The Hashemite Kingdom of Jordan

Jordan's update of the National Implementation Plan under the Stockholm Convention referring to the COP4 decision including 9 additional POPs

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List of Abbreviations

AFFF	Aqueous Film Forming Foam
ASTM	American Society for Testing and Materials
ATC	Alcohol Type foam Concentrate
BAT	Best Available Technology
BDE	Brominated Diphenyl ether
COP	Conference of the Parties
CRT	Cathode Ray Tube
DDT	Dichlorodiphenyltrichloroethane
DoS	Department of Statistics
EEE	Electric and Electronic Equipment
EIA	Environmental Impact Assessment
ELV	End of Life Vehicles
EPA	United States Environmental Protection Agency
GC/ECD	Gas Chromatography / Electron Capture Detector
GC/MS	Gas Chromatography/Mass Spectrometer
HCH	Hexachlorocyclohexane
ISO	International Organization for Standardization
LC/UV	Liquid chromatography−Ultraviolet
LCD	Liquid-Crystal Display
LED	Light Emitting Diodes
MRL	Maximum Residue Limit
NIP	National Implementation Plan
OCPs	Organochlorine pesticides
PBDEs	Polybrominated Diphenylether
PCBs	Polychlorinated biphenyl
PCDD	Polychlorinated Dibenzodioxins
PCDF	Polychlorinated Dibenzofurans
PeCB	Pentachlorobenzene
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctanesulfonate
POPs	Persistent Organic Pollutants
PUF	Poly Urethane Foam
PUR	Polyurethane
RSS	Royal Scientific Society
WEEE	Waste Electric and Electronic Equipment

Executive Summary

At COP 4 Stockholm Convention held in Geneva in May 2009, the Conference of the Parties adopted amendments to Annexes A, B and C to list nine additional chemicals, five POPs pesticides and four industrial POPs.
The five POPs pesticides are:

1. alpha hexachlorocyclohexane;
2. beta hexachlorocyclohexane;
3. chlordecone;
4. lindane;
5. pentachlorobenzene;

The five POPs pesticides are banned, the decisions were taken by the pesticides registration committee in 1993 and 2001. They are not imported nor produced neither registered to be used in Jordan. In a survey, all importing and manufacturing companies in Jordan replied that they don't have expired pesticides according to a checklist of an official letter sent to them by the Ministry of Agriculture. Agriculture directories from all regions of Jordan provided information that some districts have expired pesticides but not from the list of POPs pesticides.

The four industrial POPs are:

6. tetrabromodiphenyl ether and pentabromodiphenyl ether.
7. hexabromodiphenyl ether and heptabromodiphenyl ether;
8. hexabromobiphenyl;
9. perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride;

Import, export and management of hazardous substances is banned by the bylaw no. 24, 2005 articles 7 and 8. The environmental law 52/2006 in article 6 regulates importing and exporting of hazardous wastes. The amended import instruction no 1, 2012 by the Ministry of Industry and Commerce allows the import of used computers only if they are not more than three years old.

Based on calculations, the total quantity of c-pentaBDE in the transport sector in Jordan for 2014 is around 13 tons, divided to be 59% in cars, 40% in busses and 1% in trucks. The distribution of the other polybrominated diphenyl ethers in the transport sector in Jordan in 2014 is 33% c-TetraBDE, 58% c-pentaBDE, 8% c-HexaPDE and 0.5% c-HeptaBDE. In the WEEE (Waste Electrical and Electronic Equipment) more than 50% of the polybrominated diphenyl ethers are in CRTs (Cathode Ray Tubes) from TV and computer monitors. These amounts in 2007 were estimated to be 10.8 tons c-octaBDE, 4.6 tons c-HexaPBDE and 1.4 tons c-HeptaPBDE.

Questionnaires for PFOS consumption and storage were sent out to industry in 2014 in order to investigate in the industrial sectors Textile, Synthetic Carpets and Synthetic leather, and factories or maintenance centers which are making Chromium Plating. The result of the survey showed that no factory that answered used PFOS or any related substance in their industry. Detailed information of PFOS foam consumption 2010 – 2013 and of PFOS foam available in 2014 in Civil Defense was provided by the Civil Defense Directorate.

1. Policy statement

Jordan signed the Stockholm Convention and ratified the Convention in November 2004, and entered into force by February 2005. Under Article 7 of the SC, Parties are required to develop and endeavor to implement a plan for the implementation of their obligations under the Convention.

Jordan is one of the leading countries in the developing world and the region that has taken care of the local environment since 1970s. The remarkable step was the establishment of the Department of Environment in 1980. The leadership of the country always insisted to adhere to the international community and United Nations requirements and instruments concerning all issues especially environmental protection. The Environmental policy of Jordan is defined by the National Environment Strategy. It is considered as important national document and source book, and the National Socio-Economic Development Plan as well as other similar planning documents related to economy, agriculture and health sectors. This created a common foundation for the development and implementation of the national sustainable development policy. The environmental policy of Jordan emphasizes on the coordination effort on a regional and global basis in close cooperation with concerned international bodies and agencies addressing all global environmental issues, such as ozone layer depletion and POPs and greenhouse gas emissions.

Improved quality of life for the people of Jordan, economic growth, protection of the environment and maintenance of the natural environmental balance are related and very important to achieve only sustainable developments. Such a rational approach should promote environmental protection and sustainable development strategy in Jordan.
The Government of Jordan is committed to manage POPs chemicals with the main aim of protecting its people and environment. As an active member of the international community, Jordan will also undertake essential measures for protecting the global environment from negative impacts of dissemination of POPs compounds throughout the world.

During the fourth Conference of the Parties (COP4) to the Stockholm Convention on Persistent Organic Pollutants (POPs) held from 4-8 May 2009, in Geneva, Switzerland, over 800 participants attended the meeting. Jordan representatives joined the sessions during adoption of 33 decisions on, inter alia, nine new chemicals, financial resources, guidance to the financial mechanism, implementation plans, technical assistance, synergies and effectiveness evaluation

Jordan chairs the Stockholm Convention from May 2017 (COP 8) to May 2019 (COP 9), Mr. Mohammed Oglah Hussein Khashashneh serves as the President of the Bureau of the Stockholm Convention.

2. Scope of the update according to COP4 Decision

At its fourth meeting held in Geneva, Switzerland, from 4 to 8 May 2009, the Conference of the Parties adopted amendments to Annexes A, B and C, in decisions SC-4/10, 4/11, 4/12, 4/13, 4/14, 4/15, 4/16, 4/17 and 4/18 to list 9 (nine) additional chemicals, respectively:

1. alpha hexachlorocyclohexane;
2. beta hexachlorocyclohexane;
3. chlordecone;
4. lindane;
5. pentachlorobenzene;
6. tetrabromodiphenyl ether and pentabromodiphenyl ether.
7. hexabromodiphenyl ether and heptabromodiphenyl ether;
8. hexabromobiphenyl;
9. perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride;

The amendments were communicated by the depositary to all Parties on 26 August 2009 (Depositary notification (Reference: C.N.524.2009.TREATIES-4, English, French).

3. Legal framework

In pesticides rules and Acts of 2002 and 2003, general rules and instructions are given. Existing regulations for controlling the smuggling of banned pesticides are not sufficient. Table below gives the existing legislation linked with certain new POPs pesticides in Jordan.

Table 1. Existing legislation linked with certain new POPs pesticides in Jordan

New POPs Pesticides	Current legislation	Date of Publication
Alpha hexachlorocyclohexane (α-HCH) **Beta hexachlorocyclohexane (β- HCH)** **HCH Mixed Isomers**	Banned, the decision was taken by the pesticides registration committee due to the information received from PIC.	Final decision was published on: 12/7/ 1993
Chlordecone	Not imported nor produced neither registered to be used in Jordan	-
Lindane (γ-HCH)	Banned, the decision was taken by the pesticides registration committee due to the information received from PIC.	Final decision was published on : 12/12/ 2001
Pentachlorbenzene	Not imported nor produced neither registered to be used in Jordan	

The Laws, regulations, specifications or bylaws in Jordan have not directly tackled POP-BDEs releases. Although much of this legislation, when implemented, can contribute to decreasing the POP-BDEs releases to some extent, current legislation is insufficient to ensure proper management of End of Life vehicles.

The regulation related to the Management, Transportation and Handling of Harmful and Hazardous Substances (by Law No: 24/2005) forbid the disposal of hazardous substances in the dumping sites designated for general waste, or into drainage networks, due to their hazardous characteristics and their harmful effects on the environment and life forms.

The relevant national legislation refers to production, import, export of POPs- PBDEs and PFOS management and elimination are given in the table below:

Table 2. Relevant legislation on new POPs industrial chemicals in Jordan

New POPs industrial chemicals	Relevant legislation of Jordan
PBDEs and PFOS	Banned under the Environmental law 52/2006 in article 6, which regulates importing and exporting of hazardous wastes. Import, export and management of hazardous substances is banned by the bylaws no. 24, 2005 articles 7 and 8. Amended import Instruction no 1, 2012 by Ministry of Industry and Commerce allows for the import of used computers not more than three years old.

4. Assessment of the nine new POPs

4.1. POPs Pesticides

Short introduction

At present, there are about 1668 imported and locally formulated pesticide products referring to about 200 pesticides common names in Jordan. These are registered through the registration committee in the ministry of Agriculture. None of these pesticides belong to chlorinated hydrocarbon pesticides. At present, there is no manufacturing, formulation, import and legal use for any chlorinated hydrocarbon pesticides in Jordan.

There are different national sources of information on pesticides describing their quantities, import, handling, storage, use, risks, and registration and banning. In fact, the Government of Jordan has banned many types of pesticides prior to the Stockholm Convention. For example the use of DDT was banned in 1980 by the Ministry of Agriculture for agricultural uses, and in 1992 it was banned by the Ministry of Health for combating Malaria. Toxaphene was banned by the Ministry of Environment. The existing quantities of pesticides, as well as, the locations of stockpiles of DDT, Dieldrin, and Agrocide are defined and documented.

Few studies on pesticide residues in soil, water, mothers' milk, animal products and food stuff were conducted by Jordanian experts. However, further studies are needed, particularly on the suspected contaminated sites.

Several national institutions are working on pesticides management within the overall chemical management context. The Ministry of Agriculture, Ministry of Health, Ministry of Environment, Ministry of Labor, Customs Department, Civil Defense Directorate are the main governmental institutions concerned with chemical compounds management. Other agencies such as Chamber of Industry and Farmers Union have a role in this regard.

4.1.1 Inventory of POPs Pesticides

Mechanism/Methodology of Inventory of Persistent Organic Pesticides

The inventory included all sectors dealing with pesticides in private and governmental sectors:
1. Companies which imported pesticides;
2. Manufacturers of pesticides;
3. All directorates of agriculture, which have warehouses for the storage of pesticides;
4. Pesticides registration committee;
5. Center of Analysis of Pesticides and their residues in the Ministry of Agriculture.

Inventory Results
The inventory team communicated that the data and information given bellow were obtained from all relevant stakeholders:
1. All importing and manufacturing companies in Jordan replied that they don't have expired pesticides according to the attached checklist of the official letter sent to them by the Ministry of Agriculture.
2. Agriculture directories from all regions of Jordan provided information that some districts have expired pesticides but not from the list of POPs pesticides.

The data on new POPs pesticides that were provided during the survey made by the team have been added to the old NIP as shown the following Table 3, which gives a summary of the data and information obtained in course of NIP updating activities.

Table 3. Common name, trade name, pesticide group, CAS NO., mode of action, date of prohibition, reason of prohibition of the added POPs pesticides.

Common Name	Trade Name	Pesticide Group	CAS NO	Mode of action	Date of banning	Reason of banning
Alpha hexachlorocyclo-hexane (α-HCH) **Beta hexachlorocyclo-hexane (β-HCH)** **HCH Mixed Isomers**	-	Insecticide	- Mixed isomers	Non systemic	Final decision Published on : 12/7/ 1993	According to PIC
Chlordecone	-	Insecti-cide	143-50-0	Insecticidal control of cockroaches and ants	-	-
Lindane (γ-HCH)	Gamma-Col' 'Lindamu l' 'Lintox'	Insecti-cide	608-73-1	Mode of action: Insecticide with contact, stomach and respiratory actior Uses mainly for soil and seed treatment Control of a broad spectrum of phytophagous anc soil-inhabiting insects, public-health pests, and animal ectoparasites. Used on a wide range of crops	Final decision was publishe d on: 12/12/ 2001	According to PIC
Pentachloro-benzene	---	Fungicide	608-93-5	Curative	Not imported nor produced neither registere d to be used in Jordan	-

4.1.2 Current situation of stockpiles of POPs Pesticides

The Ministry of Environment undertook action to identified obsolete POPs pesticides quantities. The results of the survey are given in the Table (1-4) given below.

Table 4. The new POPs pesticides and the actions taken by Ministry of Agriculture of Jordan.

New POPs Pesticides	Inventory in 2014
Alpha hexachlorocyclohexane (α-HCH),& Beta hexachlorocyclohexane (β- HCH),&(HCH Mixed Isomers)	There is no quantity found in stores
Chlordecone	-
Lindane (γ-HCH)	There is no quantity found in stores
Pentachlorobenzene	-

4.1.3 Institutional infrastructure for analysis and management of new POPs Pesticides

Only capacities for analyses of pesticide are present in the country. The laboratories that analyze pesticides are present mainly at Ministry of Agriculture, Ministry of Health, universities and RSS (Royal Scientific Society).

The following institutions have experienced resources in chlorinated hydrocarbon pesticides and polychlorinated biphenyls analysis in Jordan:

1. Ministry of Agriculture.
    - Center of Pesticides Analysis and Their Residues
2. University of Jordan:
    - Environmental Pollutant Research Laboratory - Analytical Chemistry / Department of Chemistry.
    - Water and Environmental Research and Study Center.
3. Mota University:
    - Water and Environmental Studies Center (POPs Laboratory).
    - Engineering Faculty Laboratories.
4. Amman National University:
    - Organic and Pharmaceutical Organic Chemistry Laboratory.
    - Analytical Organic Chemistry Laboratory.
    - Automatic Analysis Laboratory.
5. Yarmouk University.
6. Hashemiya University.
7. Petra Private University.
8. Jordan University of Science and Technology.
    - Environmental Science Section.
    - Public Health.
    - Chemistry Section.
9. Royal Scientific Society.
    - Industrial Chemistry Center.
    - Environmental Research Center.
10. Ministry of Health.

11. Ministry of Energy and Natural Resources
12. Ministry of Environment/POPs

The Ministry of Environment has additional directorates and national committees that are established as per the environment protection law such as the Directorate of Licensing and Guidance, Central Licensing Committee, Environmental Impact Assessment (EIA) committee, and Directorate of Hazard substances and Waste Management.

Headed by the Ministry of Environment, a national committee is formed as per the harmful and hazardous waste bylaws number 24/2005 called «the National Technical Committee for Harmful and Hazardous Chemicals Management". This national committee is in charge of setting up national policies to manage hazardous and toxic materials among of which is the WEEE (waste electrical and electronic equipment). This committee is comprised of 14 governmental, private, academic and governmental institutions. Jordan classifies WEEE as a hazardous waste according to the National Technical Committee, established by the Directive 24/2005 that manages and handles hazardous and harmful substance.

4.1.4 New POPs Pesticides Monitoring

Evidence of presence of chlorinated hydrocarbon pesticides

Alawi et al. (1999) reported the presence of some chlorinated hydrocarbon pesticides in human adipose tissues. Besides, these pesticides were observed in milk samples taken from women living in different parts of the country (Alawi et al. 1992, Nasir et al. 1998). An inverse relationship between the concentration of pesticides in the milk fat and the lactation period was reported (Nasir et al. 1998). This was interpreted as the loss of organochlorines stored in the body as a result of breast- feeding. Hence, the breast-fed newborns were fed by pesticides contaminated milk which would be deposited and concentrated in their bodies.

One another study conducted in 2004, in the frames of the master thesis showed the following: The analysis of organochlorine pesticides in the field samples indicated the presence of trace amounts of pesticides in all samples (Table 5). However, the analyzed pesticides varied in their abundance and distribution among the samples, where α-BHC and lindane showed the highest concentrations obtained, i .e. ca 9 and 4 ng/l, respectively. Endosulfan I, showed the highest abundance among the analyzed pesticides, where it was detected in nine samples.

The pesticides also varied in the number of samples in which they were detected. β-BHC, δ-BHC, endrin, endrin aldehyde, aldrin, heptachlor, heptachlor epoxide and the diphenyl pesticides, i.e. DDD, DDE and DDT, were not detected in any of the analyzed samples. α-BHC was detected in two, lindane in five and endosulfan sulfate in eight samples.[1]

[1] *Analysis of some Chlorinated Pesticides in Jordanian Ground- and Surface Waters by Solid Phase Extraction and Mass Spectrometric Detection- A Method Development 2004, Shahin, Lara, Linköping University, The Tema Institute, Department of Water and Environmental Studies. http://liu.diva-portal.org/smash/record.jsf?pid=diva2:19583*

Table [5]Concentrations of pesticides (ng/l) in samples taken from locations along the Jordan Valley. Samples 2 & 13 were spiked with 1 µl of the standard pesticides mixture (ranging 9.96-60.04 ng/l).

	Sample number													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
α-BHC	0	49	0	+	0	9	+	4	0	0	0	0	62	0
Lindane (γ-BHC)	3	53	+	+	+	0	+	4	0	4	3	4	67	4
β-BHC	0	59	0	0	0	0	0	0	0	0	0	0	69	0
Endosulfan ether	0	+	+	0	0	0	0	0	0	0	0	0	+	0
δ-BHC	0	57	0	0	0	0	0	0	0	0	0	0	75	0
Heptachlor	0	34	0	0	0	0	0	0	0	0	0	0	25	0
Aldrin	0	38	0	0	0	0	0	0	0	0	0	0	22	0
Heptachlor epoxide	0	35	0	0	0	0	0	0	0	0	0	0	37	0
Endosulfan I	0.08	83	+	0.3	0.07	0	0.1	0.1	0.1	0.05	0	0.08	62	0.06
DDE	0	45	0	0	0	0	0	0	0	0	0	0	37	0
Endrin	0	110	0	0	0	0	0	0	0	0	0	0	99	0
Endosulfan II	0.04	90	+	0.2	0	0	0.06	0.04	+	0.03	0	+	77	0
DDD	0	211	0	0	0	0	0	0	0	0	0	0	113	0
Endrin aldehyde	0	327	0	0	0	0	0	0	0	0	0	0	296	0
Endosulfan sulfate	0.5	290	0.3	1	0.5	0	0.3	0.4	0	0.05	0	0.05	265	0
DDT	0	54	0	0	0	0	0	0	0	0	0	0	181	0

Underlined; concentrations were calculated from the qualifier.

+; Below quatification limit. 0; Undetected.

Threat of Pesticides to Public Health

- **Acute toxicity**

Those numbers of poisoning accidents (53 cases) between 1997 and 2002 could not represent the actual status due to the lack of documentation for poisoning cases in hospitals and health centers. However, 27-69 % of poisoning cases indoors were due to pesticides handling and storing. Projects for improvement of poisoning documentation are needed, in addition to national poisoning center to be established in Jordan to take care of all related issues.

- **Chronic Toxicity**

Banned chlorinated hydrocarbon pesticide residues were found in some samples of local or imported agricultural and food commodities. In addition, these banned compounds were found in imported and local animal products and mothers' milk. International references indicate the possibility for these compounds to cause carcinogenic effects, mutagenicity, teratogenicity, fetal toxicity and reproduction effects. A total of 3362 cases of cancer were recorded among Jordanians in 2000. This figure increased to 4187 in 2002.

Eighty breast milk samples were analyzed in three middle districts of Jordan, in 2004/2005. The results showed that the average in the three districts was 0.17 mg/kg milk fat for HCHs, 0.28 mg/kg milk fat for DDTs, and 0.01 mg/kg milk fat for cyclodiens.

Also, eighty breast milk samples were analyzed in four north districts of Jordan, in 2005/2006.

The results showed that the average in the four districts was 0.13 mg/kg milk fat for HCHs, 0.25 mg/kg milk fat for DDTs, and 0.01 mg/kg milk fat for cyclodiens. One hundred eighty breast milk samples from four south districts were analyzed in 2007/2008 period showed that the average in these four districts was 0.15 mg/kg milk fat for HCHs, 0.28 mg/kg milk fat for DDTs, and 0.01 mg/kg milk fat for cyclodiens.[2]

There is no documented link between exposure to pesticides and cancer cases yet; research studies and monitoring of pesticide residues particularly chlorinated hydrocarbons in food study are needed to minimize the potential health risks.

a. ***Monitoring of Pesticides in Agricultural Crops***

Monitoring is an on-going component of the project that started in 1993 and was carried out by the Center of Analysis of Pesticides and their Residues in the Ministry of Agriculture.

[2] https://www.researchgate.net/publication/236863105_Comparative_Study_for_Chlorinated_Pesticides_in_Human_Breast_Milk_from_Jordan_between_2004_and_2008

Table 2.2.1 shows a comparison between pesticide residues in the imported agricultural commodities during 1993 up to date.

Results of the study in 2011/2012 showed that 5.5 % of the samples contained pesticide residues. 5.5 % of the total samples contained chlorinated hydrocarbon pesticide residues but less than the MRL (maximum residue levels). 0.25% of the imported samples contained pesticide residues more than the MRL and all the residues were from non persistent organic pesticides.

In 2007/2008 study showed that 11 % of the samples contained pesticide residues. 11 % of the total samples contained chlorinated hydrocarbon pesticide residues but less than the MRL. 0.25 % of the imported samples contained pesticide residues more than the MRL and all the residues do not belong to the persistent organic pollutants group of pesticides.

In 2004/2005 study, 16.7 % of the total samples contained residues but less than the MRL. As a conclusion, none of the polluted samples contained chlorinated hydrocarbon pesticides
In 2002/2003 study, none of the imported samples contained residues more than the MRL. 1 % of the total imported samples contained chlorinated hydrocarbon pesticide residues less than MRL.

In 2001/2002 study, none of the imported samples contained pesticide residues more than the MRL, but the detected residues do not belong to the persistent organic pollutants's group of pesticides. These data are reported below at the end, see:

Annex 1: Comparison between pesticide residues in agricultural commodities in the study of 2011-2012 and studies conducted in 2000-2001, 2002-2003, 2007-2008 for imported samples.

Annex 2: Comparison between pesticide residues in agricultural commodities in the study of 2011-2012 and studies conducted in 2000-2001, 2002-2003, 2007-2008 for local agricultural commodities.

b. Monitoring of Chlorinated Hydrocarbons Residues in Animal Product.

A study conducted by the RSS (Royal Scientific Society) in June 2011/2012 showed that 38 % of animal product samples were contaminated with pesticide residues but less than the MRL, although 2.5 % of the samples contained residues more than the MRL. In 2000, 2001, 2005 and 2007 studies conducted by RSS indicated that, 20 %, 43 %, 35% and 40.8% of the samples, respectively, were contaminated with pesticides residues but less than the MRL, whereas 5%, 2.5 %, 3 % 4 % and 2.5% of the samples contained residues more than the MRL (Figure 1).

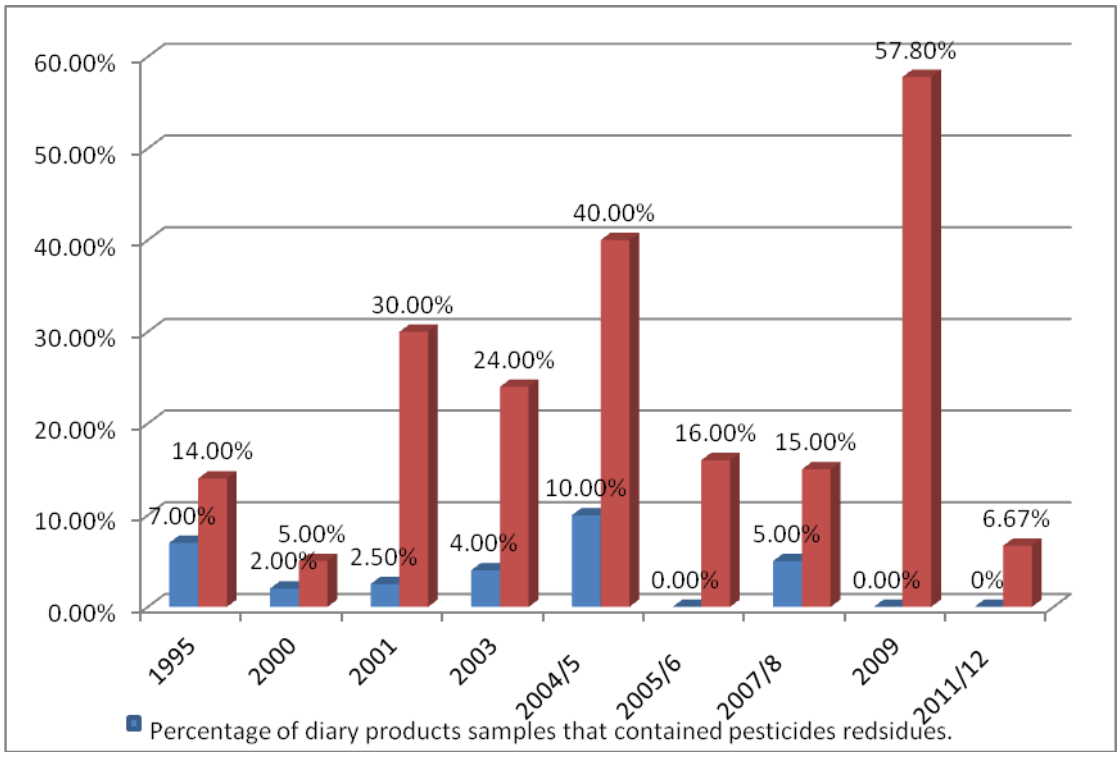

Figure 1: Pesticide residues in dairy products between 1995 and 2012; left column: % samples above MRL; right column: % samples below MRL.

Organochlorine pesticide (OCP) residues in 519 samples; comprising eggs, chicken and meat (lamb and beef), collected from Jordan were determined. All samples were analyzed for their residual contents of aldrin, dichlorodiphenyltrichloroethane and metabolites (DDTs), dieldrin, endosulfan isomers, endrin, hexachlorocyclohexane isomers (HCHs), heptachlor, heptachlor epoxide and hexachlorobenzene (HCB).

The results indicated that 28% (38/134), 20% (23/115) and 49% (131/270) of the examined eggs, chicken and meat samples, respectively, were contaminated with OCP residues. HCHs and DDTs are the most prominently noticed compounds, as they were detected at a high incidence. On the other hand, heptachlor, heptachlor epoxide, HCB, aldrin and endrin compounds were only present in less than 7% of the analyzed samples. These residues are present despite complete ban on the use of OCPs for agricultural purposes in Jordan. No residues of op'-DDD, op'-DDT, dieldrin, alpha-endosulfan and beta-endosulfan were detected.

Threats of Pesticides on Environment

The pesticides particularly chlorinated hydrocarbon compounds have an adverse effect on the different environmental systems in Jordan and everywhere in the world. This effect leads to negatives charges in the food chain. It is well known that 0.1 % of the sprayed pesticide is able to reach the target. The remained amount of pesticides goes to soil, water, air, wild life and food chains. The chlorinated hydrocarbon residues in Jordan were found in soil, sediments and in few cases in water. Eggs of several wild birds were not able to hatch due to the effect of DDT on its calcium. Residues of some chlorinated hydrocarbon pesticides were detected in fish in Jordan Valley. Many rodentia fish were found poisoned in Jordan Valley which in its turn killed many of a Grey Arelea cenerea. The actual threats of pesticides particularly chlorinated hydrocarbon as pollutant, on the environment needs to be studied to decrease its threat.

4.2 **POPs industrial chemicals PBDEs and PFOS**

Short Introduction on PBDEs and PFOS

In May 2009, the Conference of the Parties amended the Stockholm Convention on persistent organic pollutants (POPs) to add Hexabromobiphenyl, PBDEs and PFOS in Annex A and Annex B of the Stockholm Convention.
Polybromodiphenyl ethers (PBDEs) are a group of brominated industrial chemicals which have been widely used since 1970s as flame retardants in the form of additives in consumer articles such as plastics in electronics, upholstery in transport and furniture or textiles. The acronym PBDEs is used for the generic term polybromodiphenyl ether, covering all congeners of the family of brominated diphenyl ethers. PBDEs were produced at three different degrees of bromination, in particular commercial Pentabromodiphenyl ether (c-pentaBDE), and commercial Octabromodiphenyl ether (c-octaBDE). An approximate distribution of global c-pentaBDE use of 36% in transport, 60% in furniture and a 4% residual in other articles is considered to be reasonable. The average content of c-pentaBDE in PUR foam is around 3-5% for upholstery, cushions, mattresses and carpet padding. The main challenge for their elimination is the identification of existing stockpiles and articles containing PBDEs and their disposal at end of life.
PFOS are a subgroup of the bigger group of hazardous compounds Persistent organic pollutants (POPs). Perfluorooctane sulfonic acid (PFOS) – its salts and perfluorooctane sulfonyl fluoride (PFOSF) are explicitly listed in Annex B. Many PFOS-related chemicals are not specified in Annex B. Generally there are many applications of PFOS in various industries: textile impregnation (2-3%), synthetic carpet impergation (2%), metal plating (5-10%), heavy & decorative chrome (5-50%), coating (1%), etc. Currently PFOS is still produced and used in several countries

4.2.1 Preliminary Inventory on PBDEs

A. Mechanism/methodology for the inventory development

The main focus of the Jordan NIP regarding the new industrial POPs was identification and assessment of POP-PBDEs chemicals groups and establishes the inventories focused on:

a) Electrical and Electronic Equipment and WEEE for c-octaBDEs inventory and

b) Transport sector for c-pentaBDEs inventory

In order to develop comprehensive preliminary inventory serial of activities under the prior defined approach (given below) were undertaken.

Jordanian approach toward development of c-pentaBDEs inventory

At the NIP update workshop held in November 2013, it was agreed that the inventory is considering the total c-pentaBDE amount for Polyurethane (PUR) foam and textile (automotive seating; head rests; vehicle ceilings, acoustic management systems). However, the use of c-octaBDE in the plastic fraction (dashboard etc.) is not considered in this inventory since it's total use in transport sector is relatively considered of minor importance compared to c-pentaBDE (in the PUR foam/textile fraction) and hence is excluded from the inventory for reasons of simplification.

The working team assigned at the inception workshop held in November 2013 to undertake the PBDE preliminary inventory included experts on the transport sector and researchers from the University of Jordan, Jordan University of Science & Technology, Ministry of Environment, Public Defense, Amman Chamber of Industry, and Jordanian Custom Department. The team set the project approach including the objectives and scope of the inventory and in line with the PBDE inventory guidance developed by the Stockholm Convention ("Guidance for the Inventory of Polybrominated Diphenyl Ethers (PBDEs) listed under the Stockholm Convention on Persistent Organic Pollutants. At the closing session of the workshop a work plan was developed by the team and represented by the project team leader.

The following project stakeholders have been contacted to gather national data and comprehensive inventory of the transport sector: Jordanian Department of Statistics, Greater Amman Municipality, Ministry of Environment (MoEnvt),, Customs Dept/ Ministry of Finance, Transportation Ministry, Traffic Dept/ Ministry on Interior, Ministry of Trade and Industry, Aqaba Special Economic Zone Authority, University of Jordan, Jordan University of Science & Technology, Jordanian Environment Society, Royal Scientific Society, End-of-life vehicles stores, Vehicles' items recyclers and automobile plastics scavengers.

Jordanian approach towards development of c-octaBDEs inventory

In case of development of c-octaBDEs inventory a series of letters were sent to different departments, institutions and authorities (Ministry of Telecommunication, Ministry of Finance- Supply Central Department and Custom Department, Department of Statistics, Jordan Chamber of Commerce, chamber of industry and the 12 major municipalities of Jordan) in addition to the member of the team who did not need letters but were able to look for data such as the Ministry of Industry and Commerce, Ministry of Health and the Ministry of Environment. The purpose of these letters was to get the following:

- Examine whether certain relevant countries as per PBDEs Guidance are relevant to Jordan and thus could be considered to conclude Tier I.
- Obtain Jordan population and the penetration rate of computers and TVs to calculate the initial assessment inventory study (Tier II).
- Get a list of all recyclers of plastics, refurbished companies of computers, internet coffee who in addition do maintenance to computers, TV computer shops, importers of electrical and electronic companies in Jordan, retail shops of selling computers in Jordan,
    - Distribute the four questionnaires among the team to translate into Arabic and tailor to the Jordanian situation. The four focus groups were: Importers, recyclers, householders and corporate and institutional consumers. The four questionnaires are translated. Then they were tested and then applied. The purpose is to improve the inventory figures revealed from the initial assessment of inventory "Tier II". The questionnaires number, geographic, and stakeholders that were translated will be filled in accordance with the following Table 6:

Table 6. Number of participating stakeholders

Number	Stakeholders	Urban	Rural	Total
1	Households in the 12 governorates	100	100	200
2	Institutional and corporate in Amman (5 hotels, 10 private schools, 10 Ministries, 10 large companies, 5 banks)	040	000	040
3	Importers (20 new and 10 second handed) in Amman	030	000	030
4	Recyclers 14 in Amman, 2 in Zarqa, 2 in Irbid and 2 in Mafraq	020	000	020

As none of the countries that have done their PBDE's inventory is similar and relevant to Jordan, then the team could not calculate the Jordanian initial assessment study based on this factor and thus has skipped Tier I to move to Tier II where actual national Jordanian penetration rates are calculated leading to the calculation of the inventory.

4.2.1.1 Inventory of POP-PBDEs in Transportation Sector

Since there is no vehicles production in Jordan, then all vehicles in the transport sector in Jordan are imported with annual increase. Data received from the Traffic Department via the Ministry of Environment were used as input data for the **preliminary assessment of quantity of c-pentaBDE in Jordan.** POP-BDEs were produced and used in the period 1975 to 2004, so only vehicles produced in this period need to be inventoried for BDEs consideration

The total number of registered vehicles which are manufactured between 1975 and 2004 is 893.577 vehicles (cars, buses, and trucks) in the year of inventory– 2014 (Figure 1). Table 1, shows the existing vehicles containing PBDEs still in use in Jordan, as well as per their country of origin:

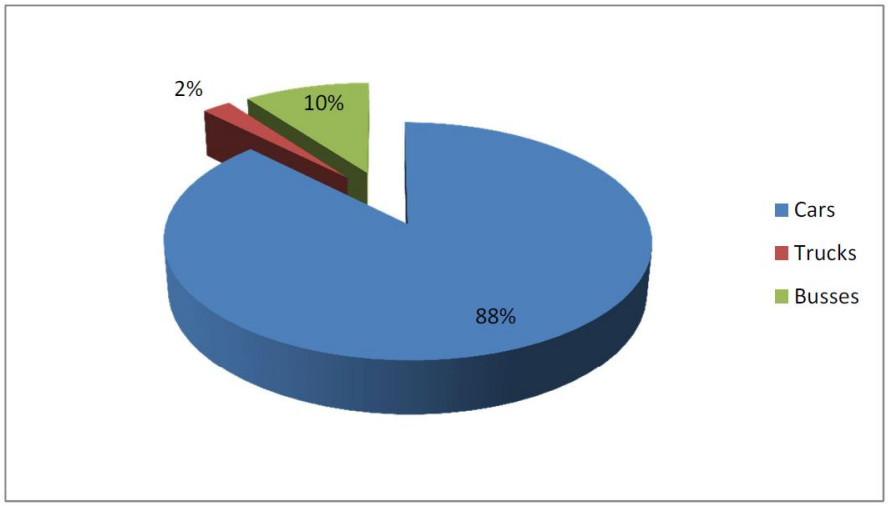

Figure 2. Distribution of vehicles in transport sector

Table 7. Existing vehicles registered and still in use in Jordan

Number of vehicles still in use in 2014 in Jordan and produced between 1975 and 2004			
Vehicle	Manufactured in USA	Manufactured in other regions	Total
Cars	19.492	762.748	782.240
Trucks	308	20.720	21.028
Busses	1.355	88.954	90.309

The official data were received by the Traffic Department for **number of vehicles in use in 2014**, with production years varied from 1900 to 2014. The vehicles included all types such as (cars, buses, trucks, tractors, motorcycles, automobiles used in public works and agricultural activities etc). As to the number of vehicles produced between 1900 and 1974, they were excluded from the inventory study since it is believed that these vehicles belong to the governmental organizations and bodies and are not in use in 2014 but still registered even though they are dysfunctional.

However, the working team has screened the data to only focus on the numbers of vehicles produced between 1975 and 2004 (information about the year of production was provided) and still in use in 2014, and grouped them into three categories (cars, trucks and buses).

The received data that were considered to be useful for the development of the Inventory are:

a) number of registered and used vehicles (all three category) manufactured between 1975 and 2004, and still in use in 2014,

b) year of production of vehicles,

c) number of registered vehicles with provided model/brand name.

The expert team has identified the country of origin of each vehicle based on its model name (brand). Consequently, the number of vehicles produced in USA and other regions were determined.

The Inventory is based on the amounts of c-pentaBDE s in the following categories:

- Vehicles (manufactured between 1975 and 2004) in use in the year of inventory – 2014 in Jordan;
- End of Life Vehicles (ELV) (manufactured between 1975 and 2004)) and vehicles taken to the landfill and/or for recycling.

The experts were facing lack of relevant and reliable data related to the following:

- End of Life vehicles data:
  - The number of the End of Life vehicles taken to landfill was difficult to determine and/or to receive any data related to this information. Only, it has been known that very little parts can be delivered to any landfill or solid waste facility.
  - The number of the End of Life vehicles taken for recycling was also difficult to determine and/or to receive any data related to this information. It was very difficult to meet with any recyclers who are dealing with this stream of waste. The NGOs who are focusing on waste scavengers and waste recyclers could not provide any data related to the vehicles plastic waste recycling or fate, however, the recycling activities cannot be excluded from the inventory assessment.

Accordingly, the End of life vehicles data was excluded from the present inventory project.

The following assumptions and input data were included in the preliminary assessment of c-pentaBDE in vehicles still in use in Jordan in the inventory year (2014) for calculating the quantity of the POP impeded in the PUR foam of vehicle seats:

- Number of vehicles registered and in use (produced between 1975 and 2004) for the category (car, bus or truck),
- All vehicles related to public works and agricultural fields (such as road fixing and painting mobile-machines, tractors, motorcycles, airport shipping and transferring automobiles, etc) were excluded from the assessment,
- The amount of c-pentaBDE for each category of vehicle (car, bus and truck) used for treating vehicles (which varies from 0,16 kg for cars and trucks to 1 kg for busses)
- And the regional vehicle factor F, for USA: F=0.5 (50% of vehicles are impacted) and a factor of F = 0.05 is suggested as a factor for regional adaptation for Europe (5% of vehicles produced in the region between 1975 and 2004 is estimated to be impacted by c-pentaBDE) and the other regions.
- The preliminary assessment of c-pentaBDE in vehicles still in use in Jordan in the inventory year (2014) for calculating the quantity impeded in vehicles is done by using Stockholm Convention Guidance and recommendations, and is shown in Annex III.

The formula applied to calculate the amount of c-pentaBDE is given below and one uses the numbers in Table 7:

- Number of cars from region (US)*0.16 Kg*0.5

- Number of cars from other regions*0.16 Kg*0.05
- Number of trucks from region (US)*0.16 Kg*0.5
- Number of trucks from other regions*0.16 Kg*0.05
- Number of buses from region (US)*1 Kg*0.5
- Number of buses from other regions*1 Kg*0.05

Table8 presents the obtained results from the preliminary assessment of the quantity of c-pentaBDE in vehicles still in use in Jordan.

Table8. Preliminary distribution of c-pentaBDE in the transport sector in Jordan for 2014.

Preliminary distribution of quantity of c-pentaBDE in the transport sector in Jordan for 2014	
Cars	7.661,3 kg
Trucks	190,4 kg
Busses	5.125,2 kg
Total	12.976,9 kg

Based on the calculation methodology, the distribution of c-pentaBDE in transport sector in Jordan is expected to be 59% in cars, 40% in busses and 1% in trucks. The following figure (Figure 3) shows the initial assessment for distribution of c-pentaBDE in the transport sector in Jordan.

Figure 3 shows that the main concentration of c-pentaBDE in Jordan is contained in both cars (59%) and busses (40%). Therefore, the life-cycle of these both categories of vehicles should be subject to proper monitoring system in order to achieve proper management of c-pentaBDE.

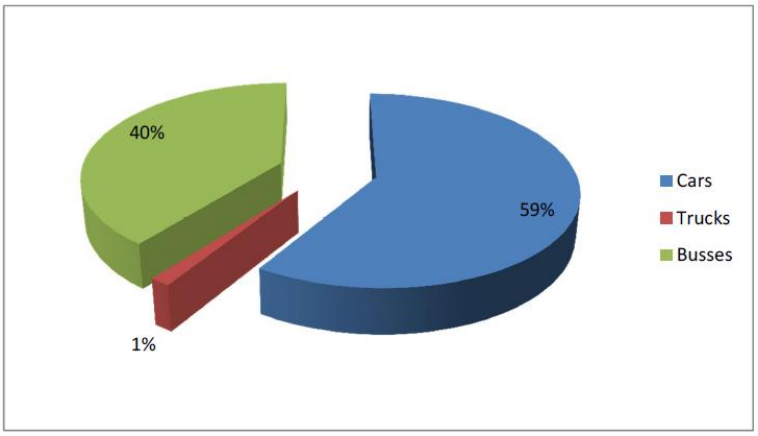

Figure 3. Distribution of c-pentaBDEs in transport Sector- Preliminary assessment for vehicles in use

The inventory assessment of c-pentaBDE quantities of vehicles according to country of origin (USA and EU & other regions of the world) in Jordan for 2014 has been undertaken as shown in Table 8.

Table 9. Input data for the detailed inventory assessment of c-pentaBDE quantities in Transport sector in use in Jordan for 2014

Quantity of c-pentaBDE in the transport sector in Jordan for 2014		Quantity of c-pentaBDE in vehicles s produced in USA (2.4% of total vehicles)	Quantity of c-pentaBDE in vehicles produced produced in EU & other regions (97.6% of total vehicles)
Cars	7.661,3 kg	1.559,3kg	6.101,9 kg
Trucks	190,4 kg	24,6 kg	165,7 kg
Buses	5.125,2 kg	677,5 kg	4.447,7 kg
Total Quantities	**12.976,9 kg**	**2.261,5 kg (17.4%)**	**10.715,4 kg (82.6%)**

Based on the results shown in Table 9, vehicles produced in USA and imported in Jordan takes up to 2.4% of the total imported vehicles in all categories (cars, busses and trucks) in Jordan. The distinction of vehicles on USA produced vehicles and produced in EU & other regions in the world is important because the concentration of added in PUF foams in USA vehicles is 10 times greater than other regions in the world, so although the 2.4% imported USA vehicles in Jordan is comparatively a low percentage, however, it significantly contributes by about 17.4% of the total c-pentaBDE inventory.

Based on all above calculations, the total quantity of c-pentaBDE s in the transport sector in Jordan (in all categories:cars, busses and trucks) for 2014 is 12.976,9 kg.

However, it is not the amount of c-pentaBDE or c-octaBDE in the material flow that is reported for the Stockholm Convention but more specifically the relevant POP-PBDEs homologues: TetraBDE, PentaBDE, HexaBDE and HeptaBDE. These homologues can be calculated from the estimated amount of c-pentaBDE (or c-octaBDE) by considering the percentages of homologues in the commercial mixtures shown in Table 10.

It was difficult to quantify the amount of BDEs in the number of the End of Life vehicles taken for recycling due to the lack of data related to this information (no information on recycling activities in the vehicles waste stream); however, the recycling activities cannot be excluded from the inventory assessment.

Accordingly, the calculation of POP-BDEs homologues (TetraBDE, PentaBDE, HexaBDE and HeptaBDE) in vehicles still in use in 2014 are shown below in Table 10.

Table 10. POP-BDEs homologues (TetraBDE, PentaBDE, HexaBDE and HeptaBDE) quantities in Transport sector in use in Jordan for 2014

Inventoried POP-BDEs	Distribution homologues c-pentaBDE	POP-PBDEs in vehicles currently in use in 2014
Tetra-BDE	33%	4.282,3 kg
Penta-BDE	58%	7.526,6 kg
Hexa-BDE	8%	1.038,1 kg
Hepta-BDE	0.5%	64,8 kg

4.2.1.2 Inventory of POPs-BDEs in EEE/WEEE

As Jordan is one of the countries that have not yet established an EEE/WEEE inventory, therefore an initial estimation the c-octaBDE amount in CRT is done. This has been done through calculating the Jordan's TVs penetration rate (number of TVs per capita) and the computer penetration rate obtained from the Ministry of Telecommunication.

Once the per capita data have been estimated, the POP-PBDEs content in CRT Cathode Ray Tube casings (TVs and computer monitors) can be calculated taking into consideration the following additional data:

- Population of Jordan;
- Weight of the CRTs: **25 kg per device** (estimated average weight of a CRT monitor, either TV or PC monitor;
- Polymer content of CRT casings: **30%** (estimated average);
- A range of c-octaBDE content, **0.87-2.54 kg/tons,** for these polymers used in CRT casings (estimated average).

A range of c-octaBDE in CRT devices can be calculated as follows:

MPBDE (*i*) = [Number of CRTs/capita Region] x population x 25 kg x 0.3 x [0.00087 to 0.00254]

Where: - MPBDE (i) is the amount of POP-PBDEs (i) in [kg]

(in Polymer (k) of electrical and electronic equipment (EEE) (j))

The POP-PBDEs (heptaBDE and hexaBDE) in the c-octaBDE can be calculated according to the homologue content. (c-octaBDE, the heptaBDE homologue is estimated as 43% and the hexaBDE as 11%)

Table 11. Total polymer fractions and c-octaBDE concentrations in relevant EEE categories (data from Europe; Waeger et al., 2010)

Relevant EEE	Total polymer fraction (mean)	c-octaBDE content (mean) in plastics
	$f_{Polymer}$ [in % by weight]	$C_{OctaBDE;Polymer}$ in [kg/ metric ton]*]
WEEE category 3 (without CRTs)	42%	0.225
CRT computer monitors	30%	2.54
WEEE category 4 (without CRTs)	24%	0.15
CRT-TVs	30%	0.87

Note: * RoHS limit for c-octaBDE is 1 kg/metric ton or 0.1 wt %.

Source: Table 4-11 of the guidance document.

The following Table 12 shows the estimated population of Jordan in selected years in millions (Source: DoS).

Table 12. Estimated population (millions inhabitants) of Jordan 2001 -2013

2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
4.978	5.098	5.23	5.35	5.473	5.60	5.723	5.85	5.98	6.113	6.249	6.388	6.53

The following Table 13 shows the estimated number of families in Jordan during selected years (Source: DoS).

Table 13. Estimated number of families in Jordan 2001-2013

2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
913669	935694	959921	981946	1004522	1027832	1050407	1073717	1097578	1122698	1147674	1173201	1199283

Based on the previous two tables, the average Jordanian family is calculated for the years 2007-2012 to be able to calculate the penetration rate of computers per person is as follows:

Table 14. Calculation of the penetration rate of computers per person in an average Jordanian family

Indicator	2007	2008	2009	2010	2011	2012

Average Jordanian family	5.45	5.45	5.45	5.45	5.45	5.45

The following Table 15 shows the penetration of TVs in Jordan 2001-2011 (calculated based on data obtained from the Ministry of Finance / Custom Department and the DoS). The data obtain are actually the import of TV per year. Therefore, to calculate the penetration rate in 2007, the total importation of TVs from 2001-2007 is added and the sum is 489.690 to give an estimate of TVs in the country that are considered to contain in their CRT Cathode Ray Tube casings c-octaBDE.

Table 15. Total TVs imported per year

Year	Total TVs imported per year	Population
2001	32.120	4.978 000
2002	36.262	5.098 000
2003	52.353	5.230 000
2004	71.682	5.350 000
2005	132.824	5.470 000
2006	94.127	5.600 000
2007	70.312	5.723 000
2008	56.329	5.850 000
2009	150.730	5.980 000
2010	108.306	6.113 000
2011	185.466	6.249 000

The penetration rate per capita for TVs is calculated by dividing the number of TVs estimated to contain c- octaBDE in the country of 489690 by the population in Jordan in 2007 of 5723000 to give a penetration rate of 0,08557. The following Table 16 shows the estimated c-octaBDE contained in CRT casings from TVs as follows:

Table 16. The estimated c-octaBDE contained in CRT casings from TVs

Year	Population in millions	Penetration rate	c-octaBDE's in tons (0.87kg/ton)	heptaBDE (43%) in tons	HexaBDE (11%) In tons
2007	5.723	0.08557	3.195	1.37	0.351

If the penetration rate for monitors and TVs is known, one can use for CRT computer monitors the factor 2.54 (kg/metric tons) and for TVs the factor of 0.87 (kg/metric tons), see Table 7.

The following table 17 shows the penetration rate of personal computer / Laptop per family in Jordan 2007-2012 (Source Ministry of Telecommunication):

Table 17: Penetration rate of personal computer / Laptop per family in Jordan 2007-2012

Year	2007	2008	2009	2010	2011	2012
Penetration rate per family	35.7%	39.3%	54.3%	56.1%	61.2%	57.4%

The inventory targets computer monitors presumably were stopped to be manufactured by the end of 2004. Then mainly laptops replacing computer monitors which do not contain the flame retardant c-octaBDE as a POPs pollutant were imported after 2007 in to Jordan. Therefore, the penetration rate of 2007 of 35.7 % per family was used for the inventory calculation.

To be able to apply the equation, then the computer penetration rate has to be calculated per person which is found in the following Table 18. This has been done by dividing the penetration rate by the average family size in Jordan for 2007 and later calculated below and included in a table based on the data obtained from the Department of Statistics. Therefore the following Table contains the computers penetration rate per person:

Table 18: Computers penetration rate per person

Year	2007	2008	2009	2010	2011	2012
Penetration rate per person	0.07	0.07	0.10	0.10	0.13	0.11

In view of the above Table and applying the Tier I equation, then the POP-PBDE's generated from CRT casings of monitors of computers in Jordan in 2007 is estimated as per the following table:

Table 19. POP-PBDE's generated from CRT casings of monitors of computers in Jordan in 2007

Year	Population in millions	Penetration rate	c-octaBDE's in tons (2.54kg/tone)	HeptaBDE (43%) in tons	HexaBDE (11%) in tons
2007	5.723	0.07	7.631	3.281	0.839

The number of CRT casings of monitors of computers considered to contain c- OctaPBDE in Jordan in 2007 is 5723000*0, 07 = 400610.

Since the CRT casings (TVs and computer monitors) are expected to contain more than 50% of the total POP-PBDEs present in EEE, data calculated in the initial assessment Tier II could provide an estimate of the major portion of POP-PBDEs in the EEE/WEEE sector in Jordan. **The results could give a first indication of management needs in Jordan where CRTs are the predominant source of POP-PBDEs.** The in-depth inventory consisted of the field survey using the questionnaires on EEE in use or stored at the consumer level (stocks) will improve preliminary inventory data reported in the above tables.

In the following equation the total amount of c-octaBDE, HexaBDE and HeptaBDE from POPs contaminated CRT casings of computer monitors and CRT casings of TV monitors is calculated using the numbers estimated above.

- c-octaBDE 7.631 + 3.195 = 10.826 tons
- HexaBDE 3.281 + 1.37 = 4.651 tons
- HeptaBDE 0.839 + 0.351 = 1.390 tons

After the preliminary inventory report, one needs to examine and consider a couple of factors:

- Average life span of each individual appliance (distinguishing between how long an appliance is in use and how long it is stored before being given away/ entering the waste stream, respectively. For TVs and as per the discussion of the team, it is estimated that the TVs life span exceeds 20 years. Moreover, it rarely that people in Jordan dispose of TVs in the garbage bins. In most cases they donate or keep in the house corners. This means that the households are the least contributor to the WEEE. In the case of institutions they sell on tender basis. These are the ones that end either in recycling, refurbished or re-exported. Many of the household TVs end nowadays with the Egyptians workers and Syrian refugees, the guards or in the houses (mainly in rural areas). The life span of computers was 5 years and then decreased to reach 3 years. But, second handed computers are legally allowed to import to the country as per the Ministry of Industry and Commerce legislation;
- Jordan population is nowadays considering the influx of refugees from Syria and Iraq has increased (unofficial declaration) to more than 10 million inhabitants. Many Jordanian families CRT TVs ended with the Syrians too as the majority who flew to Jordan are from low income classes;
- Regarding the equation of time versus number of purchased TVs and computers, the team with its brainstorming session believes that the 90's are the year of TVs and the 2005 is the year of computers influx and penetration high rate into the community. Moreover, for the TVs (LCDs and LEDs) in addition to Laptops, the past 5-10 years has witnessed a jump in the rate. One could say that during the past 5 years the majority of Jordanians have shifted to LCDs and LEDs TVs replacing the CRT ones;
- Size of the household (number of persons);
- Demographic location of the household (rural or urban);

- Income class of the household (classified according to the official national income classification, in order to be compatible with national statistics).

4.2.2 Preliminary Inventory on PFOS

Jordan approach towards development of PFOS inventory and inventory data

The national inventory team assigned at the inception workshop held in 2013 to undertake the PFOS preliminary inventory included experts from scientific and practical chemical and industrial fields, the team includes a nominated expert from the following parties: (the University of Jordan, Jordan University of Science & Technology, Ministry of Environment, Civil Defense directorate, Jordan Chamber of Industry, and Jordanian Customs Department). The team set the project approach including the objectives and scope of the inventory and in line with the PFOS inventory guidance developed by the Stockholm Convention. At the closing session of the workshop a work plan was developed.

The various types of fire fighting foam which are used for **the special type of fires have** high potential that the fire fighting foam contains PFOS. The targeted types of foam are (AFFF Foam, ALCOSEL, High Expansion Foam and Floro protein).

So, the main potential users foam-containing PFOS in Jordan, the parties which may deal with special type of fires and may have a large quantity of such type of foam, were:

1. Civil Defense Directorate.
2. Jordan Petroleum Refinery Company.
3. Electrical generation companies (i.e. AL Hussein thermal station).

So, the most applicable methodology was to communicate with these parties regarding the quantity of AFF Foam or other types, and then to arrange for a site visit conducted by scientific experts from the team members in order to take samples from the foam and conduct testing in locally and internationally accredited laboratory in Jordan to detect whether it contains PFOS or not.

Having investigated **industrial sectors (Textile, Synthetic Carpets and Synthetic leather) , and factories or maintenance centers which are making Chromium Plating**, it is not an easy task to get reliable information from targeted private industrial sector, especially that the numbers of factories within the targeted sectors is so big. So, Jordan team negotiated and suggested different scenarios to get the required information, and agreed on the following steps:

- Determine the largest factories from each targeted sector, and gather contact information about each one (location, phone number, fax number, email).
- Design a simple and directed survey questionnaire to get the required information.
- Send the survey questionnaire to all targeted factories by all communication tools (fax, email and then call all of them to ask them to fill the required information).

- If the response after the above steps is still not as expected, then we have to conduct a site visit to each factory to interview the technical person and fill the survey questionnaire.

The formal letters have been sent to the determined parties to ask about the quantities of the types of foam which are used for special fires; (AFFF foam, ALCOSEL, High Expansion Foam and Floro protein), that they currently have and the quantity consumed in the three of four years ago; and discuss the possibility to conduct a site visit to their premises to take samples and test it whether it contains PFOS or not.

Jordan team received an answer just from one stakeholder (Civil Defense directorate). However, no answer was received from other contacted parties (Jordan Petroleum Refinery Company, AL Hussein thermal station).

Table 20. The Quantities of Foam Consumed during last four years, and till the end of May 2014 in Civil Defense directorate, as following (in Liters):

	2010	2011	2012	2013
Floro Protein	16524	23740	18154	22744
AFFF	1	1	3	1
ALCOSEL	300	600	125	1000
High Expansion Foam	250	------	------	2680

Table 21. The Quantities of foam available in 2014 in the Civil Defense directorate:

Quantity Available (L)	Type
46.490	Floro Protein
3.307	Synthetic Foam
28.425	ALCOSEL (Littre)
2.621	Protein Foam (Littre)
8.203	High Expansion Foam (Littre)
292.064	Floro Protein Foam (Littre)
393	Foam of Solid material fires (per number of cans)
198	AFFF Foam (Per number of cans)
4.932	Expandol 3% Foam (Littre)
3.017	Petroseel Foam 6% Mixing (Littre)
67	Mechanical Foam (Littre)
3	AFFF Foam 6% (Per number of cans)

280	AFFF Foam (Littre)

Based on the information about some manufacturer of foam:

- **Ciba produced Lodyne™** grades with PFOS up to 2003.
- Brands manufactured by **Chemguard** do not contain PFOS or its related substances.
- 3M phased out its manufacture of fire fighting foams with PFOS (3M™ Light Water™ foam agents - AFFF or AFFF-ATC) in 2003.
- Tyco FS&BP also manufactured some fire fighting foam agents containing PFOS before 2000.

Civil defense department answer us that no one of the above manufacturers has been dealt with to purchase foam, and they are dealing with different suppliers and they don't have information about containing PFOS in their foam.

So, the quantities consumed and available of the **Firefighting** foam in Civil Defense Directorate needs to be checked if it contains PFOS or not, so Jordan team decided to make a real visit to make a sampling methodology scientifically regarding a sampling procedure, but after making a search about the methods of testing the samples before taking it, Jordan team found the following issues regarding testing methods:
PFOA and PFOS have unique chemical and physical properties which adversely affect analysis, including:

- No chromophores: prevents using conventional methodology such as UV -Vis spectroscopy or LC/UV.
- Extremely low volatility: eliminating the possibility of using conventional methodology such as GC/MS, GC/ECD for analysis.
- Not easily derivatized to volatile form for GC or GC/MS:
- Strong anions: PFOA and PFOS form strong anions which may adhere to various container surfaces, suspended particulates, and biomass, causing them to be unavailable for analysis.

The following specialized labs were contacted:

- Royal Scientific Society
- Laboratories of Customs Department
- Jaber Bin Hayan Laboratory.
- The University of Jordan.
- Jordanian University of Science and Technology.

Some of these Testing labs are not well-equipped with the testing devices and instruments (standards and spare testing parts) to make the test to check whether the foam samples contain PFOS or not. Hence, this step is considered as gabs and limitation for the inventory report,
To start the strategy of controlling process on PFOS in the country, it is important to have the technical testing method to check the existence of PFOS.
Regarding the above methodology Jordan team started the process by determining the targeted factories of the largest producers of (Textile, synthetic carpet, synthetic leathers) and the factories that are applying chromium plating process.
The Leather and Garments sector in Jordan comprises mainly of textile industries and garments and leather products; the total facilities operating in theses industrial sector recorded in the three industrial chambers (Amman, Zarqa, and Irbid) at the end of April 2014 amounted to 1.054 facility.

So, because of this big number of factories, and most of them are considered as small or medium enterprises (SME's), we focused on the largest factories that have more potential to use PFOS in this industry.
Regarding the factories or companies or maintenance centers that are making a chromium plating process; regarding the data of local industrial chambers and (MoEnv), it was decided to focus on the biggest factories and whose make this process and the total number of them is about 10 factories e.g: army operating maintenance, and companies of maintenance of aircraft engines and other heavy industry making chromium plating. See table below:

Table 22: Number of capacities making a chromium plating process

Region	Factories of Synthetic Leather; Synthetic Carpets; Textile; factories using chromium plating process.
Amman	75
Mafraq	25
Zarqa	35
Irbid	40
South of Jordan (Karak, Tafeelah, Ma'aan, Aqaba)	5
Total	180

Using the survey questionnaire to get the required information from the factories; Jordan team conducted the survey on the targeted factories that have to fill the questionnaire. The Survey team started visits for all the mentioned factories in the above table, and started to fill the questionnaire to check if any factory uses PFOS or any polymer for coasting purposes.
After completing the process of filling the questionnaires, the team found that all the visited factories answer by (NO- We don't use PFOS, or any polymers for coating, most of them don’t make the process of coating after producing) and some of factories that are making Chromium plating did not answer us till now.
So, after all the above process, Jordan team discovered that the initial result for the inventory of PFOS in the targeted sectors is that they don’t use PFOS and there are no stockpiles of PFOS.
The result of the survey showed that no factory that answered used PFOS or any related substance in their industry either in textile, leather or carpets or chromium plating, and there are reasons for this result:

1. PFOS is used for a special purposes, so using it in a product like textile would only be done for a special application like (divers suits), or any other special use clothes. There is no factory in Jordan that produces clothes with these special uses.
2. PFOS is an expensive material, so to use it in any product it will raise its price and minimize competitiveness ability. (e.g. for carpets; to use PFOS it leads to raise the cost of the product)
3. Maybe some of the visited factories didn't have interest to fill the data seriously which means a low cooperation from private sector during this exercise.
4. Maybe some visited factories did not understand the issue, or the person who filled the data was not the technical person who was aware of all details and the chemical raw material used.

5. There is a big percentage of textile factories that don't produce the textile from the beginning, but import the ready textile, and then process it like cutting and sowing it to a required frame or shape, packaging.
6. Maybe some of visited factories were frightened by visits of regulators (especially by the team from the Ministry of Environment) and were reluctant to fill a questionnaire related to persistent organic pollutants which could be banned or restricted and thus leading to the effect that they could no longer import the raw materials used in their industry.

Since the result of the activities described above allowed determining with certainty any quantity of PFOS or PFOS related substances; this lead to the following conclusion for the preliminary inventory for PFOS:

- PFOS could be used in the factories of big maintenance centers that apply the chromium plating process, who didn't answer the survey questionnaire.

PFOS could be used in factories of textile leather or carpet production, but the detailed chemical contents of their raw material is not known.

5. Implementation Status

Jordan signed the Stockholm Convention and ratified the Convention in November 2004, and entered into force by February 2005. In sense of the Stockholm Convention implementation the Jordan Ministry of Environment developed the required National Implementation Plan (NIP) and submitted it in 2006 with GEF assistance and has been undertaking its implementation since that time. This is currently being updated again with GEF assistance. The mentioned documents give data and information that shows that certain activities linked with management and elimination of the new POPs are undertaken.

The legal framework linked with new nine POPs is relatively established and implemented. In this sense, five POPs pesticides are banned, the decisions were taken by the pesticides registration committee in 1993 and 2001. In regard the industrial POPs, its import, export and management of hazardous substances is banned by the bylaw no. 24, 2005 articles 7 and 8. The environmental law 52/2006 in article 6 regulates importing and exporting of hazardous wastes. The amended import instruction no. 1, 2012 by the Ministry of Industry and Commerce allows the import of used computers only if they are not more than three years old.

The preliminary inventory of PBDEs and PFOS presence in Jordan was created.

In order to accelerate the Stockholm Convention provisions implementation the Jordan Ministry of Environment used the PBDEs inventory as a basis for creation of concrete project on reduction and elimination of POPs and other chemical releases through implementation of environmentally sound management of E-Waste, healthcare waste and priority U-POPs release sources associated with general waste management activities. The project objective is protection of human health and the environment through reduction and elimination of POPs, and other chemicals through implementation of environmentally sound management (ESM) for e-waste, healthcare waste and priority U-POPs release sources associated with general waste management activities. Among other benefits, the project will allow creation of ESM E-waste management system. Additionally, the project will strengthened cooperation and coordination within the region and internationally on import/export and Basel Convention compliance issues, both related to e-waste but also including application of appropriate controls and bans on such POPs as PBDEs in imported products. In general the project will contribute in estimating the actual quantities of POPs where release elimination and

reduction is achieved and prevent release of approximately 500 kg of commercial PBDE and other brominated flame retardants. The project duration will take 60 months (5 years).

6. Conclusions

POPs-pesticides
The five POPs pesticides are banned, the decisions were taken by the pesticides registration committee in 1993 and 2001. They are not imported nor produced neither registered to be used in Jordan. In a survey, all importing and manufacturing companies in Jordan replied that they don't have expired pesticides according to a checklist of an official letter sent to them by the Ministry of Agriculture. Agriculture directories from all regions of Jordan provided information that some districts have expired pesticides but not from the list of POPs pesticides.

POPs-PBDEs
Import, export and management of hazardous substances is banned by the bylaw no. 24, 2005 articles 7 and 8. The environmental law 52/2006 in article 6 regulates importing and exporting of hazardous wastes. The amended import instruction no 1, 2012 by the Ministry of Industry and Commerce allows the import of used computers only if they are not more than three years old.

The c-pentaBDEs quantity **in transport sector** in use in Jordan for 2014 is around 13 tons, divided to be 59% in cars, 40% in busses and 1% in trucks. The vehicles produced in the EU and other regions contain 82.6% of the total BDEs quantity and 17.4% of BDEs belongs to the vehicles imported from the USA, although the share of imported vehicles from the USA is only 2.4%. The distribution of the other polybrominated diphenyl ethers in the transport sector in Jordan in 2014 is 33% c-TetraBDE, 58% c-pentaBDE, 8% c-HexaPDE and 0.5% c-HeptaBDE.

The total amount of c-octaBDE from POPs contaminated CRT casings of **computer monitors** and CRT casings of **TV monitors** in Jordan has been estimated to 10.8 t, HexaBDE quantity is 4.6 t and HeptaBDE is 1.4 t. In the WEEE (Waste Electrical and Electronic Equipment) more than 50% of the polybrominated diphenyl ethers are in CRTs (Cathode Ray Tubes) from TV and computer monitors.

The conducted preliminary POPs-PBDEs assessment is a first step for addressing and managing PBDEs in Jordan. Using the tools and techniques proposed within the "Guidance for the Inventory of Polybrominated Diphenyl Ethers (PBDEs) by the Stockholm Convention", the national inventory teams developed the inventories focused on transport sector in Jordan (cars, buses and trucks in use) for estimation of quantity of c-pentaBDEs and the Electrical and Electronic Equipment and WEEE (TVs and computer monitors with CRT in households, importers, institutions and recycles) for estimation of c-octaBDEs. The national inventory teams were faced with lack of information and data (e.g., no data on number of End of life vehicles disposed on landfills or being recycled, no data on vehicles for public works and agricultural purposes, life span of each individual appliance, number of TVs and computer monitors containing c-octaBDEs disposed on landfill or recycled/exported, etc.). Considering the fact that the accuracy of estimations depends on the accuracy of the data and information collected and on the success rate of assumptions made where no accurate data is available, the members of the inventory team proposed the detailed identification and

assessment of POPs-PBDEs in these two sectors for the next period. The actions plans need to be developed for the management of material flows containing POP-BDEs.

PFOS

Questionnaires for PFOS consumption and storage were sent out to industry in 2014 in order to investigate in the industrial sectors Textile, Synthetic Carpets and Synthetic leather, and factories or maintenance centers which are making Chromium Plating. The result of the survey showed that no factory that answered used PFOS or any related substance in their industry. Detailed information of PFOS foam consumption 2010 – 2013 and of PFOS foam available in 2014 in Civil Defense was provided by the Civil Defense Directorate.

The national PFOS inventory team members proposed (among others) the following measures:

- Preparation and adoption of national legislation regulating the PFOS content in the products produced, import or in use in Jordan,
- Adoption of internationally recognized testing method (ISO/EPA/ASTM or other) for determination of PFOS content in the products into the national legislation,

Annex 1. Comparison between pesticide residues in the agricultural commodities in the study of 2011-2012 and studies conducted in, 2000-2001, 2002-2003 , 2007-2008 for imported samples.

	Study in 2011/2012	Percentage %	Study in 2007/2008	Percentage %	Study in 2000 - 2001	Percentage %	Study in 2002 - 2003	Percentage %	Study in 2004 - 2005	Percentage %
Samples number	400	---	400	---	200	---	200	---	195	---
Number of samples that contained pesticides below MRL.	22	5.5	44	11	29	14.5	26	13	12	**6.2**
Number of samples that didn't contain pesticides	377	94.25	355	88.75	170	85	174	87	183	**93.8**
Number of samples that contained pesticides higher than MRL.	---	---	---	---	1	0.5	---	---	---	---
Number of samples that contained pyrethroid compounds	3	0.75	3	0.75	10	5	6	3	4	**2.1**
Number of samples that contained organophosphorus compounds	13	3.25	18	4.5	21	10.5	12	6	9	**4.6**
Number of samples that contained organochlorine compounds	-	-	-	-	6	3	2	1	---	---
Number of samples that contained banzelite compounds	-	-	-	-	2	1	4	2	2	**1**
Number of samples that contained phthalamid compounds	-	-	-	-	---	---	---	---	---	---
Number of samples that contained conzawl compounds	2	0.5	---	---	3	0.5	---	---	---	---
Number of samples that contained other pesticides group	**4**	**1**	**---**	**---**	**1**	**0.5**	**4**	**2**	**1**	**0.5**

Annex 2. Comparison between pesticide residues in the agricultural commodities in the study of 2011-2012 and studies conducted in 2000-2001, 2002-2003 , 2007-2008 for local agricultural commodities.

	Study in 2011-2012	Percentage %	Study in 2007-2008	Percentage %	Study in 2000-2001	Percentage %	Study in 2002-2003	Percentage %	Study in 2004-2005	Percentage %
Samples number	400	---	400	---	200	---	200	---	195	---
Number of samples that contained pesticides below MRL.	16	4	33	8.25	47	23.5	45	22.5	16	**8.2**
Number of samples that contained pesticides which don't have MRL.	---	---	-	-	2	1	---	---	---	---
Number of samples that contained pesticides higher than MRL.	1	0.25	2	0.5	---	---	---	---	---	---
Number of samples that didn't contain pesticides	383	95.75	365	91.25	151	75.5	155	77.5	179	**91.8**
Number of samples that contained pyrethroids	2	0.5	6	1.5	6	3	3	1.5	2	**1**
Number of samples that contained organophosphates	3	0.75	8	2	9	4.5	14	7	3	**1.5**
Number of samples that contained chlorinated hydrocarbons	-	-	-	-	10	5	7	3.5	1	**0.5**
Number of samples that contained banzelites	-	-	-	-	5	2.5	5	2.5	2	**1**
Number of samples that contained phthalamids	-	-	-	-	---	---	---	---	---	---
Number of samples that contained dithiocarbamates	-	-	-	-	18	9	16	8	2	**1**
Number of samples that contained oxazoledeniles	1	0.25	1	0.25	---	---	---	---	---	---
Number of samples that contained bridzenones	-	-	-	-	1	0.5	---	---	---	---
Number of samples that contained conzawls	2	0.5	3	0.75	5	2.5	3	1.5	6	**3**
Number of samples that contained other pesticides	**3**	**0.75**	**13**	**3.25**	**5**	**2.5**	**4**	**2**	**2**	**1**

Annex 3. Preliminary assessment of c-pentaBDE: Calculation methodology

Amount of c-PentaBDEs in PUR foam of vehicles in current use in the inventory year

Number of cars (manufactured in the US 1975- 2004)	Average amount of c-PentaBDEs per car	Total amount of c-PentaBDEs in cars **in use** (manufactured in the US)						
	160 g per car (0.16 kg)	19492		0.16		0.5		1559.36
		No. of cars	X	unt of c-Penta	X	Regional factor *	=	kg
Number of cars (manufactured in other regions 1975- 2004)	Amount of c-PentaBDEs per car	Total amount of c-PentaBDEs in cars in use (manufactured in regions other than US)						
	160 g per car (0.16 kg)	762748		0.16		0.05		6101.984
		No. of cars	X	unt of c-Penta	X	Regional factor *	=	kg
Number of trucks (manufactured in the US 1975- 2004)	Average amount of c-PentaBDEs per truck	Total amount of c-PentaBDEs in trucks **in use** (manufactured in the US)						
	160 g per Truck (0.16 kg)	308		0.16		0.5		24.64
		No. of trucks	X	unt of c-Penta	X	Regional factor *	=	kg
Number of trucks in use (manufactured in other regions 1975- 2004)	Amount of c-PentaBDEs per Truck	Total amount of c-PentaBDEs in trucks in use (manufactured in regions other than US)						
	160 g per truck (0.16 kg)	20720		0.16		0.05		165.76
		No. of trucks	X	unt of c-Penta	X	Regional factor *	=	kg
Number of buses in use (manufactured in the US 1975- 2004)	Amount of c-PentaBDEs per bus	Total amount of c-PentaBDEs in buses in use (manufactured in the US)						
	1000 g per bus (1 kg)	1355		1		0.5		677.5
		No. of buses	X	unt of c-Penta	X	Regional factor *	=	kg
Number of buses in use (manufactures in other regions 1975- 2004)	Amount of c-PentaBDEs per bus	Total amount of c-PentaBDEs in buses in use (manufactured in regions other than US)						
	1000 g per bus (1kg)	88954		1		0.05		4447.7
		No. of buses	X	unt of c-Penta	X	Regional factor *	=	kg
Total c-PentaBDE		Sum of c-PentaBDEs						12976.944 kg

* Factor estimating the share of impacted vehicles in the region of production (1975-2004)

Annex 4. Survey questionnaire for related industrial private sector (Textile, Leather, carpet , and factories that use chromium plating process).

غرفـــة صناعـــة الأردن
Jordan Chamber of Industry

Ref. No. ٩/١٩/٩٩٣ الرقم
Date ١٧/٥/٢٠١٢ التاريخ

هام وعاجل

السيد رئيس مجلس الإدارة / المدير العام المحترم

- ***قطاع الصناعات النسيجية المحترمين***
- ***قطاع صناعة الجلود المحترمين***
- ***قطاع صناعة السجاد المحترمين***
- ***المصانع والمشاغل التي تقوم بعمليات طلاء المعادن المحترمين***

تحية طيبة وبعد،،

تهديكم غرفة صناعة الأردن أطيب تحياتها وامنياتها لكم بالتوفيق.

في اطار الدور الذي تقوم به غرفة صناعة الاردن في تمثيل القطاع الصناعي في مختلف المجالات والمحافل لا سيما في اللجان المشتركة مع القطاع الحكومي، وفي اطار ما تهدف إليه غرفة صناعة الاردن في ربط الجهات الرقابية المختلفة مع القطاع الصناعي وتعزيز التعاون والثقة ما بين الجانبين.

فإن غرفة صناعة الأردن تشارك حالياً في مشروع وطني يهدف إلى تطوير وتمكين الاردن عالمياً ضمن اطار اتفاقية استكهولم العالمية للحد من الملوثات العضوية، حيث تضم هذه الاتفاقية 172 دولة من مختلف دول العالم، وتم تحديثها عند نهاية العقد الماضي، حيث كانت تضم بين طياتها 12 من المركبات التي صنفت على انها خطرة على الانسان والبيئة، وتم في عام 2009 اضافة تسعة مواد جديدة بعد دراسات وابحاث من المختصين والتي اثبتت مدى خطورة وسمية هذه المواد على صحة الانسان والبيئة.

وان الاردن من الدول السباقة إلى تحديث ما يوجد على اراضيها من هذه المواد، حيث انه سيتم حالياً حصر امكانية وجود هذه المركبات فقط بشكل مبدئي ولن يتم منعها خلال الوضع الراهن.

تم تشكيل ستة فرق ميدانية لتحديث (Profile) والمعلومات الخاصة بالاردن بما يتعلق باتفاقية استكهولم ضمن مشروع مدعوم من منظمة (UNDP) وتنفذه وزارة البيئة ويضم اعضاء من كافة الجهات والمؤسسات الرسمية ذات العلاقة لما للموضوع اهمية قصوى.

وعليه، فإن غرفة صناعة الاردن ممثلة في كافة اللجان وكافة اعمال المشروع الوطني، ومن ضمن فريق المسح الميداني لمركبات (PFOS) فإننا نحتاج إلى تعاونكم بتزويدنا ببعض المعلومات المطلوبة، وليست بالمعلومات الخاصة او الخطيرة جداً، انما لحصر امكانية وجود هذه المركبات في الاردن.

ملاحظة: سيتم عقد ورشة عمل للمصانع المعنية بهذا الموضوع لتعبئة استبيان، وعليه، يرجى التكرم بالاطلاع على الملف المرفق وتزويدنا بالمعلومات المطلوبة.

كما يرجى التنسيق بهذا الخصوص مع:

م. معن عياصره / وحدة التنمية الصناعية / غرفة صناعة الاردن
رئيس فريق المسح الميداني لمركبات PFOS
maen@jci.org.jo
4642649 –ext 577
0788581662

مع جزيل الشكر لتعاونكم

المرفقات:

- ملخص عن مركبات PFOS.

وتفضلوا بقبول فائق الاحترام،،

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فاكس: 4643719 (6 962+) هاتف: 4642649 (6 962+)
P.O. Box 811986 Amman 11181 Jordan

Annex 5. Project Company General Information Form.

Section I: General Information

Company Name **اسم الشركة**		
Address **العنوان**		
Phone		
Fax		
Email		
Web		
Established since (year) **تأسست في عام**		
Normal Operating Schedule **فترة التشغيل**	Hours per day: -------	Days per week: -------
Contact Person info **معلومات التواصل مع الشخص المعني**	Name:	
	Position:	
	Phone Ext.:	
	Cell Phone:	
	Email:	

Section II: Technical Information

Sector **اسم القطاع الصناعي**	
List of Manufactured Products **قائمة بأسماء المواد النتجة من المصنع**	---------- ---------- ---------- ---------- ---------- ---------- ----------
Average Annual Production Capacity for Each Production Line **معدل الانتاج السنوي لخط انتاج المصنع**	---------- ---------- ---------- ---------- ---------- ---------- ----------

هل تستعمل اي من المبلمرات لاغراض الطلاء(Coating)؟ اذا كان الجواب نعم, ما هو رقم CAS لذلك اللبوليمر؟			
هل تستعمل اي من المبلمرات لاغراض طلاء الكروم ؟ اذا كان الجواب نعم, ما هو رقم CAS لذلك اللبوليمر؟			
Main Raw Materials for coating product/surface active agents product **PFOS related substances or PFOS-containing products like (polymers, ..etc)** **(Check the MSDS, contact your suppliers)** اسم المواد الخام التي تحتوي على مركبات PFOS	**Main Raw Material**	**Total Quantity / Year**	
		Total Quantity / Year	
Filled By:	**Name**	**Signature**	
Date:			