International POPs Elimination Project

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

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Pesticide Stockpile in Derince, Kocaeli

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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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This report is available in the following languages: English language, Turkish language

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1. Introduction

This report aims to illuminate both the specific case and the broader problem regarding Persistent Organic Pollutants (POPs) within Turkey. This is the first time that information has been collected and verified for public release with the intention of creating a greater awareness of and engagement in the issue. This issue is regulated by the Stockholm convention. As part of the International POPs Elimination Project (IPEP), this report aims to provide information and data that is relevant to a comprehensive analysis of the site. The report also attempts to show an understanding of its accordance, or otherwise, with those regulations.

The report's research has included consultation with independent environmental experts and all parties involved. In order to further the debate surrounding its future, the report will clarify all aspects of the history of the site, its production and ownership record, and previous governmental action towards a solution. It will go on to present a concise overview of the current conditions of the site, a chemical characterization of the contaminants involved, the environmental impact of said contaminants, and implications for the surrounding area.

The report aims to move the dispute towards resolution considering the issues of responsibility and liability. It also discusses options for the disposal of POPs. The report discusses the feasibility of each, always with the aim to minimize the environmental and health consequences for the area. It will present the recommendations, to date, of the NGOs and comment on the best course of action for the site.

Picture 1: Warehouse
(Source: T. Turkmen, 2004)

2. Physical description of site

2.1 Type of site

The contaminated site is an obsolete pesticide dump, which consists of approximately 3000 tones of BHC and DDT (Picture 1). These chemicals, produced 20 years ago to be used in the production of Lindane, are stored as white powder in 50 kg nylon bags and metal barrels in 4 warehouses within the 8120 square-meter plot owned by Merkim Industrial Products Co. The warehouse was sealed by the local branch of the Ministry of Environment and Forestry (MoEF) in Kocaeli on 28.12.2003. This action was taken following the 3515-29139 numbered correspondence of (MoEF) dated 10.12.2003.[1]

2.2 Physical condition of site

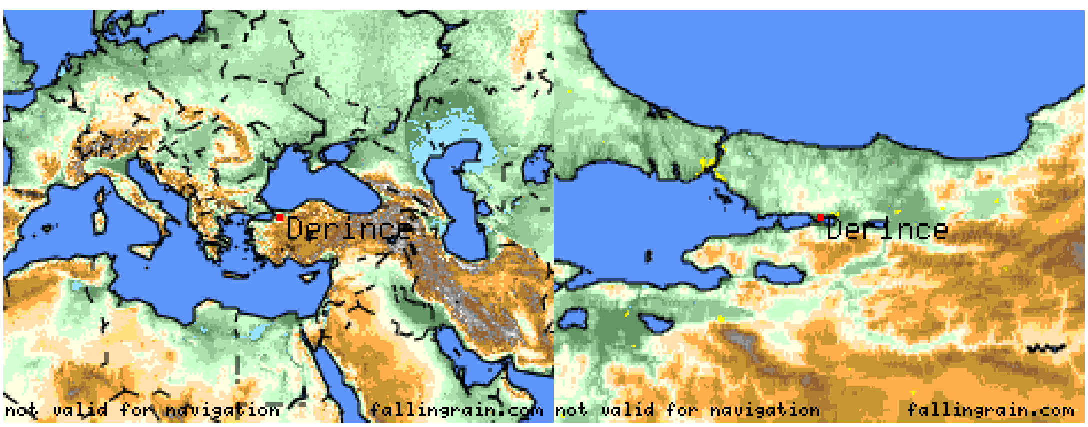
The same correspondence authorizes the local branch to organize a fact-finding mission to survey the contaminated site. According to the findings; "*a wire fence preventing access surrounds the storage area. The outer facade, the ground, and the roof of the warehouses are physically inappropriate to store such chemical substances. 85% of the chemical substances are stored in the torn or worn-out nylon bags and the rest is spread on the warehouse floor. Rainwater contact with chemicals inside the warehouse is evident: a result of leakage through the roof and outer facade. The accumulation of water mixed with chemical substances is visible in many parts of the warehouse floor. This creates a high possibility of leakage through permeable ground layers of soil and underground water. There is also a dense smell caused by the chemicals inside the warehouse.*"[2]

2.3 Geographical location

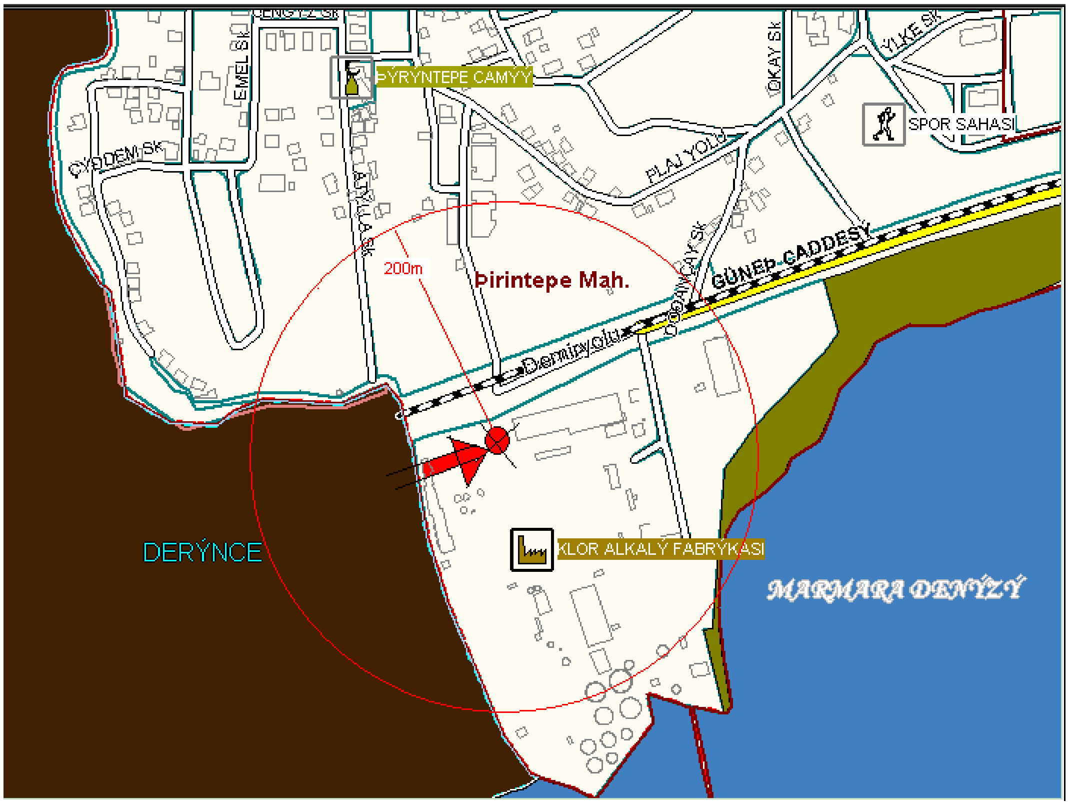
The contaminated site is located in the Sirintepe Region of the Derince town of Kocaeli (Pictures 2 and 3, Table 1). This region is known as a heavily industrialized area. The coastline is dotted with scraps from the petrochemical, pulp and paper, and scrap metal industries. There are also a few harbors along the coastline of Derince for the transportation needs of these industries. There are 4 warehouses (Picture 4) in the plot of 8120 square meters where obsolete pesticides are stored. The site is approximately 300 m to the shore and 300 m to the nearest settlement, which is the Sirintepe district of Kocaeli. Roads lead in from 4 sides. The nearest facilities are the oil distribution centers of the oil companies Shell, Petrol Ofisi and BP. The facility called Koruma Tarim, where the pesticides are produced, is approximately 700 m from the site. No certain vegetation or animal life is documented in the area.

Table 1: Geographical location

Latitude	40.7569	**Longitude**	29.8147	**Altitude (feet)**	0
Lat (DMS)	40° 45' 25N	**Long (DMS)**	29° 48' 53E	**Altitude (meters)**	0



Pictures 2: Geographical location - Turkey, Izmit, Derince



Pictures 3: Geographical location - Turkey, Izmit, Derince

Picture 4: Warehouses containing the obsolete pesticides (Source: T. Turkmen, 2004)

3. History of the site
3.1 Ownership of site

At present, Merkim Industrial Products Co. legally owns the plot where the chemicals are stockpiled. According to Merkim's Board Director, Mr. Ersan Kaynas, the commercial activities of Merkim can be summarized as transportation, shipping, and retail sales of imported chemical products. He also mentions that Merkim has a close commercial relationship with Koruma Tarim A.S., the company that today owns the facility where the obsolete pesticides are produced. Mr. Kaynas denies any other kind of bound or legal partnership.[3]

Picture 5: Surroundings of the warehouse
(Source: T. Turkmen, 2004)

3.2 Production history of the producer

The contaminated site is located near the facility of Koruma Group Tarim, including the factories of its companies such as Koruma Klor-Alkali A.S., Koruma Tarim A.S, etc. Koruma Tarim produces various chlorinated herbicides and pesticides (Table 2). A chlorine-alkali production factory, which shifted from mercury to membrane processing in the year 2000, is also included within the facility. The chemicals stored in the stockpile were produced in this facility until 1983; however, at present, two different companies own the facility and the plot.

Between 1963 and 1983, part of the chlorine produced in the chlorine-alkali factory was used to produce DDT. Production ceased after 1983 when DDT was banned in Turkey. Between 1963 and 1983, technical hexachlorocyclohexane (HCH) was produced containing around 14% of the insecticidal isomer together with HCH isomers. After the use of technical HCH ceased in 1985, gamma-HCH was separated from the other isomers, which were stockpiled in a plot on the site. Currently, it is estimated that approximately 3000 tones of HCH residues (predominantly alpha-, beta- and delta-HCH isomers) remain stored in a warehouse at the plot next to the factory.[4] The estimations of the amount of waste are based on correspondence written by the previous owner of the facility, Endustri A.S. in 1992. Since then, no other quantitative waste analysis was conducted and even the Ministry of Environment and Forestry uses this estimation in its documents. On the other hand, Koruma Klor Alkali A.S. claims these numbers are misleading and that 500 tonnes of these pesticides were already sent to India in 1992 and 1993.

The chlorine-alkali factory within the Koruma facilities is one of the biggest producers in Turkey. More than 150 kinds of pesticides, fungicides, or herbicides are produced in the facility (Table 2). The wastewater discharge as a result of production activities during the 41-year lifetime of the factory demonstrates a great environmental and health concern. Sampling activities (see 4.2) around Koruma Tarim Factory indicate that the pollutants caused by it are not only obsolete pesticides but also untreated wastewater discharge including highly toxic chemicals. While this pesticide factory is the producer of the wastes in the contaminated site, the company that today owns the factory, bears no legal responsibility.

3.3 Changes in ownership

Especially in the last 20 years, ownership has changed many times. However, the facility has only existed since the second half of the 20th century. According to the deed in the office records, Koruma Tarim A.S owned the facility: (Endustri A.S.) of Turkiye Is Bankasi A.S. and Turkiye Sanayi ve Kalkinma Bankasi A.S. (which are partially or fully-funded governmental banks) until 1985. Then Koruma Endustri Urunleri A.S. of Santral Holding had ownership until 1994. Between the years 1994 - 1996, after the bankruptcy of Koruma Endustri A.S., the ownership of the contaminated site passed from Koruma Industrial Products Co. (Endustri A.S. of Santral Holding A.S.) to Interbank Co., as part of a debt collection. At that point, ownership of the plot and the facility were separated. Tevfik Ridvan Yenipazar owned the plot while Koruma Tarim A.S. bought the facility. Finally, since 27.12.1996, the warehouse has been owned by Merkim Industrial Products Co. Merkim Industrial Products Co. has no relationship with the production activities or the ownership of the facility.[6] It is a matter of concern that the facility is mortgaged and that its ownership may change, although there has been no documented reference given to prove this claim during research.

3.4 Government regulatory actions

3.4.1 Ban on related POPs

The BHC and DDT chemicals in the warehouse were produced by Koruma Tarim Ilaclari A.S. (Endustri A.S.) to be used in the production of Lindane before 1985.[7] Since the effects of 12 POPs to human health and environment were recognized by the Ministry of Agriculture and Rural Affairs in 1985, the use and production of a few POPs including BHC and DDT has been banned by law 6968[8].

Additionally, the chemicals in the warehouse are subject to the international regulation called The Stockholm Convention. This convention entered into force on 17 May 2004 after the ratification of France as the 50th Party. The Stockholm Convention is a global treaty to protect human health and the environment from persistent organic pollutants (POPs). POPs are chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of living organisms and are toxic to humans and wildlife. POPs circulate globally and can cause damage wherever they travel. In implementing the Convention, governments will take measures to eliminate or reduce the release of POPs into the environment.

The Stockholm Convention was signed by the Turkish government in 2001 but has not yet been ratified. MoEF expects to ratify the convention after the completion of national POPs inventory in 2005. The signature of Turkey creates opportunities for funding cleanup activities of POPs, as Banu Dokmecibasi of Greenpeace, Turkey mentioned.[9]

<u>The recent position of the ministry on The Stockholm Convention is mentioned in their official letter dated 15 July 2003 to Greenpeace Mediterranean as below:</u>

"It is under our country responsibility to prepare a national and regional action plan, to limit and ban the use and production of mentioned chemicals, down the emissions to zero, and dispose the wastes, stocks, and systems with the best available technologies for the environment according to this Treaty.
Under this framework, our country has been funded with 500.000 USD as technical support by GEF for a project prepared by UNIDO. This project is named as the priority activities needs to be done for the implementation of Stockholm Convention on POPs and has a two years period. With the help of this project the profile of the chemicals in our country will be defined, an inventory of the POPs and other chemicals will be prepared, our national priorities will be identified and action plans and strategies will be improved. "

Table 2: Products of Koruma Tarim[5]

Commercial Name of Product	Active Ingredient	Formulation Type	Effective Group
Tarkor Super	50 g/Lt Quizalafob - p - ethyl	-	Herbicide
Koruma Yazlık Yağı	850 g/Lt Pure Mineral Oil	-	Insecticide
K.Orthocide Soil Treater X	%10 Quintozene %10 Captan	-	Fungicide - Fungicide
Helimacide	%4 Metaldeyhde	Bait	Slug & Snail Control
Neo - Stop	%1 Chlorpropham	BGD	Diğerleri
Bio Gibb - TB	1 g/tablet Gibberellic acid	BGD	Diğerleri
Fruitone	%1.18 Alpha - Naphtylacetamide (NAD) %0.43 Alpha - Naphtylacetic acide (NAA)	BGD	Diğerleri
Lonrice 60 DF	%60 Bensulfuron Methyl	DF	Herbicide
Rubin 2 DS	%2 Tebuconazole	DS	Fungicide
Dinit DS	%1 Diniconazole	DS	Fungicide
Meprol 35 DS	%35 Metalaxyl	DS	Fungicide
Koruma Orthocide 10 DUST	%10 Captan	DUST	Fungicide
Korban 2 DUST	%2 Chlorpyrifos	DUST	Insecticide
Komityon %3 DUST	%3 Fenitrothion	DUST	Insecticide
Koruneb %10 dust	%10 Propineb	DUST	Fungicide
Avantaj 2 DUST	%2 Carbosülfan	DUST	Insecticide
Malathion DUST %5	%5 Malathion	DUST	Insecticide
Korlon 4 Toz	%4 Phosalone	DUST	Insecticide
Korvin dust	%5 Sevin	DUST	Insecticide
Trikofon 5 DUST	%5 Trichlorphon	DUST	Insecticide
Koruma Malathion DUST 2	%2 Malathion	DUST	Insecticide
Koruma Metil Kotniyon %2,5 D	%2,5 Azinphos-methyl	DUST	Insecticide
Korban 25 DUST	%25 Chlorpyrifos	DUST	Insecticide
Korsikol 18 dust	%18 PCNB	DUST	Fungicide
Korsilex 10 dust	%10 Tolclofos-Methyl	DUST	Fungicide
Korsülfan Methyl EC	300 g/Lt Endosülfan + 128 g/Lt Parathion Methyl	EC	Insecticide
Korsülfan 36 EC	360 g/Lt Endosülfan	EC	Insecticide
Kortac 100 EC	100 g/Lt Alpha Cypermethrin	EC	Insecticide
Korthion M	360 g/Lt Saf Parathion Methyl	EC	Insecticide
Korthroid EC 050	50 g/Lt Cyfluthrin	EC	Insecticide
Kor-Dion V-18 EC	75,2 g/Lt Tetradifon	EC	Insecticide
%65 Malathion EM	650 g/l Malathion	EC	Insecticide
Kortaz 20 EC	200 g/Lt Saf Amitraz	EC	Insecticide
Status 330 E	330 g/Lt Pendimethalin	EC	Herbicide
Koruma Busan 72-A	745 g/Lt TCMTB	EC	Fungicide
Koruma Dram 6 E	720 g/Lt Saf Molinate	EC	Herbicide
Koruma EPN EC	490 g/Lt EPN	EC	Herbicide
Korthion 20 EC	185 g/Lt Saf Fenpropathrin	EC	Insecticide
K.Kelthane EC	195 g/Lt Dicofol	EC	Insecticide
Avantaj 25 EC	250 g/Lt Carbosülfan	EC	Insecticide
Avirmec EC	18 g/Lt Abamectin	EC	Insecticide - Insecticide
Bazinon 20 EM	185 g/Lt Saf Diazinon	EC	Insecticide
Bazinon 63 EM	630 g/Lt Diazinon	EC	Insecticide
Constar 100 EC	100 g/Lt Hexaflumuron	EC	Insecticide
Dentis 25 EC	20 g/Lt Deltamethrin	EC	Insecticide
Dinit 5 EC	50 g/Lt Diniconazole	EC	Fungicide

Flashed 440	400 g/Lt Profenofos 40 g/Lt Cypermethrin	EC	Insecticide
Korlon 35 EC	350 g/Lt Phosalone	EC	Insecticide
Jüpiter 50 EC	520 g/Lt Throbencarb	EC	Herbicide
Korsathion 25 EC	240 g/Lt Dioxation	EC	Insecticide
Kem-Ray	360 g/Lt Saf Propanil	EC	Herbicide
Komityon 55 EC	550 g/Lt Fenitrothion	EC	Insecticide
Korban 4	480 g/Lt Saf Chlorpyrifos	EC	Insecticide
Kordial 50 EC	475 g/Lt Phenthoate	EC	Insecticide
Koru Alpha 5 EC	50 g/Lt Esfenvalerete	EC	Insecticide
Kor-Ester	480 g/Lt Isosctylester	EC	Herbicide
Kormite 57 EC	588 g/Lt Propargite	EC	Insecticide
Kormite 79 EC	190 g/Lt Propargite	EC	Insecticide
Kornet 400 EC	400 g/Lt Furathiocarb	EC	Insecticide
İllofob 28 EC	284 g/Lt Diclofob-methyl	EC	Herbicide
Koruma Triflin EC	480 g/Lt Triflurarin	EC	Herbicide
Koruma Metil Kotniyon 23 EC	230 g/Lt Azinphos-methyl	EC	Insecticide
Malathion %20 EM	190 g/Lt Saf Malathion	EC	Insecticide
Kung-Fu 5 EC	50 g/Lt Lambda - Cyhalothrin	EC	Insecticide
Kungapp	20 g/Lt Lambda - Gyhalothrin + 100 g/Lt Buprofezin	EC	Insecticide
Nemacap 20 EC	200 g/Lt Ethoprophos	EC	Nemotasit - Insecticide
Parole 12 EC	120 g/Lt Deltamethrin	EC	Insecticide
Perfect 550	50 g/Lt Cypermethrin + 500 g/Lt Chlorpyrifos	EC	Insecticide - Insecticide
Pyramite	%20 Pyridaben	EC	Insecticide
Ridokor 50 EC	500 g/Lt Saf Ethion	EC	Insecticide
Korumagor 40 EC	400 g/Lt Dimethoate	EC	Insecticide - Insecticide
Siperkor 20	%25 Chlorpyrifos	EC	Insecticide
Miclothane 24 E	245 g/Lt Myclobütanil	EC	Fungicide
Koruma V-92	700 g/Lt Saf Mineral Yağ	EC	Insecticide
Siperkor 25	250 g/Lt Saf Cypermethrin	EC	Insecticide
Thonil 60 EC	400 g/Lt Throbencarb + 200 g/Lt Propanil	EC	Herbicide + Herbicide
Nemaphos EC 400	400 g/Lt Fenamiphos	EC	İnektisit
Koruma Weed Killer D	500 g/Lt Dimethylamin	EC	Herbicide
Torchy 550 EC	550 g/Lt Fenbutation Oxide	EC	İnektisit
Sityon	500 g/Lt Saf Malathion	EC	Insecticide
Tanazole	390 g/Lt Prothoate	EC	Insecticide
Koruma Stopp 330 E	330 g/Lt Pendimethalin	EC	Herbicide
Koruma Sumusudin %20 EC	190 g/Lt Saf Fenvalerate	EC	Insecticide
Suprakor 4 EC (İthal)	426 g/Lt Methidathion	EC	Insecticide
Suprakor 4 EC (İmal)	426 g/Lt Methidathion	EC	Insecticide
Sting	240 g/Lt Glyphosateisopropyl	EC	Herbicide
Koruma DDVP 55 EM	550 g/Lt Dichlorvos	EM	Insecticide
Korfen 50 EM	525 g/Lt Fenthion	EM	Insecticide
Trikofon 50 EM	600 g/Lt Saf Trichlorfos	EM	Insecticide
Nemacap 10 G	%10 Ethoproshos	G	Nemotasit
Kortam	500 g/Lt Metham Sodium	GAZ	Fumigant
Nemaphos GR 10	%10 Fenamiphos	GR	Nematosit
Koruma Kışlık Yağ	%65 Nötr yağ - %1,61 DNOC	MAYONEZ	Insecticide
Korfamidon	500 g/Lt Phosphamidon	SC	Insecticide

Korfos 40 SC	400 g/Lt Monocrotophos	SC	Insecticide - Insecticide
Ancor	50 g/l Hexaconazole	SC	Fungicide
Koruma Tonik	2+3+1 g/Lt Sodyum Türevi	SC	Diğerleri
Precarb SL	722 g/Lt Propamocarb hyd.	SL	Fungicide
Metakor 60 SL	600 g/Lt Methamidophos	SL	Insecticide - Insecticide
Domafix	7 g/Lt 4-CPA	SL	Diğerleri
Korfosat 24 SL	240 g/Lt Glyphosateisopropyl	SL	Herbicide
Kormix	50 g/Lt Mepiquat Chloride	SL	Diğerleri
Purtapyr 100 SL	100 g/Lt Imazethaplr	SL	Henbisit
Domafix 15	14.53 g/Lt 4-CPA	SL	Diğerleri
Biogibb	20 g/Lt Gibberellic Acid	SL	Diğerleri
Korfosat 48 SL	480 g/Lt Glyphosateisopropyl	SL	Herbicide
Kortan 75 SP	%75 Acephate	SP	Insecticide
Kortomil 90 SP	%90 Methomyl	SP	Insecticide
Trikofon 80 SP	%80 Trichlorphon	SP	Fungicide
Mostar 20 SP	%20 Acetamiprid	SP	Insecticide
Komityon 40 ULV	400 g/Lt Fenitrothion	ULV	Insecticide
Alpha-Super 10 ULV	10 g/Lt Alpha Cypermethrin	ULV	Insecticide
Koruma Malathion 95 ULV	950 g/Lt Malathion	ULV	Insecticide
Dentis 1,5 ULV	15 g/Lt Deltamethrin	ULV	Insecticide
Siperkor 2,5 ULV	25 g/Lt Cypermethrin	ULV	Insecticide
%85 Korvin WP	%85 Carbarly	WP	Insecticide
Allegro	%80 Fosetly - Al	WP	Fungicide
Koruma Dithane M-45 Hub. Toh.İ.	%46 Etilen-bis-diphipcarba	WP	Fungicide
Koruma Faltan 50 WP	%50 Folpet	WP	Fungicide
Dikotan M-45	%80 Mancozeb	WP	Fungicide
Dikotan M-22	%80 Maneb	WP	Fungicide
Koruma Kemdazin 50 WP	%50 Carbendazim	WP	Fungicide
Koruma Göztaşı	%98 Bakır Sülfat	WP	Fungicide
Koruma Kükürt WP	%73 Kükürt	WP	Fungicide
Koruma Metil Kotniyon 25 WP	%25 Azinphos-methyl	WP	Insecticide
Curcoz 50 WP	%45 Mancozeb - %5 Cymoxanil	WP	Fungicide - Fungicide
Koruma Promidon 50 WP	%50 Procymidone	WP	Fungicide
Kortiram Forte 80 WP	%80 Thiram	WP	Fungicide
Bitacor WP 25	%25 Bitertanol	WP	Fungicide
Trinstin 25 WP	%25 Cyhexatin	WP	Insecticide
Benolex	%50 Benomyl	WP	Fungicide
Dikotan Blue	%72 Mancozeb	WP	Fungicide
Korconil W 75	%75 Chlorothanonil	WP	Fungicide
Microst M	%8 Oxadixyl + %3,2 Cymoxanil + %56 Mancozeb	WP	Fungicide -
Kor-Miltox	%20 Mancozeb + %21 Metalik Bakır	WP	Fungicide - Fungicide
Kormilin 25 WP	%25 Diflubenzuron	WP	Insecticide
Kor-Prex Dodline 65 W	%65 Dodine	WP	Insecticide
Korlon 30 WP	%30 Phosalone	WP	Insecticide
Korleton WP	%5 Triadimefon	WP	Fungicide
Korgaren 70 WP	%70 Hymexazol	WP	Fungicide
Malathion WP	%25 Malathion	WP	Insecticide
Korsilex 50 WP	%50 Tolclofos-Methyl	WP	Fungicide
Korsülfan 35 WP	%32,9 Saf Endosülfan	WP	Fungicide
Koruma Bakır WP	%50 Bakır	WP	Fungicide

Koruneb Combi WP 76	%70 Propineb + %6 Cymoxanil	WP	Fungicide
Du-ter Wettable Powder	%20 Fentin Hydroxide	WP	Fungicide
Korban 25 WP	%25 Chlorpyrifos	WP	Fungicide
Koruneb %10 WP	%70 Propineb	WP	Fungicide
Komityon 40 WP	%40 Fenitrothion	WP	Insecticide
Ridozeb MZ 72 WP	%8 Metalaxyl + %64 Mancozeb	WP	Fungicide - Fungicide
Koruma-green 10 WP	%10 Chlorsulfuron	WP	Fungicide
Koruklor 48 EC	480 g/Lt Alachlor	WP	Herbicide
Heptachlor WP	%25 Heptchlor	WP	Fungicide
Guard	%25 Chlorothabnilt + %25 Metalik Bakır	WP	Fungicide
Koruma Captan 50 WP	%50 Captan	WP	Fungicide
Korvin 50 WP	%50 Carbaryl	WP	Insecticide
Promise W 570	%70 İmidoclopríd	WS	Fungicide

3.4.2 First attempt on the case

It is known that the Endustri A.S. of Santral Holding applied to the ministry in the years 1992 and 1993 declaring the amount of the stock and requesting permission for disposal. All the assumptions about the amount of the chemicals in the warehouse are made based on this declaration.[10]

Plans for mono-storage are known to have been prepared by the company. However, the correspondence between the two parties failed to lead to an agreement and the case wasn't taken into consideration by the government until 2003. There are several speculations as to why the case has not yet been resolved, such as the bankruptcy of the owner of the companies. The inaction of the government or the ministry during these years is another point of concern since no legal steps were taken at the time when the case was defined as a problem.

3.4.3 Recent action on the case

The latest attempt of the MoEF in 2003 to solve the problem was to prevent the workers from scooping the substances spread on the floor into nylon bags. The workers recruited by Merkim were said to act under unhealthy working conditions by the local branch of the MoEF. And in response to the correspondence by MoEF, the stockpile was sealed. Merkim claims that the workers' previous activities were performed with the knowledge of local branch of MoEF.

In March 2003, a pre-feasibility report was prepared by the two scientists Prof. Dr. Cem Avci and Prof. Dr. Kahraman Unlu. They were authorized by MoEF to define the current situation and set alternatives for the clean-up plan. Their report includes all the necessary steps to be taken and defines all commercially feasible alternatives existing in the world. After their report, an evaluation commission established in the MoEF decided to confine the substances in a temporary security cell that will be constructed by IZAYDAS Izmit Hazardous and Clinical Waste Incinerator within its territory. Similarly, in a previous attempt of the ministry in 1993, the decision was made to temporarily store these hazardous wastes in a controlled landfill (mono-storage)[11]. It is remarkable that Prof. Dr. Cem Avci owns a family company that works as a consultant for IZAYDAS A.S. and this is feared to affect the credence of the report[12]. The evaluation commission has yet to make any decision on any plan to clean up the contaminated site.

4. Chemical characterization

There are two scientific analyses available for the chemical characterization of the waste included within the contaminated site.

4.1 Analyze of TUBITAK

The most recent chemical characterization was done by TUBITAK-MAM (Scientific and Technical Research Agency of Turkey - Marmara Research Center), a respected governmental agency for scientific research.
3 random samples were taken inside the warehouse:

- One of the samples was taken from the uncontained pile, located on the floor of the warehouse.
- 2 other samples were taken from substances contained within the plastic bags.

It has been confirmed that 10.25 % (by weight) of the first sample includes organic matter while 78.6 % by weight includes inorganic filling material as the result of the extraction process done in the laboratories of Material and Chemistry Technologies Research Institute of TUBITAK-MAM. The same process was applied to the other two samples and it was found that those samples included 90.35 - 99.4 % (by weight) organic matter and 0 - 0.25 % (by weight) inorganic filling material. [13]

Afterwards, analysis proceeded to determine the organic proportion of these samples using the gas chromatograph-mass spectroscopy (GC/MS) method and, also, Fourier transform infrared spectra-photometer in the TUBITAK-MAM Food Science and its Technologies Research Institute. Results of these analyses revealed that the organic phase of the first sample is DDT (dichlorodiphenyltrichloroethane; 2-4 DDE, 4-4 DDE, 2-4 DDD, 2-4 DDT, 4-4 DDD, 4-4 DDT) while the organic phase of the other two samples taken from the nylon bags are HCH (hexachlorocyclohexane; a-HCH or a-BHC).

4.2 Sampling by Greenpeace Mediterranean

Another sampling was undertaken by Greenpeace Mediterranean after the Marmara earthquake in 1999 to reveal possible toxic pollution or leakage from the industrial areas around Marmara Sea. Five samples (M-19160 and M-189164) were taken around the Koruma Tarim chemical plant. All samples were analyzed in the Greenpeace Laboratories in Exeter University in the UK. Organic samples were identified qualitatively and quantitatively using the GC-MS. Heavy metals were analyzed by ICP-AES. These samplings are quite significant since they are the only sampling activities around the facility that provide a clear idea about the extent of pollution in the near environment.

Various industries located in Yarimca region, Izmit Bay, September 1999	
M19160	Sediment collected close to the jetty in front of Koruma Tarim chlorine plant
M19161	Sediment collected approx. 100m from Koruma Tarim Jetty, adjacent to buoys
M19162	Solid waste collected from pond on waste ground in front of Koruma Tarim
M19163	Solid waste collected from pile on waste ground in front of Koruma Tarim
M19164	Effluent collected from a channel running adjacent to Koruma Tarim

Mercury is at a concentration of 170 µg / l in the aqueous sample (M-19164) collected from an effluent channel adjacent to the facility. But it is important to notice that this concentration of mercury in the effluent was present when the mercury cell technology for chlorine manufacture was in place in 1999. Mercury was also found to be elevated in the sediment.

"A sediment sample (M19160) from the shore close to the jetty in front of the plant was found to contain readily detectable isomers of DDT and of the DDT degradation products DDE and DDD. All three chemicals were also found in the offshore sediment sample (M-19161) indicating persuasive contamination with these persistent and bio-accumulative chemicals. The near shore sediment was also found to contain the isomers of chlorobenzenes. These chemicals were also found in the effluent collected as sample M-19164. DDT and its metabolites were also found in waste sample on the derelict ground (M-19162) together with DDMU isomers and chlorobenzenes. DDMU is a persistent metabolite/breakdown product of DDT. Sample M-19163, of solid waste also sampled on the derelict ground in front of the plant was also found to contain chlorinated benzene isomers together with several HCH isomers and residues of DDT. The qualitative composition of this effluent sample suggests that it is primarily production waste from the manufacture of HCH. HCH has generally been produced by the chlorination of benzene under UV-light and the final reaction mixture is known to contain partially or fully substituted chlorinated benzenes as well as several of the HCH isomers. The active gamma isomer can be separated from the reaction mixture leaving 85 % remaining as waste. The detection of di- and tri-chlorobenzene isomers in the sampled waste is intriguing since it might be expected that these would largely volatilize from a waste exposed in the open air over a number of years." [14]

The analytical results obtained from samples collected in the vicinity of Koruma Tarim A.S. broadly reflect the known history of pesticide production at this plant. However, the results cannot be directly indicative for the pollution caused by the stockpile. But it is feasible that pollution in the vicinity of the facility and pollution in the stockpile should be associated. Also, continuous waste discharge from the facility should be considered the main source before any cleanup efforts.

5. Environmental and Health Consequences

Both BHC and DDT found in the samples taken from the contaminated site are subjects of great environmental and health concern. DDT is listed as one of 12 other POPs under the Stockholm Convention. Lindane, consisting of HCH or BHC is being lobbied to be included within the convention. The Turkish government has banned the production and use of Lindane since 1985. [15]

There are no monitored or reported health or environmental consequences related to the contaminated site. This is not due to a lack of consequence, but rather to the fact that neither survey nor in-depth research has been undertaken.

5.1 BHC

According to Stringer and Johnston, BHC is an incorrect name for HCH[16]. But the name BHC is used all during this report not to continue a mistake but to prevent any confusion by the parties involved. Lindane is a 99% pure gamma isomer of hexachlorocyclohexane.[17] Lindane is a known persistent organic pesticide that accumulates in the body fat of living organisms. As with all other persistent organic substances, Lindane can migrate over long distances and is thus found throughout the global environment including the tissues of humans. Lindane has been banned in many countries. Lindane is banned in 52 countries and severely restricted in more than 33 others. [8] India and Romania remain the only producers of this toxic chemical according to IPEN pesticides working group. In many countries where Lindane is still in use, it faces pressure for phase out and substitution.[19]

5.1.1 Health Consequences of BHC

Short term and long term effects of exposure to Lindane are as follows according to USA EPA (Environmental Protection Agency):
Short-term: EPA has found Lindane to potentially cause the following health effects when people are exposed to it at levels above the MCL for relatively short periods of time: high body temperature and pulmonary edema.
Long-term: Lindane has the potential to cause the following effects from a lifetime exposure at levels above the MCL: liver and kidney damage. In addition, lindane is a neurotoxin, probable human carcinogen, and a suspected endocrine disruptor. [10] [11] [12] Since lindane affects the central nervous system, it may cause headaches, dizziness, nausea, vomiting, mental confusion, seizures, coma and respiratory depression. [13] Children are significantly more susceptible to the toxic effects of lindane than adults. [14]

5.1.2 Environmental Consequences of BHC

When released into water, Lindane is not broken down by microbes, but is attacked by chemicals in basic waters. It is degraded by soil microbes, and may evaporate from the surface, or slowly leach into ground water. Lindane is very toxic to wildlife including fish, bees, birds, and mammals. [15] Lindane will accumulate slightly in fish and shellfish.[116]

5.2 DDT

DDT is a well-known pesticide used intensively in the early 1900s. After the effects on humans and environment became known, most governments, including the Turkish government, banned the production and use of DDT. DDT is a persistent bioaccumulative organic pollutant that accumulates in fatty tissue. It is carried through the food chain and reaches its highest concentrations in the human body. Accumulation occurs particularly in women's breasts, which then contaminates breast milk, causing health problems in newborns.

5.2.1 Health Consequences of DDT

USA EPA defines the harmful effects of DDT to human health as[20]:

- Probable human carcinogen
- Damages the liver
- Can cause liver cancer
- Temporarily damages the nervous system
- Reduces reproductive success
- Damages the reproductive system

6. Responsible party

6.1 Ongoing Dispute

As indicated in the history of ownership, there is an ongoing dispute on who is responsible for the waste. The latest attempt of the MoEF to deal with the contaminated site, which started in late 2003, does not cover any liability framework on the ownership of the waste. The attempt includes a preliminary analysis of the situation and a report evaluating possible alternatives for disposal. The latest decision made by MoEF to temporarily store the wastes in Izaydas fails to close the case. This is due to the fact that the current owner of the site, Merkim, does not accept any responsibility for the waste that was produced before its ownership. Neither Merkim nor the MoEF accept financial responsibility.

6.2 Local NGO Involvement

The cost of scientific analysis paid by a local NGO called Kocaeli Environmental Association (KEA) demonstrates a good example on how tangled the case is. KEA has been campaigning for years for this waste to be disposed of. According to the head of the KEA, Nuriye Kazaner, the MoEF communicated the bill for analysis to Merkim without any legal ground asking the bill to be paid as well as further costs related to disposal or clean up actions. After Merkim's refusal to pay the bill, the local NGO incurred the costs in order to facilitate progress for a solution to the problem.[21]

6.3 Legal Action

The initiative of the MoEF to solve the problem of the contaminated site without maintaining a liability framework among the parties has landed the situation in court. Both the MoEF and Merkim have sued each other and the hearing is still in progress.

After a correspondence from Merkim to the ministry saying that Merkim will not accept any legal responsibility for the waste, the MoEF charged Merkim a 36.485.040.000 TL penalty. The reason given for this penalty was that Merkim "pollute(d) and continue(s) to pollute the environment" as stated in article 8/2 of the law of the environment. Merkim opened a court case in Kocaeli to eradicate this penalty. Then Merkim opened another court case in Ankara to halt a decision of the ministry to oblige Merkim to perform a project. This project proposed that Merkim carry all the waste to Izaydas A.S. and store them in a temporary mono-storage facility. The cost of this action was estimated at approximately $1 million USD. MoEF claims that Merkim should pay the costs of this project. The MoEF denounced Merkim for not fulfilling its legal responsibilities.

Legal processes are estimated to continue a few years. No precautionary steps are expected to be taken before the responsible parties are clarified. Thus, it is expected that contamination will continue all during this time.

6.4 Owner's Claim

While the ministry defines Merkim as the responsible party for the waste, Merkim denies any responsibility. Merkim's defense is based on the "polluter pays" principle (article 5e of the control of hazardous wastes regulations). Merkim claims that the government banks, Is Bankasi and Kalkinma Bankasi, which owned the factory during the period of the production of the wastes, are the responsible parties. The regulation indicates that the owner is responsible for the waste only if the manufacturers are unknown (article 4).

The case is complicated not only because of the complex ownership history of the plot where the stockpile is located, but also due to the issue of the bankruptcy of the previous owner of the chemical facility. No settlement is expected in the near future without the cooperation and compromise of both parties.

7. Plans for cleanup

7.1 Pre-feasibility report

Plans for the disposal are based on the pre-feasibility report prepared by Prof. Dr. Cem Avci and Prof Dr. Kahraman Unlu with the authorization of the MoEF. The report presents an overview of similar obsolete pesticide dumps from other eastern European countries. It supplies brief information on how these countries tackled problems presented by the contaminated sites. Alternative destruction technologies are also covered within the report with reference to the International HCH and Pesticides Association, IPHA; NATO/CCMS (2002); PPIP Sixth Forum (2002); IHOBE Fifth Forum (1999) and UN FAO. The alternatives assessed with their relative pros and cons included: incineration, gas-phased chemical reduction (GPCR), base catalyzed decomposition (BCD), cement kilns, molten salt, molten metal, molten glass, plasma arc, long term storage and export.

7.1.1 Recommended disposal method in the Avci – Unlu report

The next section of the report highlights incineration, GPCR, BCD, and long-term storage as possible and/or the most applicable technologies for disposal. Each process is assessed according to its cost, destruction time, efficiency, and final products. However, the report advises an in-depth cost analysis to assess the feasibility of possible solutions. The report focuses closely on two of the four alternatives, namely, incineration and long-term storage. It is remarkable that IZAYDAS A.S. is addressed in these two recommended alternatives. The scientific paper claims that temporary confinement is the only economically feasible solution for the elimination of HCH wastes. Also attached to the report are options for how to deal with HCH-contaminated soil.

7.1.2 Action Plan in the Avci – Unlu report

The final section includes proposals for short, middle, and long-term action plans. The short-term action plan includes:

- the chemical characterization of the contaminated site,
- a call for an increase in warehouse safety to maintain environmental isolation,
- proposals of detailed feasibility work to further assess destruction alternatives, and
- a proposal for the establishment of a database for the destruction of obsolete pesticides in cooperation with other central European countries.

Middle and long-term action plans are dependent on clarification of the responsible parties. Additionally, liability framework, public participation, and feasibility work for cost-efficient destruction alternatives are mentioned as the key points for implementation of a successful solution. The steps to be taken in long-term are:

- To improve legal and administrative framework, create national plans and strategies for the management of hazardous wastes or obsolete pesticides.
- To comply with related international conventions, finalize legislative work, and implement the legislation.
- To set goals for technical activities, training, and basic infrastructure.

- To assess the issues of public health and environment, the opinions of NGOs, and financial sufficiency. And, where applicable, to prioritize said issues.

As a conclusion, the report proposes a national program for the contaminated sites. It includes an overview and modification of all regulations and laws as well as the establishment of an inventory to be prepared of all contaminated sites.

The final decision of the government was to transfer and store the wastes in a mono-storage area that would be constructed inside the waste management complex of IZAYDAS A.S[22]. The cost of this operation is estimated approximately 285-Euro per tone. The overall cost amounts to about 885 000 Euro, according to the estimated 3000 tones of waste[23]. It is also mentioned that this long-term storage will continue until technological and financial resources are available for the destruction of the waste. So far, neither plans nor decisions have been made regarding the clean-up of the contaminated site. Actions regarding the issue have been discontinued until the settlement in court defines the responsible party.

8. Recommendations of NGO

8.1 Emergency action plan

Highly toxic chemicals have been stored in physically inappropriate warehouses since 1985, and correspondence between the responsible parties has been going on since 1993. And as the case is in court, no action is expected before the court decides who should pay for the destruction of the obsolete pesticides and for the clean-up of the contaminated site. Immediate steps should be taken by the MoEF to prevent ongoing contamination, which may lead to a great environmental disaster in the near future. The financial costs related to destruction and clean-up can be billed to the responsible party after the court decision.

8.2 Defining the contamination

The pre-feasibility report is a considerable step forward to define the extent of the contamination and to offer alternative solutions. Following this step, qualitative and quantitative analysis should be undertaken for the obsolete pesticide contained in the site. A geological survey is necessary to monitor contamination through the layers of the soil as well as contamination to the underground water reservoir.

8.3 Destruction Alternatives

The method of destruction for the obsolete pesticides should be examined carefully. Consideration should be given to the environmental and social costs of each alternative, particularly incineration. Dioxin emissions, related to incineration of POPs, create great environmental risks that counteract efforts to decontaminate the environment.

In addition to the fact that the decision of the MoEF to temporarily store the wastes in a mono-storage facility is not a viable solution; it is too expensive. 885 000 Euro is estimated for this option. There is no certain timeline set for this so called “temporary storage”. This choice is justified within MoEF as the most economically sound alternative, but it ignores the fact that this method is not a destruction alternative. Adding costs for further destruction after mono-storage would definitely reflect the true cost of the option. As recommended in the pre-feasibility report prepared for the MoEF by scientific authorities, better cost analysis should be undertaken before any decision is made. This cost analysis should include other obsolete pesticide dumps or hazardous waste facilities throughout Turkey, which would create a broader projection of the cost as well as a more comprehensive approach for a national strategy for POPs elimination. Also, the environmental and social risks of destruction alternatives should also be considered while calculating the costs.

8.3.1 Traditional POPs disposal methods

See Table 3.

8.3.2 Modern POPs destruction technologies

Evidence of the environmental and public health impacts of incinerators, cement kilns, and similar combustion systems has created strong public opposition to incineration. This factor as well as increasing infrastructural needs, particularly those associated with the management of air emissions and other residues, has encouraged the development of other destruction technologies. Some of the more recently developed technologies offer significant advantages over combustion in both performance and cost through the use of dedicated incinerators and cement kilns. It is important to note, however, that the resource demands for facility siting and construction, performance testing, operation, routine monitoring of operations, and other infrastructural needs of both conventional and modern destruction technologies render both unsuitable for continued, long-term use, as in the disposal of domestic and industrial wastes.

Table 3: Selection of traditional POPs disposal methods.
(Source: http://ipen.ecn.cz/handbook/html/index.html)

Technology	Comments
Storage	In addition to spills and leaks, volatilization of POPs from storage sites is problematic, particularly in tropical climates. Even in a temperate climate, chemicals are released into the environment despite the use of the best available preventive measures.
Landfill	For persistent substances, burial in landfills is not a destruction technology; it is only a method of containment. Chemicals in buried wastes can and do escape into the surrounding environment, primarily through leaching into groundwater and volatilizing into the air. Landfill fires may be a significant source of dioxins and POPs released into the atmosphere and groundwater.
Deep wells	Chemical releases from such deep wells are not uncommon. No methods exist for predicting the paths or rates at which injected wastes may migrate into groundwater or evaporate from the surface. Little is known about the long-term behavior of chemicals that have seeped into deep wells.
Cement kilns	Dioxin emissions from cement kilns burning hazardous wastes are significantly higher than non-waste burning facilities. Dioxins have been detected in solid residues. FAO warn that disposal of hazardous materials, such as obsolete pesticides by burning them in cement kilns is *often not applicable in a safe and/or cost-effective manner.* The Stockholm Convention lists cement kilns burning hazardous waste as having the potential for *"comparatively high formation and release"* of by-product POPs such as dioxins and furans.
High temperature incineration	Modern incinerators are commonly described as destroying POPs and similar chemicals very efficiently. However, recent tests suggest that incinerators achieve destruction efficiencies that are considerably lower than those achieved by certain non-combustion technologies. Dioxins and other POPs are released in stack gases and solid residues.

Table 4: Selection of modern POPs destruction technologies.
(Source: http://ipen.ecn.cz/handbook/html/index.html)

Technology	Process
Gas-phase chemical reduction	Hydrogen reacts with chlorinated organic compounds, such as PCBs, at high temperatures, yielding primarily methane and hydrogen chloride which have high destruction efficiencies. All emissions and residues are captured for assay and reprocessing, if needed.
Electro-chemical oxidation	At low temperature and atmospheric pressure, electrochemically-generated oxidants react with organochlorines to form carbon dioxide, water, and inorganic ions; again, with high destruction efficiencies. All emissions and residues can be captured for assay and reprocessing, if needed.
Molten metal	Organochlorines and other materials are oxidized in a vat of molten metal, yielding hydrogen, carbon monoxide, ceramic slag, and metal by-products. Destruction efficiencies are not known, but DREs are high.*
Molten salt	Organochlorines and other materials are oxidized in a vat of molten salt, yielding carbon dioxide, water, molecular nitrogen, molecular oxygen, and neutral salts. Destruction efficiencies may be high.
Solvated electron process	Free electrons in a solvated electron solution convert contaminants to relatively harmless substances and salts. Destruction efficiencies vary from 86 to 100 percent. All emissions and residues can be captured for assay and reprocessing, if needed.
Supercritical water oxidation	Under high pressure and temperature, organochlorines and other materials are oxidized in water. Destruction efficiencies are unknown, but DREs are high. All emissions and residues can be captured for assay and reprocessing, if needed.
Plasma arc	Organochlorines and other materials are oxidized at very high temperatures. Destruction efficiencies are unknown, but DREs are high. Dioxins have been identified in process residues.
Catalytic hydrogenation	Organochlorines are reacted with hydrogen in the presence of noble metal catalysts, yielding hydrogen chloride and light hydrocarbons, producing high destruction efficiencies.
Base catalyzed dechlorination	Organochlorines are reacted with an alkaline polyethylene glycol, forming a glycol ether and/or a hydroxylated compound, which requires further treatment, and a salt. Dioxins have been identified in process residues, but are retained and can be re-treated.

* Destruction efficiencies are determined by considering the occurrence of undestroyed chemicals of concern in all gaseous, liquid and solid residues. For DREs, only gaseous residues are considered.

8.4 National Strategy on POPs

A national strategy requires a national inventory for POPs as a first step and all other kinds of hazardous wastes. The inventory work started by the MoEF in cooperation with UNIDO on a limited scale should be extended. This inventory should lead Turkey to ratification of the Stockholm Convention not later than 2006. The ratification of the Stockholm Convention creates funding opportunities, which may help solve problems such as the case in Derince more rapidly. The ratification should be followed up with an urgent implementation plan, which should include changes on the existing directives, particularly the ones on hazardous wastes and chemicals. Alternative destruction technologies should be included in the directives as a way of disposing stockpiles since they are not mentioned or advised in the existing directives. Only incineration and storage in landfill are given as options.

8.5 NGO Involvement

Liability framework and the dialogue among the parties in such cases should be handled in a constructive way. Local and national NGOs should be involved and consulted in every stage. There should be working committees created involving all parties (NGOs, government, companies, and experts) regarding each step of the projects eliminating POPs.

References

[1] Ministry of Environment of Turkey, General Directorate of Environmental Management. “Report of the evaluation commission regarding the pre-feasibility report on the destruction of BHC.” 19 March 2004.
[2] Avci, Cem and Kahraman Unlu. “Pre-feasibility report on BHC”. 08 March 2004. This report was prepared due to the decision taken in the meeting in 20.02.2004 in MoEF and approval of general directorate no:48
[3] Kaynaş, Ersan. Personal Interview. 14 Sep. 2004.
[4] Temuge, T. Heavy metals and organic contaminants associated with wastes generated by industries located in Izmit Bay, Turkey. Istanbul: Greenpeace Mediterranean, 2000
[5] Law of agricultural struggle, no: 6968
[6] Stringer, R. and P. Johnston, 2001, Chlorine and the Environment, Kluwer Academic Publishers
[7] <http://www.headlice.org/faq/treatments/whatslindane.htm>
[8] Blake A, 2005. The next generation of POPs: PBDEs and lindane, International POPs Elimination Network
[9] <http://ipen.ecn.cz/index.php?z=&l=en&k=documents&r=viewtxt&id=77&id_rubriky=9>
[10] US Agency for Toxic Substances and Disease Registry, “Toxicological Profile for Alpha-, Beta-, Gamma- and Delta-Hexachlorocyclohexane,” 1999, www.atsdr.cdc.gov/toxprofiles/tp43.html.
[11] U.S. Environmental Protection Agency, Office of Pesticide Programs List of Chemicals Evaluated for Carcinogenic Potential.” July 19, 2004
[12] Communication from the Commission to the Council and the European Parliament, Community Strategy for Endocrine Disruptors, November 10, 2000, COM (99)706.
[13] U.S. EPA, “Recognition and Management of Pesticide Poisoning,” 5th edition, Chapter 6, page 58.
[14] U.S. EPA, “Overview of Lindane Risk Assessment.” August 2001. Available at www.epa.gov/oppsrrd1/reregistration/lindane/
[15] U.S. EPA, “Reregistration Eligibility Decision (RED),” Case 315, September 25, 2002.
[16] <http://www.epa.gov/safewater/contaminants/dw_contamfs/lindane.html>
[10]See ref. 1
[11] Letter from Minister of Environment to the government of Kocaeli regarding the BHC stored in the warehouse of Koruma Tarim. 22 September 1993. no: B190ÇKÖ0080000/2007
[12] see ref . 3
[13] See ref. 2
[14] See ref. 4
[15] Law of agricultural struggle, no: 6968
[16] Stringer, R. and P. Johnston, 2001, Chlorine and the Environment, Kluwer Academic Publishers
[17] <http://www.headlice.org/faq/treatments/whatslindane.htm>
[18] <http://ipen.ecn.cz/index.php?z=&l=en&k=documents&r=viewtxt&id=77&id_rubriky=9>
[19]<http://www.epa.gov/safewater/contaminants/dw_contamfs/lindane.html>
[20] <http://www.epa.gov/pbt/ddt.htm>
[21] Kazaner, Nuriye. Personal Interview. 15 August 2004.
[22] Letter from General Directorate of Environmental Management to the Minister of Environment. Document no: B.18.0.ÇYG.0.04.00.05/2977 subject: BHC. Approval by the minister of environment and forestry for the long-term mono-storage alternative. 30 March 2004.
[23] See ref. 1.

Abbreviations

A.S.: corporation
BHC: benzene hexachloride, incorrect name for HCH
DDE: 2,2- dis(p-chlorophenyl)-1,1-dichloroethylene, metabolite of DDT
DDT: dichlorodiphenyltrichloroethane
GC/MS: chromatograph-mass spectroscopy
HCH: hexachlorocyclohexane
IPEN: International POPs Elimination Network
IPEP: International POPs Elimination Project
IZAYDAS: Izmit Waste Treatment, Incineration and Valuation Corporation
MoEF: Minister of Environment and Forestry
POP: persistent organic pollutant
TUBITAK-MAM: Scientific and Technical Researches Agency of Turkey - Marmara Research Center
UNDP: United Nations Development Programme
UNIDO: United Nations Industrial Development Organisation
USEPA: United States Environmental Protection Agency

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