, Czech Republic) to identify atmospheric background levels of PCBs, PAHs (polyaromatic hydrocarbons) and OCPs (organochlorine pesticides) in December 2009. Passive air samplers consisting of polyurethane foam disks have been used for the collection of ambient air samples in a rural site named as Çamkoru having an altitude of 1 350 m, 110 km northwest of Ankara, the capital of Turkey. Unfortunately, no data is officially published on background levels of such pollutants, but will be very soon.

Contaminant levels showed up to be 3.10 - 13.5 ng/sample for total OCPs, BDL - 3.80 ng/sample for 7 indicator PCBs, and 177 – 1 747 ng/sample for 29 PAHs. Comparison with the other background stations from different parts of the world showed that background concentrations in Turkey were comparable or lower. Results of ongoing POPs monitoring studies in Camkoru, Turkey, as a part of MONET programme can be seen at http://www.recetox.muni.cz/index-en.php?pg=structure--genasis-information-system.

Monitoring of Pesticides

POPs residues have been found in the fat of fish and animals, as well as in human breast milk, on a global scale. Some of the highest levels have been recorded in the arctic areas of both hemispheres. Reproductive failures, deformities, malfunctions in fish and wildlife are linked by a growing body of evidence to these persistent pollutants. Often the true extent of the wildlife effects is subtle, and can be triggered at extraordinarily low concentrations.

Humans are generally exposed to POPs through their food supply. A growing body of scientific evidence associates human exposure to individual POPs with cancer, neurobehavioural impairment, immune system biochemical alterations and possibly disfunction, reproductive dysfunction, shortened period of lactation, and diabetes. The mechanism for many of these effects appears to be through disruption of the human endocrine system, often, during fetal development.

Pesticide usage in Turkey has started with the use of DDT basically against all kinds of pests in the 1950‟s. Turkey is a land of agriculture, therefore, agricultural pest control is compulsory and the most effective method for agricultural pest and malaria vector control is to use chemicals particularly DDT. A considerable number of synthetic organochlorine pesticides have been produced and offered for usage against pests since the 1940´s. Among these, aldrin, DDT and heptachlor have been used until the 1980‟s, when their usage was prohibited. In Turkey, especially after 1980, primarily the items consumed by humans including fish, mussels and milk have been analyzed for organochlorine insecticide residues and the results have either been published or reported.

The Black Sea Coast, which is located at the north of Turkey, has been highly contaminated due to sea transportation without any restrictions, mineral processing, dumping of toxic wastes, discharging domestic waste and toxic substances, carried by rivers. Pesticide residues were also found in the sea water. Samples, gathered from the coasts of Black Sea were analyzed and 11 types of pesticides such as lindane, heptachlor, heptachlor epoxide, aldrin, dieldrin, endrin, pp´-DDE, op´-DDE, op´-DDD, op´-DDT and pp´-DDT are found. Some of the chlorine compounds are found at concentrations lower than the limit of detection. High flowrate rivers are found out to contain heptachlor and aldrin lower than the limit of detection.

The concentrations of some pesticides measured in each stream and river are demonstrated in **Table AVI/1**. It is apparent that Sakarya River is the biggest source of pollution since the pollutant load is relatively high with respect to others, which is expected since its drainage basin is located in Northwest where fertile plains are mostly present. The other two rivers that are following the Sakarya River as a major source of pollution are Kızılırmak and Yeşilırmak. Even though these rivers have high flowrates, their drainage area is located in dense agricultural lands therefore; the pollutants carried by the rivers are significant. Other streams do not carry a major role as their drainage areas are not located close to any industrial or agricultural lands.

Table AVI/1: Discharged loads of pesticides from streams and rivers to the Black Sea (kg yr^{-1})

	Heptachlor	Aldrin	Dieldrin	Endrin	pp'DDE	op'DDE	op'DDD	op'DDT
Sakarya River	<11 200	8 400	25 300	112 000	21 000	296 000	105 000	29 000
Guluc Stream	2 200	110	680	500	50	610	340	750
Neyren Stream	90	22	55	75	13	90	95	90
Kilimli Stream	9,6	<1	3.7	<3	0.1	7.1	4.1	9.7
Çatalağzı Stream	90	41	<30	27	<24	<24	<30	<30
Filyos River	2 400	<1 700	310	200	670	1 200	210	420
Bartın Stream	740	18	70	42	29	95	24	52
Kızılırmak River	< 23 000	920	3 500	53 000	840	14 000	7 800	23 300
Yeşilırmak River	92	330	420	8 700	170	3 400	860	1 400
Miliç Stream	310	43	13	<12	<2	<3	<2	<3
Civil Stream	30	1.7	<4	<24	200	<4	<5	<5
Melet Stream	500	170	131	940	420	700	340	940
K. Güre Stream	3,9	1.1	1,7	3.2	8.6	1.7	1.3	2.9
Aksu Stream	6 100	740	110	220	35	170	270	330
Tabakhane Stream	50	2.3	12	15	4.6	16	21	18
Değirmendere Stream	11	<500	20	<620	4	230	90	290

Organochlorine pesticide residues of the more commonly used compounds were detected in natural fresh water bodies in Central Anatolia. A total of 13 organochlorine pesticides and their residues have been determined in water and sediment in Tuz Lake Hirfanlı Dam Lake, Eşmekaya Lake, Tersakan Lake and Bolluk Lake. In the Table 76 OC pesticide residues in sediment sample were generally higher than residue levels in water samples. Alpha-HCH, beta-HCH, heptachlor epoxide, aldrin, op´-DDT, op´-DDD, pp´-DDT were detected in high levels in sediment samples. In Tuz Lake, Hirfanlı Dam Lake, EĢmekaya Lake, Tersakan Lake, and OC pesticide residues (especially alpha-HCH, beta-HCH, aldrin, dieldrin, heptachlor epoxide and DDT metabolites op-DDT, pp-DDT, pp-DDD) in water and sediment samples 135 were generally higher than in other lakes, because they are located in wide agricultural areas.

The highest amount of extractable alpha HCH was 1.38 µg g^{-1} (range ND – 2.719 µg g^{-1} mean) which was found in the sediment sample of Bolluk Lake. The highest residue level of heptachlor epoxide was 1.398 µg g^{-1}, which was found in sediment samples of Kozanlı Lake. Also the highest average amount of extractable beta HCH (2.328 µg g^{-1} mean of Hirfanlı Dam Lake) was detected in sediment samples. DDT and its metabolites pp´-DDE, o´-DDD, op´-DDT, pp´-DDD, pp´-DDT (mean concentrations 1.421, 1.389, 2.244, 0.969 µg g^{-1} in Tuz Lake, Hirfanlı Dam Lake, Tuz Lake Tuz Lake respectively) were detected at high levels in sediment samples. These high residue levels of pesticides may be due to continuous usage of OC pesticides [97]

Concentrations of DDE and DDD range between 10 - 18 and 0.86 - 4.5 ug kg^{-1} (wet wt) respectively in Mullus baratus in Aegean Sea. The level of aldrin varied between 0.10 and 0.61ug kg^{-1} in samples in Aegean Sea. The composition of DDT and its metabolites were generally p,p´-DDD (34%), p,p´-DDT (16%) and o,p´-DDT (4%) respectively.

The analyses were carried out in samples of various soils from different parts in Göksu Delta. As a result of the study, 13 OC pesticides and their residues were detected in various parts of Göksu Delta (residues ranging from 0.013 ppm lindane in non-agricultural soils to 5.416 ppm pp´-DDE in agricultural soils). OC concentrations in soil samples from agricultural areas were generally higher than in water and sediment. HCH, aldrin, heptachlor, op´-DDT, op´-DDD, and pp´-DDE were detected at high levels in soil samples [98]

Apart from the studies cited above, there are a number of recent studies depicting pesticide levels (OCPs) in Taurus mountains [96], in agricultural soils of Sakarya [95] and Soke [97], surface sediments of eastern Aegean coasts [94].

PCB Monitoring Activities

There is no systematic monitoring program on the determination of releases, health risks and emission statements of PCBs in Turkey as was mentioned in the beginning of this chapter. . Therefore, information on the releases, health risks and emission statements of PCBs in Turkey was reviewed from scientific literature and provided below. All studies yielding information on PCB pollution are presented in table format. The variety in the use of concentration basis for PCBs (wet weight, lipid, WHO-TEQ g^{-1} wet weight or lipid) makes it difficult to compare results. Moreover, the trend analysis on PCB occurrence and distribution would be limited due to the nature of data having no systematic background.

PCBs in Environmental Medium

PCB data from studies in different environmental mediums such as soil, air, water, sediment are summarized as tables in [1] and updated versions are presented as **Tables AVI/2-5**. When the tables are investigated 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. Historically, transformers were brought to this facility from many power plants around Turkey, to be opened for repair and/or change of the insulating oil. Leakage to the environment due to poor waste management practices and storage conditions lead this region to be affected. However, further studies in the vicinity of the region, for example Lake Eymir does not show very high concentrations of PCBs. Since higher chlorinated PCBs are less likely to be transported over long distances due to their low volatility, although the result indicated the presence of PCBs due to the transformer repair facility, surficial sediments did not yield significant concentrations (Table IV/5). On the other hand, studies on gas and particle phase concentrations of atmospheric PCBs in urban/industrial sites suggested that local sources mainly contribute to PCB pollution.

Table AVI/2: Updated data on the level of PCBs in soil

Location	Year	N	Area	∑PCBs (ng g^{-1} dw)	Reference
Taurus Mountain	-	7	Rural	0.062 - 0.228	[9]
Bursa	2008 - 2009	30	Commuter town	0.062 - 1.535 (0.256 ± 0.450)	[10]
Bursa	2008 - 2009	30	Urban	0 - 0.825 (0.258 ± 0.236)	[10]
Bursa	2009	43	Urban	0.2076 - 5.461 (2.121)	[11]
Ankara	2008	30	Rural, Industrial	ND - 84	[12]
Ankara	2007	11	Rural, Industrial	ND - 10	[13]
Hatay	2008	20	Industrial	17 ± 17	[14]
İzmir	2004 - 2006	48	Rural, Industrial	0.23 - 805	[15]
İzmir	2005	6	Urban, Industrial	4.9 - 66	[16]
Antalya	1998	1	Uncultivated Soil	0.344	[8]
İzmir	2001	1	Industrial	640	[17]
Ankara	1997	18	Rural, Industrial	0.53 - 464	[18]

Table AVI/3: Updated data on the level of PCBs in air

Location	Year	N	Area	∑PCBs (pg m^{-3})	Reference
Bursa	June 2008 - 2009	25	Around sanitary landfill	311 ± 178	[19]
Bursa	2008 - 2009	30	Commuter town	72 - 629.6 (268.1 ± 166.7)	[10]
Bursa	2008 - 2009	30	Urban	74.6 - 437.6 (314.7 ± 82)	[10]
Bursa	2008 - 2009	60	Urban	72 - 629.6	[20]
Bursa	June 2008 - 2009	34	Urban/Heavy traffic	Gas phase: 370 ± 200 Particle phase: 20 ± 20	[21]
Mudanya (Bursa)	June 2008 - July 2009	175	Coastal	Gas phase: 530 ± 290 Particle phase: 92 ± 115	
Bursa	2008 - 2009	-	Coastal Traffic (Urban) Campus (Suburban)	316 - 570	[23]
Konya	2006 - 2007	-	Urban	110	[24]
İzmir	2007	11	Urban, Industrial	62 000 ± 35 000	[2]
Bursa	2004 - 2005	60	Urban, Industrial	35 – 1 112	[25]
Bursa	2004 - 2005	18	Campus (Suburban)	Gas phase: 328.1 ± 284.2	[26]

İzmir	2005	16	Urban, Industrial	1 720 – 2 120	[15]
İzmir	2004 - 2005	30	Urban, Industrial	1 160 – 3 370	[15]
Konya	-	5	Urban	1 780	[27]
İzmir	2005	16	Urban, Industrial	1 720 – 2 120	[28]
İzmir	2004 - 2005	~30	Urban, Industrial	1 160 – 3 370	[15]
İzmir	2005	26	Urban, Industrial	300 – 3 140	[16]
Bursa	2004 - 2005	-	Urban	85.8 ± 127.8	[29]
Bursa	2004 - 2005	15 - 25	Urban, Industrial	20 – 1 600	[30, 31]

Table AVI/4: Updated data on the level of PCBs in water

Location	Year	N	Area	∑PCBs (ng l^{-1})	Reference
Bosphorus and Sea of Marmara	March 2009	5	Maritime traffic	0.01 11.0	[32]
İzmir	2005	16	Urban, Coastal	0.25 - 0.39	[28]
Ordu and Sinop	1999 - 2000	6	Urban, Coastal	ND	[33]
Konya	-	17	Urban, Sewage	505 – 2 377	[34]
Konya	-	5 5	Urban - Water supply network Urban, Sewage	27 - 44 80 - 190	[35]
Konya	-	5	Urban, Sewage	0.27 - 1.39	[36]
İzmit	1999	9	Urban, Coastal	1.96 - 23.2	[37]

Table AVI/5: Updated data on the level of PCBs in sediment

Location	Year	N	Area	∑PCBs (ng g^{-1} dw)	Reference
Ankara	2008	29	Rural, Recreational	0.1 - 84.2 0.1 - 21.7	[38]
Ankara, Eymir lake	2009	62	Rural, Recreational	1.09 - 2.33	[7]
Ankara Creek	2008	20	Urban, Industrial	3.7 – 743.3 (67.8)	[39]
Bosporus	2009	5	Seaway	0.04 - 520	[32]
Aegean Sea	2008	14	Coastal	Bdl - 26.07	[40]

Çandarlı Gulf	2009	18	Industrial /Dense marine activity/ Untreated domestic effluent	2.8 - 205	[41]
Kırıkkale (Kızılırmak)	2009	10	River	ND - 19.5	[42]
Mersin	2009	11	Coastal	0.61 - 1.04	[43]
İzmit	2008	24	Urban, Industrial	Sea: 2.90 - 85.4 Freshwater: ND -47.7	[1]
Bosphorus- Marmara Island	2007	17	Seaway	0.0179 - 539.75	[44]
Bosphorus	2007	17	Urban	0.02 - 540	[45]
Mediterranean	2008	42	Coastal	ND - 12.5 ND - 13.7	[46]
Ankara, Eymir Lake	2007	4	Rural, Recreational	ND - 84	[13]
Mediterranean	2007	21	Coastal	ND - 18.4 ND - 16.5	[47]
Mediterranean	2006	7	Coastal	0.36 - 23 0.32 - 15.9	[48, 49]
Mediterranean	2005	11	Coastal	87 - 513 32 - 195	[50]
Mediterranean	2003	8	Coastal	ND ND - 1.96	[51]
Mediterranean	2004	8	Coastal	ND - 117 ND - 121	[51]
Central Blacksea	1999-2000	14	Urban river, Coastal	ND	[52]
Blacksea	1995	10	Rural	0.3 - 4.9 <0.06 - 1.55 0.45 - 4.43	[53]
İzmir	2001	3	Industrial	81 - 320	[17]
Ankara, Eymir Lake	1997	20	Rural, Industrial	ND - 196	[18]
Mersin	-	8	Urban, Coastal	<2 - 4	[54]

PCBs in Biological Medium

A summary of studies showing PCB concentrations in biological media (such as fish, human milk, human adipose tissue, mussel) are given in **Table AVI/6.** The data that are not a part of systematic monitoring study, limit the trend analysis of PCB occurrence and distribution in biological medium.

Table AVI/6: Updated data on the level of PCBs in biological medium

Location	Year	N	Area	∑PCBs (ng g^{-1} lipid weight)	Reference
Mersin	2009	47	Breast milk	>LOD - 7.994	[55]
Antalya	September 2007 - April 2008	100	Breast milk	27.46 ± 11.58	[56]
Konya	2010	45	Breast milk	Mean: 104.95	[57]

Ankara, İstanbul, Antalya, Kahramanmaraş, Afyon	2007	51	Breast milk	10.7 - 25.0	[58]
Kahramanmaraş	2003	37	Breast milk	0.15 - 1.92*	[59]
Ankara	1999 - 2000	32	Breast milk	266	[60]
Ankara	1996 - 1998	50	Breast milk	ND	[18]
Ankara	2002 - 2007	21healthy, 25 patient	Adipose tissue	Healthy: 339.68 ± 27.4, Patient: 382.21 ± 18.8	[61]
Ankara	2003 - 2005	45	Adipose tissue/Operation-man	19	[62]
Ankara	1999 - 2000	29	Adipose tissue/Operation	383	[63]
Ankara	199 6- 1998	50	Adipose tissue /cadaver	ND - 780	[18]
Van	2008	13	Mussel	-	[64]
Bosporus, Marmara Island	January-February 2007	21	Mussel	1.026 - 35.983*	[44]
İzmir	2008	9	Mussel	5.4 - 31.4 4.3 - 11.7	[46]
İzmit	2000	8 region	Mussel	11.2 - 36.0*	[65]
İzmir	2007	9	Mussel	ND - 43.6 ND - 10.4	[47]
İzmir	2006	9	Mussel	8.91 - 70 1.94 - 12.1	[48, 49]
İzmir	2005	6	Mussel	ND - 416 ND - 340	[50]
İzmir	2004	6	Mussel	ND - 306 ND - 99	[51]
Central Black sea	1999 - 2000	6 region	Mussel	ND	[33]
İzmit	1999	8 region	Mussel	4.69 - 28.1	[37]
Samsun	2008 - 2009	54	Fish	17.68 - 3235	[66]
Mediterranean	2006	18 region	Fish species	83.4 - 268 1.12 - 23	[47]
Mediterranean	2005	10 region	Fish species	4.1 - 10.7 1.2 - 18.2	[48, 49]
Marmara Sea	2003	12	Fish	63.3 - 509	[67]
Kahramanmaraş	2003	80	Fish	ND - 42.3	[68]
Mediterranean	2004	18 region	Fish species	ND - 492 ND - 417	[50]
Mediterranean	2003	15 region	Fish species	ND - 9.45 ND - 9.45	[51]
Mediterranean	2002	36	Marine species	ND - 28.0 ND - 10.1	[69]
İstanbul Anamur	-	5 5	Fish	169 - 652 90 - 914	[70]
Sinop	1993	49	Phocoenidae	1 600 – 39 000	[71]

Sinop	1993	14	Fish	130 – 3 500	[71]
Mersin	1976-1981	109	Marine organisms	0.4 - 77	[72, 73]
Mersin	-	149	Marine organisms	ND - 39	[54]

*wet weight

uPOPs Monitoring Activities

Some studies especially in industrial regions concerning estimated levels of PCDDs/Fs are gathered in **Table AVI/7.**

Table AVI/7: PCDDs/Fs levels in different regions of Turkey

Media	Location	Results	Kaynak
Sediment	Kocaeli	0.45 - 255 ng kg^{-1} DW	[82]
Sediment	İstanbul Strait and Islands	0.01 – 2.85 pg g^{-1} DW	[44]
Mussel	İstanbul Strait and Islands	0.57 – 1.50 pg g^{-1} DW	[44]
Soil Surface	Kocaeli	0.4 - 4.27 pg g^{-1} DW	[75]
Air	Kocaeli	23 – 563 fg m^{-3}	[75]
Grass	Kocaeli	1.41 ng kg^{-1}	[80]
Adipose (male)	Ankara	3.2 - 19.7 pg g^{-1} fat	[79]
Human Milk	Ankara, Istanbul, Antalya, Kahramanmaras, Afyon	0.78 - 29.3 pg g^{-1} DW	[58]
Fish	Commercial Farms	0.14 - 0.70 pg g^{-1} WW	[76]
Argentine	Hirfanlı Dam Lake	0.16 - 0.17 pg g^{-1} DW	[77]
Fish	Black Sea	0.28 - 0.91 pg g^{-1} WW	[76]
Egg	Kocaeli, Afyon	0.24 – 3.79 pg g^{-1} fat	[82]
Egg	Kocaeli, Afyon	0.23 – 18.4 pg g^{-1} fat	[82]
Egg	Kocaeli	0.63 – 3.64 pg g^{-1} fat	[74]
Egg	Afyon, Ankara, Sakarya, Balıkesir, Çorum, İzmir, Konya	0.247 – 1.527 pg g^{-1} fat	[83]
Vitellus	Afyon, Ankara, Sakarya, Balıkesir, Çorum, İzmir, Konya	0.122 – 0.494 pg g^{-1} fat	[83]
Cows' milk	Kocaeli	69.3 pg kg^{-1}	[80]
Cows' milk	Kocaeli	0.95 – 1.74 pg g^{-1} fat	[74]
Butter	Kocaeli, Afyon	0.21 – 0.62 pg g^{-1} fat	[82]
Butter	Kocaeli, Afyon	0.40 – 0.30 pg g^{-1} fat	[82]
Butter	Zonguldak, Denizli, Konya, İstanbul, Kocaeli, Mersin, Bursa, Batman, Karaman, Kayseri, Bilecik, Adana, Sakarya, İzmir	0.12 – 1.56 pg g^{-1} fat	[84]
Sheep	Kocaeli, Afyon	1.13 – 1.67 pg g^{-1} fat	[82]
Cattle	Kocaeli, Afyon	0.41 – 0.45 pg g^{-1} fat	[82]

Meat	Kocaeli	0.62 – 1.25 pg g^{-1} fat	[74]
Chicken	Kocaeli	0.32 – 1.02 pg g^{-1} fat	[74]
Green leaved vegetable	Kocaeli	0.11 pg g^{-1} WW	[74]
Fat	Kocaeli, Afyon	0.19 – 0.20 pg g^{-1} fat	[82]

It can be seen that these estimates are considered to be high for the country. However, the number of samples and their representativeness is inadequate to reach a conclusion. Therefore, a more comprehensive research should be done in order to reach accurate results. As the pathway of exposure is generally via digestion, food samples should be analyzed thoroughly to make further comments on the issue.

Concerning to the measurements and monitoring of pocyclic aromatic hydrocarbonts, a lot of studies was realized in Turkey during last years. The most relevant of them, are summarized under numbers of references [99-124] and these papers can be used as a base for the evaluation of PAHs contamination in the country.

PBDE Monitoring Activities

There is no data on the amount of PBDEs used in Turkey. However, studies conducted in Turkey reports PBDEs in environmental compartments including air, biota, mother's milk, window dust films, indoor air and indoor dust.

Table AVI/8: Studies reported PBDEs in environmental compartments in Turkey

Environmental Compartment	Concentration	Reference
Fish	<DL - 600 pg g^{-1} ww (varies by congeners) <nd - 6.7 ng g^{-1} ww (Σ_6PBDEs)	[89] [90]
Mothers Milk	0.005 – 0.014 ng g^{-1} lipid(Σ_7PBDEs) 67.34 ng g^{-1} lipid (Σ_5PBDEs)	[91] [93]
Air	8.6 – 28.9 pg m^{-3}, gas phase (Σ_7PBDEs) 12.1 – 62.2 pg m^{-3}, particulate phase (Σ_7PBDEs)	[86]
Air	1 451 ± 954 pg m^{-3}, gas phase	[2]
Air	21 - 117 pg m^{-3} (gas+particulate)	[87]
Window Film	43.5, 45.5, and 206 ng m^{-2} (background, urban and industrial)	[88]
Indoor Air	163 – 10 000 pg m^{-3}	[92]
House dust	395 – 12 500 ng g^{-1}	[92]
Office Dust	330 – 32 200 ng g^{-1}	[92]

PBDEs in mother's milk measurements are mainly conducted in Konya [93] and Kahramanmaraş [90, 91] and 45 and 37 samples are taken respectively. According to the results it can be seen that PBDE levels are higher in mothers in Konya than that of the ones in Kahramanmaraş.

The air samples are only collected in İzmir Region and levels are 8.6 - 1.451 pg m^{-3} in gas phase and 12 - 62 pg m^{-3} in particulate phase.

For the window film dust the highest concentration detected is in the industrial regions and it was seen that in the house dust samples the c-DecaBDE is the most abundant PBDE among others. This could be because that c-DecaBDE is used as an additive used in textiles and consumer products like carpets and the samples are taken from the surface of the carpets and other soft surfaces. Every house dust taken has shown that c-pentaBDE is present as PUR Foam contains c-pentaBDE as a flame retardant. These studies require further research in order to come up with a conclusion.

References

1. Gedik K., İmamoğlu, İ. A*n assessment of the spatial distribution of polychlorinated biphenyl contamination in Turkey*. CLEAN-Soil Air Water, **38**(2), 117-128 (2010).
2. Odabasi, M., et al., *Electric Arc Furnaces for Steel-Making: Hot Spots for Persistent Organic Pollutants.* Environ. Sci. Technol., 2009. **43(**14): p. 5205-5211.
3. Odabasi, M., et al., I*nvestigation of Soil Concentrations of Persistent Organic Pollutants, Trace Elements, and Anions Due to Iron-Steel Plant Emissions in an Industrial Region in Turkey.* Water Air and Soil Pollut, 2010. **213**(1-4): p. 375-388.
4. Kuzu, S. L., et al., *Estimation of atmospheric PCB releases from industrial facilities in Turkey.* Atmos. Pollut. Res., 2013. **4**(4): p. 420-426.
5. Wikstrom, E., et al., *Influence of level and form of chlorine on the formation of chlorinated dioxins, dibenzofurans, and benzenes during combustion of an artificial fuel in a laboratory reactor.* Environ. Sci. Technol., 1996. **30**(5): p. 1637-1644.
6. Özyürek, N., Sevingel, N., Kurusakız, K. *PCB yönetimi konusunda Türkiye'deki mevcut durum.* Katı Atık ve Çevre, 2012. **85**: p. 21-29.
7. Gedik, K. Imamoglu, I. *Levels, Distribution, and Sources of Polychlorinated Biphenyls in Sediments of Lake Eymir, Turkey.* Arch. Environ. Contam. Toxicol., 2013. **65**(2): p. 203-211.
8. Meijer, S. N., et al., *Global distribution and budget of PCBs and HCB in background surface soils: Implications or sources and environmental processes.* Environ. Sci. Technol., 2003. **37**(4): p. 667-672.
9. Turgut, C., et al., *The occurrence and environmental effect of persistent organic pollutants (POPs) in Taurus Mountains soils.* Environ. Sci. Pollut. Res., 2012. **19**(2): p. 325-334.
10. Tasdemir, Y., et al., *Air-soil exchange of PCBs: seasonal variations in levels and fluxes with influence of equilibrium conditions.* Environ Pollut, 2012. **169**: p. 90-7.
11. Salihoglu, G., et al., *Spatial and temporal distribution of polychlorinated biphenyl (PCB) concentrations in soils of an industrialized city in Turkey.* J. Environ. Managmnt., 2011. **92**(3): p. 724-32.
12. Demircioglu, F., Gedik, K., Imamoglu, I. *Investigation of the PCB Contamination around Lake Eymir.* in Proc. of 6th Symp. on Priorities of Environmental Pollution in Turkey, Gebze Institute of Higher Technology, Kocaeli, Turkey, (in Turkish), 2009: p. 76.
13. Imamoglu, İ., Gedik, K., Akduman, N. *Investigation of PCB Pollution in Turkey.* in Abstract Book of the Sixth Int. Conf. on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA 2008.
14. Odabasi, M., vd., and vd., *The Effect of Iron-steel Industry Emissions on Soil Pollution in the Hatay-Iskenderun Region.* in Proc. of the Nat. Symp. on Air Pollution and Control (Eds.: T. Elbir, Y. Dumanoglu, A. Bayram, M. Odabasi, S. Ornektekin), Hatay, Turkey (in Turkish), 2008: p. 581.
15. Bozlaker, A., Odabasi, M., Muezzinoglu, A. *Dry deposition and soil-air gas exchange of polychlorinated biphenyls (PCBs) in an industrial area.* Environ Pollut, 2008. **156**(3): p. 784-93.
16. Cetin, B., et al., *Ambient concentrations and source apportionment of PCBs and trace elements around an industrial area in Izmir, Turkey.* Chemosphere, 2007. **69**(8): p. 1267-1277.
17. Greenpeace, *Ships for Scrap V – Steel and Toxic Wastes for Asia – Greenpeace Report on Environmental, Health and Safety Conditions in Aliaga Shipbreaking Yards, Izmir, Turkey, Greenpeace, Mediterranean,* 2002.
18. Yeniova, M. *Biological and Environmental Monitoring of Polychlorinated Biphenyls.* Ph.D. Thesis, 1998. **A**nkara Üniversitesi(Ankara).
19. Esen, F. *Development of a Passive Sampling Device Using Polyurethane Foam (PUF) to Measure Polychlorinated Biphenyls (PCBs) and Organochlorine Pesticides (OCPs) near Landfills.* Environ. Forens., 2013. **14**(1): p. 1-8.
20. Birgul, A., Tasdemir, Y. *Determination of the sampler type and rainfall effect on the deposition fluxes of the polychlorinated biphenyls.* ScientificWorldJournal, 2012. **2012**: p. 798020.
21. Gunindi, M., Tasdemir, Y. *Wet and Dry Deposition Fluxes of Polychlorinated Biphenyls (PCBs) in an Urban Area of Turkey.* Water Air and Soil Pollut., 2011. **215**(1-4): p. 427-439.
22. Günindi, M., Tasdemir, Y. *Atmospheric polychlorinated biphenyl (pcb) inputs to a coastal city near the marmara sea.* Mar. Pollut. Bull., 2010. **60**(12): p. 2242-2250.
23. Cindoruk, S. S., Tasdemir, Y. *Ambient Air Levels and Trends of Polychlorinated Biphenyls at Four Different Sites.* Arch. Environ. Contam. Toxicol, 2010. **59**(4): p. 542-554.
24. Ozcan, S., Aydin, M. E. *Polycyclic aromatic hydrocarbons, polychlorinated biphenyls and organochlorine pesticides in urban air of Konya, Turkey.* Atmos. Res., 2009. **93**(4): p. 715-722.
25. Salihoglu, G., Tasdemir, Y. *Prediction of the PCB pollution in the soils of Bursa, an industrial city in Turkey.* J. Hazard Mater., 2009. **164**(2-3): p. 1523-31.

26. Cindoruk, S. S., Tasdemir, Y. *Atmospheric Gas and Particle Phase Concentrations of Polychlorinated Biphenyls (PCBs) in a Suburban Site of Bursa, Turkey.* Environ. Forens., 2008. **9**(2-3): p. 153-165.
27. Ozcan, S., Aydin, M. E., Tor, A. *Chromatographic Separation and Analytic Procedure for Priority Organic Pollutants in Urban Air.* CLEAN – Soil, Air, Water, 2008. **36**(12): p. 969-977.
28. Odabasi, M., et al., *Air–water exchange of polychlorinated biphenyls (PCBs) and organochlorine pesticides (OCPs) at a coastal site in Izmir Bay, Turkey.* Mar. Chem., 2008. **109**(1-2): p. 115-129.
29. Cindoruk, S. S., Esen, F., Tasdemir, T. *Concentration and gas/particle partitioning of polychlorinated biphenyls (PCBs) at an industrial site at Bursa, Turkey.* Atmos. Res., 2007. **85**(3-4): p. 338-350.
30. Cindoruk, S. S., Tasdemir, Y. *Deposition of atmospheric particulate PCBs in suburban site of Turkey.* Atmos. Res., 2007. **85**(3-4): p. 300-309.
31. Cindoruk, S. S., et al., *Measurement of atmospheric deposition of polychlorinated biphenyls and their dry deposition velocities in an urban/industrial site in Turkey.* J. Environ. Sci. Hlth. A Tox. Hazard Subst. Environ. Eng, 2008. **43**(11): p. 1252-60.
32. Karacık, B., et al., *Water concentrations of PAH, PCB and OCP by using semipermeable membrane devices and sediments.* Mar. Pollut. Bull., 2013. **70**(1–2): p. 258-265.
33. Kurt, P. B., Ozkoc, H. B. *A survey to determine levels of chlorinated pesticides and PCBs in mussels and seawater from the Mid-Black Sea Coast of Turkey.* Mar. Pollut. Bull., 2004. **48**(11-12): p. 1076-1083.
34. Aydin, M. E., et al., *Polychlorinated biphenyls in wastewater of Konya-Turkey.* Fres. Environ. Bull., 2004. **13**(11A): p. 1090-1093.
35. Aydin, M. E., Wichmann, H., Bahadir, M. *Priority organic pollutants in fresh and waste waters of Konya-Turkey.* Fres. Environ. Bull., 2004. **13**(2): p. 118-123.
36. Tor, A., et al., *Polychlorinated biphenyls (PCB) and polycyclic aromatic hydrocarbons (PAH) in wastewater samples from the sewage system of Konya-Turkey.* Fres. Environ. Bull., 2003. **12**(7): p. 732-735.
37. Telli-Karakoc, F., et al., *Polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) distributions in the Bay of Marmara sea: Izmit Bay.* Environ. Pollut., 2002. **119**(3): p. 383-397.
38. Karakas, F., Gedik, K., Imamoglu, I. *Apportionment of PCB Sources Near a Transformer Maintenance and Repair Facility in Ankara, Turkey.* Bull. Environ. Contam. Toxicol., 2013. **91**(2): p. 141-147.
39. Ozyurek, N. A., et al., *Levels and sources of polychlorinated biphenyls in Ankara creek sediments, Turkey.* J. Environ. Sci. Hlth. Part a-Tox./Hazard. Substan. Environ. Engn., 2013. **48**(7): p. 800-808.
40. Kucuksezgin, F., L. T. Gonul, L. T. *Distribution and ecological risk of organochlorine pesticides and polychlorinated biphenyls in surficial sediments from the Eastern Aegean.* Mar. Pollut. Bull., 2012. **64**(11): p. 2549-2555.
41. Pazi, I., Kucuksezgin, F. Gonul, L. T. *Occurrence and distribution of organochlorine residues in surface sediments of the Candarli Gulf (Eastern Aegean).* Marine Pollution Bulletin, 2012. **64**(12): p. 2839-2843.
42. Gedik, K. and I. Imamoglu, *Chemical Mass Balance (CMB) Evaluation of Polychlorinated Biphenyl (PCB) Sources in Sediments of Kizilirmak River, Turkey, Near a Scrap Yard.* Environ. Forens., 2012. **13**(1): p. 39-44.
43. Gedik, K., Imamoglu, I. *Assessment of temporal variation and sources of PCBs in the sediments of Mediterranean Sea, Mersin Bay, Turkey.* Mar. Pollut. Bull., 2011. **62**(1): p. 173-177.
44. Okay, O. S., et al., *PCB and PCDD/F in sediments and mussels of the Istanbul strait (Turkey).* Chemosphere, 2009. **76**(2): p. 159-166.
45. Okay, O. S., et al., *PCB and PCDD/F in sediments and mussels of the Istanbul strait (Turkey).* Chemosphere, 2009. **76**(2): p. 159-166.
46. Tugrul, S., Küçüksezgin, F., Yemenicioglu, S. *Long Term Biomonitoring, Trend and Compliance Monitoring Program in Coastal Areas from Aegean, Northeastern Mediterranean and Eutrofication Monitoring in Mersin Bay (MEDPOL Phase IV).* Ministry of Environment and Forestry, Ankara, 2008.
47. Tugrul, S., Küçüksezgin, F., Yemenicioglu, S. *Long Term Biomonitoring, Trend and Compliance Monitoring Program in Coastal Areas from Aegean, Northeastern Mediterranean and Eutrofication Monitoring in Mersin Bay (MEDPOL Phase IV).* Ministry of Environment and Forestry, Ankara, 2007.
48. Yemenicioglu, S., et al., *Long Term Biomonitoring, Trend and Compliance Monitoring and Eutrofication Monitoring Program in Coastal and Hot-Spot Areas of the Northeastern Mediterranean (MEDPOL Phase IV).* Ministry of Environment and Forestry, Ankara, 2006.
49. Küçüksezgin, F., *Long Term Biomonitoring, Trend and Compliance Monitoring Program in Coastal Areas from Aegean, Northeastern Mediterranean and Monitoring Eutrofication of Mersin Bay – Aegean Sea (MEDPOL Phase IV).* Ministry of Environment and Forestry, Ankara, 2006.
50. Tugrul, S., vd., and vd., *Long Term Biomonitoring. Trend Monitoring and Compliance Monitoring Program in Coastal and Hot-spot Areas from Northeastern Mediterranean and Eutrophication Monitoring in Mersin Bay (MEDPOL Phase III).* Ministry of Environment and Forestry, Ankara (in Turkish), 2005.
51. Yemenicioglu, S., Ediger, D., Tugrul, S. *Long Term Biomonitoring, Trend Monitoring and Compliance Monitoring Program in Coastal and Hot-spot Areas from Northeastern Mediterranean (MEDPOL Phase III)* Ministry of Environment and Forestry Ankara (in Turkish), 2004.
52. Bakan, G. Ariman, S. *Persistent organochlorine residues in sediments along the coast of mid-Black Sea region of Turkey.* Mar. Pollut. Bull., 2004. **48**(11-12): p. 1031-1039.
53. Fillmann, G., et al., *Persistent organochlorine residues in sediments from the Black Sea.* Mar. Pollut. Bull., 2002. **44**(2): p. 122-133.

54. Basturk, O., et al., *DDT, DDE, and PCB residues in fish, crustaceans and sediments from the Eastern Mediterranean coast of Turkey*. Mar. Pollut. Bull., 1980. **11**(7): p. 191-195.
55. Çok, İ., et al., *Analysis of Human Milk to Asses Exposure to PAHs ,PCBs and Organochlorine Pesticides in the Vicinity Mediterterranean City Mersin, Turkey*. Environ. Intern., 2012. **40**: p. 63-69.
56. Çok, İ., et al., *Polychlorinated Biphenyl and Organochlorine Pesticide Levels in Human Breast Milk from the Mediterranean city Antalya, Turkey.* Bull. Environ. Contam. Toxicol., 2011. **86**(4): p. 423-427.
57. Ozcan, S., Tor, A., Aydin, M. E. *Levels of Organohalogenated Pollutants in Human Milk Samples from Konya City, Turkey.* Clean-Soil Air Water, 2011. **39**(10): p. 978-983.
58. Cok, I., et al., *Polychlorinated dibenzo-p-dioxins, dibenzofurans and polychlorinated biphenyls levels in human breast milk from different regions of Turkey*. Chemosphere, 2009. **76**(11): p. 1563-1571.
59. Erdogrul, O., et al., *Levels of organohalogenated persistent pollutants in human milk from Kahramanmaras region, Turkey.* Environ. Intern., 2004. **30**(5): p. 659-666.
60. Cok, I., et al., *Polychlorinated biphenyl (PCB) levels in human milk samples from Turkish mothers.* Bull.Environ. Contam. Toxicol., 2003. **70**(1): p. 41-45.
61. Cok, I., et al., *Determination of organochlorine pesticide and polychlorinated biphenyl levels in adipose tissue of infertile men.* Environ. Monitor. Assess., 2010. **162**(1-4): p. 301-309.
62. Cok, I., et al., *Concentrations of polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), and dioxin-like PCBs in adipose tissue of infertile men.* Arch. Environ. Contamin. Toxicol., 2008. **55**(1): p. 143-152.
63. Cok, I. Satiroglu, M. H. *Polychlorinated biphenyl levels in adipose tissue of primiparous women in Turkey.* Environ. Internat., 2004. **30**(1): p. 7-10.
64. Aksoy, A., et al., *Organochlorine Pesticide and Polychlorinated Biphenyls Levels in Fish and Mussel in Van Region, Turkey.* Bull. Environ. Contam. Toxicol., 2011. **87**(1): p. 65-69.
65. Tolun, L., et al., *PCB pollution of Izmit Bay (Marmara Sea) mussels after the earthquake*, in *Fate of Persistent Organic Pollutants in the Environment*, E. Mehmetli and B. Koumanova, Editors. 2008. p. 127-139.
66. Aksoy, A., et al., *Seasonal Variation of Polychlorinated Biphenyls and Organochlorine Pesticide Levels of Sea and Cultured Farm Fish in the Samsun Region of Turkey.* Bull. Environ. Contam. Toxicol., 2012. **88**(6): p. 842-849.
67. Coelhan, M., Johanna, S., Barlas, H. *Organochlorine levels in edible fish from the Marmara Sea, Turkey.* Environment International, 2006. **32**(6): p. 775-780.
68. Erdogrul, O., Covaci, A., Schepens, P. *Levels of organochlorine pesticides, polychlorinated biphenyls and polybrominated diphenyl ethers in fish species from Kahramanmaras, Turkey.* Environ. Intern., 2005. **31**(5): p. 703-711.
69. Yemenicioglu, S., *Long Term Biomonitoring, Trend Monitoring and Compliance Monitoring Program in Coastal and Hot-spot Areas from Northeastern Mediterranean and Aegean Sea (MEDPOL Phase III).* Ministry of Environment and Forestry, Ankara, (in Turkish), 2003.
70. Coelhan, M., Barlas, H. *Levels of some organochlorine contaminants in fishes from Turkey.* Fres. Environ. Bull., 1998. **7**(5A-6A): p. 388-395.
71. Tanabe, S., et al., *Isomer-specific analysis of polychlorinated biphenyls in harbour porpoise (Phocoena phocoena) from the Black Sea.* Mar. Pollut. Bull., 1997. **34**(9): p. 712-720.
72. UNEP, *Baseline Studies and Monitoring of DDT, PCBs and Other Chlorinated Hydrocarbons in Marine Organisms (MED POL III): Final Reports of Principal Investigators*. 1986: UNEP.
73. UNEP, *Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL Phase II) Final Report 1975-1980.* MAP Technical Reports Series No.9, 1986. Athens.
74. Aslan, S., Korucu, M. K., Karademir, A., Durmusoglu, E. *Levels of PCDD/Fs in Local and Non-Local Food Samples Collected from a Highly Polluted Area in Turkey*. Chemosphere 2010. **80** (10): p. 1213-19.
75. Bakoglu, M., Karademir, A., Durmusoglu, E. *Evaluation of PCDD/F Levels in Ambient Air and Soils and Estimation of Deposition Rates in Kocaeli, Turkey*. Chemosphere 2005. **59** (10): p. 1373-85.
76. Çakıroğulları, G. C., Uçar, Y., Oymael, B., Bozkurt, E. N., Kılıç, D. *PCDD/F, Dl-PCB and Indicator PCBs in Whiting, Horse-Mackerel and Anchovy in Black Sea in Turkey*. Turk J Fish Aquat Sci 2010 **10**: p. 357-62.
77. Çakıroğulları, G. Ç., Uçar, Y., Kılıç, D. *PCDD, PCDF and PCB Contamination in Atherina Boyeri (Risso, 1810) from Turkey*. Food Control 2011. **22 (**1): p. 67-71.
78. Çelik, Ç. G., Kılıç, D., Uçar. Y. *Levels of Polychlorinated Dibenzo-p-Dioxins, Dibenzo-p-Furans and Polychlorinated Biphenyls in Farmed Sea Bass (Dicentrarchus Labrax) and Sea Bream (Sparus Aurata) from Turkey*. Food Control 2010. **21** (9): p. 1245-49.
79. Cok, I., Keski Donmez, M., Satıroğlu, H., Aydınuraz, B., Henkelmann, B., Kotalik, J., Schramm, K.-W. *Concentration of Polychlorinated Dibenzo-p-Dioxins, Polychlorinated Dibenzofurans and Dioxin-Like PCBs in Human Adipose Tissue from Turkish Men*. Chemosphere 2007. **66** (10): p. 1955-61.
80. Karademir, A,, Durmusoglu, E., Bakoglu, M. *Health Risk Assessment of Background PCDD/F Exposure Levels in Kocaeli, Turkey*. J. Environ. Sci. Hlth. *Part A* 2007. **42 (**6): p. 729-39.
81. Karademir, A., Ergül, H. A., Telli, B., Kılavuz, S. A., Terzi, M. *Evaluation of PCDD/F Pollution in Surface Sediments of Izmit Bay*. Envir. Sci. Pollut. Res. 2013: p. 1-9.
82. Kilic, D., Çakıroğulları, G. Ç., Uçar, Y., Theelen, R., Traag, W. *Comparison of PCDD/F and Dl-PCB Levels in Turkish Foodstuffs: Industrial Versus Rural, Local Versus Supermarket Products, and Assessment of Dietary Intake*. Food Additives & Contaminants: Part A 28, 2011. **7** : p. 913-24.

83. Olanca, B., Cakirogullari, G. Ç., Ucar, Y., Kirisik, D., Kilic, D. *Polychlorinated Dioxins, Furans (PCDD/Fs), Dioxin-Like Polychlorinated Biphenyls (Dl-PCBs) and Indicator PCBs (Ind-PCBs) in Egg and Egg Products in Turkey*. Chemosphere 2014. **94**: p. 13-19.

84. Uçar, Y., Traag, W., Immerzeel, J., Kraats, C., van der Lee, M., Hoogenboom, R., van der Weg, G., Cakirogullari, G. Ç., Oymael, B., Kilic, D. *Levels of PCDD/Fs, PCBs and PBDEs in Butter from Turkey and Estimated Dietary Intake from Dairy Products*. Food Addit. Contamin. Part *B* 2011. **4 (**2): p. 85.141-51.

86. Cetin, B., Odabasi, M. *Particle-Phase Dry Deposition and Air-Soil Gas-Exchange of Polybrominated Diphenyl Ethers (PBDEs) in Izmir, Turkey*, Environ. Sci. Technol. 2007. **41**: p. 4986-4992

87. Cetin, B., Odabasi, M.. *Atmospheric concentrations and phase partitioning of polybrominated diphenyl ethers (PBDEs) in Izmir, Turkey*, Chemosphere 2008, **71:** p. 1067-1078

88. Cetin, B., Odabasi, M. *Polybrominated diphenyl ethers (PBDEs) in indoor and outdoor window organic films in Izmir, Turkey*, J. Haz. Mat. 2011. **185**: p. 784-791.

89. Çakıroğulları, Ç., Traag, W., Hoogenboom, R., Immerzeel, J., Kraats, C., Van Der Weg, G., Ten Dam, G., Wijma, E., Van Der Lee, M., Van Wakeren, C., Uçar, Y., Kılıç, D. http://edepot.wur.nl/178186.

90 Erdoğrul, Ö., Covaci, A., Schepens, P. *Levels of Organochlorine pesticides, polychlorinated biphenyls and polybrominated diphenyl ethers in fish species from Kahramanmaras, Turkey*. Environ. Internat. 2005. **31**: p. 703-711

91. Erdoğrul, Ö., Covaci, A., Kurtul, N., Schepens, P. *Levels of organohalogenated persistent pollutants in human milk from Kahramanmaraş region, Turkey*. Environ. Internat. 2004. **30**: p. 659-666.

92. Kurt-Karakus. İç ve dış mekan hava örneklerinde ve iç mekan toz örneklerinde Kalıcı Organik Kirleticilerin (KOK'lar) incelenmesi, TÜBİTAK 1002 Short Term Research Grant # 112Y004 Project Final Report, 2013.

93. Özcan, Ş., Tor, A., Aydin, M.E. *Levels of Organohalogenated Pollutants in Human Milk Samples from Konya City, Turkey*, Clean-Soil, Air, Water 2011. **39** (10): p. 978-983

94. Kucuksezgin F., Gonul T. L. *Distribution and ecological risk of organochlorine pesticides and polychlorinated biphenyls in surficial sediments from the Eastern Aegean*. Mar. Pollut. Bull. 2012. **64**: p. 2549–55.

95. Isleyen M., Sevim P., Uslan M. *DDX Profiles in Agricultural Fields Used for Cucurbit Production in Sakarya, Turkey* Soil Sediment Contam. An. Int. J. 2013. **22:** 689–700.

96. Turgut C., Atatanir L., Mazmanci B., Mazmanci M. A., Henkelmann B., Schramm K.-W. *The occurrence and environmental effect of persistent organic pollutants (POPs) in Taurus Mountains soils*. Environ. Sci. Pollut. Res. 2012. **19** (2): p. 325-334.

97. Turgut C., Cutright T.J., Mermer S., Atatanir L., Turgut N., Usluy M., Erdogan O., *The source of DDT and its metabolites contamination in Turkish agricultural soils*. Environ. Monit. Assess. 2013. **185**: p. 1087–93.97. Barlas, N. E. *Determination of organochlorine pesticide residues in water and sediment samples in inner Anatolia in Turkey*. B. Environ. Contam. Toxicol. 2002. 69(2): p. 236 242.

98. Ayas, Z., Barlas, N.E., Kolankaya, D. *Determination of organochlorine pesticide residues in various environments and organisms in Goksu Delta, Turkey.* Aquat. Toxicol. 1997. **39** (2): p. 171-181 Published: SEP 1997

References to PAHs abiotic and biotic occurrence amd methods of sampling and determination:

99. Bozlaker, A., Muezzinoglu, A., Odabasi, M. *Atmospheric concentrations, dry deposition and air; soil exchange of polycyclic aromatic hydrocarbons (PAHs) in an industrial region in Turkey.* J. Haz. Mat. 2008a, **153**: p. 1093-1102.

100. Demircioglu, E., Sofuoglu, A., Odabasi, M. *Particle; phase dry deposition and air; soil gas exchange of polycyclic aromatic hydrocarbons (PAHs) in Izmir, Turkey.* J. Haz. Mat. 2011a, **186:** p. 328-335.

101. Odabasi, M,, Bayram, A., Elbir, T., Dumanoglu, Y., Kara, M.,Altiok, H., Cetin, B., *Investigation of seasonal variations and sources of atmospheric polychlorinated naphthalenes (PCNs) in an urban area.* Atmos. Pollut. Res. 2012. **3: p.** 477–484

102. Karaca, G., Tasdemir, Y: *Temporal and spatial variations in PAH concentrations in the sediment from the Nilufer Creek in Bursa, Turkey.* J. Environ. Sci. Hlth., Part A. Tox/Haz. Subst. Environ. Engn. 2014, **49**(8): p. 900-912.

103. Karaca, G., Cindoruk, S. S., Tasdemir, Y: *Migration of polycyclic aromatic hydrocarbons (PAHs) in urban treatment sludge to the air during PAH removal applications.* J. Air Waste Managm. Assoc. 2014, 64(5): p. 568-577.

104. Cabuk, H., Kilic, M. S. Oren, M. *Biomonitoring of polycyclic aromatic hydrocarbons in urban and industrial environments of the Western Black Sea Region, Turkey.* Environ. Monitor. Assessm. 2014, **186**(3): p. 1515-1524.

105. Binici, B., Yenisoy-Karakas, S., Bilsel, M. et al. *Sources of polycyclic hydrocarbons and pesticides in soluble fraction of deposition samples in Kocaeli, Turkey.* Environ. Sci. Pollut. Res. 2014, **21**(4): p. 2907-2917.

106. Kucuksezgin, F., Pazi, I., Tolga, G. L. et al. *Distribution and sources of polycyclic aromatic hydrocarbons in Cilician Basin shelf sediments (NE Mediterranean).* Mar. Pollut. Bull. 2013, **71**(1-2): p. 330-335

107. Kucuksezgin, F., Pazi, I. G., Tolga, L. *Marine organic pollutants of the Eastern Aegean: Aliphatic and polycyclic aromatic hydrocarbons in Candarli Gulf surficial sediments.* Mar. Pollut. Bull. 2012, 64(11): p. 2569-2575

108 Ozcan, S., Tor, A., Aydin, M. E. *Investigation on the Levels of Heavy Metals, Polycyclic Aromatic Hydrocarbons, and Polychlorinated Biphenyls in Sewage Sludge Samples and Ecotoxicological Testing.* CLEAN – Soil, Air, Wat., 2013, **41**(4): p. 411-418

109. Demir, V., Ergin, S. *Occurrence and Assessment of Chemical Contaminants in Drinking Water in Tunceli, Turkey.* J. Chem. 2013, Article Number: 238374

110. Gaga, E. O., Dogeroglu, T., Ozden, O. et al. *Evaluation of air quality by passive and active sampling in an urban city in Turkey: current status and spatial analysis of air pollution exposure.* Envir. Sci. Pollut. Res. **19**(8): p. 3579-3596.
111. Neser, G., Kontas, A., Unsalan, D. et al. *Polycyclic aromatic and aliphatic hydrocarbons pollution at the coast of Aliaga (Turkey) ship recycling zone.* Mar. Pollut. Bull. 2012, 64(5): p. 1055-1059.
112. Çok, İ., et al., *Analysis of Human Milk to Asses Exposure to PAHs ,PCBs and Organochlorine Pesticides in the Vicinity Mediterterranean City Mersin, Turkey.* Environ. Intern., 2012. **40**: p. 63-69.
113. Balkis, N., Aksu, A., Ersan, M. S. *Petroleum hydrocarbon contamination of the Southern Black Sea Shelf, Turkey.* Envir. Sci. Pollut. Res. **19**(2): p. 592-599.
114. Kaya, E., Dumanoglu, Y., Kara, M. et al. *Spatial and temporal variation and air-soil exchange of atmospheric PAHs and PCBs in an industrial region.* Atmos. Pollut. Res. **3**(4): p. 435-449.
115. Demircioglu, E., Sofuoglu, A., Odabasi, M. *Atmospheric Concentrations and Phase Partitioning of Polycyclic Aromatic Hydrocarbons in Izmir, Turkey.* CLEAN – Soil, Air, Wat. 2011, **39**(4): p. 319-327.
116. Demircioglu, E., Sofuoglu, A., Odabasi, M. *Particle-phase dry deposition and air-soil gas exchange of polycyclic aromatic hydrocarbons (PAHs) in Izmir, Turkey*. J. Haz. Mat. 2011. **186**(1): p. 328-335.
117. Odabasi, M., Bayram, A., Elbir, T. et al. *Electric Arc Furnaces for Steel-Making: Hot Spots for Persistent Organic Pollutants.* Envir. Sci. Technol. 2009, **43**(14): p. 5205-5211
118. Bozlaker, A., Muezzinoglu, A., Odabasi, M. *Atmospheric concentrations, dry deposition and air-soil exchange of polycyclic aromatic hydrocarbons (PAHs) in an industrial region in Turkey.* J. Haz. Mat. 2008, **153**(3): p. 1093-1102.
119. Odabasi, M., Cetin, E., Sofuoglu, A. *Determination of octanol-air partition coefficients and supercooled liquid vapor pressures of PAHs as a function of temperature: Application to gas-particle partitioning in an urban atmosphere.* Atmos. Envir. **40**(34): p. 6615-6625.
120. Vardar, N., Tasdemir, Y., Odabasi, M. et al. *Characterization of atmospheric concentrations and partitioning of PAHs in the Chicago atmosphere.* Sci. Total Environ. **327**(1-3): p. 163-174.
121. Vardar, N., Odabasi, M., Holsen, T. M. *Particulate dry deposition and overall deposition velocities of polycyclic aromatic hydrocarbons.* J. Environ. Engn. **128**(3): p. 269-274.
122. Sofuoglu, A., Odabasi, M., Tasdemir, Y. et al. *Temperature dependence of gas-phase polycyclic aromatic hydrocarbon and organochlorine pesticide concentrations in Chicago air.* Atmos. Environ. 2001, **35**(36): p. 6503-6510
123. Odabasi, M., Sofuoglu, A., Holsen, T. M. *Mass transfer coefficients for polycyclic aromatic hydrocarbons (PAHs) to the water surface sampler: comparison to modeled results.* Atmos. Environ. 2001, **35**(9): p. 1655-1662.
124. Odabasi, M., Sofuoglu, A., Vardar, N. et al. *Measurement of dry deposition and air-water exchange of polycyclic aromatic hydrocarbons with the water surface sampler.* Env. Sci. Technol. 1999, **33**(3): p. 426-434.

Annex VII: Overview of technical infrastructure for POPs assessment, measurement, analysis, alternatives and prevention measures, management, research and development - linkage to international programs and projects

The projects listed below contributed to build infrastructural and institutional capacity to meet the Turkey's liabilities and responsibilities to the Stockholm Convention on POPs. Turkey has conducted the following projects in regards to components within the scope of EU harmonization and technical assistance.

Table VII/1: Overview of projects within the scope of EU harmonisation and technical assistance

Project		
The overall objective	**The purpose of the project**	**Comments**
Twinning Project for Strengthening the Capacity of Turkey in the field of Special Waste Management [TR/2004/IB/EN/01]		
The project is to strengthen the capacity of the Ministry of Environment and Forests in the field of special waste management and noise management.	To establish the necessary system, institutional structure, the institutional capacity and the legal framework and to strengthen the regulatory cycle for implementation of the following set of EU Waste Directives in Turkey: Waste Catalogue (2000/532/EC), Waste Oil (75/439/EEC), PCB/PCT (96/59/EC), Used battery and accumulator (91/157/EEC and 98/101/EC), End of Life Vehicle (2000/53/EC).	With this project six EU directives related with special waste (includes the Directive 96/59/EEC on disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT)) were transposed, a special waste inventory was established, a training needs analysis was carried out and according to that gap analysis training programmes were composed and delivered to related staff of MoEU at central and local level. The directives also cover the elimination of POPs Wastes that are also refered in POPs Regulation. Therefore, implementation of these Directives will contribute the implementation of POPs Regulation.
Capacity building on the adoption and implementation of the IPPC (Integrated Pollution Prevention and Control) Directive in Turkey [MATRA-PSO]		
To achieve a high level of protection of the environment taken as a whole by introducing integrated prevention and control of pollution arising from the activities listed in Annex I of the IPPC Directive by the date of accession.	To build capacity and perform a legal and institutional analysis required for establishing a future IPPC implementation structure.	Within the framework of this project, the institutional framework and functions for the coordination and implementation of IPPC was defined. Legislative alignment and develop policy options for effective implementation of IPPC in Turkey. Determine the required technical, institutional and financial capacities for Competent Authorities for future IPPC implementation. Increase the institutional and technical capacity of all relevant stakeholders, especially the industry and the NGOs concerned and to designate Competent Authorities for IPPC permitting. The output of the project related with POPs Regulation is the understanding of POPs implementation stakeholders about BAT/BEP issues that are close related with the regulation. In order to minimize the emissions of POPs especially unintentional POPs BAT/BEP applications are necessary for the industry.
IPPC implementation in Turkey [MATRA-PSO]		
To achieve a high level of protection of the environment taken as a whole by introducing integrated prevention and control of pollution arising from the activities listed in Annex I of the IPPC Directive by the date of accession.	To establish the framework conditions to achieve reform of the administrative, legal and technical structures to implement integrated environmental permitting of IPPC installations in Turkey.	Within the framework of this project, legal and institutional analysis and the number of IPPC installations in Turkey are elaborated. The establishment of an action plan (including road map) for IPPC implementation in Turkey is prepared and training programme on IPPC permitting at selected IPPC pilot plants has been performed. Within the framework of these projects all the Turkish stakeholders (Ministries, the industrial sector and NGOs etc.) has been gathered together to understand the basis

Project		
The overall objective	**The purpose of the project**	**Comments**
		of the Directive and the permitting procedure and define the framework of the competence of other authorities. The same as previous project the output of the project related with POPs Regulation is the understanding of POPs implementation stakeholders about BAT/BEP issues that are close related with the regulation. This project increase the synergy between institutions that should implement the BAT/BEP documents in their area one of which is the minimization of POPs chemicals.
2008/01/EC Integrated Pollution Prevention and Control – IPPC [TR080204]		
To achieve a high level of protection of the environment by introducing integrated prevention and control of pollution.	To establish the framework conditions to achieve reform of the administrative, legal and technical structures to implement integrated environmental permitting of IPPC installations in Turkey by the end of the project.	With this project the institutional Framework and functions for the coordination and implementation of IPPC defined in detail. Legislative alignment achieved and policy options (strategy and timetable for the full implementation of the IPPC Directive) developed and agreed for effective implementation of IPPC in Turkey by the end of the Project. Required technical, institutional and financial capacities for Competent Authorities for future IPPC implementation have been determined at the end of the Project. Further, increase of the institutional and technical capacity of all relevant stakeholders, especially the industry concerned, the NGOs concerned and the designated Competent Authorities for IPPC permitting. The output of the project is the implementation of IPPC directive in Turkey that supports the full implementation of POPs Regulation due to the references in POPs Regulation to IPPC Directive.
TA for Control of Industrial Volatile Organic Compound Emissions [TR2009/327.01-02]		
To Control the Volatile Organic Compound (VOC) emissions to improve environmental quality in Turkey and to reduce or prevent the potential risks to human health and to prevent ground level ozone pollution.	To develop administrative and legal conditions and structures to harmonize and implement the three EU Volatile Organic Compound Directives (Storage-94/63/EC, Solvents-99/13/EC, and Paints-2004/42/EC).	With the project draft legal text and implementation plan was prepared. Administration and technical capacity to roll-out implementation plan was developed. The VOC directive covers also emission control of some of the POPs chemicals that means the implementation of the Directive will support the full implementation of POPs Regulation.
Capacity Building in the Field of Environment Project [TR0702.08]		
To facilitate transposition, implementation and enforcement of the EU environmental acquis thereby	To enhance environmental management of Turkey by strengthening the capacity of key environmental stakeholders	With this project, the institutional and technical capacities of the MoEU and other governmental institutions were strengthened through trainings and technical

Project		
The overall objective	**The purpose of the project**	**Comments**
accelerating Turkey's EU accession process in the field of environment.	in Turkey active in the field of promoting the implementation of the environmental acquis.	assistance in order to effectively transpose and implement the EU environmental acquis; and to successfully plan environmental investments through participatory processes. Significant impacts of implementation of specific EU environmental legislation on the Turkish economy and society were assessed (in general and also on the basis of the selected sectors). The RIAs and SIAs included in the project will be beneficial for this project in terms of the lessons learnt for conducting the impact analysis studies. The institutional capacity of local authorities on environmental planning and management and on the implementation of EU environmental acquis at the local level was improved. The technical expertise of the private sector and environmental NGOs were improved to facilitate the implementation of EU environmental acquis and to access and use of environmental information thereby public participation was increased in environmental decision-making with respect to EU accession.
Strengthening the Ministry of Health to Harmonise and Implement Legislation Project in the Field of Biocides and Water [TR0402.10]		
To strengthening the Ministry of Health to harmonise and implement legislation in the field of biocides (Biocidal Products Directive) and Water (for public health protection).	There are three purpose of the project for each component that are; C1. The strengthening of the institutional and administrative capacity on approximation and implementation of the Directive 98/8/EC on biocidal products. C2. Institutional and administrative capacity of the Ministry of Health to adopt and implement the EU Directives on Bathing Water (76/160/EEC), Drinking Water (98/83/EC) Mineral Waters (80/777/EEC). C3. Supply of equipment to improve the laboratory conditions to such a level that this will enable good coordination with member states including harmonised analytical methods in relation to the implementation of the Directive 98/8/EC on biocidal products, Directive 98/83/EC on drinking water, Directive 80/777/EEC on mineral waters and the Directive 76/160/EEC concerning the quality of bathing water.	With this project there are several achievements due to its multi-component structure that are; C1. Inventory report of the biocidal products on the Turkish market including a description of present authorisation procedures. Competent authorities agreed and designated including institutional, procedural and financial arrangements for the implementation procedures and a handbook outlining the above. Approved Action Plan for the introduction of the BPD identifying clear tasks and milestones. Biocidal Products Directive 98/8/EC transposed into Turkish national legislation. Trained staff and improved capacities to implement the Action Plan on national and regional level and administrative capacity in place for handling authorisation procedures of biocidal products to be placed on the Turkish market. An approved business plan for the Refik Saydam Hygiene Centre. This business plan will form the basis for future investments. Adequate laboratory facilities in place (and in the process of accreditation) to support implementation of the BPD in accordance with GLP (Good Laboratory Practice) C2. Institutional and procedural arrangements for the full implementation of the EU Directives on Bathing Water (76/160/EEC), Drinking Water (98/83/EC) and Mineral Waters (80/777/EEC) assessed, clarified and further needs identified (4th Quarter after start of the project) and trained staff. Quality of bottled water up to EU

Project		
The overall objective	**The purpose of the project**	**Comments**
		standards by end of 2006 with particular reference to both the water and the packaging. More comprehensive systems of data and information management and reporting arranged for implementation of the Directives on Bathing Water (76/160/EEC) and Drinking Water (98/83/EC) and trained staff as regards data and information management at central and provincial level. Protocols (standard operating procedures) developed or updated for monitoring, sampling and analysis in accordance with the Directives on Bathing Water (76/160/EEC) and Drinking Water (98/83/EC) and trained staff as regards monitoring, sampling and analysis at central and provincial level. National Guidelines agreed and adopted to deal with incidents posing unacceptable risks to Public Health as regards the Directive on Bathing Water (76/160/EEC) and the Directive on Drinking Water (98/83/EC) at the end of the project. Updated procedures and test methods for the approval of substances and materials in contact with water intended for human consumption as regards the Directive on Drinking Water (98/83/EC) at the end of the project. C3. The Refik Saydam Hygiene Centre, Ankara, adequately equipped for efficient analysis in accordance with EU Directives on Biocidal Products and Water for human consumption, mineral waters and bathing water quality by June 2006. Training in use of equipment provided. The MoH Provincial Public Health Laboratories sufficiently equipped and trained for monitoring and analysis of designated bathing waters by end of 2006. The MoH Provincial Directorates sufficiently trained for sampling of designated bathing waters by end of 2006. Furthermore, the outputs of the project will give synergy on this project specially the project groups and attendees of this project are similar with the POPs Project. Also the results of the project is also contributing the effective implementation of POPs Regulation.
Technical Assistance for Harmonisation of Regulation (EC) 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures in Turkey [ALTUN/TAHAR/TR0702.28-01/FWC/056] (SEI)		
to improve the protection of human health and environment as well as the free movement of substances, mixtures and articles by implementation of CLP Regulation in Turkey.	to develop administrative capacity, strengthen the capacities of other major stakeholders and to harmonise CLP Regulation.	With this project, “Draft By-law on the Classification, Labelling and Packaging of the Substances and Mixtures” and “Strategy and Implementation Plan” was prepared. Two technical training regarding the implementation of CLP Regulation for the all related stakeholders from the governmental institutions and industry was held. Technical assistance was taken in order to establish the Turkish National CLP Helpdesk. “Guidance on the Application of the CLP Criteria1” which was prepared

Project		
The overall objective	**The purpose of the project**	**Comments**
		by ECHA was translated to Turkish. The CLP Directive covers also classification of the POPs chemicals that are even banned or candidate to be banned which means the implementation of the Directive will support the full implementation of POPs Regulation.
Institution Building on Air Quality in Marmara [TR0702.07]		
To improve the environmental conditions in Turkey by implementation and enforcement of the EU environmental acquis in the frame of ambient air quality.	To establish the framework conditions for efficient, effective and transparent implementation of the Air Quality Framework Directive (AQFD) requirements in the Marmara Region which will serve as a model for Turkey to implement those requirements	With this project for the implementation of AQFD and daughter directives in a regional level, Regional Ambient Air Quality Monitoring System were established and operated. For the implementation of the AQFD and Daughters directives requirements, the development of the institutional and technical capacity was ensured. Awareness of priority groups and decision makers were raised. The AQFD covers monitoring of the Poly Aromatic Hydrocarbons (PAHs) that consists the unintential POPs. Therefore, implementation of Directive will support the effective implementation of POPs Regulation
Sound management of PCB in Turkey [UNEP/MAP]		
To protect human health and environment from adverse effects of PCBs.	To eliminate of PCB, establishment of PCB Inventory and capacity building, and Training and Public Awareness.	With this project, 800 tons of PCB was identified, analyzed and then eliminated. PCB inventory was established. Capacity building and public awareness were increased. According to the POPs Regulation PCBs have to be disposed until 2025 as indicated in the Stockholm Convention and this project will support the disposal of these chemicals. Therefore, implementation of this project will contribute the fulfilment of the obligation of POPs Regulation.
The REACH Chemicals Project [TR0802.02]		
To improve the protection of human health and environment in Turkey by implementation and enforcement of the specific EU legislation on chemicals.	To strengthen the existing capacity of the governmental institutions involved in implementation of the chemicals management legislation and establishing the necessary system, institutional structure and legal framework, and increasing the institutional capacity for the implementation of the REACH Regulation in Turkey.	At the end of the project; Required institutional arrangements for the implementation of REACH will be determined. Existing registration system and inventory system of chemicals will be improved. Draft legislation on REACH and guidelines in Turkish will be prepared. Awareness of major groups (manufacturers, importers, downstream users of chemicals) and decision makers will be raised. Impact analysis for the implementation of REACH will be made. At the end of the project there will be established a new chemical management system in Turkey and it will support the implementation of the POPs Regulation

Project		
The overall objective	**The purpose of the project**	**Comments**
		especially on placing out of banned POPs chemicals from the Turkish market.
Capacity Building on Water Quality Monitoring [TR2009/0327.02]		
To achieve a good environmental status for surface waters.	To strengthen Turkey's capacity to implement the EU Water Framework Directive (2000/60/EC-Art. 8/Annex 5)	With this project, the legal and institutional gap analyses are executed between Turkey and EU in terms of WFD requirements. Capacity building of related institutions is provided on water quality monitoring, analysis and assessment of surface water bodies in line with WFD. Pilot implementation is executed related to monitoring of surface water bodies for selected basins. The EU Water Framework Directive also covers monitoring of POPs that are released to aquatic systems. Therefore, implementation of such Directive will support the full implementation of POPs Regulation.
Technical Assistance in the Field of Chemicals (TeACH) [EUROPEAID/120220/D/SV/TR]		
To improve the environmental conditions in Turkey by implementation and enforcement of the EU environmental acquis.	To establish the necessary system, institutional structure, the institutional capacity and the legal framework and to strengthen the regulatory cycle for implementation of the two key EU Chemicals Directives in Turkey (67/548/EEC and 1999/45/EEC Directives) and their two daughter Directives (91/155/EEC and 93/67/EEC).	With this project, Competent authority(ies) designated including Institutional and procedural arrangements for the implementation and control to implement the key EU Chemical Directives (Council Directive 1967/548/EEC; Directive 1999/45/EEC; Directive 1993/67/EEC; Directive 91/155/EEC). A new registration system and inventory system of chemicals and, first chemical substances inventory supported with a data base. Full operational National Chemicals Monitoring Database. Amended Chemicals Sector Strategy in the frame of the 4 EU Chemicals Directives. Increased administrative capacity to transpose and implement the Chemicals Directives. Improved understanding of the implementation requirements spread over the chemicals sector and regional and local authorities in Turkey. Draft legal framework for the transposition and implementation of the Chemicals Directives. One of the output of the project was draft by-law on restriction of dangerous chemicals which has been published and also covers the banning of some POPs. Therefore, the output of this project is contributing the effective implementation of POPs Regulation.
Practical implementation of the Council Regulation No. 1907/2006/EC Reach Regulation and 1272/2008/EC CLP Regulation and their effects on Turkish Chemical Industry (MATRA)		
To support the chemicals management structure of Turkey which will parallel support the full implementation of POPs Regulation.	To help the actors of related public and trade associations/institutions to get necessary training for their stuff in order to assist companies all through the value chain to prepare and implement REACH and CLP- Regulation by	With this project, by bilateral cooperation between Turkish instutions and Dutch counterparts on the implementation of REACH and CLP through training programme including the activities given in the next coulumn so as to build the capacity in related actors. Training of trainers by exchange of experience between Turkish and

Project		
The overall objective	**The purpose of the project**	**Comments**
	building up sub-industrial helpdesks that is connected to main helpdesk and by increasing the level of knowledge among small and medium enterprises and companies.	Dutch interested parties. Similar to the structure of REHCORN, under the coordination of İMMİB's REACH and CLP Helpdesk 7(seven) Industry Help Desks will be established where the chemical sector is clustered (İstanbul, Kocaeli, İzmir, Ankara, Bursa, Konya, Mersin).
Enabling activities to facilitate early action on the implementation of the Stockholm Convention on Persistent Organic Pollutants (POPs) in Turkey [GEF/TUR/03/008]		
To protect human health and environment from adverse effects of Persistent Organic Pollutants.	To strengthen national capacity and the enhance knowledge and understanding amongst decision-makers, managers, the industry, NGOs and the public at large on POPs to develop and formulate a National Implementation Plan (NIP).	With this project, the National Implementation Plan was developed for Turkey including priority actions of the country for sound management of POPs. In POPs Project, the NIP for Stockholm Convention will be used to be updated in order to generate NIP for POPs Regulation. Also the participants of this project will be very similar to POPs project, therefore the synergy in this project will be used in POPs Project.
Establishment of an Environmental Information Exchange Network (TEIEN) in Turkey [TR0603.12]		
To strengthen National Policy Formulation, Planning, Environmental Management, Natural Resource Management, Regulatory Frameworks and Environmental Monitoring Capabilities through the regular exchange of environmental information; thereby implementation of environmental acquis will be accelerated in Turkey.	To establish and further development of Turkish Environmental Information Exchange Network to improve the integration of environmental concerns into sectoral policies, plans and programmes.	With this project, The National Exchange Network is established which enhances inter-institutional collaboration in the environment sector and supports national policy and planning processes. The relevant national institutions together with MoEU enhance their capability of accessing, querying, reporting, visualising the environmental data in a timely and consistent manner. The capacity of the members of the Turkish EIONET structure and NFP team is enhanced. The environmental monitoring and inspection capability of the TEIEN will be useful for effective implementation of POPs Regulation in Turkey. The output of the project will contribute the management of POPs chemicals effectively.
Technical Assistance for Improving Emissions Control in Turkey [EuropeAid/128897/D/SER/TR]		
To improve the environmental conditions in Turkey by implementation and enforcement of the EU environmental acquis in the frame of ambient air quality.	To establish the necessary capacity within Ministry of Environment and Forestry to transpose and implement National Emission Ceilings Directive (2001/81/EC) in Turkey.	With this project, Legal transposition of National Emission Ceilings Directive was fulfilled. National emission inventory and emission projections with various scenarios for four pollutants (SO_2, NO_x, VOC, NH_3) were developed. Regulatory Impact assessments for the implementation of different NE Ceilings were done. An agreed long-term comprehensive strategy to improve the air quality for pollutants defined in NEC directive was developed. Required institutional structure, technical capacity and procedural arrangements defined and developed to implement NEC Directive.

Project		
The overall objective	**The purpose of the project**	**Comments**
		Some of unintentional POPs and candidate POPs for POPs Regulation are the area of interest this Directive. Therefore, implementation of such legislation will contribute the full implementation of POPs Regulation.
Capacity Building on E-PRTR in Turkey		
To improve environmental conditions, monitoring and registering industrial pollution in Turkey.	The transposition of the Regulation (EC) No 166/2006 on European Pollutant Release and Transfer Register and strengthening institutional and technical capacity on the implementation of E-PRTR.	With this project, National E-PRTR System will be established. Institutional, individual and technical capacities for Competent Authorities and priority groups will be increased. Awareness of priority groups and decision makers will be raised. The inventory and monitoring of the POPs chemicals are referred to be handled with respect to PRTR Regulation as referred in POPs Regulation. Therefore, the inventory and monitoring activities of POPs Project are removed except the inventory of unintentional POPs that are calculated by using a model called standard toolkit.
Technical Assistance for Implementation of Export and Import of Dangerous Chemicals Regulation		
To protect human health and the environment from potential harm of certain hazardous chemicals subjected to international trade by promoting shared responsibility and cooperative efforts in the international movement of hazardous chemicals with contributing the environmentally sound management, use and trade of hazardous chemicals concerned.	To establish the necessary capacity for effective implementation of EU Regulation no 689/2008/EC on Export and Import of Dangerous Chemicals in Turkey at national level by institutional arrangement, accession to relevant EU database, capacity building and public awareness activities.	With this project, required institutional arrangement for the implementation of EU Regulation on Export and Import of Dangerous Chemicals will be determined. The institutional capacity for effective implementation of the Rotterdam Convention will be enhanced and requirements will be fulfilled to implement the EU Regulation on Export and Import of Dangerous Chemicals. Requirements for full accessing and using the European Database for Export and Import of Dangerous Chemicals (EDEXIM) will be completed by Turkish Side. The institutional capacity for effective control of import and export of dangerous chemicals in customs will be enhanced. The outputs of this project will contribute the effective control of international trade of dangerous substances that also consists some POPs Chemicals. Therefore, implementation of this directive will support the effective implementation of POPs Regulation.
Project on the Control of Hazardous Material Pollution		
To prepare the hazardous material inventory and priorization studies has been carried out by determination of their production, use and import amounts depending on theproperties such as toxicity, bioaccumulation, and		Project is done by the Ministry of Forestry and Water Affairs between 2011-2013. Monitoring studies that has been carried out for 1 year period aimed to determine the levels of substances listed in specific pollutants, including some of the Persistent Organic Pollutants, in thedomestic and industrial discharges and also in water resources in the pilot basins. By this monitoring study environmental quality standards

Project		
The overall objective	**The purpose of the project**	**Comments**
persistency.		representing receiving body standards for spesific pollutants are designated and revealed a methodology which can be implemented during the transition from environmental standards to discharge standards. On the other hand; a web based geographical information system has been developed " Hazardous Material Information System (TEMBIS)" which all information gathered can be integrated and is in service at "tembis.ormansu.gov.tr" address. This project will be a big step in the control of the POPs related pollution in water resources in Turkey.
Project on Detection of Hazardous Materials in Coast and Transition Waters and Coast Dynamics Project		
The aim of the project is to detect the potential hazardous substances in coastal and transitional waters for preparation of industrial hazardous substancesl inventory, identification of specific pollutants and determination of environmental quality standards. Studies are carried out in selected pilot areas (Izmir- Nemrut and Aliaga Gulfs, Hatay- Iskenderun Gulf, Izmit Gulf and Samsun Harbour) between the years 2012-2014. The project is carried out by Ministry of Forestry and Water Affairs. ,		Some POPs are also listed under the spesific pollutants and their levels are determined under the project scope. Identified pollutants are being monitored in coastal and transitional waters, domestic and industrial waste waters. On the other hand, studieshave been conducted to present the ecological structre and coast dynamics. The project will be a big step to control POPs related pollution in Turkey's water resources. Another benefit of the project is building - laboratory analysis capacity for for detecting POPs and other micro pollutants in water in TUBITAK-MAM Environment and Cleaner Production Institute where the analysis are done.
Project on Determination of Water Pollution caused by Use of Plant Protection Products and Determining Environmental Quality Standards for Substances or Substance Groups		
The aim of the project carried out by Ministry of Forestry and Water Affairs in Firat-Dicle, Seyhan- Ceyhan and Buyuk Menderes basins and Amasya, Sakarya and Manisa between 2012 and 2014; to detect the water pollution caused by the use of Plant Protection Products and to determine the environmental quality standards of these chemicals.		Inventory studies were conducted to determine the amount of the plant protection products used in the past and present and a Active Material Comparison List was formed including POPs pesticides. Monitoring studies is carried out to determine the levels of identified materials in the water resources. Studies are still continiung toderive Environmental Quality Standards for the identified materials. The project will be a big step to control the pollution in water resources caused by the POPs related chemicals. Another benefit of the project is to build capacity to measure POPs pesticides in water and sediment in the TUBITAK_MAM Environment and Cleaner Production Laboratories. .Laboratories.
Review and Update the National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants		
The aim is to update and review the National Implementation completed and submited to Stockholm Secreteriat in 2010 including the new chemicals added to		The project started at August 2012 and planned as 1 year. Developing Coordination mechanism, Creating present and new chemical inventories, review of NIP, determination of priorization from the point of National Capacity and new POPs,

Project		
The overall objective	**The purpose of the project**	**Comments**
the Convention Annex.		evaluation and update of NIP will be done by the project.

Project Grant on POPs Legacy Elimination and POPs Release Reduction Project

A detailed design and planning of the proposed project will require a preparation stage that would be financed by GEF funded Project Preparation Grant for The Elimination of POPs releases and reduction of Unintentional POPs Releases Project..

The Project Preparation Grant Project will be carried out for 18 months andeffective since May 2013. Within the scope of the project grant, determination of a framework for sound management and elimination of POPs pesticide and PCB stockpiles, - detailed scoping of the development of PCB management plan process including the framework for supporting infrastructure, determination of a framework for National Action Plan concerning unintentionally produced POPs and for Technical Assistance on BAT/BEP, determination of a framework on the management of contaminated sites,an analysis for reguirements concerning legalislative and regulatory framework and preparation of the Full-Sized Project document will be carried out.

Annex VIII: Accredited Laboratories that can carry out POPs analysis

Chemical Name/Group	Accredited Laboratories	Location
Pesticides	ARTEK MÜHENDİSLİK Çevre Ölçüm ve Danışmanlık Hizmetleri Tic. A. Ş.	İstanbul
	NEN Mühendislik ve Laboratuvar Hiz. Tic. Ltd. Şti.	Ankara
	GIDA, TARIM VE HAYVANCILIK BAKANLIĞI Ankara Gıda Kontrol Laboratuvar Müdürlüğü	Ankara
	GIDA TARIM VE HAYVANCILIK BAKANLIĞI İstanbul Gıda Kontrol Laboratuvar Müdürlüğü	İstanbul
	GIDA TARIM VE HAYVANCILIK BAKANLIĞI İzmir Gıda Kontrol Laboratuvar Müdürlüğü	İzmir
	GIDA, TARIM VE HAYVANCILIK BAKANLIĞI Gıda Ve Yem Kontrol Merkez Araştırma Enstitüsü Müdürlüğü	Bursa
	AYTB AYDIN LABORATUAR HİZMETLERİ Kimyasal Maddeler İle Lab. Malz. San. Ve Tic. A. Ş.	Aydın
	ALKA İNŞAAT TEKSTİL ELEKTRİK ÇEVRE SAN. VE TİC. LTD. ŞTİ. Alka Laboratuvarları Merkez Şubesi	İstanbul
	GIDA TARIM VE HAYVANCILIK BAKANLIĞI Mersin Gıda Kontrol Laboratuvar Müdürlüğü	Mersin
	ÇINAR ÇEVRE LABORATUVARI A.Ş. Çınar Çevre Laboratuvarı	Ankara
	EGE ÜNİVERSİTESİ ARGEFAR İlaç Gel. Ve Far. Araş. Uyg. Merk. Çev. Ve Gıd. Anal. Lab.	İzmir
	EGE CHELAB Gıda Ve Endüstriyel Analiz Laboratuvarı A. Ş.	İzmir
	GIDA, TARIM VE HAYVANCILIK BAKANLIĞI Konya Gıda Kontrol Laboratuvar Müdürlüğü	Konya
	GIDA, TARIM VE HAYVANCILIK BAKANLIĞI Antalya Gıda Kontrol Laboratuvar Müdürlüğü	Antalya
	GIDA, TARIM VE HAYVANCILIK BAKANLIĞI Gaziantep Gıda Kontrol Laboratuvar Müdürlüğü	Gaziantep
	DOKUZ EYLÜL ÜNİVERSİTESİ MÜHENDİSLİK FAKÜLTESİ Çevre Mühendisliği Bölümü Ölçüm Laboratuvarları	İzmir
	GIDA, TARIM VE HAYVANCILIK BAKANLIĞI Kocaeli Gıda Kontrol Laboratuvar Müdürlüğü	Kocaeli
	EKOSİSTEM Analiz Proje Dan. Hiz. Peyzaj Müh. İnş. Çevre Lab. Taah. Tic. Ltd. Şti.	Adana
	ESÇEM Enerji Sistemleri Ve Çevre Etüd Merkezi San. Ve Tic. Ltd. Şti.	Kocaeli
	GIDA, TARIM VE HAYVANCILIK BAKANLIĞI Adana Gıda Kontrol Laboratuvar Müdürlüğü	Adana

	T.C. GIDA, TARIM VE HAYVANCILIK BAKANLIĞI Pendik Veteriner Kontrol Ve Araştırma Enstitüsü Müdürlüğü	İstanbul
	PİA FRUCHT GIDA LOJİSTİK VE DIŞ TİCARET LİMİTED ŞİRKETİ Özel Pia Gıda Kontrol Laboratuvarı	Manisa
	AEM Çevre Laboratuvar Analiz Tic. A. Ş.	İstanbul
	MRL Merkez Kalıntı Araştırma Laboratuarı A. Ş.	Mersin
	GALAB ANTALYA KUMLUCA Lab. Hiz. Tic. Ltd. Şti.	Antalya
	SASKİ GENEL MÜDÜRLÜĞÜ Sakarya Su Ve Kanalizasyon İdaresi Atıksu Laboratuvarı	Sakarya
	T.C. SAĞLIK BAKANLIĞI ERZURUM HALK SAĞLIĞI MÜDÜRLÜĞÜ Halk Sağlığı Laboratuvarı	Erzurum
	T.C GIDA, TARIM VE HAYVANCILIK BAKANLIĞI Hatay Gıda Kontrol Laboratuvar Müdürlüğü	Hatay
	YEŞİL BEYAZ Kalite Ve Çevre Analiz Laboratuarı San. Tic. Ltd. Şti.	Tekirdağ
	GIDA, TARIM VE HAYVANCILIK BAKANLIĞI Isparta Gıda Kontrol Laboratuvar Müdürlüğü	Isparta
	İZMİR HALK SAĞLIĞI LABORATUARI İzmir Halk Sağlığı Laboratuarı	İzmir
	GIDA, TARIM VE HAYVANCILIK BAKANLIĞI Çanakkale Gıda Kontrol Laboratuvar Müdürlüğü	Çanakkale
	PROFESYONEL Çevre Analiz Laboratuvar Gıda Tarımsal Ve Kalibrasyon Hiz. San. Ve Tic. Ltd. Şti.	Antalya
	OLUŞ ÖZEL Gıda Analizleri Ve Lab. Hiz. Tic. Ltd. Şti.	Antalya
	BAREM ÇEVRE Laboratuvar Hizmetleri San. Tic. Ltd. Şti.	Kocaeli
	ÖZEL MSM (MERSİN SGS) Gıda Kontrol Laboratuvarı Dan. Hiz. Tic. A. Ş.	Mersin
	ÇEVRE ENDÜSTRİYEL Analiz Laboratuvar Hizmetleri Tic. A.ş.	İstanbul
	DÜZEN NORWEST Çevre, Gıda Ve Vet. Sğl. Hiz. Eğt. Dnş. Tic. A.ş.	Ankara
	TÜBİTAK - MAM Gıda Enstitüsü	Kocaeli
	UL VS Laboratuvar Hizmetleri A. Ş.	İstanbul
	AGRİOLABEN Gıda Ve Zirai Laboratuvar Hizmetleri San. Tic. Ltd. Şti.	Antalya
	T.C. SAĞLIK BAKANLIĞI BURSA HALK SAĞLIĞI MÜDÜRLÜĞÜ Halk Sağlığı Laboratuvarı	Bursa
	AİR ALAŞEHİR Analytik Özel Gıda Kontrol Laboratuvarı	Manisa
	KKTC SAĞLIK BAKANLIĞI Devlet Laboratuvarı Dairesi	Lefkoşa
	PRONİTRON ANALİTİK CİHAZLAR SAN. TİC. LTD. ŞTİ. Fethiye Eşen Şubesi - Nitrolab Özel Gıda Kontrol Laboratuvarı	Muğla
	MSA Tarımsal Analiz Laboratuvarı Tarım Gıda İnş. San. Tic. Ltd. Şti	Antalya
	GIDA, TARIM VE HAYVANCILIK BAKANLIĞI Ulusal Gıda Referans Laboratuvar Müdürlüğü	Ankara
	A&G PUR ANALİZ Laboratuvar Hizmetleri Ticaret A. Ş.	İzmir

	NANOLAB Laboratuvar Hizmetleri Kimya Gıda Dan. Çevre Eğitim San. Ve Tic. Ltd. Şti.	İstanbul
	EDGE GIDA YEM ÇEVRE SAĞLIĞI ANALİZ VE LABORATUVAR AR-GE VE DANIŞMANLIK HİZ. SAN. VE TİC. LTD.ŞTİ. Özel Gıda Kontrol Laboratuvarı	İzmir
	INTERTEK TEST HİZMETLERİ A.Ş. Manisa Özel Gıda Kontrol Laboratuarı	Manisa
	STA KALİTE KONTROL VE GIDA LAB.SAN.TİC.AŞ. Sta Kalite Kontrol Ve Gıda Lab. San. Tic. A.ş	Mersin
	ÖZEL HATAY Gıda Kontrol Laboratuvarları Ve Danışmanlık Hizmetleri Tic. Ltd. Şti.	Hatay
	DEPPO LOJ.OR.TAR.LAB.HİZ.TAŞ.GIDA SU ÜRÜ. MAD. MET. PET. KİM. SAN.TİC. A.Ş. Bornova Şubesi 2	İzmir
	ALFA Özel Gıda Kontrol Su Yaprak Toprak Analiz Laboratuvarları Dan. Hiz. Tic. San. Ltd. Şti.	Antalya
	ALAŞEHİR TİCARET BORSASI Vali Celalettin Güvenç Toprak, Yaprak Ve Su Laboratuvarları Ltd. Şti. Atb Özel Gıda Kontrol Laboratuvarı	Manisa
	OLUŞ ÖZEL GIDA ANALİZ VE LAB. HİZ. TİC. LTD. ŞTİ. - MERSİN ŞUBESİ Ballab Özel Gıda Laboratuvarı	Mersin
	SGS Özel Gıda Kontrol Laboratuvarı	İstanbul
	UNİLAB KALİTE KONTROL GIDA LABORATUVARI SAN. VE TİC. LTD.ŞTİ. Unilab Kalite Kontrol Gıda Laboratuvarı San. Ve Tic. Ltd. Şti.	Mersin
HBB	BV CPS Test Laboratuvarları Ltd. Şti.	İstanbul
	SGS Supervise Gözetme Etüd Kontrol Servisleri A. Ş. Gıda Dışı Tüketici Ürünleri Test Lab.	İstanbul
PCBs	BURSA ORGANİZE SANAYİ BÖLGESİ MÜDÜRLÜĞÜ Bursa Çevre Merkezi Laboratuvarı	Bursa
	ARTEK MÜHENDİSLİK Çevre Ölçüm Ve Danışmanlık Hizmetleri Tic. A.Ş.	İstanbul
	ORTA DOĞU TEKNİK ÜNİVERSİTESİ P A L - Petrol Araştırma Merkezi	Ankara
	NEN Mühendislik Ve Laboratuvar Hiz. Tic. Ltd. Şti.	Ankara
	ALKA İNŞAAT TEKSTİL ELEKTRİK ÇEVRE SAN. VE TİC. LTD. ŞTİ. Alka Laboratuvarları Merkez Şubesi	İstanbul
	ÇINAR ÇEVRE LABORATUVARI A.Ş. Çınar Çevre Laboratuvarı	Ankara
	EGE ÜNİVERSİTESİ ARGEFAR İlaç Gel. Ve Far. Araş. Uyg. Merk. Çev. Ve Gıd. Anal. Lab.	İzmir
	T.C. GIDA TARIM VE HAYVANCILIK BAKANLIĞI Etlik Veteriner Kontrol Merkez Araştırma Enstitüsü Müdürlüğü	Ankara
	DOKAY Mühendislik Danışmanlık Ltd. Şti. Çevre Laboratuvarı	Ankara
	DOKUZ EYLÜL ÜNİVERSİTESİ MÜHENDİSLİK FAKÜLTESİ Çevre Mühendisliği Bölümü Ölçüm Laboratuvarları	İzmir
	ASO-KOSGEB Çevre Laboratuvarı	Ankara
	İSTANBUL BÜYÜKŞEHİR BELEDİYESİ ÇEVRE KORUMA MÜDÜRLÜĞÜ Çevre Laboratuvarları	İstanbul
	EKOSİSTEM Analiz Proje Dan. Hiz. Peyzaj Müh. İnş. Çevre Lab. Taah. Tic. Ltd. Şti.	Adana
	ESÇEM Enerji Sistemleri Ve Çevre Etüd Merkezi San. Ve Tic. Ltd. Şti.	Kocaeli

	AEM Çevre Laboratuvar Analiz Tic. A. Ş.	İstanbul
	YEŞİL BEYAZ Kalite Ve Çevre Analiz Laboratuarı San. Tic. Ltd. Şti.	Tekirdağ
	T.C. ÇEVRE VE ŞEHİRCİLİK BAKANLIĞI ÇEVRE YÖNETİMİ GN. MD. LABORATUVAR, ÖLÇÜM VE İZLEME DAİRE BŞK. Çevre Referans Laboratuvarı Şube Md.	Ankara
	MMoH ANKARA KALİTE YÖNETİM BÖLGE BAŞK. Akaryakıt, Madeni Ve Atık Yağ Lab. Müd.	Ankara
	BAREM ÇEVRE Laboratuvar Hizmetleri San. Tic. Ltd. Şti.	Kocaeli
	AKÇANSA Çimento Sanayi Ve Ticaret A. Ş.	İstanbul
	ÇEVRE ENDÜSTRİYEL Analiz Laboratuvar Hizmetleri Tic. A.ş.	İstanbul
	DÜZEN NORWEST Çevre, Gıda Ve Vet. Sğl. Hiz. Eğt. Dnş. Tic. A.ş.	Ankara
	TÜBİTAK - MAM Gıda Enstitüsü	Kocaeli
	TÜBİTAK MARMARA ARAŞTIRMA MERKEZİ Çevre Ve Temiz Üretim Enstitüsü	Kocaeli
	ATMOSFER Gıda Turizm Tarım Laboratuvar Danışmanlık San. Ve Tic. Ltd. Şti	Antalya
	İZAYDAŞ İzmit Atık Ve Artıkları Arıtma Yakma Ve Değerlendirme A. Ş.	Kocaeli
	MESS Mess Entegre Geri Kazanım Ve Enerji San. Tic. A.ş.	İstanbul
	TÜBİTAK BUTAL Tübitak Bursa Test Ve Analiz Laboratuvarı	Bursa
	AST LABORATUVAR HİZMETLERİ Ast Laboratuvar Hizmetleri Ve Danışmanlık Tic. A.ş.	İstanbul
	ENGİN Geri Kazanım Tesisleri Petrol Ürünleri Ltd. Şti.	Ankara
	SGS Supervise Gözetme Etüd Kontrol Servisleri A. Ş. Gıda Dışı Tüketici Ürünleri Test Lab.	İstanbul
	BV CPS Test Laboratuvarları Ltd. Şti.	İstanbul
PBDEs	SGS Supervise Gözetme Etüd Kontrol Servisleri A. Ş. Gıda Dışı Tüketici Ürünleri Test Lab.	İstanbul
	UL VS Laboratuvar Hizmetleri A. Ş.	İstanbul
PFOS	TÜBİTAK MARMARA ARAŞTIRMA MERKEZİ Çevre Ve Temiz Üretim Enstitüsü	Kocaeli
PCDDs/Fs	A&G PUR ANALİZ Laboratuvar Hizmetleri Ticaret A. Ş.	İzmir
	TÜRKİYE ÇİMENTO MÜSTAHSİLLERİ BİRLİĞİ Kalite Kontrol Bağımsız Deney Laboratuvarları	Ankara

Source: Acredited Institutions Database, TÜRKAK, 2014.

Annex IX: List of Stakeholders

1. Ministry of Environment and Urbanization
2. Ministry of Development
3. Ministry of Energy and Natural Resources
4. Turkish Electricity Distribution Inc. (TEDAŞ)
5. Turkish Electricity Transmission Inc. (TEİAŞ)
6. Turkish Electricity Production Inc (EÜAŞ)
7. Ministry of Science Industry and Technology
8. Ministry of Economics
9. Ministry of Health
10. Ministry of Food Agriculture and Livestock
11. Turkish Cement Manufacturers Union
12. Ministry of Customs and Trade
13. Turkish Statistics Institute (TURKSTAT)
14. Ministry of National Education
15. Ministry of Labour and Social Security
16. Ministry of Transportation, Maritime Affairs and Communications

17. Ministry of Forestry and Water Affairs

Annex X: GAP analysis

1. Introduction

This report on the Legal GAP Analysis of Persistent Organic Pollutants (POPs), is provided for the Project on Technical Assistance for Implementation of the Persistent Organic Pollutants Regulation, TR2010/0327.03-01/001 - EuropeAid/132428/D/SER/TR, whose main focus is to strengthen the capacity to adequately cope with managing Turkey’s priority on POPs related issues in line with sustainable development.

This document determines the legal approach on the existing legislation related with POPs in Turkey and European Union POPs Regulation

The purpose of this Report will be to determine fundamental legal issues and provide a succinct overview of the most significant legislative gaps in legislation on POPs in Turkey in comparison to the existing POPs EU acquis.

The comments received from the stakeholders during various missions for the Project are also incorporated to the report.

2. Objective for the Legal Framework Review

The legal review of the current regulations and laws governing of POPs chemicals has been conducted with line with the specific objectives identified below:

a. To confirm the mutual (consistent) provisions in the current environmental regulations of Turkish and EU covering POPs chemicals,
b. To determine inconsistent provisions of Turkish and EU legislation on the POPs chemicals that might be eliminated or improved in line with EU legislation,
c. To identify the gaps of the Turkish and EU legislation on POPs chemicals.

This Legal GAP Analysis Report will:

- be the constituent for the new legislation on POPs that will be prepared in line with the requirements of EU legislation on POPs chemicals.
- provide recommendations where appropriate, to be used in drafting the new legislation on POPs.

The review has been carried out by the legal expert of the Project who is specialized in environmental and chemical legislation.

3. Documents Reviewed During the Process

3A. The following documents were reviewed:

EU LEGISLATION

- Stockholm Convention on Persistent Organic Pollutants
- Basel Convention on the Control of Trans-boundary Movement of Hazardous Wastes
- Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade.
- Regulation (EC) No 850/2004 of the European Parliament and Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EC
- Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (By-law transposing REACH is prepared but not in force).
- Regulation (EC) No 689/2008 of the European Parliament and Council of 17 June 2008 concerning the export and import of dangerous chemicals (PIC Regulation)
- Council Directive 96/59/EC of 16 September 1996 on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT is transposed to our legislation as By-law on Control of PCB and PCTs dated 27/12/2007 and numbered 26739.
- Directive 96/61/EC concerning integrated pollution prevention and control (the IPPC Directive)
- Directive 2000/76/EC on the incineration of waste is transposed to our legislation as By-law on Incineration of waste dated 06/10/2010 and numbered 27721.
- Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)
- Regulation (EC) No 528/2012 concerning the making available on the market and use of biocidal products replacing Directive 98/8/EC concerning the placing of biocidal products on the market. Regulation (EC) No 334/2014 amending Regulation (EC) No 528/2012 concerning the making available on the market and use of biocidal products, with regard to certain conditions for access to the market. According to new Regulation treated articles should not be placed on the EU market

unless all active substances contained in the biocidal products with which they were treated or which they incorporate are approved for use in Biocidal Product Regulation.

TURKISH LEGISLATION

Legislation of MoEU

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

Legislation of MoE

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

The legislation of MoH

- Cosmetic By-law published in the Official Journal dated 23.05.2005, No. 25823
- By-law on Biocidal Products published in the Official Journal dated 31.12.2009, No. 27449 and amendment to By-law on Biocidal Products published in the Official Journal dated 12.03.2014, No. 28939.

Legislation of MoFAL

- Law on Veterinary Services, Plant Health, Food and Feed published in the Official Journal dated 11.06.2012, No. 5996
- By-law on Control of Pesticides published in the Official Journal dated 20.05.2011, No. 27939 (Banned Pesticides Directive 79/117/EEC)
- By-law on the Certification of Pesticides published in the Official Journal dated 25.03.2011, No. 27885 (Pesticide Authorisation Directive 91/414/EEC)

- By-law on Sale and Storage of Pesticides published in the Official Journal dated dated 10.03.2011, No. 27870
- Turkish Food Codex By-law on Contaminants published in the Official Journal dated 29.12.2011, No. 28157

Legislation of MLSS

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

The legislation of MoFWA

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

3B. Relavant EU Legislation on POPs and Their Relation with Regulation on POPs

- REACH Regulation contains provisions specifying how substances should be assessed with regard to their POP characteristics. Under REACH, the production and use of substances exhibiting POP can be prevented and new POP candidates can be identified.
- PIC Regulation prohibits the export of 10 out of the 22+1 substances currently listed in the Stockholm Convention.
- PCB/PCT Directive aims to completely dispose of PCBs and equipment containing PCBs as soon as possible and equipment with PCB volumes of more than 5 litres before the end of 2010. It also sets requirements for the environmentally sound disposal of PCBs.
- IPPC Directive lays down control measures to reduce emissions of unintentionally produced POPs by covering the major industrial stationary sources of these POPs.
- Directive 2000/76/EC on the incineration of waste covers all waste incineration facilities that are a very important source of POPs by-products. The Directive sets strict limits for emission rates of dioxins /furans in the air.
- Regulation (EC) No 528/2012 concerning the making available on the market and use of biocidal products contains provisions about deliberately manufactured POPs that are placed on the market.

3C. Relavant Turkish Current Legislation on POPs and Their Relation with Regulation on POPs

- Environmental Law defines hazardous waste, sets principles for the manufacturing, use, storage, transportation, import and export of hazardous chemicals and management of hazardous wastes by referring to the related regulations. Moreover, it is stated that Ministry of Economy can prohibit or restrict the import of certain chemicals, products and wastes by consulting the Ministry of Environment and Urbanization. The law appoints administrative fines for the case of violation of the provisions.
- Law on the Approval of Ratification of the Stockholm Convention states that the ratification of Stockholm Convention by Turkey was approved.
- By-law on Control of PCB and PCTs sets methods and principles of disposal of PCB containing equipments and prohibits the production and import of PCBs
- By-law on Inventory and Control of Chemicals gathers and presents data on production and import of chemicals and control of the associated risk caused by chemicals
- By-law on Classification, Packaging and Labeling of Dangerous Substances and Preparations is about the management and control of classification, packaging and labeling of hazardous substances on the market with the aim of ensuring the protection of environment and human health and establishment of "Chemicals Advisory Board" to follow up the implementation of the by-law

- By-law on Compilation and Distribution of Safety Data Sheets for Hazardous Substances and Preparations sets the principles of compilation and distribution of material safety data sheets to protect the environment and human health
- Restriction of Manufacturing, Placing on the Market and Use of Certain Hazardous Substances, Preparations and Articles Restricts and prohibits the production, use and placing on the market of PCBs and PBBs
- Notification on Auditing of Import of Chemicals that are Controlled for Environmental Protection the import of chemicals listed in Annex II of the notification including PCBs and PBBs is banned.
- By-law on Control of Hazardous Wastes basic principles are determined on sites contaminated with POPs
- By-law on Control of Waste Oils Limiting the amount of PCB in the waste oil, prevention of firing of these oils and disposal of the oil in an environmentally sound manner
- By-Law on Control of Waste Electrical and Electronic Equipments Statement of methods and principles of disposal of the waste electric and electronic equipment containing PCB, PBB and PBDEs and ban the use of PBDE and PBBs in electric and electronic articles
- By-law on the General Principles of Waste Management States the basic principles of management of waste contaminated by POPs in a cradle to grave approach
- By-law on Landfill of Wastes Regulates the landfilling of PCB containing waste
- By-law on the Incineration of Wastes States and regulates the basic principles of incineration of hazardous waste such as PCB
- By-law on Control of Pollution Caused by Dangerous Substances in Aquatic Environment Determination of water pollution caused directly by POPs or POPs contaminated waste and its reduction
- By-law on Control of Soil Pollution and Sites Contaminated by Point Sources States the basic principles and methodologies to determine the possibly contaminated or contaminated sites, cleaning methodologies and monitoring of the sites in a sustainable manner.
- By-law on Control of Air Pollution Arising from Industrial Facilities States the emission limits of PCDD/F and PCB from various industrial applications along with other control of other air pollutants
- Law on Veterinary Services, Plant Health, Food and Feed Sets forth the principles of production, import, use, packaging, labeling, transport, storage, certified or non-certified sale, certification, control and supply of pesticides and provides the legal basis for the relevant by-laws
- By-law on Control of Pesticides Banning or phasing out of the pesticides listed or will be listed in Stockholm Convention are under the provision of this Law.
- By-law on the Certification of Pesticides
- By-law on Sale and Storage of Pesticides Prohibiting the sale of POP pesticides
- Turkish Food Codex By-law on Contaminants sets limit to food containing PCDD/F and dioxin like PCB levels
- By-law on the Prevention and Reduction of the Effects of Major Industrial Accidents sets methods and principles concerning the necessary measures to ensure the efficient and continual prevention of the major industrial accidents in the facilities in which PCDD/Fs can be formed as by-products of processes

4. Key Factors Considered During the GAP Analysis Study

The key factors considered during the review of the legal framework for POPs chemicals and the basic requirements to be taken into consideration during the GAP Analysis study must include the following factors:

4.1 Obligations of Industry

Parallel to the obligations of the relevant ministries and governmental authorities, the obligations of the private sector users of POPs must be clearly defined. Industry has obligations for reduction of unintentional POPs (uPOPs) releases. Although total uPOP releases in Turkey reduced about 35 % in the last three years mainly due to the measures taken for the control of air pollution from industrial sector, releases of uPOPs is still too high in Turkey and the levels of uPOPs contamination from past activities are largely unknown. The results of the updated uPOP inventory show that the metal industry is still the most important sector for the release of uPOPs to air and residues, while disposal of municipal and industrial solid wastes, open burning processes, production of some consumer goods including leather and textile industry, and heat and power generation by coal combustion are other source groups with considerable contribution to the total inventory. Therefore, measures to reduce the releases from unintentional production of PCDDs/Fs, HCB and PCBs should include primarily the actions related to these source groups and to potentially contaminated sites.

According to Article 15 of Stockholm Convention each Party shall report to the Conference of the Parties on the measures it has taken to implement the provisions of this Convention and on the effectiveness of such measures in meeting the objectives of the Convention.

The unique aspects of the management and disposal requirements on POPs chemicals should be understood by the industrialists that handle the POPs chemicals.

4.2 The Management of POPs Chemicals and Reporting and Monitoring Activities

The legislation should provide adequate guidance for the management of POPs chemicals and any derived wastes from their use, in the areas of:

- Storage of the materials at appropriate levels of security
- Transport of the materials in a safe and secure manner
- Use of the materials under safe conditions
- Identification and management of wastes from the POPs chemicals
- Import of chemicals and / or export of wastes.
- Record Keeping - the use of the chemicals, concentrations, dates, and other relevant documentation
- Transport Records - records of transport, any lost or spilled chemicals
- Health & Safety - health and safety records of handlers and users of the dangerous chemicals and hazardous wastes
- Accidents - emergency action in case of accidents, spills, and severe misuse of the dangerous chemicals, or their wastes. The responsible party for management of the response to an emergency should be identified.
- Reporting activities should be mentioned in the new legislation in order to secure implementation of Article 15 of Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009.

4.3 Enforcement Provisions

The enforcement provisions for appropriate use, storage, transport, and like activities involving dangerous chemicals and their wastes should be clearly defined, as well as the enforcing body responsible. The enforcement provisions should be sufficient to ensure general compliance to the legislation.

5. Current Turkish Legislation on POPs

Current Turkish legislation is based on Stockholm Convention.

The Convention was adopted on 22 May 2001 at the Conference of Plenipotentiaries on the Stockholm Convention on Persistent Organic Pollutants, Stockholm, 22-23 May 2001.

In accordance with its article 24, the Convention has been opened for signature at Stockholm by all States and by regional economic integration organizations on 23 May 2001 at the Stockholm City Conference Centre/Folkets Hus, and at the United Nations Headquarters in New York from 24 May 2001 to 22 May 2002. Turkey has signed the Convention on 23 May 2001.

Following the procedure Stockholm Convention has been ratified in the Turkish Grand National Assembly by means of the Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009 and put into force on October 14, 2009.

Stockholm Convention aims at protecting human health and the environment by reducingand eliminating releases of persistent organic pollutants (POPs).

The Stockholm Convention addresses these border-crossing chemicals by requiring a number of control actions aiming at ultimate elimination of the releases of POPs. The Convention covers pesticides, industrial chemicals and the unintentionally produced by-products. It initially covered twelve POP substances namely: aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene, polychlorinated biphenyls (PCBs), DDT, dioxins and furans (polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans) but in 2009 another nine were added by the Conference of Parties: chlordecone, hexabromobiphenyl, alpha-hexachlorocyclohexane, beta-hexachlorocyclohexane, lindane (gama-hexachlorocyclo-hexane), tetrabromodiphenyl, pentabromodiphenyl ethers, hexabromodiphenyl and heptabromodiphenylethers, perfluorooctane sulfonic acid and its salts (or perfluorooctanesulfonyl fluoride). After the Fifth Conference of Parties, held in 2011, the member states agreed on adding technical endosulfan and appropriate isomers to the list of chemicals in Annex A of the Convention, removal with specific exemptions. Endosulfan is a pesticide with wide application in the production of cotton, coffee and other food products. When the removal of endosulfan enters into force in 2012, endosulfan shall become the 22nd persistent organic pollutant added to the list of chemicals of the Stockholm Convention. HBCDD, also referred to as HBCD, is a bioaccumulative and toxic flame retardant, and it will be banned under the Stockholm convention as the 23rd substance to be added to the annex A of the Stockholm Convention. EU legislation will be modified acordingly and HBCDD will be highly regulated from August 2015, as part of the authorisation procedure of the REACH regulation. Furthermore, the exemption for HBCDD in insulation foam of polystyrene was set to five years considering there are numerous non-chemical alternatives available.

6. Implementation of the Stockholm Convention (Convention) in the European Union

The EU legal instrument for implementing the Stockholm Convention is Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC.

This Regulation entered into force on 20 May 2004 and is directly applicable in all EU Member States.

The Regulation complements earlier EU legislation on POPs and aligns it with the provisions of international agreements on POPs.

The main objective of the Regulation is to enhance synergies and strengthen cooperation between the relevant international organizations and secretariats of the Basel and Stockholm Conventions. Besides, the Regulations make emphasis to cooperate and givinginput to the development of the Strategic Approach for International Chemicals Management (SAICM). SAICM is a policy framework to foster the sound management of chemicalswhich wasadopted by the International Conference on Chemicals Management (ICCM) on 6 February 2006 in Dubai, United Arab Emirates.

The Regulation aimed at further development of the Convention as EU designed the Regulation with emphasis to the following topics:

- Establishing the POP Review Committee that will work on proposals for new POPs,
- Providing guidence for the member states to support them in developingNational Implementation Plans as mentioned in Stockholm Convention,
- Arranging appropriate reporting mechanism for adopting remarkable progress and procedures to promote compliance with the Convention;
- Preparing guidelines and providing guidance to the member states for effectiveimplementation of the Convention, especially on the best availabletechniques (BAT) and best environmental practice(BEP) to eliminate and reduce releases of chlorinated dioxins and furans from artificial sources;
- Designing measures in order to reduce the reliance on DDT by encouraging methods to limit or eradicate the insects or other arthropods which transmit disease pathogens for disease vector control and carrying out studies to identifysubsitutes for DDT;
- Promotingmeasures for the elimination of phase-out PCB equipment.

The Regulation goes further than international agreements, emphasising the aim to eliminate the production and use of the internationally recognised POPs.

The Regulation bans production, placing on the market and use of the intentionally/unintentionally produced POP substances listed in the Stockholm Convention.

The Regulation shows the implementation of Stockholm Convention with its extensive provisions so during the GAP Analysis of the each article the readers can follow the detailed processes and procedures with regards to POPs.

7. Legal GAP Analysis of the Specific Legislation

Provisions written in boldare the common provisions that exist in both Turkish and EU legislation.

Explanations written in Italic are the explanations of the author.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 1

Objective and Scope

The objective of this Regulation is to protect human health and the environment from persistent organic pollutants by prohibiting, phasing out as soon as possible, or restricting the production, placing on the market and use of substances subject to the Stockholm Convention on Persistent Organic Pollutants, hereinafter 'the Convention', or the 1998 Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Persistent Organic Pollutants, hereinafter 'the Protocol', and by minimising, with a view to eliminating where feasible as soon as possible, releases of such substances, and by establishing provisions regarding waste consisting of, containing or contaminated by any of these substances.
2. Articles 3 and 4 shall not apply to waste consisting of, containing or contaminated by any substance listed in Annexes I or II.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009 (Stockholm Convention ratified by Law No.5871)

Article 1

Objective

Mindful of the precautionary approach as set forth in Principle 15 of the Rio Declaration on Environment and Development, the objective of this Convention is to protect human health and the environment from persistent organic pollutants.

REMARK I

Regulation (EC) No 850/2004 makes reference to Stockholm Convention and also to Basel Convention on Long-Range Transboundary Air Pollution on Persistent Organic Pollutantswhich was ratified by Turkish Grand National Assembly by means of Law 3957 dated 28 December 1993 on on Long-Range Transboundary Air Pollution on Persistent Organic Pollutants.

In the following provisions the Regulation also gives special emphasis on SAICM as it was developed by a multi-stakeholder and multi-sectoral Preparatory Committee and supports the achievement of the goal regarding the use of chemicals agreed at the 2002 Johannesburg World Summit on Sustainable Development. The goal was ensuring that, by the year 2020, chemicals are produced and used in ways that minimize significant adverse impacts on the environment and human health.

The objective of the Regulation (EC) No 850/2004, is broader than Stockholm Convention ratified by Law No.5871 as it gives details on implementation.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC.

Article 2

Definitions

For the purposes of this Regulation:

(a) 'placing on the market' means supplying or making available tothird persons against payment or free of charge. Imports into thecustoms territory of the Community shall also be deemed to beplaced on the market;
(Please see, By-law on Classification, Labelling and Packaging of Substances and Mixtures article 4 (1) bb for the same definition)
(b) 'article' means an object composed of one or more substancesand/or preparations which during production is given a specificshape, surface or design determining its end use function to agreater extent than its chemical composition does;
(Please see, By-law on Classification, Labelling and Packaging of Substances and Mixtures article 4 (1) k for the same definition)
(c) 'substance' is as defined in Article 2 of Council Directive67/548/EEC *(Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances)*;
(Please see, By-law on Classification, Labelling and Packaging of Substances and Mixtures article 4 (1) bb for the same definition)
(d) 'preparation' is as defined in Article 2 of Directive 67/548/EEC; *(Please see, By-law on Classification, Labelling and Packaging of Substances and Mixtures article 4 (1) bb for the same definition)*
(e) 'waste' is as defined in Article 1(a) of Council Directive75/442/EEC *(Council Directive 75/442/EEC of 15 July 1975 on waste, Waste Framework Directive),*
(Please see, By-law on the Control of Dangerous Wastes article 4for the same definition);
(f) 'disposal' is as defined in Article 1(e) of Directive 75/442/EEC
(Please see, By-law on the Control of Dangerous Wastes article 4 for the same definition);
(g) 'recovery' is as defined in Article 1(f) of Directive 75/442/EEC
(Please see, By-law on the Control of Dangerous Wastes article 4 for the same definition).

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Article 2

Definitions

(a) "Party" means a State or regional economic integration organization that has consented to be bound by this Convention and for which the Convention is in force;
(b) "Regional economic integration organization" means an organization constituted by sovereign States of a given region to which its member States have transferred competence in respect of matters governed by this Convention and which has been duly authorized, in accordance with its internal procedures, to sign, ratify, accept, approve or accede to this Convention;

(c) "Parties present and voting" means Parties present and casting an affirmative or negative vote.

REMARK II

The definitions of Stockholm Convention are limited however the definitions of the Regulation (EC) No 850/2004 are detailed and technical definitions. Turkish Environmental Legislation meets the requirements of the definitions of Regulation (EC) No 850/2004 as in Italic, the reader can see the Turkish legislation that include the definitions in By-law on Control of Hazardous Wastes dated 14.03.2005 and numbered 25755 and By-law on Classification, Labelling and Packaging of Substances and Mixtures dated 11.12.2013 and numbered 28848.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 3

Control of production, placing on the market and use

1. **The production**, placing on the market and **use of substances listed in Annex I**, whether on their own, in preparations or as constituents of articles, **shall be prohibited**.
2. **The production,** placing on the market **and use of substances listed in Annex II**, whether on their own, in preparations or as constituents of articles, **shall be restricted in accordance with the conditions set out in that Annex.**
3. Member States and the Commission shall, within the assessment and authorisation schemes for existing and new chemicals and pesticides under the relevant Community legislation, take into consideration the criteria set out in paragraph 1 of Annex D to the Convention and takeappropriate measures to control existing chemicals and pesticides and prevent the production, placing on the market and use of new chemicals and pesticides, which exhibit characteristics of persistent organic pollutants.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Article 3

Measures to reduce or eliminate releases from intentional production and use

1. Each Party shall:
(a) **Prohibit and/or take the legal and administrative measures necessary to eliminate**:
(i) **Its production and use of the chemicals listed in Annex A subject to the provisions of that Annex; and**
(ii) **Its import and** export **of the chemicals listed in Annex A in accordance with theprovisions of paragraph 2; and**
(b) **Restrict its production and use of the chemicals listed in Annex B in accordance with theprovisions of that Annex.**
(b) Restrict its production and use of the chemicals listed in Annex B in accordance with the provisions of that Annex.

2. Each Party shall take measures to ensure:

(a) That a chemical listed in Annex A or Annex B is imported only:
(i) For the purpose of environmentally sound disposal as set forth in paragraph 1 (d) of Article 6; or
(ii) For a use or purpose which is permitted for that Party under Annex Aor Annex B;
(b) That a chemical listed in Annex A for which any production or use specificexemption is in effect or a chemical listed in Annex B for which any production or use specific exemption or acceptable purpose is in effect,taking into account any relevant provisions in existing international prior informed consent instruments, is exported only:
(i) For the purpose of environmentally sound disposal as set forth inparagraph 1 (d) of Article 6;
(ii) To a Party which is permitted to use that chemical under Annex A orAnnex B; or
(iii) To a State not Party to this Convention which has provided an annual certification to the exporting Party. Such certification shall specifythe intended use of the chemical and include a statement that, withrespect to that chemical, the importing State is committed to:
a. Protect human health and the environment by taking the necessary measures to minimize or prevent releases;
b. Comply with the provisions of paragraph 1 of Article 6; and
c. Comply, where appropriate, with the provisions of paragraph 2 ofPart II of Annex B.
The certification shall also include any appropriate supportingdocumentation, such as legislation, regulatory instruments, or administrative or policy guidelines. The exporting Party shall transmitthe certification to the Secretariat within sixty days of receipt.
(c) That a chemical listed in Annex A, for which production and use specificexemptions are no longer in effect for any Party, is not exported from itexcept for the purpose of environmentally sound disposal as set forth in paragraph 1 (d) of Article 6;
(d) For the purposes of this paragraph, the term “State not Party to this Convention” shall include, with respect to a particular chemical, a State or regional economic integration organization that has not agreed to be bound by the Convention with respect to that chemical.

3.Each Party that has one or more regulatory and assessment schemes for new pesticides or new industrial chemicals shall take measures to regulate with the aim of preventing the production and use of new pesticides or new industrial chemicals which, taking into consideration the criteria in paragraph 1 of Annex D, exhibit the characteristics of persistent organic pollutants.

4. Each Party that has one or more regulatory and assessment schemes for pesticides or industrial chemicals shall, where appropriate, take into consideration within these schemes the criteria in paragraph 1of Annex D when conducting assessments of pesticides or industrial chemicals currently in use.

By-law on Restriction of Manufacturing, Placing on the Market and Use of Certain Hazardous Substances, Preparations and Articles
Article 5 – (1)
Substance and substance group subject to restriction and their restriction conditions are given in Annex-1. PCBs and PBBs are included in Annex-1 and use and placing on the market of PCB and PBB are prohibited.

By-law on Control of Waste Electrical and Electronic Equipments
Article 5 (1) (a)
By-law prohibits production of electrical and electronic equipments containing polybromobiphenyl (PBB) and polybromodiphenyleter (PBDE).

By-law on Control of PCBs and PCTs
Article 5 (1) (c)
By-law prohibits production and import of PCBs.

By-law on Cosmetics
Article 7
This by-law bans the use of α-Hexachlorocyclohexane in cosmetic products

By-law on the Certification of Pesticides
Article 22
Certificates of the pesticides which have been prohibited by the international organisations due to effect on human and environment health and similar subjects are cancelled out by the MoFAL.

By-law on Control of Pesticides
Article 36
Production, import and sale of the pesticides whose certificates are invalidated is ceased out.

REMARK III
Stockholm Convention ratified by Law No.5871 covers the provisions of the Regulation and states other measures about implementation. Related Turkish by-laws also prohibits production, import, use and placing on the market of PCBs, PBBs, production of electrical and electronic equipments containing PBB and PBDE. Related by-laws on pesticides states that certificates of pesticides prohibited by international organisations are cancelled out and also their production, import and sale is prohibited.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 4

Exemptions from control measures

1. Article 3 shall not apply in the case of:

(a) a substance used for laboratory-scale research or as a reference standard;

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Article 3

Paragraph 5

5. Except as otherwise provided in this Convention, paragraphs 1 and 2 shall not apply to quantities of a chemical to be used for laboratory-scale research or as a reference standard.

By-law on Control of PCB and PCTs

Article 5(1)(c)
Production and import of PCBs are prohibited except use in scientific experiments, laboratory analysis and measurements.

REMARK IV

Stockholm Convention ratified by Law No.5871 covers the provisions of the Regulation as the chemicals for laboratory-scale research are exempted. By-law on Control of PCB and PCTs also includes the same exemption.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 4

Exemptions from control measures

1. Article 3 shall not apply in the case of:
(b) a substance occurring as an unintentional trace contaminant in substances, preparations **or articles.**

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Annex A Part I Notes:

(i) Except as otherwise specified in this Convention, quantities of a chemical occurring as unintentional trace contaminants in products **and articles shall not be considered to be listed in this Annex;**

REMARK V

Stockholm Convention ratified by Law No.5871 covers the provisions of the Regulation however the exemptions are placed in Annex A Part 1 Notes.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 4

Paragraph 2

Article 3 shall not apply in respect of substances occurring as a constituent of articles produced before or on the date of entry into force of this Regulation until six months after the date of its entry into force.

Article 3 shall not apply in the case of a substance occurring as a constituent of articles already in use before or on the date of entry into force of this Regulation.

However, immediately upon becoming aware of articles referred to in the first and second subparagraph, a Member State shall inform the Commission accordingly.

Whenever the Commission is so informed or otherwise learns of such articles, it shall, where appropriate, notify the Secretariat of the Convention accordingly without further delay.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Annex A Part I Note:

(ii) This note shall not be considered as a production and use specific exemption for purposes of paragraph 2 of Article 3. **Quantities of a chemical occurring as constituents of articles manufactured or already in use before or on the date of entry into force of the relevant obligation with respect to that chemical, shall not be considered as listed in this Annex,provided that a Party has notified the Secretariat that a particular type of article remainsin use within that Party. The Secretariat shall make such notifications publicly available.**

REMARK VI

Stockholm Convention ratified by Law No.5871 covers the provisions of the Regulation. In the Regulation the provisions include notification of the Member States to Commission and in Turkish Legislation notification process was defined in by-law on Classification, Labelling and Packaging of Dangerous Substances and Preperations. However, this by-law will be replaced by by-law on Classification, Labelling and Packaging of Substances and Mixtures dated 11 December 2013, numbered Official Gazette No. 28848 (bis) and the notifications will be made in line with article 41 (1) of this by-law as of 1 june 2015.

Please be informed that the notification system was replaced by REACH which means Registration, Evaluation, Authorisation and Restriction of Chemicals. The REACH system entered into force on 1 June 2007 with European Parliament and Council Regulation (EC) No 1907/2006. Turkey has drafted the by-law on REACH and the Chemicals Department is ready for adopting the REACH system in line with the Strategy of Chemicals Management of Turkey.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 4

3. **Where a substance is listed in Part A of Annex I or in Part A of Annex II, a Member State wishing to permit, until the deadline specified in the relevant Annex, the production and use of that substance as a closed-system site-limited intermediate shall notify accordingly the Secretariat of the Convention.**

However, such notification may be made only if the following conditions are satisfied:

(a) an annotation has been entered in the relevant Annex expressly to the effect that such production and use of that substance may be permitted;
(b) the manufacturing process will transform the substance into one or more other substances that do not exhibit the characteristics of a persistent organic pollutant;
(c) it is not expected that either humans or the environment will be exposed to any significant quantities of the substance during its production and use, as shown through assessment of that closed system in accordance with Commission Directive 2001/59/EC. The notification shall be communicated also to the other Member States and to the Commission and shall give details of actual or estimated total production and use of the substance concerned and the nature of the closed-system site-limited process, specifying the amount of any nontransformed and unintentional trace contamination by any persistent organic pollutant starting material in the final product.

The deadlines referred to in the first subparagraph may be amended in cases where, following a repeat notification from the Member State concerned to the Secretariat of the Convention, express or tacit consent is issued under the Convention for the continued production and use of the substance for another period.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Annex A Part I Note iii

This note, which does not apply to a chemical that has an asterisk following its name in the Chemical column in Part I of this Annex, shall not be considered as a production and use specific exemption for purposes of paragraph 2 of Article 3.**Given that no significant quantities of the chemical are expected to reach humans and the environment during the production and use of a closed-system site-limited intermediate, a Party, upon notification to the Secretariat, may allow the production and use of quantities of a chemical listed in this Annex as a closed-system site-limited intermediate that is chemically transformed in the manufacture of other chemicals that, taking into consideration the criteria in paragraph 1 of Annex D, do not exhibit the characteristics of persistent organic pollutants. This notification shall include information on total production and use of such chemical or a reasonable estimate of such information and information regarding the nature of the closed-system site-limited process including the amount of any non-transformed and unintentional trace contamination of the persistent organic pollutant-starting material in the final product.** This procedure applies except as otherwise specified in this Annex. **The Secretariat shall make such notifications available to the Conference of the Parties and to the public.** Such production or use shall not be considered a production or use specific exemption. **Such production and use shall cease** after a ten-year period, **unless the Party concerned submits a new notification to the Secretariat, in which case the period will be extended** for an additional ten years **unless the Conference of the Parties, after a review of the production and use decides otherwise. The notification procedure can be repeated.**

REMARK VII

Stockholm Convention ratified by Law No.5871 covers the provisions of the Regulation. In the Regulation, the provisions include information of the Member States to Commission and in Stockholm Convention ratified by Law No.5871 informing the Secretariat of the Convention.

Commission Directive 2001/59/EC of 6 August 2001 adapting to technical progress for the 28th time Council Directive 67/548/EEC on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances mentions Criteria for assessment of closed system but this topic is not mentioned in Turkish legislation.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 5

Stockpiles

1. **The holder of a stockpile, which consists of or contains any substance listed in Annex I or Annex II, for which no use is permitted, shall manage that stockpile as waste and in accordance with Article 7.**

2. The holder of a stockpile greater than 50 kg, consisting of or containing any substance listed in Annex I or Annex II, and the use of which is permitted shall provide the competent authority of the Member State in which the stockpile is established with information concerning the nature and size of that stockpile. Such information shall be provided within 12 months of the entry into force of this Regulation and of amendments to Annexes I or II and annually thereafter until the deadline specified in Annex I or II for restricted use.

The holder shall manage the stockpile in a safe, efficient and environmentally sound manner.

3. Member States shall monitor the use and management of notified stockpiles.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Article 6

Measures to reduce or eliminate releases from stockpiles and wastes

1. **In order to ensure that stockpiles consisting of or containing chemicals listed either in Annex A or Annex B** and wastes, including products and articles upon becoming wastes, consisting of, containing or contaminated with a chemical listed in Annex A, B or C, are managed in a manner protective of human health and the environment, each Party shall:

(a) Develop appropriate strategies for identifying:

(i) Stockpiles consisting of or containing chemicals listed either in Annex A or Annex B;

and

(ii) Products and articles in use and wastes consisting of, containing or contaminated with a chemical listed in Annex A, B or C;

(b) Identify, to the extent practicable, stockpiles consisting of or containing chemicals listed either in Annex A or Annex B on the basis of the strategies referred to in subparagraph (a);

(c) Manage stockpiles, as appropriate, in a safe, efficient and environmentally sound manner.

Stockpiles of chemicals listed either in Annex A or Annex B, after they are no longer allowed to be used according to any specific exemption specified in Annex A or any specific exemption or acceptable purpose specified in Annex B, except stockpiles which are allowed to be exported according to paragraph 2 of Article 3, **shall be deemed to be waste and shall be managed in accordance with subparagraph (d);**

By-law on Control of Hazardous Wastes

The hazardous waste categories given in the Annex III A of By-law on Control of Hazardous Wastes does not include all the POPs. Therefore, the Annex III A of the by-law should be updated.

By-law on Control of PCBs and PCTs

Art 6

By-law on Control of PCBs and PCTs states provisions on the inventory of PCB containing equipments and wastes. The ministry developed an inventory system for PCBs. However, the system is not in use currently.

REMARK VIII

Stockholm Convention ratified by Law No.5871 does not cover the provisions of the Regulation as the Regulation sets limits for the amount and gives detailed process. Annex III A of By-law on Control of Hazardous Wastes does not include all the POPs. Therefore, it should be updated. By-law on Control of PCBs and PCTs includes provisions on the inventory of PCB containing equipments and wastes. However, the inventory system developed by the Ministry is not in use currently.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 6

Release reduction, minimisation and elimination

1. Within two years of the date of entry into force of this Regulation, **Member States shall draw up and maintain release inventories for the substances listed in Annex III** into air, water and land in accordance with their obligations under the Convention and the Protocol.
2. A Member State shall communicate its action plan on measures to identify, characterise and minimise with a view to eliminating where feasible as soon as possible the total releases developed in accordance with its obligations under the Convention, to both the Commission and the other Member States as part of its national implementation plan, pursuant to Article 8.
The action plan shall include measures to promote the development and, where it deems appropriate, shall require the use of substitute or modified materials, products and processes to prevent the formation and release of the substances listed in Annex III.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Article 5

Measures to reduce or eliminate releases from unintentional production

(a) Develop an action plan or, where appropriate, a regional or subregional action plan within two years of the date of entry into force of this Convention for it, **and subsequently implement it as part of its implementation plan specified in Article 7, designed to identify, characterize and address the release of the chemicals listed in Annex C and to facilitate implementation** of subparagraphs (b) to (e). The action plan shall include the following elements:
(i) **An evaluation of current and projected releases, including the development and maintenance of source inventories and release estimates, taking into consideration the source categories identified in Annex C;**
(ii) An evaluation of the efficacy of the laws and policies of the Party relating to the management of such releases;
(iii) Strategies to meet the obligations of this paragraph, taking into account the evaluations in (i) and (ii);
(iv) Steps to promote education and training with regard to, and awareness of, those strategies;
(v) A review every five years of those strategies and of their success in meeting the obligations of this paragraph; such reviews shall be included in reports submitted pursuant to Article 15;
(vi) A schedule for implementation of the action plan, including for the strategies and measures identified therein;
(b) Promote the application of available, feasible and practical measures that can expeditiouslyachieve a realistic and meaningful level of release reduction or source elimination;

(c) Promote the development and, where it deems appropriate, require the use of substitute or modified materials, products and processes to prevent the formation and release of the chemicals listed in Annex C, taking into consideration the general guidance on prevention and release reduction measures in Annex C and guidelines to be adopted by decision of theConference of the Parties;

REMARK IX

Stockholm Convention ratified by Law No.5871 does not cover the provisions of the Regulation as the Regulation asks for release inventories from the member states within 2 years following the putting into force of the Regulation. There is no action plan in Turkey regarding the control of emissions of Annex III chemicals.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 6

Release reduction, minimisation and elimination

3. Member States shall, **when considering proposals to construct new facilities or significantly to modify existing facilities using processes that release chemicals listed in Annex III,** without prejudice to Council Directive 1996/61/EC (Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control), **give priority consideration to alternative processes, techniques or practices that have similar usefulness but which avoid the formation and release of substances listed in Annex III.**

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Annex C Unintentional Production

Part 5 General guidance on best available techniques and best environmental practices B

(b) General release reduction measures: When considering proposals to construct new facilities or significantly modify existing facilities using processes that release chemicals listed in this Annex, priority consideration should be given to alternative processes, techniques or practices that have similar usefulness but which avoid the formation and release of such chemicals.

REMARK X

Stockholm Convention ratified by Law No.5871 does not cover the provisions of the Regulation as the Regulation sets conditions to be fullfilled in line with EU legislation concerning integrated pollution prevention and control. Turkey has drafted the by-law on Integrated Environmental Permits in line with EU law, but not approved yet.

There are studies concerning the reduction of POPs releases. The most important ones among them are EU IPPC Directive’s (Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control) adaptation projects. As a result of these projects, future unintentional POPs releases using Best Available Techniques and Best Environmental Practices criteria will be accomplished.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 7

Waste management

1. Producers and holders of waste shall undertake all reasonable efforts to avoid, where feasible, contamination of this waste with substances listed in Annex IV.

2. Notwithstanding Directive 96/59/EC (Council Directive 96/59/EC of 16 September 1996 on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT)), waste consisting of, containing or contaminated by any substance listed in Annex IV shall be **disposed** of or recovered, without undue delay and in accordance with Annex V, part 1 **in such a way as to ensure that the persistent organic pollutant content is destroyed or irreversibly transformed so that the remaining waste and releases do not exhibit the characteristics of persistent organic pollutants.**

In carrying out such a disposal or recovery, any substance listed in Annex IV may be isolated from the waste, provided that this substance is subsequently disposed of in accordance with the first subparagraph.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Article 6

Measures to reduce or eliminate releases from stockpiles and wastes

1 In order to ensure that stockpiles consisting of or containing chemicals listed either in Annex A or Annex B and wastes, including products and articles upon becoming wastes, consisting of, containing or contaminated with a chemical listed in Annex A, B or C, are managed in a manner protective of human health and the environment, each Party shall:

(d) Take appropriate measures so that such wastes, including products and articles upon becoming wastes, are:

(i) Handled, collected, transported and stored in an environmentally sound manner;

(ii) Disposed of in such a way that the persistent organic pollutant content is destroyed or irreversibly transformed so that they do not exhibit the characteristics of persistent organic pollutants or otherwise disposed of in an environmentally sound manner when destruction or irreversible transformation does not represent the environmentally preferable option or the persistent organic pollutant content is low, taking into account international rules, standards, and guidelines, including those that may be developed pursuant to paragraph 2, and relevant global and regional regimes governing the management of hazardous wastes;

By-law on Control of Waste Oils

Article 5(2)

Water, solvents, PCB, toxic and dangerous substances and other substances and different categories of waste oils should not be mixed with each other.

REMARK XI

Stockholm Convention ratified by Law No.5871 does not cover the provisions of the Regulation as the Regulation sets processes to be fullfilled in line with EU legislation and moreover makes reference to Council Directive 96/59/EC of 16 September 1996 on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT). In Turkey, the above mentioned Directive has been transposed and put into force as a by-law on the control of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT) dated 27 December 2007, published in Official Gazette No. 26739 although the provision of the by-law seems consistent the Annexes should be taken as is from the Regulation. On the other hand by-law on Control of Waste Oils states that PCB and waste oils should not be mixed with each other.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 7

Waste management

3.Disposal or recovery operations that may lead to recovery, recycling, reclamation or re-use of the substances listed in Annex IV shall be prohibited.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Article 6

Measures to reduce or eliminate releases from stockpiles and wastes

1 (d) (iii)
Not permitted to be subjected to disposal operations that may lead to recovery, recycling, reclamation, direct reuse or alternative uses of **persistent organic pollutants**;

REMARK XII

Stockholm Convention ratified by Law No.5871 covers the provisions of the Regulation.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 7

Waste management

4. By way of derogation from paragraph 2:

(a) waste containing or contaminated by any substance listed in Annex IV may be otherwise disposed of or recovered inaccordance with the relevant Community legislation, providedthat the content of the listed substances in the waste is below the concentration limits to be specified in Annex IV. Those measures, designed to amend non-essential elements of this Regulation, shall be adopted in accordance with the

regulatory procedure with scrutiny referred to in Article 17(3). Until suchtime as **concentration limits** are established in accordance with such procedure, the competent authority of a Member State mayadopt or apply concentration limits or specific technicalrequirements in respect of the disposal or recovery of waste under this point.
(b) a Member State or the competent authority designated by thatMember State may, in exceptional cases, allow wastes listed in Annex V, part 2 containing or contaminated by any substance listed in Annex IV up to **concentration limits** to be specified inAnnex V, part 2, to be otherwise dealt with in accordance with amethod listed in Annex V, part 2 provided that:
(i) the holder concerned has demonstrated to the satisfaction ofthe competent authority of the Member State concerned that decontamination of the waste in relation to substances listed in Annex IV was not feasible, and that destruction or irreversibletransformation of the persistent organic pollutant content,performed in accordance with best environmental practice orbest available techniques, does not represent the environmentallypreferable option and the competent authority hassubsequently authorised the alternative operation;
(ii) this operation is in accordance with the relevant Community legislation and the conditions laid down in relevant additional measures referred to in paragraph 6; and
(iii) the Member State concerned has informed the other Member States and the Commission of its authorisation and the justificationfor it.
5. Concentration limits in Annex V, part 2 shall be establishedby the Commission for the purposes of paragraph 4(b) of thisArticle. Those measures, designed to amend non-essential elements ofthis Regulation, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 17(3).

Until such time as these **concentration limits** are established:

(a) the competent authority may adopt or apply **concentration limits** orspecific technical requirements in respect of waste being dealt withunder paragraph 4(b);
(b) where waste is being dealt with under paragraph 4(b), the holdersconcerned shall provide information on the persistent organicpollutant content of the waste to the competent authority.

6. The Commission may, where appropriate, and taking into consideration technical developments and relevant international guidelines and decisions and any authorisations granted by a Member State, or thecompetent authority designated by that Member State in accordancewith paragraph 4 and Annex V, adopt additional measures relating tothe implementation of this Article. The Commission shall define aformat for the submission of the information by Member States inaccordance with paragraph 4(b)(iii). Such measures shall be decidedin accordance with the procedure laid down in Article 17(2).

7. The Commission shall, before 31 December 2009, review thederogations in paragraph 4 in the light of international and technicaldevelopments, in particular with regard to their environmental preferability.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009
No information about concentration limit

By-law on Control of Soil Pollution and Sites Contaminated by Point Sources

Annex 1 of the by-law contains generic limit values for certain POPs in soil including aldrin, DDT, dieldrin, endosulfan, endrin, α-HCH and β-HCH, lindane, hexachlorobenzene, heptachlor, pentachlorobenzene, PCB, toxaphene, PCDD.

REMARK XIII

Stockholm Convention ratified by Law No.5871 does not cover the provisions of the Regulation as there is no information about concentration limit. On the other hand by-law on Control of Soil Pollution and Sites Contaminated by Point Sources contains generic limit values for certain POPs.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 8

Implementation plans

1. **When preparing their national implementation plans, Member States shall, in accordance with their national procedures, give the public early and effective opportunities to participate in this process.**
2. **As soon as a Member State has adopted its national implementation plan in accordance with its obligations under the Convention, it shall communicate it both to the Commission and to the other Member States.**
3.When preparing their implementation plans, the Commission and the Member States shall exchange information on the content, as appropriate.
4.The Commission shall, within two years of the entry into force of this Regulation, draw up a plan for the implementation of Community obligations under the Convention.

As soon as the Commission has adopted the Community implementation plan, it shall communicate it to the Member States.

The Commission shall review and update the Community implementation plan, as appropriate.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

ARTICLE 7

Implementation plans

1. Each Party shall:
(a) **Develop and endeavour to implement a plan for the implementation of its obligations under this Convention;**
(b) **Transmit its implementation plan to the Conference of the Parties within two years of the date on which this Convention enters into force for it; and**
(c) Review and update, as appropriate, its implementation plan on a periodic basis and in a manner to be specified by a decision of the Conference ofthe Parties.
2. The Parties shall, where appropriate, cooperate directly or through global, regional and subregional organizations, and consult their national stakeholders,including women's groups and groups involved in the health of children, inorder to facilitate the development, implementation and updating of theirimplementation plans.

3. The Parties shall endeavour to utilize and, where necessary, establish themeans to integrate national implementation plans for persistent organicpollutants in their sustainable development strategies where appropriate.

REMARK XIV

Stockholm Convention ratified by Law No.5871 covers the provisions of the Regulation in general but the Regulation sets procedures for the member states.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 9

Monitoring

The Commission and the Member States shall establish, in close cooperation, appropriate programmes and mechanisms, consistent with the state of the art, for the regular provision of comparable monitoring data on the presence of dioxins, furans and PCBs as identified in Annex III in the environment. When establishing such programmes and mechanisms, due account shall be taken of developments under the Protocol and the Convention.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Article 16

Effectiveness evaluation

1. Commencing four years after the date of entry into force of this Convention, and periodically thereafter at intervals to be decided by the Conference of the Parties, the Conference shall evaluate the effectiveness of this Convention.
2. In order to facilitate such evaluation, the Conference of the Parties shall, at its first meeting, initiate the establishment of arrangements to provide itself with comparable monitoring data on the presence of the chemicals listed in Annexes A, B and C as well as their regional and global environmental transport. These arrangements:
(a) Should be implemented by the Parties on a regional basis when appropriate, in accordance with their technical and financial capabilities, using existing monitoring programmes and mechanisms to the extent possible and promoting harmonization of approaches;
(b) May be supplemented where necessary, taking into account the differences between regions and their capabilities to implement monitoring activities;and
(c) Shall include reports to the Conference of the Parties on the results of the monitoring activities on a regional and global basis at intervals to be specified by the Conference of the Parties.
3. The evaluation described in paragraph 1 shall be conducted on the basis of available scientifi c, environmental, technical and economic information, including:
(a) Reports and other monitoring information provided pursuant to paragraph 2;
(b) National reports submitted pursuant to Article 15; and
(c) Non-compliance information provided pursuant to the procedures established under Article 17.

REMARK XV

Stockholm Convention ratified by Law No.5871 covers the provisions of the Regulation as the Regulation sets processes to be fullfilled in line with Stockholm Convention.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 10

Information exchange

1. The Commission and the Member States shall facilitate and undertake the exchange within the Community and with third countries of information relevant to the reduction, minimisation or elimination, where feasible, of the production, use and release of persistent organic pollutants and to alternatives to those substances, specifying the risks and the economic and social costs related to such alternatives.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Article 9

Information exchange

1. Each Party shall facilitate or undertake the exchange of information relevantto:
(a) The reduction or elimination of the production, use and release of persistentorganic pollutants; and
(b) Alternatives to persistent organic pollutants, including information relatingto their risks as well as to their economic and social costs.
2. The Parties shall exchange the information referred to in paragraph 1 directly or through the Secretariat.
3. Each Party shall designate a national focal point for the exchange of such information.
4. The Secretariat shall serve as a clearing-house mechanism for informationon persistent organic pollutants, including information provided by Parties, intergovernmental organizations and non-governmental organizations.
5. For the purposes of this Convention, information on health and safety of humans and the environment shall not be regarded as confidential. Parties that exchange other information pursuant to this Convention shall protect any confidential information as mutually agreed.

REMARK XVI

Stockholm Convention ratified by Law No.5871 covers the provisions of the Regulation.

Turkey does not have specific information on the elimination/reduction of production, use and releases of POPs since the scientific studies and governmental efforts are limited.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 10

Information exchange

2. The Commission and Member States, as appropriate**, shall promote and facilitate with regard to persistent organic pollutants:**
(a) **awareness programmes, including relating to their health and environmental effects and their alternatives and on the reduction or elimination of their production, use and release, especially for:**
(i) **policy and decision makers,**
(ii) **particularly vulnerable groups;**
(b) **the provision of public information;**
(c) **training, including workers, scientists, educators and technical and managerial personnel.**

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Article 10

Public information, awareness and education

1. Each Party shall, within its capabilities, **promote and facilitate**:
(a) **Awareness among its policy and decision makers with regard to persistent organic pollutants**;
(b) **Provision to the public of all available information on persistent organic pollutants**, taking into account paragraph 5 of Article 9;
(c) Development and implementation, **especially for women, children and the least educated, of educational andpublic awareness programmes on persistent organic pollutants, as well as on their health and environmental effects and on their alternatives;**
(d) Public participation in addressing persistent organic pollutants and theirhealth and environmental effects and in developing adequate responses, including opportunities for providing input at the national level regardingimplementation of this Convention;
(e) **Training of workers, scientists, educators and technical and managerial personnel;**
(f) Development and exchange of educational and public awareness materials at the national and international levels; and
(g) Development and implementation of education and training programmesat the national and international levels.
2. Each Party shall, within its capabilities, ensure that the public has access tothe public information referred to in paragraph 1 and that the information iskept up-to-date.
3. Each Party shall, within its capabilities, encourage industry and Professional users to promote and facilitate the provision of the information referred to in paragraph 1 at the national level and, as appropriate, subregional, regionaland global levels.
4. In providing information on persistent organic pollutants and their alternatives,Parties may use safety data sheets, reports, mass media and other meansof communication, and may establish information centres at national andregional levels.
5. Each Party shall give sympathetic consideration to developing mechanisms,such as pollutant release and transfer registers, for the collection anddissemination of information on estimates of the annual quantities of thechemicals listed in Annex A, B or C that are released or disposed of.

REMARK XVII

Stockholm Convention ratified by Law No.5871 covers the provisions of the Regulation.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 10

Information exchange

3. Without prejudice to Directive 2003/4/EC of the European Parliament and of the Council of 28 January 2003 on public Access to environmental information, **information on health and safety of humans and the environment shall not be regarded as confidential.**

The Commission and the Member States that exchange other information with a third country shall protect any confidential information as mutually agreed.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Article 9

Information exchange

5. For the purposes of this Convention, **information on health and safety of humans and the environment shall not be regarded as confidential.Parties that exchange other information pursuant to this Convention shall protect any confidential information as mutually agreed.**

REMARK XVIII

Stockholm Convention ratified by Law No.5871 covers the provisions of the Regulation.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 11

Technical assistance

In accordance with Articles 12 and 13 of the Convention, **the Commission and the Member States shall cooperate in providing appropriate and timely technical and** financial **assistance to developing countries and countries with economies in transition to assist them, upon request and within available resources and taking into account their particular needs, to develop and strengthen their capacity to fully implement their obligations under the Convention. Such support may also be channelled through non-governmental organisations.**

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Article 12

Technical assistance

1. **The Parties recognize that rendering of timely and appropriate technical assistance in response to requests from developing country Parties and Parties with economies in transition is essential to the successful implementation of this Convention.**
2. **The Parties shall cooperate to provide timely and appropriate technical assistance to developing country Parties and Parties with economies in transition, to assist them, taking into account their particular needs, to develop and strengthen their capacity to implement their obligations under this Convention.**
3. In this regard, technical assistance to be provided by developed country Parties, and other Parties in accordance with their capabilities, shall include, as appropriate and as mutually agreed, technical assistance for capacity building relating to implementation of the obligations under this Convention.

Further guidance in this regard shall be provided by the Conference of the Parties.
4. The Parties shall establish, as appropriate, arrangements for the purpose of providing technical assistance and promoting the transfer of technology to developing country Parties and Parties with economies in transition relating to the implementation of this Convention. These arrangements shall include regional and subregional centres for capacity-building and transfer of technology to assist developing country Parties and Parties with economies in transition to fulfil their obligations under this Convention. Further guidance in this regard shall be provided by the Conference of the Parties.
5. The Parties shall, in the context of this Article, take full account of the specific needs and special situation of least developed countries and small island developing states in their actions with regard to technical assistance.

REMARK XIX

Stockholm Convention ratified by Law No.5871 covers the provisions of the Regulation.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 12

Reporting

1. **Member States shall every three years forward to the Commission information on the application of this Regulation, including information on infringements and penalties.**
2. **Member States shall provide the Commission every year withstatistical data on the actual or estimated total production and placingon the market of any substance listed in Annex I or II.**
3. Within three years of the date of entry into force of this Regulation and every three years thereafter, Member States shall provide theCommission with:
(a) summary information compiled from the notifications, concerning stockpiles, received pursuant to Article 5(2);
(b) summary information compiled from the release inventories drawnup pursuant to Article 6(1);
(c) summary information on the presence of dioxins, furans and PCBs as identified in Annex III in the environment, as compiled pursuantto Article 9.

4. As regards the data and information to be provided by MemberStates pursuant to paragraphs 1, 2 and 3, the **Commission shall develop in advance a common format** in accordance with the procedure referredto in Article 16(2).
5. Regarding the substances listed in the Convention, theCommission shall, **at intervals to be determined by the Conference of the Parties of the Convention**, compile a report on the basis of theinformation provided by the Member States in accordance withparagraph 2 and communicate it to the Secretariat of the Convention.
6. The Commission shall every three years compile a report on the application of this Regulation and shall integrate it with the information already available in the context of the EPER, as established by Commission Decision 2000/479/EC (Commission Decision 2000/479/EC of 17 July 2000 on the implementation of a European pollutant emission register (EPER) according to Article 15 of Council Directive 96/61/EC concerning integrated pollution prevention and control (IPPC), and CORINAIR Emission Inventory of EMEP (Cooperative Programme for Monitoring andEvaluation of the Long-Range Transmission of Air Pollutants inEurope), and with the information provided by the Member States under paragraphs 1, 2 and 3 to form a synthesis report. This report shall include information on the use of derogations as referred to in Article 7(4). It shall forward a summary of the synthesis report to the European Parliament and to the Council and make it available to the public without delay.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Article 15

Reporting

1. Each Party shall report to the Conference of the Parties on the measures it has taken to implement the provisions of this Convention and on the effectiveness of such measures in meeting the objectives of the Convention.
2. Each Party shall provide to the Secretariat:
(a) Statistical data on its total quantities of production, import and export **of each of the chemicals listed in Annex A and Annex B or a reasonable estimate of such data; and**
(b) To the extent practicable, a list of the States from which it has imported each such substance and the States to which it has exported each such substance.
3. Such reporting shall be at periodic intervals and in a format to be decided by the Conference of the Parties at its first meeting.

REMARK XX

Stockholm Convention ratified by Law No.5871 covers the provisions of the Regulation.

Convention on Long-Range Transmission of Air Pollutants was ratified by Law No. 26677 on28 April 1982 and published on 23 March 1983,Official Gazette No.17996 so Turkey became a party to Cooperative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe (EMEP). Turkey is not a party to POPs Protocol of EMEP yet. Also the draft Integrated Permit By-Law article 16 covers the requirements set in the Regulation.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 13

Penalties

Member States shall lay down the rules on penalties applicable toinfringements of the provisions of this Regulation and shall take allmeasures necessary to ensure that they are implemented. The penaltiesprovided for must be effective, proportionate and dissuasive. TheMember States shall notify those provisions to the Commission oneyear after entry into force of this Regulation at the latest and shallnotify it without delay of any subsequent amendment affecting them.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Article 17

Non-compliance

The Conference of the Parties shall, as soon as practicable, develop and approve procedures and institutional mechanisms for determining non-compliance with the provisions of this Convention and for the treatment of Parties found to be in non-compliance.

REMARK XXI

Stockholm Convention ratified by Law No.5871 does not cover the provisions of the Regulation as the Regulation sets specipic implementation processes for the member states. However these provisions are non applicable to Turkey since Turkey is not a member of EU.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 14

Amendment of Annexes

1. Whenever a substance is listed in the Convention or the Protocol, the Commission shall, where appropriate, amend Annexes I, II and III accordingly.
Those measures, designed to amend non-essential elements of this Regulation, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 16(3).
2. Whenever a substance is listed in the Convention or the Protocol, the Commission shall, where appropriate, amend Annex IV accordingly.
Those measures, designed to amend non-essential elements of this Regulation, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 17(3).
3. The Commission shall adopt modifications to the existing entries in Annexes I, II and III, including their adaptation to scientific and technical progress.
Those measures, designed to amend non-essential elements of this Regulation, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 16(3).
4. The Commission shall adopt modifications to the existing entries in Annex IV and modifications to Annex V, including their adaptation to scientific and technical progress.

Those measures, designed to amend non-essential elements of this Regulation, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 17(3).

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Article 22

Adoption and amendment of annexes

1. Annexes to this Convention shall form an integral part thereof and, unless expressly provided otherwise, a reference to this Convention constitutes at the same time a reference to any annexes thereto.
2. Any additional annexes shall be restricted to procedural, scientific, technical or administrative matters.
3. The following procedure shall apply to the proposal, adoption and entry into force of additional annexes to this Convention:
(a) Additional annexes shall be proposed and adopted according to the procedure laid down in paragraphs 1, 2 and 3 of Article 21;
(b) Any Party that is unable to accept an additional annex shall so notify the depositary, in writing, within one year from the date of communication by the depositary of the adoption of the additional annex. The depositary shall without delay notify all Parties of any such notification received. A Party may at any time withdraw a previous notification of non-acceptance in respect of any additional annex, and the annex shall thereupon enter into force for that Party subject to subparagraph (c); and
(c) On the expiry of one year from the date of the communication by the depositary of the adoption of an additional annex, the annex shall enter into force for all Parties that have not submitted a notification in accordance with the provisions of subparagraph (b).
4. The proposal, adoption and entry into force of amendments to Annex A, B or C shall be subject to the same procedures as for the proposal, adoption and entry into force of additional annexes to this Convention, except that an amendment to Annex A, B or C shall not enter into force with respect to any Party that has made a declaration with respect to amendment to those Annexes in accordance with paragraph 4 of Article 25, in which case any such amendment shall enter into force for such a Party on the ninetieth day after the date of deposit with the depositary of its instrument of ratification, acceptance, approval or accession with respect to such amendment.
5. The following procedure shall apply to the proposal, adoption and entry into force of an amendment to Annex D, E or F:
(a) Amendments shall be proposed according to the procedure in paragraphs1 and 2 of Article 21;
(b) The Parties shall take decisions on an amendment to Annex D, E or F byconsensus; and
(c) A decision to amend Annex D, E or F shall forthwith be communicated tothe Parties by the depositary. The amendment shall enter into force for allParties on a date to be specified in the decision.
6. If an additional annex or an amendment to an annex is related to anamendment to this Convention, the additional annex or amendment shall not enter into force until such time as the amendment to the Conventionenters into force.

REMARK XXII

Stockholm Convention ratified by Law No.5871 does not cover the provisions of the Regulation as specific conditions and processes are set in the regulation for the member states.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 15

Competent authorities

Each Member State shall designate the competent authority or authorities responsible for the administrative tasks required by this Regulation. It shall inform the Commission of such designation at the latest three months after the entry into force of this Regulation.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Not present

REMARK XXIII

Stockholm Convention ratified by Law No.5871 does not cover the provisions of the Regulation as the competent authority was not specified in the Convention.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 16

Committee for general matters

1. The Commission shall be assisted by the Committee established by Article 29 of Directive 67/548/EECfor all matters under this Regulation except for those relating to waste.
2. Where reference is made to this paragraph, Articles 5 and 7 of Decision 1999/468/EC (Council Decision of 28 June 1999 laying down the procedures forthe exercise of implementing powers conferred on the Commission) shall apply, having regard to the provisions of Article 8 thereof.

The period laid down in Article 5(6) of Decision 1999/468/EC (Council Decision of 28 June 1999 laying down the procedures for the exercise of implementing powers conferred on the Commission) shall be set at three months.
3. Where reference is made to this paragraph, Article 5a(1) to (4) and Article 7 of Decision 1999/468/EC (Council Decision of 28 June 1999 laying down the procedures for the exercise of implementing powers conferred on the Commission)shall apply, having regard to the provisions of Article 8 thereof.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Not present

REMARK XXIV

Stockholm Convention ratified by Law No.5871 does not cover the provisions of the Regulation as the commmittee for general matters was not specified in the Convention.

However, the above Article 29 of the Directive 67/548/EEC is on Procedure for adaptation to technical progress and on applicable until accession.

Decision 1999/468/EC (Council Decision of 28 June 1999 laying down the procedures for the exercise of implementing powers conferred on the Commission) will be found as an Annex 1 of this document.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 17

Committee for waste matters

1. The Commission shall be assisted by the Committee established by Article 18 of Directive 75/442/EEC (Council Directive 75/442/EEC on waste/TehlikeliAtıklarınKontrolüYönetmeliği), for matters relating to waste under this Regulation.
2. Where reference is made to this paragraph, Articles 5 and 7 of Decision 1999/468/EC (Council Decision of 28 June 1999 laying down the procedures for the exercise of implementing powers conferred on the Commission) shall apply, having regard to the provisions of Article 8 thereof.
The period laid down in Article 5(6) of Decision 1999/468/EC(Council Decision of 28 June 1999 laying down the procedures for the exercise of implementing powers conferred on the Commission) shall be set at three months.
3. Where reference is made to this paragraph, Article 5a(1) to (4) and Article 7 of Decision 1999/468/EC (Council Decision of 28 June 1999 laying down the procedures for the exercise of implementing powers conferred on the Commission) shall apply, having regard to the provisions of Article 8 thereof.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Not present

REMARK XXV

Stockholm Convention ratified by Law No.5871 does not cover the provisions of the Regulation as the commmittee for waste matters was not specified in the Convention.

Decision 1999/468/EC (Council Decision of 28 June 1999 laying down the procedures for the exercise of implementing powers conferred on the Commission) will be found as an Annex 1 of this document.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 18

Amendments to Directive 79/117/EEC

In Part B of the Annex to Directive **79/117/EEC** 'Persistent organochlorine compounds', items 1 to 8 shall be deleted.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Not present

REMARK XXVI

Stockholm Convention ratified by Law No.5871 covers the provisions of the Regulation.

However, Council Directive 79/117/EEC of 21 December 1978 on prohibiting the placing on the market and use of plant protection products containing certain active substances has been transposed by means of a Communique No.2003/43 on prohibiting the placing on the market and use of plant protection products containing certain active substances. In Attachment B of this Communique, 'Persistent organochlorine compounds' were listed and these compounds were deleted in the new by-law on Control of Plant Production Products and in the by-law on Lisensing of the Plant Protection Products.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

Article 19

Entry into force

This Regulation shall enter into force on the twentieth day following that of its publication in the Official Journal of the European Union.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Article 26

Entry into force

1. This Convention shall enter into force on the ninetieth day after the date of deposit of the fiftieth instrument of ratification, acceptance, approval or accession.
2. For each State or regional economic integration organization that ratifies, accepts or approves this Convention or accedes thereto after the deposit of the fiftieth instrument of ratification, acceptance, approval or accession, the Convention shall enter into force on the ninetieth day after the date of deposit

by such State or regional economic integration organization of its instrument of ratification, acceptance, approval or accession.

3. For the purpose of paragraphs 1 and 2, any instrument deposited by a regional economic integration organization shall not be counted as additional to those deposited by member States of that organization.

REMARK XXVII

Entering into force procedures are different in EU and Turkey so this article is non applicable.

ANNEX I

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC **ANNEX I** **LIST OF SUBSTANCES SUBJECT TO PROHIBITIONS** **Part A Substances listed in the Convention and in the Protocol**		**Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009** **ANNEX A** **ELIMINATION** **Part I**	
		Activity	**Specific exemption**
Aldrin	No Specific Exemption on Intermediate Use or Other Specification	**Production**	None
		Use	Local ectoparasiticide insecticide
Chlordane		**Production**	as allowed for the parties listed in the register
		Use	Local ectoparasiticide Insecticide Termiticide Termiticide in buildings and dams Termiticide in roads Additive in plywood adhesives
Dieldrin		**Production**	None
		Use	Use in agricultural operations
Endrin		**Production**	None
		Use	None
Heptachlor		**Production**	None
		Use	Termiticide Termiticide in structures of houses Termiticide (subterranean) Wood treatment In use in underground cable boxes
Hexachlorobenzene		**Production**	Production as allowed for the Parties listed in the Register
		Use	Intermediate, solvent in pesticide, closed system site limited intermediate
Mirex		**Production**	Production as allowed for the Parties listed in the Register
		Use	Termiticide
Toxaphene		**Production**	None

		Use	None
Polychlorinated Biphenyls (PCB)	Without prejudice to Directive 96/59/EC *(Council Directive 96/59/EC of 16 September 1996 on the disposal of polychlorinated biphenyls and polychlorinated terphenyls* (PCB/PCT*)*, articles already in use at the time of entry into force of this Regulation are allowed to be used.		Use in articles in use in accordance with the provisions of **Part II** (Polychlorinated biphenyls) of this Annex **REMARK XXVIII** Stockholm Convention ratified by Law No.5871 does not cover the provisions of the Regulation as the Regulation sets processes to be fullfilled in line with EU legislation and moreover makes reference to Council Directive 96/59/EC of 16 September 1996 on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT). In Turkey, the above mentioned Directive has been transposed and put into force as a by-law on the control of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT) dated 27 December 2007, published in Official Gazette No. 26739 although the provision of the by-law seems consistent the Annexes should be taken as is from the Regulation.
DDT (1,1,1-trichloro-2,2-bis(4-chlorophenyl) ethane)	Member States may allow the existing production and use of DDT as a closed-system site-limited **intermediate for the production of dicofol** until 1 January 2014, in accordance with Article 4(3) of this Regulation. The Commission shall review this exemption by 31.12.2008 in the light of the outcome of the evaluation in the framework of Directive 91/414/EEC *(Council Directive 91/414/EEC of 15 July 1991 concerning the placing of plant protection products on the market)*	**Production**	**REMARK XXIX** This part is present in ANNEX B RESTRICTION Part I of Stockholm Convention ratified by Law. No 5871. However, Council Directive 79/117/EEC of 21 December 1978 on prohibiting the placing on the market and use of plant protection products containing certain active substances has been transposed by means of a Communique No.2003/43 on prohibiting the placing on the market and use of plant protection products containing certain active substances. In Attachment B of this Communique, 'Persistent organochlorine compounds' were listed and these compounds were deleted in the new by-law on Control of Plant Production Products and in the by-law on Lisensing of the Plant Protection Products. Acceptable purpose: Disease vector control use in accordance with **Part II of this Annex (DDT (1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane))** Specific exemption: **Intermediate in production of dicofol intermediate**
		Use	Acceptable purpose: Disease vector control in accordance with Part II of this Annex Specific exemption: Production of dicofol Intermediate

LIST OF SUBSTANCES SUBJECT TO PROHIBITIONS Part B Substances listed only in the Protocol			
Chlordecone	No Specific Exemption on Intermediate Use or Other Specification	**Activity**	**Specific Exemption**
Hexabromobiphenyl		**Production**	None
		Use	None
HCH, including lindane	By way of derogation, Member States may allow the following uses (a) until 1.9.2006: — Professional remedial and industrial treatment of lumber, timber and logs; — Indoor industrial and residential applications; (b) until 31.12.2007: — Technical HCH for use as an intermediate in chemical manufacturing; — Products in which at least 99 % of the HCH isomer is in the gamma form (lindane) are restricted for use as public health and veterinary topical insecticide.	**Production**	**None**
		Use	Human health pharmaceutical for control of head lice and scabies as second line treatment

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

ANNEX II

LIST OF SUBSTANCES SUBJECT TO RESTRICTIONS

PART A Substances listed in the Convention and in the Protocol No substance
PART B Substances listed only in the Protocol No substance

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

ANNEX B

RESTRICTIONS

Chemicals

1.DDT (1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane) CAS No: 50-29-3
2.Perfluorooctane sulfonic acid (CAS No:1763-23-1), its salts and perfluorooctanesulfonyl fluoride (CAS No: 307-35-7)

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

ANNEX III

LIST OF SUBSTANCES SUBJECT TO RELEASE REDUCTION PROVISIONS

Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDF)
Hexachlorobenzene (HCB) (CAS No: 118-74-1)
Polychlorinated biphenyls (PCB)
Polycyclic aromatic hydrocarbons (PAHs)
Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

ANNEX C

UNINTENTIONAL PRODUCTION

Part I Persistent organic pollutants subject to the requirements of Article 5 (Measures to reduce or eliminate releases from unintentional production)
Hexachlorobenzene (HCB) (CAS No: 118-74-1)
Pentachlorobenzene (PeCB) (CAS No: 608-93-5)
Polychlorinated biphenyls (PCB)
Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDF)

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

ANNEX IV

List of substances subject to waste management provisions set out in article 7.

Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009

Not present

REMARK XXX

There is no concentration limits in Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009.

Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC

ANNEX V

WASTE MANAGEMENT

REMARK XXXI

Stockholm Convention ratified by Law No.5871 does not cover the provisions of the Regulation as this Annex is not present in the Stockholm Convention ratified by Law No.5871.

Please find below the articles and Annexes of Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009, which are not mentioned inRegulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC;

Article 4Register of specific exemptions
Article 14 Interim financial arrangements
Article 8 Listing of chemicals in Annexes A, B and C
Article 19 Conference of the Parties
Article 20 Secretariat
Article 23 Right to vote
Article 24 Signature
Article 25 Ratification, acceptance, approval or accession
Article 27 Reservations
Article 28 Withdrawal
Article 29 Depositary
Article 30 Authentic texts
ANNEX D, E, F, G

8. Conclusion

Since EU legislation on POPs is based on Stockholm Convention like Turkey, member states drafted the legislation in order to establish the system for the management of POPs in line with the principles of Stockholm Convention.

As a consequence of this fact, the Regulation on POPs determines the implementation of Stockholm Convention.

The gap analysis will help in identifying various government departments and institutions that should be involved in subsequent stages of the POPs management process.

Recommendations:

It is recommended to MOEU:

- To follow the same way as EU and establish the institutional and legal system pursuant to the current EU Regulation.
- To use the SWOT Analysis Report and the draft by-law on POPs which will be prepared in the context of the Project to establish the institutional and legal framework as the identification of various government departments and institutions that should be involved in subsequent stages of the POPs management process.
- To consider the outcomes of sectoral and regulatory impact analysis on POPS while finalizing the institutional and legal framework on POPs.

- To ensure cooperation between the stakeholders especially direct coordination is essential among the governmental institutions in other words competent and relevant authorities.
- To draft the new by-law with official participation of Ministry of Environment and Urbanization, Ministry of Health, Ministry of Food, Agriculture and Livestock in order to ensure the implementation of POPs and to ensure institutional corporation.
- To establish an integral POPs monitoring and implementing system as a separate General Directorate in MoEU i.e. to restructure the Chemicals Management Department as a General Directorate with direct correlation to permitting and inspection unit.
- To encourage the institutional strengthening of the other relevant authorities and to prepare the a joint by-law especially for the development of NIP for POPs management with high priority to ensure the implementation
- To have staff educated in multidisciplinary area including chemistry, biology, environment.
- To activate the Chemicals Council, whose purpose is to promote information and collaboration between industry, government and other stakeholders on matters concerning the national implementation of the chemicals legislation in Turkey. The Council will be linked to the MoEU and the General Director of Environmental Management of MoEU will be the Chairman of the Council, which has the following composition: The Council will be designed as an expert body, providing scientific advice and consultation on chemical issues to government agencies within the environmental sector. The different expertise of the Council members will contribute to improve contacts between the stakeholders.
- To allocate funds to carry out capacity development and training activities in the expert level of competent and relevant authorities.
- To encourage BAT and new processes that facilitates the elimination of POPs.
- To organise trainings for raising the level of awareness of the industry and public on POPs.
- To accept EU guidelines as a communiqué of MoEU.
- To define and implement the coordination process between individual departments of the Ministry of Environment and Urbanization and other responsible ministries and institutions will be improved as key strategic process for successful and effective implementation of the NIP measures on the technical aspects connected with the new and candidate POPs.
- Since EU legislation on POPs is based on Stockholm Convention like Turkey, member states have drafted the legislation in order to establish the system for the management of POPs in line with the principles of Stockholm Convention.
- As a consequence of this fact, the Regulation on POPs determines the implementation of Stockholm Convention.

TURKISH SECONDARY LEGISLATION

Council Directive on the Disposal of Polychlorinated Biphenyls and Polychlorinated Terphenyls 96/59/EC, 16.09.1996	**By-law on the Control of Polychlorinated Biphenyls and Polychlorinated Terphenyls**	**Gaps**
Article 1	Article 1	Article of by-law is consistent with Directive
Article 2	Article 4	Article of by-law is consistent with Directive
Article 3	Article 5(ç)	Article of by-law is consistent with Directive
Article 4	Article 12, Annex 3	Article of by-law is consistent with Directive
Article 5	Article 5(h)	Article of by-law is consistent with Directive
Article 6	Article 22	Article of by-law is consistent with Directive

Article 7	Article 5(1)(f)	Article of by-law is consistent with Directive
Article 8	Article 16	Incineration should be done according to Council Directive 94/67/EC of 16 December 1994 on the incineration of dangerous waste. In our by-law it is stated that incineration should be done acc to By-law on Control of Hazardous Wastes which is transposed from Basel Convention 91/689/EEC (Council Directive on Hazardous Wastes)
Article 9	Article 15	Article of by-law is consistent with Directive
Article 10	Article 10	Article of by-law is consistent with Directive

Table showing comparison of EU legislation and Turkey legislation on POPs

EU Regulation	TR POPS	Compotent authority	REMARK
Art 1	Stockholm Convention Art 1	MoEU	See Remak I
Art 2	Stockholm Convention Art 2	MoEU	See Remark II
Art 3 (1), (2), (3)	Stockholm Convention Art 3 (1), (2), (3), (4) By-law on Restriction of Manufacturing, Placing on the Market and Use of Certain Hazardous Substances, Preparations and Articles Art 5 (1) By-law on Control of Waste Electrical and Electronic Equipments Art 5(1)(a) By-law on Control of PCBs and PCTs Art 5 (1)(b) By-law on Cosmetics Art 7 By-law on the Certification of Pesticides Art 22 By-law on Control of Pesticides Art 36	MoEU MoEU MoEU MoEU MoH MoFAL MoFAL	See Remark III
Art 4 (1)(a)	Stockholm Convention Art 3(5) By-law on Control of PCBs and PCTs Art 5(1)(c)	MoEU MoEU	See Remark IV
Art 4(1)(b)	Stockholm Convention Annex A Part I Note (i)	MoEU	See Remark V
Art 4(2)	Stockholm Convention Annex A Part I Note (ii)	MoEU	See Remark VI
Art 4(3)	Stockholm Convention Annex A Part I Note (iii)	MoEU	See Remark VII
Art 5	Stockholm Convention Art 6 By-law on Control of Hazardous Waste Annex IIIA By-law on Control of PCBs and PCTs Art 5(1)(c)	MoEU MoEU MoEU	See Remark VIII
Art 6(1), (2)	Stockholm Convention Art 5	MoEU	See Remark IX

Art 6(3)	Stockholm Convention Annex C Part 5	MoEU	See Remark X
Art 7	Stockholm Convention Art 6 By-law on Control of Waste Oils Art 5(2)	MoEU	See Remark XI
Art 7(3)	Stockholm Convention Art 6(1)(d)(iii)	MoEU	See Remark XII
Art 7(4)	By-law on Control of Soil Pollution and Sites Contaminated by Point Sources Annex I	MoEU	See Remark XIII
Art 8(1), (2)	Stockholm Convention Art 7(1)(a), (b)	MoEU	See Remark XIV
Art 9	Stockholm Convention Art 16	MoEU	See Remark XV
Art 10(1)	Stockholm Convention Art 9(1)	MoEU	See Remark XVI
Art 10(2)	Stockholm Convention Art 10(1)	MoEU	See Remark XVII
Art 10(3)	Stockholm Convention Art 9(5)	MoEU	See Remark XVIII
Art 11	Stockholm Convention Art 12(1)(2)	MoEU	See Remark XIX
Art 12	Stockholm Convention Art 15	MoEU	See Remark XX
Art 13			See Remark XXI
Art 14			See Remark XXII
Art 15			See Remark XXIII
Art 16			See Remark XXIV
Art 17			See Remark XXV
Art 18			See Remark XXVI
Annex I	Stockholm Convention Annex A	MoEU	See Remark XXVII
Annex II List of substances subject to restrictions does not contain substance			
Annex III	Stockholm Convention Annex C	MoEU	See Remark XXVIII and XXVIII
Annex IV			See Remark XXX
Annex V			See Remark XXXI

Annex XI: SWOT Analysis of POPs management in Turkey

1 Introduction

Strength Weakness Opportunity Threats (SWOT) Analysis is a composite part of the activities of the Project Technical Assistance for Implementation of the Persistent Organic Pollutants Regulation, TR2010/0327.03-01/001 – EuropeAid/132428/D/SER/TR, whose main focus is to strengthen the capacity to adequately cope with managing Turkey's priority on POPs related issues in line with sustainable development.

The SWOT Analysis Report aimed at providing a form of technical support to initiate the process of POPs management in Turkey.

In SWOT Analysis Report mainly the below topics are used to determine the current situation:

- the assessment of the institutional structure
- the assessment of capacity building as the current capacities and their needs stated in the prepared National Implementation Plan for the Stockholm Convention
- the preliminary assessment of priority needs, definition of goals and activities necessary for the improvement of the abilities of institutions and procedures in order to sufficiently form and implement them efficiently in a sustainable manner as a draft by-law will be prepared and some modifications should be made on a number of current legislation for the management of persistent organic pollutants (POPs) in Turkey as follows

Briefly, the SWOT Analysis is based on country profiling and its needs for support in order to meet all requirements in the draft by-law.

During the Project Activities the below topics were discussed in the training programs and issues that came up during discussions are used in the SWOT Analysis Report;

- Ratification of the Stockholm Convention by means of Law,
- Completion of the NIP, strategies and the Action Plan,
- Develop the NIP ensure sustainability,
- Establishment of a structure for implementing the legislation,
- Ensure financial support at all levels due to the impact of the procedures on POPs,
- Fulfilment of obligations concerning relevant authorities as MoH, MoFAL,
- Coordination of competent authority and relevant authorities.

As a consequence of GAP Analysis and SWOT Analysis the Technical Assistance Team (TAT) identifies the state of and the need for capacities. While drafting the legislation the results of those studies will be taken into consideration in order to implement the requirements from the respective EU legislation.

1.1 SWOT Analysis Goals

The primary goals of the SWOT analysis are:

- To identify, through a country-driven consultative process, priorities and needs for capacity building to provide suitable management of the POPs in Turkey.
- To conduct the analyses of the existing capacities of the country, its advantages, limitations and needs to provide recommendations for the measures necessary for achieving the desired results
- To assess the establishment of the necessary capacities, which implies the implementation of activities to meet the requirements on POPs for the sustainable development and environmental protection in line with the obligations arising from Turkey's current legislation on POPs.
- To foster a higher level of synergy between the competent authorities and relevant institutions that implement activities necessary for meeting the environmental management and protection requirements arising from EU legislation.

SWOT Analysis was applied for indications alongside the prioritisation and GAP Analysis. Through the application of these analyses, TAT is able to define problems (weaknesses) and identify the existing or the potential capacities (strengths) to consider them in drafting the legislation. The facts reached after the SWOT Analysis will be good indicators for solving the problems and their causes. The identified factors which might support the capacity building or a more rational use of the current capacities will be taken into consideration in establishing the institutional framework in the draft legislation. As a consequence, the basis for the preparation of the draft by-law which recommends specific provisions for the implementation and promoting synergies between the competent authorities will determined in the draft legislation.

The lack of capacities for the development and implementation of the EU legislation are identified to take the necessary measures in the NIP which is a must in line with the current legislation.

1.2 Methodology for SWOT Analysis

The main activities can be summarized as follows:

- Review of the relevant current Turkish and EU legislation on POPs. Participation in some of the training programs and workshops with the experts of MOEU and other stakeholders.
- Completion of GAP analysis on current Turkish and EU legislation.

In line with the above activities the following phases and topics were taken into account in SWOT Analysis Report:

- Review of administrative, management and consultative bodies relevant to POPs.
- Forming the inventory of the existing data and performed activities which give a basis for future activities.
- Determination of requirements of the current legislation based on Stockholm Convention as Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009
- Assessment of capacities and needs in order to meet the requirements of the draft by-law .

The capacity building concept represents all activities that improve the capability of individuals, institutions and the entire system to perform the duties in order to meet the requirements of the EU legislation in an efficient, effective and sustainable manner. Capacity building at the institutional level aims at improved organisational structure and increased cooperation between competent and/or relevant authorities, groups or sectors working on POPs.

The institutional capacity components are assessed as follows in the SWOT Analysis Report:

- *human resources* – the quantity experts with special education on POPs of the competent authorities or relevant authorities who are designated to perform activities and requirements designed in the current legislation,
- *administrative resources* – institutions and organisations structures and processes in line with the current legislation, operational proficiency,
- *financial resources* – the availability of the budget of these authorities and management of the financial resources,
- *informative resources* – availability and reliability of necessary information and information management between the competent authority and relevant authorities,
- t*echnical resources* – the location of the workplace and availability and distribution of technical equipment.

In order to assess the level of the capacities of the institutions dealing with POPs, in the implementation of their activities the following topics are considered as follows:

- *political framework* - political support is the basis of legal framework, suitable political framework to foster implementation of the requirements of international conventions on POPs;
- *legal framework* – assessment of the appropriate laws and other legal instruments in force, are the responsibilities of the competent and relevant authorities shared in current legislation, do the appropriate institutions/organisations exist with their own specific legislation;
- *implementation of current legislation* – assessment of the competent and relevant authorities dealing with POPs. Checking the affirmative conflict of duty between the competent and relevant authorities, the responsibilities of the competent and relevant authorities in implementation;
- *economic framework* – assessment of the economic impact of the new procedure of POPs is the market;
- *resources* – the level of human, financial and information resources available to the national or local governments, economy sector, civil society;
- *support of the public* – the assessment of the public awareness and support exist regarding the POPs;
- *coordination* – the mutual relations and cooperation between the competent authorities and relevant authorities.

During the SWOT Analysis the complex political, legal and administrative structure of Turkey is considered and the special emphasis is put on linking the institutions and creating a functional framework aimed at identifying and implementing the current legislation.

1.3. Technical Context of the Current Legislation on Persistent Organic Pollutants

The primary goal of the Convention is to take measures to eliminate or reduce persistent organic pollutants in the nature to protect the humans and the nature. The goal is to limit, prohibit production, use, releases, export and import of highly toxic substances recognised as persistent organic pollutants for the protection of humans and environment.

Persistent organic pollutants are among the most dangerous pollutants that are released into the environment due to human activity. Persistent organic pollutants are organic compounds relatively resistant to the chemical, photolytic and biological degradation with high lipophilicity which allows them to bioaccumulate inside living organisms and also in organic phases of soils and sediments. Due to their high stability, they can be transported from the sites where were produced and applied to the remote sites where never been produced and never been used. They are ubiquitous and they can circulate globally through a process called “cold condensation”. They can be transported via air, waters, migratory species, materials, products and wastes. They are highly toxic and cause an entire range of adverse effects in humans and animals - cancer, allergies and hypersensitivity, damage to the central and peripheral nervous system, reproductive disorders and immune system disorders.

The goal of the Stockholm Convention is to eliminate or reduce the production and use of all intentionally produced POPs, pollutants (for example, industrial chemicals and pesticides). The Convention also seeks to accomplish the continuing minimisation of these pollutants and elimination of releases of unintentionally produced POPs, pollutants such as dioxins and furans (polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans, PCDDs/Fs).

Article 7 of the Convention it is obliged to develop National Implementation Plan (NIP) by March 30th 2012. At the national level the Convention is implemented through the NIP prepared by under the responsibility of Ministry of Environment and Urbanization. NIP defines activities, strategies and action plans for POPs management in the country. NIP, established on the basis of the actual POPs inventory, shall provide the making of strategic decisions for the identification of priority activity and the drafting of new policy that shall help Turkey implement the Stockholm Convention on POPs.

In the implementation of the Convention at the first instance, the Convention regulated 12 chemicals, namely: aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene, polychlorinated biphenyls (PCBs), DDT, dioxins and furans (polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans).

After the Fourth COP, held from 4th to 8th May 2009 in Geneva, a Decision was adopted on the Amendment to the Annex A, B and C of the Convention and on this occasion 9 new chemicals were added to the original list: chlordecone, hexabromobiphenyl, alpha-hexachlorocyclohexane, beta-hexachlorocyclohexane, lindane (gama-hexachlorocyclo-hexane), tetrabromodiphenyl and pentabromodiphenyl ethers, hexabromodiphenyl and heptabromodiphenyl ethers, perfluorooctanesulfonic acid and its salts (or perfluorooctanesulfonyl fluoride).

Furthermore, in August 2010, the Amendment which included 9 new chemicals came into force. After the Fifth COP, held in Geneva from 25th to 29thApril 2011, the member states agreed on adding technical endosulfan and appropriate isomers to the list of chemicals in Annex A of the Convention, removal with specific exemptions. Endosulfan is a pesticide with wide application in the production of cotton, coffee and other food products. When the removal of endosulfan enters into force in 2012, endosulfan shall become the 22nd persistent organic pollutant added to the list of chemicals of the Stockholm Convention. HBCDD, also referred to as HBCD, is a bioaccumulative and toxic flame retardant, and it will be banned under the Stockholm convention as the 23rd substance to be added to the annex A of the Stockholm Convention. EU legislation will be modified acordingly and HBCDD will be highly regulated from August 2015, as part of the authorisation procedure of the REACH regulation. Furthermore, the exemption for HBCDD in insulation foam of polystyrene was set to five years considering there are numerous non-chemical alternatives available.

1.4. Requirements of the EU Legislation on Persistent Organic Pollutants

The basic requirements of the EU legislation include a continuous reduction of persistent organic pollutants as far as possible and wherever possible as well as a final elimination of the emission of unintentionally produced POPs such as dioxins and furans.

These obligations of the EU legislation can be summarized as follows:

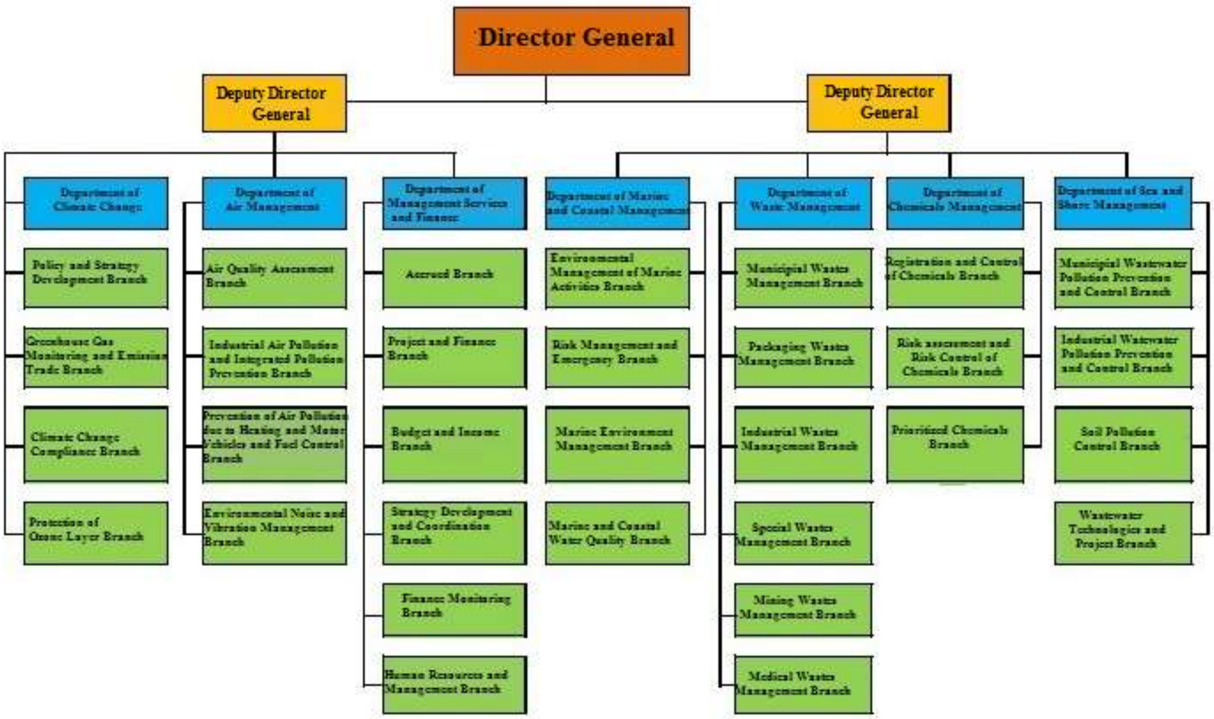
- to control the use of POPs including production, import, export, disposal;
- to encourage the best available technologies, practices and substitute substances for replacing existing POPs;
- to take legal and institutional measures for the management of waste includes POPs
- to draft a compact legislation, to ensure the competent authority and relevant authorities are established and the share of duties and responsibilities are completed.
- to take necessary measures to prevent the development of new POPs
- to implement the new by-law drafted under the activities of this project and
- to form and implement National Implementation Plan (NIP).

1.5. General view of organizational structure of the competent authority, MOEU

The competent authority for the implementation of POPs legislation is the Ministry of Environment and Urbanization (MoEU) that has overall authority for the protection of the environment and the human health in Turkey. Besides, health, biodiversity impact, and overall adverse agricultural, commercial, and economic impacts of inappropriate or unlawful use of dangerous chemicals and hazardous wastes are considered under the duties and responsibilities of the MoEU.

The MoEU and the provincial directorates for MoEU are the governing authorities for the storage, transport and disposal of hazardous wastes. Other relevant ministries as Ministry of Forestry and Water Affairs, Ministry of Health and Ministry of Food, Agriculture and Livestock are assigned appropriate roles with respect to dangerous chemicals and hazardous wastes, so POPs. However although control of POPs are the principal function of the MoEU due to the lack of cooperation between the mentioned ministries the results of the studies on POPs are not shared with the other relevant ministries including MoEU (pls see the GAP Analysis Report for the other component authorities by-laws and their implementation).

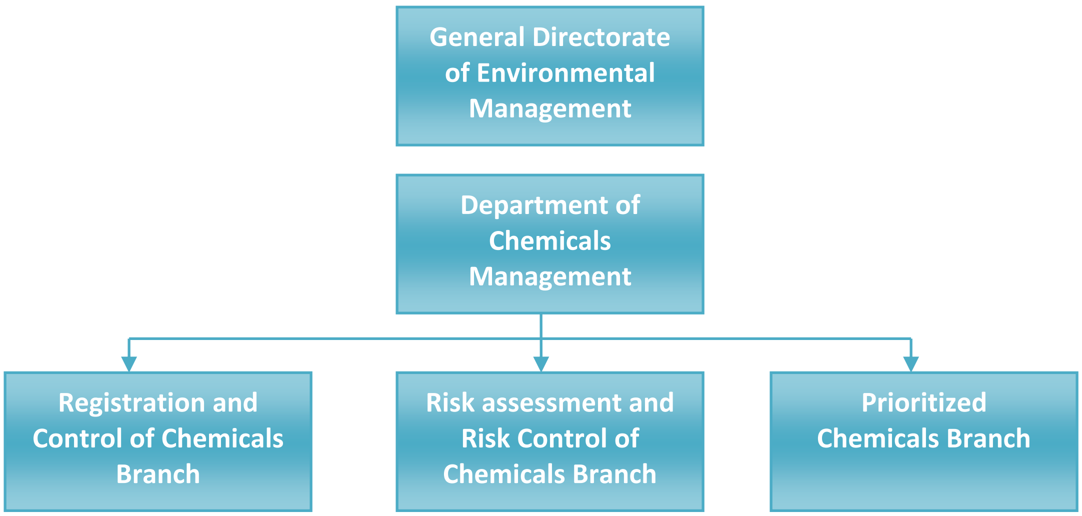
Department of Chemicals Management, positioned under General Directorate of Environmental Management, is responsible for the management of chemicals, whereas General Directorate of Environmental Impact Assessment, Permitting and Inspection is responsible for their inspection. Organizational chart of General Directorate of Environmental Management is as below.



Within the scope of Ministerial Strategic Plan, strategic objectives related to Management of Chemicals are configured as one article in all ministerial goals. In SA2 H2.6 of Plan it is stated that in the process of accession to the European Union, studies about prohibition and restriction of 20 chemicals will be carried out for effective management of chemicals. These chemicals are subject to relevant EU legislation and international conventions related to chemicals management, including dangerous chemicals and affects adversely human health and the environment and produced, imported, used and placed on the market. Studies on transposition of REACH Regulation and CLP Regulation were completed and other related regulations and directives will be transposed to our national legislation.

The main activity of Head of Chemicals Management Department (CMD) is within the framework of sustainable development, to ensure chemical safety by determination of action plans adopted pursuant to policies and strategies, to carry out relevant research and projects, to take measures necessary for their implementation, to carry them out, to supervise and inspection their implementation, to observe international developments and projects in the area, to coordinate the activities ministerial departments, civil society organizations, and public organizations, to provide advice on the betterment of areas polluted by chemicals.

Organizational chart of the CMD is as below:



Roles and Responsibilities of the Chemicals Management Department:

- To apply countrywide, to determine goals and criteria for chemicals which create risks to human health and the environment,
- To set the procedures and principles of implementation of chemicals management,
- To create and keep records of chemicals, to create a priority list for chemicals which create risks to human health and the environment, to conduct risk assessment for chemicals in the priority list, to take measures of risk reduction, and to ensure the continuity of the operations,
- Within the framework of international conventions and protocols, to observe and implement international endeavours,
- To implement and coordinate projects concerning compatibility to the European Union acquis and fulfilling the requirements of international conventions which comes within its scope of duties,
- To create the coordination necessary to ensure the fast, ordered, productive, and effective delivery of General Management services geared toward compatibility with the European Union and with international institutions,
- To serve as a National focal point of the Stockholm Convention
- To determine the goals and the principles regarding the management of chemicals which are high concern and the criteria, methods and the essentials regarding the restriction and prohibition of their use and their import and the export,
- To make the necessary studies for the harmonization of EU legal acquis in the issues of its assigned position, to carry on and coordinate the projects in this frame,

- To have corporation with the associations, organizations and the sectors in the issues of it assigned position, to organize trainings and the seminars in order to increase the technical and administrative capacity
- Setting up the Chemical Substances Inventory and Prioritized Chemical Substances List.
- Preparing and performing the projects within the framework of harmonization to EU Regulations and International Agreements, organizing training and seminar to increase technical and administrative capacity.
- To provide the corporation and the coordination with the local and international organizations in the issues of its assigned position, to perform required studies for the harmonization of EU legal acquis, to organize trainings and seminars in order to increase the technical and administrative capacity
- Determining the principles and procedures related with classification, packaging and labelling of dangerous substances and mixtures placed on market and compilation and distribution of safety data sheets.
- Follow up the international studies on the risk management, prohibition and restriction of the chemicals, to propose and to conduct required projects and to enable them carried out in the international level.
- Make risk assessment for prioritised substances, risk reduction measures to be taken.
- Determination of principles and procedures on restriction and prohibition of production, use and placing on market of dangerous substances.
- Perform socio-economic analysis for restriction and prohibition of chemicals.
- Performing related functions assigned by the General Directorate.
- Updating the National Implementation Plan related to the Persistent Organic Pollutants.

When the activities and processes of the department are examined; administrative and support processes directly related with department's performance are structured to serve all the general directorates at the ministerial level, and performance of the processes about positioning of department specific objectives, implementations, and measures should be monitored and improved. As all work performance regarding the creation of department specific objectives during planning process involving all the units throughout the ministry could not be taken into consideration enough, sub-planning should be provided to each department, and department budget should be structured in accordance with the strategic plan. There is not a unit neither at ministerial level nor department level that is responsible for identifying and reducing the risks which block evaluation of department activities and effective execution of the department activities. Related organization and processes should be structured.

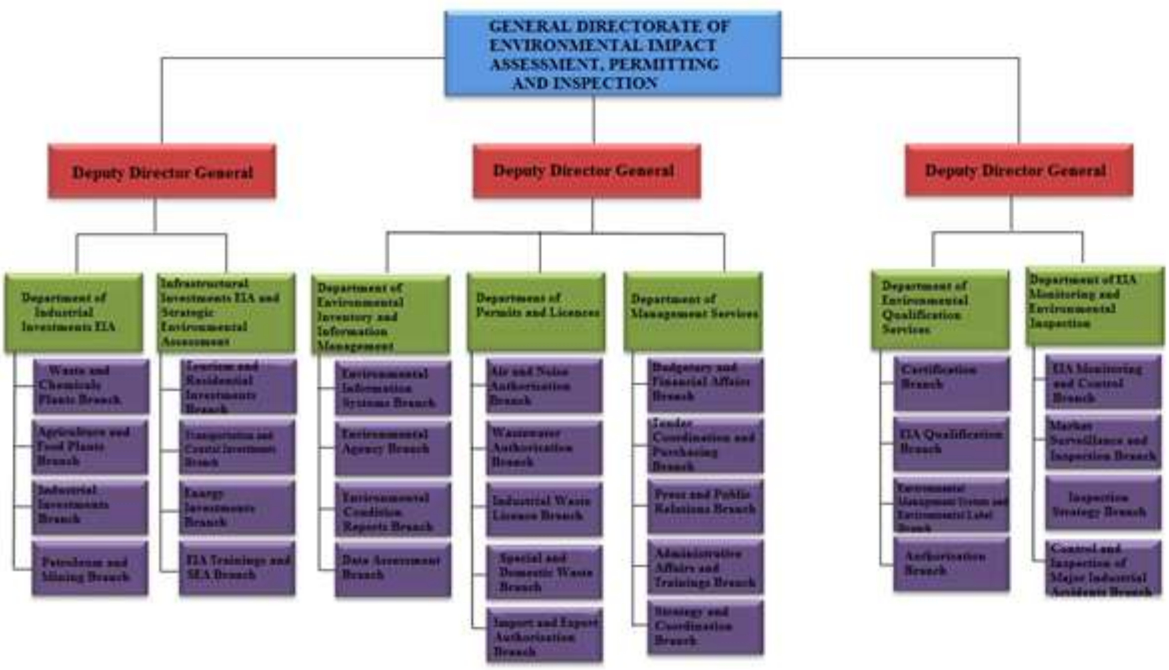
In order to manage the department activities efficiently and effectively:

- Strategy regarding the chemical management should be clarified at country level, and a structuring model should be specified within this direction.
- Department of Chemical Management should be structured in accordance with these strategies (organization, job descriptions, process procedures), and an information system substructure enabling efficiency for all, should be established.
- The competence of present personnel should be developed in accordance with the strategy and objectives and policies for the retention of competent personnel should be defined.
- Both financial and human resources should be planned and supplied in accordance with department strategies and targets.
- Coordination and communication between units should be strengthened with an efficient process structuring and performance system.
- Being responsible with activities (EIA and the EEA meetings, etc.) for executive managers and personnel that are not directly related to presidential activities, adversely affects

organizational efficiency. Activities that are not directly related to department processes should be determined and improved under structuring.

- On the other hand, Branch of Market Surveillance and Inspection, and Branch of Control and Inspection of Major Industrial Accidents which are under the Ministerial General Directorate of Environmental Impact Assessment, Permitting and Inspection, assume responsibility for the control of chemicals compliance with Environmental Law. For POPs related tasks excluded priority chemicals department staff, total number of staff in Chemicals Management Department should be about 12 however following the preparation of draft by-law the number can be determined in line with the duties and responsibilities designed in NIP.

The relevant organization chart for the General Directorate of Environmental Impact Assessment, Permitting and Inspection is as follows:



Although the General Directorate of Environmental Impact Assessment, Permitting and Inspection is responsible for monitoring, granting authorisation, evaluating, and inspection of activities which cause environmental pollution or otherwise have adverse effects to the environment, the job description of the General Directorate of Environmental Impact Assessment, Permitting and Inspection experts does not contain a reference to the monitoring and inspection activities on POPs.

Within the job description of General Directorate of Environmental Impact Assessment, Permitting and Inspection responsibilities about monitoring, permitting, evaluation, and control of environmental impacts and activities that have negative impacts on environment and that cause environmental pollution are mentioned; there is not any phrase about monitoring and control of chemicals in general, and about control and monitoring activities related to implementations of POPs specifically. As a detached unit is not authorized on this subject, and because the authority and responsibilities are not defined clearly, the performance of the monitoring activities on this subject is affected adversely. A self-contained unit should be configured to control chemicals and inspection processes should be strengthened. General Directorate of Environmental Impact Assessment, Permitting and Inspection should be supported by adequate and competent personnel for process management, coordination and performance measurement. Branch directorates should be configured also for control and reporting.

1.5.2 Relation between the MOEU and the Relevant Ministries Governmental Organizations

Responsibilities of the relevant ministries dealing with the management of dangerous chemicals and waste are mentioned below in a Table.

Since there are a number of relevant ministries and governmental authorities who are dealing with POPs in the current legislation the management and monitoring of the POPs should be explained in the legislation clearly.

REMARK

The obligations of the respective governmental organizations and the ways and means for cooperation should be defined by means of a protocol to be completed among them. In this protocol, the duties and responsibilities of the relevant authorities should be defined in line with the current legislation and the work load should be shared by the relevant ministries. The overlapping activities should be identified in order to prevent waste of resources and encourage rational use of human and financial resources.

Besides in order to ascertain the cooperation between the relevant ministries periodic meetings should be held to monitor the implementation.

Competent Authorities	Duties and Responsibilities
Ministry of Environment and Urbanization	To draft legislation on POPs. To perform, monitor and coordinate activities of POPs as competent authority.
Ministry of Forestry and Water Affairs	To coordinate and control the national water resources management and to create policies for protecting water resources for sustainable use of water. Deriving the quality standards for POPs in water and monitoring and control of pollution caused by POPs in water resources
Ministry of Science Industry and Technology	Determination of industrial strategies and aims by constituting industrial committees and monitor the studies on these subjects. Control of the production of chemicals.
Ministry of Economy	Ensuring top legislative harmonization between the product safety, technical regulations, technical obstacles, technical suitability assessment and monitoring of the applications and adapting the technical legislations related to the products working in coordination with relevant institutons to the foreign trade. Determining the regulatory principles of product safety, import and export of chemicals
Ministry of Energy and Natural Resources	Supervision of the chemical waste and the equipments used in distribution and production of electricity and taking relevant precautions on the subject.
Ministry of Food Agriculture and Livestock	Control, regulate and monitor the licensing, production, import, export, sales, use and storage of agricultural chemicals.
Ministry of Customs and Trade	Taking consumer precautions on consumer goods that pose or may pose a hazard to the environment, preparing quality control and quality checking systems to raise the quality of food, making

	suggestions to the related foundations pursuant to the standards. Control of the chemicals that are coming in and going out of the country and making sure the relevant legislations are followed while import and export of the chemicals.
Ministry of Development	Development and Public investment policies' determination regarding chemicals and environment and its coordination of during implementation.
Ministry of Health	Development of sectoral health policies, implementation of national health strategies, investigation of the effects of chemicals on human health after short and long term exposure
Ministry of Labour and Social Security	Monitoring of occupational health and safety issues, auditing, policy development and planning, developing health and safety units and certifying the practices. Determining the rules and principles of working with chemicals and the measures necessary for the prevention of industrial accidents.

1.6. Facts, Problems and Solutions

1 – Involvement of competent authority and relevant authorities in fulfilling the duties for implementing the current legislation

Facts

POPs are multidisciplinary and complex and next to the primary environmental aspect, they include a trade aspect as well as many other aspects such as the economic, health, agricultural aspects etc., therefore the involvement of the relevant authorities are essential.

In the existing legislation the legal framework for its implementation has defined in different legislations as there are mainly 10 ministries dealing with POPs in Turkey as elaborated above.

Problems

For Turkey to full its obligations under the Stockholm Convention for POPs depend on the provision of adequate financial and technical assistance. There are some implementation problems at all levels because of the complex administration system and inadequate administrative capacities due to financial restrictions and human resources. One of the important implementation principle of the NIP is the inclusion of public and stakeholder participation and contribution. To ensure the regular annual budget for inventories, disposal, monitoring, research and awareness raising based on the NIP conclusions and measures for technical and financial assistance.

Solution

A draft by-law is necessary for the full implementation of POPs legislation in Turkey so transposition of EU Legislation is essential. The existence of an institutional and organizational framework for supporting the implementation of the POPs legislation should be supported with legislation. The identification of competent authorities, relevant authorities and stakeholders and their participation/involvement in management process on the implementation of the legal requirements should be defined in the draft by-law in order to ascertain their active participation in the management of POPs especially in decision making process.

2 -The existence of a joint management committee for implementation mechanism

Facts

The experts of the Department of Chemicals Management in MoEU have good communication with the other relevant departments of MoEU, the relevant authorities and the stakeholders so they are all open to work together and share information with the other stakeholders. Also the competent and relevant authorities implement certain activities on the basis of other legislation such as the legislation on waste, biocidal products and pesticides. However the institutions are in need of support for possible solutions of the matters on POPs.

Problems

Since there are several ministries/organizations dealing with POPs a Joint Management Committee for the management of POPs is essential. Some joint management mechanisms have been formally established pursuant to the provisions of laws and regulations as Chemicals Advisory Committee. In line with the Article 8 of By-law on the Classification, Packaging and Labelling of Dangerous Substances and Preparations in order to harmonize the national policy and ensure information exchange between relavant institutions, the Chemicals Advisory Committee established under the co-odination of Ministry of Environment and Urbanization. This committee is not working at the moment.

Solutions

The establishment and nature of the Joint Management Committee should be defined and established formally in the draft legislation to work efficiently. It may be the same committee as previously described in Article 8 of By-law on the Classification, Packaging and Labelling of Dangerous Substances and Preparations. This committee should be mentioned in the draft by-law and it should be an active committee.

3 –Public Awareness, Access to Information and Training programs for Public Awareness on POPs

Facts

One of the important implementation principle of the NIP is the inclusion of public and stakeholder participation and contribution. In addition the POPs issue impacts on many sectors of society and economy including policy-making, the public and various interest groups. The competent authority and the other stakeholders are aware of Turkish and EU legislation on POPs and they try to develop awareness by means of project activities and dissemination seminars. Relevant national stakeholder institutions and groups were identified, sensitized and assigned with responsibilities from the on set of the NIP development process.

Problems

The access to information is mentioned in the current legislation in other words Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009 however the current legislation is based on Stockholm Convention so access to information is not defined with details in the legislation so the information management system should be sufficiently defined in the draft by-law including the information management infrastructure.

Solutions

Raising awareness of public for the convention and obligations will help increasing the efficiency of activities within the scope of implementation plan. The training programs should be developed to raise awareness of the relevant organizations and general public. Especially training of trainers programs should be performed for the experts of competent and relevant authorities should be referred in the draft by-law. Strengthening and continuous training of the experts about POPs and all relevant fields should be performed regularly. However, the experts of the competent authority have knowledge on the concept and goals of the current POPs legislation and also EU legislation. The experts of the competent authority and relevant authorities have participated in training programs and all have good scientific knowledge on POPs and implementation of activities on POPs.

4 – Environmental planning and the strategy development

Facts

As stated by the Article 7 of the Stockholm Convention, Turkey prepared the first NIP in 2004 to 2006 funded by GEF and revised it in 2010 submitted to the Stockholm Secretariat in 2011 which included initial 12 POPs issues of concern like uses, import, export, production, distribution in country and source related inventory, current stockpiles and its disposal options assessment, contaminated sites, POPs chemicals related infrastructure, legal instruments, monitoring, research and development capacity, monitoring system establishment and use.

Problems

The process is not well coordinated and adequate plans and strategies are not produced due to the lack of special provisions in the current legislation. NIP has been prepared by the competent authority however in order to ensure the full implementation of NIP, it should be approved by the Joint Management Committee and should be considered as National Development Plans. The draft legislation should include such provisions on implementation of NIP.

Besides, the strategy and action plan for implementing the Stockholm Convention on POPs should be taken into consideration with Basel Convention and Rotterdam Convention requirements.

Solutions

The NIP has been developed, but it is partly implemented due to financing restrictions. Organisations/institutions relevant to POPs do not have adequate financial and human resources for their programmes In order to have the adequate human and financial resources at the first instance the requirements should be designed in the NIP.

5 – Existence of a complete policy on POPs and legal framework

Facts

In Turkey, the issues of chemicals including POPs are of great concern. There are comprehensive legislations for Convention on POPs mandates Parties to take certain measures to achieve the objective of the Convention. A successful implementation of the Convention in Turkey would therefore involve the integration of some of these provisions into the current institutional and regulatory framework for managing chemicals in the country.

Problems

The legal framework is not sufficient as draft by-law is necessary to provide an adequate implementation of the main legislation by taking actions. EU Regulation will be transposed by means of a by-law. Today, in addition to the NIP, some relevant protection policies and legislation are used for controlling POPs. There are some provisions in a number of legislation on POPs and for the implementation of the draft by-law the implementation of that supplementary legislation should be implemented. Currently there is no subordinate legislation in line with EU legislation to implement the legislation based on Stockholm Convention. While discussing POPs also Basel and Rotterdam Conventions should be considered together while structuring the organization for POPs management. The structure for the implementation of conventions pertaining to chemicals has not been established however the synergy of the 3 conventions will be a good opportunity for POPs management.

Solutions

New by-law is necessary in line with the project activities and the ratification of Rotterdam Convention is highly recommended. On July 22, 2010 the Prime Ministry Office General Directorate for Laws and Resolutions has sent the Rotterdam Convention to the Turkish National Grand Assembly to be ratified by means of law.

6 – Availability of necessary technical skills and technology transfer

Facts

For successful management of POPs and implementation of Convention, establishment of local and sub-local centers in the need of capacity building and technology transfer is necessary.

Problems

The necessary skills and technology are partly available as the competent authority and relevant authority experts have the necessary skills but the provincial directorates' experts of the authorities partly have the skills and trainings.

Solutions

The training programs should be developed and the quantity of the experts should be increased to meet the requirements of draft by-law.

7 – Sufficiency of the implementation of monitoring process and inventory

Facts

There is no systematic monitoring program on POPs emissions, releases and occurrence in the abiotic and biotic matrices and in technical matrices. However some POPs (hexachlorobenzene, pentachlorobenzene, endosulphan) will be monitored as a part of Regulation on Surface and Underground Waters and Regulation on Surface Water Quality. Studies on monitoring POPs periodically will be included in the National Monitoring Network and monitoring programmes as a part of the Regulation on Surface and Ground Waters and specific parameters. In addition, a systemic monitoring background will be developed as a part of EU POPs Rules Harmonization process and related e-PRTR Rules. Moreover, there are several academic survey and research studies conducted in different media where possibly POPs concentrated regions and results of these studies are present.

Problems

Monitoring is conducted without an adequate monitoring legal framework. Monitoring should be placed in the draft by-law with emphasis on how it is to be conducted. The new system should include monitoring at all levels and the results of the implementation process should be regularly monitored and shared with the relevant authorities and institutions.

Solutions

It is aimed at in the draft by-law the monitoring is timely and correctly conducted and the results are applied as a basis for forming knowledge and should be used as a basis for changing the existing technical process.

8 –Assessment of the implementation of the legal framework

Facts

The primary current legislation on POPs is based on Stockholm Convention ratified by Law No.5871 on Ratification of Stockholm Convention on Persistent Organic Pollutants dated April 14, 2009. There are some provisions in different legislation of different ministries.

Problems

Evaluation and monitoring of the activities are made partly due to the lack of legal and institutional framework for evaluation plan. Evaluation should be carried out in line with the evaluation plan, and the evaluation plan should be updated regularly by using the evaluation results. In the draft by-law the measures for effective evaluations should be placed and the evaluations should be made timely and correctly and the results and experience should be used as the basis for changing activities and as insight for further implementation of activities.

Solutions

As a priority, it is necessary to adopt subordinate legislation, to ensure that implementing authorities are established and functioning. Also necessary provisions should be mentioned in the draft by-law to establish a system for inventory and to monitor work results. Inventory will be the first step of determination of financial burden on industry. Other priorities will be defined in the NIP as stated in Fact 7.

1.7. Recommended future steps for POPs management in Turkey:

It is recommended to MOEU:

- To follow the same way as EU and establish the institutional and legal system pursuant to the current EU Regulation.
- To use the SWOT Analysis Report and the draft by-law on POPs which will be prepared in the context of the Project to establish the institutional and legal framework as the identification of various government departments and institutions that should be involved in subsequent stages of the POPs management process.

- To consider the outcomes of sectoral and regulatory impact analysis on POPS while finalizing the institutional and legal framework on POPs.
- To ensure cooperation between the stakeholders especially direct coordination is essential among the governmental institutions in other words competent and relevant authorities.
- To draft the new by-law with official participation of Ministry of Environment and Urbanization, Ministry of Health, Ministry of Food, Agriculture and Livestock in order to ensure the implementation of POPs and to ensure institutional corporation.
- To establish an integral POPs monitoring and implementing system as a separate General Directorate in MoEU i.e. to restructure the Chemicals Management Department as a General Directorate with direct correlation to permitting and inspection unit.
- To encourage the institutional strengthening of the other relevant authorities and to prepare the a joint by-law especially for the development of NIP for POPs management with high priority to ensure the implementation
- To have staff educated in multidisciplinary area including chemistry, biology, environment.
- To activate the Chemicals Council, whose purpose is to promote information and collaboration between industry, government and other stakeholders on matters concerning the national implementation of the chemicals legislation in Turkey. The Council will be linked to the MoEU and the General Director of Environmental Management of MoEU will be the Chairman of the Council, which has the following composition: The Council will be designed as an expert body, providing scientific advice and consultation on chemical issues to government agencies within the environmental sector. The different expertise of the Council members will contribute to improve contacts between the stakeholders.
- To allocate funds to carry out capacity development and training activities in the expert level of competent and relevant authorities.
- To encourage BAT and new processes that facilitates the elimination of POPs.
- To organise trainings for raising the level of awareness of the industry and public on POPs.
- To accept EU guidelines as a communiqué of MoEU.
- To define and implement the coordination process between individual departments of the Ministry of Environment and Urbanization and other responsible ministries and institutions will be improved as key strategic process for successful and effective implementation of the NIP measures on the technical aspects connected with the new and candidate POPs.
- Since EU legislation on POPs is based on Stockholm Convention like Turkey, member states have drafted the legislation in order to establish the system for the management of POPs in line with the principles of Stockholm Convention.
- As a consequence of this fact, the Regulation on POPs determines the implementation of Stockholm Convention.

1.8. SWOT Analysis Table for POPs Management

STRENGTHS	WEAKNESSES
• Ratification of Stockholm Convention and its amendments by means of law • Existence of chemicals management system with institutional and legal framework. • Experience in developing chemical strategies with regards to EU legislation. • Experience in developing current subordinating chemical legislation with regards to EU legislation. • Trained experts of the competent authority on the concept and goals of the POPs legislation • Trained experts of the competent authority and relevant authorities with scientific knowledge on POPs. • Existence of ongoing projects on POPs that will support the establishment of the system on management of POPs. • Existence of some provisions on POPs in the legislation of competent and relevant authorities. • Development and update of NIP in line with Stockholm Convention. and CRLTAP/POPs Protocol	• Non-existence of harmonisation between existing law and EU legislation • Non-existence of a legal framework in the field of POPs with current subordinate legislation. • Non-existence of harmonisation between existing law and subordinate legislation of different authorities. • Existence of complex institutional framework for POPs management. • Non-existence of mechanism and process for POPs management. • Non-existence of sufficient infrastructural and institutional support for POPs management. • Low level of public awareness as POPs is a new concept for the public. • Inadequate financial and human resources for POPs management. • Non-existence of regulatory impact assessment on POPs especially cost and benefits analysis studies. • Non-existence of inter-institutional Joint Management Committee. • Non-existence of a general directorate for chemicals. • Lack of information, inventory is not realized as permanent, ongoing process. • Non-existence of coordination between the authorities and institutions. • Non-existence of harmonisation and connection between strategic and related development documents. • Non-existence of a specific inspection and permitting department dealing with POPs management. • General low level of awareness on actions specified in the previous SC NIP, resulting in very low level of implementation of SC NIP measures.
OPPORTUNITIES	**THREATS**
• Existence of competent and relevant authorities/institutions at state level • Partly existence of the structure for the implementation of legislation on POPs which needs capacity development. • Development of international cooperation and correlation on POPs with Convention Secretariatsand through links made in numerous international technical assistance and other projects. • Development of BAT and processes that eliminates intentional and unintentional involvement of POPs. • Establishment of an integral POPs monitoring and implementing system as a separate General Directorate in MoEU further institutional strengthening of the other relevant authorities. High level of international cooperation shall be resorted to, in order to support BAT to be used in industry. • Organisation of trainings for raising the level of awareness of the industry and the public. • Increased share of Turkish trade organizations via adoption of BAT/BEP regarding POPs in the production sector. • Synergy of three conventions (the Basel, Stockholm and Rotterdam Conventions).	• Affirmative conflict of duty on POPs management • Instability of people in positions of importance for POPs management, including those receiving specific training. • Sustainability of the current ministerial organization. • High costs of BAT and new processes to be used for POPs management. • Non-allocation of funds for supporting the implementation of the Convention, trainings and other activities. • Incomplete and non-functional institutional restructuring for efficient management of POPs. Inability of institutions to follow through on responsibilities specified in NIP, e.g.role in interministerial committees, etc. • Horizontal and verticaldisconnection between the Competent and Relevant authorities • Non-existence of cooperation and information flow between the Competent and Relevant authorities and all other stakeholders • Failure in harmonisation and connection between strategic and related development documents in the forestry, agriculture and health and the field of POPs management. • Disconnection and poor coordination between the government and non-government sectors and between the academic institutions • Insufficient data that can mislead the stakeholders in the POPs management.

Annex XII: Preliminary inventory of banned flame retardants in Turkey

PRELIMINARY INVENTORY OF BANNED FLAME RETARDANTS IN TURKEY

Coordinator (s): Perihan Binnur Kurt-Karakuş

ABBREVIATIONS

ABS	Acrylonitrile-butadiene-styrene
ASR	Automotive shredder residue
BAT	Best Available Techniques
BEP	Best Environmental Practices
BEUD	Turkish Appliance Manufacturers Association
BFR	Brominated flame retardant
c-OctaBDE	Commercial octabromodiphenyl ether
COP	Conference of Parties
c-pentaBDE	Commercial pentabromodiphenyl ether
CRT	Cathode ray tube
DPT	State Planning Department
EEE	Electrical and electronic equipment
ELV	End of Life Vehicle
EPS	Expanded polystyrene
EU	European Union
GHG	Greenhouse gases
HBCDD	Hexabromocyclododecane
HIPS	high impact polystyrene
HS	Harmonized System
IZODER	Association of Thermal Insulation, Waterproofing, Sound Insulation and Fireproofing Material Producers, Suppliers and Applicators
LCD	Liquid-crystal display
MoCT	Ministry of Customs and Trade
MoE	Ministry of Economy
MoEU	Ministry of Environment and Urbanization
MoSIT	Ministry of Science, Industry and Technology
NIP	National Implementation Plan
ODS	Ozone-depleting substances
PBDD/F	Polybrominated dibenzo-p-dioxins and dibenzofuran
PBDE	Polybrominated diphenyl ether
PBT	Persistent Bioaccumulative and Toxic
PC	Personal computer
POP	Persistent Organic Pollutant
POP-PBDE	PBDEs in POPs list in Stockholm Convention
PS	Polystyrene
PUR	Polyurethane
PVC	Polyvinylchloride
TAIA	Turkish Automotive Industry Association
TBBPA	Tetrabromobisphenol A
TEF	Toxic Equivalent Factor

TEQ	Toxic equivalency
TSCA	Toxic Substances Control Act
TÜİK	Turkish Statistics Institution
TV	Television
UNEP	United Nations Environment Programme
US	United States
WEEE	Waste electrical and electronic equipment
XPS	Extruded polystyrene

Brief

Current report focuses on polybrominated diphenyl ethers (PBDEs) and hexabromocyclododecane (HBCDD). The basic impulse for focusing on the issue of PBDEs and HBCDD in Turkey is the fact that their world-wide ban by Stockholm Convention as well as their negative impacts on human health and the environment. As a signatory of the Convention, Turkey requires to update National Implementation Plan (NIP) on Persistent Organic Pollutants and this report is prepared as a part of updated NIP.

The current document reports a preliminary inventory of PBDEs in Turkey in transportation and electrical and electronic equipment and related wastes (EEE/WEEE). Furthermore, this document reports a preliminary estimation of HBCDD in polystyrene foam. Turkey did not produce PBDEs or HBCDD, however data obtained from inventory study reveals that a significant amount of these chemicals entering the waste stream at a given time in Turkey.

In May 2009, tetrabromodiphenyl ether, pentabromodiphenyl ether (components of commercial pentabromodiphenyl ether, c-pentaBDE) hexabromodiphenyl ether and heptabromodiphenyl ether (components of commercial octanbromodiphenyl ether, c-octaBDE) were included in Stockholm Convention whereas HBCDD was included to the Convention in November 2014. Thus, it is prohibited production, use, import and export of these chemicals. The Convention was put in force in Turkey in 2010. According to Article 6 of the Convention, each Party is required to develop and implement strategies to identify existing POPs stockpiles, and to develop strategies for identifying products in use that contain or are contaminated with POPs and POPs-containing wastes.

1. PBDEs

PBDEs represent one of the sub-groups of brominated flame retardants (BFRs). PBDEs posses similar characteristics to PCBs [2]. When PBDEs are incinerated, they have a high risk in formation of polybrominated dibenzo-p-dioxins and dibenzofurans (PBDD/Fs), having similar effects as PCDD/Fs.

Since the twentieth century, manufacturers began to replace traditional materials such as wood, metal, and wool with petroleum-derived products such as plastics and polyurethane foam. These new "treated" materials are either less flammable or slowed down the rate of fire growth. The latter is achieved by treating the materials by flame retardants. PBDEs are brominated chemicals used as flame retardants and hence widely used in items that are susceptible to catch or sustain fire such as plastic in electronic devices, polymers in automobile, certain synthetic textiles and polyurethane foam in certain applications.

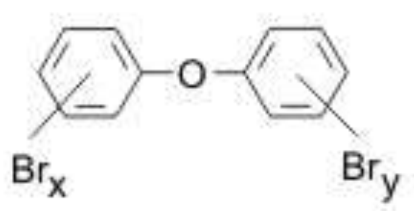


Figure 1. Molecular Structure of PBDEs

There are three types of commercial PBDE products – commercial pentabromodiphenyl ether (c-PentaBDE), commercial octabromodiphenyl ether (c-OctaBDE), and commercial decabromodiphenyl ether (c-DecaBDE). Commercial PentaBDE (c-PentaBDE), the homologues "tetrabromodiphenyl ether and pentabromodiphenyl ether" as well as c-OctaBDE, "hexabromodiphenyl ether and heptabromodiphenyl ether" are listed under the Stockholm Convention on Persistent Organic Pollutants (POPs). In 2002, the European Parliament adopted a ban on marketing and use of c-PentaBDE and c-OctaBDE throughout the European Union and the ban took effect in August 2004.

There is no data on the amount of PBDEs used in Turkey. However, studies conducted in Turkey reports PBDEs in environmental compartments including air, biota, mother's milk, window dust films, indoor air and indoor dust (see table below).

[2] PCB has also been used as flame retardant but to a minor extent

Table 1. Studies reported PBDEs in environmental compartments in Turkey

Environmental Compartment	Concentration	Location of Study	Reference
Fish	<DL-600 pg/g ww (varies by congeners)	Mediterranean Sea & Bafa Lake	Çakıroğulları et. al. (http://edepot.wur.nl/178186)
	<nd-6.7 ng/g ww (Σ_6PBDEs)	Kahramanmaras	Erdoğrul et al., 2005
Mothers Milk	0.005–0.014 ng/g lipid(Σ_7PBDEs)	Kahramanmaras	Erdoğrul et. al. , 2004
	67.34 ng/g lipid (Σ_5PBDEs)	Konya	Özcan et. al., 2011
Air	8.6–28.9 pg/m^3 , gas phase (Σ_7PBDEs) 12.1–62.2 pg/m^3 , particulate phase (Σ_7PBDEs)	İzmir	Cetin and Odabasi, 2007
	1451±954 pg/m^3, gas phase	İzmir	Odabasi et al. 2009
	21-117 pg/m^3 (gas+particulate)	İzmir	Cetin and Odabasi. 2008
Window Film	43.5, 45.5, and 206 ng/m^2 (background, urban and industrial)	İzmir	Cetin and Odabasi, 2011
Indoor Air	163-10000 pg/m^3	İstanbul	Kurt-Karakus, 2013 (unpublished data, TUBITAK Short Term Research Project 112Y004 Final Report)
House dust	395-12500 ng/g	İstanbul	Kurt-Karakus, 2013 (unpublished data, TUBITAK Short Term Research Project 112Y004 Final Report)

Office Dust	330-32200 ng/g	İstanbul	Kurt-Karakus, 2013 (unpublished data, TUBITAK Short Term Research Project 112Y004 Final Report)
Soil	0.70 to 203 µg/kg (Σ_7PBDEs)	Kocaeli	Cetin, 2014

Without any doubt, the main challenge in efforts to eliminate POP-PBDEs is identification of import/export figures of these chemicals or goods treated with such chemicals, existing stockpiles, POP-PBDE-containing articles still used by consumers, and their disposal practices at the end-of-life, determination of the life cycle of such articles and of potential contaminated sites. This preliminary inventory of PBDEs aims to take a snapshot on the current amount of PBDEs and volume of potentially impacted materials such as plastics and polyurethane foam in transport sector (cars, buses and trucks) and electrical and electronic equipment (EEE)/waste electrical and electronic equipment (WEEE) in Turkey as well as initiate actions to address contaminated sites problem.

2. INVENTORY - PBDEs

Some part of this report was prepared by an inventory team within the scope of update of the 1st NIP of Turkey on POPs. The inventory report for PBDEs was created on the basis of tier 1 and tier 2 of the tiered approach provided by the guidance document (Stockholm Convention Secretariat, 2012a). Tier 1 is the initial assessment that generally relied on desk studies while tier 2 reports the preliminary assessment based on calculations. The methodologies include indicative, qualitative, and quantitative methods (Stockholm Convention Secretariat, 2012a). The indicative method provides initial information about the different applications of POP-PBDEs. The initial information has helped the team determine the focus of the inventory. It also helped identify data gaps and served as basis of further planning. The qualitative method includes Focus Group Discussions during regional workshops.

Neither a detailed national transportation nor an EEE/WEEE inventory which could have been used as base for this POP-PBDE inventory has been established for Turkey before. Therefore a preliminary inventory of the transport and EEE/WEEE sector of Turkey was established in this study. There is no doubt that such sector-based inventories are also a “must” for science-sound and integrated waste management and resource management planning.

2.1 Planning of the inventory and identification of stakeholders

In this first step the objectives and scope of the inventory need to be defined and a work plan developed (see section 3.1. of the PBDE Inventory Guidance (Stockholm Convention Secretariat, 2012a)). The POP-PBDEs inventory of the transport sector is expected to address the following life cycle stages:

- Vehicles imported/exported in the inventory year. Possibly import data of previous years as a basis for estimating/evaluating stocks;

- Stocks of vehicles (vehicles in use/possession of consumer/corporates);
- End-of-life vehicles entering the waste stream;
- Polymers from end-of-life vehicles recycled;
- Polymers of end-of-life vehicles disposed in the past.

At an inception workshop on new listed POPs (considering old and new listed POPs covering POP-PBDEs) held in early March 2013 in Turkey, a working group initiated the work to develop a POP-PBDE inventory. It became clear during the workshop that no national inventory on the transport sector or on EEE/WEEE inventory was available. It was also not known if and to which extent polymers from the end-of-life management of vehicles or WEEE were recycled. At the workshop a core inventory team to establish the preliminary inventory was formed and the team was supported by Ministry of Environment and Urbanization and also by a national and international consultant. Inventory team leader, national consultant and consultant assistants compiled the information in cooperation with the Ministry of Environment and Urbanization and approaching other stakeholders having information on the transport and EEE/WEEE sector.

For the establishment of the POP-PBDE inventory a work plan was developed late March 2013 with a ambiguous planned time frame of 12 weeks to compile the information.

a. Choosing the inventory methodology

This inventory is limited to major uses of POP-PBDE. According to the guidance document (Stockholm Convention Secratariat, 2012a), the main use of c-OctaBDE was in acrylonitrile-butadiene-styrene (ABS) polymers, accounting for about 95% of c-OctaBDE supplied in the EU. The treated ABS was mainly used for housings/casings of EEE, particularly for cathode ray tube (CRT) housings and office equipment such as copying machines and business printers. On the other hand, it is considered that between 90% and 95% of the use of c-PentaBDE was for the treatment of polyurethane (PUR) foam. These foams were mainly used in automotive and upholstery applications. Furthermore, other uses of PBDE are considered of minor relevance (Stockholm Convention Secretariat, 2012a) and are excluded in this preliminary inventory.

For c-PentaBDE, the amount of end-of-life vehicles was estimated using the average life span of vehicles, and data on the number of registered vehicles. For c-OctaBDE, the amount of e-waste recycled and landfilled was calculated using the End-of-Life Model (Peralta and Fontanos, 2006).

3. PRELIMINARY INVENTORY OF POP-PBDES IN THE TRANSPORT SECTOR

3.1. Methodology for Data Collection

The evaluation of available and relevant national data on the transport sector was conducted by using the approach of the *PBDE Inventory Guidance* (Stockholm Convention Secretariat, 2012a) with the available data identified and by estimating the data to fill data gaps. Calculations were made for cars, buses, vans/trucks and mini/midibuses for Turkey.

a. Formula used for calculating POP-PBDEs in vehicles

The following basic formula from the Guidance document (Stockholm Convention Secretariat, 2012a *)* is used to calculate the POP-PBDEs content of vehicles for the different categories (cars/trucks or busses) in different life cycle stages:

$$\boxed{\text{Quantity of POP-PBDEs}_{\text{Vehicle category}} = \text{Number of vehicles}_{\text{category}} \times \text{POP-PBDEs}_{\text{category}} \times F_{\text{regional}}} \qquad (1)$$

Where:

- *Number of vehicles$_{category}$* is the number of vehicles (manufactured 1975-2004) present in a category (car, bus or truck) calculated for the different life cycle stages.
- *Amount POP-PBDEs$_{category}$* is the amount of POP-PBDEs in an individual car, truck or bus treated with POP-PBDEs
- *$F_{regional}$* The regional factor of percentage of POP-PBDE impacted vehicles produced in a region

Factors needed for POP-PBDE calculation for vehicles were:

- the amount of vehicles for the different sectors (cars, buses and trucks)
- the amount of vehicles in the different life cycle stages (import, use, end-of-life)
- the origins of manufacturers of vehicles
- impact factors for the different vehicle types. The estimated contents of POP-PBDE in respective vehicle type are given by the *POP-PBDE Inventory Guidance (*Stockholm Convention Secratariat, 2012a). However one different approach was taken by Turkish inventory team: The Inventory Guidance suggests an amount of 1,000 g PentaBDE for a bus (with average 33 seats). For Turkey, however, there is a considerable amount of mini/midibuses operates within the country. As country specific impact factor 500 g c-PentaBDE (corresponding to 50% of PUR foam of a bus) was selected for this vehicle category.

Cars, buses, mini/midi buses, vans/trucks are the major portion of the transport sector containing the largest volume of POP-PBDEs. The focus and methodology for the initial assessment are therefore centered on these vehicles. Some of these vehicles are imported whereas some of them are produced within the country. A large proportion of c-PentaBDE use has been within the transport sector; the major use was for treatment of flexible PUR foams (automotive seating, head rests, car ceilings, acoustic management systems, etc.) and a minor use was in back-coating of textiles used on car seats. c-OctaBDE has also been used in plastics vehicle parts (steering wheels, dashboards, door panels, etc.). Only a portion of the cars produced between 1975 and 2005 worldwide have been treated with c-PentaBDE. It is estimated that about 35% of the approximately 100,000 tonnes c-PentaBDE production has been used in the transport sector (Alcock et al. 2003, UNEP, 2010a, 2010b). Thus, the transport sector is one of the large material flows of goods and ultimately becomes a large waste and recycling flow. Moreover, the end-of-life management of the transport sector is a highly relevant material flow for the recovery of materials and for managing pollutants (Vermeulen et al., 2011).

Since POP-PBDEs were produced and used in the period from approximately 1975 to 2004, only vehicles produced during this period need to be inventoried for POP-PBDEs. National data provided by the concerned government agencies was rather fragmented. However, it was possible to obtain number of registered vehicles and number of vehicles produced within the country from Turkish Statistics Institution (TUİK) and Turkish Automotive Industry Association (TAIA) for the period between 1970 and 2012 and the national import/export statistics obtained from Customs Office for the same period.

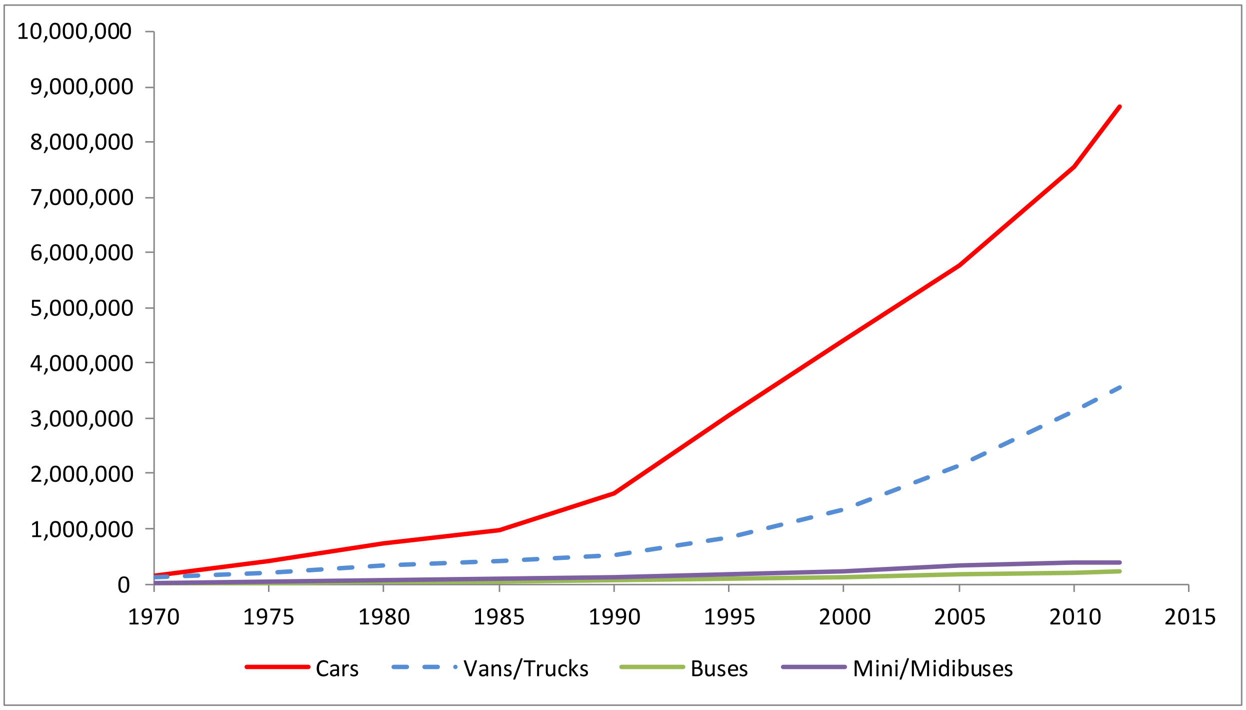


Figure 2. Registered motor vehicles in Turkey (1970-2012)

Figure 2 shows the number of motor vehicles in Turkey from 1970 to 2012. There has been more than forty fold increase in the number of road vehicles in the last three decades from 300000 in 1970 to approx. 13 million in 2012.

b. Distribution of the different vehicle types

The distribution of the different vehicle types is shown in Figure 3. The distribution is calculated for each year individually using import data obtained from Customs Office and was used for calculations in this inventory.

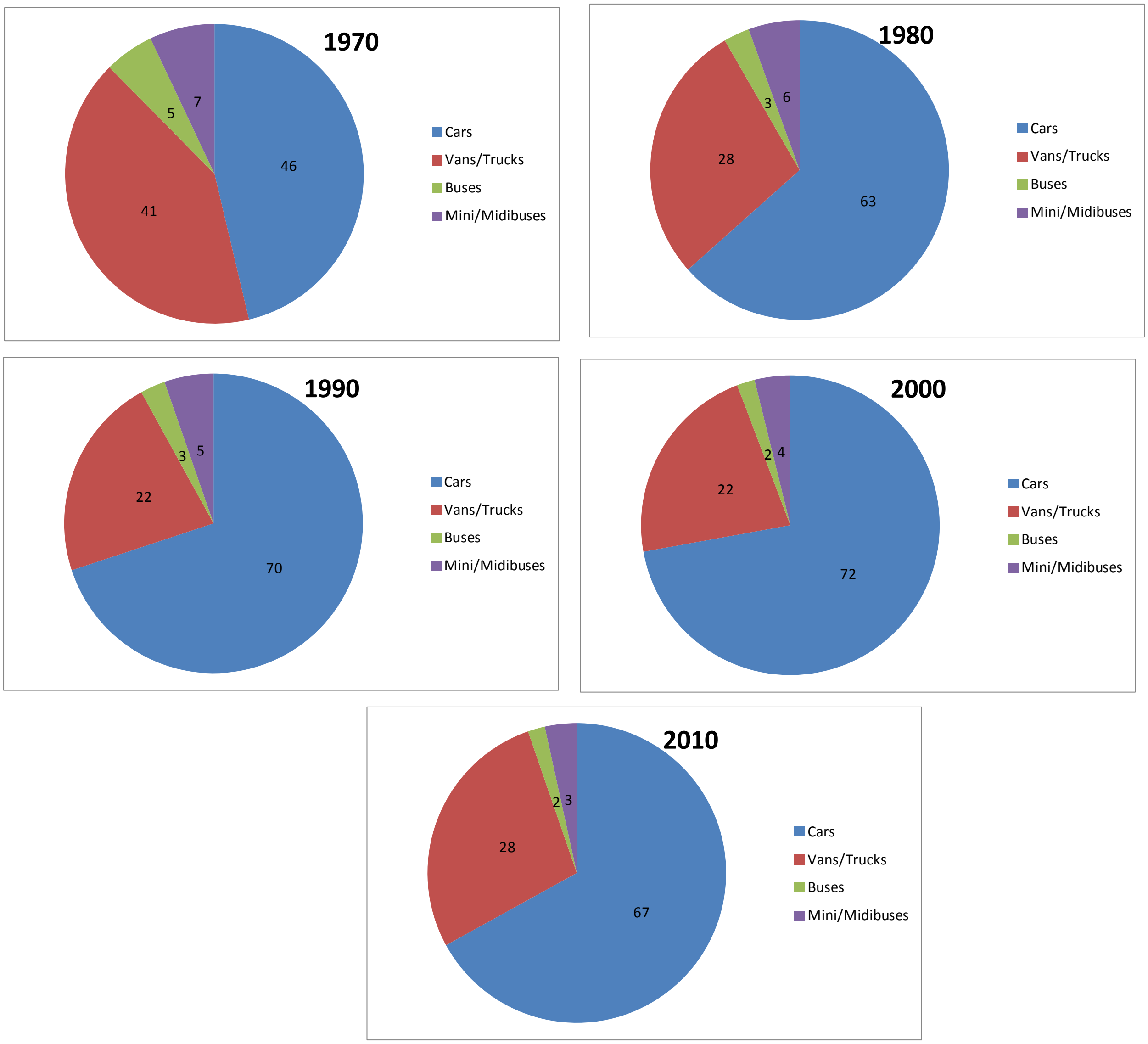


Figure 3. Percent distribution of different vehicle types in Turkey

c. Regional Import Distribution Figures

Only a part of vehicles produced between 1975 to 2004 worldwide have been treated with c-PentaBDE. In addition the use of c-PentaBDE depends on the national/regional legislations and production/use patterns. Approximately 90% of c-PentaBDE has been used in the US/North America (*POP-PBDE Inventory Guidance* Chapter 5 (Stockholm Convention Secretariat; 2012a)). According to the use pattern of c-PentaBDE, approximately 200 million cars produced in the US/North America from 1975 to 2004 could have been contaminated with c-PentaBDE. It is most likely that some cars produced in US/North America during this period (1975 to 2004) contain other flame retardants (e.g. phosphorous flame retardants and later brominated alternative Firemaster 550/600). Therefore an impact factor of 0.5 (50% of cars impacted) is suggested for vehicles imported from US/North America (*POP-PBDE Inventory Guidance* Chapter 5 (Stockholm Convention Secretariat; 2012a)). An impact factor of 0.05 is suggested as regional adjustment factor for other regions (*POP-PBDE Inventory Guidance* (Stockholm Convention

Secretariat; 2012a))*.* Since there was vehicle manufacture data for Turkey for this inventory's coverage period, the impact factor of 0.05, which is suggested for other regions is also used for vehicles manufactured in Turkey.

In the inventory, based on import data provided from Customs Office, two different distribution patterns were used. The first pattern covered the period from 1970 to 1990 and the second pattern covered the period from 1991-2004 (Table 2). When no data was available for a particular vehicle type, then these two patterns were used as an alternative to each other.

Table 2. Vehicle Import Distribution Pattern for Turkey between 1970-2004

Region	**1990-2004**	**1970-1990**
Cars		
North America	3.0	13.6
Europe	75.9	73.2
Japan/Asia	21.1	13.2
Latin America/Caribbean	na	na
Buses		
North America	1.8	27.0
Europe	73.1	68.1
Japan/Asia	25.2	4.9
Latin America/Caribbean	na	na
Vans/Trucks		
North America	7.0	21.2
Europe	93.0	78.8
Japan/Asia	na	na
Latin America/Caribbean	na	na
Mini/Midibuses		
North America	0.1	na
Europe	46.1	na
Japan/Asia	53.8	na
Latin America/Caribbean	na	na

na; no data

These estimates were derived using relatively comprehensive data from Customs Office Import Database which also mentions the origin of the vehicle. For this preliminary inventory it was assumed that the vehicles origin distribution for a given year (i.e. 1980) in a particular time period (i.e. 1970-1990) is similar as in that time period. This assumption is a reasonable approach since annual distribution patterns in a particular time span are similar.

This information and assumption allowed the choice of the regional factor given in the *POP-PBDE Inventory Guidance* for calculating the c-PentaBDE impact factor for the vehicles.

d. Recycling of polymers from end-of-life vehicles

One of the biggest data gap which could not be adequately filled within the short time of inventory development was the estimation of the amount of recycling of polymers. Registered recycling of ELVs in Turkey has been started in 2011 and data was available for 2011 to 2014. Therefore, an average increase factor of 30 %, which was reported for plastics recycling in Turkey (Ambalaj Atıklarının Kontrolü Yönetmeliği, 2011), was used to estimate the number of cars to be processed in recycling facilities in coming years. PUR foam content of a car or a truck is taken as 16 kg (Stockholm Convention Secratariat, 2012a) while it is chosen as 100 kg for buses, 50 kg (corresponding to 50% of PUR foam content of a bus) for mini/midi buses.

e. Assumptions made in the calculations

Number of registered vehicles within the country for each group between 1970-2012 was available from TÜİK and Turkish Automotive Industry Association (TAIA). However, data on export was available only for period between 2000 and 2012.

Further details are given below.

a) **Cars:** Export data was available between 1990-2012 and data was missing between 1970-1989. As a first thought, we assumed that the number of motor vehicles exported is proportional to the population to estimate the number of exported cars, however, since yearly breakdown of population data was not available prior to 2007 for Turkey, this approach was not found suitable for this calculation. As a second attempt, we tried to correlate number of exported cars vs year and interpolate the data to find the values for missing years, however this approach did not work either as we got negative values for certain years. Finally, we decided to apply "geometric increase method", which is used to estimate population, on the data to estimate the cars data. The formula of the method is given below.

$$\ln(N2) = \ln(N1) - k * (t2 - t1)$$

Whereas

N2: number of exported vehicles in future year

N1: number of exported vehicles in the past year

k= increase factor

t2: future year

t1: past year

Using the existing data, k value is calculated to be 0.21.

b) **Trucks:** The export data was available between 1990-2012. Geometric increase method was applied on the data and k value was found to be 0.41. The calculations yielded reasonable numbers until year of 1982, however, prior to this date the numbers did not look reasonable. Therefore, between 1970 and 1981, number of exported trucks were assumed to be 5, which is same as for year of 1982.

c) **Buses:** Export data for buses was not available from TÜİK or TAIA. However, some data was available from Customs Office for period between 1996-2012. The data compiled from detailed exportation numbers of Customs Office for buses for between 1996-2012 and this data was used to calculate k factor to be able to estimate the export data for missing years. A k value of 0,25 is calculated using available data.

d) **Mini/Midibuses:** Export data for mini/midibuses was not available from TÜİK or TAIA. However, some data was available from Customs office for period between 1996-2012. The data compiled from detailed exportation numbers of Customs Office for buses between 1996 and 2012 and this data was used to calculate k factor to be able to estimate the export data for missing years. A k value of 0,085 is calculated using available data.

Number of manufactured vehicles within the country for each group between 1970 and 2012 was partly available from TÜİK and TAIA. Using the same estimation method, missing numbers were estimated.

Import numbers for each vehicle group is compiled from database of Customs Office except for vans/trucks. The data was not available for this group and therefore, in calculations of amount of c-pentaBDE, trucks/vans were not included.

A summary of available/estimated data is given in Table 3.

Table 3. Number of imported, exported, manufactured and registered vehicles in Turkey between 1970-2012

	Cars				**Buses**				**Vans/Trucks**				**Mini/Midibuses**			
	I	**E**	**M**	**R**	**I**	**E**	**M**	**R**	**I**	**E**	**M**	**R**	**I**	**E**	**M**	**R**
1970	724	60	3,660	137,771	4	3	810	15,980	na	5	10,436	122922	34	377	1,099	20,916
1971	849	74	12,888	153,676	5	3	638	17,040	na	5	9,255	130444	41	411	1,891	22,380
1972	995	91	29,628	187,272	6	4	988	18,504	na	5	14,640	141716	49	447	3,748	25,559
1973	1166	112	46,855	240,360	8	5	1,289	20,011	na	5	20,397	157823	58	486	4,533	30,055
1974	1368	139	59,906	313,160	10	7	1,261	21,404	na	5	22,452	176334	69	529	4,584	34,122
1975	1604	171	67,291	403,546	13	9	1,523	23,763	na	5	33,159	206960	82	576	5,222	40,623
1976	1880	210	62,992	488,894	17	11	1,678	25,388	na	5	39,913	239037	98	627	4,910	46,066
1977	2204	259	58,245	560,424	21	15	1,544	27,096	na	5	34,716	272306	116	682	5,152	51,999
1978	2584	320	54,085	624,438	28	19	1,416	28,559	na	5	20,023	291246	139	743	3,163	56,836
1979	3030	394	43,808	688,687	35	24	1,698	30,634	na	5	22,751	312373	165	808	4,222	61,596
1980	3553	486	31,529	742,252	45	31	1,592	32,783	na	5	15,630	330714	196	880	2,130	64,707
1981	4165	599	25,306	776,432	58	39	1,962	33,839	na	5	17,940	344641	234	957	2,040	66,514
1982	4884	738	31,195	811,465	74	50	2,290	35,432	na	5	20,122	359534	279	1042	4,850	69,598
1983	5726	910	42,509	856,350	95	64	3,346	38,478	na	7	24,336	376704	332	1134	6,712	73,585
1984	6714	1121	54,832	919,577	121	82	4,516	43,638	na	11	24,797	395827	395	1234	7,460	80,697
1985	7872	1382	60,353	983,444	155	105	3,828	47,119	na	17	26,050	418001	470	1343	7,397	87,951

1986	9229	1704	82,032	1,087,234	199	134	3,321	50,798	na	26	20,251	441866	560	1462	7,318	97,917
1987	10821	2100	107,185	1,193,021	254	172	2,571	53,554	na	40	21,125	459352	667	1591	8,026	106,314
1988	12687	2589	120,796	1,310,257	326	220	2,527	56,172	na	62	20,038	474884	794	1731	6,401	112,885
1989	14875	3191	118,314	1,434,830	417	281	3,053	58,859	na	95	19,013	489959	945	1884	5,898	118,026
1990	17440	5,533	167,556	1,649,879	534	360	5,977	63,700	na	146	27,486	520760	1126	2051	7,898	125,399
1991	20448	5,790	195,574	1,864,344	683	460	5,476	68,973	na	220	30,459	554300	1341	2232	9,912	133,632
1992	23975	8,996	265,245	2,181,388	874	589	7,814	75,592	na	288	38,250	687590	1596	2429	11,450	145,312
1993	28109	8,846	348,095	2,619,852	1119	754	9,368	84,254	na	578	51,109	760688	1901	2644	12,084	159,900
1994	32957	12,802	212,651	2,861,640	1433	964	3,889	87,545	na	737	21,710	793847	2263	2877	4,924	166,424
1995	38641	33,224	233,412	3,058,511	1835	1234	4,816	90,197	na	3,140	36,567	829959	2695	3131	7,645	173,051
1996	45305	33,404	207,757	3,274,156	2,349	1579	8,355	94,978	na	4,948	50,464	896584	3209	3408	10,171	182,694
1997	50483	22,612	242,780	3,570,105	4,705	6714	12,509	101,896	na	1,779	76,128	1018909	5670	492	12,935	197,057
1998	88553	25,380	239,937	3,838,631	908	4702	13,315	108,361	na	1,241	77,340	1145753	12511	5288	13,910	211,495
1999	78120	77,753	222,041	4,072,326	652	2694	12,280	112,186	na	1,576	50,647	1224625	2218	4149	12,894	221,683
2000	204649	90,135	297,476	4,422,180	1,016	3087	15,719	118,454	na	2,130	97,155	1351754	3333	2959	20,597	235,885
2001	48000	145,457	175,343	4,534,803	411	0	5,501	119,306	na	51,458	83,355	1395238	348	0	6,486	239,381
2002	50737	169,944	204,198	4,600,140	105	5229	7,061	120,097	na	81,945	129,167	1442533	565	2176	6,139	241,700
2003	134639	215,317	294,116	4,700,343	1,147	5422	11,284	123,500	na	124,781	214,647	1552467	337	2025	13,625	245,394

2004	260344	305,072	447,152	5,400,440	1,476	5544	14,742	152,712	na	192,888	333,353	1907287	593	3058	28,161	318,954
2005	266031	319,849	453,663	5,772,745	131	5639	12,515	163,390	na	224,126	387,112	2151986	2560	6402	26,162	338,539
2006	250092	430,528	545,682	6,140,992	765	9838	14,282	175,949	na	255,923	406,888	2405159	2450	11465	20,728	357,523
2007	241005	518,328	634,883	6,472,156	361	9443	16,251	189,128	na	282,416	426,281	2619661	4823	8157	21,999	372,601
2008	213069	530,175	621,567	6,796,629	562	9581	18,186	199,934	na	358,554	486,234	2810224	3935	9670	21,123	383,548
2009	224138	340,211	510,931	7,093,964	1,264	7834	8,555	201,033	na	272,784	338,290	2932253	1568	5407	11,829	384,053
2010	367195	393,577	603,394	7,544,871	181	6101	7,926	208,510	na	342,473	466,259	3125397	5214	6076	16,978	386,973
2011	429113	405,919	639,734	8,113,111	379	6783	10,416	219,906	na	358,068	516,506	3339562	7525	6412	22,475	389,435
2012	387765	383,850	577,296	8,648,875	737	6790	10,585	235,949	na	323,903	455,762	3546256	7435	8040	29,335	396,119

I: Import, E: Export, M: Manufactured in the country, R: registered (total registration including previous years)

No color:	Data from TAIA
	Estimated using "Geometric Increase Method"
	Data from Customs Office

f. POP-PBDEs in vehicles in use and stockpiled

The inventory was based on the national registrations, additional data from TAIA as well as an estimation method explained above.

In this inventory, vehicles in current use refer to vehicles registered under the Traffic Registration Office of Ministry of Internal Affairs. Vehicles in use represent a major stock of POP-PBDEs and are important for the future planning of waste management of the transport sector. Using the data on registered vehicles (Table 3) provided by TAIA, the amount of POP-PBDEs in PUR foam of vehicles in current use was calculated.

For all vehicle types, a maximum of 2 years stock lifetime after 2004 was assumed. Additionally, it was assumed that 20 % and 10% of vehicles sold in 2005 and 2006 were manufactured in 2004. This means that the sale date of a car which was manufactured in 2004 is latest in 2006. Thus, number of vehicles registered in 2005 and 2006 were also included in calculations. Additionally, since no data on vehicle registrations prior to 1970, it was assumed that 90% of the registered vehicles were registered before 1970. This assumption was based on average ratio of new registration to total registered vehicles between 1970 and 1980. Using Formula (1), the POP-PBDEs content of vehicles for the different categories (cars, trucks or buses) in different life cycle stages (see section 5.3.4; figure 5-1 of the Stockholm Convention Secretariat, 2012a) was calculated.

Data on registered cars, busses and trucks between 1970 and 2012 were available at the national level (see Table 3). In calculating the amount of c-Penta BDE per car/truck, the number of registered cars, buses, vans/trucks and mini/midibuses were added to represent the number of vehicles in use 1975-2004. According to guidance document, vehicles from all regions produced after 2004 or produced before 1970 can be considered largely POP-PBDEs and HBB free with the exemption of recycled polymers used. Ignoring the possibility that recycled polymers might have been used in vehicles that were included in this inventory study, the amount of POP-PBDEs in PUR foam of vehicles in use for the twenty year period is presented in Table 4.

Table 4: Amount of POP-PBDEs in PUR foam of impacted vehicles in period between 1975-2004 in Turkey

Vehicle Category	# of Registered Vehicles	Amount of c-Penta PBDE in vehicle category (g)	Amount of c-PentaBDE in vehicles from North America (kg)	Amount of c-PentaBDE in vehicles from Europe (kg)	Amount of c-PentaBDE in vehicles from Japan/Asia (kg)	Amount of c-PentaBDE in vehicles from Latin America/Caribbean (kg)	TOTAL (kg)
Cars	3,285,676	160	7840	19948	5549	4	33341
Buses	79,585	1000	711	2907	1001		4619

Mini/Midibuses	178932	500	25	2064	2407		4496
Vans/Trucks	1,267,468	160	7129	9427			16556
TOTAL							**59012**

g. POP-PBDEs in Impacted Vehicles

The importation statistics of cars, buses and mini/midibuses were obtained from Ministry of Customs and Trade (MoCT) for the period between 1996-2012. Importation data for trucks was not available and not included in the calculations. Number of imported vehicles between 1970-1995 was estimated by employing geometric increase method. All data is represented in Table 5. Impacted vehicles refer to vehicles produced between 1975-2005. In the case of Turkey, vehicles imported before 2005 are considered impacted vehicles (considering the related impact factors).

Table 5. Data of impacted vehicles before 2005 covering a 29-year period (1975-2006)

	# of Cars			**Amount of c-pentaBDE (kg)**		
	I	**M**	**E**	**I**	**M**	**E**
1975	1604	67120	171	29	537	1
1976	1880	62782	210	33	502	2
1978	2204	57986	259	39	464	2
1979	2584	53765	320	46	430	3
1980	3030	43414	394	54	347	3
1981	3553	31043	486	63	248	4
1982	4165	24707	599	74	198	5
1983	4884	30457	738	87	244	6
1984	5726	41599	910	102	333	7
1985	6714	53711	1121	119	430	9
1986	7872	58971	1382	140	472	11
1987	9229	80328	1704	164	643	14
1988	10821	105085	2100	192	841	17
1989	12687	118207	2589	226	946	21
1990	14875	115123	3191	264	921	26

1991	17440	163623	3933	310	1309	31
1992	20448	190726	4848	207	1526	39
1993	23975	259270	5975	243	2074	48
1994	28109	340730	7365	285	2726	59
1995	32957	203573	9078	334	1629	73
1996	45305	193964	13793	460	1552	110
1997	50483	235391	7389	512	1883	59
1998	88553	231755	8182	899	1854	65
1999	78120	179665	42376	793	1437	339
2000	204649	238926	58550	2077	1911	468
2001	48000	175343	0	487	1403	0
2002	50737	74835	129363	515	599	1035
2003	134639	111689	182427	1366	894	1459
2004	260344	173942	273210	2642	1392	2186
2005	266031	160848	292815	2700	1287	2343
2006	225083	170142	375540	2284	1361	3004
2007	192804	202192	432691	1956	1618	3462
2008	127841	167640	453927	1297	1341	3631
2009	89655	122235	388696	910	978	3110
2010	73439	194353	409041	745	1555	3272
2011	42911	225920	413814	435	1807	3311
2012	19388	166789	410507	197	1334	3284
TOTAL	2212739	5127849	3939694	23286	41026	31519

	# of Buses			**Amount of c-pentaBDE (kg)**		
	I	**M**	**E**	**I**	**M**	**E**
1975	1002	1514	9	185	76	0.4
1976	1002	1667	11	185	83	0.6
1977	1002	1529	15	185	76	0.7

1978	1002	1397	19	185	70	0.9
1979	1002	1674	24	185	84	1.2
1980	1002	1561	31	185	78	1.5
1981	1002	1923	39	185	96	2.0
1982	1002	2240	50	185	112	2.5
1983	1002	3282	64	185	164	3.2
1984	1002	4434	82	185	222	4.1
1985	1002	3723	105	185	186	5.2
1986	1002	3187	134	185	159	6.7
1987	1002	2399	172	185	120	8.6
1988	1002	2307	220	185	115	11.0
1989	1002	2772	281	185	139	14.1
1990	1002	5617	360	59	281	18.0
1991	1002	5016	460	59	251	23.0
1992	1002	7225	589	59	361	29.4
1993	1002	8614	754	59	431	37.7
1994	1002	2925	964	59	146	48.2
1995	1002	3582	1234	59	179	61.7
1996	2349	6776	1579	138	339	79.0
1997	4705	5795	6714	277	290	335.7
1998	908	8613	4702	53	431	235.1
1999	652	9586	2694	38	479	134.7
2000	1016	12632	3087	60	632	154.4
2001	411	5501	0	24	275	0.0
2002	105	1832	5229	6	92	261.5
2003	1147	5862	5422	68	293	271.1
2004	1476	9198	5544	87	460	277.2
2005	131	6876	5639	8	344	282,0

2006	689	4444	9838	41	222	491,9
2007	289	6808	9443	17	340	472,2
2008	337	8605	9581	20	430	479,1
2009	506	721	7834	30	36	391,7
2010	36	1825	6101	2	91	305,1
2011	38	3633	6783	2	182	339,2
2012	37	3795	6790	2	190	339,5
TOTAL	35874	171090	102597	4002	8555	2029

	# of Mini/Midibuses			**Amount of c-pentaBDE (kg)**		
	I	**M**	**E**	**I**	**M**	**E**
1975	1900	4646	576	429	116	14.4
1976	1900	4283	627	396	107	15.7
1977	1900	4470	682	413	112	17.1
1978	1900	2420	743	224	61	18.6
1979	1900	3414	808	316	85	20.2
1980	1900	1250	880	116	31	22.0
1981	1900	1083	957	100	27	23.9
1982	1900	3808	1042	352	95	26.0
1983	1900	5578	1134	516	139	28.3
1984	1900	6226	1234	575	156	30.9
1985	1900	6054	1343	560	151	33.6
1986	1900	5856	1462	541	146	36.5
1987	1900	6435	1591	595	161	39.8
1988	1900	4670	1731	432	117	43.3
1989	1900	4014	1884	371	100	47.1
1990	1900	5847	2051	172	146	51.3
1991	1900	7680	2232	226	192	55.8
1992	1900	9021	2429	266	226	60.7

1993	1900	9440	2644	278	236	66.1
1994	1900	2047	2877	60	51	71.9
1995	1900	4514	3131	133	113	78.3
1996	3209	6763	3408	199	169	85.2
1997	5670	12443	492	367	311	12.3
1998	12511	8622	5288	254	216	132.2
1999	2218	8745	4149	258	219	103.7
2000	3333	17638	2959	520	441	74.0
2001	348	6486	0	191	162	0.0
2002	565	3963	2176	117	99	54.4
2003	337	11600	2025	342	290	50.6
2004	593	25103	3058	740	628	76.5
2005	2560	19760	6402	582	494	160,1
2006	2205	9263	11465	273	232	286,6
2007	3858	13842	8157	408	346	203,9
2008	2361	11453	9670	337	286	241,8
2009	627	6422	5407	189	161	135,2
2010	1043	10902	6076	321	273	151,9
2011	752	16063	6412	473	402	160,3
2012	372	21295	8040	627	532	201,0
TOTAL	82462	313119	117242	13269	7829	1390

	# of Trucks			**Amount of c-pentaBDE (kg)**		
	I	**M**	**E**	**I**	**M**	**E**
1975	na	33159	5	na	265	0.040
1976	na	39913	5	na	319	0.040
1977	na	34716	5	na	278	0.040
1978	na	20023	5	na	160	0.040

1979	na	22751	5	na	182	0.040
1980	na	15630	5	na	125	0.040
1981	na	17940	5	na	144	0.040
1982	na	20122	4.78	na	161	0.038
1983	na	24336	7.32	na	195	0.059
1984	na	24797	11	na	198	0.090
1985	na	26050	17	na	208	0.14
1986	na	20251	26	na	162	0.21
1987	na	21125	41	na	169	0.32
1988	na	20038	62	na	160	0.50
1989	na	19013	95	na	152	0.76
1990	na	27486	146	na	220	1.17
1991	na	30459	220	na	244	1.76
1992	na	38250	288	na	306	2.3
1993	na	51109	578	na	409	4.6
1994	na	21710	737	na	174	5.9
1995	na	36567	3140	na	293	25
1996	na	50464	4948	na	404	40
1997	na	76128	1779	na	609	14
1998	na	77340	1241	na	619	10
1999	na	50647	1576	na	405	13
2000	na	97155	2130	na	777	17
2001	na	83355	51458	na	667	412
2002	na	129167	81945	na	1033	656
2003	na	214647	124781	na	1717	998
2004	na	333353	192888	na	2667	1543

2005	na	387112	224126	na	3097	1793
2006	na	406888	255923	na	3255	2047
2007	na	426281	282416	na	3410	2259
2008	na	486234	358554	na	3890	2868
2009	na	338290	272784	na	2706	2182
2010	na	466259	342473	na	3730	2739
2011	na	516506	358068	na	4132	2865
2012	na	455762	323903	na	3646	2591
TOTAL	na	5161033	2886401	na	41288	23090
GRAND TOTAL	2331075	10773091	7045934	40557	98698	58029

Note: For vehicles imported after 2004, % values reported in Table 6 was used to estimate number of vehicles that might be impacted by POP-PBDEs; I: Import, E: Export, M: Manufactured in the country; na: no available data

As it is seen from Table 5, over the 38-year period, the total amount of PBDEs in imported vehicles is estimated at 40956 kg. On the other hand, the amount of PBDEs in vehicles produced in Turkey is estimated at 59183 kg. Note that some of the vehicles manufactured within the country is exported and PBDE in exported cars is estimated at 39668 kg. Note that while Table 3 considers all vehicles currently registered in Turkey, Table 5 estimates the amount of PBDEs in a 38 year period. Also note that the latter provides more information on the amount of registered vehicles in Table 5 by presenting an annual estimate of PBDEs from imported vehicles. However, in calculations, it is assumed that all the imported vehicles have been registered.

3.9. POP-PBDEs in End-of-Life Vehicles (ELVs)

3.9.1. Vehicles reaching end-of-life based on average life span

Since the use of POP-PBDEs ended in most regions before 2000, a large share of these vehicles are not in operation any more in industrial countries but have reached end-of-life or have been exported to developing countries. In many countries including Turkey, where vehicles are used for decades, many cars from the 1980s and 1990s are still in operation. In this context, POP-PBDEs in the transport sector could be of particular relevance. Human exposure to POP-PBDEs from POP-PBDE-containing vehicles could be relevant, especially for aged vehicles with bridal PUR foam considering results of exposure studies (Stapleton et al., 2008). Therefore the reuse of vehicles containing POP- PBDEs is not recommended.

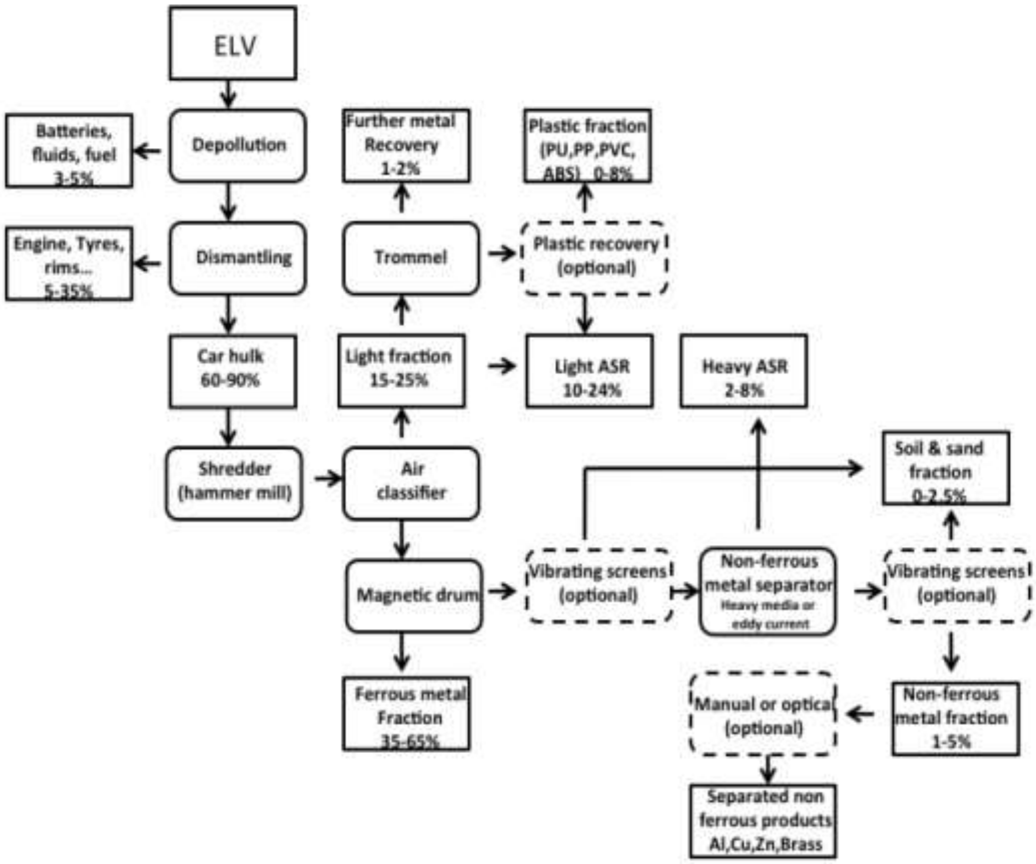


Figure 4. Schematic diagram of the processing of an ELV (Vermeulen et al., 2011)

However, there is no available national long term data on the number of vehicles being scrapped or the number of vehicles whose registration was cancelled. In 2009, Turkish government put into force a legislation namely Legislation on Control of End-of-Life Vehicles and data on processed ELVs is available for 2011, 2012 and 2013. This data is provided from Waste Management Directorate of Ministry of Environment and Urbanization (MoEU). However, it should be noted that the legislation is very new to the country and the numbers provided by the waste management department may not reflect the real potential of ELV processing in the country. Thus, an estimation of number of ELVs is made based on the number of vehicles in use and their estimated life expectancy. The lifespan for cars in industrial countries is 10 to 12 years, while buses and trains might have a longer life expectancy (Stockholm Convention Secretariat, 2012a). As a result of communications with Ministry of Science, Industry and Technology in Turkey, we have been recommended that an average lifespan of a vehicle in Turkey is approximately 20 years although there are vehicles currently operating older than this lifespan within the country.

As it is explained above, POP-PBDE inventory Guidance document states that vehicles from all regions produced after 2004 can be considered largely POP-PBDEs and HBB free. However, based on a vehicle lifespan of 20 years, it is surely expected that vehicles from production period 1975 to 2004 will go to end of life after 2004. Therefore, "% vehicles containing POP-PBDE reaching end of life" after 2004 was assumed based on the percentages summarized in Table 6 below. The assumption was not based on a scientific data, it was concluded after personal communications with Dr. Roland Weber (POPs Environmental Consulting, Göppingen, Germany)

Table 6. Assumed percentages of POP-PBDE containing vehicles completing its lifespan after ban of POP-PBDEs

Year	%
2005	100
2006	90
2007	80
2008	60
2009	40
2010	20
2011	10
2012	5

POP-PBDEs in PUR foam of ELVs from year 1990 to 2012 using the data on registered vehicles from 1975 to 2012 with an average vehicle life expectancy of 20 years for cars/trucks, buses and mini/midibuses were made. It is estimated that by the end of 2012, the number of end-of-life vehicles (ELVs) was 4218835, which amounts to 14657 kg of POP-PBDEs in a 135767 tonnes of PUR foam of these ELVs. By 2026 (considering a vehicle manufactured in 2004 will be sold latest in 2006), total POP PBDE from PUR foam of ELVs registered between 1975-2006 will result an amount of 52080 kg and 399177 tonnes of PUR foam.

3.9.2. End-of-life vehicles due to accidents

According to a joint report prepared by General Directorate of Public Security and Turkish Statistics Institute (Trafik Kaza İstatistikleri-Karayolu, 2012), ratio between vehicle involved in an accident to total number of registered vehicles are as follows (approximate value between 2003 and 2007); Cars: 10%, Buses: 30%; Mini/Midibuses: 20%; Vans/Trucks: 12%. For all vehicle types, this ratio drops to approximately 1 % between 2008 and 2012. Therefore, in calculations, an approximate value of 6%, 15%, 10% and 6% were assumed for cars, buses, mini/midibuses and vans/truck, respectively. Once again, assuming that these ratios are valid from 1970 to 2012 and all of the vehicles involved in the accident are completely damaged and have also reached end-of-life, the total amount of end-of-life vehicles is slightly higher. POP-PBDEs in end-of –life vehicles due to accidents are not added to results reported in section 3.9.1.

End-of-life vehicles contain valuable materials and therefore recycling rate of ELVs has always been high (about 70%). In general, 5-35% of an ELV's mass can be removed for reuse or recycling, depending on the age of ELV, the market value of the removed parts, and the labor costs to remove these parts. In the dismantling step, reusable and recyclable components are removed, with special emphasis on components with a sufficient market value or containing valuable materials. However, the environmental impact of the non-recycled fraction of an ELV should not be overlooked, as it often exhibits hazardous characteristics due to the presence of spent oils and lubricants, heavy metals and POPs (Vermeulen, 2011). Many ELVs today also have air conditioning ozone-depleting substances (ODS) and/or greenhouse gases (GHGs). Thus, the dismantling and de-pollution step is of crucial importance for environmentally sound management of ELVs. Normally, the materials containing POP-PBDEs end up in the automotive shredder residue (ASR) fraction when processing ELVs. The ASR is further separated into a "light ASR" and a "heavy ASR", where the PUR foam is contained in the light ASR fraction and makes 4% to 20% of this fraction.

To the best knowledge of the authors, there is no specific recycling activity of POP-PBDE containing materials from the transport sector (plastic and PUR foam) in Turkey. There is no appropriate BAT/BEP incineration capacity in Turkey to treat POP-PBDE containing ASR. Most landfills do not meet the standards for sanitary landfills and thus are far from meeting the criteria of landfills to which POP-PBDE containing wastes may be disposed. Therefore, Turkey does not currently have an appropriate end-of-life treatment option for POP-PBDE containing polymers from ELVs. Therefore, support is evidently needed to ensure that these wastes are treated in an environmentally sound manner.

3.10. POP-PBDEs in recycled foam from end-of-life vehicles treatment

Based on data provided by Waste Management Directorate of Ministry of Environment and Urbanization (MoEU), number of ELVs submitted to the Ministry between 2011, 2012, 2013 and 2014 were 4565, 8067, 10635 and 11998, respectively. 605 vehicles were processed January 2015 that is the date of preparation of current report, however this figure was excluded from the calculations. According to the legislation on End-of-Life vehicles in Turkey, there is no lifespan definition an ELV, however, based on the reasons explained earlier, at least 20 years age limit has been defined for ELVs. Moreover, it was stated by the waste management directorate of MoEU that processed vehicles were only cars. Assuming that there is 16 kg of polyurethane foam (PUR) in a car and by using (Stockholm Convention Secretariat, 2012a) Table 5.3 of Stockholm Convention Secretariat Guidance Document, following amounts of POP PBDEs are calculated.

Table 7. Polyurethane foam and POP PBDEs entered its end-of life phase in 2011 and 2012

Year	# of vehicles processed	PU Foam entered End-of-Life Phase (kg)	c-penta-BDE (kg)	Tetra-BDE (kg)	Penta – BDE (kg)	Hexa-BDE (kg)	Hepta-BDE (kg)
2011	4565	73040	46	15	27	4	2
2012	8067	129072	82	27	47	7	4
2013	10635	170160	108	36	63	9	5
2014	11998	191968	122	40	71	10	6
TOTAL	35265	564240	358	118	208	30	17

In total it was estimated that 564 tonnes of polyurethane foam from vehicles entered its end-of-life phase in 2011-2015 (Table 7) containing c-PentaBDE amount of 358 kg. Assuming a life span of 20 years for vehicles and also assuming that all types of the registered vehicles will be delivered to the Waste Management Directorate of MoEU at the end of its life span, it is calculated that approx. 12674955 POP-PBDE treated vehicles (cars+buses+vans/trucks+mini/midibuses) will be processed by the end of 2032 resulting with a recovered PUR foam of 315560 tonne with a c-PentaBDE amount of 282 tonne.

During the short study period no solid assessment could be conducted on recycling quota of these polymers which would allow estimation for this inventory. Therefore as a simple approach for this preliminary inventory it was assumed that the polymers from vehicles were treated in the same proportions as the general municipal solid waste in Turkey. According to a report by Turkish Plastics Industry Research Development and Education Foundation (Ergün, 2007), solid waste produced in Turkey contains about 22.6% of recyclable material. This gives a remaining rate of 87.4%, which needs to be managed in other terms. Based on 2010 municipal waste management practices data provided from TÜİK, the remaining solid wastes are disposed off by the following methods: 54.4% landfills, 43.5% wild disposal, 0.8% composting, 0.5% open burning, 0.2% dispose off to lakes or rivers, 0.1% wild burial and 0.5 % other methods. Based on this data, it can be stated that the most commonly applied solid wastes disposal methods in Turkey would be as follows: 22.6% recycling, 47.55% landfills, 38% wild disposal and 0.5% open burning.

With this simple assumption for 2011-2013 from the 240000 kg of polyurethane (containing 152 kg POP-PBDEs) reaching end-of-life, 54240 kg (containing 34,4 kg POP-PBDE) were recycled and 1200 kg of polyurethane (containing 0,76 kg POP-PBDEs) was thermally treated (open burning). The remaining 205320 kg of polyurethane foam (contains 130 kg POP-PBDEs) were considered to be landfilled and/or disposed/dumped. As it is mentioned above, there is no specific recycling activity of POP-PBDE containing materials from the transport sector (plastic and PUR foam) in Turkey. The exact fate of this reclaimed foam is not known. However, one possibility could be using it as chopped to produce "rebond" foam. Such re-bond foam material is used especially in sound-proofing in heavy machinery, industry and in buildings as well as applications in re-decoration of vehicle interiors and old furniture. It should be assessed to what extent these recycled materials contain PBDEs and if it is possible to chose waste PUR foam which does not contain recycled PUR foam (see PBDE BAT/BEP guidance (Stockholm Convention Secretariat, 2012b).

3.11. Calculation of individual POP-PBDEs homologues in the transport sector

For the Stockholm Convention, the listed POP-PBDE homologues: tetraBDE, pentaBDE, hexaBDE and heptaBDE need to be finally considered and not the total amount of c-PentaBDE or c-OctaBDE. These homologues were calculated from the estimated amount of c-PentaBDE (or c-OctaBDE) by considering the percentages of homologues in the commercial mixtures given in Table 8.

Table 8. ***Recalculation of c-PentaBDE present in the transport sector to the listed POP-PBDEs for the relevant life cycle stages (Corresponding to table 5- 1 in the PBDE inventory guidance (Stockholm Convention Secretariat, 2012a)***

(in kg)	Distribution homologues c-PentaBDE	POP-PBDEs in vehicles currently in use in inventory year (2012) (kg)	POP-PBDEs imported* in vehicles in the inventory year (2012) (kg)	POP-PBDEs in end-of-life vehicles in the inventory year (2012) (kg)	POP-PBDEs recycled from transport sector (2012) (kg)	POP-PBDEs disposed off in the past from the transport sector (1990-2012) (kg)
Inventoried c-PentaBDE		59012	40956	303118	21897	199636
TetraBDE	32%	18884	13106	96998	7007	63884
PentaBDE	56%	33047	22935	169746	12262	111796
HexaBDE	9%	5311	3686	27281	1971	17967
HeptaBDE	0.5%	295	205	1516	110	998

* Note that the imported vehicles are also included in the inventory of "current transport" and that these two categories are not summed up

4. Preliminary Inventory of PBDEs in Electrical and Electronic Equipment

Following the dampening effect of the 2000-2002 economic recessions, following years marked strong retail volume and value sales growth in Turkey. This was due to increasing consumer confidence, despite the series of measures by the government aimed at reducing ferocious consumer spending. Fuelled by the rising consumer confidence, the use of new technologies in existing and new product categories drove consumption growth.

Technological innovations in a number of product categories, including mobile phones, PCs, digital TVs and video players, drove demand and boosted retail value growth in consumer electronics in Turkey. The availability of 3D digital TVs and tablets, the launch of the Smart TV concept, the growing functionality of smart phones and offer of cheaper alternatives encouraged consumers to replace their existing old models with newer technologies. In addition to shortened replacement cycles, the consumer demand for advanced technologies created revenue growth in consumer electronics.

Turkey has benefited greatly from the advancements in the electronics and electrical industry. However, along with all the comfort and convenience we get from Electrical and Electronic Equipment (EEE) comes the alarming volume of generated e-wastes. The electronics industry is the world's largest and fastest growing manufacturing industry but discarded electronics is now the fastest growing waste stream in the industrialized world (Pucket, et. al., 2002). EEEs are the largest material flows containing c-OctaBDE (Stockholm Convention Secretariat, 2012a).

In Turkey, the import of electrical and electronic equipment (EEE) from industrial countries increased during the last ten years. According to State Planning Department (Devlet Planlama Teşkilatı-DPT), there were approx. 30 million TVs in Turkey in 2000. According to Turkish Appliance Manufacturers Association (BEUD), 6.7 million appliances were entered to the market in Turkey and 4.3 million of them were imported. Vestel, one of the biggest house appliance manufacturers of the country has a manufacture capacity of 10 million of CRT-TV, 4 million of LCD-plasma TV, 3.5 million of fridge, 2.5 million of washing machine, 1 million of dish washer, 1 million of stove, 12 million of laptop computer in the country (Elektronik Atıklar, 2013). Import of WEEE or second hand electronics is banned by law in Turkey however, licenced companies are permitted to import rubber, glass and plastic waste (Communiqué on Import Controls of waste for protection of Environment (Product Safety and Inpection:2013/3)). Therefore, any EEE in this inventory is considered as new.

4.1. **POP-PBDEs from CRT Computer Monitors**

The first computer in Turkey was utilized at General Directorate of National Highways in 1960. Personal computers became widespread in Turkey after 1984 (BT Sektörü, accessed in October 2013). According to Revenue Administration Department of Turkey, lifespan of a personal computer in Turkey is approx. 4 years (Gelir İdaresi Başkanlığı, accessed in October, 2013). Additionally, a stockpile period of 1 year was assumed for imported computers. Therefore, the current inventory covers CRT computers from 1984 to 2009 assuming that some of the PCs imported in a particular year will be stored for 1 year and will be used for another 4 years and will reach its end of life in 5 years after imported. Turkey does not have any computer manufacturing facilities; however, assembling of computers which are imported as parts is present. However, in this inventory, it is assumed that all computers are imported to the country as assembled. Furthermore, it is assumed that all of the imported PCs were CRT casing computers between 1984 and 2005 (Table 9).

Total POP PBDE amount in CRT monitors is calculated using the following equation

$$\boxed{M_{PBDE(i)} = [\text{total weight of CRTs}] \times 0.3 \times [0.87 \text{ to } 2.54\text{kg/tonne}]}$$

Where,

Total weight of CRTs= Average weight of 25 kg x total number of CRT Computers
Polymer content of 30 %
c-OctaBDE content of polymer= 1.71 kg/tonne (average of 0,87 and 2,54)

Table 9. Number of Computers in Turkey

Year	Number of Computers imported $^{\phi}$	Number of Computers Sold $^{\varphi}$	Number of Stocked Computers$^{\psi}$	Ratio of Import/Sale	Number of Computers in use$^{\varphi}$
1984	197[a]	134[a]	63		134[c]
1985	394	268[b]	126		466[c]
1986	560	381[b]	179		973[c]
1987	634	431[b]	203		1583[c]
1988	1447	985[b]	463		2770[c]
1989	115351	78470[b]	36881		81703[c]
1990	185223	100000	85223	1.85	100000
1991	171687	150000	21687	1.14	250000
1992	192630	175000	17630	1.10	425000
1993	250336	200000	50336	1.25	625000
1994	175908	150000	25908	1.17	775000
1995	372875	198000	174875	1.88	973000
1996	398104	235200	162904	1.69	1108200
1997	494358	345600	148758	1.43	1303800
1998	566707	389500	177207	1.45	1518300
1999	830788	498200	332588	1.67	1816500
2000	122536	756500	0	0.16	2423000
2001	163377	352000	0	0.46	2577000
2002	309923	516000	0	0.60	2857800
2003	475001	810000	0	0.59	3322200
2004	620493	1125000	0	0.55	4057700
2005	2360820	1606000	754820		5165500
2006	2388750	1625000	763750		6034000
2007	2646000	1800000	846000		7482000
2008	2829750	1925000	904750		8891000
2009	3307500	2250000	1057500		10331000
2010	3307500	2250000	1057500		11456000

ϕ Unless specified data from UN Comtrade, 2013; an assumed 50% of value in 1985; ψ Difference between Imported and Sold items; b Calculated using an average Import/Sale ratio of 1,47, which is the average of ratios between 1990-1999; $^{\varphi}$ otherwise stated data from Referans Noktası, 2013 ^{c}= sum of Sold in the current year+in use from previous year+in stock from previous year

Table 10. c-OctaBDE amount from CRT Computers

Year	Inventory Year (After 5 years)	Number of Total computers in Use in the Inventory Year	Waste CRT casing Computers (tonne)	Polymer content in Waste CRT Computers (tonne)	c-OctaBDE in waste CRT casing computers (kg)	Hepta BDE in waste CRT casing computers (%43 in kg)	Hexa BDE in waste CRT casing computers (11% in kg)
1984	1989	134	3.4	1.0	1.7	0.7	0.2
1985	1990	466	9.9	3.0	5.1	2.2	0.6
1986	1991	973	14.0	4.2	7.2	3.1	0.8
1987	1992	1583	15.8	4.8	8.1	3.5	0.9
1988	1993	2770	36.2	10.9	18.6	8.0	2.0
1989	1994	81703	2883.8	865.1316	1479.4	636	163
1990	1995	100000	4630.6	1389.1689	2375.5	1021	261
1991	1996	250000	4292.2	1287.6537	2201.9	947	242
1992	1997	425000	4815.8	1444.7253	2470.5	1062	272
1993	1998	625000	6258.4	1877.5218	3210.6	1381	353
1994	1999	775000	4397.7	1319.3091	2256.0	970	248
1995	2000	973000	9321.9	2796.5589	4782.1	2056	526
1996	2001	1108200	9952.6	2985.777	5105.7	2195	562
1997	2002	1303800	12358.9	3707.6844	6340.1	2726	697
1998	2003	1518300	14167.7	4250.3022	7268.0	3125	799
1999	2004	1816500	20769.7	6230.9067	10654.9	4582	1172
2000	2005	2423000	18912.5	5673.75	9702.1	4172	1067
2001	2006	2577000	8800.0	2640	4514.4	1941	497
2002	2007	2857800	12900.0	3870	6617.7	2846	728
2003	2008	3322200	20250.0	6075	10388.3	4467	1143
2004	2009	4057700	28125.0	8437.5	14428.1	6204	1587
2005	2010	5165500	40150.0	12045	20597.0	8857	2266
TOTAL		29385629	223066	66920	114433	49206	12588

As it is seen from Table 10, a total of 124113 kg of c-OctaBDE, 53368,7 kg HeptaBDE and 13652.5 kg HexaBDE waste generated from waste CRT computers by the end of 2010 in Turkey

a. POP-PBDEs from CRT TVs

The first TV broadcasting was made in Turkey in 1969, however, TVs became more widespread in 1970s in Turkey. Therefore, the inventory covers the period between 1970 and 2005. Turkish audiovisual market is one of the largest in Europe with almost 18 million television households (MAVISE, 2013) (Table 11)

Table 11. Number of TVs in different categories in Turkey between 1970-2005

Year	Import to Turkey[φ]	Made in Turkey[ψ]	Sale in Turkey[ψ]	Export from Turkey[ψ]	Total TVs within Turkey[Ø]	%Penetration rate calculated based on TV sales
1970	61	0	61	0	61	0.00
1971	1	142	142	0	143	0.00
1972	4	3374	3374	0	3378	0.03
1973	3	22574	22574	0	22577	0.23
1974	15	51401	51401	0	51416	0.51
1975	10	112811	112811	0	112821	1.10
1976	0	60998	60998	0	60998	0.58
1977	0	48766	48766	0	48766	0.46
1978	0	96918	96918	0	96918	0.90
1979	0	98477	98477	0	98477	0.89
1980	0	56017	56017	0	56017	0.50
1981	1	114543	114543	0	114544	1.0
1982	789	91245	91245	0	92034	0.8
1983	1	137119	137119	0	137120	1.2
1984	1210	217443	217443	0	218653	1.8
1985	3715	368957	368957	0	372672	3.0
1986	4987	304189	304189	0	309176	2.5
1987	579	244921	244921	0	245500	1.9
1988	1360	374776	268027	106749	269387	2.1
1989	13735	593213	338681	254532	352416	2.7
1990	170107	1088700	576572	512128	746679	5.6
1991	184470	1338586	757059	581527	941529	6.9
1992	92065	1087128	638412	448716	730477	5.3
1993	47177	964276	631850	332426	679027	4.8
1994	24550	905529	419894	485635	444444	3.1
1995	57175	1155907	510552	645355	567727	3.9
1996	303518	1602961	748933	854028	1052451	7.1
1997	540184	3611000	1486006	2124994	2026190	13.4
1998	608514	4888294	1103184	3785110	1711698	11.1
1999	828570	5454345	838817	4615528	1667387	10.6
2000	31027	7140648	987281	6153367	1018308	6.4
2001	51545	6736961	702523	6034438	754068	4.6
2002	55450	10600793	790885	9809908	846335	5.1
2003	94736	12815754	1233720	11582034	1328456	7.9
2004	184681	16747576	1671768	15075808	1856449	10.8
2005	123948	14065280	1630851	12434429	1754799	10.03
TOTAL	3424188	93201622	17364971	75836712	20789098	139

φ United Nations Commodity Trade Statistics Database, ψ sum of two main Home Electronics Companies in Turkey)names are kept anonymous due to confidentiality issues; [Ø] sum of import and sale

According to Revenue Administration Department of Turkey, lifespan of a television in Turkey is approx. 5 years (Gelir İdaresi Başkanlığı, 2013). Considering that some households just store the items hoping to engage in a more profitable activity in the future than by simply selling it to junkshops or dumping into the waste. According to Peralta and Fontanos (2006), the average lifespan of televisions is 8 years. Therefore, a lifespan of 8 years was chosen for Turkey in calculation of POP PBDEs from CRT televisions. According to the data obtained from two main home electronics manufacturers (names are kept anonymous due to confidentiality regulations of the companies), there is no stock on TVs, which means all TVs manufactured within a particular year is completely sold out in that year. This simple assumption was made in the calculations.

Table 12. POP PBDEs from end of life CRT TVs in Turkey

Year	# Total TVs	Inventory Year (After 7 years)	Waste CRT casing TVs (tonne)	Polymer content in Waste CRT TVs (tonne)	c-OctaBDE in waste CRT casing TVs (kg)	Hepta BDE in waste CRT casing TVs (%43 in kg)	Hexa BDE in waste CRT casing TVs (11% in kg)
1970	61	1978	2	0.46	0.79	0.34	0.09
1971	143	1979	4	1.07	1.84	0.79	0.20
1972	3378	1980	84	25	43	19	4.8
1973	22577	1981	564	169	290	125	32
1974	51416	1982	1285	386	659	284	73
1975	112821	1983	2821	846	1447	622	159
1976	60998	1984	1525	457	782	336	86
1977	48766	1985	1219	366	625	269	69
1978	96918	1986	2423	727	1243	534	137
1979	98477	1987	2462	739	1263	543	139
1980	56017	1988	1400	420	718	309	79
1981	114544	1989	2864	859	1469	632	162
1982	92034	1990	2301	690	1180	508	130
1983	137120	1991	3428	1028	1759	756	193
1984	218653	1992	5466	1640	2804	1206	308
1985	372672	1993	9317	2795	4780	2055	526
1986	309176	1994	7729	2319	3965	1705	436
1987	245500	1995	6138	1841	3149	1354	346
1988	269387	1996	6735	2020	3455	1486	380
1989	352416	1997	8810	2643	4520	1943	497
1990	746679	1998	18667	5600	9576	4118	1053
1991	941529	1999	23538	7061	12075	5192	1328
1992	730477	2000	18262	5479	9368	4028	1031
1993	679027	2001	16976	5093	8709	3745	958
1994	444444	2002	11111	3333	5700	2451	627
1995	567727	2003	14193	4258	7281	3131	801
1996	1052451	2004	26311	7893	13498	5804	1485
1997	2026190	2005	50655	15196	25986	11174	2858
1998	1711698	2006	42792	12838	21953	9440	2415
1999	1667387	2007	41685	12505	21384	9195	2352
2000	1018308	2008	25458	7637	13060	5616	1437

2001	754068	2009	18852	5656	9671	4158	1064
2002	846335	2010	21158	6348	10854	4667	1194
2003	1328456	2011	33211	9963	17037	7326	1874
2004	1856449	2012	46411	13923	23809	10238	2619
2005	1754799	2013	43870	13161	22505	9677	2476
TOPLAM	20789098	71838	519727	155916	266620	114647	29329

As it is seen from Table 12, a total of 266620 kg of c-OctaBDE, 114647 kg HeptaBDE and 29328 kg HexaBDE waste generated from waste CRT TVs by the end of 2013 in Turkey

5. DIRECT IMPORT OF DIPHENYL ETHER, TETRA- and PENTABROMODIPHENYL ETHER

On the basis of data obtained from Customs Office of Turkey, 547 tonnes of diphenyl ether and 177 tonnes of penta / tetra bromo diphenyl ether were imported to the country, respectively between 1996 and 2013. However, there is no information statistics on the use/application areas of these chemicals in the country and these chemicals are not included in the inventory study.

6. IMPORTED ACRYLONITRILE-BUTADIENE-STYRENE

The main former use of c-OctaBDE was in acrylonitrile-butadiene-styrene (ABS) polymers, accounting for about 95% of c-OctaBDE supplied in the EU. The treated ABS was mainly used for housings/casings of electrical and electronic equipment (EEE), particularly for cathode ray tube (CRT) housings and office equipment such as copying machines and business printers. Typical concentrations in the major applications were between 12 wt % and 18 wt %, with approximately 100,000 tonnes of c-OctaBDE at an application rate of 15 wt %. Assuming ABS imported to Turkey contain 15 wt% c-OctaBDE, POP PBDE in imported ABS to Turkey between 1996-2004 is about 997684 tonne (Table 13). According to TÜİK database, number of dwellings in Turkey in 2012 was 19842850 which results an approx. amount of 50 kg of ABS per dwelling or 13 kg (based on 2013 population of the country) ABS per person.

Table 13. Imported ABS to Turkey

Year	ABS Imported (tonnes)*		Year	ABS Imported (tonnes)*
1970	0		2002	31826
1980	0		2003	38319
1990	0		2004	50688
1993	0		2005	53900
1994	0		2006	58996
1995	0		2007	66279
1996	36412		2008	63800
1997	99104		2009	64119
1998	31895		2010	84433
1999	29455		2011	87319
2000	33556		2012	86951
2001	24609		2013	56023

*Ministry of Customs and Trade Database

7. **The End-of-life Model for CRTs**

A simple model utilized by Peralta and Fontanos (2006) was used to illustrate the end-of-life options of electronic products. Details on the model is given by Matthews et al. (1997) and Peralta and Fontanos (2006). Using this model, we predicted the weight of WEEE from CRT computers and TVs that would be reused, stored, recycled, or landfilled in Turkey by 2016.

Based on figure below, a newly purchased EEE item becomes obsolete after a certain time. Once it is obsolete, it might be reused, stored, landfilled or recycled. However, reuse and storage are only intermediate phases in the lifecycle of electronic items. Eventually, reused and stored items will go through the terminal points in the model – recycled and landfilled.

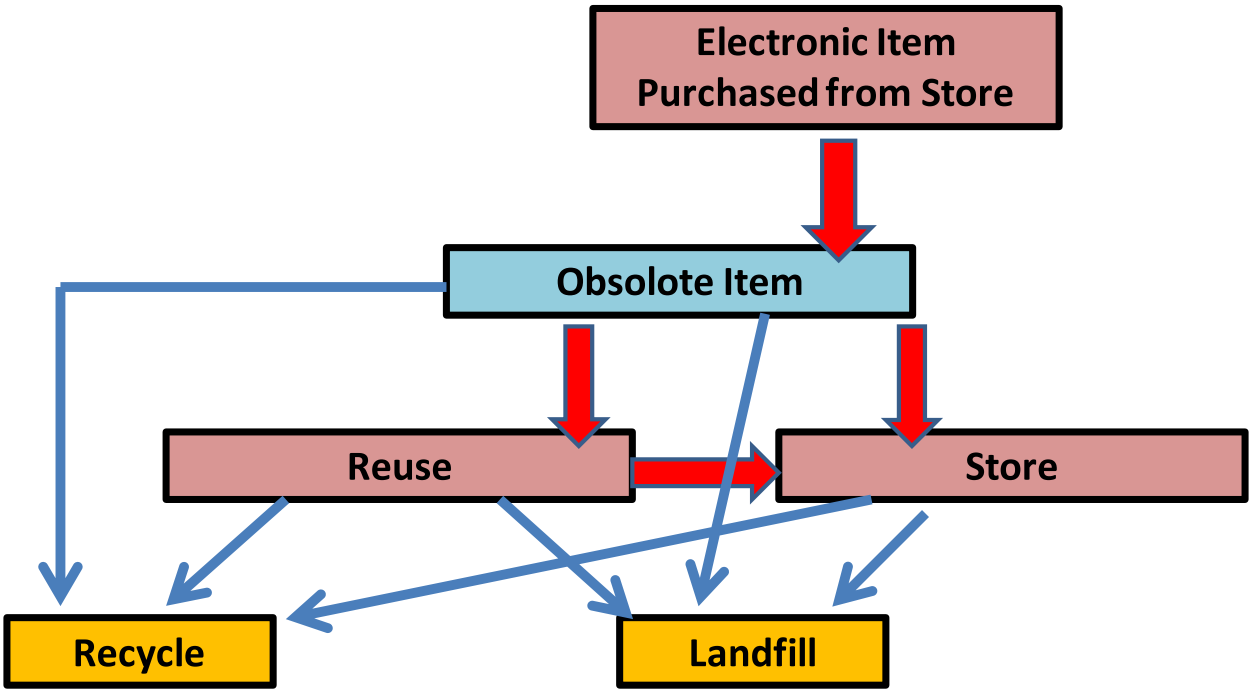


Figure 5: Schematic of End-of-Life Model

In estimation process carried out in this inventory, we used the same assumptions made by Peralta and Fontanos (2006) on how an electronic item advances through the various lifecycle options after it becomes obsolete. According to the model, televisions, computers and cell phones are expected to become obsolete 8 years after it was purchased. The life span of stored and reused items is extended by another 3 years. Reused items may be stored, recycled or landfilled while those items that were stored may only be recycled or landfilled.

A summary of assumptions made is shown in figure below. Purchased electronic items become obsolete after 8 years. Out of these obsolete items, 50% are reused while 30% are stored, both for another 3 years. The remaining 20% is either recycled (5%) or landfilled (15%). Three years after, the reused obsolete items are stored (50%) for another 3 years, recycled (20%), and landfilled (30%). Stored items can only go through the endpoints of the process – 20% recycled and 80% landfilled.

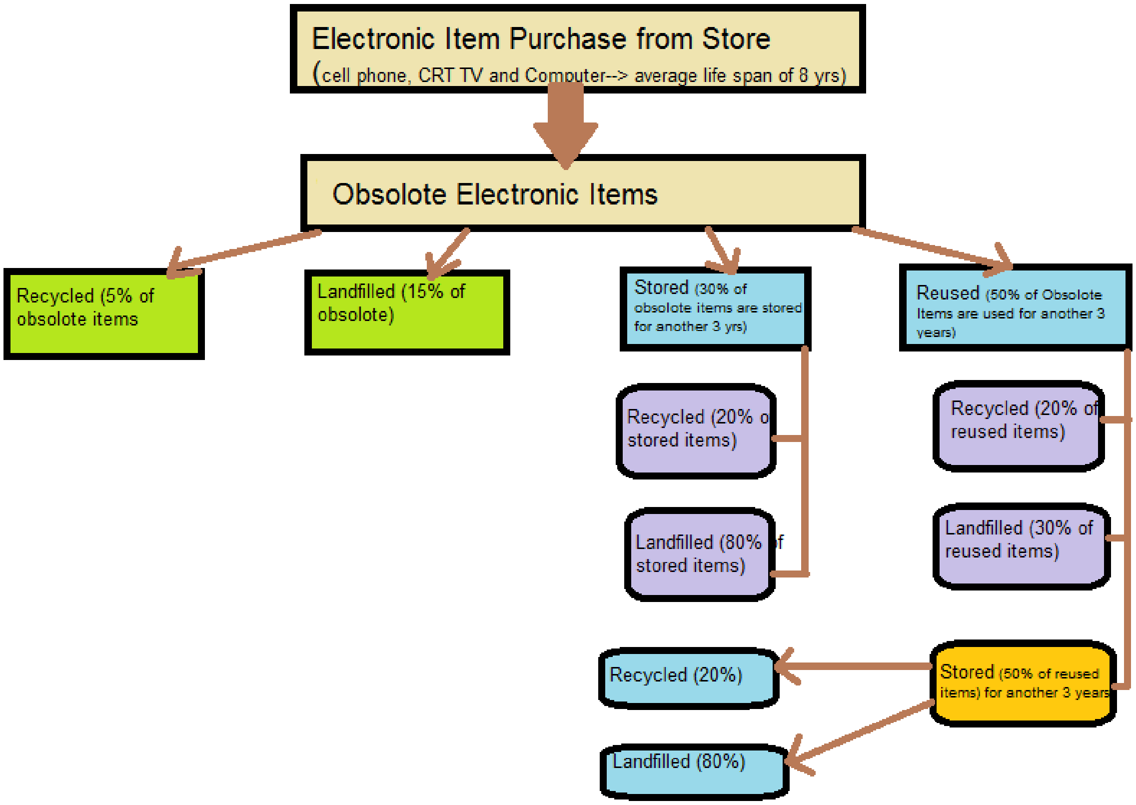


Figure 6. End-of-Life Model (Peralta and Fontanos, 2006)

7.1. Estimation Equations

Based on model illustrated in the figure above, the following equations are used to estimate the number of units that are reused, stored, recycled, and landfilled. As it is noted by Peralta and Fontanos (2006), the one should keep in mind that the equations are highly dependent on the assumptions made and will vary when changes are made in them.

Number of obsolete items during the inventory year i is calculated using Equation 1 and it is equal to the number of items purchased eight years ago. Equation 2 calculates the number of reused obsolete items. Equation 3 determines the number of stored items for a given year.It should be noted that this is dependent on the current number of obsolete items as well as the obsolete items 3 years before the current year

$$(1)\ O_i = P_{i\text{-}8}$$
$$(2)\ R_u = 0.5O_i$$
$$(3)\ S_t = 0.3O_i + 0.5O_{i\text{-}3}$$
$$(4)\ R_c = 0.05O_i + 0.20O_{i\text{-}3} + 0.20O_{i\text{-}6}$$
$$(5)\ L_a = 0.15O_i + 0.80O_{i\text{-}3} + 0.80O_{i\text{-}6}$$

Where:
O_i = is the number of obsolete items for the year. It is also equal to the purchased CRTs, eight years ago **$P_{i\text{-}8}$**
i = is the inventory year, and the subscript i−3 and i−6 means 3 or 6 years before the current year
R_u = is the number of reused items for the year
S_t = is the number of stored items for the year
R_c is the number of recycled items for the year
L_a = is the number of landfilled items for the year

Results obtained from above equations were converted to kg POP-PBDE based on 30 % polymer content of a CRT item and 1.71 kg c-OctaBDE content of 1 tonne of polymer.
After 11 years of purchase of an item, reused and stored items will again go through another stages of the process. Out of the 30% stored obsolete items, 20% are recycled while 80% are landfilled.
On the other hand, 20% of the reused obsolete items will be recycled, 30% are landfilled and 50% are stored again for another 3 years before it is finally recycled and landfilled.
Finally, at the end of the 14th year after the item was purchased, 20% of those stored during the 11th year will be recycled while 80% are landfilled.
The number of available items for recycling and landfilling is determined by Equations 4 and 5, respectively. Following these equations the complete inventory of recycled and landfilled CRTs may be only obtained 14 years after the last available data. It means that the data on estimated amount of CRTs from 1970-2004 can only have a complete inventory of recycled and landfilled EEEs for the period 1984-2013 (Table 14).

Table 14. HexaBDE and heptaBDE present in EEE, WEEE and in polymers in recycling from CRT computer monitors (kg)

Homologues	**Distribution homologues c-OctaBDE**	**POP-PBDEs in imported CRT for inventory year 2013**	**POP-PBDEs in stocks for inventory year 2013**	**POP-PBDEs entering the waste stream 2013**	**POP-PBDEs in recycled polymers for inventory year 2013***
Inventoried c-OctaBDE		Σc-OctaBDE	Σc-OctaBDE	Σc-OctaBDE	
		390733	168016	42981	80378
HexaBDE	11%	42981	18482	4728	8842
HeptaBDE	43%	168015	72247	18482	34563
OctaBDE	35%	136757	58806	15043	28132

*based on End-of-Life model estimation value between 1970-2005

7.2. POP-PBDEs in Material/Recycling Flows and at End-of-Life

Although production and use of commercial POP PBDEs are stopped, now the main challenge countries is facing is their elimination, identification of existing stockpiles and articles containing POP-PBDEs and their disposal at end-of-life. Large volumes of these materials are in the global recycling flow and will continue to be used in consumer articles (UNEP, 2010a, 2010b). The existing reuse and recycling of materials and wastes containing POP-PBDEs were the trigger for the COP4 specific exemption that allows recycle and reuse under certain conditions. This is addressed in the Guidance on Best Available Techniques and Best Available Practices for the Recycling and Disposal of Articles Containing Polybrominated Diphenyl Ethers (PBDEs) Under the Stockholm Convention on Persistent Organic Pollutants (PBDE BAT/BEP Guidance; Stockholm Convention Secratariat, 2012b).

7.3. C-PentaBDE in reuse, recycling and waste flows

The main uses of c-PentaBDE were in PUR foam used in the transport sector (e.g. cars, buses, trains etc.) and furniture (e.g. couches, seats, cushions etc.), with limited use in mattresses and some other uses. Therefore, the reuse and recycling of these major material flows need to be addressed. Other applications with former minor uses (e.g. insulation in construction, treated rubber, textiles, polyvinylchloride (PVC), epoxy resins in printed circuit/wiring board, etc.) may only be assessed if they appear relevant in the country. The major use and recycling flows of materials containing c-PentaBDE are shown below.

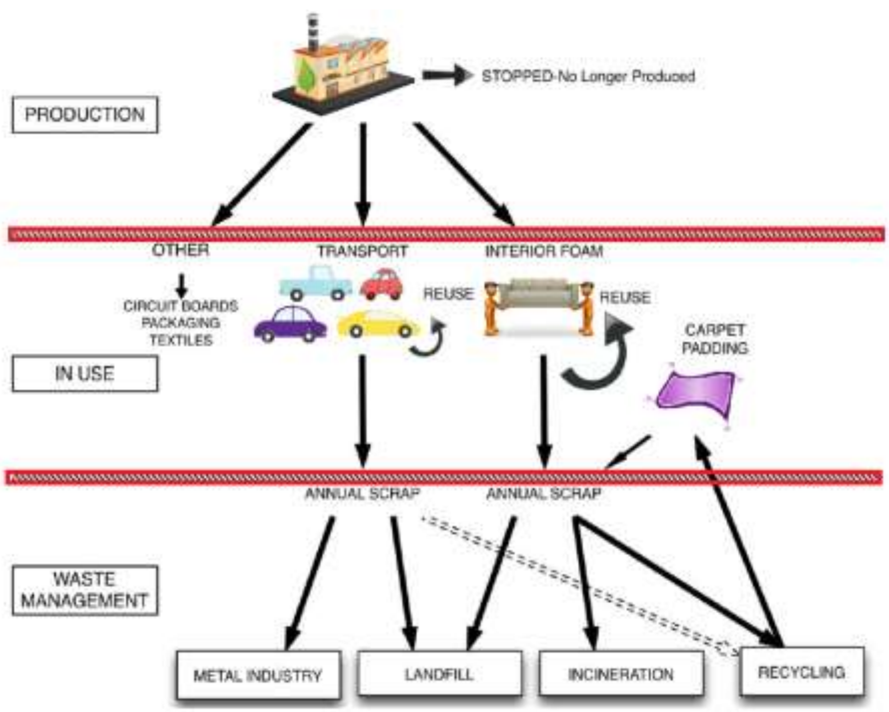


Figure 7. Schematic diagram of the life cycle of c-PentaBDE (adapted from Alcock *et al.*, 2003; UNEP, 2010a; 2010b)

7.4. C-OctaBDE in reuse, recycling and waste flows

EEE and WEEE polymers contain the largest c-OctaBDE. The use of c-OctaBDE in polymers in the transport sector was limited. Figure 8 illustrates the life cycle of c-OctaBDE.

Electronics produced before 2005 may be flame retarded with c-OctaBDE. The main appliances are televisions and computer CRT monitors. Primitive recycling technologies for WEEE have resulted in large contaminated areas in developing countries and exposure of recyclers and the general population (Wong *et. al*., 2007; UNEP, 2010a, 2010b).

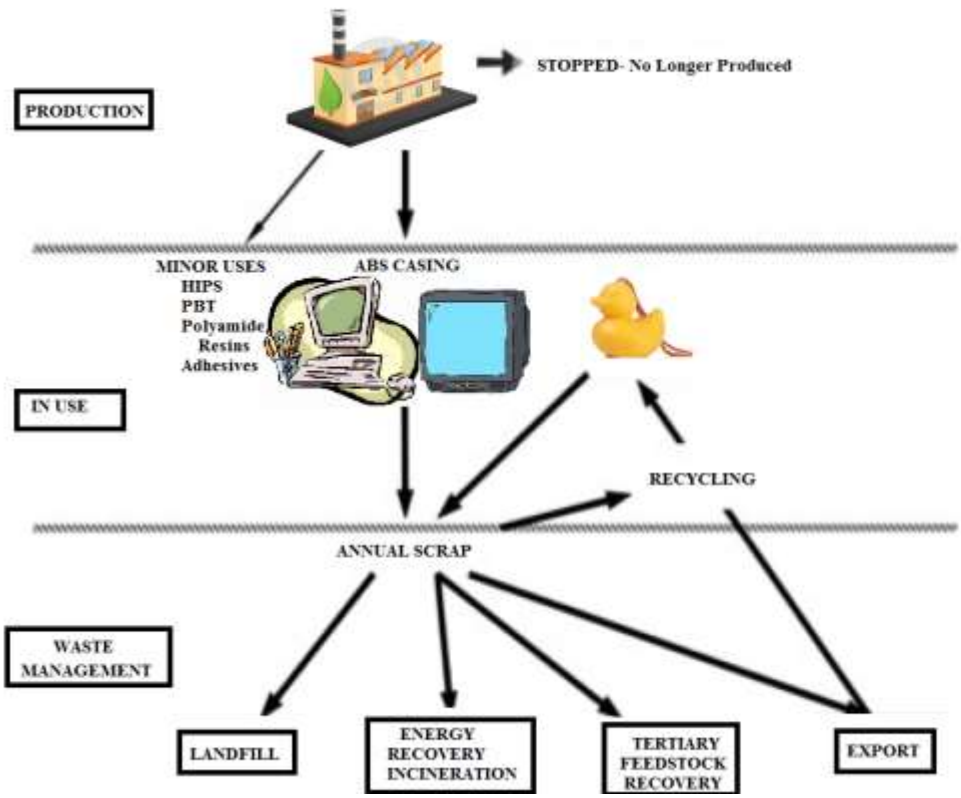


Figure 8 Schematic diagram of the life cycle of c-OctaBDE (adapted from Alcock *et al.*, 2003; UNEP, 2010a; 2010b)

The mechanical recycling of plastic for further use is strongly favoured from a waste hierarchy and life cycle assessment perspective (PBDE BAT/BEP guidance; Stockholm Convention Secretariat 2012b). The recycling of WEEE results in a fraction of flame-retarded plastic, possibly containing POP-PBDEs. Considerable amount of WEEE plastic is sent to developing countries where it is recycled into new articles. Recent studies have shown that plastics containing POP-PBDEs and other BFRs have been recycled in the production of articles for which no flame retardancy is required including children's toys, household goods and video tapes (Chen et al., 2009; Chen et al., 2010, Samsonek & Puype 2013). Therefore, in some cases, the use of recycled plastic may be significantly more hazardous than the original use. Therefore it is of high importance to separate POP-PBDE containing plastic before further recycling (Stockholm Convention Secretariat 2012b) as highlighted by the recommendations from POP Reviewing Committee and COP5.

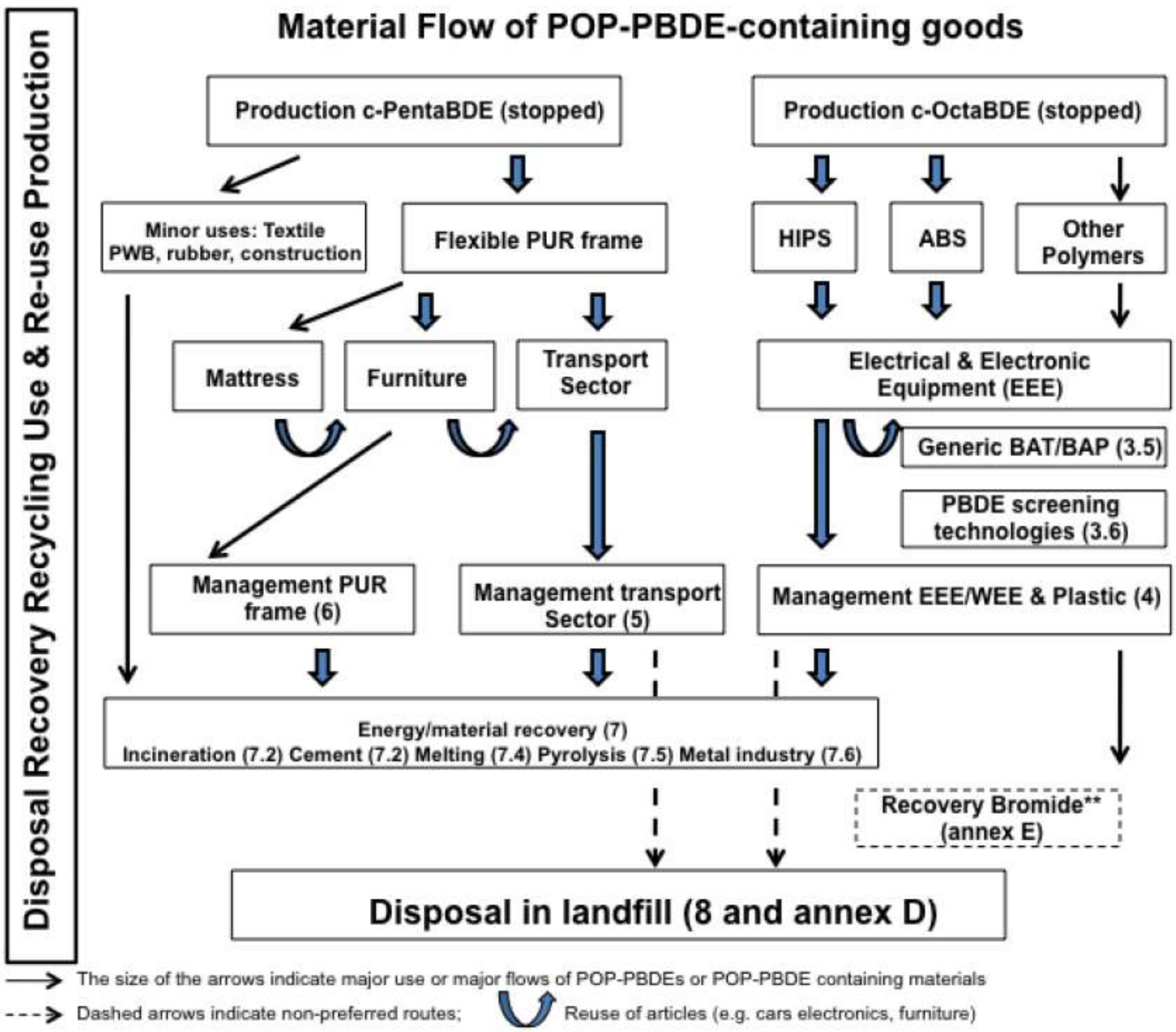


Figure 9. Material Flow of POP-PBDE-containing goods (Stockholm Convention Secretariat ,2012b)

Other uses of POP-PBDEs (e.g. furniture, mattresses, rebond materials, textiles, construction materials, rubber, and drilling operations) are thought to be of minor relevance for most countries (Stockholm Convention Secretariat, 2012a). The original application of POP-PBDEs and the articles in various categories including PUR foam in furniture, mattresses, and rigid foam in construction, mainly took place in the United States, to some extent in Europe, and possibly in China (UNEP, 2010a, 2010b). Export of these articles to developing countries from the United States and United Kingdom is considered limited. For other countries and regions, c-PentaBDE in these applications are considered low and might not be of relevance for a POP-PBDEs inventory (UNEP, 2010a, 2010b). However, considering Turkey's increased trade with China, it can become an important issue.

8. POTENTIAL CONTAMINATED SITES

All sites where POP-PBDEs have been used, for any of the activities outlined in figures 7 and 8, could be potentially contaminated with POP-PBDEs. Landfills are the ultimate destination of many POP-PBDEs-containing materials due to their widespread application in consumer and industrial goods. POP-PBDEs can be leached from refuse by landfill leachate.

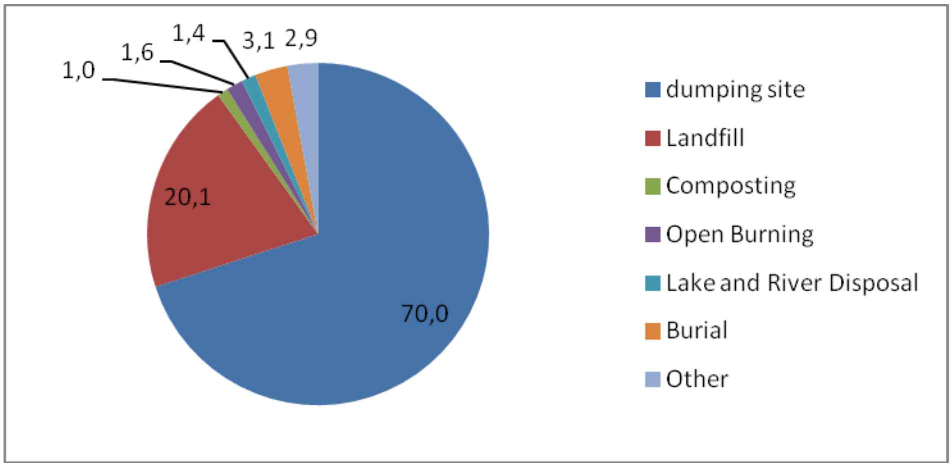


Figure 10. Waste Management Practices in Turkey between 1994 and 2004 (TÜİK)

Figure 10 shows waste management practices applied in Turkey between 1994-2004 (TÜİK). Based on these practices landfills and dumpsites that are scattered all over the country may be potentially contaminated with POP-PBDEs. Further work is required to identify all the sectors involved, manufacturing locations and locations of storage, wastes being disposed, biosolids application, methods of waste disposal or treatment, and waste disposal locations.

POP-PBDEs are precursors of brominated dibenzofurans (PBDF) and dibenzo-p-dioxins (PBDD) (WHO 1998; UNEP 2010b, Shaw et al. 2010). They are largely formed during primitive recycling of e-waste and non-BAT incineration or other thermal treatment of POP-PBDEs-containing materials (UNEP, 2010b; Weber & Kuch 2003; Ebert & Bahadir 2003). Recently the WHO TEF expert panel concluded that PBDD, PBDF, and some dioxin-like biphenyls (dl-PBBs) may contribute significantly in daily human background exposure to the total dioxin toxic equivalencies (TEQs) (Van den Berg et al. 2013). Therefore the locations of these activities should also be identified and assessed.

In addition, biosolids from wastewater treatment plants are known to contain POP-PBDEs, which were/are partly disposed in landfills and applied in agricultural lands or thermally treated.

Data on human exposure to Brominated Flame Retardants (BFRs) in Turkey is rather scarce and comprehensive studies have not been made. A study conducted in Istanbul to determine concentrations of PBDEs in indoor air and house dust was the first scientific study to assess the levels of these chemicals in indoor environments (Kurt-Karakus, 2013) and also to understand the relative significance of human non-dietary exposure via dust ingestion for children and adults. Recent studies discovered that the main exposure route of PBDEs in the general population is house dust, not diet, because PBDEs are used as additives to retard fire and flames in a variety of commercial and household products (Stapleton et al., 2008).

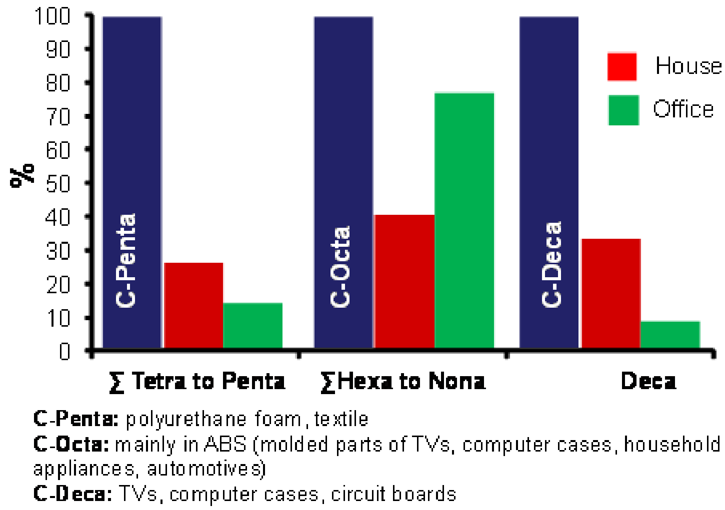


Figure 11. PBDE Congener profile of indoor dust from Istanbul, Turkey (Kurt-Karakus, 2013)

c-DecaBDE is a dominant technical formulation present in the homes investigated. The reason for extremely high values in this study is most likely due to dust samples being collected via carpet and soft surfaces, and c-DecaBDE is widely used as an additive in carpet textiles (Malarvanan et al., 2010). c-PentaBDE formulation was present in all homes investigated. The c-PentaBDE formulation is primarily used to retard flame in polyurethane foam used in household furniture. Further work is required to confirm this finding to elucidate the source, although these data suggest that usage patterns for PBDEs in reference and dumping sites are not significantly different. As it is seen from the figure 11, c-OctaBDE levels were highest in house and office dust from Istanbul. Median values of Σ_{12}PBDEs in house dust ranged between 1200-2500 ng/g whereas it was between <MDL to 2500 ng/g for office dust. The median PBDE concentrations in home dust in Thailand (Σ_{10} PBDE:10 ng/g, Muenhor, 2011) and Germany (Σ_7PBDE: 74 ng/g, Sjodin et al. 2008) were lower whereas samples from USA (Σ_{21}PBDE: 21000 ng/g, Battermann et al., 2009), UK (Σ13PBDE: 3500 ng/g, Harrad et al. 2008a) were higher compared to levels detected in dust from Turkish homes. Turkish office dust samples showed relatively lower median concentrations of ΣPBDEs compared to samples collected from China (Σ10PBDE: 30700 ng/g, Ma et al., 2009), USA (Σ21 PBDE: 8754 ng/g, Batterman et al., 2010) and UK (Σ13PBDE: 7400 ng/g, Harrad et al., 2008a). Findings of the study in Istanbul provided a snapshot of chemical contamination in indoor environments in Turkey and suggest that exposure to dust is a significant route of human non-dietary exposure to PBDEs. Moreover, the widespread distribution of these chemicals highlights the fact that humans are continuously exposed to low doses of these chemicals in the indoor environment.

HBCDD

1,2,5,6,9,10-Hexabromocylcododecane (HBCDD) is defined as a novel flame retardant and it has been increasingly used as a substitute for other brominated flame retardants such as polybrominated diphenyl ethers (PBDEs). The world production has increased from 16 000 tonnes in 2000 to 23 000 tonnes in 2008, and the most of this increase has occurred in China (Klif 2011). Approx. 80% of HBCDD produced is estimated to be used as a flame retardant in expanded polystyrene (EPS) and extruded polystyrene (XPS) insulation products for buildings and construction (EU, 2008). Transport of compounded polystyrene (PS) with HBCDD (granules, masterbatch or beads) over long distances cannot be excluded, but information on this is totally lacking.

EPS is available with or without HBCDD and if HBCDD is used, it constitutes approx. 0.5% (0.5-0.7 % HBCDD w/w) of the final product by weight (EUMEPS, 2002). EPS is usually provided at a density of 15.9-32.1 kg per cubic meter.

HBCDD-containing EPS is mainly used for the following purposes:
• insulation panels/boards in the construction sector
• automobile cushions for children (KemI, 1994) to meet the needs of the standards
• rigid packaging material for fragile equipment (minor use)
• packaging material such as “chips” and shaped EPS-boards (minor use)
• in props for theatre and film, and in exhibitions (minor use)

XPS is supplied in densities from 29 to 32,1 kg per cubic meter and it is used primarily for roofing and various architectural molding applications in the building and construction industry (with HBCDD content from 0.8 to 2% w/w.

HBCDD-containing XPS is mainly used for the following purposes:
• Cold bridge insulation
• Sandwich Panels and Laminates
• Cavity Insulation
• Floors
• Basement Walls and Foundations
• Inverted Roofs
• Ceilings

Another but a minor application area of HBCDD is in high impact polystyrene (HIPS) (1-7 % HBCDD w/w) in electrical or electronic parts of customer products. It can also be found in polymer-dispersion coating agents used in textiles (10-15% HBCDD w/w) for upholstered fabric, furniture, mattress ticking and for seating in vehicles (EU 2008). The textiles with the back-coating containing HBCDD are mainly used for:

• flat and pile upholstered furniture (residential and commercial furniture)
• upholstery seating in transportation
• draperies, and wall coverings
• bed mattress ticking
• interior textiles e.g. roller blinds
• automobile interior textiles and car cushions.

HBCDD is added to products at certain rates, it is not chemically bound. Therefore, it is more likely to dislodge from the product that it is applied in over time during use or after the product is disposed (Environmental Protection Agency [EPA], 2014; Government of Canada, 20104). There is also evidence that HBCDD may be replacing some polybrominated diphenyl ether (PBDE) flame retardants, notably the commercial decabromodiphenyl ether formulation (POPRC 2011). In Western Europe approximately 70% of EPS used for construction applications is flame-retarded, whereas more than 99% of flame-retarded EPS is used in Eastern Europe (ECHA annex XV dossier).

High impact polystyrene (HIPS) containing HBCDD is likely to be imported to Turkey in electrical and electronic equipment, but no data on this has been gathered. Import of polymer dispersions for textiles containing HBCDD cannot be excluded. Textile that is back-coated with a HBCDD containing layer is imported from China, the US and other countries in unknown quantities. In summary, import (and export) of HBCDD in articles is likely to occur but has not been possible to quantify.

Industry data for 2007 also show that HBCDD is widely used to manufacture EPS and XPS across the EU (Table 15).

Table 15. EPS and XPS manufacture facilities in Europe

Country	**Number of Sites**	
	EPS	**XPS**
Austria	1	1
Belgium	2	1
Czech Republic	2	
Finland	1	
France	1	3
Germany	4	6
Greece	1	1
Hungary	1	1
Italy	1	5
Netherlands	4	1
Norway		1
Poland	1	
Portugal		1
Serbia		1
Spain	2	4
Sweden		1
Turkey		3
United Kingdom		2

There are four types of commercial HBCDD mixtures produced and each has different melting points. All mixtures contain the isomers α-, β- and γ-HBCDD (Zegers, 2004). Trade names/product names of HBCDD are Saytex HP-900, FR-1206 and CD-75P.

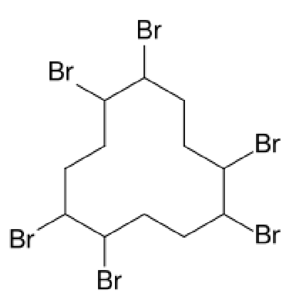


Figure 12. Molecular structure of HBCDD

EPA reports that HBCDD is persistent and mobile in the environment and very bioaccumulative. Although persistence degree of HBCDD is lower compared to half life criteria set forth in the EPA Toxic Substances Control Act (TSCA) and the international Persistent Organic Pollutant protocol (EPA, 2014), like other brominated flame retardants, HBCDD has also been found in unexpected places in the natural environment such as Arctic (EC, 2008; ECHA, 2014; EPA, 2014). Risk assessment studies indicated that HBCDD has high potential for long range transport.

Table 16. Brominated Flame Retardant Global Market Demand in 2001 (BSEF)

Brominated Flame Retardant	Market Demand (Metric Tonnes)	% of Total
Tetrabromobisphenol A (TBBPA)	199700	58,7
Decabromodiphenyl ether (Deca-BDE)	56100	27,5
Hexabromocyclododecane (HBCDD)	16700	8,2
Pentabromodiphenyl ether (Penta-BDE)	7500	3,7
Octabromodiphenyl ether (Octa-BDE)	3790	1,9
Total	203790	100

Table 17. HBCDD market demand by region (Morose, 2006)

Region	Market Demand	Percentage of Total
Europe	9500	56,9
Asia	3900	23,3
Americas	2800	16,8
Rest of the World	500	3,0
Total	16700	100

Total global demand for HBCD increased over 28% in 2002 to 21447 metric tonnes and rose again slightly in 2003 to 21951 metric tonnes (BSEF)

HBCDD Inventory

To our best knowledge, HBCDD is not produced in Turkey and yet there is not a defined Harmonized System code (HS Code, GTIB code) in Importers' Search Engine Trade Atlas (http://www.tradeatlas.com/page/gtip-nedir-gtip-no-sorgulama-gtip-no-ogrenme?ID=gtip-nedir), thus it is assumed that it has not been imported in its pure form to the country. However, it might be imported under the following GTIB number(s) which cover more general chemical group(s)
290359, 29369, 290399, 293190, 294200

Current inventory covers only EPS and XPS products and excludes textile and HIPS products. Production of EPS or XPS in Turkey is not enough to meet the demand of the market, therefore, EPS and XPS is exported at higher amounts to meet this demand. Some of domestic product is exported to various countries including Greece, Bulgaria, Russia, Lebanon, Jordan, Israel, Spain, Italy and US. IZODER is a non-profit union holding membership of 90% of companies who produces heat, water, sound and fire insulation products. Based on database of IZODER (www.izoder.org.tr), number of companies that produces fire insulation products is 15. However, it is not stated in detail whether these companies uses HBCDD in their products or not.

In 2005, approx. 1.4 million cubic meter EPS and 750000 cubic meter XPS were sold in Turkey (Kulaksızoglu, 2006). Based on 2010 data, size of insulation products market in Turkey was 3.5 million cubic meter whereas amount of insulation products used per capita in the country is 0.05 cubic meter. Figure 13 show changes in heat insulation sector in Turkey between 2004-2009.

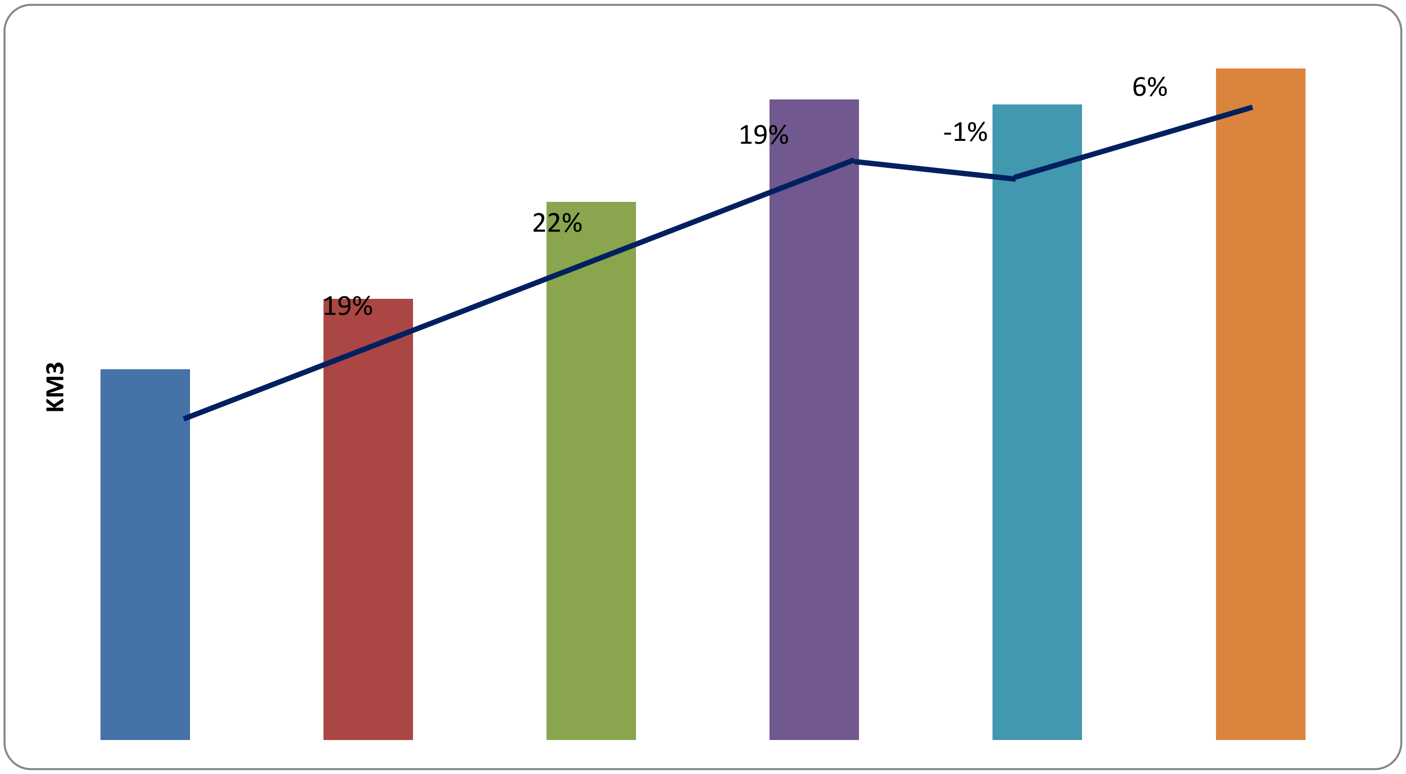


Figure 13. Heat Insulation Market in Turkey (Hacıbebekoglu et al., 2011)

According to Turkish Statistics Institute (TUIK) database, population of Turkey in 2013 was 76667864 and number of people per dwelling was 3.8. Using these figures, it can be calculated that the number of dwellings in country in 2013 was 20175753 (www.tuik.gov.tr). As it is stated above, amount of insulation products consumed in the country per capita is 0,05 cubic meter and using this number, it can be calculated that the amount of insulation products that shall be sold/used in the country to be approx. (76667864 people * 0,05 m^3/person =) 1,533,357,280 cubic meter.

Table 18. Amount of EPS and XPS imported to and exported from Turkey between 1985 to 2013 (UN International Trade Statistics Database)

	IMPORT (kg)			**EXPORT (kg)**			**DIFFERENCE BETWEEN IMPORT&EXPORT (kg)**			**TOTAL of IMPORT-EXPORT DIFFERENCE**
YEAR	***Polystyrene, expansible in primary forms****	***Polystyrene, except expansible in primary forms*****	***Polystyrene waste or scrap******	***Polystyrene, expansible in primary forms****	***Polystyrene, except expansible in primary forms*****	***Polystyrene waste or scrap******	***Polystyrene, expansible in primary forms****	***Polystyrene, except expansible in primary forms*****	***Polystyrene waste or scrap******	
2013	104133538	268553124	1419.137	16066120	1978681	1000	88067418	266574443	419.137	354642280
2012	121133816	284467497	392405	31077029	2126514	9415	90056787	282340983	382990	372780760
2011	100626324	267498576	291435	3477345	4172159	73620	97148979	263326417	217815	360693211
2010	83868932	249768686	663930	2309114	663080	30620	81559818	249105606	633310	331298734
2009	63324364	219470599	478290	799133	708591	36151	62525231	218762008	442139	281729378
2008	799133	708591	36151	1846816	813967	9342	-1047683	-105376	26809	-1126250
2007	84352136	254898391	1636354	269946	1404947	10470	84082190	253493444	1625884	339201518
2006	74299554	250069693	103837	147669	1095886	32504	74151885	248973807	71333	323197025
2005	60474115	209205811	27936	286122	740392	5920	60187993	208465419	22016	268675428
2004	52704201	192078048	55016	139953	442123	0	52564248	191635925	55016	244255189
2003	39263698	162937198	29151	140026	479067	0	39123672	162458131	29151	201610954
2002	30450217	146763344	44269	150138	380141	152	30300079	146383203	44117	176727399
2001	22621034	83545024	2785	31368	355944	0	22589666	83189080	2785	105781531
2000	27893832	87481328	10344	193877	211444	0	27699955	87269884	10344	114980183
1999	24375089	109739103	0	151514	224188	0	24223575	109514915	0	133738490
1998	22600944	89899848	0	28412	116778	0	22572532	89783070	0	112355602
1997	19841518	87329160	1011	33038	194814	0	19808480	87134346	1011	106943837
1996	16248020	66711344	796	2355	195498	21644	16245665	66515846	-20848	82740663
1995	14340309	47989768	12875	10453	23000	0	14329856	47966768	12875	62309499
1994	13467504	35033265	2125	63635	111149	5687	13403869	34922116	-3562	48322423
1993	12638334	40378765	7500	28039	153471	0	12610295	40225294	7500	52843089
1992	9209756	32894433	0	66287	0	0	9143469	32894433	0	42037902

1991	8484998	28653446	699	73	26539	0	8484925	28626907	699	37112531
1990	6987283	27786804	0	2161	414687	0	6985122	27372117	0	34357239
1989	5056291	10769090	0	596	375827	4750	5055695	10393263	-4750	15444208
1988	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0
TOTAL							961873721	3237222049	3557053	

*GTIB number 390319; ** GTIB number 390311; *** GTIB number 391520

Assuming an average density of 24 kg/m^3 of EPS and 30,6 kg/m^3 XPS, it can be calculated the amount of EPS remained (import-export) in the country between 1985-2013 was 961873721kg/24kg/m^3=40078072 m^3 whereas XPS amount was 3237222049kg/30,6kg/m^3=105791570 m^3.

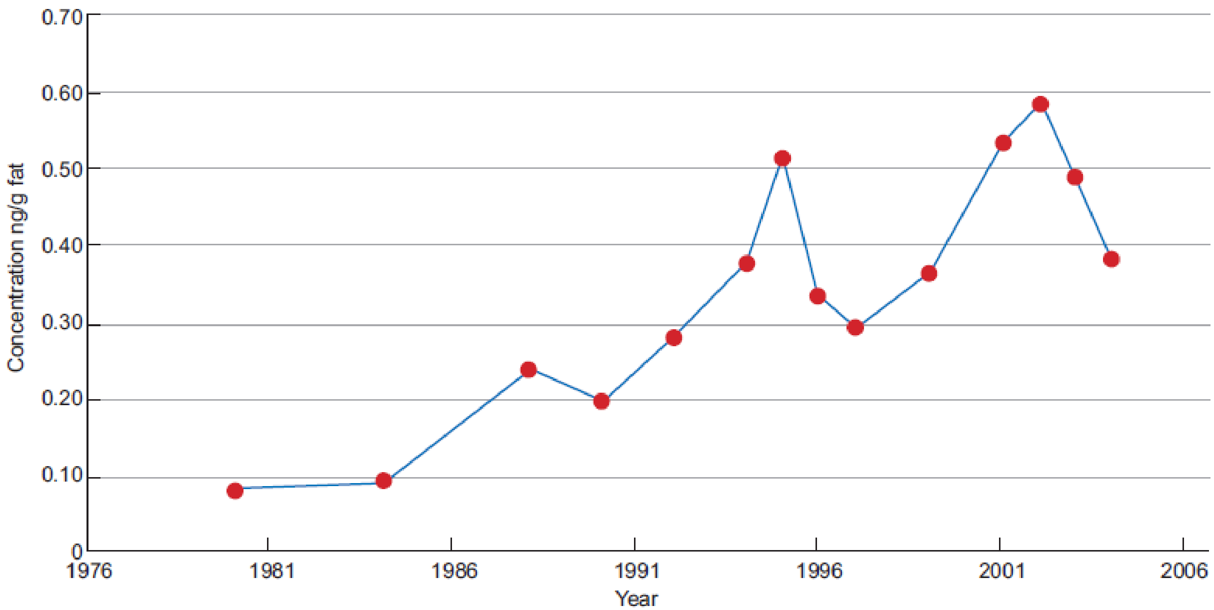


Figure 14. Time trend of HBCDD concentration in mother's milk in Sweden (Fängström, 2008)

As it is seen from Figure 14, HBCDD started increasing in human (and presumably in the environment) in 1985. Therefore, the calculations for Turkey HBCDD inventory is made for 1985 and so on.

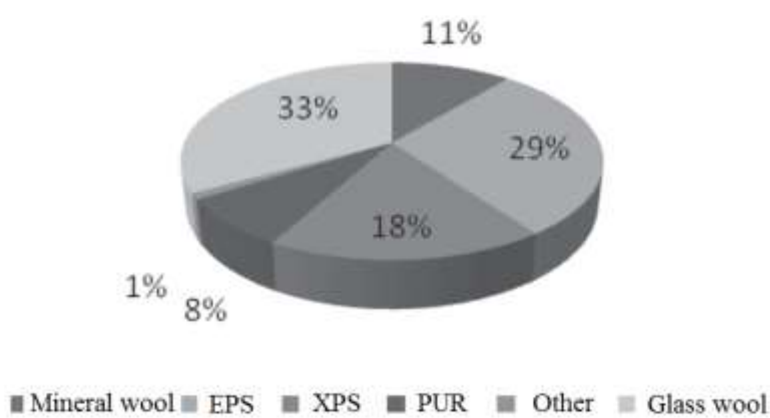


Figure 15. Turkish insulation products market distribution (PUR: polyurethane foam) (Alkaya et al., 2012)

Figure 15 shows insulation products market shares in Turkey. Assuming the % distribution in Figure 15 is valid for Table 18, thus, it can be assumed that EPS and XPS amounts in imported/exported polystyrene products to/from Turkey equal to 29% and 18%, respectively.

Assuming HBCDD content of 0.5% (w/w) and 1.4% (w/w) for EPS and XPS, respectively, it can be calculated that the amount of HBCDD in EPS and XPS remained in the country and it is shown in the table 19.

Table 19. Estimated HBCDD amounts in EPS and XPS and waste polstyrene in Turkey

YEAR	**HBCDD in EPS (tonnes)****	**HBCDD in XPS (tonnes)****	**HBCDD in Polystyrene waste or scrap (tonnes)*****
2013	350	1058	0.002
2012	358	1121	1.520
2011	386	1045	0.865
2010	324	989	2.514
2009	248	868	1.755
2008	-4	0	0.106
2007	334	1006	6.455
2006	294	988	0.283
2005	239	828	0.087
2004	209	761	0.218
2003	155	645	0.116
2002	120	581	0.175
2001	90	330	0.011
2000	110	346	0.041
1999	96	435	0
1998	90	356	0
1997	79	346	0.004
1996	64	264	na

1995	57	190	0.051
1994	53	139	na
1993	50	160	0.030
1992	36	131	0
1991	34	114	0.003
1990	28	109	0.000
1989	20	41	na
1988	0	0	0
1987	0	0	0
1986	0	0	0
1985	0	0	0
TOTAL	3823	12852	14

*GTIB number 390319; ** GTIB number 390311; *** GTIB number 391520; na: below zero

As it is seen from the table, a total of approx. 16000 tonnes of HBCDD is present in insulation products that are in use/disposed products in Turkey. However, this number is higher than it should be noted that insulation materials should be tested to determine % HBCDD content of materials.

According to a survey conducted by VECAP (2009), an emission of 6 g, 7 g and 22 g of HBCDD from per tonne sold HBCDD product is released to air, water and to the land, respectively (VECAP, 2009). Moving from this point, it can be calculated that of the 16000 tonnes of HBCDD present in insulation products in Turkey, there will be released 96 kg, 112 kg and 352 kg HBCDD to air, water and to the land, respectively.

There is no measurements/monitoring study results regarding HBCDD in Turkish environmental compartments. The only study was a short-term arir/dust monitoring project carried out by Dr. Kurt-Karakus in 2012 in Istanbul. Obtained results from that study showed ambient air concentration of HBCDD in Istanbul ranged between 38-1200 pg/m3 whereas indoor air concentrations ranged between <MDL-400 pg/m3 in homes and <MDL-24000 pg/m3 in offices. Indoor dust concentrations ranged between <MDL-29000 ng/g in homes and <MDL to 94000 ng/g in offices (Kurt-Karakus, 2013). In general, levels in Istanbul are lower than HBCD levels reported for UK classrooms (Harrad et al., 2010). Levels are generally similar to levels of HBCD reported for UK offices and homes (Harrad et al., 2008b) and Canadian homes (Wilford et al., 2005) and living rooms in US homes (Restrepo-Johnson and Kannan, 2009).

9. Preliminary outline of ACTION PLAN for managing POP-PBDEs and HBCDD

HBCDD

- On the basis of existing information, the following actions would be warranted:

- In general, HBCDD should be covered by national environmental and worker protection legislations but without specific provisions for HBCDD.

- Consider initiating rulemaking to add HBCDD to the list of chemicals which present or may present an unreasonable risk of injury to health or the environment.

- Government should propose a ban on the use of HBCDD and other flame retardant substances in consumer products.

- Initiating rulemaking to designate manufacture or processing of HBCDD for use in consumer textiles as a flame retardant as a significant new use which would require manufacturers and processors to notify MoEU before manufacturing or processing HBCDD for the significant new use. This "New Use Rule should be proposed to apply to imports of consumer textiles articles containing HBCDD.

- It can be suggested that the use of HBCD in textiles may be limited to specialty commercial applications, and that general consumer textile use may be extremely limited.

- There is a need to reduce the exposure via dermal contact and inhalation for workers. To minimise the inhalation exposure in the working environment the concentrations of HBCDD in the air should be minimised, and to minimise the dermal exposure in the working environment the potential for skin contact with HBCDD must be minimised. Both can be achieved through substitution of HBCDD, or through organizational and technical measures, e g more closed processes, improved local exhaust ventilation, or through the use of protective gloves and clothing for the individual.

- The proposed strategies for limiting the risks for the environment and humans exposed via the environment are

    - to impose restrictions on the marketing and use of HBCDD in general, i.e. in textiles, HIPS, EPS and XPS
    - to consider the need for time limited exemptions for certain uses of HBCDD in EPS and XPS
    - to classify used material and products containing HBCDD as hazardous waste under the hazardous waste directive
    - to include HBCDD as a priority hazardous substance in Water Pollution Control Legislation
    - elimination/limitation of uncontrolled landfilling/dumping

- The Voluntary Emissions Control Action Programme (VECAP, 2009) states that the disposal of used packaging containing residues is a much more important issue than had been realised until now and the associated potential emissions to land are much higher than those to air and water. Therefore, it is suggested to take action in better control of emissions.

- Best practices for handling and disposal should be adopted

- In order to regulate HBCD, action could take the form of a comprehensive ban on the manufacturing, processing, distribution in commerce and use of a chemical substance, or a more targeted regulation to address specific activities.

- Initiating rulemaking on listing that will require manufacturers or importers to provide environmental release information not currently captured by existing rules.

- Conduct an environment and green chemistry alternatives assessment of HBCDD. The information developed could be used to encourage industry to move away from HBCDD instead of, in addition to, or as part of any regulatory action. The alternatives assessment would build upon existing knowledge and would consider various exposed populations, including sensitive human subpopulations, as well as environmental exposure.

- Introducing safe end-of-life treatment of polystyrene foam (PSF) boards containing HBCDD.

- An appropriate handling of PSF in large-scale municipal solid waste (MSW)

- Monitoring studies should be carried out, especially to investigate personal exposures during packing, compaction process operations and warehouse work.

- Releases through wastewater and solid wastes should be assessed

PBDEs
Below action plan remarks are suggested for PBDEs but not limited to these chemicals, it is suggested for HBCDD and any new chemical added to the Convention.

Although studies on POP-PBDEs in Turkish environmental compartments are very limited and not much is done to determine amount of these chemicals in Turkey, based on evaluation of scientific studies and available information from other regions as well as growing international evidence on bioaccumulation, persistence and toxicity of PBDEs, Turkish government is willing to take any kind of measures to reduce risks of PBDEs to Turkish people. Therefore, the current inventory is a pioneer study to evaluate PBDEs in Turkey. However, due to limited time and financial sources, the borderline of the current inventory study has some limitation. For example no measurements of PBDE content of consumer products and waste and recycling flows have been performed. Also no surveys to determine EEE consumer products penetration rates have been conducted.

Based on results of the current inventory, the following action plan components are proposed.

1. **Legislation**

Assessment of the legal, institutional, regulatory, and enforcement systems for management, recycling and end-of-life treatment of POP-PBDE-containing materials (in particular electric and electronic equipment and the transport sector and related wastes):

- Update of all relevant current Turkish legislations based on Updated Stockholm Convention List
- Implementation of CLRTAP Convention

- Adoption of EC POPs Regulation No. 850/2004 on POPs, as amended concerning newly adopted POPs;
- Further update of subsequent legislation in respect to other needs identified under NIP update process (if additional issues discovered);
- Assessment and possibly restriction on recycling of POP-PBDE containing plastics. Link to EU WEEE Directive and the Turkish adoption/transposition. Assessment if the Turkish regulation contains the separation of BFR containing plastic as EU WEEE Directive, which already includes separation BFR plastic;
- Restriction on export of PBDE containing materials with exemption of environmentally sound management (ESM) destruction;
- Assessment of the implementation of this regulative frame.
- Assessment of implications of PBT criteria under REACH regulation in respect to assessment of PBDE alternative chemicals. Scheringer et al. (2012) and Strempel et al. (2012) assessed chemicals for their PBT properties based on REACH PBT criteria. Such an assessment of PBDEs alternatives might be performed by a Turkish research institution for the chemicals that are being used in Turkey.
- Proper legislation should be created on appropriate flammability standards which consider minimizing exposure to harmful substances without compromising safety. In this manner, it should be assessed that what measures to meet flammability standards in Turkey and such an assessment should be carried out by MoEU, industry partners Turkish Standards Institute and other relevant stakeholder. It should be kept in mind that flammability standards can be met by alternatives and such applications may offer better environmental benign solutions. However, the alternatives are all associated with lower levels of concern for persistence and bioaccumulation than pentaBDE, but none of the alternatives is free from concern.

2. Awareness Raising

- Awareness raising activities should be carried for industry, manufacturers, importers, exporters, policy Makers and public
- Actions should be carried out to support and encourage the voluntary phase-out of use /import of commercial PBDEs (Considering the RoHS directive it should be assessed if also DecaBDE should be considered here). Commitments from the principal importers/users is crucial in terms of to initiate reductions in the import and sales of PBDE-added goods.
- Using PBDE chemicals as a case study to highlight the challenge of POPs (and other PBT substances) in the recycling flow and therefore an obstacle for a circular economy.
- Industrial partners should be informed about elaboration of the risk evaluation for recycling flows in industrial sectors. Elaboration of the chemicals assessment for moving to more sustainable production by the phase out of POPs, PBT and other hazardous chemicals in consumer goods and production processes[3].
- Public Awareness raising should focus on education of consumers for more sustainable consumption (e.g. ecolable)
- Show risks for a circular economy in the recycling flow and in the water cycle

3. Measures and Controls

[3] Examples for practical phase out examples including POPs and other hazardous chemicals have been compiled at the EU project SUBSPORT

a) Chemical Import/Export Tracking:

- Ministries of Customs, Economy and Trade: re-arrangement of control and monitoring systems to be able to track import and export data, i.e. use of imported chemicals The control mechanism at the Customs should serve to purpose of control, record and aim of use activities.
- Customs Office databases is the main source to track such chemicals that are imported to the country. Therefore, protocols between Customs Office and Ministry of Environment and Urbanization should be more solid so that access to records of the chemicals is obtained easily in a more comprehensive manner.
- Improvement on documentation regarding the challenge to track (and therefore control) PBDEs as chemical and in particular as chemical in products by current custom control measures;
- With Ministries of Customs, Economy and Trade: improvement of the traceability of chemicals and chemicals in products.
- Re-arrangement of control and monitoring systems to be able to track import and export data; Assessment if imported (hazardous) chemicals could be better tracked (e.g. CAS numbers).
- Current legislation on vehicle/goods import should be re-assessed if there is a need for modifications.

b) Monitoring activities of PBDE in the technosphere and in environmental compartments

- *Capacity Building and Accreditation:* Ministry should take action on the setting up a national network to monitor POPs in different regions of the country. This can be done via collaboration between MoE and researchers at the universities carrying out studies on the fate of POPs in Turkish environmental compartments.

- *A National POPs Monitoring programme should be formed.* The biggest challenge on the the assessment of POPs issue in Turkey is lack of baseline data in each environmental compartment. Therefore, a monitoring plan covering a spatial and temporal trend study should be formed a.s.a.p. and should continue in the lead of MoE.

While there are some studies on PBDE in Turkey several critical life cycle stages have not been monitored yet, including occupational exposure in facilities treating possibly PBDE containing materials

Monitoring activities can be focused on the following issues

Compilation of PBDE levels in Turkey and of international studies;

1) Monitoring in articles and products (with emphasize of recycling);

- Monitoring in E-waste plastic (in particular if recycled or exported);

- Monitoring of PUR foam (generally and in recycling);

- Monitoring in articles produced from recycled materials.

2) Monitoring of human exposure:

- Occupational exposure (recycling sector; disposal including certain secondary metal industries)

- Indoor exposure

3) Monitoring of potentially contaminated sites:

-Sites with specific activities (see inventory guidance, Stockholm Convention Secratariat, 2012a).

4) Monitoring of cattle and wildlife:

- Monitoring of cattle and wildlife (including fish);

- having potential exposure (near selected industries);
- background exposure

5) ***Random sampling and testing of PBDE as component in local production of goods known/suspected to contain PBDE.***

4. Determination of Contaminated Sites

Storage Areas, landfills, wastewater treatment plants, wastewater sludge disposal areas, waste recycling facilities would be the initial contaminated site assessment areas.

Following activities be considered in respect to PBDE contaminated sites

- Compilation of potentially PBDE contaminated sites and potential related risks and inclusion in a database of contaminated sites.
- Assessment of the need of limit values for soils or sediments.
- Assessment of risk of PBDD/PBDF as co-contaminants (which are relevant for thermal treatment of PBDE-containing wastes) and their connection to Dioxin/UPOPs contaminated sites. The only report of a life-cycle assessment on management of a PBDE contaminated waste stream shows that the impacts of PBDD/DF are by far the most significant contributor to total health impacts for recycling and feedstock recycling scenarios (Hirai et el., 2008)
- Potential remediation activities needed (including assessment of dumpsites/landfills).
- Identification of hot spots on a nationwide study

5. E-waste Plastic Recycling

Unfortunately, there is no data available on the amount/fate of recycled e-waste plastic in Turkey. Therefore, the following actions are recommended on this component

- Assessmnet of recycling activities of WEEE plastic in Turkey.

- Assessment of current used technologies status of WEEE plastic recycling in Turkey.
- Current option of separation of PBDE containing plastic (including assessment of compliancy according to Turkish WEEE directive/EU WEEE Directive);
- Need assessment for improving/changing the recycling of WEEE plastic; this assessment should best be done in the frame of overall WEEE management in the country.

Another area with absence of information is recycling and disposal of potentially PBDE-containing materials such as PUR foam. It should be noted that most PUR foam does not contain PBDEs. However, some surely does and therefore the following activities should be initiated

- An assessmenet of presence of PBDE in PUR foam in Turkey and recycling activities of PUR foam
- An assessment of current used technologies of PUR foam recycling and need assessment for improving/changing the recycling of PUR foam.
- Analysis of polymer scrap produced in the WEEE recycling facility for PBDE content

6. **Application of BAT/BEP if flame retardants are used in industrial applications**

    - Assessment what flame retardants are currently used in production and evaluation if better alternatives are available.
    - Assessment of the material flow of flame retarded articles and products. In the assessment the risks to humans and the environment to be evaluated and the risks to future recycling and end of life management.

7. **Destruction of PBDE-containing materials/waste**

Action plan activities should cover disposal and destruction of PBDE containing materials including:

- Assessment of current status and option for disposal of polymers from end-of-life vehicles.
- Assessment of current status of PBDE-containing WEEE plastic in Turkey.Based on the end-of-life model conducted in the current inventory study, it is estimated that the total amount of recycled and landfilled plastics from CRTs would be at 47000 tonne and 127200 tonne, respectively, by the end of 2013.
- Measures for implementation of BAT/BEP for treatment and disposal techniques for PBDE-containing materials.
- Assessment of existing capacity in Turkey for disposal and destruction of PBDE containing materials in this respect and need assessment for appropriate treatment.
- Minimisation and possibly restriction of landfilling PBDE-containing materials and application of the waste management hierarchy (see PBDE BAT/BEP guidance (Stockholm Convention Secretariat 2012b);

- Integration of the management of POP-PBDE-containing articles and materials in overall WEEE management and overall management of of end of life vehicles (cars and other transport). Also other possibly impacted waste flows such as furniture and mattresses can be assessed. For an appropriate assessment the material flows assessment should be further developed. If detailed waste management and recycling concepts of these material flows do not exist, then they should be established considering the waste management hierarchy. Here then the ESM of POP-PBDE-containing and other hazardous substance containing materials within the respective waste categories should be considered as well as the resource recovery of valuable materials and elements.

8. Environmentally sound management (ESM) of PBDE-containing articles and materials

- PBDE-containing materials to be stored in an environmentally safe manner. The overal risks of PBDE-containing plastic and other polymers is considerable lower compared to e.g. PCB oil or pesticides which should be taken into account. However, PBDE containing articles and materials poses a risk to human and such items should be managed in an Environentally sound manner.

- Separation of household waste containing PBDEs.
- Guidelines concerning articles which must not be reused and recycled: Guidelines concerning articles which must not be reused and recycled as a consequence of a content of POP-BDE exceeding the set limit should be established
- Assessment of listing of exemption: After assessment of recycling activity and the assessment of separation of PBDE containing:

  - Recycling of WEEE plastic

  - Recycling of PUR foam

If exemption is needed then registration at the Stockholm Convention Secretariat should be submitted.

During the inventory studies, some data from Customs Office showed the import of diphenyl ether (approx.. 500 tonnes) to the country. It is not known what kind of diphenyl ether was imported or whether there are any stockpiles in Turkey or not. This should be identified and destructed properly. Additonally, records of Customs Office statistics, between 1996-2013, ~1000000 tonnes of ABS has been imported to Turkey. However, it is not known whether this ABS is new or used and no data on the percentage of flame retarded fraction. The fate of these imported diphenyl ethers and ABS polymers should be assessed within the above mentioned overall assessement and management of material flows.

9. Refining and improvement of PBDE inventory

Based on the conduct and results of this inventory, the team strongly recommends that an in depth inventory (Tier 3 of Stockholm Convention Secretariat PBDE Inventory Guidance 2012a) be carried out. In this inventory minor uses of PBDE in all inventory procedures should also be assessed.

1) Improvement of the PBDE inventory:

- PBDE in WEEE plastic: An overall e-waste inventory needed for the appropriate management for EEE/WEEE should be carried out. Within this activity the PBDE inventory should be updated to close gaps;
- PBDE in end of life vehicles: An overall inventory of the transport sector including an inventory of end-of-life vehicles (including future time perspective). Within this activity the PBDE inventory should be updated to close gaps;
- PBDE in minor applications (construction/insulation, textile, furniture, mattresses, rubber) should also be included in an updated inventory. In such an update HBCD (listed in the Convention) should also be included which is the main listed POP in construction/insulation and also used in the textile sector (see below).

2) Inventory of HBCD (and possibly DecaBDE): Integration in inventory activities for HBCD and possibly DecaBDE[4] should be done

3) Material Flow Analysis:

Development of material flow analysis and substance flow analysis of PBDE containing materials and their relevance for recycling. For practical usefulness:

- Beneficial for waste management planning;
- Beneficial for recycling and recovery;
- Assessment of PBDE in recycling.

4) Inventories for the Stockholm Convention are to be periodically updated

[4] DecaBDE is listed in the RoHS directive. Also DecaBDE is currently assessed by the POP Reviewing Committee for possible listing in the Stockholm Convention.

Table 23: Action Plan activities for reduction, elimination and control of PBDE containing materials in Turkey

Activity	**Responsible Ministry/Institution**		**Priority Degree**
	Leading	**Assisting**	
Legislation	MoEU	-	High
Awareness Raising	MoEU	MoEU	High
Measures and Controls	MoEU	Customs	Very High
Determination of Contaminated Sites	MoEU	-	Medium/High
E-waste Plastic Recycling	MoEU	Municipalities	Medium/High
Application of BAT/BEP if flame retardants are used in industrial applications	MoEU	MoSIT	High
Destruction of PBDE-containing materials/waste	MoEU	MoCT MoSIT	Medium
Environmentally sound management of PBDE-containing items	MoEU	MoEU, MoCT, Municipalities	High
Repeat/Improvement of PBDE Inventory	MoEU	MoE, MoCT	High/Medium

MoEU: Ministry of Environment and Urbanization, MoCT: Ministry of Customs and Trade; MoE: Ministry of Economy; MoSIT: Ministry of Science, Industry and Technology

References

Alcock R.E, Sweetman A.J, Prevedouros K, Jones, K.C. 2003. Understanding levels and trends of BDE-47 in the UK and North America: an assessment of principal reservoirs and source inputs. Environment International 29, 691- 698

Batterman, S., Chernyak, S., Jia, C., Godwin, C., Charles, S. 2009. Concentrations and emissions of polybrominated diphenyl ethers from U.s. Houses and Garages. Env. Sci. Technol., 43, 2693-2700

Batterman, S., Godwin, C., Chernyak, S., Jia, C., Charles, S. 2010. Brominated flame retardants in offices in Michigan, U.S.A. Env. Int. 36, 548-556

Breivik, K., Sweetman, A., Pacyna, J.M., Jones, K.C. 2002. Towards a global historical emission inventory for selected PCB congeners - A mass balance approach: 1. Global production and consumption. Science of the Total Environment, 290, 1-3, 181-198

BT Sektörü, 2013. http://www.despec.com.tr/img/sektor.pdf

Cetin, B. And Odabasi, M. 2007. Particle-Phase Dry Deposition and Air-Soil Gas-Exchange of Polybrominated Diphenyl Ethers (PBDEs) in Izmir, Turkey, Environ. Sci. Technol. 41, 4986-4992

Cetin, B. And Odabasi, M. 2008. Atmospheric concentrations and phase partitioning of polybrominated diphenyl ethers (PBDEs) in Izmir, Turkey, Chemosphere, 71, 1067-1078

Cetin, B. And Odabasi, M. 2011. Polybrominated diphenyl ethers (PBDEs) in indoor and outdoor window organic films in Izmir, Turkey, Journal of Hazardous Materials, 185, 784-791

Chen S-J, Ma Y-J, Wang J, Chen D, Luo X-J. Mai B-X. 2009. Brominated Flame Retardants in Children's Toys: Concentration, Composition, and Children's Exposure and Risk Assessment. Environ Sci Technol 43(11): 4200-4206

Chen S-J, Ma Y-J, Wang J, Tian M, Luo X-J, Chen D, Mai B-X. 2010. Measurement and human exposure assessment of brominated flame retardants in household products from South China. Journal of Hazardous Materials 176(1-3): 979-984

Çakıroğulları, Ç., Traag, W., Hoogenboom, R., Immerzeel, J., Kraats, C., Van Der Weg, G., Ten Dam, G., Wijma, E., Van Der Lee, M., Van Wakeren, C., Uçar, Y., Kılıç, D. http://edepot.wur.nl/178186

Ebert, J. Bahadir, M. 2003. Formation of PBDD/F from flame-retarded plastic materials under thermal stress, Environment International 29, 711 – 716.

European Chemical Agency (ECHA) Annex XV Dossier. Proposal for Identification of Hexabromocyclododecane as a SVHC. Accessed at http://echa.europa.eu/documents/10162/3f5de199-8732-4881-aec6-730bf9499a36

European Chemical Agency (ECHA), 2008. Data on Manufacture, Import, Export, Uses and Releases of HBCDD as well as Information on Potential Alternatives to its Use, Report No:ECHA /2008/02/SR4/ECA.226

European Chemical Agency (ECHA). 2008. European Chemicals Agency. Member State Committee Support, Document for Identification of Hexabromocyclododecane and All Major Diastereoisomers Identified as a Substance of Very High Concern. Retrieved from http://echa.europa.eu/documents/10162/13637/afa_hbcdd-0013-01-es_en.pdf, Accessed December 27, 2014.

Elektronik atıklar, 2013. http://www.cevreonline.com/atik2/elektronik%20atik.htm

EPA. 2014. U.S. Environmental Protection Agency. Hexabromocyclododecane Action Plan. Retrieved from http://www.epa.gov/oppt/existingchemicals/pubs/actionplans/hbcd.html. Accessed December 10, 2014.

Erdoğrul, Ö., Covaci, A., Schepens, P. 2005. Levels of Organochlorine pesticides, polychlorinated biphenyls and polybrominated diphenyl ethers in fish species from Kahramanmaras, Turkey. Environment International, 31, 703-711

Erdoğrul, Ö., Covaci, A., Kurtul, N., Schepens, P. 2004. Levels of organohalogenated persistent pollutants in human milk from Kahramanmaraş region, Turkey. Environment International, 30, 659-666

Ergün, N., 2007. Türkiye'de Atık Yönetimi, Türk Plastik Sanayicileri Araştırma, Geliştirme ve Eğitim Vakfı (PAGEV)

European Manufacturers of Expanded Polystyrene (EUMEPS), Healthy Building with EPS, January 2015, http://www.sundolitt.dk/download.aspx?object_id=505CFD59EE894464879C124D41C944CE.pdf

European Union (EU). 2008. Risk Assessment Report on Hexabromocyclododecane, CAS-No. 25637-99-4. Final draft May 2008. http://ecb.jrc.ec.europa.eu/.

Gelir İdaresi Başkanlığı, 2013. http://www.gib.gov.tr/fileadmin/user_upload/Yararli_Bilgiler/amortisman_oranlari2011.html

Hirai et al. 2008. Impact of PBDD/DFs in life cycle assessments on recycling of TV cabinet back covers. Organohalogen Compounds 70, 1418-1421

Government of Canada. 2014. Draft Screening Assessment of Hexabromocyclododecane. Retrieved from http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=A27E7A60-1&offset=10&toc=show. Accessed December 10, 2014

Hacıbebekoglu, M., Yigitbaşı, G., Ercan, Ş. 2011. Dış Cephe Yalıtım Ürünleri (EPS) Üretimi Yatırım Fizibilitesi, Proje Geliştirme Merkezi PROGEM Eğitim Danışmanlık Ltd. Şti, 47 pp.

Harrad, S., Ibarra, C., Diamond, M., Melymuk, L., Robson, M. Douwes, J., Roosens, L., Dirtu, A.C., Covaci, A. 2008a. Polybrominated diphenyl ethers in domestic indoor dust from Canada, New Zealand, United Kingdom and United States. Env. Int. 34, 232-238

Harrad, S.; Ibarra,C.; Abdallah, M.A.-E.; Boon,R.; Neels, H.; Covaci, A. Concentrations of brominated flame retardants in dust from United Kingdom cars, homes, and offices: Causes of variability and implications for human exposure. Environ. Int., 2008b, 34, 1170-1175

Harrad, S.; Goosey, E.; Desborough, J.; Abdallah, M.A.-E.; Roosens, L.; Covaci, A. Dust from UK primary school classrooms and daycare centers: The significance of dust as a pathway of exposure of young UK children to brominated flame retardants and polychlorinated biphenyls. Environ. Sci. Technol., 2010, 44, 4198-4202

Holoubek, I., Falandysz, J., Kallenborn, R. 2012: Chemie životního prostředí IV. Polutanty s dlouhou dobou života v prostředí Další typy POPs – PCNs, SCCPs, PBDEs, PFCs. Power point presentation at RECETOX website: http://www.recetox.muni.cz/sources/prednasky/chzp_iv/chzp_iv_25.pdf

Importers' Search Engine Trade Atlas, http://www.tradeatlas.com/page/gtip-nedir-gtip-no-sorgulama-gtip-no-ogrenme?ID=gtip-nedir

IZODER, www.izoder.org.tr, accessed December 15, 2014

Karunanidhi, S.V. 2013. http://www.tasit.com/oto-bilgileri/oto-haberleri/cevre-ve-maliyet-sartlari-otomobilin-kimyasini-degistiriyor.html (Accessed in October, 2013)

Klif. 2011. Alternatives to the use of flame retarded EPS. TA-2827. http://www.klif.no/no/Publikasjoner/Publikasjoner/2011/Juli/Alternatives-to-the-use-offlame-retarded-EPS/.

Kulaksızoglu, Z. 2006. Isı Yalıtım Sektör Araştırması, ITO Piyasa Araştırma Raporu

Kurt-Karakus, 2013. İç ve dış mekan hava örneklerinde ve iç mekan toz örneklerinde Kalıcı Organik Kirleticilerin (KOK'lar) incelenmesi, TÜBİTAK 1002 Short Term Research Grant # 112Y004 Project Final Report

Ma, J., Addink, R., Yun, S.H., Cheng, J.P., Wang, W.H. Kannan, K. 2009. PBDD/Fs and PBDEs in soil, vegetation, workshop floor dust, and electronic shredder residue from an electronic waste recycling facility and in soils from a chemical industrial complex in eastern China. Env. Sci. Technol. 43, 7350-7356

Malarvanan G, Isobe T, Covaci A, Prudente M, Tanabe S. 2013. Accumulation of brominated flame retardants an polychlorinated biphenyls in human breast milk and scalp hair from the Philippines: levels, distribution and profiles. SciTotal Environ. 442:366-79

Matthews, et. al. 1997. Disposition and End-of-Life Options for Personal Computers. Carnegie Mellon University Schenley Park Pittsburgh, PA 15213

MAVISE, 2013. Database on TV and on-demand audiovisual services and companies in Europe, http://mavise.obs.coe.int/country?id=32

Morose, G. 2006. An Overview of Alternatives to Tetrabromobisphenol A (TBBPA) and Hexabromocyclododecane (HBCD), Lowell Center for Sustainable production, University of Massachusetts Lowell, 26 pp.

Muenhor, D. 2011. Polybrominated diphenyl ethers (PBDEs) in indoor and outdoor environments. Thesis, University of Birmingham

Odabasi, M., Bayram, A., Elbir, T., Seyfioglu, R., Dumanoglu, Y., Bozlaker, A., Demircioglu, H., Altıok, H., Yatkın, S., Cetin, B. 2009. Electric Arc Furnaces for Steel-Making: Hot Spots for Persistent Organic Pollutants, Environ. Sci. Technol. 43, 5205-5211

Özcan, Ş., Tor, A., Aydin, M.E. 2011. Levels of Organohalogenated Pollutants in Human Milk Samples from Konya City, Turkey, Clean-Soil, Air, Water. 39, 10, 978-983

Peralta, G.L., and Fontanos, P.M. 2006. E-waste issues and measures in the Philippines J Mater Cycles Waste Management. Springer-Verlag

Persistent Organic Pollutants Review Committee (POPRC). 2011. Hexabromocyclododecane. Draft Risk Management Evaluation. Accessed at http://chm.pops.int/Portals/0/download.aspx?d=UNEP-POPS-POPRC6WG-EVAL-HBCD-draftRME-110412.En.doc

Pucket, et. al. 2005. Exporting Harm: The High-Tech Trashing of Asia. The Basel Action Network (BAN), Silicon Valley Toxics Coalition (SVTC)

Referans Noktası, 2013. http://referansnoktasi.blogcu.com/bilgisayar-sektorumuz/4415433

Restrepo-Johnson, B. and Kannan, K. An assessment of sources and pathways of human exposure to polybrominated diphenyl ethers in the United States. Chemosphere, 2009, 76, 542-548.

Samsonek, J., Puype, F., 2013. Occurrence of brominated flame retardants in black thermo cups and selected kitchen utensils purchased on the European market. Food Additives & Contaminants. Part A, Chemistry, Analysis, Control, Exposure & Risk Assessment. DOI: 10.1080/19440049.2013.829246.

Scheringer M, Strempel S, Hukari S, Ng CA, Blepp M, Hungerbuehler K (2012) How many persistent organic pollutants should we expect? Atmospheric Pollution Research 3, 383-391

Shaw SD, Blum A, Weber R, Kannan K, Rich D, Lucas D, Koshland CP, Dobraca D, Hanson S, Birnbaum LS. (2010) Reviews on Environmental Health 25(4): 261-305.

Sjodin, A., Papke, O., McGahee, E., Focant, J.F., Jones, R.S., Pless-Mulloli, T., Leontjew Toms, L.M., Hermann, T., Mueller, J., Needham, L.L., Patterson, D.G.J. 2008. Concentration of polybrominated diphenyl ethers (PBDEs) in household dust from various countries, Chemosphere, 73, S131-S136

Stapleton, H., Kelly, S.M., Allen, J.G., Mcclean, M.D., Webster, T.F. 2008. Measurement of Polybrominated Diphenyl Ethers on Hand Wipes: Estimating Exposure from Hand-to-Mouth Contact Environ Sci Technol. 42, 3329- 3334

Stockholm Convention Secretariat, (2012a) Guidance for the inventory of polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention on Persistent Organic Pollutants. (Draft)

Stockholm Convention Secretariat (2012b) Guidelines on Best Available Techniques and Best Environmental Practice for the Recycling and Disposal of Articles containing Polybrominated Diphenyl Ethers (PBDEs) under the Stockholm Convention on Persistent Organic Pollutants; (Draft)

Strempel S, Scheringer M, Ng CA, Hungerbühler K (2012) Screening for PBT Chemicals among the “Existing” and “New” Chemicals of the EU. Environmental Science & Technology 46, 5680-5687

Trafik Kaza İstatistikleri-Karayolu, 2012. Emniyet Genel Müdürlüğü ve Türkiye İstatistik Kurumu, Yayın No: 4115, ISSN: 1300-1175

TÜİK, Turkish Statistics Institution, www.tuik.gov.tr

UN Comtrade, 2013. http://comtrade.un.org/db/

UNEP. 2010a. Technical review of the implications of recycling commercial Penta and Octabromodiphenyl ethers. Stockholm Convention document for 6th POP Reviewing Committee meeting (UNEP/POPS/POPRC.6/2) Geneva 11-15. October 2010

UNEP. 2010b. Technical review of the implications of recycling commercial Penta and Octabromodiphenyl ethers. Annexes. Stockholm Convention document for 6th POP Reviewing Committee meeting (UNEP/POPS/POPRC.6/INF/6) Geneva 11-15. October 2010

Van den Berg M, Denison MS, Birnbaum LS, DeVito MJ, Fiedler H, Falandysz J, Rose M, Schrenk D, Safe S, Tohyama C, Tritscher A, Tysklind M, Peterson RE (2013) Review Polybrominated Dibenzo-p-Dioxins, Dibenzofurans, and Biphenyls: Inclusion in the Toxicity Equivalency Factor Concept for Dioxin-Like Compounds. Toxicological Sciences 133, 197–208.

VECAP, 2009. The Voluntary Emissions Control Action Programme Measurable Achievements Annual Progress Report 2009.

Vermeulen I, Van Caneghem J, Block C, Baeyens J, Vandecasteele C. 2011. Automotive Shredder Residue (ASR): Reviewing its Production from End-of-Life Vehicles (ELVs) and its recycling, energy or chemicals' valorisation. J Hazard Mater. 190, 8-27

Weber, R., Kuch, B. 2003. Relevance of BFRs and thermal conditions on the formation pathways of brominated and brominated-chlorinated dibenzodioxins and dibenzofurans. Environmental International 29, 699-710.

World Health Organization (WHO) (1998) Polybrominated dibenzo-p-dioxins and dibenzofurans. Environ Health Criteria 205 [Geneva].

Zegers, B.N., Mets, A., van Bommel, R., Minkenberg, C., Hamers, T., Kamstra, J.H., Learmont, J.A., Vazquez, B., Pierce, G., Reid, B., Patterson, T., Rogan, E., Murphy, S., Addink, M., Hartmann, M., Smeenk, C., Dabin, W., Ridouxi V., Gonzalez, A., Lopez, A., Jauniaux, T., Boon, J., Stereo-isomer Specific Bioaccumulation of Hexabromocyclododecane (HBCD) in Marine Mammals, BFR, 2004, 411-414

Wilford, B.H.; Shoeib, M.; Harner, T.; Zhu, J.; Jones, K.C. Polybrominated diphenyl ethers in indoor dust in Ottawa, Canada: Implications for sources and exposure. Environ. Sci. Technol., 2005, 39, 7027-7035

Wong MH, Wu SC, Deng WJ, Yu XZ, Luo Q, Leung AO. 2007. Export of toxic chemicals - A review of the case of uncontrolled electronic-waste recycling. Environmental Pollution 149, p 131-40

Annex XIII: Initial inventory of PFOS for implementation of EU POPs Regulation in Turkey

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.

Initial Inventory of PFOS for the implementation of EU Persistent Organic Pollutants Regulation in Turkey

27. February 2014

Prepared by Sinem Erdoğdu, Short Term Expert

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

Table of Contents

Abbreviations i
1. Executive Summary 3
2. Methodology 5
3. Information about PFOS 6
3.1. Properties of PFOS and its related substances 6
3.2. Production and Use on Global Scale 7
3.3. PFOS in the Environment 9
4. Study of Industrial Releases 12
4.1. Electronics, Semiconductor and Photographic Industries 13
4.2. Metal Plating Industry 18
5. Study of Releases due to Articles 22
5.1. Synthetic Carpets 22
5.2. Fire Fighting Foams 24
5.3. Aviation Hydraulic Fluids 28
5.4. Textile and Leather Industries 30
5.5. Other 32
6. Waste Management and Stockpiles 34
7. Alternatives 38
8. Discussion and Conclusion 40
REFERENCES 42
ANNEX 44
ANNEX A. 44
ANNEX B. 44
ANNEX C. 45
ANNEX D. Waste Management Activities Related to PFOS 45
ANNEX E.1 46
ANNEX E.2. The List of Hydraulic Oil Recycling Facilities 60
ANNEX F. Questionnaires for Industries 64
F.1. Questionnaire for Metal Plating Industry 65
F.2. Questionnaire for Textile Manufacturers And Retailers 67
F.3. Questionnaire for Synthetic Carpets Sector 71

F.4. Questionnaire for Pulp and Paper Industries 75
F.5. Questionnaire for Semi-Conductor Industry, Electronic Industry and Photographic Industry .. 79
F.6. Questionnaire for Chemical Industries And Product Suppliers 83
F.7. Questionnaire for Retailers of Commercial Products 86
F.8. Questionnaire for Fire Fighting Foams 88
F.9. Questionnaire for Waste Treatment Facilities 91
ANNEX G. Leachate Treatment Activities in Turkey 93
ANNEX H. Actual Capacity of Turkish Civil Aviation Industry (TOBB, 2013) 94
ANNEX I – Structure of Different PFOS Related Substances (Xie, et al., 2013) 94
ANNEX J. PFOS in Different Media 95
ANNEX K. Provincial emissions of PFOS equivalents from major industrial sources in China (t/a) (Xie, et al., 2013) 98
ANNEX L. Approximate PFOS Concentration in Articles (UNIDO, 2012) 99
ANNEX M. Approximate PFOS Concentration in Product Mixtures (UNIDO, 2012) 100
ANNEX N. Summary of the survey and literature finding on standardized analytical methods for PFOS analysis (UNIDO, 2012) 101

Table 3-1 : CAS Numbers of Commercially Significant PFOS related substances ____ 7
Table 3-2 Three Major Source Pathways of PFOS-related compounds ____ 7
Table 3-3: Predicted no Effect Concentration for PFOS (NPCA, 2008) ____ 11
Table 4-1: Use of PFOS Related Substances within Sectors (Posner, 2010) ____ 12
Table 4-2: Annual Production Values with Respect to Sub sectors (2010) ____ 14
Table 4-3: Production and Trade amount in whole Electronics Sector (Büyükyol, K;, 2013) ____ 14
Table 4-4: Use of PFOS in Photographic Industry (Brooke, Footitt, & Nwaogu, 2004) ____ 16
Table 4-5: Ongoing Use of PFOS in Hard Chrome Plating (ESWI; EC, 2011) (Lassen, et al., 2012) ____ 18
Table 4-6 Derivatives of PFOS used in Hard Chrome Plating Process (Herzke, Posner, & Olsson, 2009) ____ 19
Table 4-7: Concentration of PFOS in Hard Chrome Plating Processes (Poulsen, et al., 2011) ____ 19
Table 4-8: PFOS Releases from the Sector (Brooke, Footitt, & Nwaogu, 2004) ____ 20
Table 4-9: Concentration of PFOS in Hard Chrome Plating Emissions (ESWI; EC, 2011) ____ 21
Table 4-10: Properties of PFOS Containing Waste from Hard Plating Industry (ESWI; EC, 2011) ____ 21
Table 4-11: Total Production Amounts of Metal Plating Sector in Turkey, 2011 ____ 22
Table 5-1: Releases of PFOS from synthetic Carpets (Brooke, Footitt, & Nwaogu, 2004) ____ 22
Table 5-2: Concentration of PFOS at synthetic carpet components ____ 23
Table 5-3: Purpose of Use for Different Fire Figthing Foams ____ 24
Table 5-4: Facility/Institutions that Use AFFFs (COWI A/S Norway, 2012) ____ 25
Table 5-5: Properties of PFOS Related Substances used in Fire Fighting Industry (ESWI; EC, 2011) (COWI A/S Norway, 2012) ____ 25

Table 5-6: Example of AFFF providers in Turkey ______ *26*
Table 5-7: Potential AFFF Related PFOS Release from Airports (worst case scenario estimation) ______ *27*
Table 5-8: Properties of PFOS Emissions from Aviation Hydraulics (ESWI; EC, 2011) ______ *28*
Table 5-9:Concentration of PFOS releasein Textile Industry (Brooke, Footitt, & Nwaogu, 2004) ______ *30*
Table 5-10: Production and Trade Flows of Textile Industry in Turkey (Futo & Karluvali, 2015) ______ *31*
Table 5-11: Potential PFOS Containing Textile Wastes from Domestic Origin ______ *31*
Table 5-12: Gold Mine Operations in Turkey ______ *34*
Table 6-1:Estimated Service Life of Articles ______ *36*
Table 7-1: Properties of Various Alternatives of PFOS ((Poulsen, et al., 2011), (UNEP, 2012) ______ *39*
Table 8-1: Overview of PFOS Related Sectors in Turkey ______ *41*
Table 8-2:Overview of PFOS Related Sectors in Turkey ______ *42*

Figure 3-1Perfluorooctane Sulfonic Acid Structure ______ *6*
Figure 3-2 Cumulative Production and Use of PFOS between 2003 – 2008 (Carloni, 2009) ______ *8*
Figure 3-3 Transformation Pathways for PFOS Related Substances (Buck, et al., 2011) ______ *10*
Figure 4-1 PFOS Flow in Electronics Sector (UNIDO, 2012) ______ *13*
Figure 4-2: Electronics Industry Sub-Sectors Trade Information (Million USD) (Büyükyol, K;, 2013) ______ *15*
Figure 4-3: Mass Flow Pathways of PFOS related substances in Photographic Industry (ESWI; EC, 2011) ______ *17*
Figure 4-4 Mass Flow Pathways of PFOS related substances in Metal Plating Industry (ESWI; EC, 2011) ______ *20*
Figure 5-1: Worst Case Scenario for Accumulation of PFOS in Environment from Synthetic Carpets ______ *24*
Figure 5-2: Airports in Turkey, 2014 ______ *29*
Figure 5-3: Distribution of Textile Recycling Industries in Turkey (Ekti, Ercan, 2013) ______ *32*
Figure 6-1: Projected Total Sludge Generation in Turkey (Öztürk, İzzet; MoEU, CYGM, 2010) ______ *35*
Figure 6-2: Characterization of MSW in Turkey (Öztürk, İzzet; MoEU, CYGM, 2010) ______ *36*
Figure 6-3: Reasons behind Soil Pollution in Turkey (MoEU, 2014) ______ *38*
Figure 6-4: Reasons Behind Water Pollution in Turkey (MoEU, 2014) ______ *38*

Abbreviations

AFFF	Aqueous Film Forming Foam
BAT	Best Available Technique
BEP	Best Environmental Practice
BREF	BAT (Best Available Techniques) Reference Document
CLRTAP	Convention on Long Range Transboundary Air Pollution
DHMI	General Directorate of State Airports Authority
EU	European Union
HW	Hazardous Waste
IPPC	Integrated Pollution Prevention and Control
MESS	Metal Sanayicileri Sendikasi (Turkish: Metal Industrialists' Union)
MoEU	Ministry of Environment and Urbanization
MSDS	Material safety data sheet
MSW	Municipal Solid Waste
NIP	National Implementation Plan
NOEC	No Effect Concentration
NOx	Nitrogen Oxides
PFA	Perfluoroalkyl acids
PFBS	Perfluorobutane sulfonate
PFOA	Perfluorooctanic acid
PFSA	Perfluoroalkane sulfonic acids
PFCAs	Perfluoroalkyl carboxylic acids and their salts
PFOS	Perfluorooctane Sulfonate
PNEC	Predicted No Effect Concentration
POSF	Perfluorooctanesulfonyl fluoride
POPs	Persistent Organic Pollutants
ppm	Parts per Million
SC	Stockholm Convention
SIA	Sectoral Impact Assessment
SME	Small and Medium Scale Industries
METU	Middle East Technical University
MSW	Municipal Solid Waste
THY	Turkish Airlines

UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
US	United States
WWTP	Wastewater Treatment Plant
YITAL	Semi-Conductor Technology Research Laboratory

1. Executive Summary

This Inventory Report regarding Perfluorooctane Sulfonate (PFOS) has the functions of identifying and prioritizing industrial sectors which have continuous and historical releases of PFOS, describing the present situation of prioritized sectors with available information in order to calculate the sectorial potential of PFOS release and drawing an overall picture of PFOS inventory in Turkey with the available data so far.

The summary of the report goes as follows.

Preliminary information on PFOS. PFOS was listed by the Stockholm Convention on Persistent Organic Pollutants (POPs) as one of the 9 “new” POPs, for its persistent, bioaccumulative, toxic and longrange transport properties. It is widely used for industrial and domestic purposes in providing grease, oil and water resistance to materials such as textiles, carpets, paper and coatings in general. Major sources of PFOS to the environment include direct artificial production and/or atmospheric and biological degradation of precursor compounds into the end product PFOS moiety. Although its consumption has sharply decreased due to a major decrease in manufacture; still there are number of uses which are in process of being phased out or have been phased out. Secondly, there are uses for which are going on. The first category is dominated by consumer products and the second by industrial intermediaries or industrial processes. According to the Stockholm Convention on Persistent Organic Pollutants, although the ultimate goal is elimination of PFOS-based substances, production of these chemicals may continue for limited purposes including coatings for *semiconductors, fire-fighting foam, photoimaging, aviation hydraulic fluids, metal plating, and certain medical devices*. These areas should be considered as ongoing usages of PFOS.

PFOS releases from industry. There are mainly small and medium scale industries (SMEs) in Turkey. Metal Processing, Petrochemicals, Automotive Industry, Home Appliances, Textile and Leather sectors are the major contributor to manufacturing industry of the country. According to the prioritization analysis electronics, semiconductor and photographic industry are not significant sources of production in the country. As a matter of fact, the only significant ongoing release from the industry will be from hard metal plating (chrome plating) sector. From this process, emissions to water are still expected to be a significant contribution to PFOS release to environment. An overestimate calculation gives the *maximum release of* PFOS to environment due to metal plating sector as 0,7 tons/year to water media.

PFOS releases by the use of articles. Articles with a short service life (i.e. paper products, some textiles) and articles which contain very low amounts of PFOS (i.e. rubber and plastic products) is not expected to have a significant contribution to PFOS release. However, carpets and textiles which are still being used and/or already wasted are expected to contribute to a great deal of PFOS contamination especially to waste management sub-sector. There is licensed textile licensed facilities in Turkey, which mainly operate with industrial textile wastes. However, PFOS are expected to be contained in household goods. Most of the textile waste which is not segregated from the municipal solid waste flow ends up in wild dumpsites. The case is similar for the synthetic carpets sector as there is not any licensed recycling plant for synthetic carpets in Turkey. These articles are disposed to landfills/dumpsites at the end of their service lifetime. In addition to these; other two major contributions to ongoing release of PFOS to environment are the aqueous fire fighting foams (AFFF) and aviation hydraulic fluids. AFFFs are mainly used for oil based fires. They are commonly used/stocked/operated in military bases, airports, oil and gas stations. According to sector information, AFFFs are neither stocked nor are PFOS containing AFFFs on the market. On the other hand, it is known that AFFF trade is not well monitored; there are unqualified products on the market. Therefore, it is recommended to carry out a further detailed survey on potential ongoing presence and past releases from this sub-sector. A general estimation basing on the amount of AFFFs in airports today, results in 297 tons of PFOS release due to firefighting foams in airports since 1980. Yet again, aviation hydraulic fluids, containing PFOS are still being used in the market. Maintenance data was retrieved from the civil aviation industry in order to form a basis for the initial inventory study. More detailed information about the emission factors (how much hydraulic oil is consumed per maintenance/plane etc.) shall be surveyed for this particular case.

PFOS releases by waste management activities. Wild dumpsites are a major problem in Turkey which polluted the soil and groundwater media. Articles with short lifetime (paper products, textile goods, surfactants etc.) end up in dumpsites at the end of their service life. Therefore, PFOS release due to end-of-life articles occurs at landfills/dumpsites directly to the environment.

Recommendations. Information gaps while preparing this inventory included, trade information regarding PFOS containing substances from the customs. Although the content of PFOS in consumer products/articles could be estimated by using literature data it is a known fact that this data is formed as a result of several case studies. Therefore, estimations based on these factors would include error factors for the case of Turkey. A more detailed site survey must be carried out with case studies with the aim of finding emission factors for especially; hard chromium plating, aviation hydraulics and fire fighting sectors. In addition to this, waste management sector in Turkey is not readily controlled. Dumpsites are the major sink for PFOS containing articles therefore, an inventory of waste management activities must be studied separately in recommendations shall be formed for remediation of those sites.

2. Methodology

The purpose of this study is to identify presence of PFOS in Turkey with its historical and ongoing production and releases, transportation to environmental matrices and presence in the environment by the help of publicly available information up to date.

Since there has not been any studies specifically related to PFOS in the country before, a preliminary assessment of available data on global scale is accomplished. Desk research was the basic source of information, which included the study of statistical sources, research articles, SC and EU guidelines, official documents and reports. PFOS Inventory guideline and national PFOS inventory reports by Governments of various States were taken as examples and major basis of the study.

Prioritization. Production of PFOS is ceased in many countries; its use is generally banned/limited except for; aviation hydraulic fluid, chemically driven oil and gas production, electric and electronic parts for some color printers and color copy machines, fire fighting foams and hard metal plating processes. Therefore, a prioritization analysis was carried out for the case of Turkey as the first step of the study by; determining major contributors of manufacture industry and investigating significance of PFOS use for the exempted cases.

Secondly, emission factors for the priority sectors were researched and available information was classified. In addition to this, content factors for the PFOS containing articles were investigated. Major sources for article content factors and emission factors were exemplary inventory studies of other countries and reports published by the UNEP.

Available emission factors were applied to production/consumption data retrieved from sources like; Turkish Union of Chambers and Commodity Exchanges, Sector Reports published by Ministry of Customs and Trade and Ministry of Science, Industry and Technology, Guidelines Published by the Ministry of Environment and Urbanization, Sector Reports Published by the Chamber of Industries. Moreover, records of production, import and consumption data were investigated for the relevant sectors with past uses in order to have an estimate of historical accumulation of PFOS from articles.

Regarding the stockpiles of PFOS there are two alternatives to obtain information; first is to ask for available information from the Ministry of Customs and Trade; second is applying questionnaires to companies. The Ministry of Customs was contacted online to assess readily available information on the import and export of products and chemical agents possibly containing PFOS or its related substances. However, sufficient information that will serve to the purpose of this inventory is not publicly available.

PFOS and its related substances are not produced in Turkey and retailers' information is not publicly available. Locations and production capacities/demands of PFOS using sectors (aviation, fire fighting, textile, electronics, metal plating leather, mining, plastics and rubber, and synthetic carpets were determined.

Information from the site survey interviews of "Sectoral Impact Assessment" study was used in order to assess acknowledgement of major indutrial sectors on PFOS related materials and further investigation plan is prepared accordingly. All stakeholders which might be an asset to the inventory and/or have a direct impact are investigated and contact informations are listed for the sake of further studies.

Finally, a summary of whole information available was collected towards formation of initial inventory so that boundaries of problem are clearly defined and recommendations for further actions for development of the inventory is given.

3. Information about PFOS

3.1. Properties of PFOS and its related substances

PFOS is a synthetically produced fully fluorinated anion with a linear perfluoroalkyl carbon chain of eight and a sulfonic acid functional group (Poulsen, et al., 2011). In May 2009, it was listed by the Stockholm Convention on Persistent Organic Pollutants (POPs) as one of the 9 “new” POPs, for its persistent, bioaccumulative, toxic and longrange transport properties. The structure of PFOS can be seen on figure below.

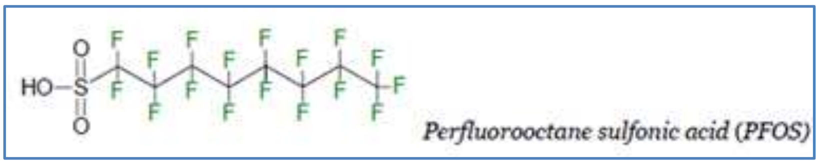


Figure 3-1Perfluorooctane Sulfonic Acid Structure

PFOS belongs to a larger class of chemicals called perfluoroalkyl acids (PFAs), which are used for their simultaneous hydrophobic and oleophobic properties as surfactants and coatings, as they can repel both water and oils, reduce surface tensions, and act as catalysts for polymerization under high temperatures with stability (Lim & Wang, 2011) and the main subgroups of PFOS related substances are the perfluoroalkane sulfonic acids (PFSAs) and their salts and the perfluoroalkyl carboxylic acids and their salts (PFCAs) (Lassen, et al., 2012).

The global commercial production of PFOS and related compounds has been based on Electrochemical Fluorination. In this process, the electrolysis of a solution of octane sulfonyl fluoride in anhydrous hydrogen fluoride leads to POSF (perfluorooctane sulfonyl fluoride; C8F17SO2F) (Buck, et al., 2011). POSF is used as the key intermediate from which all PFOS-related products are subsequently produced; production of POSF can be used as an indicator of the total production of PFOS-related substances (Lassen, et al., 2012).

Apart from artificial production, PFOS can be formed by degradation from a large group of related substances which are members of the large family of PFA substances (Posner, 2010). The term PFOS-related substance is used to refer to any or all of the substances which contain the PFOS moiety and may break down in the environment to give PFOS (Brooke, Footitt, & Nwaogu, 2004).

Precursor compounds themselves degrade to PFOS in activated sludge treatment, biotransformation, atmospheric oxidation, and metabolic processes. Finished PFOS-based products contain not only residual PFOS, but also its precursor compounds, which together make up the "indirect sources" of PFOS to the environment (Lim & Wang, 2011).

PFOS is not a discrete substance and does not have a CAS number. The parent sulphonic acid and some of its commercially important salts are given in table below (Brooke, Footitt, & Nwaogu, 2004):

Table 3-1 : CAS Numbers of Commercially Significant PFOS related substances

Substance Name	CAS No.
Perfluorooctane sulphonic acid	1763-23-1
Potassium salt	2795-39-3
Diethanolamine salt	70225-39-5
Ammonium salt	29081-56
Lithium salt	29457-72-5

Major sources of PFOS to the environment include both direct emissions of PFOS salt and indirect sources, which include the atmospheric and biological degradation of precursor compounds into the end product PFOS moiety. Three major source pathways of PFOS-related compounds are summarized by (Lim & Wang, 2011) as shown in Table 3-2.

Table 3-2 Three Major Source Pathways of PFOS-related compounds

Category	Subcategory	Environmental Source
PFOS Salts	K^+ , Li^+, DEA, NH_4^+ Amines, Ammonium salts, Apmhoterics	Direct
PFOS Substances (FOSA)	Carboxylates Amides Oxazolidinones	Degredation
PFOS Polymers (FOSE) and higher molecular weight substances	Alcohols, silanes, alkoxylates, fatty acid esters, adipates, urethane, polyesters, acrylates Copolymers, phosphate esters	Degredation and residual

3.2. Production and Use on Global Scale

POSF is the raw material used to manufacture PFOS-based products. 3M started its production of POSF in 1949, worldwide production of the compound grew significantly from 1966 to 1990 (Carloni, 2009) (Lim & Wang, 2011). When the production of PFOS and its related substances was phased out by the major manufacturer in 2002; 96,000 tons of POSF has reportedly been produced since 1970 (Lassen, et al., 2012) .

Consequent to 3M's phase out of the chemical production China has begun larger-scale production of PFOS in 2003. Currently, China is the only country reported to have continuing production of PFOS and its derivatives with a production of more than 200 tons of its precursor, POSF (Buck, et al., 2011) (Poulsen, et al., 2011). Total global production of PFOS and related compounds for the period 2003-2008 was 410 tons. China accounted for more than half of this. Japan and Germany ranked second and third with cumulative productions of 100 and 25 tons, respectively (Lassen, et al., 2012).

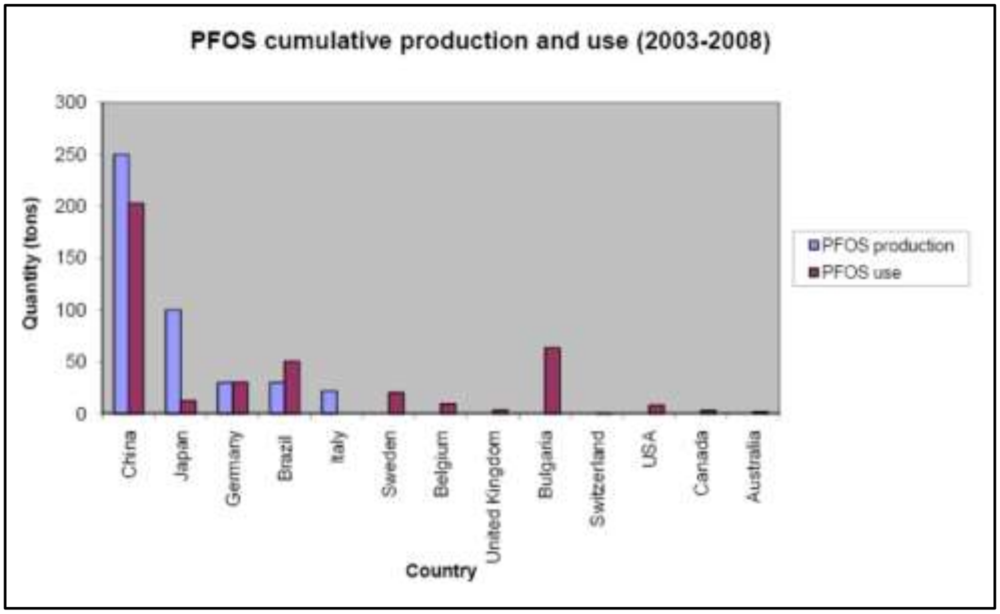


Figure 3-2 Cumulative Production and Use of PFOS between 2003 – 2008 (Carloni, 2009)

With the increasing demand on both domestic and foreign markets, the production in China is increased in recent years. Most of PFOS related chemicals are exported meanwhile a lot of PFOS/PFOA containing products are imported in China. EU PFOS directive is introduced to China and some export oriented industries followed the requirements. However, no production management measures exits such as labelling, production, technical standards etc. at the industry level (Han, 2009).

The major uses for the POSF-derived substances were in providing grease, oil and water resistance to materials such as textiles, carpets, paper and coatings in general (Brooke, Footitt, & Nwaogu, 2004). PFOS have been used for pesticides, as plumbing fluxing agent, in medical applications and devices, in flame retardants, coatings and coating additives, adhesives as well as in rubber and plastics, upholstery, leather industry as well as in the carpet industry. Many of the uses have stopped between 2000 and 2004 due to the voluntary production phase out by 3M but use of PFOS related materials is expected continue in some sectors either because there are no alternatives available at present or where there are stocks of PFOS-related substances to use up (Brooke, Footitt, & Nwaogu, 2004). In the developed world, small volumes are still used for applications exempt under the SC: *mainly chromium plating, photolithography, photography, hydraulic fluids for aviation and the semiconductor industry* (Lassen, et al., 2012) (ESWI; EC, 2011). Such applications like photo imaging, use for semi-conductors or aviation hydraulic fluids are considered as acceptable purposes, because technically feasible alternatives to PFOS are not commercially available to date (Posner, 2010).

Uses which are continuing for the present are in chromium plating, photolithography, and photography and in hydraulic fluids for aviation (ESWI; EC, 2011).

Active production of PFOS containing fire fighting foams has ceased in Europe and remaining stocks have to be destroyed by 27 June 2011 (Brooke, Footitt, & Nwaogu, 2004). Although use of PFOS as coating/conditioning material in carpets, leather/apparel, textiles/upholstery, paper and packaging and coatings and coating additives is estimated to be over, those products treated with PFOS-related substances may still be in use. The continuing use of carpets and leather products especially from the upholstery industry still leads to a PFOS content in the waste stream due their long average life times of approximately 14 and 10 years, respectively (ESWI; EC, 2011).

An important difference between developing countries and developed countries seems to be in the number of sectors in which PFOS is currently used. China used PFOS in a large range of applications in 2008: *textiles, fire fighting foams, pesticides, metal plating, semiconductors and cleaning products*. It is reported that 100 tons PFOS were used for textile treatment in China (Lassen, et al., 2012). In Europe main uses of PFOS were for *fabric and paper treatment*. Applications of PFOS no longer include surface treatment and paper protection. Moreover, PFOS-related substances are no longer used for chemically driven oil production (UNIDO, 2012)**.**

The major current use of PFOS in Europe reportedly takes place in the *metal plating industry* with a yearly consumption of about 6.500 kg of PFOS. Metal plating along with the photographic and the semiconductor industries largely account for the high production and use of PFOS in Germany and Japan. The use in the photographic industry is about 1.000 kg and the amount of PFOS for hydraulic fluids for the aviation industry is about 730 kg, the current total consumption of PFOS used by the European semiconductors in 2009 was considered to be about 9,3 kg/year (ESWI; EC, 2011).

If the aggregate data is collected with the data by country, the cumulative global reported use of PFOS in this six-year period is 504 tons. The cumulative global reported production is very similar, at 519 tons (Carloni, 2009).

To sum up; there are two main groups of uses of PFOS related substances. First, there are a number of uses which are in process of being phased out or have been phased out. Secondly, there are uses for which are going on. The first category is dominated by consumer products and the second by industrial intermediaries or industrial processes (Carloni, 2009).

According to the SC, although the ultimate goal is elimination of PFOS-based substances, production of these chemicals may continue for limited purposes including coatings for *semiconductors, fire-fighting foam, photoimaging, aviation hydraulic fluids, metal plating, and certain medical devices*. These areas should be considered as ongoing usages of PFOS (Lim & Wang, 2011).

3.3.PFOS in the Environment

The range of possible PFOS sources covers both industry and consumer use of PFOS-containing products which could release PFOS into the environment over their service lifetimes. Emissions and transfer pathways of PFOS-based higher molecular weight precursors must also be understood in order to identify indirect sources of PFOS to the environment. According to (Lim & Wang, 2011) only a small amount of parent compound POSF actually is made into PFOS, on the contrary indirect sources are likely to be and have a large contribution to overall emissions, but these make the emission sources of PFOS very diverse, non-centralized, and difficult to determine. Figure 3-3 shows a demonstration of production/transformation pathways of PFOS.

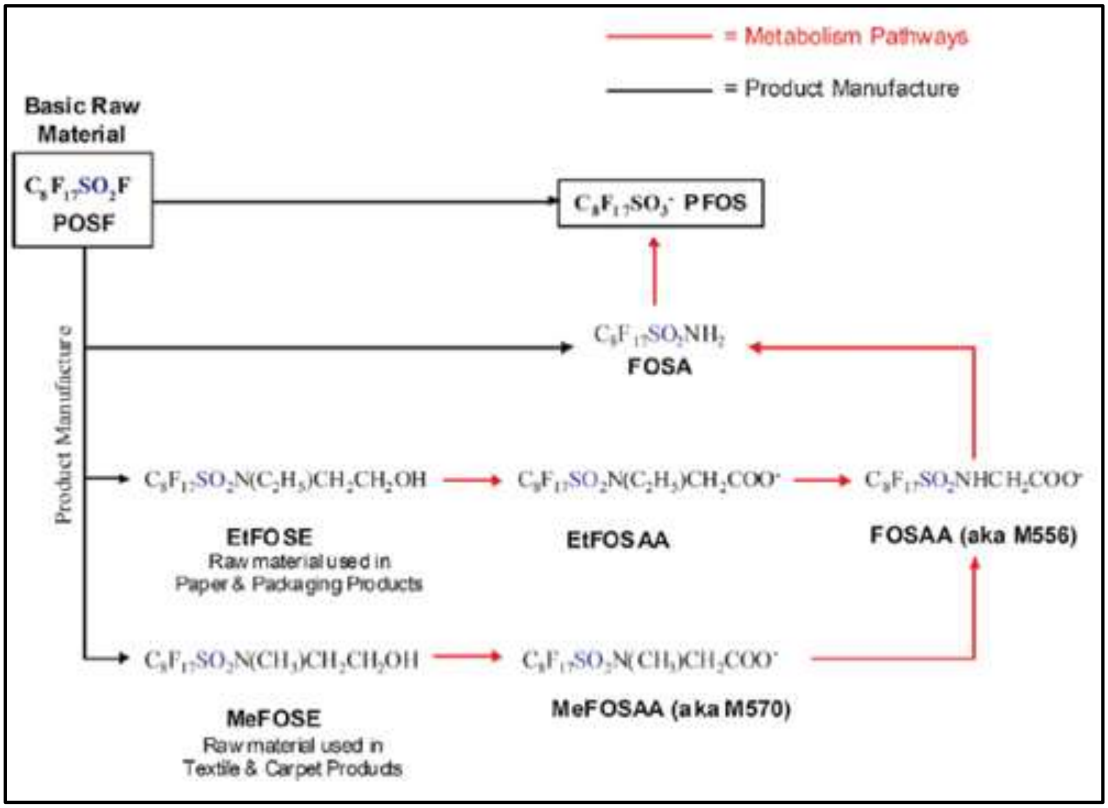


Figure 3-3 Transformation Pathways for PFOS Related Substances (Buck, et al., 2011)

PFOS in particular is extremely stable in the environment; it is very persistent and has substantial bioaccumulation and biomagnifying properties. Despite its bio-accumulative properties PFOS does not follow the classic pattern of other POPs by partitioning into fatty tissues, on the contrary, it is associated to proteins in blood and internal organs, such as spleen, lever, and kidney (Posner, 2010) it is not degradable, either abiotic or through aerobic or anaerobic biodegradation (Brooke, Footitt, & Nwaogu, 2004).

PFOS has a capacity to undergo long-range transport and also fulfills the toxicity criteria of the SC (Posner, 2010). For instance; polar bears in top of the arctic food chain have been reported to contain high concentrations of PFOS in the blood and liver. According to (Poulsen, et al., 2011) there exists a correlation between the amount of PFOS in human blood and the time it takes for women to get pregnant and a reduction in men's semen quality therefore, it is considered as an endocrine disrupting substance.

Presence in Biota. PFOS has been analysed in a limited number of European environmental and food samples. The results showed that PFOS has been shown to bioaccumulate in fish and a kinetic bioconcentration factor has been estimated to be in the range 1000 – 4000. Yet again, a measured bio concentration factor of 2796 in fish is reported by (Brooke, Footitt, & Nwaogu, 2004). There are very few data, especially for Europe, that can serve as reliable indicators of the relative importance of most other kinds of food (European Food Safety Authority, 2008).

Analysis on fish is especially important for the case of PFOS because fish products are in the food chain of human beings. The result of PFOS analysis on fish are used both to assess bio-magnification properties and exposure limits on human beings. Yet still, there is not enough data to assess relative contribution of different foodstuffs to human exposure to PFOS. However based on the limited information available, fish and fishery products seem to be one important source of human exposure to PFOS where non-food sources of PFOS were estimated to contribute in the order of 2% or less of average dietary exposure. Drinking water appears to contribute less than 0,5% (European Food Safety Authority, 2008).

PFOS in drinking and surface fresh water. Several studies on presence of PFOS in surface and drinking waters have proved contamination with PFOS in several different continents. PFOS was found in surface water and sediment, downstream of production sites, waste water treatment plant effluents, sewage sludge, landfill leachate, and in wildlife species all over the world, including very remote areas in the Arctic. Limits for PFOS concentration in drinking water are 2 µg/L as in US. EPA standart and 3 µg/L in Health Canada and United Kingdom standards (Obal, 2014). In Norway, normative level of presence in soil is accepted as 0,1 mg/kg Soil (European Food Safety Authority, 2008).

PFOS was measured in human blood/serum/plasma samples collected from the United States, Colombia, Brazil, Belgium, Italy, Poland, India, Malaysia, and Korea in order to assess the risks of exposition (Bruinen, Zweers, Bakker, & Beekman, 2009). According to studies liver PFOS concentrations range below 4,5 to 57 µg/kg and blood serum PFOS in human range from below 6,1 to 58,3 µg/L. In 2003; 3M company has published a "no effect" concentration data as tabulated below.

Table 3-3: Predicted no Effect Concentration for PFOS (NPCA, 2008)

Ecological Receptor Group	Toxicity test	Endpoint	NOEC	**Uncertainty factor***	**PNEC**
Aquatic life	35-d *M.bahia*	Reproduction and growth	0.25 mg/l	**10**	**0.025 mg/l**
Fish	62-d *L macrochirus*	Survival	80.6 µg/g (ww)	**10**	**8** µg/g (ww)
Molluscs	96-h *U.complamatus*	Survival	7.3 µg/g (ww)	**100**	**0.073** µg/g (ww)
Mammals	2-generation rat study	Reproduction	107 µg/g (liver)	**10**	**10.7** µg/g (liver)
			47.1 ppm (serum)	**10**	**4.7 ppm (serum)**
Birds	19-wk Bobwhite quail	Reproduction	Not determined	**N/A**	Not determined
	19-wk Mallard duck	Reproduction	Not determined	**N/A**	Not determined
* 10 for chronic NOECs and 100 for acute NOECs.					

Human exposure to PFOS, is likely to occur *via* a number of vectors and routes e.g. ingestion of non-food materials, dermal contact and inhalation. Based primarily on the available data for fish and fishery products, indicative estimates of dietary exposure to PFOS were 60 ng/kg body weight per day for average consumers, and 200 ng/kg per day for high consumers of fish. PFOS is also measured in house dust in 30 and 100 ng/g concentration and PFOS concentration in various air samples have changed from 0,001 to 0,01 ng/m3.

Other sources could be related to food (e.g. *via* packaging material or cookware) or be a result of more direct exposure from the technosphere (e.g. household dust). Nonetheless the total contribution from non-food articles was estimated to be less than 2% compared to the average total PFOS exposure and drinking water is estimated to contribute less than 0,5% of the indicative exposure. PFOS is readily absorbed after oral exposure. Biotransformation does not seem to play a relevant role for its elimination (European Food Safety Authority, 2008).

4. Study of Industrial Releases

Majority of industry in Turkey is small and medium scale. Metal Processing, Petrochemicals, Automotive Industry, Home Appliances, Textile and Leather sectors are the major contributor to manufacturing industry (Futo & Karluvali, 2015).

General application areas of PFOS related substances are; aviation hydraulic fluids, insecticides for control of red imported fired ants and termites, chemicals driven oil production, carpets, textiles and upholstery, leather and apparel, electric and electronic parts for some color printers and color copy machines, paper and packaging , fire fighting foams, insect baits for control of leaf cutting ants, coating and coating additives, rubber and plastics, metal plating and decorative metal plating and for other purposes (UNEP, 2012).

After the ban of PFOS from production processes there has been a strong phase out from of PFOS related substances from the products in the market. Therefore products with short life times (less than 3 years) are already end-of-life products which are yet a part of waste management sub-sector In Turkey. Apart from this, manufacture of electronic parts, printed board circuits, colored printers and medical devices are not a major factor in the manufacturing processes among the country. Moreover, red imported fired ants and leaf cutting ants are not endemic species for the country. There are other insecticides available in the market already effective on local species already. A summary of relevant sectors for the release of PFOS are given in table below.

Table 4-1: Use of PFOS Related Substances within Sectors (Posner, 2010)

Type of Industry/Product	Purpose of Use	Sectoral Relevance to Turkey
Electrics, Electronics and Semiconductor	Surfactants, electrostatic charge control agents, friction control agents, dirt repellent agents, adhesion control agents in mixtures. Etching agent	Not significant
Photographic industry	Surfactants, electrostatic charge control agents, friction control agents, dirt repellent agents, adhesion control agents in mixtures. Photo-resist and anti-reflective coatings Etching agent	Not significant

Chromium Plating Industry	Surfactant, wetting agent, mist suppressing agent (hard chrome plating process)	Significant
Paper and Packaging	Coating agent	Significant
Textiles, Carpets, leather and apparel	Coating agent	Significant
Aviation	Hydraulic fluids	Significant
Fire Figthing	Fire Fighting Foam	Significant
Rubber and plastic industry	Decorative plating	Not Significant
Pesticides	Baits for leaf-cutting ants	Not Significant
Oil/Gas Production and Gold Mining	Enhance recovery performance	Not Significant

4.1. Electronics, Semiconductor and Photographic Industries

Electronics Industry

Electrical and electronic equipment often requires hundreds of parts and thousands of processes. PFOS have many different uses in the electronic industry and is involved in a large part of the production processes needed for electric and electronic parts that include both open and close loop processes. Open processes are applied for solder, adhesives and paints. Closed loop processes mostly include etching, dispersions, desmear, surface treatments, photolithography and photomicrolitography (UNIDO, 2012). PFOS-based chemicals are used in the manufacturing of digital cameras, cell phones, printers, scanners, satellite communication systems, radar systems and a like (Posner, 2010).

PFOS can be used as a surfactant in etching processes in the manufacture of compound semiconductors and ceramic filters as well as the production of circuit boards. PFOS are then added as part of an etching agent, and rinsed out during the subsequent washing treatment (UNIDO, 2012).

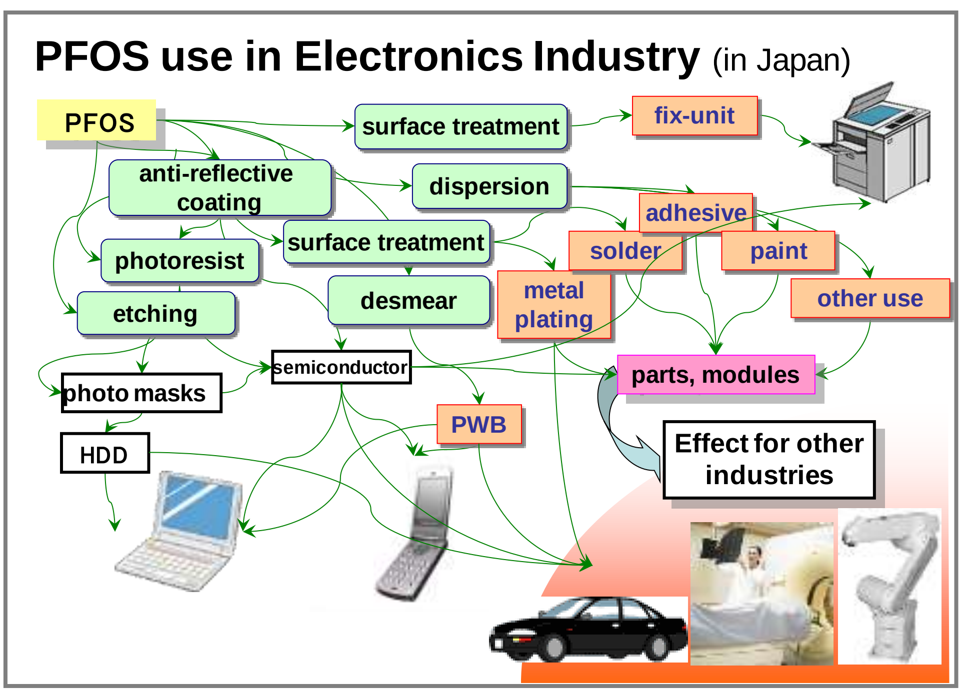


Figure 4-1 PFOS Flow in Electronics Sector (UNIDO, 2012)

The PFOS-related substances are process chemicals, and the final products are mostly PFOS-free. Photo masks in the semiconductor and liquid crystal display (LCD) industries, electric and electronic parts for some colour printers and colour copy machines are the acceptable purposes for use of PFOS in this sector.

Table 4-2: Annual Production Values with Respect to Sub sectors (2010)

	Production Value (Million USD)
Component	640
Consumer Electronics	3655
Telecommunication Devices	2112
Industrial Equipment	2374
Computer Devices	1554
Military Electronics	950

Electronics sector in Turkey comprises of consumer devices (32,4 %), communication devices 18,7 %, professional and industrial devices (21%), computer devices (13,8%), military electronics (8,4%) and components (5,7%) sub-sectors. The values of import/export and production values with respect to sectors are given in tables below (Büyükyol, K;, 2013).

Table 4-3: Production and Trade amount in whole Electronics Sector (Büyükyol, K;, 2013)

	Billion USD in 2010
Import	14,51
Export	5,58
Production	11,28

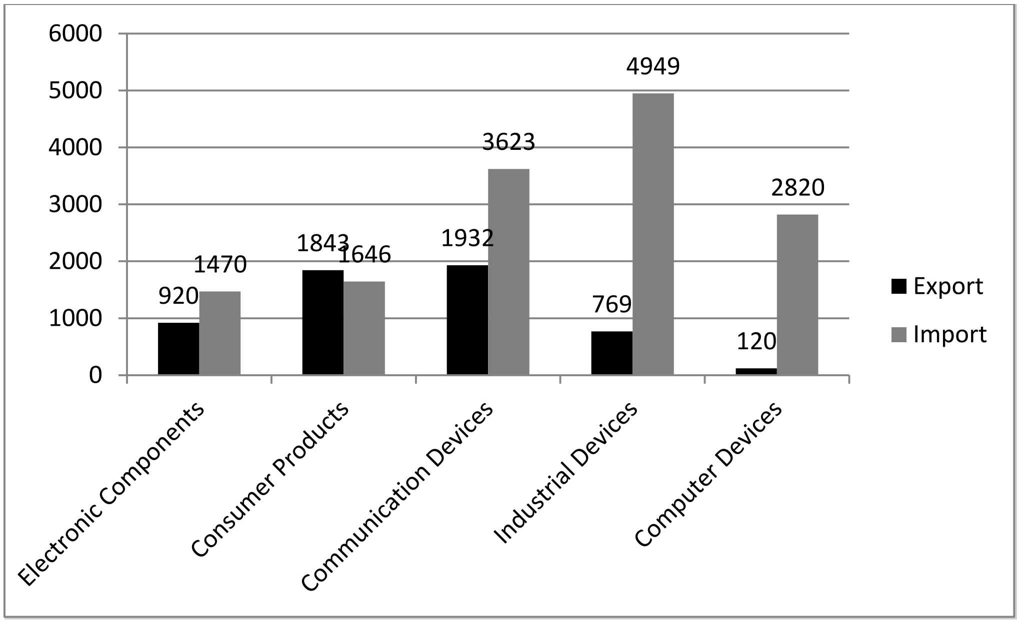


Figure 4-2: Electronics Industry Sub-Sectors Trade Information (Million USD) (Büyükyol, K;, 2013)

Production of *house appliances (consumer products)* is a major subgroup; this group consists of production of refrigerators, washing machines, dishwashers and air conditioners. Turkey is the leading country in production of consumer products with its production capacity of 25 million appliances and the actual production hit of 21 million appliances per year. Refrigerators are 38% of this production amount and washing machines are 31%. 70% of the raw materials used up for this sub-sector are local material. The industries of this type are located mainly at İstanbul, Manisa, Eskişehir, Bolu, Bursa, İzmir, Ankara, Kocaeli, Yalova, Kayseri, Konya and Bilecik provinces. China has the largest export share of Computer and Electronics, it accomplished 26% of the global electronics export on computer electronics sector. USA, Hong Kong, South Korea, Singapour, Taiwan and Japan follow China respectively on the market. In Turkey there are 45 companies with a foreign trade value greater than 50 Million USD between 2007-2012 in computer and electronics sector. 5 largest companies on this list include; Vestel Foreign Trade Co. Inc., Arçelik Co. Inc., Grunding Electronics Co. Inc., Nokia Communication Co. Inc. and Hewlett-Packard Technology Co. Inc. all of these companies are corporate institiutions which follows an operational environmental sustainability analysis for every year (Büyükyol, K;, 2013).

When *electronics industry* is of concern, PFOS related compounds are not likely to be used in the production process in Turkey. The focal points for the PFOS inventory are; stocks of historically used PFOS in different products (especially in metal parts of electronic equipment), either landfilled or reused and import of products, which potentially include PFOS containing metal elements (Arçelik, 2013).

PFOS release from electronics industry for the case of Turkey consists particularly of the products which contain PFOS that are imported to the country which needs further information from the ministry of customs and trade.

Semiconductor Industry

Semiconductors are used in many fields of electronics industry including production of diots, transistors, integrate circuits and solar batteries. In Turkey, there are two semi-conductor sector establisments YITAL (Gebze, Kocaeli) [5] and METU-MET (ODTU, Ankara) both are mainly research facilities. Initially, there is not significant semiconductor production in Turkey. [6]Semiconductors are mainly manufactured in far eastern countries (China, Malaysia, South Korea, Japan, Taiwan) and imported to Turkey. Semiconductor import has cost 21,8 billion USD in 1985 and 227,5 billion USD in 2005. [7]

Photographic Industry

The photographic industry can be split into paper, film and plate production. Surfactants in photographic industry are used in coatings for surface tension, static discharge, and adhesion control for analogue and digital imaging films, papers, and printing plates, or as a surfactant in mixtures used to process imaging films (Posner, 2010). Surfactants in photographic industry are used in coatings for surface tension, static discharge, and adhesion control for analogue and digital imaging films, papers, and printing plates, or as a surfactant in mixtures used to process imaging films (Posner, 2010) (Michiels, 2010). The main function of the substances is to act as anti-static agents, both for the possible effects on workers handling the material, and from the possible exposure of photographic materials to the discharge. The substances also help in reducing friction, thereby improving transport in cameras, printers and projectors, and are essential to the laying down of multiple thin layers of photographic material on film, creating coatings of high complexity in a highly consistent and rapid manner (Brooke, Footitt, & Nwaogu, 2004) .

Total use of PFOS-substances in photographic sector in the EU is given as 471 kg/year. However, this overall figures covers use in a range of areas and the specific use in photoresists only accounts for 46 kg/year (0,1 %). For the calculation of releases an overall EU use of 500 kg/year is applied (Brooke, Footitt, & Nwaogu, 2004).

Table 4-4: Use of PFOS in Photographic Industry (Brooke, Footitt, & Nwaogu, 2004)

Process Step	Estimated Loss	Sink
Packaging/container residuals	0,6%	Landfill – Incineration
Equipment cleaning	1%	Landfill – Incineration
Application excess	93%-98%	Waste incineration
Developer	50%	Wastewater
Etching and stripping	50%	Recycling/ Wastewater

As it is stated by the ESWI report on overall PFOS inventory for relevant sectors in EU; 85% of PFOS in photographic sector is used in x-rays (ESWI; EC, 2011). The substances used in this area are assumed to be PFOS-salt for the production of film step, and PFOS-polymers for subsequent steps. The polymers are assumed to contain 1% PFOS-substance (Michiels, 2010).

[5] http://bilgem.tubitak.gov.tr/tr/urunler/yital-yari-iletken-teknolojileri-arastirma-laboratuvari

[6] http://www.egitimhane.com/yari-iletkenler-ve-bunlarin-yurdumuzda-uretimi-m20.html

[7] http://www.aselsan.com.tr/tr-tr/basin-odasi/haberler/Sayfalar/abMikroNano20141223.aspx 2014

The use of PFOS-related chemicals for the production of film in the EU is estimated as 850 kg/year of that 850 kg of PFOS have been used for the production of film. Less than 50 kg PFOS have been used annually for paper products and <100 kg PFOS/y for plates (Lassen, et al., 2012).

The emission factors for a substance used in the production of films are 0,0001 to air (for vapor pressures below 1 Pa) and 0,002 to water (Brooke, Footitt, & Nwaogu, 2004). From the total amount of PFOS which are used in coating solutions in the photographic industry 13% do not end up on the surface of film and paper. This material can be handled by waste management companies to be used in incineration processes (NOx reduction) in cement plants (ESWI; EC, 2011). PFOS waste from this industry consists particularly of the products that are discarded after their product lifetime. Amount of PFOS containing wastewater depends majorly on the recovery rate. The concentrations of PFOA-related substances in photographic films, plates and some of the papers are very low and range from 0,1-0,8 g/cm^2 in the coating (Michiels, 2010).

Between 2000 and 2004 there has been a PFOS reduction of 83% in the processing of film, paper and plates due to the use of alternatives in different processing steps in all three sections. Similar relative reduction is expected to take place in case of the x-ray and plate industry. In case of the paper products a stronger decline was suggested due to the ongoing digitalization (ESWI; EC, 2011).

When *photographic industry* is of concern, there is no current production of PFOS containing products in Turkey. The focal points for the PFOS inventory are;

- Stocks of historically used PFOS in different film, paper and plate products, either landfilled or reused
- Import of products, which potentially include PFOS

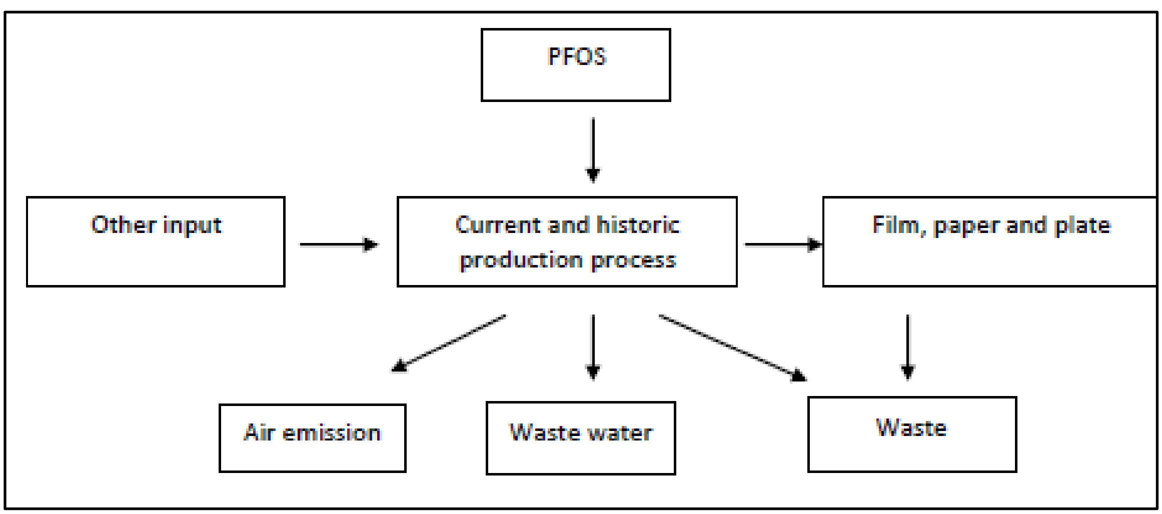


Figure 4-3: Mass Flow Pathways of PFOS related substances in Photographic Industry (ESWI; EC, 2011)

Environmental exposure during manufacture releases from production plant are directed to waste water facility:

- PFOA-related substances predominantly bound to sludge which is incinerated.
- Environmental exposure during use
- Wet film processing of medical film represent worst case

- highest concentration of PFOA-related substance required (high sensitivity film)
- in addition: the only film with emulsion layer coated on both sides of film.
- maximum carry-over in processing (only two steps followed by rinsing) (Michiels, 2010)

Air emissions from this sector are not relevant however; waste water from production facilities may contain considerable quantities of PFOS. Waste of PFOS containing materials consists of used films, papers and plates after their typical lifetime which arises in a longer time span after the production of the individual products. Unused coating solutions are recycled and do not enter the waste stream (ESWI; EC, 2011).

In Turkey there are facilities for recycling of magnetic films and photographic films but further information is needed regarding the acknowledgement of sector representatives abou that presence of PFOS that may be in the film material.

4.2. Metal Plating Industry

PFOS are mainly used as surfactant/ wetting agent and mist suppressants in hard and decorative chrome plating process to lower the surface tension of metal plating solutions to prevent the formation of mists containing potentially harmful components from the bath. Addition of PFOS and/or its derivatives to the chromic acid bath would form a thin foamy layer on the surface of the chrome bath which helps reducing aerosol formation, solving occupational safety problems as well as environmental problems (Poulsen, et al., 2011) (Zhang, Liu, & Hu, 2012). The chromate articles from this industry are used in aircraft, medical industries, vehicles and general engineering. The products from this industry should be PFOS free due to the rinsing in the metal plating process (ESWI; EC, 2011).

Previously, PFOS was used for both decorative chrome plating and hard chrome plating processes but new technology applying chromium-(III) instead of chromium-(VI) has made PFOS use in decorative chrome plating outdated. As of June 2008, the use of PFOS as mist suppressant in decorative chrome plating became illegal in the EU[8] (Poulsen, et al., 2011).

Table 4-5: Ongoing Use of PFOS in Hard Chrome Plating (ESWI; EC, 2011) (Lassen, et al., 2012)

Country	PFOS use in Hard Chrome Plating (tons/year)
Denmark	0,028
Finland	0,005 – 0,02
Belgium	0,22
Czech Republic	0,023
Sweden	0,026
Slovenia	0,005 – 0,007
UK	0,012
France	0,2
The Netherlands	<0,015
Switzerland	0,2 – 0,5
Canada	3
USA	7
China	25
Japan	2 – 3

[8] EU Directive 2006/122/EC on the restriction of the environmentally harmful substance PFOS

Australia	1,06

Table 4-6 Derivatives of PFOS used in Hard Chrome Plating Process (Herzke, Posner, & Olsson, 2009)

Substance	CAS Number	Trade Names	Notes
Tetraethylammonium perfluorooctane sulfonate	*56773-42-3*	*Fluorotenside-248, SurTec 960, FC-248 and FT-248m*	*Mostly used derivative*
Potassium perfluorooctane sulfonate	*2795-39-3*	*FC-80*	
Lithium, diethanolamine, and ammonium salts of PFOS and	-	-	
Quaternary ammonium salts and amines of PFOS		Fumetrol® 140	

Table 4-7: Concentration of PFOS in Hard Chrome Plating Processes (Poulsen, et al., 2011)

Amount of PFOS solution in bath	Concentration in Formulation
10 – 60 ml /100 liter bath	1 – 15 % in mist suppression

Feasible chemical and physical alternatives to PFOS were developed the industry continuously uses more H4PFOS as an alternative for PFOS (ESWI; EC, 2011). Non-fluorinated emerging alternatives for hard chromium are available on the European market (Posner, 2010).

In Europe common *alternatives used* in hard metal plating are H-PFOS (1H,1H,2H,2H-perfluoroctane sulfonic acid) and 6:2 FTS (6:2-Fluorotelomer sulfonate) (UNIDO, 2012). The results showed that Fumetrol 21 works as effective as PFOS as mist suppressing agent, seems to have the same durability and price level as PFOS as mist suppressing agent. It can be substituted right away, when PFOS is burnt out in the chrome bath, without the need of changing the entire chrome bath chemicals, and is an environmental improvement as it is less persistent, less bio-accumulative, and less toxic than PFOS (Lassen, et al., 2012). However, currently, no other surfactant can match the low surface tension of PFOS. Therefore, the quantity required for substitution of PFOS by polyfluorinated surfactants increases considerably about three to ten times. In addition to this, it is possible to use Chromium-III instead of Chromium VI with the new developed technology. PFOS remains in the galvanic baths after the metal plating process. The galvanic baths are often used several times before they are discarded. If treated as hazardous waste, the process is considered to be a closed process with no releases of PFOS." (UNIDO, 2012).

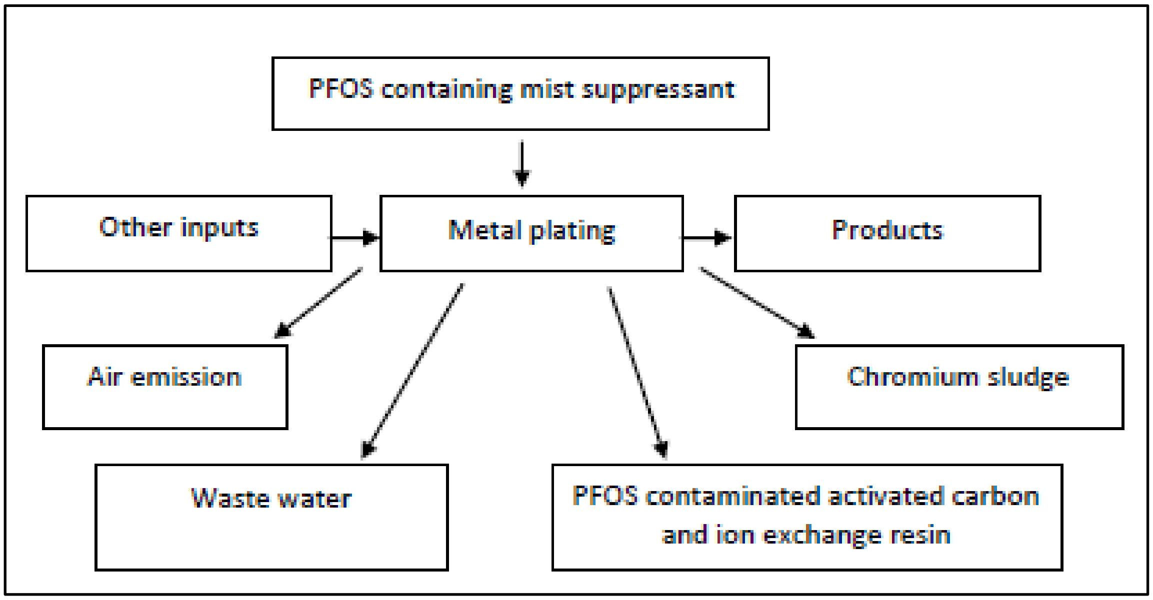


Figure 4-4 Mass Flow Pathways of PFOS related substances in Metal Plating Industry (ESWI; EC, 2011)

The emission factors; emissions to air can be neglected for the PFOS release from hard chrome plating sector. On the other hand, it is safe to assume all of the substances sold for use in this area in a year are released to waste water during the course of a year.

During the chromium process chromium sludge is generated which consist among others of different chromates. The chromium sludge is filtered and removed from the chromium bath. Filter press treatment of metal hydroxide sludge gives a final cake with 15-35 % solids, which can contain high concentration of PFOS. In some cases the chromium sludge might also contain some activated carbon, in case an activated carbon treatment is used, which shall reduce the PFOS content in the waste water (ESWI; EC, 2011). As a result PFOS contaminated activated carbon or ion exchange resins: occur as wastes when the majority of waste water is treated within the chromium facility.
When the majority of the waste water is sent to a proper treatment plant, the majority of the PFOS is kept in the wastewater. Waste water which is not treated in the facility will lead to increased PFOS concentration in the sewage sludge of downstream waste water treatment plants (Lassen, et al., 2012). A great part of PFOS used in this industry will probably end up in the nature. That is confirmed by the high levels of PFOS recently found in agricultural soils treated with sewage sludge in the US and in Germany (Poulsen, et al., 2011).

Table 4-8: PFOS Releases from the Sector (Brooke, Footitt, & Nwaogu, 2004)

Plated Surface	Loss of Product	Emission to Water
1000 m2	0,37 g	0,685 g
Input (PFOS substance)	**Emissions to Air**	**Emissions to Water**
1 ton	0,047 kg	50 kg (before WWTP) 26 kg (after WWTP)

Table 4-9: Concentration of PFOS in Hard Chrome Plating Emissions (ESWI; EC, 2011)

	Concentration of PFOS (ppm)
Wastewater	0,3 – 1 (17 -49 % of the input)
Chromium Sludge without Active Carbon	3,1 – 3,8
Activated Carbon in Chromium Sludge	300
Chromium Sludge with Active Carbon	7

In some cases activated carbon is added to the wastewater before the filter press. In this process, the activated carbon becomes part of the chromium sludge. Due to the combination of the activated carbon from the activated carbon treatment with the chromium sludge, the PFOS concentration of the sludge is increased to about 7 ppm (ESWI; EC, 2011).

Wastewater Treatment Plants with different PFOS reduction technologies include:

- Vacuum distillation (captures 88% of PFOS from the waste water stream)
- Activated carbon treatment (captures 98,8 % of PFOS from the waste water stream)
- Activated carbon filter (captures 99,1 % of PFOS from the waste water stream)
- Ion exchange resin (captures 99,1 % of PFOS from the waste water stream)

The share of each technology in the industry must be researched further for the case of Turkey. Waste generation factors in case of each option of treatment are tabulated below.

Table 4-10: Properties of PFOS Containing Waste from Hard Plating Industry (ESWI; EC, 2011)

WWTP Process	PFOS Release	Concentration (ppm)	Available Waste Treatment
Vacuum distillation	Distillate	240	Metal Recovery
Activated carbon treatment	Part of chromium sludge	300	Metal Recovery/Stabilization
Activated Carbon Filter	AC Filter	950	Incineration
Ion Exchange	Ion Exchange Resin	19.000	Incineration

It is safe to assume the worst case scenario is that all the used PFOS will end up in wastewater. In fact, in real case it might be that some PFOS is destroyed during the electrochemical process during metal plating. The difference of PFOS input and output can be explained with the effect of electrochemical degradation in the metal plating process.

Best Available Techniques for reduction of PFOS for the Chromium Plating Industry:

- Apply new technology using chromium-III instead of chromium-VI in decorative metal plating process.
- Apply closed loop system to replace the traditional open system in hard metal plating process.
- Substitute PFOS mist suppressing agent with available non-PFOS agent in hard metal plating processes.
- Provide additional extraction ventilation and/or greater tank enclosure to reduce the exposure of chromium-VI emission to acceptable levels when using chromium-VI both for decorative and hard metal plating.
- Collect and dispose the waste from the metal plating process using PFOS in environmental sound manner (Posner, 2010).

In Turkey, metal plating industry is one of the priority sectors with its production capacity of 2,3 Million tons/year. The metal plating industry is localized mainly at the provinces of İstanbul, Ankara, Bursa, İzmir, Kocaeli and Konya (MoEU, 2013)**.**

Table 4-11: Total Production Amounts of Metal Plating Sector in Turkey, 2011

Production (tons)	Production (m2)	Production (piece)
2.330.232	1.105.985.220	91.354.091

These numbers reflect the overall situation of metal plating in Turkey. A detailed survey must be carried out in order to identify the processes and used chemicals in those facilities. However, a worst case scenario assumption would be to assume that all of these facilities apply hard chrome plating by using PFOS related substances as a mist suppressing agent. In that case total emission from this sector would be 757,6 kg/year to water media.

5. Study of Releases due to Articles

5.1. Synthetic Carpets

Carpets have historically been the major application area for PFOS in the EU for the impregnation process of synthetic fibers. Fluorinated compounds are widely used during manufacture of synthetic carpets to provide stain protection, especially for synthetic carpets based on synthetic fibers being impregnated. PFOS itself is not directly applied to the fiber, but is first chemically bound in a polymer, which is then applied to the carpet. The chemical formulas used for synthetic carpets impregnation are usually manufactured by one producer using PFOS and then distributed downstream for carpet impregnation by a carpet manufacturer (UNIDO, 2012). Specifications of carpet impregnation substances are not declared due to confidentiality purposes however, it is safe to assume that 90% of the synthetic carpets are impregnated with fluorinated substances (Lassen, et al., 2012) (ESWI; EC, 2011).

Emissions. Synthetic carpets are of concern because of the possible direct exposure of small children and babies. The levels in house dust and indoor air can be a result of releases from synthetic carpets, among other sources in the home environment. The washing of synthetic carpets can be a source of the releases of PFOS into water (UNIDO, 2012).

The use of PFOS in the carpet industry is a historical use. However due to its long life time, the products of 2000 ends nowadays up as bulky waste, which contains PFOS. For this purpose it is necessary to estimate the annual production amount of carpets and their PFOS concentration before the phase out of PFOS in the carpet industry which was presumably around the year 2002 (ESWI; EC, 2011).

Emissions of polymeric material would be expected to be mostly associated with particulate material worn from the fabric; releases during the service life of carpets may arise from cleaning or through wear.

Table 5-1: Releases of PFOS from synthetic Carpets (Brooke, Footitt, & Nwaogu, 2004)

	Soil Media	Water Media
Vacuuming Outputs	37,5%	12,5%
Steam Cleaning Releases		45%
Waste Carpet	5%	
TOTAL RELEASE	42,5%	57,5 %

Therefore all of the PFOS content within the impregnated carpet will somehow end up in environment respectively in abundance to water media.

Table 5-2: Concentration of PFOS at synthetic carpet components

PFOS Containing Material	Concentration of PFOS	SOURCE
Impregnated carpet	75 ppm	(ESWI; EC, 2011)
Impregnation chemical	3%	(ESWI; EC, 2011)
PFOS Polymer	1%	(Brooke, Footitt, & Nwaogu, 2004)
Carpet Protection Agent	15%	(ESWI; EC, 2011)

Turkey exports 60% of its carpet production. 88% of the export is machinery made carpets. In Turkey Carpet sector mainly resides in Gaziantep. Other provinces with related activity are İstanbul and Kayseri. As of today 85% of the market in Turkey are machienery made carpets and 89% of the articles are produced in Gaziantep. Production capacity in 2014 is 300 million m^2 per year. (Güneydoğu Anadolu Halı İhracatçıları Birliği, 2011)

PFOS are not used for the manufacture of synthetic carpets in Turkey any more. Oldest available data is targeted regarding the carpet sector in Turkey. According to information from a sectoral esearch in 2006, total carpet market was 60 milyon m^2 in Turkey and 10% of this market is handmade products. Carpet use per capita in Turkey was 0,4 m^2 (Sevim & Emek, 2006).

Taking into account that the life time of carpets is about 15 years, and the phase out date for the use of PFOS in carpets is 2002 it is very likely that PFOS containing carpets can still be found in the bulky waste of households at least until 2016. There are no licensed facilities for carpet recycling in Turkey. Therefore, all carpet wastes are expected to end up in landfills.

Taking the population of Turkey as approximately 70 million people in 2002; it is safe to assume that the 28 million m^2 carpet is wasted per year since 2002. Lowest possible PFOS release from that amount of carpet wastes could be the limit value o 1 $\mu g/m^2$; which calculates to 28 gram of PFOS. Assuming the worst case scenario that all carpets includes 75 ppm pf PFOS concentration back then; 84 kg of PFOS will end up in environment (48,3 kg to water; 35,7 kg to soil) from carpet sector for one year.

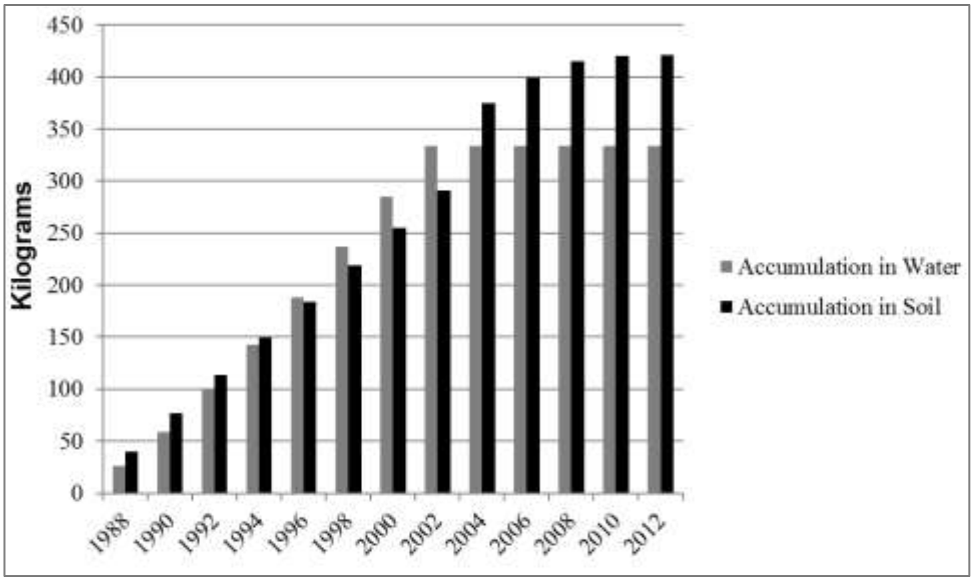


Figure 5-1: Worst Case Scenario for Accumulation of PFOS in Environment from Synthetic Carpets

5.2. Fire Fighting Foams

Aqueous film forming foam (AFFF) is a generic term for fire-fighting and/or vapor suppression products used globally to protect both lives and property (Posner, 2010). Prior to 2000, the majority of the fluorosurfactants used in the AFFF were PFOS-based which resulted in AFFF that contained PFOS and PFOS precursors. PFOS-related substances were previously used in AFFF to fight fires involving flammable liquids that are not water-soluble, such as oil, petrol and other hydrocarbons and to fight fires involving flammable water-soluble liquids such as alcohols and acetone (Zhang, Liu, & Hu, 2012).

The consumption of fire fighting foams depends on the frequency of fire drills and the rate of fire accidents. There are different types of fire fighting foams and agents containing PFOS or related substances (COWI A/S Norway, 2012):

Table 5-3: Purpose of Use for Different Fire Figthing Foams

	Area of Use
Fluoro-protein foams	Hydrocarbon storage tank protection and marine applications
Aqueous film-forming foams	Aviation, marine and shallow spill fires
Film-forming fluoroprotein foams	Aviation and shallow spill fires
Alcohol-resistant AFFF	Multi-purpose foams

Fire fighting foams containing PFOS have been in focus due to the dispersive and extensive use and risk of high releases to the environment. Fire drills and leakage from stockpiles of fire fighting foams have led to contamination of groundwater and soil. Because of the environmental problem this use represents, many countries have started to phase out PFOS-containing fire fighting foams at installations where alternatives satisfy the requirements for fire safety (Seow, 2013) (COWI A/S Norway, 2012).

Table 5-4: Facility/Institutions that Use AFFFs (COWI A/S Norway, 2012)

Facility/Institution	Significance
Offshore installations	Use large quantities of AFFF, and also have substantial stockpiles of PFOS-based foam.
Mobile Rigs	Considerably smaller than on fixed installations, of the order of 2000 litres per rig Most of the foam is stored near helicopter landing areas.
Ships and ferries	Annual consumption of fire-fighting foam is low (10–20 litres per vessel) and it is therefore unlikely that there have been any substantial historical emissions
Refineries and onshore gas terminals	There is a gap of information and high level of uncertainty. Further research is needed.
Petrochemical and other relevant industry	Low consumption of fire-fighting foam, and very few training exercises .Historical emissions have been limited.
Tank farms	Detailed survey is needed, the amount changes drastically from one farm to another
Airports	Very little information is available on historical emissions
Armed forces	No public information is available.
Fire-fighting training sites	No public information is available.
Fire and rescue services	Very little information is available on historical emissions of PFOS-related substances. It is likely that PFOS-based foam has previously been more widely used.

Considering the PFOS inventory of AFFF. Before 2003, 3M was a major supplier of AFFF concentrate. The company has now phased out its production of PFOS-related substances, and these have been replaced by other substances, largely telomers, in AFFF concentrate. It can be assumed that AFFF supplied after 1 January 2003 does not contain PFOS-related substances (COWI A/S Norway, 2012) (Brooke, Footitt, & Nwaogu, 2004).

From this sector, all of the input is released directly to the environment. Existing stock of fire fighting foams must be known as well as wasted (out of date) foam or which is released from use for fire fighting or training. Use of foams during an emergency or training, results in emission to the environment; in soil and water (i.e. sewage sludge) or it is treated as waste due to exceedance of the expiration date and is subject to incineration (ESWI; EC, 2011).

For fire fighting foams which have been used, it is assumed that approximately 70% are directed to waste water treatment and the remaining 30 % are emitted directly to water and soil whereas use of AFFFs in offshore installations will be directly to the sea environment (Brooke, Footitt, & Nwaogu, 2004).

Table 5-5: Properties of PFOS Related Substances used in Fire Fighting Industry (ESWI; EC, 2011) (COWI A/S Norway, 2012)

Type of PFOS used	PFOS Salts
Minimum concentration of PFOS within the solution	0.5-1.5 %

Maximum concentration of PFOS within the solution	10 %
Expiration date of AFFFs	4 years
Unit conversion	1% = 0.037 kg/L PFOS

In Turkey, fire safety system was not regulated until 2002. In July 26th 2002, “Regulation of Protection of Buildings againts Fire” has come into force. However, this regulation concentrates especially on applications and human safety than the quality and content of the fire fighting equipment.

It is a well known fact that there is not an effective control mehanism on fire fighting products. Cheap products, imported without quality check versus standarts results in health and security hazards (Kefeli, 2004). According to interview with one of the biggest fire fighting foam manufacturers in Turkey. PFOS content is not checked to assess the quality of products. Neither there is a standard that limits the content of PFOS in this sector. Fire fighting foam manufacture/trade sector does not have an acknowledgement of PFOS. However, PFOS is not being used in their processes within the country (Futo & Karluvali, 2015) .

Therefore the presence of PFOS due to AFFFs may only be because of imported amounts. There are many small trade companies in Turkey which buy/sell fire fighting products. The major problem with this sector is the lack of control for this kind of commercial activities.

As a result of a wide internet research on the availability of “AFFF” products in Turkey, a very long list of product providers was obtained. However very few of these providers have contact information and even fewer of them are able to provide the nature of the product. The list of the mostly promoted AFFF providers are tabulated below.

Table 5-6: Example of AFFF providers in Turkey

Company	Contact	Location	Product
Yıldız Yangın	www.yildiz-yangin.com	İzmir	-
Refleks Yangın	www.refleksyangin.com.tr	İstanbul	Fomtec
Norm Teknik	-		Buckeye Fire
Ares Yangın	www.aresyangin.com	Çanakkale	-
Ufuk Yangın	www.ufukyangin.com	Eskişehir	-
ABC	www.abcyangin.com	İstanbul	-
Aydınoğulları	www.aydinogullari.com	Bursa	-
Özal Ev Yangın Söndürme	www.ozalevyangin.com	İstanbul	-
Sinerji Yangın	www.sinerjiyangin.com	İstanbul	-
GFC	www.gfc-yangin.com	Kocaeli	Furex
Yansan Konya Yangın Güvenlik	www.yansan.com.tr	Konya	Bioversal
Lider Kardesler	www.liderkardesler.com.tr	Ankara	Bioversal
Deka Mühendislik Yangın ve Güvenlik	www.dekayangin.com.tr	İstanbul	Furex

The resources that Fatsa Chemicals using are coming from the USA and EU countries therefore their product has no restricted ingredient, although earlier it was used. It is claimed by the industry that fire brigades are continuously running drills so they purchase foam every year. These foams have lifetime of around 2 years (Futo & Karluvali, 2015).

In 2012, DHMI has bought a total of 400.000 liters of 3% AFFFs. (DHMI, 2012). In 2014; 200.000 liters of 3% AFFFs were bought for Esenboğa Airport [9] It is possible to make a wider calculation regarding PFOS inventory from the civil airports in Turkey, assuming that all the foams are in AFFF nature and the demand increases directly proportional with the terminal area. Based on that information, and the age of airports in Turkey, the worst case scenario of AFFF releases is calculated accordingly. A list of all historical AFFF supplies should be retrieved from the DHMI.

Table 5-7: Potential AFFF Related PFOS Release from Airports (worst case scenario estimation)

		Cumulative Amount	Cumulative Amount of PFOS until 2012 (liters)	
NAME OF THE AIRPORT	**PROVINCE**	**AFFF STOCKS (Lt./yr)**	**RELEASES TO ENV.**	**WASTES**
Adana Şakirpaşa	Adana	207.3	162	7147
Esenboğa	Ankara	3640	3112	150786
Hatay	Antakya	100	8	32
Antalya	Antalya	-	-	-
Milas-Bodrum	Bodrum	1913.66	431	5490
Dalaman	Dalaman	1900	884	23280
Erzurum	Erzurum	115	79	3103
Eskişehir Anadolu	Eskişehir	-	-	-
Gaziantep	Gaziantep	115.98	63	1916
Atatürk	İstanbul	6917.3	5395	238481
Sabiha Gökçen	İstanbul	4000	660	6171
Adnan Menderes	İzmir	2153.98	808	17165
Zafer	Kütahya	352	0	0
Nevşehir Kapadokya	Nevşehir	70	15	175
Çarşamba	Samsun	230	48	575
Şanlıurfa GAP	Şanlıurfa	250	19	80
Trabzon	Trabzon	474.9	392	18316
Balıkesir Koca Seyit	Balıkesir	600	135	1721
Batman	Batman	414.82	87	1037
Çanakkale	Çanakkale	2.88	1	11
Denizli Çardak	Denizli	337.8	106	1899
Erzincan	Erzincan	24.84	9	182
Isparta Süleyman Demirel	Isparta	108	24	310
Kahramanmaraş	Kahramanmaraş	10.8	3	35
Kars	Kars	718.92	259	5280

[9] DHMİ EKAP Tender Issue Number 2014/19755

Kocaeli Cengiz Topel	Kocaeli	50	1	1
Mardin	Mardin	34.72	7	75
Muş	Muş	16.3	5	83
Siirt	Siirt	7.12	1	18
Sinop	Sinop	6.86	2	32
Uşak	Uşak	29.2	6	73
Van Ferit Melen	Van	33.2	26	1145
Zonguldak	Zonguldak	28.6	2	9
Diyarbakır Air Base	Diyarbakır	53.6	48	2460
TOTAL			**8.122**	**297.248**

5.3. Aviation Hydraulic Fluids

PFOS-related substances are used as a component of fire-resistant hydraulic fluids in aircraft. They act to inhibit erosion and damage to parts of the hydraulic systems in civil and military airplanes. Hydraulic fluids are also necessary to transfer the break pressure to the breaking system of the tires (Brooke, Footitt, & Nwaogu, 2004). Yet today there are no PFOS free alternatives for the use in hydraulic fluids. Hence PFOS containing hydraulic oils are used in all commercially available aircrafts, many military and general aviation aircrafts' throughout the world (ESWI; EC, 2011).

The typical PFOS related substance which is used for this sector is the PFOS Salt. The hydraulic fluid product contains less than 0,1 % PFOS within its formulation. Global market for this material is 2,2 tons. The EU is assumed to use one third of this amount and emissions are assumed to take place over 300 days (Brooke, Footitt, & Nwaogu, 2004) .

Table 5-8: Properties of PFOS Emissions from Aviation Hydraulics (ESWI; EC, 2011)

Concentration of PFOS in product	0,05% - 0,1%
Loss during operation	Negligible
Releases to Water	0,6 % of the input
Releases to Soil	1,4 % of the input
Discard as Wastes	98 % of the input

Potential losses from the product are considered to be negligible for this sector. Basing on the sector information from different inventory studies, it is safe to assume that the sector does not keep stocks but instead carried out annual whole buying. When new product is bought, old hydraulics will be discharged as wastes.

Hydraulic fluids becoming waste must be down-cycled and handled by physical chemical treatment to generate a new product by oil recycling companies or incinerated in specialized treatment facilities

(Lim & Wang, 2011). There are two possible treatment options. One option is a physical chemical treatment to generate a new product and the other option is incineration (ESWI; EC, 2011).

In Turkey currently, of the 49 airports that are open to civil aviation, 44 are operated by General Directorate of State Airports others are operated by private companies. 24 of the airports are used for domestic and international flights and 25 of them are used only for domestic flights (TOBB, 2013).

There are 35 maintenance organizations that are authorized of these only 3 provide comprehensive service as maintenance-repair-overhaul for the commercial aircraft. In addition to this, 1 company (TEC) is in active operation in the field of engine and 1 company (Prima) in components. 10 airlines are authorized to carry out a certain degree of maintenance for their own aircraft. THY Technic is capable of carrying out 85% of the maintenance-repair-overhaul services, with an advanced maintenance experience for aircraft engine-fuselage and components. Recently THY has started the procedures to build “Aviation Maintenance Repair and Modernization Center (HABOM)” that will employ 3500 staff and serve 11 narrow-body and 3 wide-body aircraft simultaneously. Other important companies in the maintenance sector are MNG Technic and myTECHNIC. Both companies serves aircraft, engine and components. Considering the capacities and activities of the maintenance companies in Turkey, of the expected 700 million USD passenger/cargo aircraft maintenance, 85% is provided by the local companies. A significant number of the maintenance services are provided by THY Technic. Compared to 2011, in 2012 there was a 12% rise in the number of total aircraft that were provided maintenance by the 3 companies (TOBB, 2013). Locations of airports in Turkey (civil airports are marked in red and blue; military airports are marked in green) can be seen from the figure below.

Figure 5-2: Airports in Turkey, 2014[10]

[10] Information from (TOBB, 2013) is used in order to mark each airport on GoogleEarth programme

There are no current alternatives to the PFOS related substances in hydraulic fluids for aircraft systems. (UNEP, 2012) In recognition of the long time frames involved in replacing this use this application continuous review is needed for this product. PFOS related substances should be subject to conditions of permitted use, involving provisions for the collection and disposal of aviation hydraulic fluids via high temperature incineration. These substances must not be recycled. Efforts to secure an industry voluntary agreement are suggested. (ESWI; EC, 2011)

According to the (NPCA, 2008) study, the PFOS concentration in grounwater near a military air base was measured 8 µg/L – 10,5 µg/L. Therefore, it is recommended to carry out analytical investigations near air base stations in Turkey. In addition to this, it is recommended to carry out a further survey in order to find amount of actual consumption per aircraft and/or maintenance company.

5.4. Textile and Leather Industries

Textile Industry. PFOS-related substances (fluorosurfactants and polymers) have been used to provide soil, oil and water resistance for textiles, apparel, home furnishing and upholstery. Fluorinated polymers are used to render textiles stain- and waterproof when required, but they also have to keep their air and water-vapour permeability. They are mainly applied to home textiles (e.g. upholstery, apparel) and to outdoor wear, especially workwear including uniforms (Buser & Morf, 2009).

Applications with a potential risk of direct exposure, such as textiles, sports clothes, apparel, shoes, cosmetics, shampoos, food packaging, have been of special concern due to possible implications for human health (UNIDO, 2012).

The perfluoroalkyl sulfonates that were, in general, used for textile surface treatment applications are the acrylate, adipate and urethane polymers produced from the ECF intermediate, *N*-MeFOSE and *N*-Et-FOSE. Water-repellent and dirt-repellent textiles are impregnated with a chemical formula, a dispersion polymer containing PFOS.

Table 5-9:Concentration of PFOS releasein Textile Industry (Brooke, Footitt, & Nwaogu, 2004)

Concentration in Coated Textiles	**20 – 500 ppm PFOS**
Concentration in Wastewater from Textile Industry	1 µg/L

Emission Factors. No direct releases as wastewater component is expected from the textile sector. The washing of textiles is one of the sources of the releases of PFOS to water. In addition to this PFOS is found in house dust and indoor air, sewage sludge and releases from municipal treatment facilities. The levels in house dust can be a result of releases from textiles, furniture and upholstery.

Alternatives. Manufacturing of textiles, apparel, leather and upholstery industries have agreed to discontinue the manufacture of “long-chain” fluorinated products and move to “short-chain” fluorinated products. Short-chain fluorinated products, both short-chain fluorotelomer-based and perfluorobutane sulfonyl-based, have been applied for manufacture, sale and use in carpets, textiles, leather, upholstery, apparel, and paper applications. Non-fluorinated alternative technologies such as hydrocarbon waxes and silicones can provide durable water repellence but do not provide oil repellence or soil and stain release (UNIDO, 2012).

Turkish Textile is one of the significant sectors in Turkey in terms of contribution to the national GDP (gross domestic product), to the employment generation and net exports.

- *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.
- *Trade.* 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. (Ekti, Ercan, 2013)

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. (Ünlü, Namık, 2010)

Table 5-10: Production and Trade Flows of Textile Industry in Turkey (Futo & Karluvali, 2015)

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

Although there has to be a detailed study on the structure of Turkish textile industry, concerning process details and which chemicals are used for finishing processes. It is highly unlikely that PFOS are being used for the manufacturing processes in this sector.[11] Taking into account that the life time of textiles is about 5 years, it is very likely that the high majority PFOS containing textiles are already recycled/landfilled. Textile wastes with a potential of PFOS content are as listed below.

Table 5-11: Potential PFOS Containing Textile Wastes from Domestic Origin[12]

Waste Code	Description
15 01 09	Textile Packaging (Segragate Textile Wastes of Municipal Origin)
15 02 03	Filter articles, cleaning textiles and protective outwear except for 15 02 02
20 01 10	Clothes (Seperately collected fractions (except 15 01))
20 01 11	Textile products
20 03 01	Mixed municipal wastes (Other municipal wastes)
20 03 07	Bulky wastes
20 03 99	Not otherwise defined municipal wastes

In Turkey there are 147 licensed textile recycling facilities which are able to recycle those wastes given in the list above. These facilities are mainly located in Manisa, Ankara, Bursa, İzmir, Kocaeli and Tekirdağ. These results coincide with the information of location of textile industries. In that case it is safe to assume that, most of the textile input for these recycling facilities comes from industrial sources (which do not contain PFOS).

[11] Textile sector is the primary sector covered under Integrated Pollution Prevention and Control By-Law in Turkey

[12] Based on the Regulation of Fundamentals of Waste Management (Atık Yönetimi Genel Esaslarına İlişkin Yönetmelik)

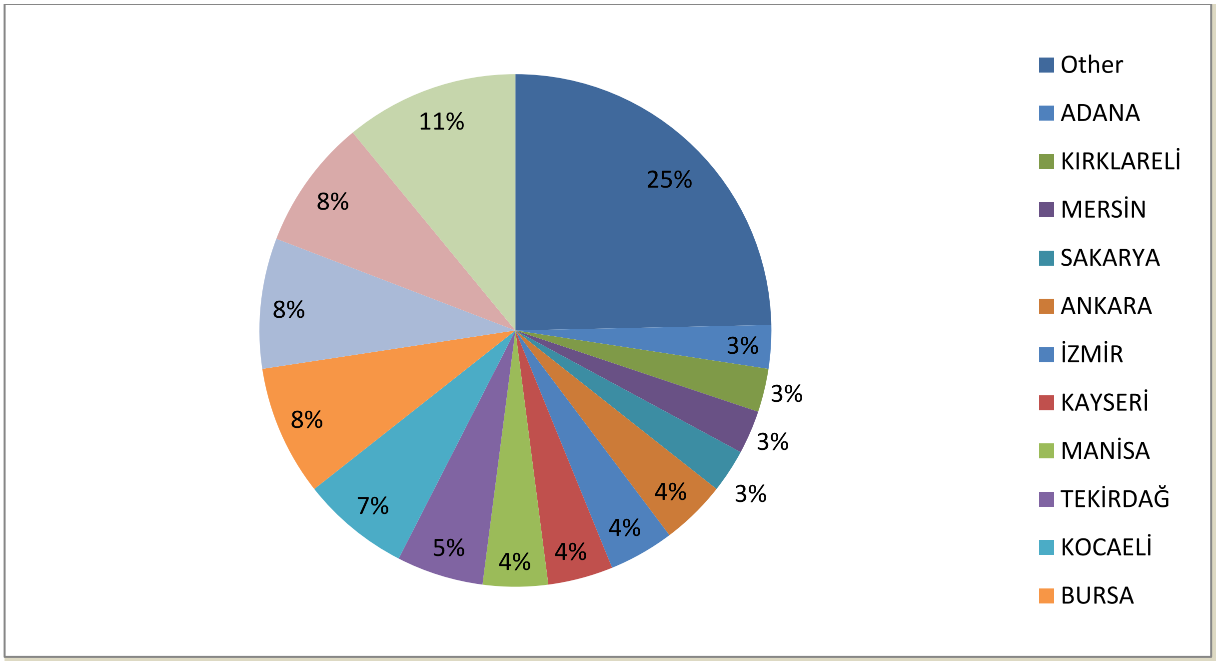


Figure 5-3: Distribution of Textile Recycling Industries in Turkey (Ekti, Ercan, 2013)

Leather Industry. In Turkey, leather industry is one of the major sectors along with the textile sector. Turkey exports majority of its leather products to Russia. On the other hand, leather products and raw leather are imported especially from Italy, Spain, Greece, India and Iran. China, is the leader of the market with trade of shoes (Bektaş, 2006) (Günay, 2004).

PFOS products are not used in the leather industry within the country (Batı Akdeniz Kalkınma Ajansı, 2012). It is safe to assume that local products do not include PFOS related substances. However, leather articles which were imported to the country might constitute a result in PFOS release to the environment as long as they end up in landfilling facilities.

5.5. Other

Industrial and household surfactants. Since PFOS are no longer used in production of surfactants, the releases from this sector is expected to be a historical impact. It is safe to assume that almost all PFOS containing surfactants in the market are already used up/wasted since the ban in 2003 (Buser & Morf, 2009).

This sector therefore, is not a priority for PFOS release in Turkey. On the other hand; if further survey is carried out just for the analysis of PFOS inventory for this sector. Hazards and risks due to releases of PFOS containing surfactants can be calculated and accumulation in environment because of this sector can be estimated (ESWI; EC, 2011).

In addition to this, a survey amongst the retailers of household/industrial surfactants and cleaning materials is advices in order to ascertain that there might be still surfactants imported to the country but could not be checked due to lack of information.

Coatings, Paint, Varnishes, Sealents and Adhesive Products. Fluorinated surfactants provide exceptional wetting, leveling and flow control for water-based, solvent-based and high-solids organic polymer coating systems when added in amounts of just 100–500 ppm. However, PFOS are no longer used in manufacture of these products (UNEP, 2012). The emissions from this sector are assumed to be already delivered to water media.

However, there are information gaps which impedes assurances that no coating, paint/varnished etc. containing PFOS enters the country. It will not be possible to check every substance at the customs. It is recommended that questionnaires are applied to retailers of those substances so that a mass balance could be formed and sector representatives would be informed about the ongoing applications of PFOS restriction.

Paper and Packaging. Turkey produced 1242 ktons of paper by 38 paper-cardboard companies as of 2009. PFOS-related substances may be used on paper and paper containing PFOS-related substances may still be imported to the country (Futo & Karluvali, 2015) . Generally speaking, however, these substances and mixtures have included short-chain PFAS and various fluorinated telomers (UNIDO, 2012). Paper products have a very short life time; they immediately end up in waste cycle. Therefore, releases from this industry are especially to soil and water. Paper and packaging products are especially important because coated articles were used as food packaging, therefore keep directly in touch with the food resulting in contamination of food products with PFOS.

Having said that, emission from this industry is considered irrelevant as of today. Historical releases due to paper and coated packaging could be related by a detailed survey in waste management sector (i.e. landfilling and wild dumping).

Rubber and Plastic Products. In Turkey Plastics industry has a share of 1,6 % among the manufacture industries. There are 6000, mostly SMEs, active in the market. The industry is mainly localized in İstanbul and İzmir. Plastic products are supplied to packaging (27%), construction (14%), textile (11%), house articles (10%) sectors. In 2004, total plastic consumption was 3,7 million tons. Turkey consumes 44 kg plastics per capita/yr and 440 thousand tons of rubber per year. 99 % of the synthetic rubber and 100% of natural rubber is exported (PLASFED, 2013).

PFOS-related substances are no longer used on rubber and plastics, although such articles may still be imported. The specific identities of replacements or substitutes for PFOS and PFOS-related substances and mixtures are readily available. Generally speaking however, these substances and mixtures include short-chain PFAS and various fluorinated telomers (UNIDO, 2012). Perfluorobutane sulphonate (PFBS) derivatives or various C4-perfluoro compounds are used as alternatives to PFOS in rubber molding defoamers in electroplating and as additives in plastics (UNEP, 2012).

Releases from this sector are also not going on for the case of Turkey since PFOS products are not used in production processes. Accumulation through these products shall be surveyed in detailed by a waste composition analysis and mass balance through actual waste management practices in Turkey.

Mining Industry. Use of PFOS derivatives in mining industry enhances the amount of recovery in copper and gold mines. Tetraethylammonium perfluorooctane sulfonate and potassium perfluorooctane sulfonate have been used as suppressing agents in mining in OECD countries. Since the major challenge in many developing countries is addressing the problem of mercury and lead poisoning from artisanal small-scale gold mining, the use of PFOS has usually not been addressed.

Altough the use of PFOS in the mining and oil industry in developed countries is most likely phased out, wastes from oil and mining industries can be important for the case of Turkey if the wastes from these industries are treated in incinerating plants with the remnants ending up in landfills and dumpsites (UNIDO, 2012).

Gold and copper mines in operational situation are depicted in figures below. Copper mines became operation in Turkey, after use PFOS was ceased in this sector.

Table 5-12: Gold Mine Operations in Turkey

	Production 1000 tons/yr	**Province**
Ovacık Gold Mine	*160*	İzmir
Mastra Gold Mine	*350*	*Gümüşhane*
Çukuralan Gold Mine	*1320*	*İzmir*
Kaymaz Gold Mine	720	*Eskişehir*
Çoraklıktepe Gold Mine	*420*	*İzmir*
Kubaşlar Gold Mine	*960*	İzmir
Söğüt Project	*63*	*Eskişehir*

6. Waste Management and Stockpiles

*Stockpiles.*The issue of stockpiles is very important in developing countries. The potential sites for stockpiles of PFOS and its derivatives are oil industry facilities and airports, warehouses and storage facilities of chemical importers. There can also be stockpiles at mines. Altough it was assumed that the use of PFOS in the mining and oil industry in is most likely phased out potential stocks of these industries must still be checked. At least there might be large stockpiles of fire fighting foams locally stored at production sites for oil and gas facilities and at airports are important targets during the inventory. However, finding out stockpiles needs site surveys and actual knowledge of the sector experts on the subject.

Sludges. In Turkey, 80% of urban wastewater is treated by means of biological (38,3%), physical (32%) and advanced (28,8%) techniques. 44,7% and 43,1% of the treated water are discharged to sea and rivers respectively. Organized industrial zones, contribute to a discharge more than 150 million m^3 wastewater every year 85% of which are treated before discharge. Approximately 500.000 tons dry WWTP sludges occur due to domestic treatment plants and 575.000 tons of dry WWTP sludges occur from industrial WWTPs. (Öztürk, İzzet; MoEU, CYGM, 2010)

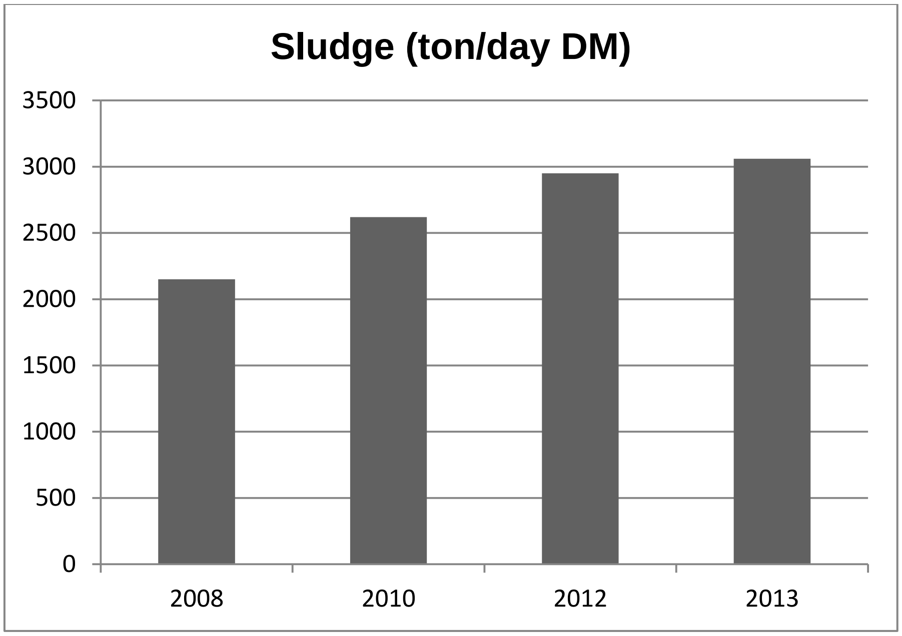


Figure 6-1: Projected Total Sludge Generation in Turkey (Öztürk, İzzet; MoEU, CYGM, 2010)

Wastewater treatment plant sludges are occasionally sent to cement kilns as an alternative fuel (5% of total) or directly layered on soil (wild dumping) or landfilled at some special cases. The cement plants do not prefer to take the sludge as supplementary fuel due to its high humidity.

Solid Waste Management. Wastes from the out-dated products (surfactants, coatings, varnishes, paints etc.) and end-of-service articles (textiles, upholstery, apparel, leather, photographic films, x-rays etc.) are potential input sources of PFOS to solid waste management sector. In Turkey, 1,15 kg of municipal solid waste is generated per capita every day. As of 2014; there are 69 solid waste landfill facilities which are about 70% in operation. Content of municipal solid waste in Turkey is shown in the graph below.

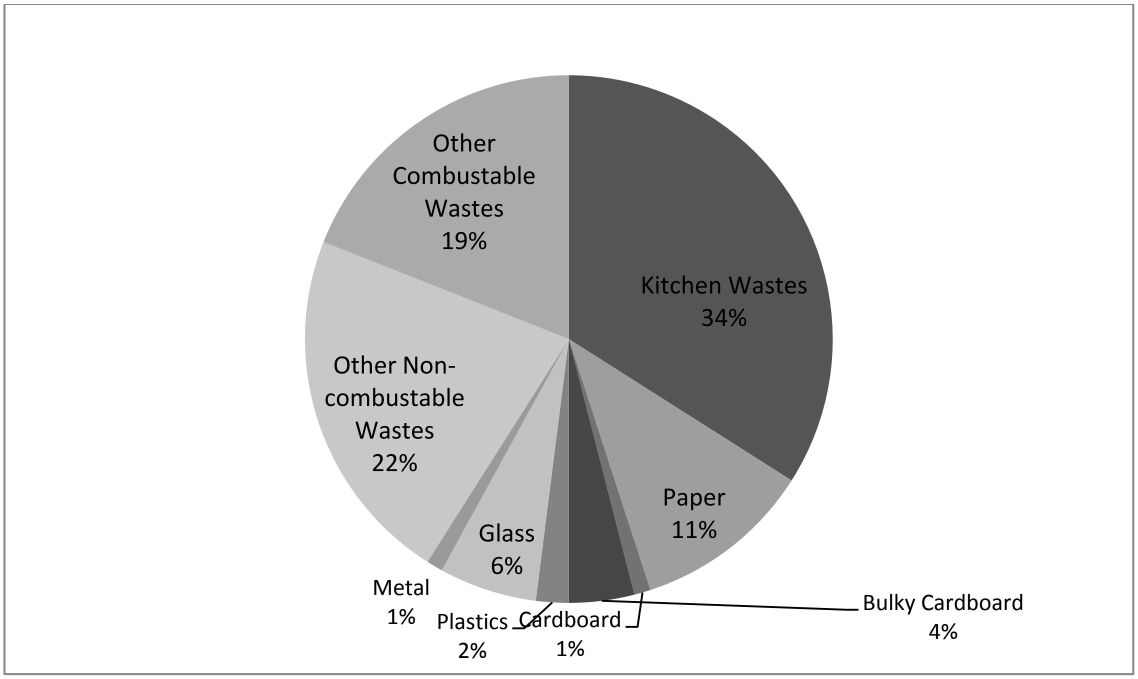


Figure 6-2: Characterization of MSW in Turkey (Öztürk, İzzet; MoEU, CYGM, 2010)

Lifetimes of products from different sectors are given in table below. It is safe to assume that products will end up in waste management cycle by the end up their service life time.

Table 6-1:Estimated Service Life of Articles

Application Area	Article	Service Life (years)
Photography	Patient documents (X-rays etc.)	~10
Textile Protection	Clothes on contact with skin	1
	Other clothes and bed linen	5
	Rain Coats	10
	Household Linen	~8
	Bedding (mattress)	10
	Tents	15
	Cars	15
Leather Protection	Sport Shoes	4
	Snowboard boots	6
Paper Protection	Paper	1
	Food contact applications	<1
Carpet Protection	Carpets	20
Paints and Lacquers	Paint, plaster, waterproof finishes	5
Wax and polish	Waterproofing finishes, sealer, silicone and waxes	3

When the stream of potentially PFOS containing wastes is analyzed individually, landfills and/or wild dumpsites have been receiving inputs of PFOS containing wastes continuously since more than 20 years from the waste flows of short lifetime products (Clothing and linen, food contact applications and paper products, waterproof finishes).

PFOS containing paper and cardboard are not any more expected to be present at households but remains of coated paper products continue its life as a PFOS source in the environment in dumpsites. Some of the coatings paint, varnishes etc. are still expected to be in use in households but this is expected to cease in latest 2016 due to lifetime of the products. Yet again, release to environment will continue because of the presence in dumpsites. PFOS containing rubber, plastics, household surfactants are neither produced not used in the country any more. On the other hand, historical use of these substances is still expected to contribute to a release to water and soil media through waste management sector.

Textile and leather industries show a similar pattern for the fate of PFOS. PFOS related substances are not applied to these sectors any more. On the other hand, articles which are still on use continue to release PFOS. In addition to this, some coated articles may also have been imported to the country which needs a further study with the Ministry of Customs and Trade.

In addition to all above, there is ongoing emission from the photographic sector, mainly X-ray films in hospitals. These films are expected to be ceased from the market but the release due to coated films will continue due to historical releases from the waste management sector. It is estimated that x-ray pictures which are kept at hospitals or similar institutions will be treated by recycling companies within 10 years. For the recycling of films the surface of the films is cleaned and the carrier material which consists of PET is recovered. The collected chemical from the surface of the film contains, among other, PFOS and silver. There are different recycling possibilities to recover the silver. PFOS either ends up in a thermal destruction or is emitted to waste water. The remaining waste from the recycling process which includes the PFOS is incinerated (ESWI; EC, 2011).

According to the Ministry of Environment and Urbanisation, soil pollution is a priortiy problem in Turkey and the major source ot this problem is wild dumpsites and miscontrol of industrial/mining wastes. Yet again, reasons behind water pollution is also lack of waste and wastewater management.

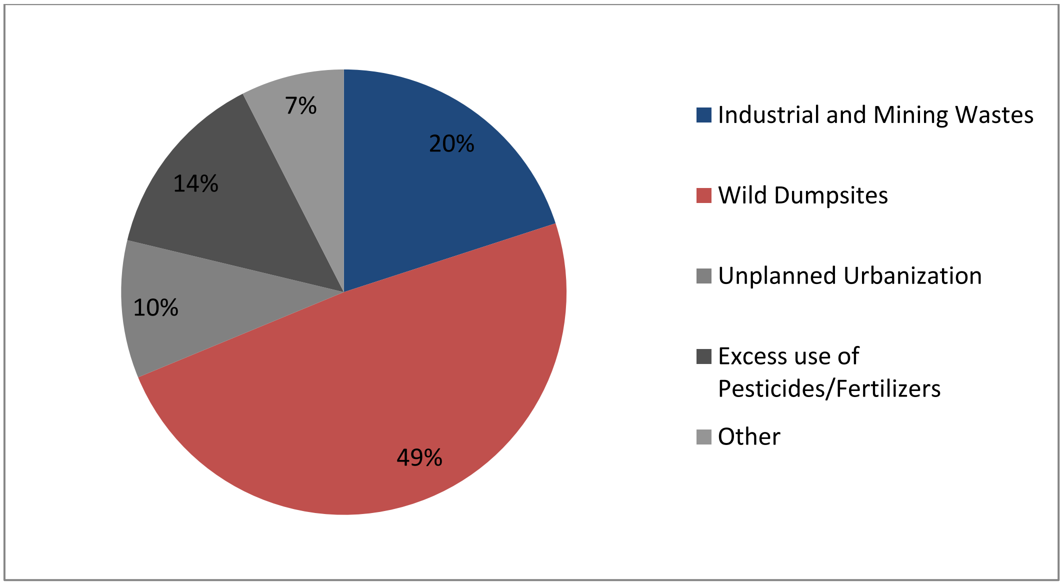


Figure 6-3: Reasons behind Soil Pollution in Turkey (MoEU, 2014)

Having in mind that the most significant amount of PFOS tends to end up in either waste management of wastewater management cycle. This brings up the center of mass of PFOS load to the point that; a majority of the contaminant is directly released to soil environment.

Another interesting chart from the MoEU shows that waster pollution is also due to lack of sound waste management activities.

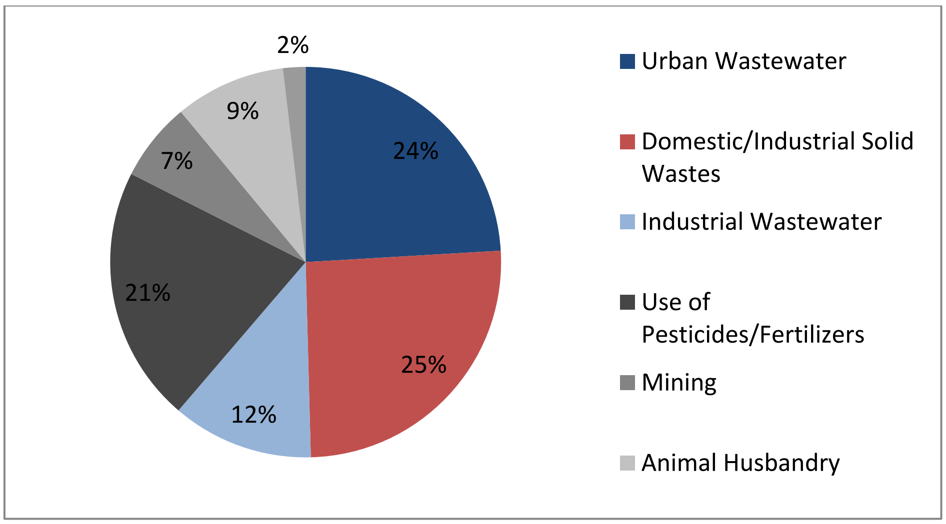


Figure 6-4: Reasons Behind Water Pollution in Turkey (MoEU, 2014)

Since there is a lack of sanitary landfills to treat domestic and industrial wastes, wastes disposed of to dumpsites cause water pollution as a result of direct contact with soil.

Waste Oil Recovery. Similar to fire fighting foams, PFOS containing aviation hydraulic fluids are still being used in Turkey. All products consumed in this sector, is wasted after its effective product life time. Hydraulic fluids are sent to oil recovery facilities after their service life. There are 33 licenced hydraulic oil recovery plants in Turkey. A full list is given in the appendices.

7. Alternatives

An economic assessment of the non-PFOS alternatives depends on:

- The price of the chemicals and or physical alternatives
- The amount needed during use
- The expenses during substitution
- Expenses to possible continuous addition of chemicals

- Expenses related to possible break down of a continuous addition system, due to problems related to non-sufficient or excess additions of chemicals. (Poulsen, et al., 2011)

Generally relevant alternatives for the use of PFOS are perfluorinated telomeres with shorter chain length with a carbon chain length of ≤C8 for perfluoralkyl carboxylates and ≤C6 for perfluoroalkyl sulfonates (ESWI; EC, 2011). The short-chain fluorinated alternatives are as mentioned still rather persistent but much less bioaccumulative and toxic than the long-chain homologues. In addition some non-fluorinated alternatives, such as siloxanes, propylated aromatics and sulfosuccinates, can be used for specific applications. The non-fluorinated alternatives are in general less persistent and bioaccumulative, but some are toxic. In general, there is a lack of public data on the properties of the alternatives, partly because the data are protected by commercial secrecy, partly because most scientific research has focused on the polyfluorinated substances (Lassen, et al., 2012)**.** There is little or no independent and reliable information publicly available on the toxicological and ecotoxicological characteristics of alternatives to PFOS and its related substances, with the exception of perfluorohexanoic acid (PFHxA) and PFBS and their related substances (UNEP, 2012).

Table 7-1: Properties of Various Alternatives of PFOS ((Poulsen, et al., 2011), (UNEP, 2012)

Code		Properties	Persistence	Toxicity & Bioacculumation
PFBS	Perbutane Sulfonic Acid	Highly water soluble. Low vapour pressure Poorly adsorbed to soils and sediments.	As persistent as other perfluorinated compounds.	Toxicity of PFBS is >100 times lower than that of PFOS and it is not bioaccumulative.
F-53	Perfluorinated dialkyl ether sulfonate.	Further research needed	Further research needed	More degradable
F-53B	Chlorofluorinated dialkyl ether sulfonate.	Further research needed	Further research needed	More degradable resulting in shorter chain derivatives.
PFHxSF	Perfluorohexane sulfonyl fluoride and its derivatives	Similar environmental impact as PFOS	Similar environmental impact as PFOS	Similar environmental impact as PFOS

Coating for textiles, leather and carpets alternatives to PFOS for impregnation or coating of textiles, leather and carpets as well as coating agents were well known. Dendrimers has been used as non-fluorine alternatives to PFOS as water proofing agents on textiles and as coating agents. However, the effect of these alternatives must be further assessed (UNEP, 2012).

Aviation hydraulic fluids. The content of the product is kept confidential by manufacturers; therefore there is lack of information on alternatives to this product.

Firefighting foams. There is a lot of chemical data for the specific fluorinated and non –fluorinated alternatives for firefighting foams that enable good health and environmental assessments of these components. However there are information gaps concerning in exact chemical composition of commercial firefighting foams due to manufacturers' trade secrets, that may result in weak points in case assessments when these firefighting foams are used in real situations.

Metal Plating. There is a lot of information and application scenarios available for alternatives to PFOS for metal plating where 6:2 FTS is considered as a possible alternative. However 6:2 FTS is not considered as equivalent to the performance of PFOS which is still used in large quantities worldwide for this purpose. More research is needed to develop equal or better alternatives to PFOS for metal plating to permit the phase out of PFOS for these applications (UNEP, 2012).

8. Discussion and Conclusion

As an outcome of the inventory study, it is determined that; PFOS is neither produced within the country nor used as a process chemical. However there are ongoing uses of PFOS containing substances such as hydraulic fluids for aviation and aqueous fire fighting foams. In addition to this, historical uses of PFOS in different articles still have an effect on the local releases.

PFOS related substances are used by hard chrome plating industries as mist suppressant. Although actual trade statistics is needed for further research, it is assumed that the mist suppressing agent is imported to the country for chromium plating purposes. Metal plating industries, release PFOS containing wastewater emissions which in return end up in water and soil media. Air emission from this sector is negligible.

The contribution to electronics, semiconductors sectors, and rubber and plastics products is negligible compared to other contributing industries. On the other hand gold and copper mining industry, similar to chemically driven oil and gas industries also do not use PFOS related substances in their processes any more. Despite the data gap on historical use of PFOS related substances for these sectors, it is assumed that if PFOS were used in previous years, then these sites are potential contaminated sites of PFOS.

Ongoing use of PFOS containing AFFFs is a major issue for the investigation and past uses are indications of already contaminated lands with PFOS. In fact, there is an ongoing release to water and soil media from this sector. In addition to this, wastage of out-of date products constitute an input to PFOS containing wastes with the historically out-dated products.
The results of general framework of the investigation are tabulated below:

Table 8-1: Overview of PFOS Related Sectors in Turkey

Life cycle stages	Location/activity	Facility	Condition in TURKEY	RISK of Presence
PFOS production	Chemicals industry	Production site	**PFOS related substances are not produced in Turkey.**	**NO**
		Sites where production waste has been destroyed		
		Landfills related to the production		
		River sediment and banks related to releases from the production site		
Use in production of PFOS-containing articles and preparations	Chromium plating	Production site and deposited wastes	**Used in chrome plating.**	**High**
	Coated paper, textile, leather and carpet industry	Production site and deposited wastes	**Deposited wastes**	**Medium-High**
	Semiconductor industry	Production site and deposited wastes	**Deposited wastes**	**Low**
	Electronics industry	Production site and deposited wastes	**Deposited wastes**	**Low**
	Photo imaging industry	Production site and deposited wastes	**Deposited wastes**	**Low**
PFOS preparations in operation	Oil, mining and gas industry	Contaminated soil and groundwater	**Contaminated soil and groundwater**	**Medium-High**
	Insecticides	Contaminated soil and groundwater	**Not used in Turkey**	**No**
		Areas of accidental leakage or spill from stockpiles	**No data**	**Unknown**
	Fire fighting foam	Fire drill areas	**Fire drill areas**	**High**
		Areas of accidental leakage or spill from stockpiles *	**Areas of accidental leakage or spill from stockpiles ***	**Unknown**
	Aviation hydraulic fluids	Areas of accidental leakage or spill from stockpiles	**Areas of accidental leakage or spill from stockpiles**	**Unknown**
Waste management of PFOS-containing articles and preparations	Waste	Landfills and dump sites	**Landfills and dump sites**	**Very High**
	Waste	Incineration	**Municipal waste water treatment plants**	**High**
	Waste	Municipal waste water	**Dump sites**	**Very High**

		treatment plants		
	Waste	Dump sites	**Municipal waste water treatment plants**	**Very High**

The majority of the solid waste containing PFOS in Turkey is disposed of to municipal solid waste landfills/wild deposition sites. But it is not known to what extent the substances are destroyed. No data were available on the destruction efficiency under the actual conditions in the incinerators/landfill operations. More studies are needed to clarify whether it would be necessary to dispose of PFOS-containing waste to hazardous waste incinerators.
As a result of this survey it is evident that; historical releases of PFOS is much significant than actual emissions of PFOS in Turkey. Most of the PFOS containing articles ended up in landfills, wild deposition sites and in environment. Therefore it is necessary to carry out detailed analysis in environment matrices in order to determine the risks arising because of PFOS emissions.

Table 8-2:Overview of PFOS Related Sectors in Turkey

	Emissions to Media			**Generates PFOS containing waste**	**PFOS in Final Product**
Type of Industry/Product	**Air**	**Water**	**Soil**		
Electrics, Electronics and Semiconductor	Low	High	No	Yes	No
Photographic industry (photographic films, papers, and printing plates) and photo imaging	Low	High	No	Yes	Yes
Chromium Plating Industry	Low	High	No	Yes	No
Paper and Packaging	No	Yes	Yes	Yes	Yes
Textiles, Carpets, leather and apparel	Low	Medium	High	Yes	Yes
Aviation	No	Yes	Yes	Yes	Yes
Fire Figthing	No	Yes	Yes	Yes	Yes
Rubber and plastic industry	No	No	No	Yes	Yes
Oil/Gas Production and Gold Mining	No	No	No	No	No

In conclusion, hard chromium plating is an important ongoing source of PFOS to the water environment in Turkey. Aqueous Fire Fighting Foams and Aviation hydraulic fluids are the other two major ongoing sources which also constitute and historical release due to past uses. Further research must be carried out in order to complete a mass balance study on these three sectors of concern.

Based on the knowledge All articles that might have contained PFOS in the past, are either landfilled or disposed in wild dumpsites. In fact, PFOS accumulation is expected to occur in soil and groundwater media. Analytical investigations are recommended in order to determine the extent of contamination so far.

REFERENCES

Akdoğan, A. (2009). Türkiye'de Plastik Hammadde Üretimi ve İthalatı.
Arçelik. (2013). Kullanımı Yasaklı ve Sınırlı Maddeler.
Batı Akdeniz Kalkınma Ajansı. (2012). *Deri ve Deri Ürünleri Sektörü Raporu.*
Bektaş, B. (2006). *Deri ve Deri Mamulleri.* T.C. Başbakanlık Dış Ticaret Müsteşarlığı.
Brooke, D., Footitt, A., & Nwaogu, A. (2004). *Environmental Risk Evaluation Report: Perfluorooctanesulphonate (PFOS).* UK Environment Agency. doi:ISBN:978-1-84911-124-9

Bruinen, Y., Zweers, P., Bakker, J., & Beekman, M. (2009). Estimation of Emissions and Exposures to PFOS used in Industry.

Buck, R. C., Franklin, J., Berger, U., Conder, J. M., Cousins, I. T., de Voogt, P., . . . van Leeuwen, S. P. (2011). Perfluoroalkyl and Polyfluoroalkyl Substances in the Environment: Terminology, Classification, and Origins. *Integrated Environmental Assessment and Management, 7*(4), 513-541.

Buser, A., & Morf, L. (2009). *Substance Flow Analysis of PFOS and PFOA in Switzerland.* Bern: Swiss Confederation Federal Office for the Environment.

Büyükyol, K;. (2013). *Bilgisayar ve Elektronik Sektor Raporu.* Ankara: Ministry of Customs and Trade Turkey.

Carloni, D. (2009). *Perfluorooctane Sulfonate (PFOS) Production and Use: Past and Current Evidence.* UNIDO.

COWI A/S Norway. (2012). *Inventory of PFOS and PFOS-related substances in fire-fighting foams in Norway.* Climate Pollution Agency.

DHMI. (2012). Annual Activity Report.

Dietz, R. (2010). Monitoring results on PFOA in Arctic marine top predators with focus on polar bears. Department of Arctic Environment, National Environmental Research Institute, Aarhus University.

Ekti, Ercan. (2013). Tekstil Sektörü Raporu.

ESWI; EC. (2011). *Study on waste related issues of newly listed POPs and candidate POPs* .

European Food Safety Authority. (2008). Perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA) and their salts (Scientific Opinion of the Panel on Contaminants in the Food Chain). *The EFSA Journal, 653*, 1-131.

Filipovic, M., Berger, U., & McLahn, M. (2013). Mass Balance of PFAAs in the Baltic Sea. *Environmental Science & Technology*, 4088-4095.

Futo, P., & Karluvali, A. (2015). Sectoral Impact Assessment Draft Report.

Günay, D. (2004). *Deri ve Deri İşleme Sanayi Sektörü - Sektörel Araştırmalar.* Ankara: Türkiye Kalkınma Bankası A.Ş.

Güneydoğu Anadolu Halı İhracatçıları Birliği. (2011). *Türkiye Dokuma Makina Halıcılık Sektörü: Envanter, Projeksiyon ve Analiz.* Gaziantep.

Han, W. (2009). PFOS related actions in China.

Herzke, D., Posner, S., & Olsson, E. (2009). Survey, screening and analyses of PFCs in consumer products. SWEREA - IVF.

İstanbul Sanayi Odası. (2011). *Avrupa Birliği'ne Uyum Sürecinde Sektör Rehberleri - Deri ve Deri Ürünleri Sanayii.* İstanbul: Avrupa İşletmeler Ağı .

Kefeli, E. (2004). *Yangın Söndürme Cihazları Raporu.* İstanbul Ticaret Odası.

Lassen, C., Jensen, A., Potrykus, A., Christensen, F., Kjolholt, J., Jeppesen, C., . . . Innanen, S. (2012). *Survey of PFOS, PFOA and other perfluoroalkyl and polyfluoroalkyl substances.* Danish Environmental Protection Agency.

Lien, N., Tanaka, S., & Fujii, S. (2008). Contamination of PFOS and PFOA in surface water of the Yodo River basin (Japan). *Desalination*, 338-347.

Lim, T., & Wang, B. e. (2011). Emission Inventory for PFOS in China: Review of Past Methodologies and Suggestion. *The Scientific World Journal*, 1963-1980.

Llorca, M., Farre, M., Pico, Y., & Müller, J. (2012). Analysis of PFOA substances in water from Germany and Spain. *Science of the Total Environment*, 139-150. doi:10.1016/j.scitotenv.2012.05.011

Mawn, M., McKay, R., Ryan, T., Szostek, B., Powley, C., & Buck, R. (2005). Determination of extractable perfluorooctanoic acid (PFOA) in water, sweat simulant, saliva simulant, and methanol from textile and carpet samples by LC/MS/MS. *The Analyst, 130*, 670-678. doi:10.1039/b414403a

Michiels, E. (2010, May 4). Use of PFOA in critical photographic applications. *Workshop on "PFOA and its Ammonium sals. Production, use, risk"*. Imaging and Printing Association - I&P Europe.

MoEU. (2013). *Metal Kaplama Sektörü - Sektörel Tehlikeli Atık Rehberleri.* Ankara: Atık Yönetimi Dairesi Başkanlığı.

MoEU. (2014). *Priority Environmental Problems of Turkey.* Ankara: Ministry of Environment and Urbanisation.

NPCA. (2008). *Screening of Polyfluorinated Organic Compounds at Four Fire Training Failities in Norway.* Norwegian Pollution Control Authority.

Obal, T. (2014). PFOS, PFOS and other Fluorinated Compounds: Overcoming Sampling and Analytical Challanges.

Öztürk, İzzet; MoEU, CYGM. (2010). *Waste Sector Status Quo Report - Development of National Climate Change Action Plan Project.*

PLASFED. (2013). *Türkiye Plastik Sektör İzleme Raporu.*

Posner, S. (2010). Best Available Techniques and on Best Environmental Practices for the Use of PFOS and related chemicals under the Stockholm Convention on Persistent Organic Pollutants. Sweeden: Technical Assistance Branch, Secretariat of the Basel, Rotterdam and Stockholm Conventions. Retrieved from www.pops.int

Poulsen, P., Gram, L., Jensen, A. R., Rawn, C., Moller, P., Jorgensen, C., & Lokkegaard, K. (2011). *Substitution of PFOS for use in non-decorative hard chrome plating.* Environmental Project No. 1371 2011 Miljoprojekt Report, Danish Ministry of the Environment Environmental Protection Agency.

Recycling of Magnetic Films. (n.d.). Retrieved from Akademi Cevre: http://www.akademicevre.com/geri-donusum/diger-geri-donusum/manyetik-film-geri-donusumu

Schaider, L., Rudel, R., & Ackerman, J. (2014). Pharmecauticals, perfluorosurfactants, and other organic wastewater compunds in public drinking water wells in a shallow sand and gravel aquifer. *Science of the Total Environment*, 468-469.

Schulte, C. (2010). PFOA- possible sources and regulatory needs. *Do without Per-and Polyfluorinated Chemicals and Prevent their Discharge into the Environment.* Federal Environment Agency - Umweltbundesemt Chemicals Branch.

Seow, J. (2013). *Fire Figthing Foams with Perfluorochemicals - Environmental Review.* Department of Environment and Conservation Western Australia.

Sevim, Ü., & Emek, A. (2006). *Halı Sanayi.* T.C. Başbakanlık Dış Ticaret Müsteşarlığı İhracatı Geliştirme Etüd Merkezi.

Tanaka, S., Fuji, S., & Lien, N. (2008). Contamination of PFOS and PFOA in Water Environment of 21 Cities in 10 Countries. *Journal of Japan Society on Water Environment*, 665-870.

TOBB. (2013). *Sector Report.* Turkish Civil Aviation Assembly.

UNEP. (2012, October 19). Technical paper on the identification and assesment of alternatives to the use of perfluorooctane sulfonic acid in open applications.

UNIDO. (2012). Guidance for the inventory of perfluorooctane sulfonic acid (PFOS) and related chemicals listed under the Stockholm Convention on Persistent Organic Pollutants .

Ünlü, Namık. (2010). Sanayi Sektörü Mevcut Durum Değerlendirmesi Raporu.

Vejrup, K. V., & Wolkoff, P. (2002). Linear alkylbenzene sulfonates in indoor floor dust. *the Science of the Total Environment*, 51-58.

Xie, S., Wang, T., Liu, S., Jones, K. C., Sweetman, A. J., & Lu, Y. (2013). Industrial source identification and emission estimation of perfluorooctane sulfonate in China. *Environment International, 52,* 1-8.

Yorulmaz, Hülya. (2014, January). Doğu Marmara Bölgesi Kağıt Sanayi Sektör Raporu.

Zhang, L., Liu, J., & Hu, J. e. (2012). The inventory of sources, environmental releases and risk assessment for perfluorooctane sulfonate in China. *Environmental Pollution*, 193-198.

ANNEX

ANNEX A. List of substances which may degrage to PFOS is available at

http://www.oecd.org/ehs/pfc/

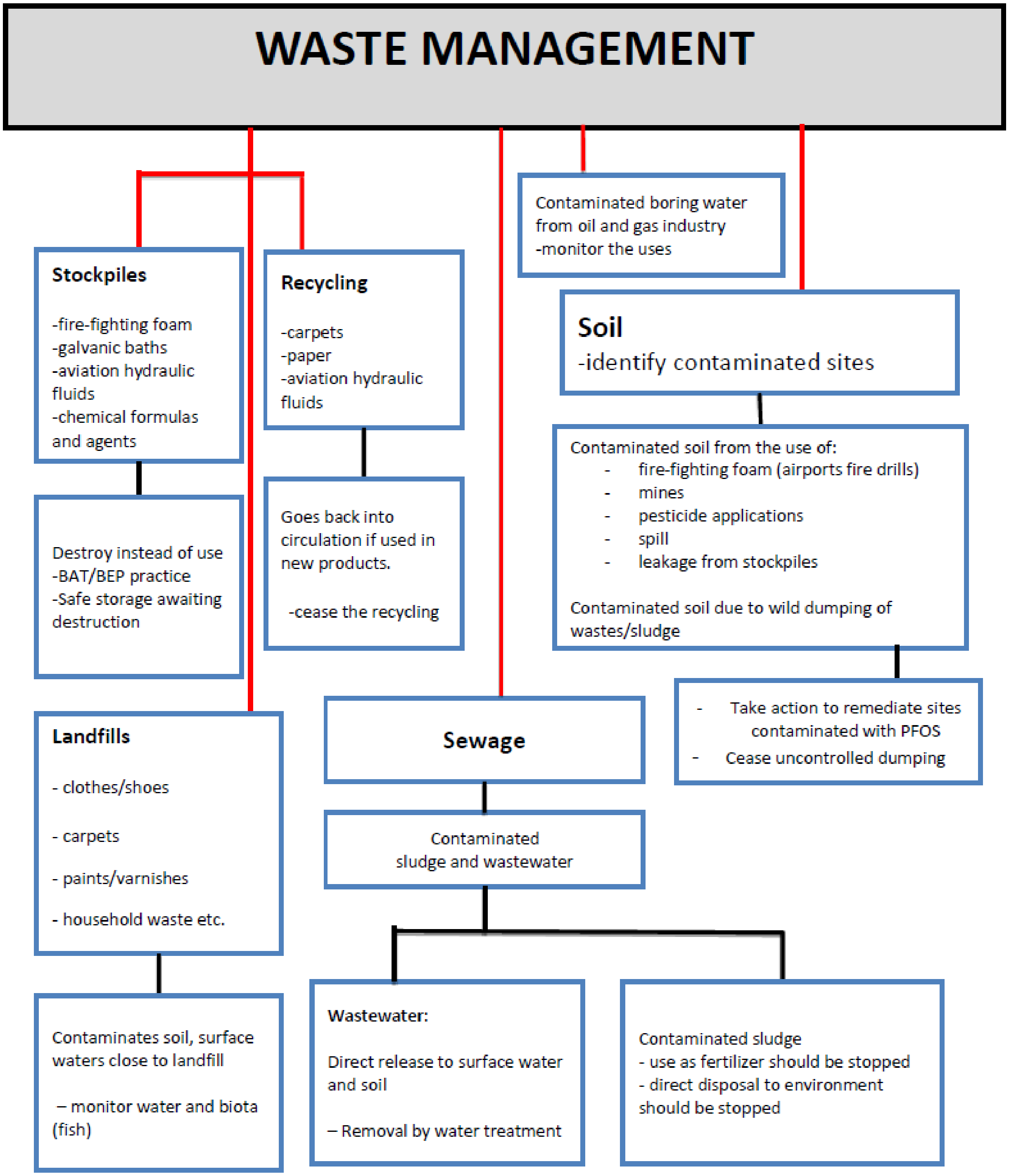
ANNEX B. Detailed information on PFOA Substance is available at

http://www.epa.gov/oppt/pfoa/index.html

ANNEX C. List of Stakeholders

- Ministry of Customs and Trade
- Ministry of Science, Technology and Industry
- The Union of Chambers of Commerce, Industry, Trade and Commodity Exchange of Turkey (TOBB).
- 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
- Turkish Electricity Producers Union
- Turkish Electricity Industry Association.
- Turkish Chemical Manufacturers Association
- Turkish Employers' Association of Metal Industries (MESS).
- Turkish Society of Toxicology
- Leather Manufacturers Association www.tdsd.org.tr
- Association of Protection Against Fire www.tuyak.org.tr

ANNEX D. **Waste Management Activities Related to PFOS**



ANNEX E.1. The List of Textile Recycling Facilities

	Company	Contact Information	Province
1	VEL AY PLASTIK AMBALAJ INŞ. NAK. TAAH. TİC. SAN. LTD. ŞTİ.	FEVZİPAŞA MAH. 41 SK. NO: 10 tel:03224282791 fax:03224281732	ADANA
2	RDF KONTAMİNE ATIK BERTARAF VE GERİ KAZ. SAN.TİC.LTD.ŞTİ. ADANA ŞUBESİ	CEYHAN YOLU ÜZERİ 12. KM. 01321 ADANA tel:3223327274 fax:3223326264	ADANA
3	ADANA ÇİMENTO SANAYİ TÜRK A.Ş.	CEYHAN YOLU ÜZERİ 12.KM. ADANA tel:0322 332 99 50 fax:0322 332 97 32	ADANA
4	ÇETİN-DAĞ KİMYASAL ÜRÜNLER SAN.TİC.V E PAZ.LTD.ŞTİ.	KAVAKLI MH T.CEMAL BERİKER BLV 686 A SEYHAN tel:03224410426 fax:03224410425	ADANA
5	ÖZEN CAM GERİ DÖNÜŞÜM KAZANIM VE İNŞ SAN LTD ŞTİ.	OSB Recep Tayyip Erdoğan Bulvarı 1. Cad. 3. Sok. No:31/C AKSARAY tel:0382 266 2274 fax:03822662276	AKSARAY
6	ÇANKAYA KATI ATIK GERİ DÖN.İNŞ. NAK MAK. SAN.VE TİC.LTD.ŞTİ	SANAYİ SİTESİ 1.C.14.S. 7-9 11 SİNCAN tel:3122685297 fax:3122684839	ANKARA
7	AMBALAJ ATIKLARI DEPOLAMA TAŞIMA VE GERİ DÖNÜŞÜM / SELAMİ ENGİN	YENİ MERMERCİLER SİT NO:242 YUVA KÖYÜ SERPMELER tel:3123960081 fax:3123960082	ANKARA
8	ÇÖZÜM END. ATIK İŞLEME SAN. A.Ş.	SAMSUN YOLU 35. KM. tel:3128640509 fax:03128640516	ANKARA
9	BİRCANLAR KATI ATIK GERİ DÖNÜŞÜM TEM.NAK.TUR.VE TİC.LTD.ŞTİ.	ORG.SAN.BÖL.DÖKÜMCÜLER SİT.10.SK.NO:116-114 SİNCAN ANKARA tel:3122670959 fax:03122671656	ANKARA
10	BAŞTAŞ-BAŞKENT ÇİMENTO SANAYİ VE TİC A.Ş.	SAMSUNYOLU 35 KM ELMADAĞ tel:03128640100 fax:03128640105	ANKARA
11	LİMAK BATI ÇİMENTO SANAYİ VE TİCARET ANONİM ŞİRKETİ ANKARA ŞUBESİ	Ankara Fabrikası Güvercinlik Mevkii06560 tel:3122110130 fax:3122110713	ANKARA

12	ADO GERİ KAZANIM PLASTİK SANAYİ VE TİCARET LTİ. ŞTİ.	AKDENİZ SANAYİ SİTESİ 5036 SOK. NO:195 tel:02422581800 fax:02422581827	ANTALYA
13	DÖNÜŞÜM KATI ATIK TOPLAMA DEĞ.PLAS.MAD.ÜR.PETROL.ÜRÜN İNŞAAT TURZİMPAZARLAMA SANAYİ VE TİCARET LTD.ŞTİ	DEĞİRMENLİK KÖYÜ 0 0 AKSEKİ tel:02426716100 fax:02426716104	ANTALYA
14	UĞUR SELÜLOZ KİMYA MAKİNA VE GIDA SANAYİ VE TİCARET ANONİM ŞİRKETİ	AYDIN ORGANİZE SANAYİ BÖLGESİ NO:7 UMURLU tel:02562591143 fax:02562591004	AYDIN
15	İHSAN KAYA KAYA GERİ DÖNÜŞÜM	TEPECİK MAH. KAYA SOKAK NO 2 EFELER tel:2562111987 fax:2562311679	AYDIN
16	BATISÖKE SÖKE ÇİMENTO SANAYİİ TÜRK A .Ş.	Atatürk Mah. Aydın Cad. No:234 tel:02565182250 fax:02565181123	AYDIN
17	ÖZNAK HURDACILIK GERİ DÖNÜŞÜMLÜ ATIK DEĞ.MÜH.HİZ.ORM.ÜR.İNŞ.İŞL.MAD.PET.ÜR.OTOM.SAN.TİC.LTD.ŞTİ	GÜMÜŞÇEŞME MAH. 250 SOK. NO:25/A tel:02662459577 fax:02662458185	BALIKESİR
18	LİMAK BATI ÇİMENTO SAN. VE TİC. A.Ş. BALIKESİR ŞUBESİ	GAZİOSMAN PAŞA MAH. YAKUP ŞEVKİ PAŞA CAD. NO:145 tel:02662212370 fax:02662212388	BALIKESİR
19	SEMA MUCUR	ORGANİZE SAN.SİT. 3.CADDE NO:7 tel:2663921026 fax:2663921511	BALIKESİR
20	BOLU ÇİMENTO SANAYİİ A.Ş.	Yuva Köyü Çimento Fabrikası Yanı Sokak No: 1 BOLU tel:0 374 226 50 60 fax:0 374 226 50 68	BOLU
21	APEKS GERİ DÖNÜŞÜM SAN.VE TİC. A.Ş. - BURSA Ş.B.	Yeni Yalova Yolu Alaşar Köyü Girişi Alaşar Cad. No:13 tel:2242616045 fax:2242616046	BURSA
22	EPSAN PLASTİK SAN.VE TİCARET A. Ş.	DEMİRTAŞ ORG.SAN.BLG A.OSMAN SÖNMEZ CAD. 16 OSMANGAZİ tel:2242612020 fax:2242612718	BURSA
23	E.U.R.O. FİBER TEKSTİL PLASTİK ELYAF TURİZM AMBALAJ ATIKLARI GERİ DÖNÜŞÜMÜ SAN.VE TİC. LTD.	NİLÜFER ORG. SAN. BÖL. SEDİR CAD. NO : 11-13 NİLÜFER BURSA tel:2244110750 fax:2244110756	BURSA

	ŞTİ.		
24	BURSA ÇİMENTO FABRİKASI A.Ş.	YENİ MAHALLE ULUDAĞ CADDE NO:170 KESTEL/BURSA tel:2243721560 fax:2243721660	BURSA
25	BAYATLI GERİ DÖNÜŞÜMCÜLÜK DEMİR ÇELİK METAL SAN. TİC. LTD. ŞTİ.	ÇALI MAH. 20. SK. NO: 4/A-4/B NİLÜFER/BURSA tel:02244823401 fax:02244823639	BURSA
26	ULVİ İSLAMOĞLU-BURSA GEÇİT 1 ŞUBESİ	GEÇİT MAH. 2. GÜNDOĞDU SOK. NO:120 tel:02244040048 fax:02244040068	BURSA
27	BURKASAN PLASTİK ATIK YÖNETİMİ VE ÇEVRE DANIŞMANLIK HİZMETLERİ İNŞAAT SANAYİ VE TİCARET LTD.ŞTİ.	AHMET VEFİK PAŞA MAHALLESİ HASAN KESTELLİ CADDESİ NO:9 KESTEL/BURSA tel:02243726001 fax:02243726003	BURSA
28	ER-KA KAĞIT VE AMBALAJ SANAYİ TİCARET LİMİTED ŞİRKETİ	İNEGÖL BURSA YOLU 3.KM KALBURT MEVKİİ . İNEGÖL tel:02247142040 fax:02247142042	BURSA
29	ERTONA TEKSTİL PLASTİK KİMYA GERİ DÖNÜŞÜM SAN. VE TİC. LTD. ŞTİ.	IHLAMUR CADDE NO:21 NİLÜFER ORGANİZE SANAYİ BÖLGESİ NİLÜFER-BURSA tel:02244110425 fax:02244110427	BURSA
30	EMNİYETLİ HURDA GERİ DÖNÜŞÜM İLETİŞİM TEKSTİL OTOMOTİV NAKLİYAT İNŞAAT SANAYİ VE TİCARET LİMİTED ŞİRKETİ	DEMİRTAŞ BARBAROS M. DEMİRTAŞ YOLU CAD 400 A-B OSMANGAZİ tel:2242621650 fax:2242621657	BURSA
31	TURHAN HURDACILIK TEM. TAŞ. TEKS. GIDA İNŞ. OTOMOTİV SAN. VE TİC. LTD. ŞTİ	YUKARIÇAKILLAR MEVKİİ YAYLACIK KÖYÜ NO:5 tel:02244825060 fax:02244825160	BURSA
32	FATİH PLASTİK RÜSTEM NİĞDELİOĞLU	YİĞİTLER MAHALLESİ 13.SOKAK NO:96 tel:02243461170 fax:02243461170	BURSA
33	EMAŞ PLASTİK SANAYİVE TİCARET A.Ş.	ORGANİZE SANAYİ BÖL. GRİ CADDE 6 NİLÜFER tel:2242438030 fax:2242434898	BURSA
34	AKÇANSA ÇİMENTO SANAYİ VE TİCARET A.Ş. ÇANAKKALE ŞUBESİ ÇİMENTO FABRİKASI	MAHMUDİYE KÖYÜ 17640 EZİNE/ÇANAKKALE tel:02862952000 fax:02862952199	ÇANAKKAL E

35	İÇDAŞ ÇELİK ENERJİ TERSANE VE ULAŞIM SAN.A.Ş. DEĞİRMENCİK ENTEGRE TESİSİ	Değirmencik Köyü, tel:2863951239 fax:2863645876	ÇANAKKAL E
36	DENKİM DENİZLİ KİMYA SANAYİ VE TİCARET A.Ş.	CUMHURİYET MAHALLESİ YATAĞAN YOLU NO:49 (YATAĞAN YOLU ÜZERİ 1. KM) tel:2585912117 fax:2585912119	DENİZLİ
37	SİDE İPLİK SANAYİ VE TİCARET LİMİTED ŞİRKETİ	ORGANİZE SANAYİ BÖLGESİ 1. KISIM BAYRAM ŞİT CADDESİ NO:2 tel:2582692006 fax:2582692269	DENİZLİ
38	VATAN İNŞ TURZ ÖZEL EĞTM GIDA DAY TÜKETİM MALL. B.SAYAR TEKSTİL HAYV. VE HURDA SAN. VE TİC. AŞ.	ORGANİZE SANAYİ BÖLGESİ BEREKET CAD. NO:21 2. KISIM HONAZ / DENİZLİ tel:02582692378 fax:02582691328	DENİZLİ
39	GEP YEŞİL ENERJİ ÜRETİM TEKNOLOJİLERİ LİMİTED ŞİRKETİ DÜZCE ŞUBESİ	MERKEZ MAH. 214. SOK. NO: 2 tel:5339553465 fax:3807313037	DÜZCE
40	HAKTAN KOCA - AYBEL PLASTİK	HACIALİLER KÖYÜ MEVKİİ HACIDAYI KARŞISI NO:253 81100 tel:03805375536 fax:03805375536	DÜZCE
41	Çimentaş İzmir Çimento Fabrikası Türk A.Ş. Trakya Şubesi	Sinanköy Mevkii 22970 Lalapaşa EDİRNE tel:2843231104 fax:2843231115	EDİRNE
42	Çimentaş İzmir Çimento Fabrikası Türk A.Ş. Trakya Şubesi	Sinanköy Mevkii 22970 Lalapaşa EDİRNE tel:2843231104 fax:2843231115	EDİRNE
43	RECYDİA Atık Yönetimi Yenilenebilir Enerji Üretimi Nakliye ve Lojistik Hizmetleri Sanayi ve Ticret A.Ş. ELAZIĞ ÇİMENTO ŞUBESİ	AKSARAY M. KAZIM KARABEKİR C. NO:12 tel:04242243921 fax:04242241670	ELAZIĞ
44	ÇİMSA ÇİMENTO SAN. VE TİC. A.Ş. ESKİŞEHİR ÇİMENTO FABRİKASI ŞUBESİ	İSTANBULYOLU 22. KM ÇUKURHİSAR ESKİŞEHİR tel:2224113200 fax:2224113131	ESKİŞEHİR
45	BENLİ GERİ DÖNÜŞÜM HIRDAVAT MAKİNA SAN.VE TİC. LTD. ŞTİ.	ORGANİZE SAN.BÖLGESİ 9/A CAD 12 tel:2222361666 fax:02222361670	ESKİŞEHİR
46	EKOLOJİK ENERJİ ANONİM ŞİRKETİ ESKİŞEHİR ŞUBESİ	İstanbul Karayolu 22.KmHisar Mahallesi, Tepebaşı/ESKİŞEHİR tel:2224113200 fax:2224113131	ESKİŞEHİR

47	KIRATLI PLASTİK SANAYİ VE TİCARET LİMİTED ŞİRKETİ	2.ORG.SAN.BÖL. 83203 CAD 49 ŞEHİTKAMİL tel:3423378898 fax:3423378899	GAZİANTEP
48	MTM PLASTİK GERİ DÖNÜŞÜM TOPLAMA VE AYIRMA KİMYA TEKSTİL DANIŞMANLIK SAN. VE TİC. LTD. ŞTİ.	2.ORGANİZE SANAYİ BÖLGESİ 83231 NOLU CD.NO:20/A tel:3423373215 fax:3423373257	GAZİANTEP
49	YENER PAMUK TEKSTİLSANAYİ TİCARET L TD. ŞTİ.	2.ORG.SAN.BÖL. M.GÜLER BUL. 34 ŞEHİTKAMİL tel:03423374200 fax:03423374425	GAZİANTEP
50	CMS İPLİK SANAYİİ VETİCARET LTD ŞTİ	1 ORGANİZE SAN BÖL 1 CAD 27 A ŞAHİNBEY tel:03423373120 fax:03423373121	GAZİANTEP
51	DOĞAN GERİ DÖNÜŞÜM VE TEKSTİL SAN VE TİC LTD.ŞTİ	1 ORG SAN 83116 Nolu Cad. No:9 tel:03423374142 fax:03423374146	GAZİANTEP
52	ASLANSOY PAMUK SAN VE TİC A Ş	1.ORGANİZE SAN.BÖL. 83105 NOLU CAD. 26 ŞEHİTKAMİL tel:03423373250 fax:03423373242	GAZİANTEP
53	TEKSAN AMBALAJ SANAYİ TİCARET ANONİM ŞİRKETİ	3.ORG.SAN.BÖLGESİ KAMİL ŞERBETÇİ BULV. 64 ŞEHİTKAMİL tel:3423379646 fax:3423379649	GAZİANTEP
54	LİMAK ÇİMENTO SAN. VE TİC. A.Ş. GAZİANTEP ŞUBESİ	Göllüce Mevkii Nizip Yolu Şehitkamil/GAZİANTEP tel:0 342 235 01 10 fax:0 342 235 01 09	GAZİANTEP
55	AYYILDIZ ELYAF SANAYİ VE TİC LTD.ŞTİ	2. ORGANİZE SANAYİ BÖLGESİ 83226 NOLU SOKAK NO:3 ŞEHİTKAMİL/GAZİANTEP tel:03423374548 fax:03423374547	GAZİANTEP
56	GÖZDE PLASTİK AMBALAJ.SAN.VE TİC.A.Ş	2.ORGANİZE SAN.BÖLG. C.DOĞANBLV.GÜN.5.CD. 20 ŞEHİTKAMİL tel:03423371009 fax:03423371008	GAZİANTEP
57	İBRAHİM HALİL AKPINAR-AKPINAR HURDA PLASTİK KIRMA VE TELİS TİCARETİ	2. ORGANİZE SANAYİ BÖLGESİ 83230 NOLU CADDE NO:19 tel:3423371058 fax:3423371059	GAZİANTEP
58	GEC KİMYA GIDA-TURZ-VE TARIM ÜR SAN TİC A.Ş.	2 ORG SAN BÖL HACI S ANİ KONUKOĞLU BLV 12 ŞEHİTKAMİL tel:3423373052 fax:3423373040	GAZİANTEP

59	AYTAÇ HANOĞLU- ERZİN ŞUBESİ	E-91 KARAYOLU ÜZERİ GÖZENE MEVKİİ İSTASYON BİTİŞİĞİ ERZİN/HATAY tel:3266910002 fax:3266910002	HATAY
60	ÖZEN CAM GERİ DÖNÜŞÜM KAZANIM VE İNŞ SAN LTD ŞTİ.	kayabaşı köyü fabrikalar mevki no:62 küçükçekmece tel:2126685877 fax:2126685878	İSTANBUL
61	AZİZ METAL GERİ DÖNÜŞÜM SANAYİ VE TİCARET LİMİTED ŞİRKETİ	İOSB ATATÜRK OTO SAN SİT 1.SOKAK 9 BAŞAKŞEHİR tel:2124852023 fax:2124852016	İSTANBUL
62	ŞAHİNLER METAL SANAYİ VE TİCARET A.Ş İSTANBUL ŞUBESİ	ORTA MAH. BÜLENT ECEVİT CAD. NO:4 34959 ORHANLI tel:02163040506 fax:02163040505	İSTANBUL
63	TUZLA DERİ OSB GERİ DÖNÜŞÜM ANONİM ŞİRKETİ	AYDINLIKÖY ORGANİZE DERİ SANAYİ BÖLGESİ ÇEVRE SOKAK NO: 3 tel:2163948068 fax:2163948069	İSTANBUL
64	GÖKSU PLASTİK AMBALAJ SAN.VE TİC.LTD ŞTİ.	ÖMERLİ MAH. NUSRET SOKAK 7 ARNAVUTKÖY tel:2126139224 fax:2126139228	İSTANBUL
65	KARABULUT DIŞ TİCARET LTD.ŞTİ.	ortaköy mah. sanayi mah. tunalı sabri cad. no:5 tel:02127343754 fax:02127343762	İSTANBUL
66	ÖNER TEKSTİL SANAYİDIŞ TİCARET LTD. ŞTİ.	KADIKÖY YOLU ÜZERİ ÜSTÜN SOKAK NO: 20 GAZİTEPE KÖYÜ tel:02127388282 fax:02127388115	İSTANBUL
67	ANDIÇ TEKSTİL GIDA TEMİZLİK TURİZM VE İNŞ.SAN.TİC.LTD.ŞTİ.	BEYCİLER KÖYÜ GİRİŞİ HASAN AĞANIN SAPLIĞI MEVKİİ 13. PAFTA tel:02127453113 fax:02127453113	İSTANBUL
68	NURSA İPLİK SAN. VE TİC. A.Ş.	UĞUR MUMCU MH. 2345 SK. NO:9-11 tel:02126193104 fax:02126680896	İSTANBUL
69	AKÇANSA ÇİMENTO SANAYİ VE TİC.A.Ş. BÜYÜKÇEKMECE FABRİKA	Mimar Sinan Merkez Mah. Marmara cad. 13/1 Aka sok. No:6 34900 Büyükçekmece İSTANBUL tel:0212866100 fax:02128661200	İSTANBUL
70	HAZAR TEKSTİL SANAYİVE TİCARET A.Ş.	ORTAKÖY M SANAYİ BULVARI 011 001 SİLİVRİ tel:02127343720 fax:02127343716	İSTANBUL

71	TİSAN MÜHENDİSLİK PLAS.SAN.VE TİC.LTD.ŞTİ.	EKŞİOĞLU MH. YAVUZ SELİM C.86.SOK 4 ÜMRANİYE tel:2164293665 fax:02163121478	İSTANBUL
72	BATIÇİM BATI ANADOLU ÇİMENTO SANAYİİ A.Ş.	ANKARA ASFALTI NO:335 BORNOVA tel:4784400 fax:02324784444	İZMİR
73	PUNTEKS TEKSTİL MAKİNA SAN.VE TİC.A.Ş.	GAZİ MUSTAFA KEMAL MAHALLESİ FATİH CAD. NO:145 TORBALI/İZMİR tel:02328662210 fax:02328662214	İZMİR
74	İZMİR ÇİMENTO FABRİKASI TÜRK A.Ş.ÇİMENTAŞ	KEMALPAŞA CAD.PK.384 IŞIKKENT İZMİR tel:0232 472 10 50 fax:0232 472 11 16	İZMİR
75	RETRO GERİ DÖNÜŞÜM PLASTİK PAZ. SAN. VE DIŞ TİC. LTD. ŞTİ.	Merkez Mah. 67 Sokak No:3 SASALI tel:2323274183 fax:2323274183	İZMİR
76	ÖZMÜŞLER ATIK YÖNETİMİ VE ÇEVRE DANIŞMANLIK HİZMETLERİ SAN TİC. A.Ş.	1187 NO:7 SARNIÇ GAZİEMİR tel:2322815557 fax:2322815414	İZMİR
77	CAM ŞİŞE İŞLETMESİ MUZAFFER PINARBAŞI - AMBALAJ ATIĞI TOPLAMA AYIRMA VE GERİ DÖNÜŞÜM TESİSİ DOĞANLAR ŞUBESİ	1605 SOKAK NO: 20 DOĞANLAR tel:02324795173 fax:02324795176	İZMİR
78	KARS ÇİMENTO SAN.VE TİC.A.Ş.-	MERKEZ BOZKALE KÖYÜ KARS tel:0474 242 62 30 fax:0474 242 62 30	KARS
79	KAHRAMAN EKO OLUKLU MUKAVVA KAĞITÇILIK AMBALAJ MALZEMELERİ GERİ DÖNÜŞÜM SANAYİ VE TİCARET LİMİTED ŞİRKETİ	ORGANİZE SAN BÖL. 6.CADDE 7 MELİKGAZİ tel:3523211064 fax:03523211045	KAYSERİ
80	MİLKAY TEKNİK TEKSTİL SANAYİ A.Ş.	1.ORGANİZE SAN.BÖL. 10.CADDE 30 MELİKGAZİ tel:03523211751 fax:03523211764	KAYSERİ
81	KAYPLAS PLASTİK MOBİLYA AKSESUAR VE MALZEMELERİ SANAYİ VE TİCARET LİMİTED ŞİRKETİ	ORGANİZE SAN.BÖL. 43 CD. 6 MELİKGAZİ tel:3523220565 fax:3523220631	KAYSERİ
82	ÇİMSA ÇİMENTO SAN.VETİC.A.Ş. KAYSERİ ÇİMENTO FABRİKASI ŞUBESİ	BÜNYAN YOLU 35. KM 38600 AĞIRNAS MELİKGAZİ tel:3527121607 fax:3527122259	KAYSERİ

83	KAY TEKSTİL VATKA KEÇE MAK. VE MOB. İMAL. SAN. TİC. PAZ. LTD. ŞTİ.	ORGANİZE SANAYİ BÖLGESİ 24.CAD. NO:48 tel:3523220290 fax:3523220399	KAYSERİ
84	MİTSAN MAKİNA İNŞAAT TİCARET VE SANAYİ A.Ş. (KEÇE-VATKA ÜRETİM TESİSİ)	ORGANİZE SANAYİ BÖLGESİ 18.CADDE NO:23 tel:03523213921 fax:03523213925	KAYSERİ
85	OPTİMET MÜHENDİSLİK ÇEVRE TEKNOLOJİLERİ SAN.VE TİC.LTD.ŞTİ. KIRIKKALE ŞUBESİ	BAHÇELİ MAH. PLANLI DERE SOK. NO:1 tel:3128151500 fax:3128151298	KIRIKKALE
86	TRAÇİM ÇİMENTO SANAYİ TİCARET A.Ş.VİZE ŞUBESİ	EVRENCİK MÜCAVİR ALANI NO:2 SERGEN tel:02883484900 fax:02883484788	KIRKLARELİ
87	YILDER TEKSTİL GERİ DÖNÜŞÜM İNŞAAT TAAHHÜT SANAYİ VE TİCARET LİMİTED ŞİRKETİ	YENİ MAHALLE D-100 KARAYOLU NO:3/F BÜYÜKKARIŞTIRAN / LÜLEBURGAZ tel:02884362202 fax:02884362202	KIRKLARELİ
88	TALEN TEKSTİL VE KİMYA SANAYİ TİCARET ANONİM ŞİRKETİ	CUMHURİYET MAH. ESKİ E-5 YOLU 14 BABAESKİ tel:02885110056 fax:02885110123	KIRKLARELİ
89	LİMAK BATI ÇİMENTO SANAYİ VE TİCARET ANONİM ŞİRKETİ TRAKYA ŞUBESİ	CAMİİ KEBİR MAH. KIRKLARELİ CADDESİ tel:02886151512 fax:02886151517	KIRKLARELİ
90	ANEL DOĞA ENTEGRE GERİ DÖNÜŞÜM ENDÜSTRİ A.Ş.	BAĞDAT CADDESİ UZAY ÇIKMAZI KARTEPE / KOCAELİ tel:02623522520 fax:02623523240	KOCAELİ
91	HELPAK AMBALAJ SAN.VE TİCARET LİMİTED ŞİRKETİ	GEPOSB 9.CAD.82.SOK.KÜÇÜK SANAYİ DÜKKANLARI NO:A1/3 GEBZE tel:2627511981 fax:02627512932	KOCAELİ
92	DOĞAM GERİ DÖNÜŞÜM PLASTİK İNŞAAT TURZİM NAKLİYAT VE TİCARET LİMİTED ŞİRKETİ	SANAYİ MAH. NERMİN SK. NO: 11 PK:41000 tel:02623350610 fax:02623350621	KOCAELİ
93	CAM KIRIĞI HURDA NAK.İNŞ.GIDA TURZ.SA N.VETİC.LTD.ŞTİ.	ÇAYIROVA MH. ŞİŞE CAM YOLU SK. 21 GEBZE tel:02626538036 fax:02626538036	KOCAELİ
94	RDF KONTAMİNE ATIK BERTARAF VE GERİ KAZANIM SAN. TİC. LTD. ŞTİ.	KARADENİZLİLER MH BAŞYİĞİT C. 164 KULLAR/BAŞİSKELE tel:02623492949 fax:02623494636	KOCAELİ

95	ASLAN ÇİMENTO ANONİM ŞİRKETİ	CAMİ MAH. KAPLAN CAD 149 DARICA tel:2627454747 fax:2627454342	KOCAELİ
96	SARIKAYA HURDACILIKİNŞAAT NAK.TAAH. VE TİC.LTD.ŞTİ.-KÖRFEZ ŞUBESİ	Yavuz Sultan Selim Mah. Şeyda Cad. No: 83 Mimaş Yolu üzeri Körfez/KOCAELİ tel:2625265696 fax:2625267757	KOCAELİ
97	İSMAİL SARIKAYA GERİ DÖNÜŞÜM HURDACILIK VE NAKLİYAT SANAYİ TİCARET LİMİTED ŞİRKETİ	Tavşancıl Mah. Kahramanlar Cad. 18 Pafta 5255 parsel Dilovası/ KOCAELİ tel:2627530577 fax:2625267757	KOCAELİ
98	PETFOR PETŞİŞE GERİ KAZANIM SAN. VE TİC. A.Ş. - GEBZE ŞUBESİ	BALÇIK KÖYÜ ORGANİZE CAD. NO:4 GEBZE/KOCAELİ tel:2627511424 fax:2627511424	KOCAELİ
99	NUH ÇİMENTO SANAYİ A.Ş. HEREKE ŞUBESİ	AKYAR MEVKİİ HEREKE - KÖRFEZ / KOCAELİ tel:2623162091 fax:0262 316 25 29	KOCAELİ
100	ROTA KAUÇUK VE PLASTİK SAN.TİC.A.Ş.	KONYA ORGANİZE SAN BÖL. T.ZİYAEDDİN CAD. NO: 29 tel:03322390940 fax:03322390420	KONYA
101	KONYA ÇİMENTO SANAYİA.Ş.	Horozluhan Mahallesi Cihan Sokak No:15 42300 Selçuklu/Konya tel:3323460355 fax:3323460365	KONYA
102	BAŞARANLAR DEMİR ÇELİK İNŞ. GERİ DÖNÜŞÜM SAN. VE TİC. A.Ş. MANİSA ŞUBESİ	ESKİ MENEMEN CAD. NO: 31 MURADİYE SAN. BÖLGESİ /MANİSA tel:02362140312 fax:02362140313	MANİSA
103	ÖMER DOĞAN DOĞAN GERİ DÖNÜŞÜM NAKLİYE SAN. VE TİC. SALİHLİ ŞUBESİ	Beşeylül Mah. 517 Sokak No:17 tel:2367134647 fax:2367134648	MANİSA
104	Aşuroğulları Tehlikeli Atıklar Ön İşl. Ara Depolama Nak ve Hurda San. Dış.Tic.Ltd.Şti.Manisa Şub.	İNÖNÜ MAHALLESİ DOKTOR ORHAN AKSOY CADDESİ NO:6 C/E BLOK PK:45140 MURADİYE/MANİSA tel:2362140206 fax:2362140180	MANİSA
105	ALTAŞ ATIK GERİ DÖNÜŞÜM HURDA METAL İNŞ. GIDA SANAYİ MAKİNALARI SAN. VE TİC. LTD. ŞTİ.AHMETLİ ŞUBESİ	ULUCAMİ MAHALLESİ, ANKARA-İZMİR ASFALTI ÜZERİ, KARAKAYA PETROL YANI, AHMETLİ tel:02367681474 fax:02367681474	MANİSA

106	SAHALAR METAL DEMİR ÇELİK HUR.NAK.HAFR.İNŞ.TAAH.İTH. İHR.SAN VE TİC. LTD.ŞTİ.	MURADİYE MAHALLESİ, MANOLYA SOKAK, NO:204 tel:02362140451 fax:02362140452	MANİSA
107	SÜREKO ATIK YÖNETİMİ NAKLİYE LOJİSTİK ELEKTRİK ÜRETİM A.Ş. KULA ŞUBESİ	ESENYAZI KÖY YOLU ÜZERİ SANDAL BELDESİ KULA/MANİSA tel:2368421010 fax:2368421030	MANİSA
108	Mezopotamya Plastik İnş.Nak.Pet.San.ve Tic.Ltd.Şti.	Organize sanayi bölgesi 1.bulvar MARDİN tel:0482 2151011 fax:0482 2151044	MARDİN
109	DOĞAN PLASTİK VE PETRO KİMYA SANAYİ VE T İC. LTD. ŞTİ	F.ŞALVUZ MH. MOLLA KERİM CD 93 TARSUS tel:03246160737 fax:03246160270	MERSİN
110	ÇİMSA ÇİMENTO SAN.VE TİC. A.Ş. MERSİN ÇİMENTO FABRİKASI ŞUBESİ	TOROSLAR MAH.TEKKE CAD.YENİTAŞKENT-MERSİN tel:3244540060 fax:3244540075	MERSİN
111	SERCAN MADENCİLİK HİZM.OTOM.İNŞ.GIDA NAKL.SAN.VE TİC.	ÇİLEK MH.TIRMIL SAN. SİTESİ AD BL. 27 MERKEZ tel:03242353541 fax:03242353542	MERSİN
112	TEKNİK MASURA AMB.KAĞIT GERİ DÖNÜŞÜM SAN VE TİC A.Ş.	MERSİN-TARSUS ORGANİZE SANAYİ BÖLGESİ 2. CADDE NO:3 AKDENİZ tel:03246764545 fax:03246764543	MERSİN
113	ÇİMSA ÇİMENTO SAN.VETİC.A.Ş. NİĞDE FABRİKASI	Hacı Sabancı Bulvarı PK. 21 51270 NİĞDE tel:3882323630 fax:3882323634	NİĞDE
114	ÜNYE ÇİMENTO SAN. VE TİC. A.Ş.	DEVLET SAHİL YOLU CEVİZDERE MEVKİİ PK.31 ÜNYE ORDU tel:04523211100 fax:04523211130	ORDU
115	KAHYA REJENERE KAUÇUK LASTİK TOZU İMALATI EĞLENCE SPOR KOMPLEKSİ ALIŞVERİŞ MRK. İŞL.SAN.TİC.LTD.ŞTİ.	TEM BAĞLANTI YOLU ÜZERİ YENİ MAH. MEVKİİHENDEK/SAKARYA tel:02646140886 fax:02646140887	SAKARYA
116	YEŞİLENERJİ BERTARAF GERİ KAZANIM SANAYİ VE TİCARET ANONİM ŞİRKETİ	PEKŞENLER MEVKİİ KOZLUK M.1 NOLU C. 20 ERENLER tel:2643535202 fax:2643535203	SAKARYA
117	BIOSUN PAMUKOVA KATI ATIK İŞLEME ENERJİ VE ÇEVRE SAN. VE TİC. A.Ş.	CUMHURİYET MAH. FATİH CAD. NO:301/1 PAMUKOVA/SAKARYA tel:02645515134 fax:02122782578	SAKARYA

118	TANRIKULU PLASTİK SAN. VE TİC. LTD. ŞTİ.(ADAPAZARI ŞUBESİ)	Dörtyol Sanayi Sitesi 17. Sk. No:39 tel:02642915401 fax:02642915402	SAKARYA
119	AKÇANSA ÇİMENTO SANAYİ VE TİC.A.Ş. SAMSUN LADİK ŞUBESİ	İskaniye Mah. Akpınar Mevkii 55760 Ladik/SAMSUN tel:3627713818 fax:3627713819	SAMSUN
120	LİMAK ÇİMENTO SANAYIVE TİCARET ANONİ M ŞİRKETİ	OYACIK KÖYÜ MEVKİİ SİİRT YOLU ÜZERİ 4.K 01 KURTALAN tel:04844112291 fax:04844112290	SİİRT
121	DÜNDAR TEKSTİL - AHMET BİLGEHAN DÜNDAR	YEŞİLTEPE MAH TABAKHANELER 3 SK. 11 B ÇORLU / TEKİRDAĞ tel:02826864555 fax:02826864540	TEKİRDAĞ
122	ŞİTAP TEKSTİL TURİZM İNŞAAT SANAYİ VE TİC.LTD.ŞTİ.	E5 KARAYOLU ÜZERİ SARAY ÇIKIŞ 1496 PARSEL VAKIFLAR KÖYÜ ÇORLU tel:0 282 675 15 65 fax:02826751564	TEKİRDAĞ
123	ALTEKS TEKSTİL ÜRÜN.İMLT.İTH.İHR.SAN VE TİC.LTD.ŞTİ.	Paskal Mevkii, Karıştıran Yolu Üzeri 2. Km tel:02823613105 fax:02823613116	TEKİRDAĞ
124	DENİZ OTOMOTİV İNŞAAT TEKSTİL SAN. VE TİC. LTD. ŞTİ.	AŞAĞI SEVİNDİKLİ KÖYÜ KORULAR MEVKİİ MURATLI/TEKİRDAĞ tel:0 282 373 74 75 fax:02823737890	TEKİRDAĞ
125	FIRAT ELYAF SANAYİ VE TİCARET A Ş	SEYMEN YOLU ÜZERİ 4.KM. ... MARMARAEREĞLİSİ tel:2826111000 fax:2826111001	TEKİRDAĞ
126	ŞİTEKS ŞİŞMANLAR TEKSTİL SANAYİ VE TİCARET ANONİM ŞİRKETİ	TEM Otoyolu Vakıflar Saray Çıkışı ,Saray Yolu 2.Km Beyazköy Saray tel:2827986893 fax:2827986886	TEKİRDAĞ
127	EKOLOJİK ENERJİ A.Ş. ÇORLU ŞUBESİ	HATİP MAHALLESİ KARATEPE KÜMEEVLERİ No: 16 ÇORLU / TEKİRDAĞ tel:2826731182 fax:2826731183	TEKİRDAĞ

128	UGS-UĞUR GERİ DÖNÜŞÜM VE ELYAF SAN.T İC.LTD.ŞTİ.	ULAŞ BELDESİ E5ÜZERİ MOTOR YERLERİ MEVKİİ ÇORLU tel:2826557110 fax:02826557109	TEKİRDAĞ
129	ADOÇİM ÇİMENTO BETON SAN.VE TİC.A.Ş. ARTOVA ŞUBESİ	ALPASLAN MAH. KEŞLİKÖZÜ MEVKİİ 60670 ARTOVA TOKAT tel:03566112500 fax:03566112232	TOKAT
130	UŞAK RENK TEKSTİL SAN.VE TİC.LTD.ŞTİ	ORGANİZE SANAYİ BÖL. 118 CADDE 486 . MERKEZ tel:2762667503 fax:2762667505	UŞAK
131	HASAN ÜLKÜ BAYKAL	MEHMET AKİF ERSOY MAH. KILCAN CAD. 15/B MERKEZ tel:2762314311 fax:2762314311	UŞAK
132	KANTTEKS TEKSTİL BOYA ŞİFONEZ GAR.NAK.SAN.TİC.LTD.ŞTİ.	ORG.SAN.BÖL. 101.CAD NO:59 tel:02762667313 fax:02762667413	UŞAK
133	NACİYE ULUDAĞ-ULUDAĞ TEKSTİL	MEHMET AKİF ERSOY MAH. ŞEHİT İSMAİL ÇETİN CAD. NO:196 MERKEZ tel:5326158148 fax:2762244555	UŞAK
134	BEPA GERİ DÖNÜŞÜM TEKSTİL DERİ SANAYİ VE TİCARET LİMİTED ŞİRKETİ	UŞAK ORGANİZE SANAYİ BÖLGESİ 108 CAD. 286 MERKEZ/UŞAK tel:2762668600 fax:2762668600	UŞAK
135	ÖNAL ELYAF TEKSTİL İNŞAAT NAKLİYE TURİZM HAYVANCILIK PAZARLAMA SAN.VE TİC.LTD. ŞTİ.	ORGANİZE SANAYİ BÖLGESİ 102.CADDE NO:6 MERKEZ/UŞAK tel:02762668808 fax:02762668806	UŞAK
136	SOM PAZARLAMA VE TEKSTİL SAN. VE TİC. A.Ş.	ORGANİZE SANAYİ BÖLGESİ 101. CADDE NO:33 tel:02762667238 fax:02762667239	UŞAK
137	BESNİ TEKSTİL SANAYİ VE TİC. A.Ş.	ORGANİZE SAN.BÖL. 106. CAD. 234 tel:02762667156 fax:02762667163	UŞAK
138	SARAR BATTANİYE TEKSTİL SAN. VE TİC. A.Ş.	ORGANİZE SAN.BÖLG. 102. CAD. 117 tel:02762667336 fax:02762667340	UŞAK
139	CCC TEKSTİL VE SANAYİ VE TİC. LTD. ŞTİ	BOZKUŞ KÖYÜ KÖY SOKAĞI 419 B/C tel:2762533248 fax:02762533249	UŞAK

140	POLAT İPLİK TEKSTİL SAN. VE TİC. LTD. ŞTİ.	ORGANİZE SAN. BÖLGESİ 101. CAD. NO:25-27 tel:2762667267 fax:2762667268	UŞAK
141	ÖZYÜREK ELYAF TEKSTİL VE GERİ DÖNÜŞÜM SANAYİ VE TİCARET LİMİTED ŞİRKETİ	ORGANİZE SAN.BÖL. 115.CAD. 455 MERKEZ tel:5363333850 fax:0	UŞAK
142	ÖZVARDAR GERİ DÖNÜŞÜM TAAHHÜT TEKSTİL İNŞAAT İÇ VE DIŞ TİCARET SANAYİ LİMİTED ŞİRKETİ	ORGANİZE SANAYİ BÖLGESİ 101. CAD. NO:5 (107 ADA, 3 PARSEL) tel:2762668080 fax:2762668087	UŞAK
143	KAVAK GIDA VE SAN. TİC. LTD. ŞTİ.	Organize Sanayi Bölgesi 120. cadde No:543 Merkez/ Uşak tel:2762667407 fax:2762667407	UŞAK
144	Nursa İplik San. ve Tic. A.Ş.-Uşak Şubesi	O.S.B. 105 cad. no: 190 tel:2762668000 fax:2762667581	UŞAK
145	MUZAFFER MERT TEKSTİL SAN. VE TİC. LTD. ŞTİ.	UŞAK ORGANİZE SANAYİ BÖLGESİ 102. CADDE NO:18 UŞAK/TÜRKİYE tel:02762667262 fax:02762667640	UŞAK
146	SARIKAYA HURDACILIKİNŞAAT NAK.TAAH. VE TİC.LTD.ŞTİ.	ÇAVUŞÇİFTLİK KÖYÜ ALTI D.Y. ALTI 012 000 ALTINOVA tel:02264612901 fax:4612901	YALOVA
147	YİBİTAŞ YOZGAT İŞÇİ BİRLİĞİ İNŞ. MALZ. TİC. VE SAN. A.Ş.	SARAY BELDESİ FATİH MAH. YİBİTAŞ BULVARI NO:29 tel:3545572150 fax:3545572161	YOZGAT

ANNEX E.2. *The List of Hydraulic Oil Recycling Facilities*

	Company	Address	Province
1	ASAŞ PETROL ÜRÜNLERİ GERİ DÖNÜŞÜM NAK. SAN. VE TİC. A.Ş	7408/1 SOKAK NO: 1 PINARBAŞI tel:02324785082 fax:02324785083	İZMİR
2	İSSAN KİMYA SAN. VE TİC. LTD. ŞTİ.	TUZLA KİMYACILAR ORGANİZE SANAYİ BÖLGESİ MELEK ARAS BULVAR ORGANİK CAD. NO: 32 TEPEÖREN-TUZLA-İSTANBUL tel:02165930024 fax:02165933346	İSTANBUL
3	KOZA SINAİ YAĞLAR SANAYİ VE TİCARET LİMİTED ŞİRKETİ	ORG SAN BÖLG 2 KIS HEMA YOLU 942 ADA 1 B ÇERKEZKÖY tel:2827268997 fax:2827264308	TEKİRDAĞ
4	LUREC KİMYA VE DESTİLASYON SANAYİ VE TİC.LTD.ŞTİ.	SANAYİ MH AÇELYA SK 37 İZMİT tel:2623354444 fax:2623354445	KOCAELİ
5	ÖZMOBİL MADENİ YAĞLAR ÜRETİM PAZARLAMA TİC.SAN.LTD.ŞTİ.	ORGANİZE SANAYİ BÖLGESİ 2.CAD.NO:15 VAN tel:04322286226 fax:04322286227	VAN
6	ATABERK ENDÜSTRİ KİMYA NAK. SAN. TİC. LTD. ŞTİ.	OSMANGAZİ MAH SANAYİ CD. ÜRETİM SK 7 DARICA tel:0 262 653 34 00 fax:2626534599	KOCAELİ
7	PETKO KİMYA ATIK YAĞ SİNTİNE VE SOLV. GERİ KAZ. MADENİ VE END. YAĞ BİYODİZEL PETROL SAN. TİC A.Ş.	DOSB 2. KISIM D-2022 SOK NO:10 DİOVASI / KOCAELİ tel:02627549600 fax:02627549605	KOCAELİ

8	ÖZ BADAY PETROL ÜRÜN. MAD. İNŞAAT NAK. TAR. SAN. VE TİC. LTD. ŞTİ.	ORGANİZE SANAYİ BÖLGESİ 20. SOKAK NO:10/1 KIZILTEPE/MARDİN tel:04822131086 fax:04822124199	MARDİN
9	PETROTEK GERİ DÖNÜŞÜM NAKLİYAT ENERJİ PETROL KİMYA SANAYİ VE TİCARET LİMİTED ŞİRKETİ	BÜYÜK KAYACIK MH. 3.ORGANİZE SAN BÖLGESİ KUDDUSİ CAD NO:4 tel:03322390777 fax:03322390778	KONYA
10	TEMEL ÇEVRE TEKNOLOJİLERİ VE KİMYA SAN. TİC. LTD. ŞTİ.	ORGANİZE SANAYİ BÖLGESİ 2. CADDE NO 24 AFYONKARAHİSAR tel:2211648 fax:2211644	AFYONKARAH İSAR
11	ŞAH-SAN MADENİ YAĞ. NAK. İNŞ. VE TUR. SAN. TİC. LTD. ŞTİ.	İSTASYON MAHALLESİ SANAYİ SİTESİ 6. CADDE NO:6-7 tel:3425130612 fax:3425130613	GAZİANTEP
12	SARALAN ATIKYAĞ VE GERİ DÖNÜŞÜM İÇ VE DIŞ TİCARET	ANKARA ASFALTI 27.KM ANSIZCA KÖYÜ tel:232 878 65 03 fax:02328786647	İZMİR
13	ÖZKALE KİMYA PET.TEM.GIDA ÜR.SAN.TİC.LTD.ŞTİ	2.ORG.SAN.BÖLGESİ 6.CADDE NO:3 tel:4222440007 fax:4222440008	MALATYA
14	ENGİN GERİ KAZANIM TESİSLERİ PETROL ÜRN. SAN.VE TİC.LTD.ŞTİ.	GÖKÇE YURT MAHALLESİ SAMSUN DEVLET YOLU NO:364 Mamak / Ankara tel:3125980178 fax:3125980434	ANKARA
15	ORÜSAN KİMYA VE AKARYAKIT ÜRÜN. SAN. TİC. LTD. ŞTİ.	İSTANBUL TUZLA KİMYA SANAYİCİLERİ ORGANİZE SANAYİ BÖLGESİ, MELEK ARAS BULVARI, ANALİTİK CADDESİ, N:86 tel:2165931773 fax:2165931774	İSTANBUL
16	DENGE PETROL SAN. VE TİC.İTH.İHR.PAZ.LTD.ŞTİ.	ANKARA İSTANBUL YOLU 30.KM.	ANKARA

		tel:3124325011 fax:03124354255	
17	SAR-PET PET. PAZ. VE NAK. LTD. ŞTİ.	ORGANİZE SANAYİ BÖLGESİ 1. KISIM 7. CADDE DÖŞEMEALTI/ANTALYA tel:02422581500 fax:02422581685	ANTALYA
18	SUDEOİL PETROL ÜRÜNLERİ SAN. VE TİC. LTD. ŞTİ.	HAVAALANI SANAYİ BÖLGESİ TURGUT ÖZAL SANAYİ SİTESİ 12 NOLU CADDE NO:20/A tel:3424771407 fax:3424771406	GAZİANTEP
19	ŞAHİNBEY DENİZCİLİKPETROL ÜRÜN.SAN. VE TİC.LTD.ŞTİ.	TURGUT ÖZAL SANAYİ SİTESİ KORAY AYDIN CADDESİ NO:6 tel:3424771604 fax:3424771605	GAZİANTEP
20	PAR-SAN MADENİ YAĞ GERİ DÖNÜŞÜM NAK. İNŞ. SAN. VE TİC. LTD. ŞTİ.	İstasyon Mahallesi Sanayi Caddesi No:30 tel:3425178925 fax:3425130800	GAZİANTEP
21	ÇEV-PET PETROL ÜRÜNLERİ GERİ DÖN. KİM. NAK. SAN.TİC. A.Ş (Konya Tesisi)	Ereğli Yolu Üzeri No:159/A tel:0 332 255 57 21 fax:03322555724	KONYA
22	ÇEVKİM KİMYA GERİ DÖNÜŞÜM SANAYİ VE TİCARET LİMİTED ŞİRKETİ	DİLOVASI ORG.SAN.BÖL 1.KISIM EYNELCE CAD 19 DİLOVASI tel:2627546266 fax:2627546268	KOCAELİ
23	BİLGİN DOĞAL ENERJİVE END.KİM.SAN.T İC.LTD.ŞTİ. GÖNEN ŞUBESİ	BANDIRMA ORGANİZE SANAYİ BÖLGESİ TAŞTEPE MEVKİİ B BLOK NO : 6 / 1 tel:02667811024 fax:02667811028	BALIKESİR
24	ASLANLI OTELCİLİK TUR.İNŞ.MİM.MÜH.HİZM.GIDA.TAR.HA YV. BİO.PET.ÜRÜN.SAN.VE.TİC.LTD.ŞTİ.	ORGANİZE SAN.BÖL. 102 ADA 5 NOLU PARSEL DİYARBAKIR tel:04123450196 fax:04123450197	DİYARBAKIR

25	ACIÖZ PETROL HURDACILIK NAKLİYE DEMİR ÜRÜNLERİ SAN. VE TİC. LTD. ŞTİ.	3.ORGANİZE SANAYİ BÖLGESİ T.ZİYAETTİN CAD. 7.SK NO:21 tel:03322391954 fax:03322391957	KONYA
26	ASLANLI TARIM ÜRÜNLERİ İNŞAAT PETROL GIDA NAKLİYAT İTHALAT İHRACAT SANAYİ VE TİCARET ANONİM ŞİRKETİ	Siirt Yolu Üzeri 5. km, Kösetarla Köyü, Karamok Mevkii, 2 Pafta, Parsel 346 tel:4882211761 fax:4882211763	BATMAN
27	AKSÜS YAPI VE ENTEGRE ATIK İŞLETMELERİ SAN. VE TİC. A.Ş. LÜLEBURGAZ ŞUBESİ	E-5 Karayolu üzeri Evrensekiz KAvşağı Lüleburgaz tel:2884438047 fax:2884438046	KIRKLARELİ
28	KÜTAHYA ENERJİ GERİ DÖNÜŞÜM KİM.MAD.YAGPET.EL.SAN.TİC.A.Ş.	ORGANİZE SAN. BÖLGESİ 5. CAD. NO:2 KÜTAHYA tel:2742662542 fax:2742662541	KÜTAHYA
29	ÇİNKANLAR KİMYEVİ MADDELER TİCARET V E SANAYİ A.Ş.	K.O.S.B. MAH. İZMİR ANKARA ASFALTI NO:328/5 (ANSIZCA) KEMALPAŞA/İZMİR tel:2328783333 fax:2328788118	İZMİR
30	ARCAN PETROL YAPI TEMİZLİK İNŞAAT TEKSTİL MAKİNE SANAYİİ VE TİCARET LİMİTED ŞİRKETİ	KOÇÖREN KÖYÜ 2. ORGANİZE SANAYİ BÖLGESİ 2. CAD. NO:27/1 tel:4143691144 fax:4143691155	ŞANLIURFA
31	İBRAHİM KARAKAYA	BOZBURUN MAH. AHMET NURİ ERİKOĞLU CAD. 7114 SOK. NO:7 DENİZLİ tel:2583716076 fax:2583716076	DENİZLİ
32	F-B OİL PETROL ÜRÜNLERİ MADENİ YAĞ ATIK GERİ KAZANIMI TESİSİ VE BİODİZEL ÜRETİMİ DAĞITIM PAZARLAMA SAN. VE TİC. LTD. ŞTİ.	OSMANİYE ORGANİZE SANAYİ BÖLGESİ OSMANİYE CADDESİ NO:24 tel:03288268427 fax:03288268426	OSMANİYE
33	KOZA SINAİ YAĞLAR SAN.VE TİC.LTD.ŞTİ. Çorlu Şubesi	Ulaş Mah. Asfalt Boyu Küme Evler No:18/A Ergene TEKİRDAĞ tel:2827253824 fax:2827264308	TEKİRDAĞ

ANNEX F. *Questionnaires for Industries*

F.1. Questionnaire for Metal Plating Industry

Name and address of plating industry:

Name and contact details of the respondent:

Type of plating process:

a. Chromium
b. Nickel
c. Other (please speficy) : ………..……..……..……..……

Chemicals used in the process (Please submit MSDS if possible)

Name of chemical mixture	**CAS number**	**Time span of use**	**Quantity/year)**	**Contains PFOS related chemicals**		
				Unknown	**Yes**	**No**

If PFOS, salt of PFOS or PFOS precursors are used; Please provide details of the chemical mixtures and their contents in the table.

Name of chemical mixture	**PFOS or PFOS related chemical**			**Function (foam suppressant, wetting agent etc.)**	**Quantity /year**
	CAS number	**Name**	**Content in mixture (%)**		

Stockpiles of chemical mixtures

Product Name/Name of chemical mixture	PFOS or PFOS related chemicals			Quantity	Storage conditions	Location
	CAS number	Content (%)	Name			

How is the waste from the metal plating process managed?

a. Deposited on the factory area
b. Destroyed in a waste treatment facility
c. Sent to a landfill
d. Use on agricultural area
e. Reuse of plating bath

Please specify:

Type of waste	Waste treatment
Chemicals becoming waste	
Plating bath when becoming waste	
Waste sludge from the waste water treatment of the rinsing water	

Please name the suppliers/producers of the chemical mixtures used in the metal plating process

Name of company	Product	Contact information

F.2. Questionnaire for Textile Manufacturers And Retailers

Name and address of the industry: ____
Name and contact details of the respondent: ____

Select the type of activity of your textile business that apply

Impregnation or coating of textiles	☐
Import of impregnated or coated textiles	☐
Manufacturing of clothing, apparel, upholstery, furniture made with impregnated textiles	☐
Import of clothing, apparel, upholstery, furniture made with impregnated textiles	☐
Disposal of clothing, apparel, upholstery, furniture made with impregnated textiles	☐
Bulk sale of clothing, apparel, upholstery, furniture made with impregnated textiles	☐
Retail sale of clothing, apparel, upholstery, furniture made with impregnated textiles	☐
Cleaning or repair of clothing, apparel, upholstery, furniture made with impregnated textiles	☐
Recycling of clothing, apparel, upholstery, furniture made with impregnated textiles	☐

Indicate the amount of textile types you deal with

	Estimated amount per year
Textiles for clothing	
Textiles for upholstery	
Textiles for cleaning or repair?	
Textiles for disposal	
Textiles for apparel	
Textiles for furniture	
Textiles for recycling to produce other products	
Others (Please specify):	

Indicate the properties of the textiles you deal with:

Water resistant/repellent	☐
Synthetic	☐
Oil and grease resistant	☐
Stain resistant	☐
Other **Please specify:**	☐

Please define details of chemicals that have been used for impregnation or coating of textiles in the textiles/products you deal with or manufacture?

Name of chemical mixtures	CAS number*	Type of textile/product	Weight ratio applied (%wt%)*	Contain PFOS or PFOS related chemicals (unknown, yes or no)

*Fill in the information available from safety data sheets or suppliers/producers.

If PFOS, salt of PFOS or PFOS precursors are used; List the chemical mixtures and their contents in the table.

Name of chemical mixture	PFOS or PFOS related chemical			Quantity /year
	CAS number	Name	Content in mixture (%)	

How are the wastes managed in the facility ?

a. Deposited on the factory area
b. Destroyed in a waste treatment facility
c. Sent to a landfill
d. Use on agricultural area
e. Reuse of plating bath

Please specify:

Type of waste	**Waste treatment**
Chemicals becoming waste	
Materials becoming waste	
Waste sludge from the waste water treatment of the rinsing water	

If you are a supplier/producer or downstream user of textiles, upholstery, clothing or apparel please name the company you sell to or buy from:

Name of company	**Product**	**Contact information**

Please specify the suppliers/producers of the chemical mixtures/materials used in the manufacturing process

Name of company	**Product**	**Contact information**

Stockpiles of PFOS containing chemicals or wastes

Product Name/Name of chemical mixture	Product code or number/ CAS number	Storage conditions	Quantity	Name of PFOS or PFOS related substance	CAS number	Content of PFOS or PFOS related substances (%)	Location

Are you aware of locations contaminated with PFOS or PFOS related substances?

Location	Type of contamination	Type of activity at the location	Have the site been investigated? (do not know, yes or no)	Levels of PFOS and PFOS related substances (if available)

F.3. Questionnaire for Synthetic Carpets Sector

Name and address of the industry:

___

Name and contact details of the respondent:

___

Select all types of activity of your business that apply

Production of synthetic carpets	☐	Retailers of synthetic carpets	☐
Import of synthetic carpets	☐	Export of synthetic carpets	☐
Cleaning and reimpregnation of synthetic carpets	☐	Waste disposal of synthetic carpets	☐
Recycling of synthetic carpets to produce materials for other consumer products	☐	Others (Please specify):	

Specify the amount of synthetic carpet types do you deal with:

3-year average amounts of synthetic carpets per year	
Synthetic carpets for households	
Synthetic carpets for hotels	
Synthetic carpets for cars	
Synthetic carpets for trains	
Synthetic carpets for any other indoor use	
Synthetic carpets for outdoor use	
Old synthetic carpets for reuse or recycling	
Others (Please specify):	

Indicate the properties and amounts of the carpets you deal with:

Average amount of products per year (kg and/or m2)			
Water resistant/repellent		Stain resistant	
Synthetic		Dirt resistant/repellent	
Oil and grease resistant		Contain flame retardants	
Other		Please specify	

What chemicals have been used for impregnation or coating of carpets you deal with or manufacture?

Name of chemical mixtures*	**Product code or number/*** **CAS number**	**Type of carpet**	**Weight ratio applied** [wt%]	**Contain PFOS or PFOS related substances (unknown, yes or no)**

* Fill in the information available from safety data sheets or suppliers/producers.

If you are aware that any of the chemicals used contain PFOS, salt of PFOS or PFOS precursors, list the chemical mixtures and their contents in the table.

Name of chemical mixtures*	Name of PFOS or PFOS related substances	CAS number	PFOS or PFOS related substances in mixture	
			% Content	Quantity/year

* Fill in the information available from safety data sheets or suppliers/producers.

How are wastes managed in the facility:

Type of waste	Waste treatment*
Chemicals becoming waste	
Materials becoming waste	
Waste sludge from the waste water treatment of the rinsing water	

*(A. deposited on the factory area, B. destroyed in a waste treatment facility, C. Sent to a landfill, D. Use on agricultural area, E. please specify)

If you are a supplier/producer or downstream user of synthetic carpets please name the company you sell to or buy from:

Name of company	Product	Contact information

Please specify the suppliers/producers of the chemical mixtures/materials used in the manufacturing process

Name of company	Product	Contact information

Stockpiles of PFOS containing chemicals or wastes

Product Name/Name of chemical mixture	Product code or number/ CAS number	Storage conditions	Quantity	Name of PFOS or related substance	CAS number	Content of PFOS or its related chemicals (%)	Location

Are you aware of locations contaminated with PFOS or its related substances ?

Location	Type of contamination	Type of activity at the location	Have the site been investigated? (unknown, yes or no)	Levels of PFOS and its related substances (if available)

F.4. Questionnaire for Pulp and Paper Industries

Name and address of the paper producer or retailer:

___

Name and contact details of the respondent:

___

State the type of technology you use in your production

___

___

What type of papers do you produce?

Uncoated wood free printing and writing papers	☐
Coated wood free printing and writing paper	☐
Coated papers for water and oil/grease repellence	☐
Tissue paper	☐
Recycled paper	☐
Speciality paper	☐
Tissue paper	☐
Other paper (please specify) ____________________	☐

What chemicals have been used for impregnation or coating of paper or paperboard in the products you manufacture or recycle?

Name of chemical mixtures	**Product code or number/ CAS number**	**Type of textile/product**	**Weight ratio applied**	**Contain PFOS or PFOS related substances (unknown, yes or no)***
			[wt%]	
			[wt%]	
			[wt%]	

***Fill in the information available from safety data sheets or suppliers/producers.

If you are aware that any of the chemicals used contain PFOS, salt of PFOS or PFOS precursors, list the chemical mixtures and their contents in the table.

Name of chemical mixtures	CAS number	PFOS or PFOS related substances		
		Name of the substances	Content in mixture (%)	Quantity/year

***Fill in the information available from safety data sheets or suppliers/producers.**

Does any of these chemicals contain other fluorinated carbons?

a) Yes
b) No
c) Unknown

What chemicals and amount?

Name of chemical	Product code or number	Weight ratio applied per synthetic carpets
		[wt%]
		[wt%]
		[wt%]

How are wastes managed?

Type of waste	Waste treatment*
Chemicals becoming waste	
Materials becoming waste	
Waste sludge from the waste water treatment of the rinsing water	

(Fill in according to the following options: A. deposited on the factory area, B. destroyed in a waste treatment facility, C. Sent to a landfill, D. Use on agricultural area, E. please specify)

Stockpiles of PFOS containing chemicals or wastes

Product Name/Name of chemical mixture	Product code or number/ CAS number	Storage conditions	Quantity	PFOS or related substances			Location
				Substance Name	Content in Mixture %	CAS number	

Are you aware of locations contaminated with PFOS or PFOS related substances?

Location	Type of contamination	Type of activity at the location	Have the site been investigated?			Levels of PFOS or PFOS related substances
			Unknown	Yes	No	

If you are a supplier or downstream user of paper or packaging please name the company you sell to or buy materials/chemicals from:

Name of company	Product	Contact information

Please specify the suppliers/producers of the chemical mixtures used in the manufacturing process

Name of company	Product	Contact information

F.5. Questionnaire for Semi-Conductor Industry, Electronic Industry and Photographic Industry

Name and address of the facility:

____

Name and contact details of the respondent:

____

Tick process stages that apply for your company

Photoresist and anti-reflective coating	☐	Photo-mask	☐
Etching agent for compound semi-conductors and ceramic filters	☐	Edge bead removers	☐
De-gluing agents	☐	Developing agent	☐
Metal plating in closed loop system	☐	Hard metal plating	☐
Decorative metal plating	☐	Desmear agent	☐
Dispersion	☐	Surface treatment	☐
Solder	☐	Paint	☐
Adhesive	☐	Photoimaging	☐
Others (Please specify):			

<u>Please complete the table below</u>

Type of sector	3-year average production of electronic devices per year
	[kg]
	[kg]
	[kg]
	[kg]

Please indicate if your process uses PFOS-contained chemicals? No ☐ Yes ☐

<u>If the answer is yes, please specify the annual amount of PFOS used</u>

Chemical's agent	Name of chemical mixture/agent	Name of PFOS or PFOS related substances	Content of PFOS or PFOS related substances [wt%]	The amount of chemical mixture/agent used in the past and planned to be used in the future [kg]					
				Year					
Etching agent									
Photoresist substance									
Photo-acid generator									
Surfactant									
Anti-reflective coating agent									
Solder									
Adhesive									
Paint									
Photoimaging									
Metal plating									
Photo-mask									
Edge bead removers									
Developing agent									
Hard metal plating									
Desmear agent									
Surface treatment									

Obsolete Stockpiles

Name of chemical agent	Product code or number/ CAS number	Storage conditions	Quantity [kg]	Name of PFOS or related substance	CAS number	Content of PFOS or related substance [wt%]	Location
Etching agent							
Photoresist substance							
Photo-acid generator							
Surfactant							
Anti-reflective coating agent							
Solder							
Adhesive							
Paint							
Photoimaging							
Metal plating							
Photo-mask							
Edge bead removers							
Developing agent							
Hard metal plating							
Desmear agent							
Surface treatment							
Mist supressant							
Galvanic bath							

21

How are the PFOS containing waste rejects from your sector processes managed?

(a) Deposited near the factory area	☐	(b) Destroyed in a waste treatment facility	☐
c) Sent to a landfill (name/address)	☐	(d) Other (please specify) _______________	☐

Are you aware of locations contaminated with PFOS or its related substances?

Location	**Type of contamination**	**Type of activity at the location**	**Have the site been investigated? (do not know, yes or no)**	**Levels of PFOS and its related substances (if available)**

If you are a supplier or downstream user of manufactured or semi-manufactured goods please name the company you sell to or buy from:

Name of company	Product	Contact information

Please name the suppliers/producers of the chemical mixtures used in the manufacture processes

Name of company	Product	Contact information

F.6. Questionnaire for Chemical Industries And Product Suppliers

Name and address of the chemical industry:

____

Name and contact details of the respondent:

____

Please select your activities:

Producer of chemicals or products ☐

Supplier of chemicals or products ☐

Downstream user of chemicals or products ☐

Please specify type of chemicals or products you produce or supply:

PFOS or its related substances	☐	Impregnation/coating formulas for textiles	☐
Fire fighting foam	☐	Impregnation/coating formula for carpets	☐
Aviation hydraulic fluids	☐	Impregnation/coating formula for leather	☐
Insecticides	☐	Impregnation/coating formula for paper and packaging	☐
Drilling fluids	☐		
Chemicals for use in the metal plating industry	☐	Chemicals for use in the electronic industry	☐
Chemiclas for use in the semi-conductor	☐	Chemicals for use in the photographic industry	
Chemical mixtures/agents, Please specify	☐	Products, such as waxes, shampoos, sealants, paint, coating, household and industrial surfactants etc. Please specify	☐

Others (Please specify):			

What kind of PFOS or PFOS related substances, chemicals or products containing those substances does your company produce, supply or use?

Name of chemical or product	Product code or number/ CAS number	Yearly amount produced, consumed or supplied (kg)	Name of PFOS or PFOS related substances	CAS number	Content of PFOS or PFOS related substances (%)

How are the PFOS containing waste rejects from your sector processes managed?

(a) Deposited near the factory area	☐	(b) Destroyed in a waste treatment facility	☐
c) Sent to a landfill (name/address)	☐	(d) Other (please specify) _______________	☐

Stockpiles of PFOS containing chemicals or wastes

Product Name/Name of chemical mixture	Product code or number/ CAS number	Storage conditions	Quantity	Name of PFOS or related substance	CAS number	Content of PFOS or its related chemicals (%)	Location

Are you aware of locations contaminated with PFOS or its related substances?

Location	**Type of contamination**	**Type of activity at the location**	**Have the site been investigated? (do not know, yes or no)**	**Levels of PFOS and its related substances (if available)**

Please name the company you sell chemicals or products to or buy from:

Name of company	Product	Contact information

F.7. Questionnaire for Retailers of Commercial Products

Name and address of the retailer:

Name and contact details of the respondent:

Does your store sell any of the following products?

a) Furniture	Yes ☐	No ☐
b) Shoes	Yes ☐	No ☐
c) Leather	Yes ☐	No ☐
d) Textiles	Yes ☐	No ☐
e) Clothing and apparel	Yes ☐	No ☐
f) Synthetic carpets	Yes ☐	No ☐
g) Industrial and household cleaning products	Yes ☐	No ☐
h) Hygienic articles and cosmetics,	Yes ☐	No ☐
i) Other	Yes ☐	No ☐

Does the product(s)/article(s) you sell have or provide the following properties:

Water resistant/repellent	☐	Stain resistant	☐
Oil and grease resistant	☐	Dirt resistant/repellent	☐
Other	☐	Please specify	

To your knowledge do any of the products/articles you sell contain or has been surface treated with PFOS or its related substances?

Yes ☐ No ☐ Don’t know ☐

If yes please specify:

Type of product	Name of chemical	CAS no.	Trade name	Content (wt %)	Sales/ yr

How do you manage wastes?

Type of waste	**Waste treatment ***

*Deposited on a landfill/deposited in the company area/incinerated etc.

Do you have stockpiles of products/articles treated with or containing PFOS or its related substances?

Type of product/article	**Storage conditions**	**Quantity**	**Name of chemical**	**CAS number**	**Content of PFOS or its related substances (wt %)**	**Location**

Please name the supplier of the commercial products you sell

Name of company	Product	Contact information

F.8. Questionnaire for Fire Fighting Foams

Name and address of fire fighting agency or factory/entity using or having used fire figthing foams (with the FFF category)

Name of fire fighting agency/factory/facility/installation/organization	Address

Name and producer (seller) of currently used fire fighting foams (Please attach safety data sheet if available)

Name of currently used fire fighting foams	Producer of the fire fighting foams	Product code or number/CAS number	Amount in storage (wt)	Year of purchase

Content of chemicals

Name of currently used fire fighting foams	Content of chemicals	CAS number	Content of PFOS or PFOS related substances (yes (wt%), unknown or no)

(Check with the safety data sheet if available. Data on chemicals listed as fluorsurfactant, surfactant or surfactant agent, is especially of interest. Please indicate if data on those chemicals are not provided in the safety data sheet. If possible check with producer.)

Usage frequency, location and amount of fire fighting foam use for training purpose

Number of times used/year	Total amount used/year	Training location (detail address)

Location and amount of fire fighting foam used in actual fire events (for the past 20 years)

S/N	Location of large fire event	Date	Type of fire fighting foam used	Rough amount used

(Use additional sheets, if necessary)

How do you manage waste generated from application of fire fighting foam in your organization?

(a) Deposited in the area ☐ (b) Destroyed in a waste treatment facility ☐

(c) Sent to a landfill (name/address) ☐ (d) Other paper (please specify) ☐

Stockpiles of PFOS containing chemicals or wastes

Name of fire fighting foam	Product code or number/ CAS number	Storage conditions	Quantity	Name of PFOS or related substance	CAS number	Content of PFOS or related chemical (%)	Location	Year of purchase

8. Have the training site/site of accident fires been investigated?

Yes □ No □ Don’t know □

If Yes:

Location	**Fire fighting foam used at the location**	**Levels of PFOS and its related substances in the fire fighting foam used (if available)**	**Levels of PFOS or its related substances at the site (If available: levels in soil/water/sediments)**

9. Please name the supplier of the fire fighting foam you use

Name of company	Product	Contact information

Name and contact details of the respondent:

____

F.9. Questionnaire for Waste Treatment Facilities

Name and address:

Name	Address

Please indicate the type of waste management facility you administer:

i. **a) Landfill** ☐
ii. **b) Incinerator** ☐
iii. **c) Waste water treatment facility** ☐

If you administer a waste treatment plant, please indicate what type of waste water you receive:

i. **Industrial waste water** Yes ☐ No ☐
ii. **Waste water from households** Yes ☐ No ☐

How do you manage the sewage sludge?

(a) Deposited on agriculture land	☐	(b) Destroyed in a waste treatment facility	☐
c) Sent to a landfill (name/address)	☐	(d) Other (please specify) _______________	☐

To your knowledge does the sewage sludge contain PFOS or PFOS related substances?

Yes ☐ No ☐ Don't know ☐

If yes, please specify if possible

Name of chemical	Content (wt %)

If you administer landfills or incinerators please indicate what kind of waste products you accept/receive:

a) Furniture	Yes ☐	No ☐
b) Shoes	Yes ☐	No ☐
c) Leather	Yes ☐	No ☐
d) Textiles	Yes ☐	No ☐
e) Clothing and apparel	Yes☐	No ☐
f) Synthetic carpets	Yes ☐	No ☐
g) Industrial and household cleaning products	Yes ☐	No ☐
h) Hygienic articles and cosmetics,	Yes ☐	No ☐
i) Chemical stockpiles	Yes ☐	No ☐
J) Industrial waste	Yes ☐	No ☐
i) Other	Yes ☐	No ☐

To your knowledge does any of the products you store or burn contain or has been surface treated with PFOS or PFOS related substances?

Yes ☐ No ☐ Don't know ☐

If yes please specify, if possible:

Type of product	Name of chemical	Content (wt %)	Yearly quantity (wt)

Please name the supplier of the waste you deal with

Name of company	Waste	Contact information

ANNEX G. **Leachate Treatment Activities in Turkey**

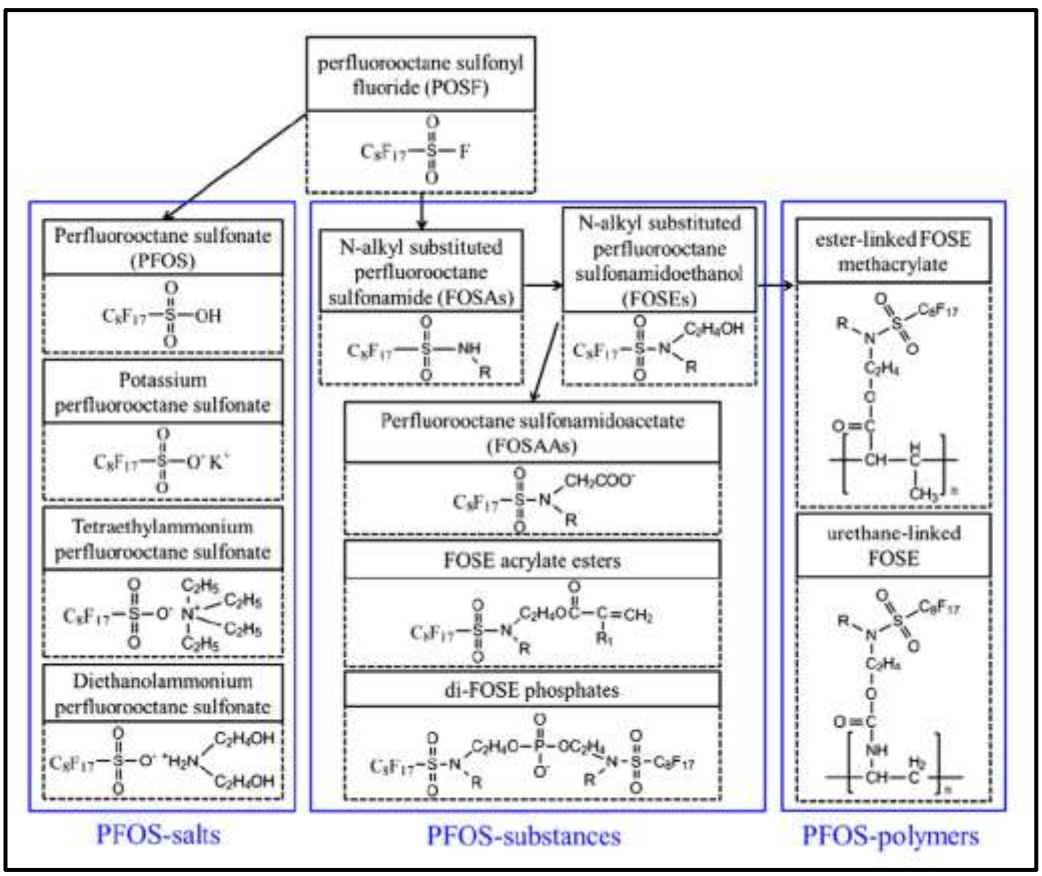
(Öztürk, İzzet; MoEU, CYGM, 2010)

Leachate treatment plants, shown in red color on the map, include reverse osmosis, membrane bioreactor and nanofiltration, anaerobic+aerobic biological treatment and chemical treatment options. 27% of treated leachate is forwarded to urban WWTPs. 21% is recycled back to the landfill and 12% are discharged to rivers/creeks. The remaining part is used for fire fighting purposes and/or kept at evaporation pools.

ANNEX H. Actual Capacity of Turkish Civil Aviation Industry (TOBB, 2013)

Companies	Main Authorizations	Total Personnel	Engineer Technician	Hangar Position	Total Area Use (m^2)	No. of Serv. Aircraft	No. of Serviced Component
THY Technic	EASA PART 21-J.418 EASA/SHY Part 145 EASA/SHY Part 147 ABD/DOT - FAA	2.021	230+1.390	4	93500[4]	481	70.564[5]
MNG Technic	EASA/SHY Part 145 EASA/SHY Part 147 SHY-33A FAR CFR-49	840	648	4	25.000	98	7.145
MRO Technic	EASA/SHY Part 145 SHY Part 147 SHY-33A	550	265	1	35.000	78	2.125

ANNEX I – Structure of Different PFOS Related Substances (Xie, et al., 2013)



ANNEX J. **PFOS in Different Media**

Region	PFOS Concentration in House Dust (ηg/g)					Media
	Q10	Q25	Q50	Q75	Q90	
Japan[13]	11		200		2500	(European Food Safety Authority, 2008)
Canada	4,6		443,68		5056	(European Food Safety Authority, 2008)
Japan[14]			19.2			(Lien, Tanaka, & Fujii, 2008)
Japan[3]			97.4			(Lien, Tanaka, & Fujii, 2008)
Japan[3]			72.2			(Filipovic, Berger, & McLahn, 2013)
Japan[3]					427,4	(Lien, Tanaka, & Fujii, 2008)
Japan[3]					168	(Lien, Tanaka, & Fujii, 2008)
Japan[3]			103,9			(Lien, Tanaka, & Fujii, 2008)

Region	PFOS Concentration in Indoor Air Dust[15] (ηg/m3)					
	Q10	Q25	Q50	Q75	Q90	
			0,022			(European Food Safety Authority, 2008)
			0,0474			(European Food Safety Authority, 2008)

Region	PFOS Concentration in Air (ng/m3)					
	Q10	Q25	Q50	Q75	Q90	
UK	0,041				0,051	(European Food Safety Authority, 2008)
UK	0,0009				0,0071	(European Food Safety Authority, 2008)
Norway	0,0009				0,0011	(Filipovic, Berger, & McLahn, 2013)
Japan	0,0006				0,0053	(Lien, Tanaka, & Fujii, 2008)
Japan	0.00046	0.0007		0.0052	0.0098	(Lien, Tanaka, & Fujii, 2008)
Japan			0,0068			(Lien, Tanaka, & Fujii, 2008)
Canada	0,0025				0,0081	(Filipovic, Berger, & McLahn, 2013)

[13] Analysis were carried out on dust taken from vacuum cleaners
[14] Analysis were carried out on “ambient air”dust.
[15] Default dust level in air is 50 μg/m3

Region	PFOS concentration in Surface Water (ηg/L)					Source
	Q10	Q25	Q50	Q75	Q90	
Europe	1	1,30	5	8	21	(European Food Safety Authority, 2008)
Asia	0,4	0,5	1,10	3,65	7,86	(European Food Safety Authority, 2008)
North America	1,6	1,70	2,85	4,90	5,47	(European Food Safety Authority, 2008)
U.S.A	16				41	(Schaider, Rudel, & Ackerman, 2014)
Japan	0,6		2,4		49	(Lien, Tanaka, & Fujii, 2008)
Japan	0,4		3,8		46	(Lien, Tanaka, & Fujii, 2008)
Japan	0,8		5,6		123	(Lien, Tanaka, & Fujii, 2008)
Pacific	0,003				0,02	(NPCA, 2008)
North Atlantic	0,001				0,05	(NPCA, 2008)
Tokyo Bay	13				25	(NPCA, 2008)
USA,Great Lakes	11				121	(NPCA, 2008)
Artic, Resolute Lake	49				90	(NPCA, 2008)
North Sea	0,03				7,3	(NPCA, 2008)
Po, Italy	2				12	(NPCA, 2008)
Möhne	135				405	(NPCA, 2008)
Steinbecke	3160				5900	(NPCA, 2008)

Region	PFOS Concentration in Drinking Water (ηg/L)					
	Q10	Q25	Q50	Q75	Q90	
Europe	0,64	1	1	6	8,10	(European Food Safety Authority, 2008)
Asia	0,015	0,1	1,25	2,83	6,3	(European Food Safety Authority, 2008)
Several	0,350	0,680	1,70	4,90	8,10	(European Food Safety Authority, 2008)
Europe	1,0	1,0	5,0	8,0	18,0	(European Food Safety Authority, 2008)
USA	1				97	(Schaider, Rudel, & Ackerman, 2014)
USA			4000[16]			(UNIDO, 2012)
Germany			3000[1]			(UNIDO, 2012)

[16] Normative level of PFOS according to (UNIDO, 2012)

Germany			1000[17]			(UNIDO, 2012)
San Jose, USA	31				192	(NPCA, 2008)
Ohio	<2				22	(NPCA, 2008)
Japan	0,16				22	(NPCA, 2008)

Concentration of PFOS in Aquatic Organisms (European Food Safety Authority, 2008)

Region	**PFOS Concentration in Fish Products (ηg/g)**				
	Q10	**Q25**	**Q50**	**Q75**	**Q90**
Several	0,351	1,31	14,6	77	120
Europe	2,13	5,73	65,1	79,5	147
Europe	0,992	2,13	5	12	37,8
Asia	0,612	0,860	0,920	2,56	37,3
North America	54,3	110	110	119	167
Region	**PFOS Concentration in Crustaceans (ηg/g)**				
	Q10	**Q25**	**Q50**	**Q75**	**Q90**
Europe	40	93	120	294	319
Asia	0,537	0,940	1,82	2,80	5,52
North America					
Region	**PFOS Concentration in Mollucs (ηg/g)**				
	Q10	**Q25**	**Q50**	**Q75**	**Q90**
Europe	63	66	71,7	77,2	79,6
Asia	0,15	0,15	0,420	0,870	35,8

[17] Tolerable Daily Intake (UNIDO, 2012)

ANNEX K. **Provincial emissions of PFOS equivalents from major industrial sources in China (t/a) (Xie, et al., 2013)**

Region	PFOS production		Textile Treatment	Metal Plating		Fire Fighting		Semiconductors
	Water	Air	Water	Water	Air	Water	Soil	Water
China	0.55-3.47	1.0-1.4	22	35	0.070	4.6	4.6	0.25
Jiangsu	0	0	5.6	4.5	9.0E-03	0.18	0.18	0.086
Guangdong	0.011-0.069	0.021-0.028	5.3	2.1	4.2E-03	0.21	0.21	0.062
Hubei	0.33-2.1	0.62-0.83	0.30	3.4	6.8E-03	0.32	0.32	3.8E-06
Zheijang	0	0	3.8	2.1	4.2E-03	0.13	0.13	0.012
Shangai	0.044-0.28	0.083-0.11	0.67	4.7	9.5E-03	0.20	0.20	0.044
Hebei	0	0	0.30	4.8	9.7E-03	0.16	0.16	5.0E-05
Shandong	0	0	2.2	2.3	4.6E-03	0.25	0.25	7.7E-04
Fujian	0.16-1.0	0.31-0.41	2.4	0.82	1.6E-03	0.14	0.14	4.6E-05
Liaoning	0	0	0.12	3.3	6.6E-03	0.19	0.19	3.9E-04
Tianjin	0	0	0.026	2.2	4.4E-03	0.040	0.040	3.4E-03
Anhui	0	0	0.15	1.5	3.0E-03	0.18	0.18	1.9E-04
Beijing	0	0	0.022	1.1	2.2E-03	0.19	0.19	9.7E-03
Sichuan	0	0	0.20	0.58	1.2E-03	0.21	0.21	0.010
InnerMongolia	0	0	0.13	0.47	9.4E-04	0.30	0.30	0
Henan	0	0	0.41	0.36	7.1E-04	0.12	0.12	0
Hunan	0	0	0.13	0.36	7.3E-04	0.10	0.10	0
Jilin	0	0	0.022	0	0	0.27	0.27	0
Xinjiang	0	0	0.038	0.12	2.3E-04	0.18	0.18	0
Jiangxi	0	0	0.16	0	0	0.16	0.16	0
Chongqing	0	0	0.052	4.9E-03	9.8E-06	0.17	0.17	0
Shannxi	0	0	0.039	0	0	0.16	0.16	0
Shanxi	0	0	9.5E-03	0	0	0.15	0.15	0
Ningxia	0	0	0,028	0	0	0.12	0.12	0
Heilongjiang	0	0	0.021	0	0	0.10	0.10	0
Gansu	0	0	4.7E-03	0.065	1.3E-04	0.039	0.039	0.021
Yunnan	0	0	4.0E-03	8.6E-03	1.7E-05	0.071	0.071	0
Guangxi	0	0	0.038	0	0	0.044	0.044	1.4E-03
Qinghai	0	0	6.6E-03	0	0	0.056	0.056	0
Guizhou	0	0	1.6E-03	0	0	0.057	0.057	8.0E-05
Hainan	0	0	1.1E-03	0	0	0.036	0.036	0
Tibet	0	0	2.7E-04	0	0	7.5E-03	7.5E-03	0

ANNEX L. **Approximate PFOS Concentration in Articles (UNIDO, 2012)**

Category of article or preparation	**PFOS content** *Approximate values* **(mg PFOS/kg article or preparation)***
Photographic sector	100
Semiconductor sector	200 - 1000
Electronics sector	200 - 1000
Aviation hydraulic fluids	500-1000
Fire fighting foams	5000-15000
Metal plating Decorative plating of metal, rubber and plastics	50 000 – 500 000
Certain medical devices	150 ng/CCD filter
Insecticides	100-1000
Coating and impregnation of - paper and packaging -synthetic carpets - leather and apparel - textiles and upholstery	500-5000
Coating and coating additives	1000-10 000
Toner and printing inks	100
Cleaning agents, waxes and polishes	50-100**

ANNEX M. **Approximate PFOS Concentration in Product Mixtures (UNIDO, 2012)**

Management process	Chemical agent	PFOS concentrations*	Guidance value
Photographic industry	Surfactant Electrostatic charge control agent Friction control agent Dirt repellent agent Adhesion control agent	about 0.01%	0.01 %
Semiconductor industry	Etching agent Photoresist substance Photo-acid generator Surfactant Anti-reflective coating agent	0.02 – 0.1% about 0.01% about 0.1%	0.02-0.1 %
Electronics industry	Etching agent Dispersion agent Desmear agent Surface treatment agent Photoresist substance Photo-acid generator Surfactant Anti-reflective coating agent Solder Adhesive Paint	0.02–0.1% about 0.01% about 0.1%	0.02-0.1%
	Metal plating	5-10%	5-10%
Metal plating (hard and decorative)	Surfactant Wetting agent Mist suppressant	5-50%	5-50%

ANNEX N. Summary of the survey and literature finding on standardized analytical methods for PFOS analysis (UNIDO, 2012)

Method	Matrix	Extraction	Clean-up	Detection	Congeners/Standards	Limits of method	Reference
Standard methods for determination of polyfluorinated substances in water							
E DIN 38407-42:2010-05 (D)	Water	SPE	No details available	LC-MS/MS	Polyfluorinated substances	No details available	[DIN 2010]
EPA 537	Drinking water	SPE	-	LC-MS/MS	Perfluorinated alkyl acids (incl. PFOS)	1.4 µg/L (DL) 6.5 µg/L(lowest concentration minimum reporting level)	[EPA 2009]
ISO 25101-2009	Water	SPE	-	LC-MS/MS	PFOA and PFOS	2,0 ng/l to 10 000 ng/l	[ISO25101]
Standard methods for determination of PFOS under development							
FprCEN/TS 15968	Coated and impregnated solid articles, liquids, fire fighting foams	Depending from matrix – no details available	Depending from matrix – no details available	LC-MS/MS; LC-MS	PFOS	0,5 ng/ml to 50 ng/ml in extract	[CEN15968]
Methods for determination of PFOS its salts and PFOA in different matrices reported in scientific literature							
Literature	Water	On-line extraction (turbulent flow chromatography)	-Column wash	LC-APPI/MS	PFOS	18 ng/L (LOQ)	[Takino et. Al. 2003]
Literature	Waste water STP sludge	Sedimantation, decatation Solvent liquid extraction drying and grinding (aqueous acetic acid and MeOH)	SPE (OASIS HLB)	LC-APPI/MS	PFOS	2.5 ng/L (LOQ) 10-25 ng/g (LOQ)	[Sinclair and Kannan., 2006]
Literature	Water, waste water	Filtration	SPE mixed hemmimicelle-based	HPLC-ESI-MS/MS	PFAs incl. PFOS	0.2 ng/L (LOD)	[Zhao et. Al., 2007]
Literature	Sediment, sludge	Solvent liquid extraction (aqueous acetic acid and MeOH)	SPE	HPLC-ESI-MS/MS	PFAs incl. PFOS	0.1 µg/kg (LOD Sediment) and 0.9 µg/kg (LOD Sludge)	[Higgings et. Al., 2005]
Literature	Sewage Sludge	Freeze drying, Soxhlet extraction, hot vapour extraction, PLE	-	HPLC-ESI-MS/MS GC-NCI-MS	PFSAs incl. PFOS	6 000 – 10 000 ng/g (LOD) 10 000 – 20 000 ng/g (LOQ)	[Schröder 2003]
Literature	Dust	Solvent liquid extraction (MeOH) sonication	Centrifugation, filtration	HPLC-ESI-MS/MS	PFSAs incl. PFOS	10 – 50 ng/g (LOQ)	[Moriwaki et Al., 2003]
Literature	Dust	Solvent liquid extraction (AcN)	Centrifugation, SPE (C18)	HPLC-ESI-MS/MS	PFSAs incl. PFOS	0.99 – 4.56 ng/g (MDL)	[Kubwabo et. Al., 2005]
Literature	Fabrics and leathers	Sonication with 0.1 M HCL and MeOH	Zorbax SB – C18 Column	LC-MS/MS	PFOS	1.5 mg/kg (LOD)	[Huang et. Al., 2007]
Literature	Packaging materials and textiles	Pressurized liquid extraction	-	GC-MS after silylation	PFOA and PFOS	13.9 ng/ml (LOD)	[Wang et. Al., 2009]
Literature	Paper Products	Methanol by the accelerated solvent extractor	Purification, film-filtration	LC-MS/MS	PFOS	0.10 mg/kg (LOD)	[Ma et. Al., 2009]
Literature	Textile/carpet	SLE(water, MeOH) shaking PLE (MeOH)	Protein precipitation /centrifugation	LC-ESI-MS/MS	PFCAs	1-3 ng/g (LOQ)	[Mawn et. Al., 2005]
Literature	Paper/textile	SLE (MeOH)	Centrifugation	LC-ESI-MS/MS	PFCAs	1-2 ng/g (LOD)	[Stadillus et Al., 2006]
Literature	Commercial articles	Methanol	Filtration	LC-MS/MS	PFCAs	0.9-6.8 ng/g	Liu et. Al., 2009]

Annex 14:

T.C.
AKDENİZ ÜNİVERSİTESİ REKTÖRLÜĞÜ
MÜHENDİSLİK FAKÜLTESİ

TEKNİK RAPOR

Raporun Konusu :"TR2010/0327.03-01/001" nolu “Kalıcı Organik Kirleticiler Tüzüğü’nün Uygulanması için Teknik Yardım” projesi kapsamında Türkiye'deki KOK'larla kirlenmiş sahaların envanteri ve Ulusal Uygulama Planı için öneri eylem planlarının hazırlanmasına dair Teknik Rapor talebi

Başvuran Kişi/Kuruluş : NIRAS IC Spz. o.o. liderliğindeki konsorsiyum

Raporu Hazırlayan Kurum : Akdeniz Üniversitesi
Mühendislik Fakültesi
Çevre Mühendisliği Bölümü

Raporu Hazırlayan : Yrd. Doç. Dr. Kadir GEDİK

Rapor Tarihi : 28/01/2015

Rapor No : 2015/1

Prof. Dr. Bülent TOPKAYA
Bölüm Başkanı

Prof. Dr. Feramuz ÖZDEMİR
Dekan

Bu raporun ekleri (28 Sayfa)
Tel. : 310 63 00
Faks: 310 63 06
E-Posta:muhendislik@akdeniz.edu.tr

Report on

POPs Contaminated Site Inventory in Turkey

Assist. Prof. Dr. Kadir Gedik

Department of Environmental Engineering

Akdeniz University

January 2015

TABLE OF CONTENTS

Table of Contents i
List of Figures ii
List of Tables ii
List of Abbreviations iii
1. Introduction 1
1.1. Background 1
1.2. Objective 2
1.3. Regulatory Framework 2
2. Methodology 4
3. Preliminary Identification of Contaminated Sites 4
3.1. Desktop Study 4
3.1.1. Overview of scientific literature 4
3.1.2. Overview of research projects and technical reports 9
3.1.3. Overview of national media and thesis 10
3.1.4. Overview of environmental status reports of provinces 12
3.2. Survey on Industrial Sector Organizations, Companies and/or Institutions 14
3.3. Overview of Potential Industries/Activities Including POPs Contaminated Sites 14
4. Current Situation and Future Expectations in Turkey 15
5. Proposed Action Plans for POPs Contaminated Sites 15
6. Acknowledgements 16
7. References 16
Appendix 22

List of Figures

Figure 1. A sample scheme for contaminated site assessment 2
Figure 2. The summary of inventory approach for contaminated sites in Turkey 3

List of Tables

Table 1. An overview of recent information on POPs in sediment 4
Table 2. An overview of recent data on PAHs and Aliphatic Hydrocarbons in sediment 6
Table 3. An overview of recent information on POPs in soil 7
Table 4. An overview of the spatial distribution of PAHs in soil 8
Table 5. A summary of MEDPOL reports between 2003 and 2009 9
Table 6. News published in national media including PAHs (n=36) 10
Table 7. News published in national media including PCBs (n=19) 10
Table 8. News published in national media including OCPs (n=13) 11
Table 9. An overview of the spatial distribution of POPs in sediment in Turkey related to graduate thesis 11
Table 10. An overview of the spatial distribution of POPs in soil in Turkey related to graduate thesis 11
Table 11. The summary of the information related to contamination in selected sites 12
Table 12. Identified candidate contaminated sites in Turkey 14
Table 13. Estimated number of CS and PCS in Turkey 15
Table 14. Proposed action plans for identification of contaminated sites and remediation in an environmentally sound manner 15
Table 15. An overview of the spatial distribution of PAHs (µg/g dry weight) in sediments in Turkey (MEDPOL reports) 22
Table 16. An overview of the spatial distribution of OCPs (ng/g dry weight) in sediments in Turkey (MEDPOL reports) 22
Table 17. An overview of the spatial distribution of PCBs (ng/g dry weight) in sediments in Turkey (MEDPOL reports) 24

List of Abbreviations

AHs	Aliphatic Hydrocarbons
CS	Contaminated site
EIONET	European Environment Information and Observation Network
ESDAC	European Soil Data Centre
ESR	Environmental Status Reports
EU	European Union
GCR	Global Competitiveness Report
GDP	Gross Domestic Product
GEF	Global Environment Facility
JRC	European Commission’s Joint Research Centre
MEDPOL	Program for the Assessment and Control of Pollution in the Mediterranean Region
MoCT	Ministry of Customs and Trade
MoEU	Ministry of Environment and Urbanization
MoH	Ministry of Health
NIP	National Implementation Plan
OCPs	Organochlorine pesticides
PAHs	Polyaromatic hydrocarbons
PBDEs	Polybrominated diphenyl ethers
PCBs	Polychlorinated biphenyls
PCDD/Fs	Polychlorinated dibenzo-p-dioxins/Polychlorinated dibenzofurans
PCN	Polychlorinated naphthalene
PCS	Potential contaminated site
PHs	Petroleum hydrocarbons
POPs	Persistent Organic Pollutants
PTS	Persistent toxic substances
UNEP	United Nations Environment Program

1. Introduction

1.1. Background

The Stockholm Convention, which was adopted in 2001 and entered into force in 2004, is a global treaty to protect human health and the environment from the harmful impacts of chemicals called Persistent Organic Pollutants (POPs). According to the Convention, all parties should take measures to eliminate or reduce the release of POPs into the environment which have unique physicochemical properties providing opportunity to them travelling with freedom in the globe. As a country with concern on this issue, Turkey ratified the Convention in 2009 (Official Gazette No: 27304). The legal procedure is completed as of January 2010 and Turkey is currently under the obligations of the Stockholm Convention. Hence, an important new stage has started for action to be taken to cease or limit the of use of POPs, preparation of inventories, identification of contaminated sites and eventually, environmentally safe disposal of wastes and remediation of contaminated sites. The first National Implementation Plan (NIP) for POPs was prepared in 2006 with the assistance of Global Environment Facility (GEF) and the support of relevant ministries, universities and non-governmental organizations. NIP was, then, revised in the upcoming years by European Union (EU) funds to improve environmental protection against POPs.

In 2013, a new project, namely, "Technical Assistance for Implementation of the Persistent Organic Pollutants Regulation (TR2010/0327.03-01/001)" financed by the EU and Turkey has been started aiming the elimination of negative effects of POPs and POPs wastes on human health and environment in line with the implementation of EU legislations (Regulation No. 850/2004/EC) and the Stockholm Convention. The project involves, in particular, the establishment and strengthening of institutional and technical capacity in the implementation of POPs regulation through trainings on all aspects of sound management of POPs, and raising the public awareness on POPs. The direct or indirect impacts of the project will be an update of the NIP-Turkey for the Stockholm Convention. Moreover, national priorities in terms of regulatory actions and sectoral impact assessment will be revisited, and one of the work packages, namely, "POPs contaminated site inventory in Turkey" will be presented to make an overview of the current situation of contaminated sites in Turkey. A contaminated site (CS) is defined as an area in which the soil, surface/ground water or sediment contains a hazardous waste or substance with a confirmed amount or concentration that may present a risk to human health or the environment according to national environmental quality standards. Given the broad definition, identification of sites contaminated with POPs and/or similar substances, and their subsequent remediation is a major effort which initially requires a broader approach (Weber et al., 2008) due to the relatively small amount of information currently present in Turkey. Hence, many countries, including Turkey, need to gather all relevant information leading to the identification of pollution hot spots with the ultimate aim of environmentally sound remediation (Gedik et al., 2010). From a reporting perspective, POPs contaminated sites can be handled broadly by the stages given in Figure 1. This report, on the other hand, includes the requirements just for the first step, namely, preliminary investigation and the subsequent stages may further handled with new projects related to topic of concern.

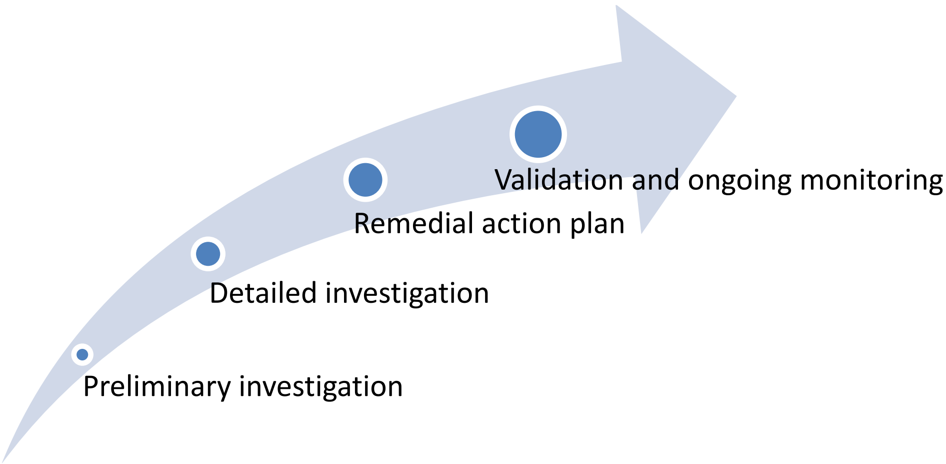


Figure 5. A sample scheme for contaminated site assessment

1.2. Objective

The objective of this preliminary assessment report is to provide supplementary information to the NIP of Turkey for effective implementation of regulations related to POPs. For this purpose, an overview of contaminated or potentially contaminated sites (PCS) in which contamination is suspected but not verified, is provided together with the main outputs demonstrating how these sites can be managed properly due to the large extent of research topic. Specifically, this report intends to;

i. carry out the inventory on sites contaminated with the current POPs (22) and other persistent toxic substances (PTS) such as polyaromatic hydrocarbons (PAHs), petroleum hydrocarbons (PHs)
ii. provide recent information on existing contaminated sites in Turkey
iii. provide recent information on potential contaminated sites in Turkey
iv. propose action plans for handling contaminated sites
v. prepare a report that will assist in the development of implementation framework for NIP

1.3. Regulatory Framework

A number of regulations came into force by the related governmental agencies implementing the provisions of the Convention to control the spread of POPs in environmental mediums or substances of which are listed in the updated version of NIP (NIP, 2014). Among these, the By-law on Control of Soil Pollution and Sites Contaminated by Point Sources (Official Gazzette No: 28323) is remarkable due to its direct relation to the topic. This regulation sets forth the prevention of soil acting as receiving environment, the identification areas and sectors that are contaminated or likely to be contaminated, and the rules for the remediation and monitoring of contaminated soils and areas in line with the objectives of sustainable development. A summary of inventory approach adopted for contaminated sites in Turkey based on the aforementioned regulation is given in Figure 2.

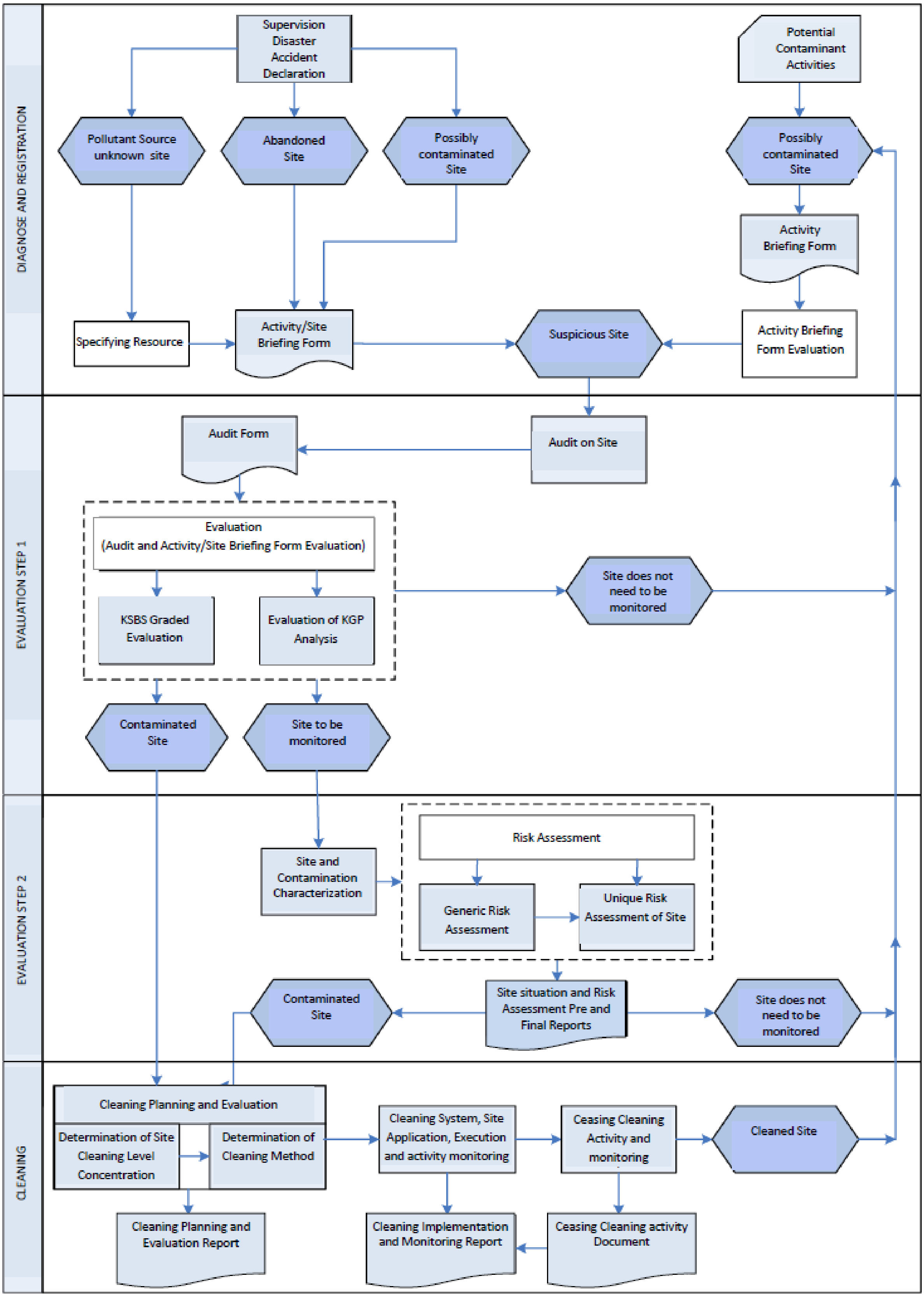


Figure 6. The summary of inventory approach for contaminated sites in Turkey

2. Methodology

The information sources used for assessing the contaminated or potentially contaminated sites in Turkey were:

i. reports prepared by national or international organizations
ii. scientific literature specific to soil and sediment medium (based on Web of Science and Scopus database)
iii. official governmental records such as Environmental Status Reports prepared by the Ministry of Environment and Urbanization (MoEU)

The results are presented considering the nature of persistent toxic substances (i.e. POPs, PAHs, PHs) and the included/observed medium (i.e. soil, sediment) for each subtopic. The content of subtopic involves recent information or available data which is not embedded in the first or updated NIP of Turkey.

3. Preliminary Identification of Contaminated Sites

3.1. Desktop Study

3.1.1. Overview of scientific literature

An overview of scientific literature concerning POPs in specific to soil and sediment medium is summarized in Table 1 to 4. In general, studies were conducted in agricultural, urban and industrial areas. Most of the studies were focused on regions in Izmit, Istanbul, Ankara, Bursa, Kocaeli provinces. The studies were concentrated on OCPs and PCBs. The pollutant concentrations are higher in industrial regions.

Table 3. An overview of recent information on POPs in sediment

Location	Year	Sampling area	n*	Analyte & Basis	Amount Min-max (mean)	Unit (dw**)	Reference
Istanbul, Marmara Sea	2009	Industrial and domestic load	7	Σ_8 OCP	4.43-22.2 (14.5)	ng/g	(Aksu and Taşkın, 2012)
Istanbul strait	2007	Domestic wastes, accidental discharges, shipping activities, atmospheric emissions	8	Σ_{17} PCDD/F	2.21-68.6 (26.2)	pg/g	(Okay et al., 2009)
Istanbul Strait	2007	Domestic wastes, accidental discharges, shipping activities, atmospheric emissions	17	Σ_{28} OCP	40.3-13853 (2208)	pg/g	(Okay et al., 2011)
Ship building/breaking yards in Turkey	2012	Industrial, Agricultural	14	Σ_{29} OCP	nd-94329 (10795)	pg/g	(Okay, O. et al., 2014)
Ship building/breaking yards in Turkey	2012	Industrial, Agricultural	14	Σ_{18} PCB	nd-138906 (9719)	ng/g	(Okay, O. et al., 2014)
Central Black Sea	2001-2003	Industrial, domestic wastewater discharge areas and the rivers	9	Σ_{10} OCP	1.54-36.9 (19.6)	ng/g wet weight	(Ozkoc et al., 2007)
Cayırhan	2008	Industrial wastewaters, urban discharges and	–	Σ_{12} OCP	3.81	mg/kg***	(Ozmen et al., 2008)

		agricultural activities					
Uşakbükü	2008	Industrial wastewaters, urban discharges and agricultural activities	_	Σ_{12} OCP	3.42	mg/kg***	(Ozmen et al., 2008)
Sarıyar	2008	Industrial wastewaters, urban discharges and agricultural activities	_	Σ_{12} OCP	1.04	mg/kg***	(Ozmen et al., 2008)
Ankara Creek	2008	Industrial	20	Σ_{7} PCB	3.7-743 (67.8)	ng/g	(Ozyurek et al., 2013)
Ankara Creek	2008	Industrial	20	$\Sigma_{Arochlor1260+1254}$	5.5-778 (83.1)	ng/g	(Ozyurek et al., 2013)
Izmir Bay	2009	Industrial	18	Σ_{9} OCP	0.26-16.9 (2.99)	ng/g	(Pazi et al., 2011)
Izmir Bay	2009	Industrial	18	$\Sigma_{Aroclor\ 1254-1260}$	0.31-43.5 (7.61)	ng/g	(Pazi et al., 2011)
Candarli bay	2009	semi-closed bay; great industry settlements, discharging solid and coastal area	18	Σ_{9} OCP	10.2-57.2 (32.9)	ng/g	(Pazi et al., 2012)
Candarli bay	2009	semi-closed bay; great industry settlements, discharging solid and coastal area	18	$\Sigma_{Aroclor\ 1254-1260}$	2.8-205 (39.7)	ng/g	(Pazi et al., 2012)
Dilek National Park	2007-2008	protected habitat for several endangered and severely threatened species	59	Σ_{15} OCP	nd-124 (45.2)	µg/kg	(Turgut et al., 2010)
BUTAL, Bursa	2008-2009	Urban, Industrial	25	Σ_{82}PCB	105-7060 (2010)	pg/g	(Yolsal et al., 2014)
Mudanya, Bursa	2008-2010	Coastal	25	Σ_{82}PCB	110-2320 (535)	pg/g	(Yolsal et al., 2014)
Kızılırmak river, Turkey	1998-2000	Agricultural, Industrial, Domestic discharges	5	Σ_{9} OCP	5-86 (38.1)	ng/g	(Bakan and Ariman, 2004)
Uluabat Lake	2002	Industrial	30	Σ_{11} OCP	1473-4414 (2922)	ng/g	(Barlas et al., 2006)
Sakarya River	1995-1996	Agricultural	8	Σ_{13} OCP	0.741-32.9 (11.4)	µg/g	(Barlas, 1999)
Kulu Lake	1998-1999	Agricultural	10	Σ_{13} OCP	nd-2.49 (1.42)	µg/g	(Barlas, 2002)
Samsam Lake	1998-1999	Agricultural	10	Σ_{13} OCP	nd-10.6 (6.94)	µg/g	(Barlas, 2002)
Çöl Lake	1998-1999	Agricultural	10	Σ_{13} OCP	1.09-11.3 (6.72)	µg/g	(Barlas, 2002)
Uyuz Lake	1998-1999	Agricultural	10	Σ_{13} OCP	0.22-5.45 (4.11)	µg/g	(Barlas, 2002)
Aliağa, Izmir	2004	Industrial, agricultural, urban loads	14	Σ_{15} OCP	11656-11970 (11813)	ng/kg	(Bozlaker et al., 2009)
Kütahya, Kocapınar Creek	2009	Industrial	12 (sediment, soil, ash, sludge)	Σ_{41} PCB	nd-385	ng/g	(Gedik and Imamoglu, 2011)
İstanbul Strait	-	Domestic wastes, accidental discharges, shipping activities, atmospheric emissions	5	Σ_{18} PCB	0.04-520	ng/g	(Karacık et al., 2013)
İstanbul Strait	-	Domestic wastes,	5	Σ_{28} OCP	1.0-450	ng/g	(Karacık et al.,

		accidental discharges, shipping activities, atmospheric emissions					2013)
Işıklı	2009	Agricultural	_	Σ_7 PCB	0.3	ng/g	(Kocagöz et al., 2014)
Işıklı	2009	Agricultural	_	Σ_4 PBDE	0.2	ng/g	(Kocagöz et al., 2014)
Işıklı	2009	Agricultural	_	Σ_{17} OCP	2.1	ng/g	(Kocagöz et al., 2014)
Söke, Plateau	2009	Agricultural	_	Σ_7 PCB	0.3	ng/g	(Kocagöz et al., 2014)
Söke, Plateau	2009	Agricultural	_	Σ_4 PBDE	1.3	ng/g	(Kocagöz et al., 2014)
Söke, Plateau	2009	Agricultural	_	Σ_{17} OCP	3.2	ng/g	(Kocagöz et al., 2014)
Söke, Estuary	2009	Agricultural	_	Σ_7 PCB	0.8	ng/g	(Kocagöz et al., 2014))
Söke, Estuary	2009	Agricultural	_	Σ_4 PBDE	1.2	ng/g	(Kocagöz et al., 2014)
Söke, Estuary	2009	Agricultural	_	Σ_{17} OCP	2.2	ng/g	(Kocagöz et al., 2014)
Aegean Sea	2008	Urban, Industrial	14	Σ_9 OCP	nd-17.8 (3.23)	ng/g	(Kucuksezgin and Tolga Gonul, 2012)
Van Lake(Van city, Edremit, Gevaş)	2011	Domestic treatment plant	3	Σ_2 OCP	0.841-1.67 (1.14)	ng/g	(Oğuz and Kankaya, 2013)

*n: number of samples, ** dw: dry weight, ***: not specified whether it is dry or wet weight ****nd: not detected

Table 4. An overview of recent data on PAHs and Aliphatic Hydrocarbons in sediment

Location	**Year**	**Sampling area**	**n***	**Analyte & Basis**	**Amount Min-max (mean)**	**Unit (dw**)**	**Reference**
Gemlik Bay	2008	Industrial, municipal wastewater, marina	62	$\sum_{13}$ PAH	36-770 (144)	ng/g	(Unlu and Alpar, 2009)
Coasts of Turkey	2014	Marinas, shipyards	17	$\sum_{16}$ PAH	nd***-79674 (6465)	ng/g	(Okay, O. S. et al., 2014)
Nilüfer River	2014	Wastewater discharges	8	$\sum_{12}$ PAH	15-9600	ng/g	(Karaca and Tasdemir, 2014)
Kilikya Basin	2011	Harbour	19	$\sum_{15}$ PAH	nd-100 (83)	ng/g	(Kucuksezgin et al., 2013)
Candarlı Bay	2009	Industrial	17	$\sum_{12}$ PAH	nd-130 (9)	ng/g	(Kucuksezgin et al., 2012)
Candarlı Bay	2009	Industrial	17	$\sum_6$ AH****	3.96-24.9 (23)	µg/g	(Kucuksezgin et al., 2012)
Candarlı Bay	2009	Industrial	17	$\sum_{12}$ PAH	nd-97.9 (111)	µg/g	(Kucuksezgin et al., 2012)
Aliağa/Izmir	2008-2009	Shipyard, Industrial	15	$\sum_{23}$ PAH	nd-11.4 (8)	µg/g	(Neser et al., 2012)
Aliağa/Izmir	2008-2009	Shipyard, Industrial	15	$\sum_{24}$ PAH	nd-4.39 (0.3)	µg/g	(Neser et al., 2012)
İstanbul	2009	Ship traffic	7	$\sum_8$ PAH	nd-1703	ng/g	(Taskin et al.,

Strait/Marmara Sea					(1279)		2011)
Ömerli Dam	2002-2003	-	6	∑ PAH	2.32-34.6	mg/g	(Morkoc et al., 2009)
İstanbul Strait/Marmara Sea	2008	Industrial, urban, ship traffic	24	$\sum_{16}$ PAH	0-539 (453)	ng/g	(Karacik et al., 2009)
Izmir Bay	2000	Industrial	16	$\sum_{5}$ AH	84-4427 (2119)	ng/g	(Darilmaz and Kucuksezgin, 2007)
Izmir Bay	2000	Industrial	16	$\sum_{16}$ PAH	3-113 (24)	ng/g	(Darilmaz and Kucuksezgin, 2007)
Izmir Bay	1999	After the earthquake	9	$\sum_{14}$ PAH	1.8-3746 (1185)	ng/g	(Tolun et al., 2006)
Gemlik Bay	2006	Industrial discharges	72	$\sum_{14}$ PAH	nd-8056 (8021)	ng/g	(Unlu and Alpar, 2006)
Izmir Bay	2012	Marina	8	$\sum_{7}$ PAH	158-1575 (599)	ng/g	(Kostopoulou et al., 2013)
Izmir Bay	2002	Industrial	35	$\sum_{16}$ PAH	1.1-68.4 (10)	µg/g	(Karakas and Pekey, 2005)
İstanbul Strait	2003	Ship traffic	8	∑ PAH	22.8-428	µg/g	(Unlu et al., 2004)
Izmit Bay	1999	Industrial	10	$\sum_{16}$ PAH	30-1670 (338)	µg/g	(Telli-Karakoc et al., 2002)
Izmit Bay	2001	Industrial	14	∑ PAH	2.5-25	µg/g	(Tolun et al., 2001)
Black Sea	2008	-	11	$\sum_{15}$ PAH	13-2342 (368)	ng/g	(Balkis et al., 2012)
Black Sea	2008	-	11	$\sum_{8}$ PAH	0.3-363 (58)	µg/g	(Balkis et al., 2012)
Eagean Coast	2008	-	14	$\sum_{20}$ PAH	0.074-2.17 (0.24)	µg/g	(Gonul and Kucuksezgin, 2012)
Eagean Coast	2008	-	14	∑ AH	0.33-2.66	µg/g	(Gonul and Kucuksezgin, 2012)
Gemlik Bay	2006	-	72	$\sum_{14}$ PAH	0-8056 (114)	ng/g	(Unlu and Alpar, 2006)

*n: number of sample, **dw: dry weight, ***nd:not detected, ****AH: Aliphatic Hydrocarbons

Table 5. An overview of recent information on POPs in soil

Location	**Year**	**Sampling area**	**n***	**Analyte & Basis**	**Amount Min-max (mean)**	**Unit (dw**)**	**Reference**
Göksu Delta	1991-1993	Agricultural	16	Σ_{13} OCP	5.4-42.3 (22.7)	ppm***	(Ayas et al., 1997)
Göksu Delta	1991-	Non-agricultural	16	Σ_{13} OCP	1.01-5.33	ppm***	(Ayas et al.,

	1993				(2.95)		1997)
Göksu Delta	1991-1993	Dune	16	Σ_{13} OCP	0.527-4.07 (1.70)	ppm***	(Ayas et al., 1997)
Horozgediği-Aliağa, Izmir	2004-2005	Urban, Industrial	48	Σ_{8} PCB	44.1	µg/kg dry weight	(Bozlaker, Ayse et al., 2008)
Horozgediği-Aliağa, Izmir	2004-2005	Rural	48	Σ_{8} PCB	0.23	µg/kg	(Bozlaker, Ayse et al., 2008)
Horozgediği-Aliağa, Izmir	2004-2005	Industrial	48	Σ_{8} PCB	805	µg/kg	(Bozlaker, Ayse et al., 2008)
Dilovası, Kocaeli	2010	Industrial	49	Σ_{7} PBDE	0.70-203 (26.3)	µg/kg	(Cetin, 2014)
Meriç River, Agean Sea	2002-2003	Wetland, Agricultural, Domestic wastes	32	Σ_{20} OCP	4.04-15.2 (8.50)	ng/g	(Erkmen and Kolankaya, 2006)
Sakarya	2007	Agricultural	33	Σ_{3} OCP	1.25-428 (47.0)	ng/g***	(Isleyen et al., 2013)
Aliağa, Izmir	2009-2010	Industrial	10	Σ_{41} PCB	0.3-461	µg/kg	(Kaya, Elife et al., 2012)
Iskenderun, Hatay	2008	Rural/Background/Agricultural, Urban/Suburban, Industrial	20	Σ_{41} PCB	19±18	µg/kg	(Odabasi et al., 2010)
Iskenderun, Hatay	2009	Rural/Background/Agricultural, Urban/Suburban, Industrial	20	Σ_{43} PCN	0.28±0.28	µg/kg	(Odabasi et al., 2010)
Iskenderun, Hatay	2009	Rural/Background/Agricultural, Urban/Suburban, Industrial	20	Σ_{7} PBDE	37±64	µg/kg	(Odabasi et al., 2010)
Izmir	2005	Industrial	3	Σ_{13} OCP	1707	ng/kg	(Odabasi and Cetin, 2012)
Bursa	2008-2009	Industrial, urban traffic	43	Σ_{83} PCB	1150-4075 (2171)	pg/g	(Salihoglu et al., 2013)
Bursa	2004-2005	Urban, suburban, residential, industrial	4	Σ_{41} PCB	25-690 (204)	pg/g***	(Salihoglu and Tasdemir, 2009)
Bursa	2008-2009	Residential, industrial	3	Σ_{83} PCB	6.2-1536 (257)	pg/g***	(Tasdemir et al., 2012)
Taurus Mountain	-	Atmospheric deposition	7	Σ_{17} PCDD/F	6.37-21.7 (11.57)	pg/g	(Turgut et al., 2012)
Taurus Mountain	-	Atmospheric deposition	7	Σ_{18} PCB	210-764 (490)	pg/g	(Turgut et al., 2012)
Taurus Mountain	-	Atmospheric deposition	7	Σ_{28} OCP	5213-25836 (14075)	pg/g	(Turgut et al., 2012)
Söke, Aydın	-	Agricultural	220	Σ_{3} OCP	1.02	µg/kg	(Turgut et al., 2013)

*n: number of samples, ** dw: dry weight, ***: not specified whether it is dry or wet weight ****nd: not detected

Table 6. An overview of the spatial distribution of PAHs in soil

Location	**Year**	**Sampling area**	**n***	**Analyte & Basis**	**Amount Min-max (mean)**	**Unit (dw**)**	**Reference**

Izmir	2004-2005	Industrial	28	$\sum_{15}$ PAH	nd-648 (4628)	µg/kg	(Bozlaker, A. et al., 2008)
Izmir	2003-2004	Semi-rural	10	$\sum_{14}$ PAH	0.4-19.7 (56.6)	ng/g	(Demircioglu et al., 2011)
Izmir	2009-2010	Industrial	6	$\sum_{16}$ PAH	1-11667	µg/kg	(Kaya, E. et al., 2012)

*n: number of sample, **dw: dry weight

3.1.2. Overview of research projects and technical reports

The official records including POPs as a parameter of pollution was prepared for the MoEU, as a part of the monitoring of organic pollutants on the Mediterranean coasts of Turkey under the Program for the Assessment and Control of Pollution in the Mediterranean region (MEDPOL), within the scope of the Mediterranean Action Plan of United Nations Environment Program (UNEP). The first group of studies was conducted between 1975–1980 as MEDPOL Phase I and the second was conducted as a part of MEDPOL Phase III, which was carried out in parallel within the same time period. Continuing studies were done in MEDPOL Phase III and IV, monitoring the sediments and marine biota along the Mediterranean and Aegean coasts, for which yearly reports are available starting from 2003. A summary of these results are presented in Table 5 and details are given in Appendix. Sampling points were not specified at 2011 and 2013 reports. Therefore, results were summarized as minimum and maximum concentrations of 49 and 46 sites for 2011 and 2013, respectively. Overall, relatively recent findings of these studies show the presence of PAHs, OCPs and PCBs in varying amounts in sediments of the Turkish coasts.

Table 7. A summary of MEDPOL reports between 2003 and 2013

Location	Year	Contaminant/ *min-max (mean)*		
		Σ PAH	**Σ OCP**	**Σ PCB (Ar1254+1260)**
Akbük	2003-2009	-	1.02-1.16 (1.07)	bdl
Antalya	2003-2009	0.02-136 (45.4)	3.99-665 (164)	0.02-269 (81.2)
B. Menderes	2003-2009	65.3	60.7	218
Çanakkale	2003-2009	0.01-34.9 (17.5)	bdl-143 (44.4)	0-578 (116)
Çandarlı	2003-2009	-	6.25-8.11 (7.21)	22.1-29.4 (26.3)
Datça	2003-2009	9.27	bdl-110 (27.9)	bdl-440 (110)
Dikili	2003-2009	-	1.56-1.95 (1.76)	bdl
Edremit	2003-2009	0.04-8.69 (4.37)	3.24-179 (40.6)	1.24-510 (100)
Fethiye	2003-2009	-	0.963-1.99 (1.48)	3.37-13.4 (8.39)
Finike	2003-2009	-	1.09-1.50 (1.30)	3.40-14.3 (8.85)
Gökova Bay	2003-2009	-	2.15-2.57 (2.36)	bdl
Göksu	2003-2009	-	0.563-10.4 (4.88)	bdl -35.8 (12.7)
Iskenderun	2003-2009	0.01-82.4 (27.6)	0.572-414 (88.8)	bdl -375 (79.1)
Izmir	2003-2009	0.01-53.4 (17.9)	bdl -417 (38.1)	bdl-682 (51.8)
Karataş	2003-2009	-	1.08-2.36 (1.72)	4.32-9.02 (6.67)
Kuşadası	2003-2009	-	bdl -0.386 (0.189)	bdl
Marmaris	2003-2009	0.02-71.0 (23.7)	0.04-344 (74.2)	bdl-633 (134)
Menderes	2003-2009	-	5.26-6.21 (5.7)	bdl
Meriç	2003-2009	0.02-114 (38.1)	2.10-648 (128)	bdl-372 (77.7)

Mersin	2003-2009	0.02-70.8 (17.8)	1.90-1185 (247)	bdl-564 (117)
Saros Bay	2003-2009	0.105-0.182 (0.141)	-	-
Taşucu	2003-2009	0.43-112 (56.2)	0.456-876 (238)	3.67-472 (179)
Tırtar	2003-2009	-	21.5	45.8
49 sites	2011	0.80-4179	0.351-96.0	0.155-227*
46 sites	2013	10-13451	0.250-30.4	5.71-105**

*Σ_{14} PCB congeners, ** Σ_7 PCB congeners

3.1.3. Overview of national media and thesis

68 news published in national media about PAHs, PCBs and OCPs were analyzed. Generally, news is about the negative effects of these chemicals to human health and environment. There is some specific news about some cities. They include possible contamination sources like shipyards, solid waste disposal. Plastic materials are concerned as they may contain PCBs and PAHs. According to some studies appear in news, these chemicals tend to bioaccumulate in food products and mother milk.

Table 8. News published in national media including PAHs (n=36)

Location/related product, matter etc.	Statement
Stationery equipment	May contain PAHs
Food products	Benzo[a]pyrene found in fish and oil
	Grilled meat may contain PAHs
Health	Cigarette smog contain PAHs
	Exhaust gas contain PAHs (scientific study)
	One of the air pollutants
	Cosmetic products may contain PAHs
	Dye used in tattoo applications may contain PAHs
	Plastic materials may contain PAHs
	PAHs may release from burning of candle and incense
Zonguldak	PAHs is one of the air pollutants
Istanbul	PAHs is one of the potential contaminant in Strait
	Construction of third bridge may increase PAHs release
Izmit Bay	PAHs measured in fishes greater than acceptable limit values
Aliağa, Zonguldak	Shipyards may be a source of PAHs release
Eğirdir Lake/Isparta	PAHs is one of the parameters that routinely analyzed in the lake
Water	PAHs content of one of the bottled water company's product was not suitable

Table 9. News published in national media including PCBs (n=19)

Location/related product, matter etc.	Statement
Food products	PCBs may bioaccumulate in fishes

	PCBs and PCDD/Fs measured in human milk
	PCBs and PCDD/Fs may exist in food products
Health	PCBs is one of the air pollutants
	PCBs is one of the chemical that cause tiredness
	Plastic materials may contain PCBs
	Electronic wastes may contain PCBs
Izmit Bay	PCBs measured in fishes greater than acceptable limit values
Aliağa, Zonguldak	Shipyards may be a source of PCBs release
Çorlu/Tekirdağ	POPs may release from the solid waste disposal site which is planned to be built
Ankara	A study was presented about the PCBs contamination in Ankara Creek
Regulations	PCBs listed under regulations;
	"Control of Waste Electrical and Electronic Equipment"
	"Restrictions on the Production, Marketing and Use of Certain Dangerous Substances and Preparations"
	" Turkish Armed Forces Environmental Audit Directive"

Table 10. News published in national media including OCPs (n=13)

Location/related product, matter etc.	Statement
Sakarya River	According to a master thesis OCPs measured in fishes taken from the river
Burdur Lake	OCPs were below detection limit in water taken from the lake
Health	Studies conducted about cancer risk of OCPs
	The usage of OCPs cause extinction of biota
	Resistant species derive because of excess OCPs usage
Eğirdir Lake/Isparta	OCPs is one of the parameters that routinely analyzed in the lake
Food products	Exported goods return because of exceeding limit values
Çukurova/Adana	OCPs determined in human milk

Table 11. An overview of the spatial distribution of POPs in sediment in Turkey related to graduate thesis

Location	**Year**	**n***	**POPs**	**Amount Min-max(mean)**	**Unit (dw**)**	**Reference**
Izmit	2006	10	$\sum_{16}$ PAH	11.5-281 (81)	ppm	(Demircioglu, 2011)
Büyükçekmece Lake	2008	5-9	$\sum_{14}$ PAH	0.43-2774 (195)	µg/kg	(Köseler, 2008)
Küçükçekmece Lake	2010	7	$\sum_{8}$ OCP	nd-7.12 (2)	ng/g	(Taşkın, 2010)
Izmit Bay	2011	54	$\sum_{15}$ PAH	53.2-6340 (744)	ng/g	(Terzi, 2011)
Izmit Bay	2011	54	$\sum_{19}$ PCB	0.9-24.2 (7.24)	ng/g	(Terzi, 2011)
Izmit Bay	2003-2004	120	$\sum_{7}$ PCB	nd-674 (325)	ng/g	(Çakıroğulları, 2006)
Izmit Bay	2003-2004	120	$\sum_{7}$ OCP	Nd-7286 (1987)	ng/g	(Çakıroğulları, 2006)

*n: number of sample, **dw: dry weight

Table 12. An overview of the spatial distribution of POPs in soil in Turkey related to graduate thesis

Location	Year	n*	POPs	Amount Min-max(mean)	Unit (dw**)	Reference
Bolu	2007	29	$\sum_{8-11}$ OCP	0.71-8.35 (3.50)	ng/g	(Öz, 2009)
Bolu	2007	29	$\sum_{15}$ PAH	8.29-1549 (365)	ng/g	(Öz, 2009)
Bolu	2007	29	$\sum_{10}$ PCB	0.073-13.1 (1.50)	pg/g	(Öz, 2009)
Kocaeli (IZAYDAS)	2011	44	$\sum_{12}$ PCB	0.01-0.94 (0.12)	mg/kg	(Çetindamar, 2011)
Kocaeli (IZAYDAS)	2011	44	$\sum_{16}$ PAH	nd-4585 (483)	mg/kg	(Çetindamar, 2011)
Bursa	2011	20	$\sum_{82}$ PCB	10-7790 (1620)	pg/g	(Yolsal, 2011)
Kocaeli	2011	17	$\sum_{16}$ OCP	0-2029 (619)	µg/kg	(Gülçiçek, 2011)
Kocaeli (IZAYDAS)	2012	11	$\sum_{61}$ PCB	1447-31455 (12018)	ng/kg	(Dönmez, 2012)

*n: number of sample, **dw: dry weight

3.1.4. Overview of environmental status reports of provinces

Environmental Status Report (ESR) aims to present the overview on the current situation of environment (i.e. natural resources, urban services) in which the potential problems to be able to handled would be warned earlier. This report provides basic information including environmental planning, assessment and coordination for each province or the whole country within the context of environmental protection and sustainable development. There is a guidance format in the website of MoEU which is updated periodically representing "how to prepare the ESR". The related unit of MoEU in each province of Turkey has responsibility to prepare this document and, later, all are offered in the corresponding websites for the benefit of public. In this subtopic, the environmental issues having a sign on PCS are summarized for the respective provinces.

619 documents of 81 provinces published between the years 2002 and 2013 were analyzed. In these reports, there is not any studies concerning about POPs contamination in soils and sediments. Results of PAH analysis in water and wastewater exists in some reports. PCB, PCN and petroleum derivatives were included in "water" title in the reports published before 2012. After 2012, they fall into "waste" main topic. Some of the information related to contaminated sites in reports was summarized in Table 11. According to reports, oil and petroleum product leakage cause pollution in regions (Kırıkkale, Batman, Diyarbakır, Mardin, Şanlıurfa, Sivas) where petroleum transfer stations, refineries, transfer lines and Organized Industrial Zones exist. In addition, intense industrial activities in some regions (Kocaeli, Çanakkale) cause pollution and threats both human and other living organisms in these regions. Waste discharges from industries like petrochemical, transportation, refineries, Iron&Steel etc. are pollution sources at these regions. Besides, agricultural activities and excess usage of pesticides is another pollution sources in some cities (Samsun, Adana). Some banned pesticides measured in soil from different villages of Adana. On the other hand, solid waste disposal may be a source of soil pollution in some regions.

Table 13. The summary of the information related to contamination in selected sites

Province	Year of ESR	Information related to contamination
Adana	2003, 2005, 2006, 2007, 2008, 2009, 2011	In 1991-92 p,p'-DDT, o,p'-DDT, Endrin and Endosulfan-Sulfate were measured in soil taken from Cırrık, Zaarlı, Kadıköy, Kamışlı and Çavuşlu villages.
Antalya	2012, 2013	Disposal of the sludge from municipal wastewater treatment plants may be a potential contamination source

		of drinking water in Termessos due to infiltration from soil.
Balıkesir	2013, 2013	A plant having a capacity of 21600 transformers/year exists for disposal of PCB and PCB containing equipments.
Batman	2004, 2007, 2008, 2009	Oil and petroleum containing wastewater from petroleum industry and municipal wastewater is discharged to Batman Creek.
Çanakkale	2012	Iron&Steel Industry is a potential pollution source in the city and monitoring study is conducted within the context of "Regulation on Soil Pollution Control and Point Source Contaminated Sites- appendix 2".
Diyarbakır	2013	Petroleum transfer stations are identified as contaminated sites. Cleaning up studies conducted by disposal of contaminated soil and improving the soil structure by using chemicals.
Kilis	2012	A small-scale contamination determined from the olive oil factories which are active 2 months per year.
Kırıkkale	2013	Petroleum refinery, storage and filling facilities, asphalt emulsion plants are potential contamination sources.
Kocaeli	2003, 2006, 2008, 2009, 2010	The city is one of Turkey's largest centers of industry. The pollution in the city is originated from the petroleum refineries, petrochemical industry and transportation. Petroleum pollution is a big problem in the Bay. Two creeks transfers pollution to the Bay. In addition bilge and ballast water is another pollution source in the Bay.
Mardin	2012, 2013	In 2012 crude oil spread with the explosion of petroleum pipeline cause pollution in the region.
Muş	2013	There is a potential contamination from dumping of solid waste.
Samsun	2013	There exists a potential pesticide and nitrate pollution in Bafra and Çarşamba plains.
Sivas	2004, 2006, 2007, 2008, 2009, 2010	Petroleum and derivatives from Organized Industrial Zones cause pollution and arrives to Kızılırmak with sewage system. Burning of waste oils in oil stoves cause air pollution in the city.
Şanlıurfa	2012	Yalıntaş/Bozova, Zorova/Bozova and Karakeçili/Siverek are identified as contaminated sites because of petroleum spills. Bioremediation applications and incineration

	activities are done to clean up these sites.

3.2. Survey on Industrial Sector Organizations, Companies and/or Institutions

The European Soil Data Centre (ESDAC) of the European Commission's Joint Research Centre (JRC) published an updated version of report titled "Progress in the management of contaminated sites in Europe" (JRC, 2014). The report presents the current state of knowledge about progress with the management of contaminated sites in Europe. It directly supports the EU Soil Thematic Strategy, which requires Member States to prevent soil contamination, to make an inventory of contaminated sites including those contaminated with POPs, and to carry out remediation of these sites. The report is based on data that were collected from 39 countries including Turkey belonging to the European Environment Information and Observation Network (EIONET) during a campaign organized by the ESDAC in 2011-2012.

A questionnaire having four main steps, namely: preliminary site identification, preliminary investigation, main site investigation, and implementation of risk reduction measures were sent to countries for the management of local contamination. PCSs in each country were, then, processed considering the data received by the centre. Turkey is one of the 12 countries that have not returned to the questionnaire. Therefore, no data can be provided on the situation of contaminated sites, which can inform policy makers, professional practitioners, researchers, citizens and the media.

3.3. Overview of Potential Industries/Activities Including POPs Contaminated Sites

An overview of the information collected in the course of this report on contaminated sites is summarized in Table 12 as a concluding remark. However, it should be noted that these information require further detailed and systematic investigation.

Table 14. Identified candidate contaminated sites in Turkey

Location	**Main contaminant**	**Source of contamination**	**Specific contamination sources**	**Reference**
Kocaeli (Izmit)	PCB, PAH, PCDD/F, PBDE	Industrial	• Petroleum refinery • Petrochemical industry • Pesticide industry • Discharge from creeks	• Scientific literature • Media news • Environmental status reports
Izmir (Aliağa, Çandarlı)	PAH, OCP, PCB	Industrial, Agricultural, Urban	• Shipbreaking yard • Petrochemical industry • Steel plant • PETKIM	• Scientific literature • Media news • MEDPOL reports
Istanbul (Strait and Marmara Sea)	PAH, OCP, PCB, PCDD/F	Industrial, Urban	• Industrial and domestic wastewater loads • shipping traffic	• Scientific literature • Media news
Ankara (Eymir Lake, Ankara	PCB	Industrial	• Industrial and domestic	• Scientific literature

Creek, Gölbaşı)			wastewater discharges	
Iskenderun	PAH, OCP, PCB	Industrial, Agricultural	• Iron-stell plant • Cement plant • Fertilizer plant	• Scientific literature • MEDPOL reports
Batman, Diyarbakır, Mardin, Şanlıurfa	Petroleum derivatives	Petroleum stations, transfer lines	• Oil and petroleum spills, accidents	• Environmental status reports

4. Current Situation and Future Expectations in Turkey

Currently, there is no known or systematically proved contaminated site in Turkey. On the other hand, Turkey has gained notable economic success over the last decade and continues to growth. According to the Global Competitiveness Report 2013-2014, Turkey is classified in transition from Stage 2 to Stage 3 (9,000-17,000 GDP per capita (US$)) together with 21 economies around the world in line with well-known economic theory of stages of development (GCR, 2014). This classification allowed us to simply determine the cost of managing the CS or PCS which is an important constituent to be considered by the policy makers. Accordingly, the data included in "Progress in the management of contaminated sites in Europe" report were reviewed (JRC, 2014) and those countries having similar developmental stages as Turkey is used for further purposes. Accordingly, Table 13 is constructed to investigate the probable number of CS or PCS.

Table 15. Estimated number of CS and PCS in Turkey

Country	**Capita**	**Surface area (km^2)**	**GDP 2010 (Mio €)**	**Identified CS**	**Identified PCS**
Croatia	4412137	56594	14800	4	2264
Hungary	9985722	93028	15800	742	200
Latvia	2229641	64559	12500	243	2654
Lithuania	3244601	65300	14000	660	5000
Poland	38200037	312685	15300	8	-
∑ Surveyed topic	*58072138*	*592166*	*72400*	*1657*	*10118*
Mean surveyed topic	*11614428*	*118433*	*14480*	*331*	*2530*
Turkey (TR)	**73722988**	**783562**	**11900**		
Ratio	*0.788*	*0.756*	*6.084*		
Estimated-TR-capita				***261***	***1993***
Estimated-TR-surface area				***250***	***1912***
Estimated-TR-GDP				***2016***	***15390***

5. Proposed Action Plans for POPs Contaminated Sites

This section lists action plans to conduct a thorough inventory of contaminated areas. Accordingly, the main steps proposed for the effective identification and management of contaminated sites are summarized in Table 14 given below.

Table 16. Proposed action plans for identification of contaminated sites and remediation in an environmentally sound manner

Action Plan No	**Content/Detail**

1	realization of current coding system (the specific Harmonized Commodity Description and Coding System for imported and exported goods) used by the Customs for the control of newly listed and candidate POPs and related products
Responsibility	MoEU in co-operation with MoCT
2	initiation of a nationwide survey specific to industries to develop a database of stockpiles and wastes
Responsibility	MoEU
3	initiation of a nationwide monitoring program with special attention to locations where the preliminary signs indicate a matter of urgency
Responsibility	MoEU
4	preparation of new regulation setting forth the identification of sediments contaminated or likely to be contaminated by POPs
Responsibility	MoEU in co-operation with other related ministries
5	monitoring and assessment of public health concerns in potential contaminated sites
Responsibility	MoEU in co-operation with MoH
6	application of a pilot remediation technology in predefined site to develop a national strategy or guideline
Responsibility	MoEU

6. Acknowledgements

The author is grateful to Ms. Bursev Doğan Artukoğlu and Mr. Ertan Öztürk (Ministry of Environment and Urbanization of Turkey); Emine Can Güven, Dilek Bolat, Halil Çelik, and Burak Ak (Department of Environmental Engineering, Akdeniz University) for their support and interest.

7. References

Aksu, A., & Taşkın, Ö. (2012). Organochlorine residue and toxic metal (Pb, Cd and Cr) levels in the surface sediments of the Marmara Sea and the coast of Istanbul, Turkey. *Marine Pollution Bulletin, 64*(5), 1060-1062.

Ayas, Z., Barlas, N. E., & Kolankaya, D. (1997). Determination of organochlorine pesticide residues in various environments and organisms in Göksu Delta, Turkey. *Aquatic Toxicology, 39*(2), 171-181.

Bakan, G., & Ariman, S. (2004). Persistent organochlorine residues in sediments along the coast of mid-Black Sea region of Turkey. *Marine Pollution Bulletin, 48*(11), 1031-1039.

Balkis, N., Aksu, A., & Ersan, M. S. (2012). Petroleum hydrocarbon contamination of the Southern Black Sea Shelf, Turkey. *Environmental Science and Pollution Research, 19*(2), 592-599. doi: 10.1007/s11356-011-0583-4

Barlas, N. (1999). Determination of organochlorine pesticide residues in aquatic systems and organisms in Upper Sakarya Basin, Türkiye. *Bulletin of environmental contamination and toxicology, 62*(3), 278-285.

Barlas, N. (2002). Determination of organochlorine pesticide residues in water and sediment samples in inner Anatolia in Turkey. *Bulletin of environmental contamination and toxicology, 69*(2), 236-242.

Barlas, N., Çok, İ., & Akbulut, N. (2006). The contamination levels of organochlorine pesticides in water and sediment samples in Uluabat Lake, Turkey. *Environmental monitoring and assessment, 118*(1-3), 383-391.

Bozlaker, A., Muezzinoglu, A., & Odabasi, M. (2008). Atmospheric concentrations, dry deposition and air-soil exchange of polycyclic aromatic hydrocarbons (PAHs) in an industrial region in Turkey. *Journal of hazardous materials, 153*(3), 1093-1102. doi: 10.1016/j.jhazmat.2007.09.064

Bozlaker, A., Muezzinoglu, A., & Odabasi, M. (2009). Processes affecting the movement of organochlorine pesticides (OCPs) between soil and air in an industrial site in Turkey. *Chemosphere, 77*(9), 1168-1176.

Bozlaker, A., Odabasi, M., & Muezzinoglu, A. (2008). Dry deposition and soil–air gas exchange of polychlorinated biphenyls (PCBs) in an industrial area. *Environmental Pollution, 156*(3), 784-793.

Cetin, B. (2014). Soil concentrations and source apportionment of polybrominated diphenyl ethers (PBDEs) and trace elements around a heavily industrialized area in Kocaeli, Turkey. *Environmental Science and Pollution Research*, 1-10.

Çakıroğulları, G. Ç. (2006). İzmit Körfezi'nde Su, Sediment, Mezgit (Gadus Merlangus L.1758) ve İstavrit (Trachurus Mediterraneus S.1868) Balıklarında Poliklorlu Bifeniller ile DDT'nin Saptanması. *Ankara Üniversitesi, Fen Bilimleri Enstitüsü, Su Ürünleri Anabilim Dalı, Doktora Tezi*.

Çetindamar, D. (2011). İzaydaş Çevresindeki Topraklarda PAH ve PCB'lerin İncelenmesi. *Kocaeli Üniversitesi, Fen Bilimleri Enstitüsü, Çevre Mühendisliği Anabilim Dalı, Yüksek Lisans Tezi*.

Darilmaz, E., & Kucuksezgin, F. (2007). Distribution and origin of hydrocarbons in surficial sediments from the eastern Aegean Sea (Izmir Bay). *Marine Pollution Bulletin, 54*(11), 1824-1830. doi: 10.1016/j.marpolbul.2007.08.012

Demircioglu, E., Sofuoglu, A., & Odabasi, M. (2011). Atmospheric Concentrations and Phase Partitioning of Polycyclic Aromatic Hydrocarbons in Izmir, Turkey. *Clean-Soil Air Water, 39*(4), 319-327. doi: 10.1002/clen.201000221

Demircioglu, S. B. (2011). Marmara Deniz Sedimanlarında PAH Kirliliğinin ve Anaerobik PAH Yıkım Aktivitelerinin Tespit Edilmesi. *İstanbul Teknik Üniversitesi, Fen Bilimleri Enstitüsü, Çevre Mühendisliği Anabilim Dalı, Yüksek Lisans Tezi*.

Dönmez, B. G. (2012). Toprak Örneklerinde Polikorlubifenil (PCB) Kirliliğinin Araştırılması ve Yasal Sınır Değerlerin Uygulanabilirliğinin Değerlendirilmesi. *İstanbul Teknik Üniversitesi, Fen Bilimleri Enstitüsü, Çevre Mühendisliği Anabilim Dalı, Yüksek Lisans Tezi*.

Erkmen, B., & Kolankaya, D. (2006). Determination of organochlorine pesticide residues in water, sediment, and fish samples from the Meriç Delta, Turkey. *International Journal of Environmental Analytical Chemistry, 86*(1-2), 161-169.

Gedik, K., Demircioglu, F., & Imamoglu, I. (2010). Spatial distribution and source apportionment of PCBs in sediments around Izmit industrial complexes, Turkey. *Chemosphere, 81*(8), 992-999. doi: DOI 10.1016/j.chemosphere.2010.09.005

Gedik, K., & Imamoglu, I. (2011). A preliminary investigation of the environmental impact of a thermal power plant in relation to PCB contamination. *Environmental Science and Pollution Research, 18*(6), 968-977.

Gonul, L. T., & Kucuksezgin, F. (2012). Aliphatic and polycyclic aromatic hydrocarbons in the surface sediments from the Eastern Aegean: assessment and source recognition of petroleum hydrocarbons. *Environmental Science and Pollution Research, 19*(1), 31-41. doi: 10.1007/s11356-011-0524-2

Gülçiçek, G. (2011). Topraktaki Polisiklik Aromatik Hidrokarbonlar (PAH) İçin Sınır Değerlerin Uygulanabilirliğinin Araştırılması. *İstanbul Teknik Üniversitesi, Fen Bilimleri Enstitüsü, Çevre Mühendisliği Anabilim Dalı, Yüksek Lisans Tezi*.

Isleyen, M., Sevim, P., & Uslan, M. (2013). DDX Profiles in Agricultural Fields Used for Cucurbit Production in Sakarya, Turkey. *Soil and Sediment Contamination: An International Journal, 22*(6), 689-700.

JRC. (2014). Progress in the management of Contaminated Sites in Europe. *Authors: Marc Van Liedekerke, Gundula Prokop, Sabine Rabl-Berger, Mark Kibblewhite, Geertrui Louwagie, JRC Reference Reports, Report EUR 26376 EN, European Commission*.

Karaca, G., & Tasdemir, Y. (2014). Temporal and spatial variations in PAH concentrations in the sediment from the Nilufer Creek in Bursa, Turkey. *Journal of Environmental Science and Health Part a-Toxic/Hazardous Substances & Environmental Engineering, 49*(8), 900-912. doi: 10.1080/10934529.2014.894330

Karacık, B., Okay, O., Henkelmann, B., Pfister, G., & Schramm, K.-W. (2013). Water concentrations of PAH, PCB and OCP by using semipermeable membrane devices and sediments. *Marine Pollution Bulletin, 70*(1), 258-265.

Karacik, B., Okay, O. S., Henkelmann, B., Bernhoft, S., & Schramm, K. W. (2009). Polycyclic aromatic hydrocarbons and effects on marine organisms in the Istanbul Strait. *Environment International, 35*(3), 599-606. doi: 10.1016/j.envint.2008.11.005

Karakas, D., & Pekey, B. (2005). Source apportionment of polycyclic aromatic hydrocarbons in surface sediments of Izmit Bay (Turkey). *International Journal of Environmental Analytical Chemistry, 85*(7), 433-442. doi: 10.1080/03067310500050809

Kaya, E., Dumanoglu, Y., Kara, M., Altiok, H., Bayram, A., Elbir, T., & Odabasi, M. (2012). Spatial and temporal variation and air-soil exchange of atmospheric PAHs and PCBs in an industrial region. *Atmospheric Pollution Research, 3*(4).

Kaya, E., Dumanoglu, Y., Kara, M., Altiok, H., Bayram, A., Elbir, T., & Odabasi, M. (2012). Spatial and temporal variation and air-soil exchange of atmospheric PAHs and PCBs in an industrial region. *Atmospheric Pollution Research, 3*(4), 435-449. doi: 10.5094/apr.2012.050

Kocagöz, R., Onmuş, O., Onat, İ., Çağdaş, B., Sıkı, M., & Orhan, H. (2014). Environmental and biological monitoring of persistent organic pollutants in waterbirds by non-invasive versus invasive sampling. *Toxicology letters*.

Kostopoulou, M., Guida, M., Nikolaou, A., Oral, R., Trifuoggi, M., Borriello, I., . . . Pagano, G. (2013). INORGANIC AND ORGANIC CONTAMINATION IN SEDIMENT FROM IZMIR BAY (TURKEY) AND MYTILENE HARBOR (GREECE). *Global Nest Journal, 15*(1), 57-68.

Köseler, M. D. (2008). Büyükçekmece Gölü'nde Polisiklik Aromatik Hidrokarbon (PAH) Konsantrasyonunun Belirlenmesi. *İstanbul Teknik Üniversitesi, Fen Bilimleri Enstitüsü, Çevre Mühendisliği Anabilim Dalı, Yüksek Lisans Tezi*.

Kucuksezgin, F., Pazi, I., & Gonul, L. T. (2012). Marine organic pollutants of the Eastern Aegean: Aliphatic and polycyclic aromatic hydrocarbons in Candarli Gulf surficial sediments. *Marine Pollution Bulletin, 64*(11), 2569-2575. doi: 10.1016/j.marpolbul.2012.07.019

Kucuksezgin, F., Pazi, I., Yucel-Gier, G., Akcali, B., & Galgani, F. (2013). Monitoring of heavy metal and organic compound levels along the Eastern Aegean coast with transplanted mussels. *Chemosphere, 93*(8), 1511-1518. doi: 10.1016/j.chemosphere.2013.07.058

Kucuksezgin, F., & Tolga Gonul, L. (2012). Distribution and ecological risk of organochlorine pesticides and polychlorinated biphenyls in surficial sediments from the Eastern Aegean. *Marine Pollution Bulletin, 64*(11), 2549-2555.

Morkoc, E., Tufekci, V., Tufekci, H., Tolun, L., Karakoc, F. T., & Guvensel, T. (2009). Effects of land-based sources on water quality in the Omerli reservoir (Istanbul, Turkey). *Environmental Geology, 57*(5), 1035-1045. doi: 10.1007/s00254-008-1389-7

Neser, G., Kontas, A., Unsalan, D., Altay, O., Darilmaz, E., Uluturhan, E., . . . Yercan, F. (2012). Polycyclic aromatic and aliphatic hydrocarbons pollution at the coast of Aliaga (Turkey) ship recycling zone. *Marine Pollution Bulletin, 64*(5), 1055-1059. doi: 10.1016/j.marpolbul.2012.02.019

Odabasi, M., Bayram, A., Elbir, T., Seyfioglu, R., Dumanoglu, Y., & Ornektekin, S. (2010). Investigation of soil concentrations of persistent organic pollutants, trace elements, and anions due to iron–steel plant emissions in an industrial region in Turkey. *Water, Air, & Soil Pollution, 213*(1-4), 375-388.

Odabasi, M., & Cetin, B. (2012). Determination of octanol–air partition coefficients of organochlorine pesticides (OCPs) as a function of temperature: Application to air–soil exchange. *Journal of environmental management, 113*, 432-439.

Oğuz, A. R., & Kankaya, E. (2013). Determination of selected endocrine disrupting chemicals in Lake Van, Turkey. *Bulletin of environmental contamination and toxicology, 91*(3), 283-286.

Okay, O., Karacık, B., Güngördü, A., Ozmen, M., Yılmaz, A., Koyunbaba, N., . . . Schramm, K.-W. (2014). Micro-organic pollutants and biological response of mussels in marinas and ship building/breaking yards in Turkey. *Science of the Total Environment, 496*, 165-178.

Okay, O. S., Karacık, B., Başak, S., Henkelmann, B., Bernhöft, S., & Schramm, K. W. (2009). PCB and PCDD/F in sediments and mussels of the Istanbul strait (Turkey). *Chemosphere, 76*(2), 159-166.

Okay, O. S., Karacik, B., Gungordu, A., Ozmen, M., Yilmaz, A., Koyunbaba, N. C., . . . Schramm, K. W. (2014). Micro-organic pollutants and biological response of mussels in marinas and ship building/breaking yards in Turkey. *Science of the Total Environment, 496*, 165-178. doi: 10.1016/j.scitotenv.2014.07.035

Okay, O. S., Karacık, B., Henkelmann, B., & Schramm, K. W. (2011). Distribution of organochlorine pesticides in sediments and mussels from the Istanbul Strait. *Environmental monitoring and assessment, 176*(1-4), 51-65.

Ozkoc, H. B., Bakan, G., & Ariman, S. (2007). Distribution and bioaccumulation of organochlorine pesticides along the Black Sea coast. *Environmental geochemistry and health, 29*(1), 59-68.

Ozmen, M., Ayas, Z., Güngördü, A., Ekmekci, G. F., & Yerli, S. (2008). Ecotoxicological assessment of water pollution in Sariyar Dam Lake, Turkey. *Ecotoxicology and Environmental Safety, 70*(1), 163-173.

Ozyurek, N. A., Gedik, K., Siltu, E., & Imamoglu, I. (2013). Levels and sources of polychlorinated biphenyls in Ankara creek sediments, Turkey. *Journal of Environmental Science and Health Part a-Toxic/Hazardous Substances & Environmental Engineering, 48*(7), 800-808. doi: Doi 10.1080/10934529.2013.744652

Öz, M. (2009). Bolu Atmosferinde PAH, PCB ve Organoklorlu Pestisitlerin Belirlenmesi ve Kaynak Dağılımı: Gaz-Partikül, Toprak Gaz ve Toprak Partikül Geçişleri. *Abant İzzet Baysal Üniversitesi, Fen Bilimleri Enstitüsü, Kimya Anabilim Dalı, Yüksek Lisans Tezi*.

Pazi, I., Kucuksezgin, F., & Gonul, L. (2011). Distribution and sources of organochlorinated contaminants in sediments from Izmir Bay (Eastern Aegean Sea). *Marine Pollution Bulletin, 62*(5), 1115-1119.

Pazi, I., Kucuksezgin, F., & Tolga Gonul, L. (2012). Occurrence and distribution of organochlorine residues in surface sediments of the Candarli Gulf (Eastern Aegean). *Marine Pollution Bulletin, 64*(12), 2839-2843.

Salihoglu, G., & Tasdemir, Y. (2009). Prediction of the PCB pollution in the soils of Bursa, an industrial city in Turkey. *Journal of hazardous materials, 164*(2), 1523-1531.

Salihoglu, G., Tasdemir, Y., Salihoglu, N. K., Baskaya, H. S., & Aksoy, E. (2013). Seasonal Variations of Polychlorinated Biphenyls in Surface Soils and Air–Soil Exchange in Bursa, Turkey. *Archives of environmental contamination and toxicology, 65*(4), 619-634.

Tasdemir, Y., Salihoglu, G., Salihoglu, N. K., & Birgül, A. (2012). Air–soil exchange of PCBs: Seasonal variations in levels and fluxes with influence of equilibrium conditions. *Environmental Pollution, 169*, 90-97.

Taskin, O. S., Aksu, A., & Balkis, N. (2011). Metal (Al, Fe, Mn and Cu) distributions and origins of polycyclic aromatic hydrocarbons (PAHs) in the surface sediments of the Marmara Sea and the coast of Istanbul, Turkey. *Marine Pollution Bulletin, 62*(11), 2568-2570. doi: 10.1016/j.marpolbul.2011.08.013

Taşkın, Ö. S. (2010). Marmara Denizi İstanbul Kıyılarında PAH ve Organoklörlü Pestisidlerin HPLC ile Tayini ve Sediment Jeokimyası. *İstanbul Üniversitesi, Deniz Bilimleri ve İşletmeciliği Enstitüsü, Kimyasal Oşinografi Anabilim Dalı, Yüksek Lisans Tezi*.

Telli-Karakoc, F., Tolun, L., Henkelmann, B., Klimm, C., Okay, O., & Schramm, K. W. (2002). Polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) distributions in the Bay of Marmara sea: Izmit Bay. *Environmental Pollution, 119*(3), 383-397. doi: 10.1016/s0269-7491(01)00341-4

Terzi, M. (2011). İzmit Körfezi Biyota ve Sediment Örneklerinde PAH ve PCB Düzeylerinin Mevsimsel Değişimlerinin Araştırılması. *Kocaeli Üniversitesi, Fen Bilimleri Enstitüsü, Biyoloji Anabilim Dalı, Yüksek Lisans Tezi*.

Tolun, L., Martens, D., Okay, O. S., & Schramm, K. W. (2006). Polycyclic aromatic hydrocarbon contamination in coastal sediments of the lzmit Bay (Marmara Sea): Case studies before and after the Izmit Earthquake. *Environment International, 32*(6), 758-765. doi: 10.1016/j.envint.2006.03.014

Tolun, L. G., Okay, O. S., Gaines, A. F., Tolay, M., Tufekci, H., & Kiratli, N. (2001). The pollution status and the toxicity of surface sediments in Izmit Bay (Marmara Sea), Turkey. *Environment International, 26*(3), 163-168. doi: 10.1016/s0160-4120(00)00096-9

Turgut, C., Atatanir, L., & Cutright, T. J. (2010). Evaluation of pesticide contamination in Dilek National Park, Turkey. *Environmental monitoring and assessment, 170*(1-4), 671-679.

Turgut, C., Atatanir, L., Mazmanci, B., Mazmanci, M. A., Henkelmann, B., & Schramm, K.-W. (2012). The occurrence and environmental effect of persistent organic pollutants (POPs) in Taurus Mountains soils. *Environmental Science and Pollution Research, 19*(2), 325-334.

Turgut, C., Cutright, T. J., Mermer, S., Atatanir, L., Turgut, N., Usluy, M., & Erdogan, O. (2013). The source of DDT and its metabolites contamination in Turkish agricultural soils. *Environmental monitoring and assessment, 185*(2), 1087-1093.

Unlu, S., & Alpar, B. (2006). Distribution and sources of hydrocarbons in surface sediments of Gemlik Bay (Marmara Sea, Turkey). *Chemosphere, 64*(5), 764-777. doi: 10.1016/j.chemosphere.2005.10.064

Unlu, S., & Alpar, B. (2009). Evolution of Potential Ecological Impacts of the Bottom Sediment from the Gulf of Gemlik; Marmara Sea, Turkey. *Bulletin of environmental contamination and toxicology, 83*(6), 903-906. doi: 10.1007/s00128-009-9803-8

Unlu, S., Ongan, D., & Alpar, B. (2004). PAH contamination sources in the sediments of the Strait of Istanbul (Bosphorus), Turkey. *Bulletin of environmental contamination and toxicology, 72*(3), 514-521. doi: 10.1007/s00128-004-0274-7

Weber, R., Gaus, C., Tysklind, M., Johnston, P., Forter, M., Hollert, H., . . . Masunaga, S. (2008). Dioxin-and POP-contaminated sites—contemporary and future relevance and challenges. *Environmental Science and Pollution Research, 15*(5), 363-393.

Yolsal, D. (2011). Poliklorlu Bifenillerin (PCB'ler) Hava-Toprak Arakesitindeki Dağılımları. *Uludağ Üniversitesi, Fen Bilimleri Enstitüsü, Çevre Mühendisliği Anabilim Dalı, Yüksek Lisans Tezi*.

Yolsal, D., Salihoglu, G., & Tasdemir, Y. (2014). Air–soil exchange of PCBs: levels and temporal variations at two sites in Turkey. *Environmental Science and Pollution Research, 21*(5), 3920-3935.

Appendix

Table 17. An overview of the spatial distribution of PAHs (μg/g dry weight) in sediments in Turkey (MEDPOL reports)

Location	Year	Basis	Amount Min-max (mean)	Reference
Meriç	2003	Σ PAH	0,02	MEDPOL 2003
Ç.Kale	2003	Σ PAH	0,01	MEDPOL 2003
Edremit	2003	Σ PAH	0,04	MEDPOL 2003
Izmir	2003	Σ PAH	0,01	MEDPOL 2003
Marmaris	2003	Σ PAH	0,02	MEDPOL 2003
Antalya	2003	Σ PAH	0,02	MEDPOL 2003
Mersin	2003	Σ PAH	0,02	MEDPOL 2003
Iskenderun	2003	Σ PAH	0,01	MEDPOL 2003
Taşucu	2004	Σ PAH	0,43	MEDPOL 2004
Mersin	2004	Σ PAH	0,28	MEDPOL 2004
Antalya	2004	Σ PAH	0,22	MEDPOL 2004
Iskenderun	2004	Σ PAH	0,29	MEDPOL 2004
Meriç	2004	Σ PAH	0,26	MEDPOL 2004
Marmaris	2004	Σ PAH	0,21	MEDPOL 2004
Izmir	2004	Σ PAH	0,35	MEDPOL 2004
Canakkale	2005	Σ PAH	34,9	MEDPOL 2005
Tasucu	2005	Σ PAH	112	MEDPOL 2005
Meric R.	2005	Σ PAH	114	MEDPOL 2005
Datca	2005	Σ PAH	9,27	MEDPOL 2005
Iskenderun	2005	Σ PAH	82,4	MEDPOL 2005
Edremit	2005	Σ PAH	8,69	MEDPOL 2005
B. Menderes	2005	Σ PAH	65,3	MEDPOL 2005
Mersin	2005	Σ PAH	70,8	MEDPOL 2005
Marmaris	2005	Σ PAH	71,0	MEDPOL 2005
Antalya	2005	Σ PAH	136	MEDPOL 2005
Izmir	2005	Σ PAH	53,4	MEDPOL 2005
Mersin	2006	Σ PAH	0,04-0,08	MEDPOL 2006
Saros Bay	2007	Σ PAH	0,182	MEDPOL 2007
Saros Bay	2008	Σ PAH	0,105	MEDPOL 2008
Saros Bay	2009	Σ PAH	0,137	MEDPOL 2009

Table 18. An overview of the spatial distribution of OCPs (ng/g dry weight) in sediments in Turkey (MEDPOL reports)

Location	Year	Basis	Amount Min-max (mean)	Reference
Meriç	2003	Σ_9 OCP	19,1	MEDPOL 2003
Çanakkale	2003	Σ_9 OCP	143	MEDPOL 2003
Edremit	2003	Σ_9 OCP	12,9	MEDPOL 2003
Izmir	2003	Σ_9 OCP	22,2	MEDPOL 2003
Marmaris	2003	Σ_9 OCP	39,6	MEDPOL 2003
Antalya	2003	Σ_9 OCP	137	MEDPOL 2003
Mersin	2003	Σ_9 OCP	20,1	MEDPOL 2003
Iskenderun	2003	Σ_9 OCP	5,35	MEDPOL 2003
Taşucu	2004	Σ_{12} OCP	876	MEDPOL 2004
Mersin	2004	Σ_{12} OCP	1185	MEDPOL 2004

Antalya	2004	Σ_{12} OCP	665	MEDPOL 2004
Iskenderun	2004	Σ_{12} OCP	414	MEDPOL 2004
Meriç	2004	Σ_{12} OCP	648	MEDPOL 2004
Marmaris	2004	Σ_{12} OCP	344	MEDPOL 2004
Izmir	2004	Σ_{12} OCP	417	MEDPOL 2004
Edremit	2004	Σ_{12} OCP	179	MEDPOL 2004
Çanakkale	2005	Σ_{12} OCP	79,1	MEDPOL 2005
Taşucu	2005	Σ_{12} OCP	76,2	MEDPOL 2005
Meriç Nehri	2005	Σ_{12} OCP	75,4	MEDPOL 2005
Datça	2005	Σ_{12} OCP	110	MEDPOL 2005
Iskenderun	2005	Σ_{12} OCP	21,3	MEDPOL 2005
Edremit	2005	Σ_{12} OCP	35,6	MEDPOL 2005
B.Menderes	2005	Σ_{12} OCP	60,7	MEDPOL 2005
Mersin	2005	Σ_{12} OCP	24,6	MEDPOL 2005
Marmaris	2005	Σ_{12} OCP	60,5	MEDPOL 2005
Antalya	2005	Σ_{12} OCP	6,88	MEDPOL 2005
Izmir	2005	Σ_{12} OCP	33,2	MEDPOL 2005
Izmir Bay	2006	Σ_9 OCP	0,774	MEDPOL 2006
Izmir Bay	2006	Σ_9 OCP	4,24	MEDPOL 2006
Datça	2007	Σ_9 OCP	1,02	MEDPOL 2007
Akbük	2007	Σ_9 OCP	1,02	MEDPOL 2007
Menderes	2007	Σ_9 OCP	5,26	MEDPOL 2007
Kuşadası	2007	Σ_9 OCP	bdl	MEDPOL 2007
Çandarlı	2007	Σ_9 OCP	8,11	MEDPOL 2007
Dikili	2007	Σ_9 OCP	1,95	MEDPOL 2007
Çanakkale	2007	Σ_9 OCP	bdl	MEDPOL 2007
Marmaris Bay	2007	Σ_9 OCP	0,690	MEDPOL 2007
Gökova Bay	2007	Σ_9 OCP	2,57	MEDPOL 2007
Izmir Bay-1	2007	Σ_9 OCP	bdl	MEDPOL 2007
Izmir Bay-2	2007	Σ_9 OCP	1,46	MEDPOL 2007
Izmir Bay-3	2007	Σ_9 OCP	15,8	MEDPOL 2007
Edremit Bay	2007	Σ_9 OCP	7,41	MEDPOL 2007
Meriç River Bay	2007	Σ_9 OCP	22,4	MEDPOL 2007
Iskenderun Bay	2007	Σ_9 OCP	2,56	MEDPOL 2007
Mersin Bay	2007	Σ_9 OCP	3,65	MEDPOL 2007
Antalya Bay	2007	Σ_9 OCP	5,70	MEDPOL 2007
Taşucu	2007	Σ_9 OCP	1,11	MEDPOL 2007
Karataş	2007	Σ_9 OCP	2,36	MEDPOL 2007
Fethiye	2007	Σ_9 OCP	0,963	MEDPOL 2007
Finike	2007	Σ_9 OCP	1,50	MEDPOL 2007
Datça	2008	Σ_9 OCP	bdl	MEDPOL 2008
Akbük	2008	Σ_9 OCP	1,02	MEDPOL 2008
Menderes	2008	Σ_9 OCP	5,63	MEDPOL 2008
Kuşadası	2008	Σ_9 OCP	0,18	MEDPOL 2008
Çandarlı	2008	Σ_9 OCP	7,27	MEDPOL 2008
Dikili	2008	Σ_9 OCP	1,56	MEDPOL 2008
Çanakkale	2008	Σ_9 OCP	bdl	MEDPOL 2008
Marmaris Bay	2008	Σ_9 OCP	0,04	MEDPOL 2008
Gökova Bay	2008	Σ_9 OCP	2,15	MEDPOL 2008
Izmir Bay-1	2008	Σ_9 OCP	0,13	MEDPOL 2008
Izmir Bay-2	2008	Σ_9 OCP	0,49	MEDPOL 2008
Izmir Bay-3	2008	Σ_9 OCP	18,1	MEDPOL 2008
Edremit Bay	2008	Σ_9 OCP	5,69	MEDPOL 2008

Meriç River Bay	2008	Σ_9 OCP	2,32	MEDPOL 2008
Datça	2009	Σ_9 OCP	0,518	MEDPOL 2009
Akbük	2009	Σ_9 OCP	1,16	MEDPOL 2009
Menderes	2009	Σ_9 OCP	6,21	MEDPOL 2009
Kuşadası	2009	Σ_9 OCP	0,386	MEDPOL 2009
Çandarlı	2009	Σ_9 OCP	6,25	MEDPOL 2009
Çanakkale	2009	Σ_9 OCP	bdl	MEDPOL 2009
Taşucu	2009	Σ_9 OCP	0,456	MEDPOL 2009
Karataş	2009	Σ_9 OCP	1,08	MEDPOL 2009
Fethiye	2009	Σ_9 OCP	1,99	MEDPOL 2009
Finike	2009	Σ_9 OCP	1,09	MEDPOL 2009
Göksu	2009	Σ_9 OCP	0,563	MEDPOL 2009
Tirtar	2009	Σ_9 OCP	21,5	MEDPOL 2009
Göksu River	2009	Σ_9 OCP	10,4	MEDPOL 2009
Marmaris Bay	2009	Σ_9 OCP	0,09	MEDPOL 2009
Göksu Bay	2009	Σ_9 OCP	3,68	MEDPOL 2009
Izmir Bay-1	2009	Σ_9 OCP	0,75	MEDPOL 2009
Izmir Bay-2	2009	Σ_9 OCP	0,86	MEDPOL 2009
Izmir Bay-3	2009	Σ_9 OCP	18,5	MEDPOL 2009
Edremit Bay	2009	Σ_9 OCP	3,24	MEDPOL 2009
Meriç River Bay	2009	Σ_9 OCP	2,10	MEDPOL 2009
Iskenderun Bay	2009	Σ_9 OCP	0,572	MEDPOL 2009
Mersin Bay	2009	Σ_9 OCP	1,90	MEDPOL 2009
Antalya Bay	2009	Σ_9 OCP	3,99	MEDPOL 2009

Table 19. An overview of the spatial distribution of PCBs (ng/g dry weight) in sediments in Turkey (MEDPOL reports)

Location	Year	Basis	Amount Min-max (mean)	Reference
Meriç	2003	$\Sigma_{Ar1254+1260}$	1,99	MEDPOL 2003
Çanakkale	2003	$\Sigma_{Ar1254+1260}$	0,03	MEDPOL 2003
Edremit	2003	$\Sigma_{Ar1254+1260}$	1,24	MEDPOL 2003
Izmir	2003	$\Sigma_{Ar1254+1260}$	0,02	MEDPOL 2003
Marmaris	2003	$\Sigma_{Ar1254+1260}$	0,04	MEDPOL 2003
Antalya	2003	$\Sigma_{Ar1254+1260}$	0,02	MEDPOL 2003
Mersin	2003	$\Sigma_{Ar1254+1260}$	0,02	MEDPOL 2003
Iskenderun	2003	$\Sigma_{Ar1254+1260}$	0,02	MEDPOL 2003
Taşucu	2004	$\Sigma_{Ar1254+1260}$	229	MEDPOL 2004
Mersin	2004	$\Sigma_{Ar1254+1260}$	Bdl	MEDPOL 2004
Antalya	2004	$\Sigma_{Ar1254+1260}$	121	MEDPOL 2004
Iskenderun	2004	$\Sigma_{Ar1254+1260}$	Bdl	MEDPOL 2004
Meriç	2004	$\Sigma_{Ar1254+1260}$	92,2	MEDPOL 2004
Marmaris	2004	$\Sigma_{Ar1254+1260}$	171	MEDPOL 2004
Izmir	2004	$\Sigma_{Ar1254+1260}$	Bdl	MEDPOL 2004
Edremit	2004	$\Sigma_{Ar1254+1260}$	88,7	MEDPOL 2004
Çanakkale	2005	$\Sigma_{Ar1254+1260}$	578	MEDPOL 2005
Taşucu	2005	$\Sigma_{Ar1254+1260}$	472	MEDPOL 2005
Meriç River	2005	$\Sigma_{Ar1254+1260}$	372	MEDPOL 2005
Datça	2005	$\Sigma_{Ar1254+1260}$	440	MEDPOL 2005
Iskenderun	2005	$\Sigma_{Ar1254+1260}$	375	MEDPOL 2005
Edremit	2005	$\Sigma_{Ar1254+1260}$	510	MEDPOL 2005
B.Menderes	2005	$\Sigma_{Ar1254+1260}$	218	MEDPOL 2005
Mersin	2005	$\Sigma_{Ar1254+1260}$	564	MEDPOL 2005

Marmaris	2005	$\Sigma_{Ar1254+1260}$	633	MEDPOL 2005
Antalya	2005	$\Sigma_{Ar1254+1260}$	269	MEDPOL 2005
Izmir	2005	$\Sigma_{Ar1254+1260}$	682	MEDPOL 2005
Izmir Bay	2006	$\Sigma_{Ar1254+1260}$	0,687	MEDPOL 2006
Izmir Bay	2006	$\Sigma_{Ar1254+1260}$	0,679	MEDPOL 2006
Izmir Bay	2006	$\Sigma_{Ar1254+1260}$	0,667	MEDPOL 2006
Datça	2007	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2007
Akbük	2007	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2007
Menderes	2007	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2007
Kuşadası	2007	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2007
Çandarlı	2007	$\Sigma_{Ar1254+1260}$	27,3	MEDPOL 2007
Dikili	2007	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2007
Çanakkale	2007	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2007
Marmaris Bay	2007	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2007
Gökova Bay	2007	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2007
Izmir Bay-1	2007	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2007
Izmir Bay-2	2007	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2007
Izmir Bay-3	2007	$\Sigma_{Ar1254+1260}$	34,9	MEDPOL 2007
Edremit Bay	2007	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2007
Meriç River Bay	2007	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2007
Iskenderun Bay	2007	$\Sigma_{Ar1254+1260}$	17,9	MEDPOL 2007
Mersin Bay	2007	$\Sigma_{Ar1254+1260}$	15,9	MEDPOL 2007
Antalya Bay	2007	$\Sigma_{Ar1254+1260}$	11,4	MEDPOL 2007
Taşucu	2007	$\Sigma_{Ar1254+1260}$	11,3	MEDPOL 2007
Karataş	2007	$\Sigma_{Ar1254+1260}$	9,02	MEDPOL 2007
Fethiye	2007	$\Sigma_{Ar1254+1260}$	13,4	MEDPOL 2007
Finike	2007	$\Sigma_{Ar1254+1260}$	14,3	MEDPOL 2007
Datça	2008	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2008
Akbük	2008	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2008
Menderes	2008	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2008
Kuşadası	2008	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2008
Çandarlı	2008	$\Sigma_{Ar1254+1260}$	22,1	MEDPOL 2008
Dikili	2008	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2008
Çanakkale	2008	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2008
Marmaris Bay	2008	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2008
Gökova Bay	2008	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2008
Izmir Bay-1	2008	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2008
Izmir Bay-2	2008	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2008
Izmir Bay-3	2008	$\Sigma_{Ar1254+1260}$	26,1	MEDPOL 2008
Edremit Bay	2008	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2008
Meriç River Bay	2008	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2008
Datça	2009	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2009
Akbük	2009	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2009
Menderes	2009	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2009
Kuşadası	2009	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2009
Çandarlı	2009	$\Sigma_{Ar1254+1260}$	29,4	MEDPOL 2009
Çanakkale	2009	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2009
Taşucu	2009	$\Sigma_{Ar1254+1260}$	3,67	MEDPOL 2009
Karataş	2009	$\Sigma_{Ar1254+1260}$	4,32	MEDPOL 2009
Fethiye	2009	$\Sigma_{Ar1254+1260}$	3,37	MEDPOL 2009
Finike	2009	$\Sigma_{Ar1254+1260}$	3,40	MEDPOL 2009
Göksu	2009	$\Sigma_{Ar1254+1260}$	2,32	MEDPOL 2009
Tirtar	2009	$\Sigma_{Ar1254+1260}$	45,8	MEDPOL 2009

Göksu River	2009	$\Sigma_{Ar1254+1260}$	35,8	MEDPOL 2009
Marmaris Bay	2009	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2009
Göksu Bay	2009	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2009
Izmir Bay-1	2009	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2009
Izmir Bay-2	2009	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2009
Izmir Bay-3	2009	$\Sigma_{Ar1254+1260}$	31,2	MEDPOL 2009
Edremit Bay	2009	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2009
Meriç River Bay	2009	$\Sigma_{Ar1254+1260}$	bdl	MEDPOL 2009
Iskenderun Bay	2009	$\Sigma_{Ar1254+1260}$	2,46	MEDPOL 2009
Mersin Bay	2009	$\Sigma_{Ar1254+1260}$	3,85	MEDPOL 2009
Antalya Bay	2009	$\Sigma_{Ar1254+1260}$	4,53	MEDPOL 2009