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International POPs Elimination Project

*Fostering Active and Efficient Civil Society Participation in
Preparation for Implementation of the Stockholm Convention*

Country situation report on POPs in the Gaza Strip

Palestinian Environmental Friends

**Palestine
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About the International POPs Elimination Project

On May 1, 2004, the International POPs Elimination Network (IPEN <http://www.ipen.org>) began a global NGO project called the International POPs Elimination Project (IPEP) in partnership with the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Program (UNEP). The Global Environment Facility (GEF) provided core funding for the project.

IPEP has three principal objectives:

- Encourage and enable NGOs in 40 developing and transitional countries to engage in activities that provide concrete and immediate contributions to country efforts in preparing for the implementation of the Stockholm Convention;
- Enhance the skills and knowledge of NGOs to help build their capacity as effective stakeholders in the Convention implementation process;
- Help establish regional and national NGO coordination and capacity in all regions of the world in support of longer term efforts to achieve chemical safety.

IPEP will support preparation of reports on country situation, hotspots, policy briefs, and regional activities. Three principal types of activities will be supported by IPEP: participation in the National Implementation Plan, training and awareness workshops, and public information and awareness campaigns.

For more information, please see <http://www.ipen.org>

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1- Introduction

Stockholm convention

The aim of the Stockholm Convention¹ is to protect human health and the environment from Persistent Organic Pollutants (POPs). Currently the Convention lists twelve POPs. They have similar physical, chemical, and biological characteristics. They possess toxic properties, resist degradation, bioaccumulate and are transported, through air, water and migratory species, across international boundaries and deposited far from their place of release, where they accumulate in terrestrial and aquatic ecosystems.

The Convention also aims to increase public awareness on POPs and on the activities related to POPs. It also requests parties to develop a National Implementation Plan, which describes what measures the Party will take and how much time and financial support would be required to meet the obligations of this treaty.

Persistent Organic Pollutants "POPs"

The chemicals known as persistent organic pollutants act as powerful pesticides and serve a range of industrial purposes. Some POPs are also released as unintended by-products of combustion and industrial processes involving chlorine. While the risk level varies from POP to POP, by definition all of these chemicals share four properties:

- 1) They are highly toxic;
- 2) They are persistent, lasting for years or even decades before degrading into less dangerous forms;
- 3) They evaporate and travel long distances through the air and through water; and
- 4) They bioaccumulate in living things, often accumulating in fatty tissue.

This is a dangerous combination. The persistence and mobility of POPs has resulted in wide contamination in the world even in the Arctic, Antarctica, and remote Pacific islands.

Their attraction to fatty tissue, known as "bioaccumulation", means that even though a poison is first dispersed widely and thinly it gradually starts to concentrate as organisms consume other organisms as they move up the food chain. The chemicals reach magnified levels – up to many thousands of times greater than background levels – in the fatty tissues of creatures at the top of the food chain, such as fish, predatory birds, and mammals, including human beings.

The Stockholm Convention addresses the challenge posed by these toxic chemicals by starting with 12 of the worst POPs ever created. Nine of the POPs are pesticides: aldrin,

chlordane, DDT (famous for decimating bald eagles, ospreys, and other predatory birds and for contaminating the milk of nursing mothers), dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, and toxaphene.

The Convention also targets two industrial chemicals: hexachlorobenzene (HCB), which is also used as a pesticide and can be a byproduct of pesticide manufacture, and the class of industrial chemicals known as PCBs, or polychlorinated biphenyls. PCBs have received a great deal of publicity for polluting rivers and lakes in industrial regions, killing or poisoning fish, and causing several human health scandals, including contamination of rice oil in Japan in 1968 and Taiwan in 1979.

In addition, the Convention covers two families of unintentional chemical by-products: polychlorinated dioxins and furans. These compounds have no commercial use. Dioxins and furans result from combustion and from industrial processes such as the production of pesticides, polyvinyl chloride, and other chlorinated substances. Dioxins and furans are the most potent cancer-causing chemicals known; they gained worldwide attention in the late 1990s when they were found to have contaminated chicken meat in several European countries.

In addition, five new substances have been proposed for inclusion in the Treaty and are currently being examined by the POPs Review Committee of the Convention (chlordecone, hexabromobiphenyl, Lindane, PBDE, and PFOS.)

The 12 POPs that are included in the Stockholm Convention and their main usage and sources are listed below:

Aldrin – A pesticide applied to soils to kill termites, grasshoppers, corn rootworm, and other insect pests.

Chlordane – Used extensively to control termites and as a broad-spectrum insecticide on a range of agricultural crops.

DDT – Perhaps the best known of the POPs, DDT was widely used during World War II to protect soldiers and civilians from malaria, typhus, and other diseases spread by insects. It continues to be applied against mosquitoes in several countries to control malaria.

Dieldrin – Used principally to control termites and textile pests, dieldrin has also been used to control insect-borne diseases and insects living in agricultural soils.

Dioxins – These chemicals are produced unintentionally due to incomplete combustion, as well as during the manufacture of certain pesticides and other chemicals and processes involving chlorine. In addition, certain kinds of metal recycling and pulp and paper bleaching can release dioxins. Dioxins have also been found in automobile exhaust, tobacco smoke and wood and coal smoke.

Endrin – This insecticide is sprayed on the leaves of crops such as cotton and grains. It is also used to control mice, voles and other rodents.

Furans – These compounds are produced unintentionally from the same processes that release dioxins, and they are also found in commercial mixtures of PCBs.

Heptachlor – Primarily employed 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.

Hexachlorobenzene (HCB) – HCB kills fungi that affect food crops. It is also released as a byproduct during the manufacture of certain chemicals and as a result of the processes that give rise to dioxins and furans.

Mirex – This insecticide is applied mainly to combat fire ants and other types of ants and termites. It has also been used as a fire retardant in plastics, rubber, and electrical goods.

Polychlorinated Biphenyls (PCBs) – These compounds are employed in industry as heat exchange fluids, in electric transformers and capacitors, and as additives in paint, carbonless copy paper, sealants and plastics.

Toxaphene – This insecticide, also called Camphechlor, is applied to cotton, cereal grains, fruits, nuts, and vegetables. It has also been used to control ticks and mites in livestock.

2- Current regulations governing POPs

The applied regulation on the Gaza Strip before establishing the Palestinian Authority was a combination of Othmanian, British, Egyptian and Jordanian regulation and Israeli military orders. But after establishing the Palestinian Authority; many regulations have been issued to protect human health and environment.

The Palestinian Authority still not acting as a separate country so it could not sign and ratify the international agreements but in Article 10 of the Palestinian law, it is stated that the Authority will work on participating in international agreements and conventions that aim to protect humans and the environment. Palestine is still work as observer country and participates in all meetings as observer but does not have the right to sign the conventions. The Authority has issued many regulations based on adopting the different international agreements which include:

Montreal Protocol
Hazardous waste Agreement
Stockholm Convention
Biodiversity agreement
Climate change agreement

Laws concerning management of POPs in Palestinian regulation

Below are the laws concerning POPs:

Palestinian Authority environmental law No. 7 year 1999

Municipality and local Authority No. 1 year 1997

Industrial and free zones law No. 10 year 1998

Public defense law No. 3 year 1998

Natural resources Law No. 1 year 1999

Law No. 2 year 1997 for establishing the Palestinian Water Authority

Agriculture law No. 2 year 2003 and No. 11 year 2005

Efforts to deal with POPs

The Palestinian environment is facing a heavy use of natural resources and pollution, some of it from Israel. One more important issue is the high density of the population in Gaza Strip and the increasing demand on all resources in the area.

After the Palestinian Authority took over the Gaza Strip, it began to take the necessary actions to solve the existing environmental problems with the assistance of international agencies. Some of the main accomplishments in Gaza since then are:

- Introducing environmental issues to all ministries and stakeholders and establishing the environmental planning directorate in 1994
- Establishing a special division or directorate in every concerned ministry
- Establishing the environmental authority to take over all the environmental issues in 1997
- Establishing the Ministry of Environment in 1998

Different efforts have been undertaken to deal with POPs issues before the Stockholm Convention entered into force. Some of these efforts can be summarized as follows:

- Ban Aldrin from use in 1985
- Ban Chlordane from trade and use in 1987
- Restrict DDT from use in 1985 and it is banned totally from trade and use in 1990
- Ban Dieldrin from trade and use in 1985
- Ban Hexachlorobenzene (HCB) from use in 1982
- Restrict Heptachlor in 1985 and ban its use since 1989
- Ban Endrin from use since 1985
- Ban Toxaphene from use since 1985
- Mirex has not been used in Palestine

3- Relevant activities of non-governmental stakeholders

The government of Palestine has always encouraged non-governmental organizations and private sector organizations to partner in developmental activities. There are a handful of NGOs working in the field of environment and ecology. The NGOs provide both information and services in making a safer environment and also contribute to waste management in the country. The activities of the majority of NGOs in the Gaza Strip with regard to environment include promoting a safe environment, preserving nature and ecology, protecting and improving the environment, and obviously raising public awareness.

Basically NGOs undertake environmental activities which could be categorized under the following the broad categories:

- Assist in protecting the environment and ecology
- Promote a safe environment
- Help people rehabilitate and protect the environment system and ecology
- Information dissemination on adverse effects of hazardous wastes and chemicals
- Organize people's participation in managing vulnerable environments
- Encourage environmental awareness for the various sectors of the community with the aim of creating national and individual interest in environmental issues.
- Co-operate with other environmental societies to influence the decision- makers for preservation of natural resources.
- Support local industries through encouraging citizens to use recycled materials.
- Encourage the preparation of studies and research related to the natural environment; sponsor positive opinions and trends in this respect; document results, enhance knowledge of the species of plants and place the same under the hand of the public
- Study and determine the nature of consumer problems, as well as work with the official and national bodies and scientific institutions to overcome them

4-Assessment of the POPs Issue in Gaza Strip

POPs Pesticides

Palestine takes prompt and appropriate decisions to protect human health and environment against the hazards caused from using chlorinated organic (POP) pesticides. The POPs pesticides in the Stockholm Convention: Dieldrin, Aldrin, Endrin Heptachlor, Hexachlorobenzene, Toxaphene, Chlordane, Mirex, DDT. This is due to the fact that POPs pesticides tend to accumulate in human and animal fat tissues and degrade slowly in the various environmental compartments.

Palestine, therefore, has taken unilateral measures by withholding the use and handling of such pesticides since the early eighties for purposes of controlling agricultural pests, while allowing their use for control of disease vectors till 1990.

Palestinian institutions especially the Ministry of Health, Ministry of Agriculture and Ministry of Municipality are the responsible bodies for applying the vector control program. A survey showed that the Ministries of Health and Agriculture were buying needed quantities of pesticides without storing them for a long period. On the other hand, the Municipality of Gaza, Dier AlBalah, and Khanyounes were storing the pesticides under good storage conditions. The quantities and types of imported pesticides from Israel are unknown due to Israeli control.

Pesticide importers are considered the main distributors of pesticides in Gaza Strip and due to the situation in Gaza and the historical full control of Israel in Gaza Strip, the Palestinian importers were unable to import anything from the international area. Instead, they were working as distributors for individual Israeli importers and there were no records kept for the types and quantities that they distributed

There were six importers in Gaza with a total of 38 employees. The storage conditions were good and the last registered time for importing the POPs pesticides was in 1987. The ban on importing POPs pesticides occurred at the same time they were banned in Israel.

DDT in Gaza

The only POPs pesticide used in the Gaza Strip was DDT. Toxaphene and the rest of POPs pesticides were never imported the territory. DDT continued to be used up to the 1980s so we should first refer to some characteristics of this pesticide.

DDT was an efficient, low-cost pesticide, easy to manufacture and to handle, with the significant characteristic of being very stable in the environment.

This compound has the potential to bio-accumulate in the fatty tissues of plants, animals and humans and becomes more concentrated as it moves from one food chain to another.

It is important to point out that information concerning the hazards associated with this pesticide have only recently been available following decades of world-wide human and environmental exposure to the dangers associated with its use, modern chemistry and analysis techniques have made possible the identification and quantification of traces of this group of pesticides.

As this information was disseminated internationally at the end of the 1970s most countries, including Palestine, prohibited the importing and use of these compounds against agricultural pests.

However, since these compounds became available in the 1930s they had been used heavily and continuously in Gaza Strip for decades in locust control and against cutworm moths and their larvae, and routinely used on all agricultural crops to control insects and mites. Pest-resistance was the inevitable outcome.

DDT was one of the most extensively used of the first group of organochlorine pesticides to be formulated and which are now considered some of the most hazardous to the environment and humans because of their bioaccumulation in fatty tissue.

Toxaphene was registered under the following trade names: Toxaphin 40 EC, Chompechor, Strobane-T, Toxakil, and Magnum-44. It was used against the following pests: cut worms, thrips, leaf hoppers, aphids, and Japanese beetles. This pesticide was also used to control the pests found in sheep and goat pens, and cow byres.

Polychlorinated Biphenyls (PCBs)

Annex A, Part II Chemicals, of the Stockholm Convention is concerned with Polychlorinated Biphenyls (PCBs). In the Gaza Strip, PCBs have never been produced or re-exported. Some of the previously imported special electrical transformers and capacitors may be contaminated with PCBs. The most common brands of PCBs which were used in transformers due to their inflammability and electrical insulation properties are Askarel and Sovtol, in which the used oil is a mixture of tetrachlorobenzene and PCBs.

The main source of PCBs in the Gaza Strip is from electrical equipment such as transformers, capacitors and other special machinery. Leakage, evaporation and/or improper disposal of the broken or used equipment, that contain PCBs might end up in the environment and then move and concentrate into humans through the food chain. However, this would need a detailed field survey in order to find out contaminated sites and/or equipment.

In the Gaza Strip, there is no regulation controlling the handling of equipment contaminated with PCBs, or disposal of such equipment, or even banning of PCBs.

Recently, a working group was formed from relevant institutions to conduct a field survey and prepare a list of transformers. The first step was defining the parties and companies that own and operate electrical transformers. The survey focused on electrical transformers only due to time limitation. Circuit breakers and capacitors were not included.

The data collected from different branches of the Electricity Distribution Company and power stations through different field visit included the types of transformers, capacity, numbers, and oil containing capacity of the different available transformers.

A quantity of 10000 L of Shell Diala-NY TRo 10 GBXT was found in the central maintenance workshop in the electrical company (not PCB-containing). In addition, the visits found 5000L of old oil storied in a plastic container with more than 30 transformers, which had been destroyed by Israeli solders. The PCB status of the oil and transformers is unknown.

Table 1. Information about transformers in different areas of the Gaza Strip

Transformer capacity, KVA	Numbers	Oil in transformer (kg)	Location
50	1	150	Rafah
	1		Gaza City
	1		North Gaza
55	1	170	Rafah
100	1	200	Rafah
160	4	220	Central Area
	2		Gaza City
	2		North Gaza
200	1	230	Rafah
250	8	280	Rafah
	8		Kanyounes
	4		Central Area
	19		Gaza City
	14		North Gaza
300	4	300	Rafah
	4		Central Area
400	22	370	Rafah
	27		Kanyounes
	35		Central Area
	74		Gaza City
	88		North Gaza
450	2	370	Rafah
500	1	390	Rafah
630	28	430	Rafah
	55		Kanyounes
	53		Central Area
	115		Gaza City
	88		North Gaza
800	1	500	Gaza City
1250	1	700	Rafah
	6		Kanyounes
	1		Central Area
	3		North Gaza
1600	12	850	Gaza City
	2		North Gaza

KVA: kilovolt - ampere

Dioxin and Furans

The Gaza Strip prepared its dioxin and furan (PCDD/PCDF) releases inventory report using the UNEP “Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases”. The main contents of the Toolkit are:

1. Identification of the main categories of possible emitting sources as well as subcategories.
2. Quantification of these categories’ contribution to the emission quantities. This contribution is based on an adversely proportional relationship between the source strength and the extent of control systems development. The relationship is expressed by the emission factors (E.F) developed in several developed countries by carrying out extensive research for different sources.
3. Identification of the environmental media (vectors) receiving such releases. These vectors could be air, water, land, products or residues. The release quantity that the vector receives depends on the strength and the nature of the emitting source. The following screening matrix. Table 2 shows the PCDD/PCDF main emission source categories and the possible receiving vectors.
4. Setting mathematical formula to calculate the annual releases from sources as follows:

Source strength (dioxin emissions / year) = (emission factor × activity rate)

Source strength is given in (µg TEQ/a),

Emission factor is given in (µg TEQ/t).

Activity rate is given in (t/a)

Where:

TEQ = Toxicity Equivalent.

µg = Microgram.

t = ton (weight of products, waste, fuel etc)

a = Annum (year).

Table 2. Screening matrix – main source categories

No	Main Source Categories	Air	Water	Land	Product	Residue
1	Waste Incineration	X				X
2	Ferrous & Non-Ferrous Metal Production	X				X
3	Power generation & heating	X		X		X
4	Production of Mineral Product	X				X
5	Transportation	X				
6	Uncontrolled Combustion Processes	X	X	X		X
7	Production of Chemicals & Consumer Goods	X	X		X	X
8	Miscellaneous	X	X	X	X	X
9	Disposal	X	X	X		X
10	Identification of Potential Hot-Spots					

X: Significant potential route

Data and information were collected from different sources and by using different approaches including: questionnaires, field visits, interviews, formal and informal communications, scientific references, previous studies and statistics.

The following results were obtained and presented for each main source category and sub-category. It should be noted that the following results are presented as a summary.

Main Source Category 1: Waste Incineration

Medical waste incineration is the main incineration subcategory that is practiced in Gaza. Table 3 shows the estimated PCDD/PCDF releases from medical waste incineration category.

Table 3. Estimated PCDD/PCDF releases from medical waste incineration

Incinerator Class	Production (t/a)	E.F. to Air ($\mu\text{g TEQ/t}$)	Release to Air ($\mu\text{g TEQ/a}$)	E.F. to Residue ($\mu\text{g TEQ/t}$)	Release to Residue ($\mu\text{g TEQ/a}$)
1	18	3,000	54	20	00
2	6	525	3	ND	----
Total	24		57		00
Grand Total	57 $\mu\text{g TEQ/a}$				

Main Source Category 2: Ferrous and Non-Ferrous Metals Production

The Gaza Strip is lacking of metallic resources, especially ferrous metals, therefore, heavy metal industries such as iron ore sintering, copper, zinc or aluminum industries do not exist. Some industries based on metal reformation under high temperatures are available.

Table 4 shows the estimated PCDD/PCDF releases from the category of ferrous and non-ferrous metals production.

Table 4. Estimated PCDD/PCDF releases from ferrous and non-ferrous metal production

	Production (t/a)	Releases to Air ($\mu\text{g TEQ/a}$)*	Releases to Residues ($\mu\text{g TEQ/a}$ **)
Total	1,574	9,702	120,200
Grand Total	129,902 $\mu\text{g TEQ/a}$		

* E.F. to the Air = 38 $\mu\text{g TEQ/t}$

** E.F. to the Residues = 415 $\mu\text{g TEQ/t}$

Main Source Category 3: Power Generation and Heating

The Gaza Strip has witnessed a considerable increase in electricity consumption since the year 2000. The central station is placed in Alnserat, which is the only station in Gaza. Table 5 shows the main specification for Alnserat station.

Table 5. The main specification for Alnserat station.

Power plant (light fuel oil)	Type of plant
Continuous (24 hours/day)	Type of operation
5.25 tons /hour 24 hour /day 46000 ton /year	Annual operation (capacity per unit)
(2 units) 10.5 tons /hour 24 hour /day 92000 tons /year	Annual operation capacity total
Heat recovery steam generation(HRSG)	Type of furnace / combustor
Main furnace 1500 c	Temperature of furnace
Lime injection	Type of abatement pollution control system (APCS)
Yes	Heat recovery system
At entry to (APCS) 750c At exit of (APCS) 100c	Temperature of gases

The total used fuel is 46,000 Ton per year

The total power produced from the station is 3,462,19 T.J per year

Main Source Category 4: Mineral Products

This category deals with manufacturing of cement, lime, bricks, ceramics and asphalt mixing which not all of them are practiced in the Gaza Strip as Gaza does not have cement manufacturing. Table 6 shows the estimated PCDD/PCDF releases from this category of mineral products.

Table 6. Estimated PCDD/PCDF releases from production of mineral products

	Production (t /a)	E.F. to Air (µg TEQ/t)	Releases to Air (µg TEQ/a)	E.F. to Residues (µg TEQ/t)	Releases to Residues (µg TEQ/a)
Total quantity	128,114	0.207	912.8	0.06	7680

Main Source Category 5: Transportation

More than 55,000 registered vehicles run on leaded gasoline and diesel fuel in the Gaza Strips. Unleaded gasoline is used for modern and high class cars. It is estimated that 55 million liters of gasoline and 160 million liters of diesel fuel are consumed yearly. Table 7 shows the estimated PCDD/PCDF releases from road transport in Jordan.

Table 7. Estimated PCDD/PCDF releases from transportation

Classification	Fuel Consumption (t/a)	E.F. to Air ($\mu\text{g TEQ/t}$)	Releases to Air ($\mu\text{g TEQ/a}$)
Fuel Engine (gasoline)	55,400,000	1.93	106,922,000
Diesel Engine	160,964,160	0.1	16,096,416
Total	123018416 $\mu\text{g TEQ/a}$		

Main Source Category 6: Uncontrolled Combustion Process

This category includes combustion processes whether they are practiced on purpose or not. Sub categories of this category include:

- Biomass burning such as forest, grassland and agricultural residues fires.
- Waste burning either inside or outside landfill sites.
- Accidental fires in house, factories and vehicles.
- Open burning of wood residues.

This category is the major PCDD/PCDF releasing source in Gaza Strip as it includes waste landfill fires.

Landfill fires are the main single source of PCDD/PCDF releases in the country. The process is illegally practiced and takes place for the following reasons:

- Lack of control and supervision in the landfill sites.
- Improper and slow landfill performance.
- Existence of scavengers who delay the landfill operations by collecting the reusable and recyclable materials in the fill land sites.
- On purpose burning to reduce waste volume in case that the site area is limited.
- Landfill fires can be originated from self-combustion or by waste residues burned outside the site and transported to landfill sites before being completely extinguished.

Accidental fires in houses and factories are also a part of this category and the annual produced quantity of solid waste in Gaza is; 360 tons from Rafah, 1400 tons central Gaza, 750 tons from the municipality of Gaza, and 730 tons from the northern part of the Gaza Strip. Less than 1% of these solid wastes were burned.

Annex 1: Some photos about POPs in Gaza Strip

Pesticides

