International POPs Elimination Project

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

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Physical Verification and Study of Contamination in and Around an Abandoned DDT Factory in North West Frontier Province (NWFP) Pakistan

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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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Table of Contents

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Executive Summary

DDT (Dichlorodiphenyltrichloroethane) belongs to one of the most hazardous groups of chemicals called Persistent Organic Pollutants (POPs), also known as "The Dirty Dozen." These very toxic chemicals, including DDT are long lasting due to their non-degradability, can travel to distant places and being fat soluble accumulate in animals and human bodies. Even in extremely small amounts, POPs cause adverse impacts on human health and environment. To save public health, specially the health of the children, the manufacturing and use of POPs have been banned in the world under the Stockholm Convention on Persistent Organic Pollutants (POPs), enacted in 2001. A number of national governments including Pakistan have signed the Stockholm Convention and so far also ratified by over 120 countries.

Due to the persistent nature of DDT and its adverse environmental and health impacts, the present study was undertaken to examine the residual DDT in and around a DDT manufacturing factory in Amman Gharh, Nowshera, NWFP. The present study is one of many activities carried out under the International POPs Elimination Project (IPEP) in eight regions of the world, including South Asia and supervised by the International POPs Elimination Network (IPEN).

The factory was established in 1963 and remained in operation until 1994. The project team visited the factory site several times to carry out the survey, held meetings with the ex-employees of the abandoned factory and other stakeholders and for taking soil and water samples for chemical examination. Composite samples of soil, sediments and water were collected in and around the factory area, nearby DDT stores, the main factory drain leading to the river Kabul and nearby villages. Standard procedures were used for the collection, transportation and storage of samples for analyses. Physical parameters of the collected water samples measured were temperature, pH and conductance. Extraction of each sample for DDT analyses was carried out in triplicate using Soxhlet extraction apparatus. The extract was transferred to a well washed, clean, dry glass vial, sealed and put in the refrigerator. Gas chromatography with electron capture detector and capillary column was used for analysis. DDT in the samples was identified on the basis of retention time and quantified on the basis of peak areas.

Soil samples from within the factory formulation unit showed residual DDT in the range 242.28+/- 0.81 to 573.02 +/- 0.94 µg/gm. DDT levels in the soil samples at different points outside the factory compound were found to be in the range 558.35+/-0.71 to 780.40+/-0.54 µg/gm. In the drain samples DDT levels were found in the range 388.57+/-0.48 to 1631.70+/-0.61 µg/gm. The highest DDT levels of 2822.08+/-0.88 and 2841.45+/-0.95 µg/gm were found in samples from the left-over old bags in the formulation unit and in the stores. Soil samples taken from five yards outside the stores

showed 1631.70+/- 0.61 µg/gm residual DDT. However, DDT was not detected in the soil samples taken from Azakhel, ten kilometer away from DDT factory. Residual DDT levels in water samples from within the vicinity of DDT factory, nearby villages and drain leading to the river Kabul showed little variation, most of the samples falling in the range 0.20+/-0.23 to 0.31+/-0.03 µg/ml. Highest and lowest DDT levels were found to be 0.40+/-0.14 and 0.07+/-0.10, respectively.

It is evident from the analytical data obtained by the present study that both water and soil in and around the factory area are still contaminated with DDT, despite the closure of the factory twelve years ago. In view of the well-established and known persistency, transportation, accumulative characteristics, environmental and health impacts of DDT, its contamination in and around the factory area pose a threat to public health and environment and may have the most serious consequences to ecosystem function, food safety and other aspects of human health, very specially in Amman Gharh/Nowshera.

The abandoned DDT factory was there for over 12 years and nobody was interested either in using, selling or buying it. However, on the last field visit to the DDT factory site, the project team was most surprised to see the factory almost demolished. It seems that a quick deal was struck by the owner(s), following the IPEP project team's frequent visits to the site and the on-going interview/meetings with the city officials/stakeholders and ex-employees of the factory.

Whereas the health of the laborers working to demolish the factory and the spread of DDT-contaminated bricks/construction material due to its transportation and further use in different near and far off localities are of grave concerns, even more so is the likely sale of the land of the factory (after all the construction material is sold and cleared away) and its further use (as commercial or residential area for housing, school, playground, park etc). The area/soil may remain contaminated with DDT for quite some time and it is strongly recommended that the land of the factory may not be sold or put to any use without prior approval of the environmental impact assessment (EIA) of the DDT factory site by the Environmental Protection Agency (EPA).

It is also recommended that the factory area be declared a danger area and banned for any human activities. A barrier/wall may be constructed around the factory area to prevent the entrance of children, wild animals, cattle, and chickens, etc.

Details of the above study, results achieved and recommendations made for control measures and remediation of the DDT contaminated land in and around DDT factory, Nowshera are described and discussed in the following pages of this report.

1. Introduction

Persistent organic pollutants, including dichlorodiphenyltrichloroethane (DDT), have become a vital issue to mankind due to their hazardous nature. These chemicals, often called "Dirty Dozen" do not degrade readily and can travel thousands of miles away from their source. Persistent organic pollutants, more commonly known as POPs are chemical compounds or mixtures that include industrial chemicals, pesticides and some industrial wastes. These are named “persistent” because these do not degrade in the environment by physical, chemical or biological processes. Out of many POPs twelve are regarded as most dangerous to human health and environment and are called the “Dirty Dozen.” Among these twelve compounds eight are pesticides DDT, aldrin, dieldrin, endrin, chlordane, heptachlor, mirex and toxaphene, two industrial chemicals PCB (polychlorinated biphenyls) and HCB (hexachlorobenzene) and two industrial waste products dioxins and furans.

Some common properties, which make the POPs group of chemicals very dangerous, are their persistent nature in the environment. POPs released in the environment can travel through water and air to regions (such as the Arctic) distant from their original sources. POPs are semi-volatile and do not readily dissolve in water but concentrate in plants, animals and also in humans. Even in extremely small amounts POPs can injure human health and health of other organisms.

Wildlife and humans can come in contact with POPs through breathing contaminated air, by eating contaminated foods or by drinking or washing in contaminated water. Fetus and unborn babies in the womb are dangerously affected through absorption of these accumulated chemicals in the fats of their parents’ bodies. Traces of POPs contamination have been found to be present in the food web, in animal products – meat, fish and milk in particular, with significant hazards to predators who consume these foods, such as dolphins, polar bears, herring gulls and people.

1.1 Dichlorodiphenyltrichloroethane (DDT)

1,1,1-trichloro-2,2-bis-(p-chlorophenyl) ethane, commonly known as DDT or Zeidane is an organochlorine-based pesticide. Sold under different formulator’s trade names such as Anofex, Dedela, Zerdane, Rukseam etc., it first appeared for use during World War II to control insects that spread diseases like malaria, dengue fever and typhus. Following this, it was widely used on a variety of agriculture crops. DDT is one of the earliest and most well known pesticides. Because of its widespread use, DDT can now be detected everywhere in the world from the Antarctic ice to our own bodies (2). DDT has been shown to have an estrogen-like activity and possible carcinogenic activity in humans. Although banned in many countries since 1972, DDT continues to be used for indoor residual spraying in a significant number of countries and for agricultural uses in some areas as well (3).Because of its effectiveness at killing insects, especially mosquitoes which cause malaria (a continuing threat to human health), the World Health Organization (WHO), while supporting its ultimate phase out, continues to endorse its limited use (4)

Even in extremely small amounts DDT can injure human health and the health of other organisms. Fetus and unborn babies in the womb are dangerously affected through absorption of the accumulated DDT in the fats of their parent’s bodies. Traces of DDT contaminations have been found to be present in the food web, in animal products such as meat, fish and milk in particular, with significant hazard to those who consume these foods. DDT can injure human health and ecosystem thousands of kilometers from its source and cause even greater injury in and near source areas. It is harmful to the stomach, intestines, liver and kidneys and can affect the nervous system and cause reproductive, developmental defects and cancer and tumors. Women, children and infants are especially vulnerable to certain effects of DDT.

1.2 Stockholm Convention on Persistent Organic Pollutants

For the protection of human health and environment, the Stockholm Convention on POPs was completed on May 22, 2001. This global convention deals with the twelve most hazardous persistent organic pollutants, including DDT which pose major and increasing threats to health and environment. So far, 151 countries have signed the convention and 122 countries have ratified it (6). Pakistan signed the Stockholm Convention on Persistent Organic Pollutants on December 6, 2001and the ratification of it is under active consideration by the government of Pakistan. The convention entered into force on May 17, 2004.

Article 3 of the Convention (7) on POPs describes the measures to reduce or eliminate releases from intentional production and use of POPs and states that each state shall (a) prohibit and /or take the legal measures necessary to eliminate (i) production and use of the chemicals listed in Annex A (which includes 8 pesticides and polychlorinated biphenyls, PCBs) and (ii) their import and export. This includes specific measures to reduce/eliminate DDT under Annex B, binding each state to eliminate the use and production of DDT except for parties that have notified the secretariat of "Restricted" production and/or use for disease vector control in accordance with the WHO recommendations and guidelines (7). Details regarding restricted use and production of DDT under the Stockholm Convention are described in Annex I.

1.3 `Pesticides in NWFP, Pakistan

Agricultural pesticide usage in Pakistan increased from 665 tons in 1980 to over 69,897 tons in 2002 (over 100-fold). The history of pesticides use and their consumption in Pakistan are briefly summarized in Annexes II and III.

In the recent past, thousands of tons of pesticides were imported from Europe and the USA for use in agriculture and public health sectors. The shift in Government policy of pesticides business in the country from public to private sector resulted in huge dumps of obsolete pesticides. According to some reported inventories and surveys the quantity of expired pesticides is estimated above 5000 tons in Pakistan. In NWFP, the quantity of expired pesticides has been estimated to be 179 tons. GTZ and the Government of Netherlands had supported activities for the disposal of some of the outdated POPs pesticides from NWFP (5). However, some of these locations are still hotspots from the human health and environmental point of view.

POPs pesticides aldrin, chlordane and mirex have never been registered in Pakistan. Dieldrin was deregistered in 1983, toxaphene and DDT in 1992, endrin and BHC (Lindane) in 1996 while heptachlor was deregistered in 1997. A list of banned pesticides in the country is given in Annex IV.

Pakistan has never been a manufacturer of any pesticides except DDT and BHC (Lindane).

1.4 DDT Levels in Environmental Samples - NWFP

According to reported survey data by Hadi (8), dieldrin, heptachlor and endrin have been used from 1981 – 1985 in Peshawar, Nowshera and Charsadda districts. In a survey of another district in NWFP, D.I. Khan revealed the availability of smuggled DDT pesticide formulations in the open market under the brand names Methyl, Dusting Powder and 785 containing 15, 5 – 15 and 100 percent DDT, respectively (8).

Ahad and Mohammad (9) have reported the results of chemical analyses of nineteen samples of soil and water from the vicinity of POPs stores in NWFP. All of the five soil and thirteen water samples studied were found to be contaminated with varying levels of residual pesticides However, pesticides levels for water samples were found to be within the maximum permissible concentration (MAC) set by European Union (9).

Studies on POPs levels in free-range chicken eggs in Peshawar have been reported by Khwaja and Petrlik (10, 11). Whereas, levels of polychlorinated biphenyls (PCBs), hexachlorobenzene (HCB), dioxins (PCDDs) and furans (PCDFs) were within European Union prescribed limits, high levels of DDT were found in the egg samples, with the measured sum equal to 2329.30 ng/g of egg fat. This DDT level in the eggs sampled near a Peshawar waste dumpsite is four and a half times higher than the EU limit for the sum of DDT in eggs (EU limit = 500 ng/g of egg fat).

Recently, studies on POPs emissions from hospital incinerators in Peshawar, Islamabad, Lahore and brick kilns have also been carried out and reported (19).

2. Aims and Objectives

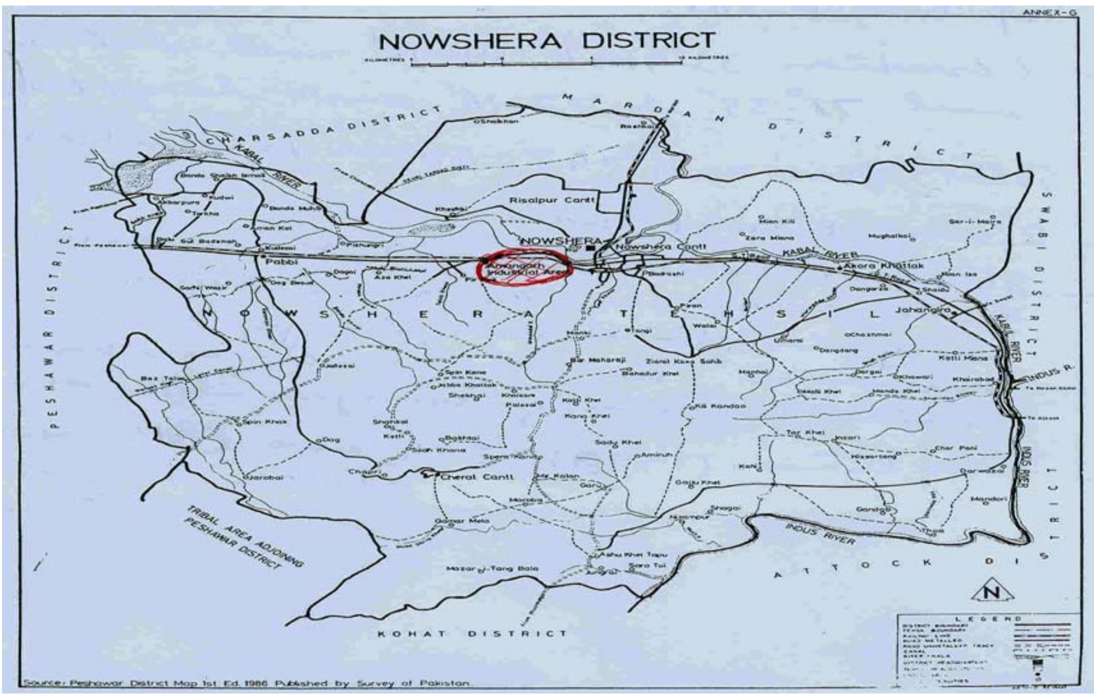
Nowshera DDT factory was established in 1963 in Amangarh (Nowshera) near Peshawar, NWFP. Since 1994 the manufacturing and use of 21 pesticides, including DDT, have been banned in Pakistan and the DDT Factory, Nowshera was also closed down.

However, the factory was in operation for many years and it is being learnt that a few thousand kilograms of the chemicals are still in the storehouses. It is now well established that DDT if released to the environment is very dangerous because of its persistent and toxic nature. Women, children and infants are especially vulnerable to certain effects of DDT. In view of the persistent nature and serious concerns with regard to the adverse environmental and health impacts of DDT and other POPs all over the world, there was a need to undertake physical verification of Nowshera DDT factory and examine the environmental and health impacts caused by its operation over the years.

Under this IPEP activity physical verification of Nowshera DDT factory was to be undertaken as well as the environmental and health impacts caused by its operation over the years examined. The project activities included physical verification of the DDT factory site, warehouse(s) and quantification of DDT, examination of the contaminated soil and water (bore-well, tube-well, any other water source) in the area and examination of blood for DDT levels of the nearby sample population especially children. The study would thus enable raising public awareness about POPs and the Stockholm Convention on POPs and draw the government's attention to taking, at the earliest, necessary remedial measures for cleaning it up. It would also enhance the public role of support towards national implementation plan for the Stockholm Convention and its ratification by the government of Pakistan.

3. Study Site Location

The DDT factory and the site proposed for the present study are in Nowshera – Peshawar, North West Frontier Province (NWFP), Pakistan (33o.10` to 34o.10` north latitudes and 71o.39` to 72o.16` east longitudes). District Nowshera , is located along the Kabul River, with an area of 1,748 square kilometers and according to a 1998 report, with a population of 874, 000 (urban population = 26%). Children under 15 years of age constitute 45% of the total population. There are numerous streams in the area which are the only source of drinking water for many villages (12)



The agricultural area of the district Nowshera is fertile and produces good crops like wheat, sugar cane maize and sugar beat. The area irrigated by Kabul River canal is 17,095 acres. The reserved forests area is reported to be 12, 936 acres. The total number of industries in the district is about 125-130, including 24 major factories... Medical facilities include 6 hospitals, 16 dispensaries, 32 basic health units and 4 mother – child care centers.

There are 745 primary schools, 81 middle schools, 77 high schools, 3 intermediate and 3 degree colleges (12).

4. Site Survey, Field Visits and Meetings with Ex-Employees of Nowshera DDT Factory

Several visits to the factory site and surroundings were made by members of the project team. Information was collected about the former employees of the factory some of which were alive and still residing in or around Nowshera whereas others had moved to their native towns/villages outside the city. Besides, factory ex-employees, interviews/meetings were also held with officials of district agriculture, industry, health and educational institutions. A complete list of all personnel met and interviewed is given in Annex V.

According to an on duty security official, Iqbal Hussain, and a representative of an English leasing company, Taj Muhammad at the site, the Nowshera DDT factory was established in 1963 in Aman Garh (Nowshera) near Peshawar NWFP. The annual production of DDT, when in operation, was about 6000 tons. The factory has been out of operation for the several years and presently is under the control of English Leasing Limited,

We observed a PVC pipe factory on one side and a paper mill on the other, while the labor colonies of these factories were situated to the south of the DDT factory. The production hall and stores within the factory vicinity (each with about 100 bags) were in very poor condition, having some unknown material or raw material, used in the manufacture of DDT. These bags were mostly worn out and the chemicals appeared to be getting mixed into soil and small pools of rainwater.

We were informed that since 1994 the manufacturing and the use of 21 pesticides, including DDT, were banned in Pakistan and the DDT factory, Nowshera was closed down as well. However, the factory was still in operation for many years and most surprisingly a few thousand kilograms of the chemical in worn out bags were still in the storehouse. The labor colony for the factory employee was deserted except one police foundation employee, Shah Muhammad who was still living there.

Mr. M. Afzal, ex-deputy manager administration for 36 years at the factory was interviewed at his residence in Nowshera town. According to him he handed over the charge in 1996. In 1997 when the US government banned DDT, the factory stopped producing DDT. The by-product of the DDT was HCL. The factory produced 75% DDT in powder form and 25% in liquid form. The spirit used in the production of DDT was produced by Mardan distillery and the benzene was imported. The total number of employees was 285 of which 260 were laborers and the rest being officers cadre.

Wastewater after lime treatment was discharged into the Kabul River. Facemasks were used by the laborers and milk was provided to them daily. At the time of closure a stack of four tones of DDT remained, which was later transported to Karachi to the factory owners.

Mr. Abdul Qadim Jan, chemical engineer and ex-managing director DDT factory Nowshera was interviewed in his native village in Charsadda. He also served at Kala Shah Kako factory of DDT, Lahore.

Mr. Qadim Jan informed the team that in the early 1950s the production unit was recommended to the government of Pakistan by the World Health Organization (WHO). The main objective of the project was to produce and distribute throughout the country various formulation of DDT for a malaria eradication program as was advised by WHO.

The site for the production unit i.e. to manufacture DDT technically and its associated formulation was an industrial zone marked and developed by Ghulam Farooq a famous industrialist from the village, Shaida which lies downstream on the Kabul River near Akora Khattak. Mr. Farooq, in the 1950s was the chairman of PIDC (Pakistan Industrial Development Corporation).

The DDT factory was spread over an area of 22 canals. A piece of land which was carved from a paper producing unit established by Pakistan government through PIDC and later sold to the Adamjee group of industries (Adamjee paper mills).

The DDT factory employed 500 people. It produced 2 tons DDT per day, till 1972, when the factory was closed after the termination of the malaria eradication program in Pakistan. However, the factory continued to operate with full strength of employment (except for those who retired or opted out of employment) till 1993-94. During this period 1993-94-97, the management / the federal ministry of industries and production carved out 8-10 canals of land for establishing a plastics industry, known as Nowshera PVC limited. Almost half of the employees of DDT Nowshera were transferred from Nowshera DDT to PVC.

According to Mian Abdul Qadeem Jan the raw material used in the production of DDT was (a)-Benzene: - imported from abroad, (b)-chlorine: - chlorine gas in a high-pressure cylinder, from Ittehad Chemicals, Kala Shah Kako, Lahore.(c). The source of alcohol was Mardan distillery (Mardan Sugar Mills)

The technical grade DDT produced was of brownish yellow color solid and had a pungent smell. It was crushed powdered into fine particles and mixed with other chemicals for suspension, so it stayed suspended and mixed with specified oil. The DDT

Nowshera produced both liquid and powder DDT. The liquid DDT was used for malaria eradication and powdered DDT for agricultural purposes. The DDT Nowshera had daily production of 2 ton per day. There was a similar factory at Kala Shah Kako (KSK), district Sheikhopura in Punjab and the total production of DDT was 4 tons per day at that time. The K.S.K. produced BHC (benzene hexachloride) at 4 tons per day as well. The K.S.K. DDT unit and the Nowshera facility were closed almost at the same time. Abdul Qadim Jan revealed that soil at a depth of five feet indicated the presence of DDT. However, water used for drinking purposes came from a well at 150 feet depth in the vicinity of the factory.

Mr. Raja Muzaffar, finance manager of the nearby PVC pipe factory informed us that no ex-employee of the old DDT factory was on their staff. He also informed us that presently the factory was owned by the English Leasing Company (E.L.C), Lahore.

Meetings were also held with Mr. Shabbir Ahmad Afridi, Industrial Development Officer and other officials of the industrial office in Nowshera.

Information data about the DDT factory Nowshera from the office records are given in Annex VI

5. Experimental Details

5.1 Sampling

All water and soil samples from within the DDT factory, surroundings, main drainage leading to Kabul River, in and around Nowshera and from the Kabul River were collected on a clear dry day during a field visit for sampling on 27th August 2005. Sampling started at 1130 hrs and continued till 1800 hrs.

5.2 Soil Samples

The soil samples were collected from within the factory and the surrounding area. A total of 16 composite soil/sediments sample were collected in polyethylene bags from a depth 0-6 inches. A randomized composite sampling technique was adopted. Soil samples were mainly collected from the formulation unit and old pesticides stores, apart from one control site far away from the surroundings of the DDT factory. Details of collected soil samples are described below:

1. 1st sample was taken from the inner side of the wall of formulation unit by scratching the wall. Sample was taken at 11:45 A.M.
2. 2nd sample was taken from bags/sacks which were left there in the formulation unit
3. 3rd sample was taken from within the factory (formulation unit).
4. 4th sample was taken from within the factory (formulation unit).
5. 5th sample was taken from within the factory (formulation unit).
6. 6th sample was taken from outside the factory at a depth of 3 inches (6/o). This sample was collected at 12:15 P.M.
7. 7th sample taken from outside the factory at a depth of 3 inches (7/o) this sample was taken at 12:45 P.M.
8. 8th sample was taken from end of the drainage near the factory wall. This sample was taken at 1:00P:M
9. 9th sample taken from material from left over bags from store house1 and 2.
10. 10th sample was taken from material left over bags from store house1 and 2 (10s)
11. 9th sample taken from 5 yards near old storehouse.
12. D 4 start of the drain towards the Kabul River depth 7 inches
13. D1, D2, D3 end of the drain towards the Kabul River. These samples were collected at 3:15 P.M.
14. CS control soil sample was taken from Azakhel near petrol pump ten kilometer away from DDT Nowshera. This sample was collected at 5:20 P.M.

5.3 Water Samples

Water samples were collected from different locations in the vicinity of the DDT factory. Sample sites were located in places from where the effluents of DDT factories were passing. To check the contamination of underground water due to leaching, samples were also collected from a tube well in the adjacent area, apart from one control site far away from the DDT factory.

A total of 13 water samples were collected in pre-washed plastic bottles in triplicate. The water samples were collected from pond, canal, well, hand pumps and a tube well adjacent to the site mentioned in study location. After the collection the samples were stored in the refrigerator. Details of water samples collected are given below:

1. 1st sample was taken from the mosque near the DDT factory.
2. 2nd sample was taken from the tape opposite to the DDT factory.
3. 3rd sample was taken from the tape near the Railway line
4. 4th sample was taken from a petrol pump on the G.T Road side in Amangarh.
5. 5th sample was taken from the tape of the mosque of Gharib Abad area. At that time the temperature was 27 °C.
6. KRDW4: This sample was taken from beginning of the drain leading to Kabul River.
7. KRDW3: This sample was taken from the first point after KRDW4 towards the Kabul River.
8. KRDW2: This sample was taken from after KRDW3
9. KRDW1: This sample was taken at the end of drain 10Yards away from the bank of the Kabul River.
10. WW1: Well water 1 the point from which this sample was collected is the closest point to KRDW4.
11. WW2: Well water 2 first point after WW1 towards our way on the road
12. WW3: Well water 3 this sample was taken from a tube well near the Kabul River.
13. Control Water sample was taken from the Azakhel Petrol Pump.

5.4 Samples Preparation and Extraction

(i) Soil Samples

All the stones, pebbles and organic matter etc were removed from the sample collected. Samples were dried in the oven at 60 °C overnight, well mixed and sieved. Approximately 500 grams were removed as a laboratory sample and the remaining portion was stored. The laboratory sample (500g) was ground to a powder in a mortar and pestle and passed through a sieve. Exactly 50 grams for an analytical portion was taken out in a thimble.

The extraction of each sample was carried out in triplicate. Each soil sample (50g) was taken in a thimble and placed in Soxhelt extraction apparatus. The apparatus was placed on a water bath kept below 100 °C. Then the sample was extracted with 150 ml of methanol in a Soxhelt extraction apparatus for 4 hours. The volume of the sample was reduced to 20 ml in the same apparatus. A 0.25 ml portion was taken from the original sample and diluted up to 10 ml with methanol. It was transferred to well-washed, clean, dry glass vial, sealed and put in the refrigerator till analysis (14).

(ii) Water Samples

A liquid-liquid extraction procedure was adopted for extraction of pesticides from water samples. A 25 ml portion of each water sample was taken in a conical flask and 10% NaCl (sodium chloride) was added to it. Then it was extracted with 125 ml ethyl acetate. Then the sample was stirred for 15 minutes with a stirrer. Then the water sample was taken out in separating funnel and the separating funnel was kept in a stand till two distinct phases were formed. After the separation through separating funnel the contents were evaporated on Rota vapor at 45 °C under vacuum and optimum rotation speed until the complete dryness of the sample. After the complete dryness the contents were reconstituted in 5 ml n-hexane for analysis on gas chromatography (GC) (14).

5.5 Analyses of Soil and Water Samples

Every possible care was taken to observe good laboratory practice to avoid contamination and keep reproducibility and precision. All the extraction and clean up steps were standardized and checked for optimum behavior and quantitative recoveries.

Shimadzu Gas Chromatograph model GC-14Awith electron capture detector and other accessories (as mentioned above) were used throughout the study. Other operational conditions were as follows

Programming for GC:

Carrier gas:	Nitrogen
Column initial temperature:	80 °C
Column initial time:	2 min
Column program rate:	20 min
Final temperature:	160 °C
Final time:	0 min
Programmed rate:	4 °C
Final temperature:	250 °C
Final time:	0 min
Programmed rate:	10 °C
Final temperature:	275 °C
Final time:	5 min
Injector temperature:	240 °C
Detector temperature:	280 °C

Pesticides in the samples were identified on the basis of their retention times, quantified on the basis of peak areas, and reported on the basis of sample volume or weight expressed in µg/g.

The conductance was measured on a Thermo Orion Conductance meter, 500 Cumming Center, Beverly USA. The pH was measured on WTW pH 422, pH meter. All the reagents and solvents used in this study were of extra pure GC grade.

6. Results and Discussion

Results are described in Tables 1, 2 and 3. Table 1 describes DDT residual levels in studied soil samples. A graphical presentation of the same is shown in Figure 1. DDT concentrations in studied water samples are given in Table 2 and their graphical presentation is shown in Figure 2. Physical parameters temperature, ph and conductance of all water samples collected in the present study were also examined and are described in Table 3.

Table 1: DDT Residues in Soil Samples (µg/g)

S. No.	Sample Name	Concentration (µg/g)
1.	Sample was taken from the inner side of the wall of formulation unit.	242.28 ± 0.81
2.	Sample was taken from bags present in the formulation unit	2822.08 ± 0.88
3.	Sample was taken from within the factory (formulation unit)	399.216 ± 0.90
4.	Sample was taken from within the factory (formulation unit)	573.02 ± 0.94
5.	Sample was taken from within the factory (formulation unit)	327.59 ± 0.63
6.	Sample taken from outside the factory at a depth of 3 inches	780.40 ± 0.54
7.	Sample taken from outside the factory at a depth of 3 inches	599.21 ± 0.98
8.	Sample taken from end of the drainage near the factory wall	558.35 ± 0.71
9.	Sample taken from material from left over bags from store house1 and 2	7.504.00 ± 0.11
10.	Sample taken from material from left over bags from store house1 and 2	2841.45 ± 0.95
11.	Sample taken 5 yards away from old store house	1858.02 ± 0.78
12.	D4 start of the drain towards Kabul River; depth 7 inches	1631.70 ± 0.61
13.	D3 ends of the drain towards Kabul River	629.04 ± 0.18
14.	D2 ends of the drain towards Kabul River	388.57 ± 0.48
15.	D1 ends of the drain towards Kabul River	1039.34 ± 0.75
16.	Control soil sample taken from Azakhel near petrol pump	Not detected

Table 2: Concentration of DDT in water µg/ml

S.No.	Sample Name	Concentration (µg/ml)
1.	Sample was taken from the mosque near the DDT factory	0.22 ± 0.01
2.	Sample was taken from the petrol pump on the G.T Road side in Amangarh	0.40 ± 0.14
3.	Sample was taken from the tape of the mosque of Gharib Abad area	0.31 ± 0.11
4.	This sample was taken at the end of the drain 10 yards away from the bank of the Kabul River	0.31 ± 0.03
5.	This sample was taken at the end of the drain 10 yards away from the bank of the Kabul River	0.20 ± 0.23
6.	KRDW3 (Kabul River drainage water 3)	0.07 ± 0.10
7.	KRDW4 (Kabul River drainage water 4)	0.22 ± 0.02
8.	Well water 1	0.21 ± 0.04
9.	Well water 3	0.30 ± 0.21

Table 3: Temperature, pH values and Conductance of samples

Sample Location	*Time*	Sample Name	Temperature (°C)	pH	Conductance
Sample taken from tape of mosque of DDT factory.	2:49 P.M.	1a	13.1	9.0	488μs
		1b	13.2	9.2	492μs
		1c	13.2	9.1	490μs
Sample taken from tape opposite to DDT factory.	3:09	2a	10.9	8	468μs
		2b	11	7.5	467μs
		2c	11.6	8.5	472μs
Sample taken from tape near the railway line.	3:30 P.M.	3a	10.6	6.5	501μs
		3b	10.2	7.1	200μs
		3c	10.4	8.0	195.5μs
Sample taken from bore well of petrol pump on G T road side of Aman Garh.	3:38 P.M.	4a	10.6	7.0	2.25μs
		4b	10.1	6.5	2.21μs
		4c	10.4	8.0	2.23μs
Sample was taken from the tape of the mosque of Gharib Abad (Aman Garh).	3:50 P.M.	5a	11.9	9.0	1226μs
		5b	11.6	9.3	1162μs
		5c	11.8	9.0	1159μs
This sample was taken from the beginning of the drain towards the Kabul River.	4:20 P.M.	6a	13.3	8.7	736μs
		6b	13.2	8.7	726μs
		6c	13.1	8.6	728μs
Sample was taken from the first point after KRDW4 towards the Kabul River.	4:26 P.M.	7a	13.5	9.1	1133μs
		7b	13.6	9.2	1154μs
		7c	13.3	9.1	1164μs
Sample was taken from point after KRDW3	4:29 P:M	8a	10.6	11.5	960μs
		8b	10.4	10.0	930μs
		8c	10.4	10.0	904μs
Sample was taken at the end of drain 10 yards away from bank of the Kabul River.	4:34 P:M	9a	23.9	8.7	886μs
		9b	23.9	8.7	887μs
		9c	23.9	8.7	887μs
Well water 1 at the closest point to KRDW4.	4:38 P:M	10a	13.3	8.5	4.72ms
		10b	13.1	8.6	4.71ms
		10c	13.4	8.6	4.72ms
Well water 2 first point after WW1 towards the road.	4:40 P:M	11a	24.0	8.5	1971μs
		11b	24.0	8.5	1970μs
		11c	24.0	8.5	1971μs
Well water 3 from a tube well near the Kabul River.	4:44 P:M	12a	13.3	8.5	4.72ms
		12b	13.1	8.6	4.71ms
		12c	13.4	8.6	4.72ms
Control Water sample taken from Azakhel Petrol Pump.	5:30 P:M	13a	9.8	9.5	855μs
		13b	10.2	9.0	860μs
		13c	10.7	9.0	836μs

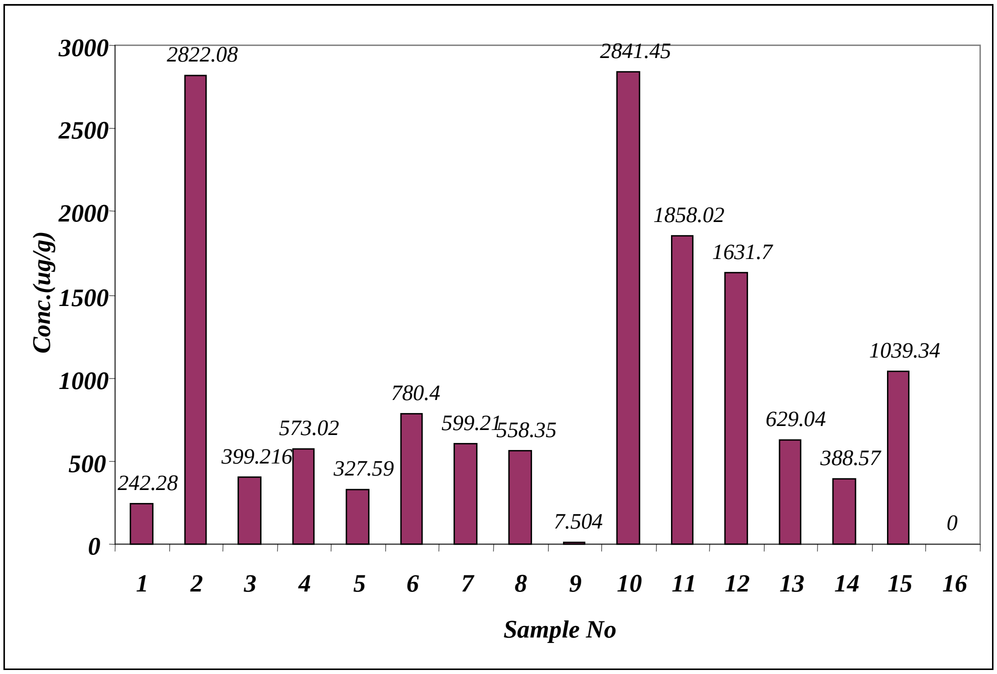


Figure 1: Concentration of DDT in soil samples (ug/gm)

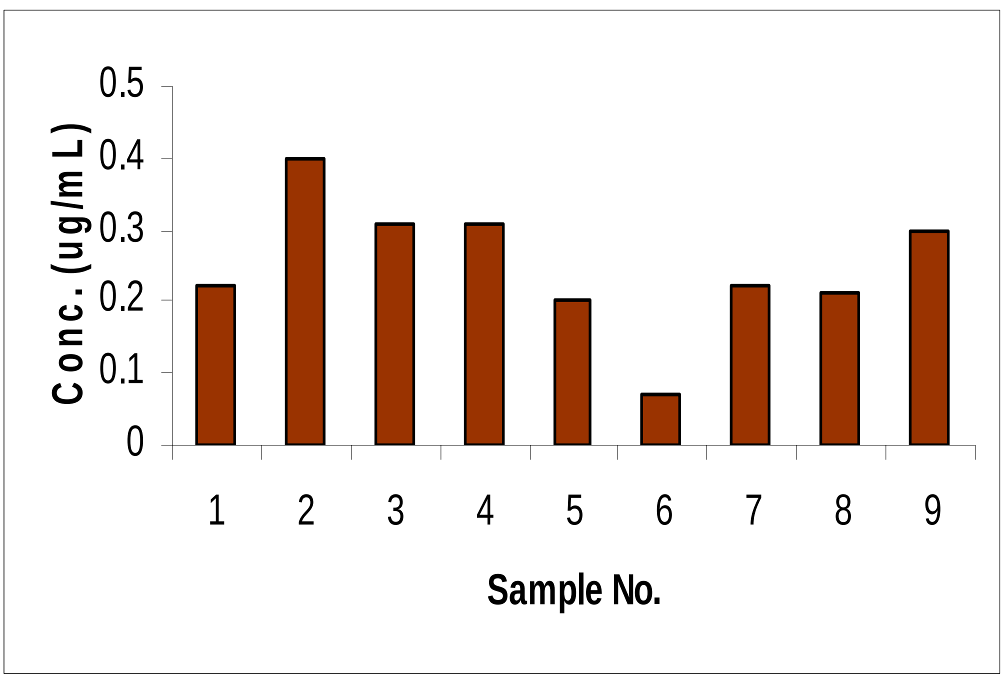


Figure 2: Concentration of DDT in water samples (ug/ml)

Under UNEP program of regionally based assessment of persistent toxic substances (PTS), levels of DDT and other persistent organic pollutants (POPs) have been monitored in samples from different environmental segments as well as food items in 12 regions of the world, including South East Asia and South Pacific (14,15). DDT has been reported in sediment samples from rivers and lakes. Reported concentration values range from not detected to thousands of µg/kg.dw. DDT concentrations have been observed to be usually higher at places where DDT is still used. Sediment samples from Indian rivers showed the highest values. High levels of DDT have also been reported in East Asian region and in the former USSR (14).

DDT residues in the soil of areas surrounding a DDT manufacturing factory in Delhi have been reported by Yadav et al and Saxena et al (16, 17). The reported data clearly indicates an upward trend residual DDT in the soil of the surrounding DDT manufacturing factory from a mean value 034+/-0.49 ppm of total DDT in 1974 to 1.43+/-1.16 and 1.67+/-1.16 in 1978 and 1983, respectively (16). The results also indicated an increase in highest DDT level of 7.27 ppm in 1983 compared to 2.61 ppm in 1974. In the studied soil samples around the DDT factory, residual DDT decreased with the increasing distance from the factory. Soil samples from agricultural land also indicated less total DDT residue as compared to samples from urban soils (17).

In the present study, soil and concrete samples from walls from within and outside the factory as well as from the main drain leading to Kabul River were taken. Samples were also taken from material in the leftover old worn out bags in the factory stores (Table 1). Soil samples (S.No.1, 3-5) from within the factory formulation unit showed residual DDT levels in the range 242.28+/- 0.81 to 573.02 +/- 0.94 µg/gm.

DDT levels in the soil samples (S.No.6-8) at different points outside the factory compound were found to be in the range 558.35+/-0.71 to 780.40+/-0.54 µg/gm.
In the drain samples (S.No.12-15) DDT levels were found in the range 388.57+/-0.48 to 1631.70+/-0.61 µg/gm.

The highest DDT levels of 2822.08+/-0.88 and 2841.45+/-0.95 µg/gm were found in samples (S.No.2 and 10) from the left-over old bags in the formulation unit and in the stores. Soil samples (S.No.11) taken from five yards away from the stores showed 1631.70+/- 0.61 µg/gm residual DDT.

However, DDT was not detected in the soil samples (S.No.16) taken from Azakhel, ten kilometer away from DDT factory.

Residual DDT levels in water samples from within the vicinity of DDT factory, nearby villages and drain leading to the Kabul River showed little variation. Most of the samples fell in the range 0.20+/-0.23 to 0.31+/-0.03 ug/ml (Table 2). The highest and lowest DDT levels were found to be 0.40+/-0.14 (S.No.2) and 0.07+/-0.10(S.No.6), respectively. It appears that either the DDT in the sediments along the factory drain and surrounding soil has already been eroded away or the erosion process is very slow.

No relationship was observed between DDT levels in the samples studied and the distance of the sampling points from the DDT factory.

There are no national standards developed as yet or minimum risk limits (MRL) defined for DDT in Pakistan. However, when compared to other known standards (22,23), the observed DDT levels both in water and soil samples are many times higher than recommended MRLs (for water =0.8 ug/L and for soil = 54.3 ug/kg)

It is evident from the analytical data described in Tables 1 and 2 and MRLs that both water and soil are still highly contaminated with DDT, despite the closure of the DDT factory over the past few years. Persistency, transportation, accumulative characteristics, toxicity, environmental and health impacts of DDT even if present in extremely small amounts are well known and already briefly described in the preceding pages. DDT contamination in and around DDT factory in Amman Gharh areas may cause most serious consequences for ecosystem function, food safety and other aspects of human health.

The presence of high level of DDT in the soil samples indicate the persistence of DDT in this high temperature zone of Pakistan, though there were reports (14, 20, 21) that DDT may not be persistent in this part of the world. The present study necessitates a fresh look into those findings and the level of the health threat to local population in this and all other areas where the formulation storage and application of DDT was practiced.
The presence of DDT residues in water samples indicates that leaching has taken place and will continue to do so as long as DDT residue remains in the soil of the contaminated site. Further work is needed to see if other degradation products like DDE are present in this vicinity.

7. Demolition of DDT Factory, Nowshera

On the last field visit to the DDT factory site on August 27, 2005, the project team was surprised to see the factory almost demolished. About a dozen of workers were still working to knock out the last remains of the factory walls.

The abandoned DDT factory was there for over 12 years and nobody seemed interested to use, sell, or buy it. There appeared to be a quick deal following project team's frequent visits to the site and the on-going interview/meetings with the city officials/stakeholders and ex-employees of the factory. We were informed by the workers demolishing the building that a bargain was effected about 4 months ago and only the standing structure (concrete, bricks, metal bars etc) has been purchased by a group in construction business, part of which had already been transported for use in other cities of NWFP and in Rawalpindi - Islamabad.

8. Recommendations

Whereas the health of the laborers working to demolish the factory and the spread of DDT-contaminated bricks/construction material due to its transportation and further use in different near and far off localities are of grave concerns, even more so is the likely sale of the land of the factory area (after all the construction material is sold and cleared away) and its further use as commercial or residential area, or for, school, playground, park etc. The area/soil may remain contaminated with DDT for quite some time and it is strongly recommended that the land of the factory area may not be sold or put to any use without prior approval of the environmental impact assessment (EIA) of the DDT factory site.

With immediate effect, the factory area may be declared as dangerous area and banned for any human activities. A barrier/wall may be constructed around the factory area to avoid entrance of children, animals, cattle, and chickens.

The exposure's potential risk to human health posed by hazardous wastes like DDT is known to be enhanced by a general lack of vegetation in the affected area, therefore, as an immediate measure excessive vegetation may be grown in the area for effective minimization of the risk.

This study has indicated-alarming situation of DDT residues in soil samples. There is a need to look into the feasibility of employing the reported processes for decontamination of DDT from the soil in and around the factory area. A number of soil decontamination process have been developed and reported (18). Some of these are referred to in Annex VI.

The presence of DDT a banned pesticide in the country, in the studied drinking water samples is a matter of grave concern, as usage of DDT-contaminated water may cause serious impacts on human health. A study relating chronic water borne diseases to pesticide levels in water may be initiated in the contaminated areas.

Control measures are also required to stop the smuggling of DDT/DDT mixed powder in the country under different trade names such as TOUP, ZOOM etc, from the neighboring countries.

In order to evaluate the risk associated with the DDT-contaminated site, studies using bio indicators like eggs, adipose tissues, milk, fish, birds, endocrine disruption and cholinesterase levels etc should be initiated in these areas.

Soil is not just a mass of dead matter rather it is a living entity. Pesticides residues in soil and their impact on beneficial macro and microorganisms should be elucidated.

9. Dissemination of Research Findings

9.1 Panel Discussion

Details of the study were presented at a "Panel Discussion" organized on May 5, 2006 at Senate Hall, University of Peshawar. Professor Dr. Haroon Rashid Vice Chancellor Peshwar University was the chief guest and chaired the proceedings. Panelists included Dr. Mahmood A. Khwaja Research Fellow, Sustainable Development Policy Institute, Prof. Muhammad Rasul Jan Director, Institute of Chemical Sciences and Mr. Kashif Gul, Research student of Institute of Chemical Sciences, Peshawar University. Dr. Mahmood Khwaja gave a brief account of POPs environmental and health issues, Stockholm Convention on POPs, 2001 and introduced the International POPs elimination network (IPEN) and International POPs Elimination Project (IPEP) and IPEP, South Asia. The present study, its objectives and details of study site/location were presented by Prof. Rasul Jan. Mr. Kashif Gul gave an account of sampling procedures, methods of analyses and analytical data. Presentations were followed by discussion and questions answers to the panelists by the participants. Over one hundred twenty students and faculty members participated in the discussion.

9.2 Press Release

The panel discussion was followed by a press release sent to electronic and press media. Project Director (MAK) was also personally interviewed by local language daily newspaper "Mashariq" Peshawar.

Reports appeared in the daily newspapers, "The News," "The Nation" and "Mashariq" May 10, May 6 and May 16. 2006 respectively (Annex IX).

9.3 Paper Presentation – 9th National Symposium on Analytical and Environmental Chemistry

An abstract of the paper entitled, "DDT residue in soil and water in and around abandoned DDT manufacturing factory," has been accepted for presentation at the 9th National Symposium on Analytical and Environmental Chemistry, 24 – 26th July, 2006 at Peshawar University Summer Campus, Baragali, NWFP, Pakistan (X)

9.4 Awareness-Raising Workshop

An awareness raising workshop on the research findings of the present study with representatives of all stakeholders has been planned to be held in August, 2006 at Nowshera/Peshawar.

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Annex I: Stockholm Convention on Persistent Organic Pollutants 2001

Annex B: Restriction

Part I

Chemical	Activity	Acceptable purpose (or) Specific exemption
DDT (1,1,1- trichloro- 2,2-bis (4-chlorophenyl) ethane) CAS No: 50-29-3	Production	Acceptable purpose: Disease vector control use in accordance with Part II of this Annex Specific exemption: Intermediate in production of dicofol Intermediate
	Use	Acceptable purpose: Disease vector control in accordance with Part II of this Annex Specific exemption: Production of dicofol Intermediate

Notes:

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

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

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

(iv) All the specific exemptions in this Annex may be exercised by Parties that have registered in respect of them in accordance with Article 4.

Part II

DDT (1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane)

1. The production and use of DDT shall be eliminated except for Parties that have notified the Secretariat of their intention to produce and/or use it. A DDT Register is hereby established and shall be available to the public. The Secretariat shall maintain the DDT Register.
2. Each Party that produces and/or uses DDT shall restrict such production and/or use for disease vector control in accordance with the World Health Organization recommendations and guidelines on the use of DDT and when locally safe) effective and affordable alternatives are not available to the Party in question.
3. In the event that a Party not listed in the DDT Register determines that it requires DDT for disease vector control, it shall notify the Secretariat as soon as possible in order to have its name added forthwith to the DDT Register. It shall at the same time notify the World Health Organization.
4. Every three years) each Party that uses DDT shall provide to the Secretariat and the World Health Organization information on the amount used, the conditions of such use and its relevance to that Party’s disease management strategy, in a format to be decided by the Conference of the Parties in consultation with the World Health Organization.
5. With the goal of reducing and ultimately eliminating the use of DDT, the Conference of the Parties shall encourage:

a. Each Party using DDT to develop and implement an action plan as part of the implementation plan specified in Article 7. That action plan shall include:

   i. Development of regulatory and other mechanisms to ensure that DDT use is restricted to disease vector control;

   ii. Implementation of suitable alternative products, methods and strategies, including resistance management strategies to ensure the continuing effectiveness of these alternatives;

   iii. Measures to strengthen health care and to reduce the incidence of the disease.

b. The Parties, within their capabilities, to promote research and development of safe alternative chemical and non-chemical products, methods and strategies for Parties using DDT, relevant to the conditions of those countries and with the goal of decreasing the human and economic burden of disease. Factors to be promoted when considering alternatives or combinations of alternatives shall include the human health risks and environmental implications of such alternatives. Viable alternatives to DDT shall pose less risk to human health and the environment, be suitable for disease control based on conditions in the Parties in question and be supported with monitoring data.

6. Commencing at its first meeting, and at least every three years thereafter, the Conference of the Parties shall, in consultation with the World Health Organization, evaluate the continued need for DDT for disease vector control on the basis of available scientific, technical, environmental and economic information, including:

   a. The production and use of DDT and the conditions set out in paragraph 2;

   b. The availability, suitability and implementation of the alternatives to DDT; and

   c. Progress in strengthening the capacity of countries to transfer safely to reliance on such alternatives.

7. A Party may, at any time, withdraw its name from the DDT Registry upon written notification to the Secretariat. The withdrawal shall take effect on the date specified in the notification.

Annex II: History of Pesticide Use in Pakistan

Period	Pesticide Usage and Policies
1954	First time import of pesticides amounting to 254 tons to control locusts.
Upto 1965	Introduction of HYVs and free of cost pesticide distribution by the public sector
1966-74	From a flat rate of Rs. 0.25/litre to 75% subsidized price; distribution by the public sector. First pesticide ordinance was promulgated in 1971
1970s	A shift in research policy. IPM research projects initiated.
1975-79	50% subsidy on ECs/WPs and 75% subsidy on granules; 25% distribution by the public sector and 75% by the private sector.
1980-85	Complete withdrawal of subsidy except in Balochistan; complete distribution by private sector, except in Balochistan. In 1985, Pakistan adopted the model rules for pesticide registration according to UN FAO's International Code of Conduct on the distribution and use of pesticides.
1986-91	Complete withdrawal of subsidy in all provinces; complete distribution by the private sector.
1991	GOP amended the 1971 Ordinance and made two relaxations in pesticide imports I. Pesticides can be imported under generic names rather than brand names, II. If a pesticide is registered in some other country, it can be imported without going through local registration process.
1992-93	Duty and surcharge exemption on herbicides
1993	Duty exemption on pesticides
1994	Banning of 21 environmentally hazardous pesticides
1997	Various sections and clauses of the 1971 Ordinance were amended to strengthen the punishment provisions for pesticide adulterators

Source: Tahir Hasnain - SDPI Working Paper Series # 42 – 1999

Annex III: Consumption of Pesticides in Pakistan

Quantity in M. Tons and Value in Million Rs.

Quantity				
Year	**Imports**	**Production**	**Total**	**Value**
1980	---	---	665	39
1981	---	---	3,677	213
1982	3,552	1,448	5,000	320
1983	4,875	1,713	6,588	629
1984	6,081	3,132	9,213	2,256
1985	8,270	4,260	12,530	2,249
1986	8,834	5,665	14,499	2,978
1987	8,019	6,829	14,848	3,259
1988	6,256	6,816	13,072	2,334
1989	6,869	7,738	14,607	3,642
1990	4,802	9,941	14,742	4,581
1991	6,157	14,056	20,213	5,536
1992	6,619	16,748	23,439	6,554
1993	6,128	14,151	20,279	5,384
1994	10,693	14,176	24,869	5,808
1995	20,134	23,239	43,373	7,273
1996	24,151	19,068	43,219	9,987
1997	31,036	13,836	44,872	9,904

Source: Tahir Hasnain - SDPI Working Paper Series # 42 – 1999

Annex IV: List of Banned Pesticides in Pakistan

Banned Pesticides
1. Binapacryl
2. Bromophos
3. Captafol
4. chlordimeform
5. Chlorobenzilate
6. Chlothiophos
7. Cyhexatin
8. Leptophos
9. Dalapon
10. DDT
11. Dibromochioropropane +
12. Dibromochioropropene
13. Dicrotophos
14. Dieldrin
15. Disulfoton
16. Endrin
17. Ethylene dichloride + Carbontetrachloride
18. Mercury Compound
19. Mevinphos
20. Propergite
21. Toxaphene
22. Zineb

Source: Tahir Hasnain - SDPI Working Paper Series # 42 – 1999

Annex V: List of Stakeholders and Ex-Employees DDT Factory, Nowshera

S.No.	Name	Designation	Place	Interviewed On
1	M. Afzal	Deputy manager Admin.	DDT factory	26 Feb 2005
2	Iqbal Hussain	Security officials	DDT factory	26 Feb 2005
3	Taj Muhammad	Representative of ELC	DDT factory	26 Feb 2005
4	Abdul Qadim Jan (Chemical Engineer)	Ex. Managing Director	DDT factory	01 Mar 2005
5	Raja Muzaffar	Manager Finance	PVC pipe factory	14 Mar 2005
6	Mr. Shabbir Ahmad Afridi	Industrial Development Officer	Nowshera	25 Apr 2005
7	Haji Shujat Ali Khan	Assistant Industrial Officer.	Nowshera	25 Apr 2005
8	Mohammad Arif	Principle	Frontier science Degree College G.T. Road Nowshera Cantt.	14 May 2005
9	Noor-Ullah	Principle	Pakistan Degree College of Commerce and Information Science. Nowshera Cantt	14 May 2005
10	Noor-ul-Mudassar	Principle	Jinnah Memorial College Nowshera Cantt	14 May 2005
11	Qazi Khalil	Principle	Govt. Degree College Nowshera	14 May 2005
12	Abdul Ahad	Principle	Muslim Degree College Nowshera Cantt	14 May 2005
13	Engr. Sultan Arif Sarwar	Principle	Govt. Technical college Nowshera.	14 May 2005
14	Sayyar Sb	Principle	Govt. High School No1 Nowshera Cantt	14 May 2005
15	Jan Mohammad	Principle	Govt. High School No 2 Nowshera Cantt	14 May 2005
16	Noor Mohammad	Aman clinical lab	Nowshera Cantt	14 May 2005

17	Gohar	Alshifa clinical lab	Nowshera Cantt.	14 May 2005
18	Arshad	Kamal clinical lab	Nowshera Cantt.	14 May 2005
19	Gul Zaman	National clinical Lab	Nowshera Cantt.	14 May 2005
20	Mahmood	City clinical lab	Nowshera Cantt.	14 May 2005
21	Abbas	Bilal Clinical lab	Nowshera Cantt.	14 May 2005
22	Sagher	Spinzar Clinical lab	Nowshera Cantt.	14 May 2005
23	Gul Mohammad	GUL Clinical lab	Nowshera Cantt.	14 May 2005
24	Zarid khan	Shafi Clinical lab.	Nowshera Cantt.	14 May 2005
25	Dr Tariq kamal	Children Specialist	D.H.Q.Nowshera	14 May 2005
26	Dr Amjad	S.M.O.	D.H.Q.Nowshera	14 May 2005
27	Dr Akram Shah	C.M.O casualty medical officer	D.H.Q.Nowshera	14 May 2005
28	Nazir Taj	In Charge Llab	D.H.Q.Nowshera	14 May 2005
29	Zubair	Technician Lab.	D.H.Q.Nowshera	14 May 2005
30	Wahid Ali khan	E.C.G. Technician	D.H.Q.Nowshera	14 May 2005
31	Hussain Ahmad Khan	District Agricultural Officer.	Nowshera	14 May 2005
32	Dr Farman	Deputy D.H.O.	Nowshera	14 May 2005
33	Noor-ul-Basar	Lab. Asst.(1961)	DDT factory	14 May 2005
34	Abdur Rahim KhanDurrani	Admin officer	Malaria Eradication Programme	14 May 2005

Annex VI: DDT – Factory Nowshera – General Particulars

Name: DDT Factory.
Proprietor: DG Health Government of Pakistan and Managing Agent P.I.D.C.
Location: GT road Nowshera District Peshawar.
Tele Graph Address: DDT Nowshera
Telephone No: 74 and 126 Nowshera
Whether registered under section 2 (I) rule-2, A-5 or 5(I) 5547.
Total Horse Power (H.P) of power driven machinery: 318

Total No of days the factory worked during the year: 236
No of Shifts worked daily: 3
Reason if not operating through out the year:

1. break down of machinery
2. over hauling of the factory
3. maintenance of the plant

CAPITAL INVESTMENT

	Addition during the year Rs	Total Investment on 30-6-1961 Rs
Land and Building	1,473.84	6,48,443.17
Machinery and Equipment	7,237.57	15,30,430.63
Other fixed assets	8,383.31	1.45,421.07
Stock and Investment	33,52,133.75	57,38,667.65
Grand Total	33,69,228.47	80,38,667.65

STAFF

Category	No of Person Employing		Total Salary Paid per Year Rs
Production Worker	Sept.30	March 31	
Skilled	40	42	64,517.80
Un Skilled	71	69	41,488.30
Technical and Professional	6	7	38,833.00
Clerical and Other Employees	21	21	19,800.08
Total	138	139	1,64,639.33

No of Ex Servicemen if any employed 15

Cash benefit paid to,

Production worker Rs 1,06,006.17

Other employees Rs 58,633.16

Total No of Cash Benefit paid 3,725.00

Housing facility for worker:

Production worker 38

Other staff 10

IMPORT LICENSE (July-Dec)

	July – Dec		Jan – June	
	Value issued	value utilized	value issued	value utilized
Raw material Rs.	5,715	5,715	3, 92,285	3, 92,285

PARTICULAR OF MACHINERY AND EQUIPMENT

Equipment	No	Producer	Year of Installation	Daily Production
Water cooling tower	1	USA	1954	25 HP
Transformer	1	UK	1954	500 KV
Water pumps	2	UK	1954	30 HP
Plant Machinery	1	USA	1954	2 Ton
De supper heating	1	UK	1954	
Tube well	1	German	1954	20 HP
Motor	25	UK and USA	1954	

PRODUCTION CAPACITY

Production	Annual Production Quantity	Annual Production Value Rs	Actual Quantity	Actual Value Rs
Technical DDT 100%	700 tons	39,20,000	186.80 tons	14,42,945

DDT consumed with in Factory: 53.70 tons value Rs 4,10, 736

DDT sold 5 tons value Rs 16.693

PRICES

		Unit	Exmill	Retail	Retail Rs
1	DDT 100%	Lbs	3.48	3.48	2.50
2	DDT 50%	Lbs	2.86	2.86	1.50
3	DDT 10%	Lbs	1.40	1.40	

BASIC MATERIAL CONSUMED

<table>
<tr><th></th><th>UNIT</th><th>QUANTITY</th><th>Rs</th><th></th></tr>
<tr><td>Benzene</td><td>Gall</td><td>55,706</td><td>3,04,161</td><td rowspan="2">Imported</td></tr>
<tr><td>Monocholorobenzene</td><td>Gall</td><td>20,332</td><td>1,41,286</td></tr>
<tr><td>HCL</td><td>Tons</td><td>311</td><td>1,26,205</td><td rowspan="5">Indigenous</td></tr>
<tr><td>Alcohol</td><td>Gall</td><td>27465</td><td>1,34,934</td></tr>
<tr><td>Chlorine</td><td>Tons</td><td>384</td><td>2,69,762</td></tr>
<tr><td>Soap Stone</td><td>Tons</td><td>10</td><td>7,762</td></tr>
<tr><td>Misc</td><td></td><td></td><td>5,595</td></tr>
<tr><td>Cellofas</td><td>CWT</td><td>45</td><td>26,815</td><td rowspan="3">Imported</td></tr>
<tr><td>Nansa</td><td>Lb</td><td>1,518</td><td>2,491</td></tr>
<tr><td>Lissapol</td><td>Lb</td><td>5,600</td><td>14,804</td></tr>
</table>

SPARE PARTS

- The spare part of the Value Rs 71212 was taken from Indigenous sources.
- The spare part of the Value Rs 24800 was imported.

FUEL AND POWER RESOURCES

	Unit	Quantity	Rupees
Electricity	KW.Hr	6.680,793	52,796.62
Kerosene Oil	I.G	72.5 gall	109.00
Petrol	I.G	1073 gall	3519.44
Diesel Oil	I.G	3997 gall	5995.50
Lubricants	I.G	237 gall	1355.00

Details of follow up data collected in 1967 are also given below

Equipment: About 62 Electric motors was present and each produced 540 HP.

Raw Material**:** value Rs 10,76,416 was used in 1966, and value Rs 8,40,166 in 1967.

Equipment**:**

1	Micronizer	1
2	Harmer Mill	1
3	Air Compressor	2
4	Storage Tank	7
5	Ammonia Compound	
6	Ammonia Compressor	3
7	Boiler	1

Employees: The total no of employees was 196 in which 70 were skilled while 126 were unskilled persons. The administrative staff was 11, and other employees 82.

Working Days per Year: 353 days

Total shift per Year: 1059

Reference of industrial office file

File of industrial office No = 1/144.

File closed in 1987.

Annex VII: Processes for Soil Decontamination and Reclamation

1. ***E. Smith, J. Smith, R. Naidu and A. L. Juhasz.***

Desorption of DDT from a Contaminated Soil using Cosolvent and Surfactant Washing in Batch Experiments

Water, Air, and Soil Pollution
Issue: Volume 151, Numbers 1-4
Date: January 2004
Pages: 71 – 86

1,1-bis(p-chlorophenyl)-2,2,2-trichloroethane (p,p-DDT) is a recalcitrant organic compound that is difficult to remove from contaminated soil due to its low solubility. In this study we investigated the effectiveness of both co-solvents and surfactants in enhancing the solubility of p,p-DDT from a soil that has been contaminated with DDT for nearly 40 yr. The presence of selected surfactants removed less than 1 to 11% of p,p-DDT compared to cosolvents, which removed less than 1 to 77% of p,p-DDT from the same soil. The low solubility of p,p-DDT in the presence of surfactants was attributed to the decreased surfactant concentration to below critical micelle concentration following sorption by soil surfaces. Enhanced solubility of p,p-DDT was achieved with the use of cosolvents that released up to 77% of p,p-DDT from a contaminated soil. Increasing the solution concentration and hydrophobicity of the co-solvent increased the amount of p,p-DDT desorbed. For example, the amount of p,p-DDT desorbed increased in the order 5% 1-propanol << 50% ethanol << 50% 1-propanol. Repeated washing of the soil with various cosolvents, in all but two cases, markedly increased the total amount of p,p-DDT desorbed from the soil. For example, repeated washing of the soil with 50% ethanol increased the amount of p,p-DDT removed by 42% while repeated washings of the soil with 50% 1-propanol had little effect on the amount of p,p-DDT desorbed. Increasing the soil-solution ratio from 1:2 to 1:10 in the presence of 40% 1-propanol increased the amount of p,p-DDT desorbed by 100%; suggesting that the soil-solution ratio was an important parameter in controlling the amount of p,p-DDT desorbed.

2. ***Albert L. Juhasz, Euan Smith, Julie Smith and Ravendra Naidu***

Development of a Two-Phase Cosolvent Washing-Fungal Biosorption Process for the Remediation of DDT-Contaminated Soil

Issue: Volume 146, Numbers 1-4
Date: June 2003
Pages: 111 - 126

A bench scale, two-phase soil washing-biosorption process was developed for the remediation of *p,p′*-DDT-contaminated soil (containing 990 and 7750 mg kg^{-1} of *p,p′*-DDT). Removal of *p,p′*-DDT from contaminated soil was achieved by washing the soil with low molecular weight primary alcohols (ethanol or 1-propanol). An improved efficiency of *p,p′*-DDT removal was observed with increasing C-chain length of the co-solvent and by increasing the co-solvent volume fraction. When 40 or 80% 1-propanol were used, greater than 93% of *p,p′*-DDT was desorbed from the respective soils. *p,p′*-

DDT was partitioned from the co-solvent solutions using biomass of *Cladosporium* sp. strain AJR[3]18,501 as the sorptive matrix. When studies were conducted using a co-solvent-recycling regime (with 80% 1-propanol) greater than 95% of *p,p'*-DDT was removed from Soil A (990 mg kg^{-1} *p,p'*-DDT) and Soil B (7750 mg kg^{-1} *p,p'*-DDT) with the majority of the desorbed organochlorine repartitioning onto the fungal biomass. Less than 2.4 μg mL^{-1} *p,p'*-DDT was detected in the co-solvent wash solution of Soil A after 80 hr: potentially the co-solvent could be further reused to treat other soil. A higher concentration of *p,p'*-DDT was detected in the co-solvent wash solution of soil B after 120 hr (13.3 μg mL^{-1}) indicating that the *p,p'*-DDT sorption sites on the fungal biomass were fully saturated.

3. *Richard G. Kuhn and Kevin R. Ballard*

Canadian Innovations in Sitting Hazardous Waste Management Facilities

Issue: Volume 22, Number 4

Date: July 1998

Pages: 533 - 545

Sitting hazardous waste facilities is an extremely complex and difficult endeavor. Public aversion to the construction of these facilities in or near their community often results in concerted opposition, referred to as the NIMBY syndrome. For the most part, siting processes do not fail because of inadequate environmental or technical considerations, but because of the adversarial decision-making strategies employed by the proponents. Innovative sitting processes used in the provinces of Alberta and Manitoba offer tangible evidence of the successful application of an innovative sitting approach based on the principles of decentralization of decision-making authority and full and meaningful public involvement. The purpose of this paper is to evaluate four Canadian siting processes from the perspective of public participation and access to decision-making authority. Examples of sitting processes related to hazardous waste management facilities are provided from the provinces of Alberta, Manitoba, British Columbia, and Ontario. Sitting has evolved from approaches dominated by top-down decision making to increasing decentralized and pluralistic approaches. Focusing on social and political concerns of potentially affected communities and on the process of decision making itself are fundamental to achieving sitting success. In Alberta initially, and later in Manitoba, this new “open approach” to sitting has resulted in the construction of the first two comprehensive hazardous waste treatment facilities in Canada.

4. *Khadam, I. and J. J. Kaluarachchi.*

Applicability of risk-based management and the need for risk-based economic decision analysis at hazardous waste contaminated sites,

Environment International, 29(4), 503-519, 2003.

Decision analysis in subsurface contamination management is generally carried out through a traditional engineering economic viewpoint. However, the new advances in human health risk assessment, namely, the probabilistic risk assessment, and the growing awareness of the importance of *soft data* in the decision-making process, require decision analysis methodologies that are capable of accommodating non-technical and politically biased qualitative information. In this work, we discuss the major limitations of the currently practiced decision analysis framework, which evolves around the definition of risk and cost of risk, and its poor ability to communicate risk-related information. A demonstration using a numerical example was conducted to provide insight on these limitations of the current decision analysis framework. The results from this simple ground water contamination and remediation scenario were identical to those obtained from studies carried out on existing Superfund sites, which suggests serious flaws in the current risk management framework. In order to provide a perspective on how these limitations may be avoided in future formulation of the management framework, more matured and well-accepted approaches to decision analysis in dam safety and the utility industry, where public health and public investment are of great concern, are presented and their applicability in subsurface remediation management is discussed. Finally, in light of the success of the application of risk-based decision analysis in dam safety and the utility industry, potential options for decision analysis in subsurface contamination management are discussed.

Annex VIII: Institution's Profile

VIII.1 Sustainable Development Policy Institute (SDPI)

SDPI was founded in August 1992 on the recommendation of the Pakistan National Conservation Strategy (NCS) that outlined the need for an independent non-profit organisation to serve as a source of expertise for policy analysis and development, policy intervention, and policy and programme advisory services in support of NCS implementation.

The mandate of SDPI is to:

- Conduct policy advice, policy oriented research and advocacy from a broad multi-disciplinary perspective.
- Promote the implementation of policies, programs, laws and regulations based on sustainable development.
- Strengthen civil society and facilitate civil society-government interaction through collaboration with other organizations and activist networks.
- Disseminate research findings and public education through the media, conferences, seminars, lectures, publications and curricula development, including the Citizens Report and State of the Environment Report.
- Contribute to building up national research capacity and infrastructure.

SDPI strives to catalyse the transition towards sustainable and just development in Pakistan; conduct policy-oriented research on sustainable development from a broad multi-disciplinary perspective; provide policy advice; contribute to strengthening the social and physical infrastructure for research; and initiate, establish and participate in collaborative advocacy and other activities with like-minded organisations in and outside the country.

The research program at SDPI drives the three main activities of policy advice, advocacy and training.

For more information, please visit http://www.sdpi.org.

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VIII.2 Institute of Chemical Sciences (ICS), Peshawar University

The Institute of Chemical Sciences is committed to the production of well rounded international standard graduates of B. Sc (Hon), M.Sc., M.Phil and Ph.D level in areas of chemistry including Analytical Chemistry, Applied Chemistry, Biochemistry, Environmental Chemistry, Fuel Chemistry, Inorganic Chemistry, Nuclear and Radiochemistry (Nuclear Medicine), Organic Chemistry, Physical Chemistry; maintaining high level of integrity and responsibility at individual and departmental level; and conducting quality research, as well as offering consultancy to local industries and institutions and to participate in community development projects.

The institute's mission is to convert the chemistry department into a center of chemical sciences and to act as a leader in excellence and performance in its objectives in the country.

The Department of Chemistry, University of Peshawar was established in September 1955 and since than has been catering to the people of North West Frontier Province (N.W.F.P), Tribal Areas, Northern Region and Kashmir for higher studies in Chemistry as well as other three Provinces of Pakistan. Each year, the department also receives international students from the Middle East, Africa, Iran and Afghanistan. With a student population of eleven, initially the department started with three teachers. In the beginning, specialization in physical chemistry, inorganic chemistry and industrial chemistry were offered. With the passage of time, the department grew in all dimensions and doctorial program was started in 1970 followed by M. Phil program in 1977. Like its past, even today, now developed into an "Institute of Chemical Sciences," it is one of the largest postgraduate departments of the University of Peshawar. Having 22 highly qualified faculty members with degrees and training in diverse areas of specialization supported by 25 para-teaching staff, the department provides an ideal environment for students in almost all areas of contemporary chemistry. The institute conducts morning and evening shifts at M. Sc as well as B. Sc (Hons) level with a total strength of 288 students. A very active research program in all disciplines mentioned earlier is being conducted. Postgraduate program at M. Phil and Ph. D. include both extensive course work and completion of research projects**.**

Contacts:
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Web: www.upesh.edu/depts/chemistry

Annex IX: Media Reports

امانگڑھ، ڈی ڈی ٹی فیکٹری انسانی زندگی کے لئے خطرہ بن گئی

گردونواح کے علاقے بھی زہریلے مادوں سے بھر گئے، کسی بھی وقت بڑا حادثہ رونما ہوسکتا ہے، ڈاکٹر محمود

نوشہرہ (نمائندہ مشرق) ضلع نوشہرہ کے علاقہ امانگڑھ میں ڈی ڈی ٹی فیکٹری اور آس پاس کے علاقوں میں پھیلے نامیاتی مادوں کی موجودگی سے انسانی وحیوانی زندگی کے لئے شدید ترین خطرات پیدا ہوگئے ہیں حال ہی میں ایس ڈی پی آئی ریسرچ فیلو کے ڈاکٹر محمود خواجہ نے ڈی ڈی ٹی فیکٹری اور اس کے گرد نواح کا تفصیلی سروے (بقیہ 32 صفحہ 10)

The News International, Wednesday, May 10, 2006

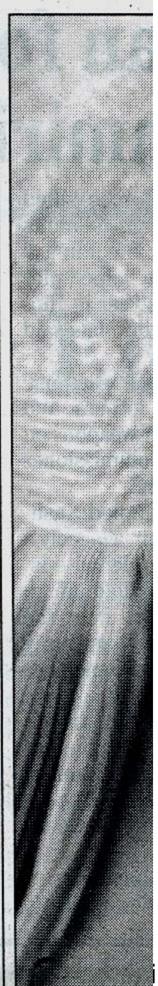
High levels of DDT found in Nowshera water, soil

Bureau report

PESHAWAR: Research findings on several samples of water and soil collected from in and around an abandoned chemicals factory in Nowshera have indicated high levels of DDT.

However, no detectable concentrations of DDT were found in water and sediment samples of Kabul River. The study was carried out jointly by Sustainable Development Policy Institute (SDPI), Islamabad and Institute of Chemical Sciences (ICS), Peshawar University, under International POPs Elimination Project (IPEP), South Asia and International POPs Elimination Network (IPEN) Details of the study were presented at a panel discussion organized at Senate Hall, University of Peshawar.

Professor Dr Haroon Rashid, Vice Chancellor Peshawar University, was the chief guest on the occasion. Panelists included Dr Mahmood A Khwaja Research Fellow, Sustainable Development Policy Institute, Dr Muhammad Rasul Jan, Director Institute of Chemical Sciences and Kashif Gul, research student of Institute of Chemical Sciences.



VACCINATION:

بقیہ نمبر 32

امانگڑھ فیکٹری

کیا ہے جس کے مطابق مذکورہ علاقے میں کئی زہریلے مادوں کے شواہد ملے ہیں انہوں نے کہا کہ ڈی ڈی ٹی کا شمار ان 12 نامیاتی مادوں میں ہوتا ہے جو سب سے زیادہ خطرناک اور مسلسل آلودہ کار نامیاتی مادے کہلاتے ہیں ان کے زہریلے پن اور تباہ کن اثرات کی وجہ سے انہیں "درجن بھر غلیظ مادے" کہا جاتا ہے انہوں نے کہا کہ بین الاقوامی معاہدے اور ملکی قوانین حکومت کو اس امر کا پابند کرتے ہیں کہ ان مادوں کے اخراج کے لئے اقدامات کئے جائیں۔

No DDT concentration in Kabul water

(791-D)

(101)

FROM OUR CORRESPONDENT

PESHAWAR-The research findings on several samples of water and soil collected from around DDT factory in Nowshehra have indicated high levels of DDT. However, no detectable concentration of DDT was found in water and sediment samples of Kabul River, says a Press Release.

The study was carried out jointly by Sustainable Development Policy Institute and Institute of Chemical Sciences, Peshawar University under International POPs Elimination Project (IPEP), South Asia sponsored by International POPs Elimination Network (IPEN). Details of the study were presented at the panel discussion organized at Senate Hall, University of Peshawar. Professor Dr. Haroon Rashid Vice Chancellor Peshwar University was the chief guest and chaired the proceedings. Panelists included Dr. Mahmood A. Khwaja Research Fellow, Sustainable Development Policy Institute, Dr Muhammad Rasul Jan, Director, Institute of Chemical Sciences and Mr. Kashif Gul, research student of Institute of Chemical Sciences, Peshawar University. Over one hundred twenty students and faculty members participated in this panel discussion.

Acronyms

^0C	Degree centigrade
DDT	Dichlorodiphenyltrichloroethane
DW	Dry Weight
EIA	Environmental impact assessment
EPA	Environmental Protection Agency
EU	European Union
GC	Gas Chromatograph
GEF	Global Environment Facility
GTZ	German Agency for Technical Cooperation
HCB	Hexachlorobenzene
HCl	Hydrochloric acid
IPEN	International POPs Elimination Network
IPEP	International POPs Elimination Project
KSK	Kala Shah Kako
MAC	Maximum allowable concentration
MIN	Minute
MINFA	Ministry of Food Agriculture and Livestock
NaCl	Sodium chloride
ng/g	Nanogram per gram
NGOs	Non-governmental organizations
NWFP	North West Frontier Province
PCBs	Polychlorinated biphenyls
PCDDs	Polychlorinated-p-dibenzodioxins
PCDFs	Polychlorinated dibenzofurans
PH	Hydrogen ion concentration
PIDC	Pakistan Industrial Development Corporation
POPs	Persistent organic pollutants
PTS	Persistent toxic substances
PVC	Polyvinyl chloride
SDPI	Sustainable Development Policy Institute
ug/g	Microgram per gram
ug/ml	Microgram per milliliter
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
WFPHA	World Association of Public Health Associations
WHO	World Health Organization