International POPs Elimination Project

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

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Country Situation Report on Persistent Organic Pollutants (POPs) in Sri Lanka

Centre for Environmental Justice (CEJ)

Sri Lanka
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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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Country Situation Report on Persistent Organic Pollutants (POPs) in Sri Lanka

1. BACKGROUND

Sri Lanka is an island country located in South Asia region, close to southern tip of India. Being primarily an agricultural country, the use of Persistent Organic Pollutants (POPs) pesticides has been rampant until 1996. The Pesticide Registrar banned POPs pesticides in 1996. As in many other countries, the PCBs were used as transformer oil until the end of the 1960s. Some of the old transformers are still available in the disposal yards or still in operation. Dioxins and furans are also a major concern for the country.

The Sri Lankan Government signed the Stockholm Convention on 5 September 2001 and the Ministry of Environment acts as the focal point for the Convention. On 1 December 2002, the Ministry established a POPs Unit within the Ministry of Environment and Natural Resources. The country ratified the Convention on 22 December 2005.

The POPs Unit started the preparation of the National Implementation Plan (NIP) on 1 December 2002, which is now in the final stages. The Unit established several committees to investigate different aspects related to POPs in the country. It works closely with other government departments to make the necessary plan.

Centre for Environmental Justice (CEJ), Sri Lanka Green Movement and Sri Lanka Environment Explorations Society (SLEES) joined the International POPs Elimination Project (IPEP) in 2004 to contribute towards POPs elimination. Since then, the Centre for Environmental Justice is working together with the POPs Unit of the Ministry of Environment and other civil society organisations to make the public aware about the ill effects of POPs and find ways and means to eliminate them.

2. WHAT ARE POPS

POPs are widely spread chemicals that resulted from the industrial revolution of 1940s. It received further thrust under the Green revolution of 1960s. Broadly speaking, POPs are highly toxic chlorine-containing organic (carbon-based) compounds that persist in the environment. POPs are semi-volatile, evaporate relatively slowly, travel long distances (in water, on air currents, or in the bodies of migratory animals), and naturally migrate to and accumulate in colder climates (some of the highest levels of POPs are in Artic areas of both hemispheres). POPs bio-accumulate in the fatty tissues of animals. They increase in intensity as they move up the food chain through a process known as bio-magnification. POPs are found globally in air, water, soil, sediments, fish, meat, and dairy products (animal fats), and human breast milk. POPs are banned in most developed countries, but still used in others.

POPs include pesticides, industrial chemicals and unintentional by-products such as dioxins and furans. Since Sri Lanka has banned all the nine pesticides on the Convention list by regulations under Control of Pesticides Act No 33 of 1980 and as amended by Act, No. 6 of 1994, Regulations published 29 May 2001 (Gazette Extraordinary No.1190/24) their use is illegal. PCBs are also not imported legally. However there is no available information to confirm that these chemicals materials are unavailable in the country.

The following table gives the identified POPs under the Stockholm convention.

Pesticides	Industrial Chemicals	Unintentional by-products
• Aldrin • Dieldrin • Endrin • Chlordane • DDT • Heptachlor • Mirex • Toxaphene • Hexachlorobenzene (HCB)	• Hexachlorobenzene (HCB) • Polychlorinated biphenyls (PCBs)	• Polychlorinated dibenzo-p-dioxins (PCDDs) • Polychlorinated dibenzofurans (PCDFs) • Polychlorinated biphenyls (PCBs) • Hexachlorobenzene (HCB)

3. SOURCES OF POPS

3.1 Pesticides

Country profile

The economy of Sri Lanka is mainly agriculture based. It has two sectors namely, domestic and plantation sector. The domestic sector, which forms the dominant part of agriculture, accounts for 1.7 million farm families in a population of around 19 million. Both sectors jointly contribute 20% to the Gross Domestic Product (GDP) and 34% to employment (Central Bank Report, 2002).

In the management of pests, the plantation sector approach is more organized whereas in the domestic sector it is more complicated due to the large number of farmers, crops and pests involved. Agriculture is the biggest user of pesticides in Sri Lanka. The extent of use in different agricultural crops is: Rice (6,85,625 hectares), Fruit crops (99,727 hectare), Other agricultural crops (1,31,220 hectares), and Plantation crops (6,94,674 hectares) (AgStat, 2004).

In Sri Lanka, pest control is mostly dependent on the use of synthetic pesticides. All pesticides used in Sri Lanka are imported spending about 1,350 million rupees annually. Pesticides are imported into the country as ready-to-use products in handy packages, bulk formulations or technical materials for local formulations. According to FAO (1997), Sri Lanka ranks very high in the Asia Pacific Region with regard to pesticide-related health hazards. Annually the total number of pesticide accidents in Sri Lanka is around 20,000 of which 1,600 are fatal with 70% of this being suicide attempts.

There is a regulatory mechanism in place for the implementation of relevant laws (i.e. Control of Pesticides Act No. 33 of 1980) in management of pesticides, which is a mandate of the Department of Agriculture. The Act provides provisions for all required regulation and control of import, distribution and safe use of pesticides, in keeping with the international guidelines. The implementation is not up to expectations, due to the lack of resources like manpower, laboratory facilities, equipment, mobility, etc. However, Sri Lanka has effectively prohibited import and use of WHO hazard class I pesticides, which are considered to be the most dangerous with high acute toxicity and also the pesticides with longer persistence in the environment. To this second category falls the POPs group of pesticides.

POPs Pesticides

The major source of POPs in Sri Lanka is agricultural pesticides. The first synthetic pesticide to be used in Sri Lanka on a large scale was DDT, which was just after the World War II in the late 1940s. It was followed by benzenehexachloride (BHC or Lindane) to control the malaria vector. Subsequently, with the successes achieved in vector control, these pesticides were used in agriculture for control of pests to meet the increasing demand for food after the War. By the next decade more toxic chemicals such as aldrin, dieldrin, endrin and others were also included in the arsenal of pesticides, which were used indiscriminately for control of pests in the fields of agriculture, veterinary, public health, and the industry.

Status of POP pesticides in Sri Lanka

Aldrin

There is no history of production or formulation of aldrin in Sri Lanka. Aldrin has been imported as ready-to-use products as Aldrin 20 EC (20% aldrin) and Aldrex 25% EC containing 25% of aldrin for control of soil pests in agricultural lands (cockchafer grub, root-eating ants and banana weevil), pests of rice (Herath and Joshi, 1986), shot hole borer (SHB) in tea and as termiticide dip (1% w/v solution) in reforestation schemes (Midgley and Weerawardane, 1986). Aldrin became the recommendation for SHB in tea in 1964 (S.I. Vitharana, Entomologist, TRI-personal communication). Consequent to the banning in agriculture in 1986, the uses were severely restricted by imposing quantity restriction and distribution with permission only; (1) for termites and beetle control in coconut nurseries (2) for ant and termite control prior to establishment of tobacco nurseries and (3) as termiticidal dip of potted plants in re-forestation schemes. Aldrex was the commercial formulation recommended by the Coconut Research Institute for the control of termites in nurseries (CRI, 1992).

Chlordane

There is no history of production or formulation of chlordane in Sri Lanka. Chlordane has been used in Sri Lanka as Chlordane 40 EC for industrial pest control purposes and a ready to use formulation for timber protection in the household environment. It had been recommended for white ant control in floricultural crops and control of cockroaches (Hagen and Ekanayake, 1977), coconut termites (CRI, 1992) and forest termites (1% w/v solution of chlordane) (Midgley and Weerawardane, 1986). Intox-8 was the registered product in 1985. Due to restrictions on minimum orders imposed by the manufacturer, Intox-8 registration was replaced with Chlordane 40% EC subsequently in October 1986. Since then, Chlordane 40% EC was the only formulation available in Sri Lanka up to 1994. An application for registration of Dee Bug, a household insecticide containing 0.5 % w/v of chlordane has been withdrawn in 1984. With few exceptions, majorities of uses were handled by pest control services such as M/s. Suren Cooke Associates, M/s. Finlay Rentokil Ceylon Limited, M/s. Lawson Pest Control Services and M/s. Ceylon Pest Control Services for termite control in building sites. Agricultural uses were basically on coconut plantations, horticultural projects and tobacco nurseries. M/s. Mike Flora (Rambukkana), M/s. Ceylon Tobacco Company (Kalagedihena) and Coconut Plantations (at various locations) were among the noticeable other users in the past. With the boom on industrial activities with the free economic policy implemented by the government in 1977, major industrial sites in Free Trade Zones and other industrial places were the, most common places to use chlordane for structural treatments against termites. Two hundred garment factory projects started across the country in 1992 might be potential "hot-spots" where chlordane had been used along with dieldrin for termite control.

Uses on pre/post construction treatment and timber treatments for control of termites have been replaced by synthetic pyrethroids and other safer alternatives. The volume of imported chlordane active ingredient imported from 1986 through 1994 was 5240 kg.

DDT

There is no history of production of DDT in Sri Lanka. DDT was first known to Sri Lanka during World War II (1946) when it was brought into combat malaria by controlling the mosquito vector. The use of DDT was extended to agricultural crops as well, in areas where it was used for the control of mosquitoes even before the insecticide was officially recommended replacing traditional insecticidal solutions (e.g. soap solutions, nicotine solutions, etc). Arkotine D18, Didimac 25 EC (200 g/l of DDT), Decnol, Sillortox and DDT 50% WP were some agricultural and public health formulations used in Sri Lanka. DDT 50% WP had been recommended for caterpillars and stem borers in floricultural crops and for cockroach control (Hagen and Ekanayake, 1977). DDT had been in use in tea lands from early 1950's until 1970 for the control of Tea Tortrix with concomitant severe mite outbreaks in several estates (e.g. Liddesdale, Halgranoya; Oltery, Dickoya; Dambetenna, Haputale) (Cranham and Danthanarayana, 1971). TRI discontinued its recommendation in 1970. However, the large stocks of DDT left in the Estates continued to be used for some time and believed to have lasted till the late 1970s (S.I. Vitharana, Entomologist, TRI-personal communication). According to 1971 import figures, some 114,000 kg of DDT was used for vector control and about 4,500 kg of DDT for agriculture (Ramasundaram, *et al*., 1978). Indoor residual application of insecticides has been one of the major measures adopted for control of malaria in Sri Lanka since 1946. The malaria eradication program was instituted in 1958 and progressed until 1977 with DDT. The strategy adopted during this period was blanket or carpet spraying of DDT for eradication of malaria. DDT had been sprayed throughout the Dry Zone and to a larger extent in the Wet Zone including some areas of the Colombo district (Dr. R.R.M.L.R. Siyambalagoda, Director, Anti Malaria Campaign-personal communication). Vector resistance to DDT was first detected in April 1969 (Clarke *et al*, 1974), and as it spread widely throughout the country, DDT was gradually replaced with malathion starting in 1977 (Wickramasinghe, 1981). Resistance of the *Anopheles nigerrimus* mosquito (a malaria vector) to DDT was recorded in 1982 though it may have developed resistance earlier (Herath and Joshi, 1986).

Dieldrin

No history of production or formulation of dieldrin in Sri Lanka is recorded. Dieldrin has been used for a wide range of applications such as agricultural crop protection, termiticide for building construction, and consumer ready-to-use timber protection in Sri Lanka. Dieldrin was first recommended in 1961 for use against shot hole borer in tea (Seneviratne, 1995) with the concomitant side effects in the form of severe outbreaks of looper and twig caterpilars in 1962-1963 but continued until its ban in 1966 (Danthanarayana and Kadirawetpillai, 1969). The tea estates like Nayapane, Pussellawa; Galaha Group, Galaha; Goorokoya, Nawalapitiya; Mahaousa, Madulkelle were believed to have had comparatively heavy usage of dieldrin in the past based on the heavy damage due to side effects (S.I. Vitharana, Entomologist, TRI-personal communication). Dieldrex, Dieldrin 20 EC and Termite Soil Concentrate were emulsifiable concentrates containing 200 g/l of dieldrin and Wood Preservative-A was a formulation containing a mixture of 2.5 g/l of dieldrin and 1.2 g/l of pentachlorophenol for wood preservation. An alternate dieldrin formulation containing 300 g/l of dieldrin emulsifiable concentrate was also imported during 1986-1987, due to the discontinuation of 20% EC formulation by the manufacturer. All agricultural uses were prohibited prior to 1980. Registered uses were only for non-crop applications viz. subterranean treatment for control of termites and application for timber treatments. The totals of imports of dieldrin active ingredient during the period from 1983 through 1991 were 4,309 kg.

Endrin

There is no history of production of endrin in Sri Lanka. There have been claims about the use of Endrin for a wide range of applications in agriculture in the past but no credible references could be found on further details of usage. According to the information available Endrex EC was the commercial formulation that existed.

Heptachlor

There is no history of production of heptachlor in Sri Lanka. Heptachlor has been used as an agricultural insecticide in banana and on cardamom rhizome borer and other soil pests. It was also used as a subsurface application for termite control in industrial sites. Heptachlor 3E and Heptox EC were among the formulations used in Sri Lanka containing 200-300 g of heptachlor per litre. The decision was taken to ban heptachlor based on regulatory actions reported in the UN Consolidated List of Products Whose Consumption and/or Sale Have Been Banned, Withdrawn, Severely Restricted or not Approved by Governments (United Nations, 1985) and IRPTC due to adverse effects on health and the environment. Chlordane and chlorpyrifos were identified as alternatives for termite control and granular formulation of carbofuran for the control of rhizome borers in agricultural crops.

Hexachlorobenzene

There is no history of production of hexachlorobenzene in Sri Lanka. Also, HCB has never been used as a pesticide in Sri Lanka. The only possibility of HCB being infiltrated into the country is through by-product /impurity in chlorinated pesticides such as pentachlorophenol (that was used as a wood preservative/fungicide) and some batches of chlorothalonil. However, maximum allowable impurity levels of 40 ppm of HCB in chlorothalonil containing products (US EPA, 1999) have been enforced through pesticide regulations, because of the carcinogenic risks associated with HCB impurities.

Mirex
There is no history of production of mirex in Sri Lanka and it has never been used as a pesticide in the country.

Toxaphene
There is no history of production of toxaphene in Sri Lanka. Toxaphene (as Shell Toxaphene 50% EC) has been used on a regional recommendation (Circular No. PP/T1/62 of Dry Zone Research Institute, Maha-illuppallama, 1st May, 1962), which was withdrawn within a short period of time. As such, its use in Sri Lanka is almost negligible.

In Sri Lanka with the implementation of the Control of Pesticides Act No 33 of 1980, presently there are no POPs pesticides used in the fields of Agriculture, Public health, Industry or any other field. The prohibition of use of POPs pesticides was initiated in the early 1970s and was completed in 1996 with the ban of chlordane, which was the last POPs pesticide used in Sri Lanka. Prior to completing the ban, the last remaining use of chlordane was termite control in a building construction sites.

Ban of POPs Pesticides -Sri Lanka

Name of pesticide	Year of administrative declaration of prohibition/restriction of imports	Last imports	
		Amount (kg)/year	Year
Aldrin	1986	7,040	1986
Chlordane	1996	4,600	1994
DDT	1976	316,522	1976
Dieldrin	1992	1,100	1991
Endrin	1970	NA	-
Heptachlor	1986*	NA	-
Hexachlorobenzene	Never been used as a pesticide	None	-
Mirex	Never been used as a pesticide	None	-
Toxaphene	1970+	NA	-

Source: Sumith Jayakody. Office of the Pesticide Registrar. April 2005
NA- Not Available
*Year of restriction for termite control
+ Year maximum expected in use

One of the main concerns associated presently with POPs pesticides is the possibility of exposure through contaminated sites/environmental compartment resulted from historical uses. However, there is very little information available on environmental levels, which seriously incapacitates arriving at sound and reasonable predictions on potential human and environmental adverse effects arising from POPs pesticide use in Sri Lanka.

3.2 PCB issues in Sri Lanka:

As per the information presented from a preliminary survey completed by the task team of the POPs unit, PCBs are only available in the transformer oil.

The Sectors using transformers are:

- Production, transport and distribution of electricity: Ceylon Electricity Board(CEB), and Lanka Electric Company (LECO)

- Manufacture and maintenance of transformers: Lanka Transformers Ltd (LTL)

- Industrial sector: individual industries

The import of transformer oil has been reported till 1988 by the Ceylon Petroleum Corporation. However, no further information is available on this. In 1985, around 795 tons arrived in Sri Lanka under the tariff heading 27.08:oil and other products (PCB assumed). All transformers that are not tested should be assumed as PCB-contaminated.

After 1988, the transformer oil used by the above users is PCB-free since PCB was banned in 1985.

During the repair and maintenance of transformers taken up by LTL, the same equipment is being used for all the transformers. Therefore cross-contamination of mineral oil by PCB oil is assumed.[1]

According to an unpublished data from ITI based on the analyses done in 1999 of the samples of sediments taken from Colombo harbour, it is indicated that sediments are contaminated with PCBs at a concentration of 10-29 micrograms per kilogram of $PCBs_{28}$ and 5 micrograms per kilogram of $PCBs_{101}$.

According to the Basel Convention guidelines, soil with concentrations higher than 10 ppm must be treated. Concentrations between 10-100 ppm should be disposed in an environmentally sound manner. However, concentrations under 10 ppm can be considered as non-contaminated for the purposes of transboundary movement. Levels of 2.5 ppm are used in several European Countries for indicating levels of PCBs in wastes that should be irreversibly transformed or destroyed to eliminate POPs characteristics.

In another analysis, samples taken from the Hambanthota coastal zone show negative results for PCBs. Sediment samples taken in 2000 from the Colombo harbour indicate the presence of PCBs in sediments. Samples of shrimps were analysed in 2002 and did not indicate the presence of

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[1] Source: Interim PCB Workshop Report, Training of the Task Team working on PCB containing equipment and contaminated sites to develop the PCB inventory in Sri Lanka, Colombo, 17-20 December 2003, Ministry of Environment and Natural Resources, Yves Guibert, Environmental Management Consultant.

PCBs. Another analysis done in 2003 on shark liver oil, shrimps and gherkins also has shown negative results."[2]

3.3 Dioxins and Furans

The following information is based on the inventory prepared in 2002 by the POPs Unit[3].

The main source categories of Dioxins and Furans are:

3.3.1. Waste Incineration

3.3.1.1. Municipal solid waste incineration:

No technical facilities for the incineration of municipal waste exist in Sri Lanka.

3.3.1.2. Medical waste incineration

Medical waste is produced at hospitals, clinics and other health care facilities throughout Sri Lanka. Advanced technological incinerators are not used currently for the disposal of medical waste. In general waste may be burned on site under a range of conditions such as in a pit in the open, enclosed walled areas and in rudimentary incinerators. At other facilities no disposal is carried out and waste from hospitals may be added to the municipal waste and dumped at local dump sites.

3.3.1.3. Sewage sludge incineration

There is no dedicated sewage sludge incinerator in Sri Lanka. The management of sewage and wastewater varies across Sri Lanka. In Colombo there is a sewer system, which collects domestic, commercial and industrial wastewater discharges. The sewer is discharged to the sea without any treatment.

Some industrial facilities have their own treatment plants, for example a two stage plant (aeration and settlement) treating primarily the domestic wastewater from the large workforce (5000 at one site) prior to its discharge in surface waters.

3.3.2. Power generation of heating plant

There is no collection and combustion of landfill or dumpsite gas in Sri Lanka.

3.3.3. Production of mineral product

[2] Draft, Preliminary Inventory on PCBs for Sri Lanka, National Implementation Plan (NIPS) on the Persistent Organic Pollutants (POPs), prepared by the Task Team 6 (TT6), Chandani Panditharatne, Lasith Wimalesena and R.K.W. Wijerathna.

[3] Inventory of dioxins and Furans in Sri Lanka, based on the year 2002

There is one cement clinker producing plant in Sri Lanka operated by Holcim. The annual production of the plant is 500,000 tonnes. Holcim is actively developing the use of alternative fuels to reduce the consumption of coal in the production of cement.

The plant operators report that they are required by the Holcim management to operate under the recognized environmental management system if they are to burn alternative fuels. In addition continuous monitoring facilities have been installed at the plant for emission of particulate, acid gases and volatile organic compounds. Monitoring for dioxins and furans is not done.

3.3.4. Uncontrolled burning

Bio mass burning: These include forest fires / scrub fires, uncontrolled fires as well as land cleared by the chena process, Agricultural residue burning, heaps and piles of wastes that are simply burned.

Waste burning: This largely results from the domestic and similar waste. In the principal urban areas, there appears to be a significant fraction of waste that ends up being burned by the side of road or at other collection points.

3.4 General sources

The following are the common sources for POPs:

- air emissions from electric power utilities, municipal incinerators, etc.
- water emissions
- health care institutions – use and incineration of disposable products
- human food supply – especially meat, fish, and dairy products
- application of pesticides
- combustion
- manufacturing chemicals

4. TYPES OF HUMAN EXPOSURE:

There are many ways in which humans and other life forms can get exposed to POPs. It can happen in the agricultural field, work place or through air, water and even through breast milk. Some of the common exposure paths include:

- ingestion (food, water, breast milk)
- inhalation (occupational, fumigated homes)
- skin contact
- developing foetus (exposure from mother)

Exposure could be:

- **High-dose acute exposure** examples of which could be accidents involving electrical capacitors or other PCB-containing equipment, high-dose food contamination and others.

- **Mid-level chronic exposure** as in cases of occupational exposure, living near storage sites, high consumption of PCB-contaminated foods (like fish or marine mammals) and others.
- **Chronic low-dose exposure**, which largely includes general exposure of the public to POPs. It varies according to diet, geography, and level of industrial pollution[4]

5. DAMAGES CAUSED BY POPS

POPs are known to have the potential to cause irreversible and debilitating damage on the ecosystem and species populations, including humans. The threat is made even more significant by the fact that once released into the environment, these chemicals resist degradation by natural process and persist in the ecosystems and other life forms for longer duration of time; travel long distances through atmosphere (air), water and other means to different parts of the Globe, even to remote areas thousands of kilo meters away from the source of POPs; accumulation in fat through food chain or inhalation and dermal exposure; and subjected to biomagnifications causing wider range of adverse toxic effects to human and wildlife.

For wildlife, the effects of POPs are well documented. They include birth defects, cancer, and dysfunction of immune and reproductive systems. For example, marine mammals, such as the common seal has suffered large population declines after being exposed to POPs.

Impact on humans:
This may include cancers, neuro-behavioural impairment (learning disorders, attention deficit, and reduced performance on standardized tests), immunotoxicity (immune system alterations and dysfunction), reproductive dysfunction, shortened period of lactation, diabetes, etc. (caused by disruption of the human endocrine system, especially during foetal development), etc. Women, infants, and children are especially vulnerable to POPs.

Impact on fish and wildlife:
This may range from reproductive failure/dysfunction, deformities and birth defects, population decline, eggshell thinning, metabolic changes, tumours, cancers, behavioural changes, abnormally functioning thyroids and other hormone system dysfunction, immune suppression, gender change (feminisation of males and masculinisation of females), etc.

POPs chemicals are able to influence cell development, carbohydrate and lipid metabolism, protein synthesis, reproductive system growth and function, and even ion and water concentration in the body.

This table below gives known health impacts of the POPs chemicals.

POP Chemical	Health Effects
Aldrin *insecticide* - used to	**HUMANS**: headaches, irritability, dizziness, loss of appetite, nausea, muscle twitching, convulsions, loss of consciousness, cancer, seizures, psychological illness, reproductive problems, deformities, and death

[4] Source Global Programme of Action (GPA) for the Protection of the Marine Environment from Land-Based Activities, http://pops.gpa.unep.org/02healt.htm

POP Chemical	Health Effects
control soil pests (like termites) in corn and potato crops breaks down into dieldrin when metabolised by a living being	[exposed through occupational use and application, consumption of food grown in treated soil, skin contact or inhalation (such as in houses treated for termites) and diet - especially fish, poultry, beef, and dairy products] **WILDLIFE**: liver damage (main problem), convulsions, hypersensitivity, tremors, neuronal degradation, transient hypothermia, anorexia **FISH**: adverse enzymatic and hormonal changes, impaired reproductive ability **WATERFOWL**: death (from eating Aldrin-treated rice)
Dieldrin *insecticide* – used on fruits, soil, and seeds, also used to control tsetse flies (which spread tropical disease) lethal dose for adult male = 5 grams possible link to Parkinson's disease	**HUMANS**: headaches, irritability, dizziness, loss of appetite, nausea, muscle twitching, convulsions, loss of consciousness, cancer, seizures, psychological illness, reproductive problems, deformities, and death [exposed through occupational use and application, consumption of food grown in treated soil, skin contact or inhalation (such as in houses treated for termites) and diet - especially fish, poultry, beef, and dairy products] **WILDLIFE**: liver damage (main problem), convulsions, hypersensitivity, tremors, neuronal degradation, transient hypothermia, anorexia **FISH**: adverse enzymatic and hormonal changes, impaired reproductive ability
Endrin *rodenticide* – used to control mice, voles *insecticide* – used on cotton, rice, maize	**GENERAL**: nervous system damage (muscle twitching, confusion, seizures), possible improper bone formation, enlarged kidneys and livers, foetus abnormalities, hepatic abnormalities (diffuse degeneration and cell vacuolisation), reproductive system dysfunctions, death (from eating contaminated flour, etc.)
Chlordane *insecticide* – used in fire ant control, on lawns, and on a number of crops, also to spray homes for termites	**GENERAL**: liver lesions, damage to central nervous system, thyroid abnormalities, convulsions, respiratory illnesses (bronchitis, sinusitis), migraines, cancer, tumours, neurological problems (poor balance, reaction time, cognitive function, motor speed), altered hormone functions [exposed through inhalation or consumption of meat and dairy products]
DDT → 1,1,1-trichloro-2,2-bis-(p-chlorophenyl) ethane	**GENERAL**: reproductive and developmental failure, immune system suppression, nervous system abnormalities, liver damage, tremors, decreased thyroid function, sweating, headaches, nausea, diarrhoea, convulsions, malaise, moist skin, hypersensitivity to contact, decreased

POP Chemical	Health Effects
insecticide – used in agriculture, also used to combat malaria and typhus	fertility, birth defects, neonatal deaths, cancer, paralysis [exposure through meat and dairy products] **WILD BIRDS**: widespread death after spraying area with DDT
Heptachlor *termiticide / insecticide* – used on seed grain and crops, also for fire ant control	**GENERAL**: nervous system disruption, liver damage, death from cerebrovascular diseases, hormonal problems, lethargy, convulsions, lack of coordination, stomach cramps, pain, coma, possible cause of breast tumours [exposure through inhalation in homes sprayed with Heptachlor, plus consumption of contaminated food]
Hexachlorobenzene (HCB) *pesticide* & *fungicide* - *industrial chemical* - produced as a by-product of manufacturing chlorinated chemicals, found in flue gas and fly ash of municipal incinerators	**GENERAL**: enlarged thyroid glands, scarring, liver damage, arthritis (especially in children of exposed women), acute illnesses and rashes (in infants whose mothers were exposed while pregnant, and through breast milk), reduced growth, altered white-blood cell function, cancer, neurological problems (tremors, weakness, convulsions, paralysis, lack of coordination), kidney damage, birth defects, decreased body weight, altered steroid production, spleen damage
Mirex *bait insecticide* - *fire retardant* – in plastics, paints, and electrical goods	**HUMANS**: not much is known about human effects **ANIMALS**: toxic effects on foetuses (such as cataract formation), liver damage, immune system suppression, kidney lesions, cancer, reproductive problems, birth defects **PLANTS**: reduction in germination
Toxaphene *insecticide* / *ascaricide* – used against maggots and on cotton	**GENERAL**: kidney, thyroid, and liver abnormalities, damage to lungs, immune system, and nervous system, cancer, reproductive problems [exposure through inhalation or ingestion]
Polychlorinated biphenyls (PCBs) *industrial chemicals* – used as coolants and lubricants in electrical transformers, capacitors and other equipment, also used as weather-proofers, dielectrics, and to prolong residual activity of	**GENERAL**: reproductive problems, impaired immune systems (infectious diseases, ear infections), liver disease, increased mortality, chemically induced acne, cancer, neurodevelopment problems (impaired short term memory, motor skills, spatial learning abilities, and overall intellectual function)

POP Chemical	Health Effects
pesticides *unwanted by-product -*	
Polychlorinated dibenzo-p-dioxins (PCDDs) *by-products* - of combustion and industrial processes (such as manufacture of chlorinated chemicals, incineration of hospital, municipal, and hazardous waste, and bleaching of paper products)	**GENERAL**: developmental problems (poor reflexes, muscle dysfunction), immuno-toxicity, altered hormone levels, reduced fertility, reproductive problems, endometriosis, gastrointestinal problems, thyroid abnormalities, cancer, metabolic changes, manipulation of gene codes (affecting tissue development in the human body), reduced testicular size (in men exposed to Agent Orange during the Vietnam war) [90% of human exposure is from food, especially fish, beef, and dairy products]
Polychlorinated dibenzofurans (PCDFs)	**GENERAL**: developmental problems (poor reflexes, muscle dysfunction), immuno-toxicity, altered hormone levels, reduced fertility, reproductive problems, endometriosis, gastrointestinal problems, thyroid abnormalities, cancer, metabolic changes, manipulation of gene codes (affecting tissue development in the human body), reduced testicular size (in men exposed to Agent Orange during the Vietnam war)

Source: Persistent Organic Pollutants and Human Health, a publication of the World Federation of Public Health Associations' Persistent Organic Pollutants Project, May 2000.

Human health and environmental effects of POP pesticides

There are serious concerns among the international scientific community on adverse human health and wildlife effects due to a specific group of chemicals known as "Endocrine Disruptors" (Colborn, *et al*. 1996; EDSTAC, 1998). Among the suspected EDs, there are number of compounds classified under the Stockholm Convention which have been used widely in the past in Sri Lanka and some are non-POPs pesticides that are still widely used in the country (i.e. mancozeb, malathion, carbaryl, chlorpyrifos, dimethoate) (Sumith, 2001). The indirect toxic effects of pesticides on wildlife and birds have been studied in detail through field studies in other countries. Abnormal gonadal developments and decreased phallus size in alligators in the Lake Apopka due to DDT, DDE and dicofol (Woodward, *et al*., 1993; Guillette, *et al*., 1994); Egg shell thinning in Falcon (Olsen and Olsen, 1979); and abnormal mating and nesting behaviour, skewed sex ratios and supernormal clutch in Western Gulls due to DDT and its metabolites (Fox, *et al*., 1978; Fry and Toone, 1981; Hunt and Hunt, 1977) are well documented.

Although some data are available concerning the concentration of limited number of pesticides in surface waters, river waters, etc. in Sri Lanka (BGS, 1992; Silva, *et al.*, 1991) little or no information is available concerning the biological significance. Isolated incidences of pesticide-related deaths of fish populations, snakes, etc. have been reported in surface waters following heavy application of mostly organophosphate and carbamate type of pesticides in agricultural fields without possible long-term environmental damages. Also, scattered incidences are reported to the Office of the Registrar of Pesticides on deaths of peacocks and other birds due to the consumption of rice grains treated with insecticides.

The acute pesticide poisoning effects often resulted in mortality are easily noticeable from sub-lethal effects, which require exposure to pesticides for a longer period of time. Though it is likely to be prevalent, long-term effects are either not diagnosed properly in some cases or difficult to establish the actual causative agent under the conditions prevailing in Sri Lanka. Since all POPs pesticides are banned for more than a decade, any observable effects due to POPs pesticides should have been associated with long-term sub lethal exposure from contaminated environmental compartments and food chains. Such effects are most often not studied to identify or associate with the cause though it is widely believed that cases of chronic health problems such as carcinogenicity and reproductive effects are rapidly increasing. Thus the real effects of POP pesticides are often underestimated.

Poisonings in occupationally exposed persons are usually associated with contract spray operator groups or farmers carrying out prolonged spray operations under hot humid conditions without adequate personal protection. An exposure study conducted by Bandara (1989) for pesticide applicators during application of aldrin as the model pesticide with knapsack sprayer showed that dermal exposure levels may reach up to 366.10 μg of aldrin in the absence of protective clothing. Recent poisoning data reveal >80% of poisonings caused by pesticides to be due to wilful ingestion of pesticides for self-harm (Ref. Police Data on Suicides, 1998; Annual Poisoning Reports 1990-1996, National Poison Information Centre). In 1979, out of all pesticide poisonings recorded, 73% were suicide attempts with unintentional poisonings accounted for occupational exposure and accidental exposure incidences reported to be 16% and 7%, respectively (Jeyaratnam, *et al*. 1982). Though the use of highly hazardous pesticide formulations (WHO hazard class Ib), such as monocrotophos 60% SL, methamidophos 60% SL, endosulfan 35% EC, carbosulfan 20% EC, etc., have been restricted or banned, poisoning was considered severe based on percentage of persons affected and recurrent of episodes.

By examining the cases of pesticide poisonings reported to the National Poison Information Centre in 1990 it was noticed that some organochlorines such as endosulfan, "Endrex", and "Gammaxene" had been reported to be used for suicidal attempts while dieldrin had been responsible for occupational poisonings. The same records of data for 1991 has enlisted that endosulfan and DDT were the members of organochlorines that had been used for suicidal attempts. The record of DDT as a suicidal tool as late as 1991 since almost 15 years have elapsed from the complete banning in 1976, is questionable due to the absence of verification of reported cases in the present system. A field inspection carried out by the Officers of the Office of the Registrar of Pesticides revealed that some unscrupulous vendors illegally sell malathion often by calling it DDT.

Many examples worldwide have shown that restricting the availability of toxic pesticides can reduce death rates from self-harm. WHO has suggested that death rates could be reduced by restricting the availability of poisons commonly used for self-harm (WHO, 2001). For example, a national ban on the organophosphate parathion reduced the total number of deaths reported to a poison centre in Rosario, Argentina during the 1990s. (Piola, *et al*., 2001) As shown in the table below, it is possible to speculate that while the total deaths due to pesticides from 1983 through

1990 remains more or less stable, the death caused by organochlorines gradually decreased, basically due to the restrictions and banning of some of the organochlorine candidates during that specified period.

A case study conducted at the Anuradhapura hospital showed that due to recent ban of endosulfan products (35% EC formulations of WHO hazard class Ib) in Sri Lanka (the last member of organochlorine pesticide) in 1998, the number of deaths of endosulfan poisoning fell quickly from 50 in 1998 to 3 in 2001 along with a fall in the total number of pesticide deaths (Roberts *et al*., 2003). The overall reduction on total death rates amidst the rising incidence of self-poisoning due to pesticides from 1998 through 2001 would have been due to displacement of a poisoning candidate (viz. endosulfan) which has a higher Case Fatality Rate (CFR) (42%) than that of common organophosphates (29%) concluded the beneficial impacts of pesticide regulation on deaths from poisoning in Sri Lanka (Roberts *et al*., 2003).

Total pesticide poisoning episodes during 1983-1990.

Pesticide Category	Year						
	1983	1984	1985	1986	1988	1989	1990
Organochlorines	269	319	105	170	95	88	94
Organophosphates/ Carbamates	900	931	1052	1022	1190	987	1069
Other Pesticides	352	209	282	260	239	-	-
Total	**1521**	**1459**	**1439**	**1452**	**1524**		

Source: Ministry of Health Statistics Division Personal Communication, Prof. Ravindra Fernando, University of Colombo, Department of Forensic Medicine, Colombo

It appears that the scientific investigation in the 1970s and 1980s linking DDT and other persistent organochlorines to impaired health in wildlife and humans in USA and other developed countries influenced environmental scientists in the world to determine their own environmental levels for those suspected chemicals. DDT has been determined in human tissues and breast milk in many parts of the world. In Sri Lanka, the mean level of DDT in breast milk collected during 1979-1981 from 185 samples was 0.087 ppm, which is relatively lower than those reported elsewhere in the world (Shanthakumar, *et al*. 1981-unpublished data).

6 LEVELS OF POPS

6.1 Pesticides

Although POPs pesticides have been banned since 1996, the residues of POPs pesticides continue to be detected in soil and water in the dry zone in quite high levels. As mentioned under 3.1, POPs residues are found in high concentrations around Colombo harbour. They are also present in high concentrations in rabbit fish in the Colombo harbour area.

Stocks of outdated pesticides

Though there had been no import of POP pesticides to Sri Lanka in the recent past, a certain amount of outdated pesticides from the earlier imports are stockpiled at different places due to their withdrawal from use. However, large cumulative quantities of other outdated pesticides are available in stocks, which have become a national problem for disposal. A complete list of outdated pesticide stocks, with specific locations, available in Sri Lanka is given in Annexure 1. Except 18 litres of aldrin and 10 kg of DDT, the rest of the stock is predominantly of non-organochlorine in origin.

Contaminated sites and environmental compartments

Contaminated sites are identified as having a history of heavy previous use or locations where pesticides are transported into and deposited from those sites. Though a somewhat complete picture on available stockpiles can be drawn (See Annexure 1), the situation on contaminated sites with regard to POPs pesticides is obscure. DDT and subsequently BHC had been used for malaria vector control programs as a household residual insecticide; door-to-door application in malaria-infested areas in the Dry Zone (Herath, 1984) and in the Wet Zone including some areas of the Colombo district (Dr. R.R.M.L.R. Siyambalagoda, Director, Anti Malaria Campaign-personal communication). Agricultural uses were basically on coconut plantations, tea plantations, horticultural projects and tobacco nurseries. However, area specific potential contamination (non-point pollution sources) could be predicted for aldrin, chlordane, DDT, dieldrin and heptachlor for which there were specific agricultural uses in plantations, horticultural nurseries, non-food crops (e.g. tobacco) and in non-agricultural termite control uses.

Although DDT was totally banned as early as 1976, its precursors and derivatives could be present in the environment for a long period of time and thus could contaminate agricultural produces. In tea, DDT isomers could have been originated from heavy use of dicofol in the past, which could be contaminated with DDT isomers depending on the production process adopted in manufacturing dicofol. Due to this reason, the use of dicofol in tea commenced in 1965 was prohibited in 1994. The total consumption of 42% dicofol (Kelthane) emulsifiable concentrate formulation was 2,084 litres from 1988-1992. A large number of estates in Uva, upcountry and mid country experienced heavy mite infestations during dry weather periods necessitating repeated use of miticides (Vitharana, 2003). Therefore, the detection of these pesticides in the environment may be due to agricultural run-off and excessive use or misuse in the past.

There is no planned monitoring system or infrastructure facility available with the pesticide registration authority to trigger remedial actions to mitigate the problems. So far no proper monitoring studies have been carried out on pesticides. Further, there is no surveillance system in place in the health sector to monitor the trends of health effects with respect to exposure to pesticides from environmental contamination. The data available in environmental concentrations are primarily produced for academic interests or data generated for export of agricultural commodities as a requirement from importing countries (residue levels) rather than for environmental or long-term monitoring purposes. This leads to rather discrete data coverage (spatial and temporal), which makes it difficult to evaluate significant trends of contamination by POP pesticides in the country.

Limited data available from a study conducted in 1999-2000 (Industrial Technology Institute) revealed the presence of some DDT residues in the form of p,p'-DDE at 2-5 µg/kg in bottom sediments in Hambantota coastal zone and up to 9.6 µg/kg of DDTs in sediments of Colombo port, though DDT was not in use in Sri Lanka for more than 30 years. The presence of DDT in the form of p,p'-DDE in almost all samples (6) in Hambantota coastal zone and though it is as high as 40-100 µg/kg in Beira Lake in Colombo (ITI, 2004), suggests the general absence of recent DDT sources in those areas. A similar trend has been observed by Guruge and Tanabe (2001) that >70% of total DDTs in sediments sampled from Negombo Lagoon, Chilaw Lagoon, Udappuwa and Mundal Lake were in the form of p,p'-DDE where they have concluded as insignificant local usage in recent times. However, the question on recent DDT sources remains active by the detection of DDT in the Colombo Port as reported elsewhere (ITI, 2000) in the form of p,p'-DDT and DDD in one out of 18 samples. More strikingly, the reason for the high p,p'-DDT concentration in rabbit fish (p,p'-DDT:ΣDDT was 74:120) from the Colombo Dockyard was also unknown (Guruge and Tanabe, 2001). More data is needed to make a reasonable scientific judgment whether it was due to inland sources or due to other transport mechanisms of POP substances.

Very little information is available on the concentration of chlordane in environmental compartments despite the fact that chlordane has been used in Sri Lanka until recently compared to other POPs pesticides which have been banned long ago. Studies conducted by Guruge and Tanabe (2001) confirmed possible recent usage of chlordane in Sri Lanka by observing a similar trend in the ratio of trans-chlordane in biological samples and sediments to that of technical chlordane. Also, the total chlordane concentration in the Kelani River was found to be higher than those concentrations reported from most developing Asian countries, reasoning for possible recent usage of chlordane in the up-stream areas of Kelani River (Guruge and Tanabe, 2001). There are few citations on the presence of several POP pesticides in vegetables, processed products and export products, particularly DDT, dieldrin and heptachlor. Available recent data is so limited about their environmental concentrations. The probable reason may be that most of these pesticides are either not formulated or not used in Sri Lanka and even if used they were not used in large quantities or banned a long time ago thereby diluting their levels in the environment quite considerably with time.

Since, some of the organochlorine concentrations are still found in some environmental compartments, coupled with the lack of knowledge on the true picture of toxicological impact of POPs pesticides in the environment and human health point of view, the situation would have to be seriously dealt with to achieve environment and human health protection goals. In this context, further research, monitoring and environment protection procedures are critically needed in Sri Lanka.

6.2 PCBs

The Ceylon Electricity Board (CEB), Lanka Electric Company (LECO) and Lanka Transformers Ltd (LTL) are the main agencies that directly deal with transformers and capacitors that could be contaminated with PCBs. There are 14,418 transformers owned by the CEB and 2,700 owned by the LECO. In addition there are around 74 transformers owned by independent power producers.

Out of these 681 have been investigated and 176 have been analysed using field test kits. Later they have been confirmed through GC.

According to the reports on the field test kits results 60% were found positive. However GC results confirmed only 80% of this amount; viz 48% of the total tested population was positive.

According to the reports from the statistics of Sri Lanka Customs, it is revealed that the subheadings under which PCB-contaminated waste oil could come in to the country are HS Codes 2903.59 and 2903.69. However the import of waste oil containing PCBs, PCT and PBB are under HS Code 2710.91 and such waste oils are under import control. Transformers oils are imported to Sri Lanka under HS Code 2710.19.03 and there is no requirement for a 'Free PCB' oil certificate. There is no separate subheading for PCB capacitors. No capacitors have been found in storage yards.

Information about informal recycling was obtained to identify issues on recycling of transformer oil and metal parts. The possibility of informal recyclers being contaminated with PCBs is quite high since there is no testing carried out for the disposed transformer oil.

The storage of transformers is also not in an environmentally sound manner and there is a high probability of contamination of soil, water and air with PCB.

The decommissioned transformers have shown a contamination rate as high as 51.2%. It could be estimated that there are 1,098 transformers in Sri Lanka contaminated with PCBs at level higher than 50 ppm.

The Country will need to have facilities to manage 2,292 tones of PCB-contaminated oil, when they are ready to be disposed. Transformers manufactured from 1971-1980 contained most of the contaminated transformers.

The following table gives information on the amount of transformer oil imported into the country that is believed to contain PCBs.

Imports with a probability of being PCB-containing transformer oil: [5]

Harmonized System (HS) Codes *from Customs Tariff Guide*	**1996**	**1997**	**1998**	**1999**	**2000**
2903.49.09 Halogenated derivatives	---	Japan, Singapore 141 kg	Belgium, Germany 104,410 kg	---	Singapore, UK 1090 kg
2903.59 Halogenated aromatics	Canada, India 1700 kg	---	---	---	---

[5] Preliminary Inventory on PCBs for Sri Lanka, prepared by the Task Team 6 (TT6) - Chandani Panditharatne, Lasith Wimalasena, and R.K.W. Wijerathna, June 2004, pages 29-31.

2903.69 Other	India, South Korea 1743 kg	---	---	Germany, India, UK, Singapore 13,308 kg	---

It is important to note that the import of waste oil containing PCBs, PCT and PBB characterized by HS Code 2710.91 are under the Import Control License. However, there is no requirement for the importer to supply a PCB-free certificate in the case of other waste oils.

Transformer oil is imported into Sri Lanka specifically by the LTL. They import transformer oil from UK, Singapore, Malaysia and USA, and these imports are regulated under the HS Code 2710.19.03. The annual consumption of transformer oil at LTL is approximately 100,000 litres. However, neither the Department of Customs not the LTL require a PCB-free certificate from the supplier/exporter to certify that the oil is free of PCBs."[6]

HS Code	2002 Imports
2710.19.09 Petroleum oils that are not categorized elsewhere	30,185,166 kg
2710.99 Waste oil that does not contain PCBs, PCT or PBB	16,763,523 kg
2710.91 Waste oil that contains PCBs, PCT or PBB	None

In case of import of transformers, following are the figures for the year 2002. These do not indicate whether the transformers are used ones or new ones. Also there is no requirement to indicate whether they are free of PCBs or not.

Information on import of different categories of transformers:

HS Code	Item	Total Nos.
850421	T – not exceeding 650 kVA	53
85042201	T – not exceeding 2000 kVA	8
85042209	T – other	53
850423	T – exceeding 10,000 kVA	7
853210	Fixed capacitors not less than 0.4 kvar	69
853221	Tantalum	4
853223	Ceramic dielectric single layer	1
853224	Ceramic dielectric multilayer	5
853225	Dielectric of paper or plastic	10
853229	Other	243
853230	Variable capacitors	67
Grand Total		**520**

[6] Source: Preliminary Inventory on PCBs for Sri Lanka, prepared by the Task Team 6 (TT6) - Chandani Panditharatne, Lasith Wimalasena, and R.K.W. Wijerathna, June 2004, pages 29-31.

PCBs[7] - Obsolete Stocks, Contaminated Sites, and Stockpiles

Spills of stored oils can cause contamination of ground and surface waters, soil and air. One of the ways of contamination of the environment with PCBs is through recyclers, scrapping yards or repair yards. The recyclers use a considerable quantity of used transformer oil in their daily operations. They use sawdust to absorb any oil that is spilled during draining of transformers and the sawdust soaked with transformer oil is handed over to the local authority for disposal. Therefore, there is a possibility of dumping and burning of sawdust used for cleaning spilled oil, which might contain PCBs.

Old storage yards indicate that some of the transformers are contaminated with PCBs. Furthermore, these transformers were not stored in a proper manner, leading to leakage of transformer oil into the ground.

Transformer repair yards, storage yards and retro filling sites are some of the other places that have a high probability for being contaminated with PCBs. At the moment, these places do not follow any labelling procedure, nor do they use safety precautions to prevent contamination with PCBs.

Samples analysed by the ITI in August 2003 indicated the presence of several congeners of PCBs in places where transformers were repaired and refilled.

According to an unpublished data from Industrial Technology Institute (ITI), an analysis has been done in 1999 on sediment samples taken from Colombo harbour, and results revealed that the sediments were contaminated with PCBs at a concentration of 19 and 29 micrograms/kg of PCB_{28} and 5 micrograms/kg of PCB_{101}. According to the Basel Convention guidelines, soil with concentrations higher than 10 ppm must be treated. Concentrations between 10-100 ppm should be disposed in an environmentally sound manner. However, concentrations less than 10 ppm can be considered as non-contaminated for purposes of transboundary transport. Levels of 2.5 ppm are used in several European Countries for indicating levels of PCBs in wastes that should be irreversibly transformed or destroyed to eliminate POPs characteristics.

PCBs are quite stable in the environment, and therefore, as the harbour sediment is contaminated even at lower concentrations, the contaminant should be identified to prevent further contamination. It should also be remembered that there is a risk of bio-concentration as well as bio-accumulation, due to the inherent properties of PCBs.

In 1988, oil was removed from two transformers at Kelanitissa Power Station, destined to be burned at Puttalam cement kiln. However, the disposal did not proceed as planned and the contaminated oil remains stored up till date. There are approximately 1,500 litres of Pyralene (which is a brand of PCB oil manufactured in France) stored at the premises of the Industrial Technology Institute (ITI). Approximately 3,500 litres of PCB-contaminated oil are also

[7] Preliminary Inventory on PCBs for Sri Lanka, prepared by the Task Team 6 (TT6) - Chandani Panditharatne, Lasith Wimalasena, and R.K.W. Wijerathna, June 2004, pages 34-36.

stored in the same place, which are the residues of washings. The concentration of PCBs in these stockpiles is unknown.

The numbers and descriptions of barrels are as follows:

i. 12 Nos. of stainless drums of approx. 20 gal of contaminated oil. 80 kgs
ii. 2 Nos. drums of approx. 45 gal of contaminated oil. 360 kgs
iii. 18 Nos. of 45 gal drums containing diesel contaminated with PCB (diesel was put into the transformers after they were emptied to flush out residues). 360 kgs"

Unintentional releases of PCBs to the environment[8]

The persistent, toxic and bioaccumulation capacity makes PCB-contaminated waste a difficult type of waste to manage. They can be transported long distance and have been detected in remotest areas of the globe, far away from where they were manufactured and used. While manufacturing has ceased, the potential or actual release of PCBs to the environment has not ceased.

PCBs can be released and undergo chemical transformations if a transformer or a capacitor is exposed to fire, and under such low temperatures, highly toxic substances like dioxins and furans can be released. Leakage is another method from which PCBs can be released to the environment from sealed appliances. Equipments containing lower congeners of PCBs are more risky since such compounds are more volatile.

According to a report titled 'Pre-feasibility Study on Hazardous Waste Management and Disposal for Sri Lanka,' by the ERM in 1996, it has been estimated that Sri Lanka generates 6.25 tons of waste containing PCBs, PCT and PBB annually. There is a possibility that this amount could be released to the environment.

As indicated above, recyclers and repair yards contaminate the environment with PCBs due to lack of proper disposal mechanisms. PCB-containing equipment and oil should be identified before they reach the recyclers."

Presence of PCB levels in human, food items and environment[9]

Industrial Technology Institute (ITI), which is the only accredited laboratory for analysis of POPs in Sri Lanka have facilities to use GC, GCMS, and HPLC for analysis of PCBs. They have the capacity to analyse seven congeners of PCBs viz., PCB 28, 52, 110, 118, 138, 153 and 180.

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[8] Preliminary Inventory on PCBs for Sri Lanka, prepared by the Task Team 6 (TT6) - Chandani Panditharatne, Lasith Wimalasena, and R.K.W. Wijerathna, June 2004, pages 37-38.
[9] Preliminary Inventory on PCBs for Sri Lanka, prepared by the Task Team 6 (TT6) - Chandani Panditharatne, Lasith Wimalasena, and R.K.W. Wijerathna, June 2004, pages 38.

According to an unpublished data of ITI, from analyses done in 1999 on samples of sediments taken from Colombo harbour, it is indicated that sediments are contaminated with PCBs at the concentration of 10 and 29 micrograms/kg or PCB_{28} and 5 micrograms/kg of PCB_{101}. According to Basel Convention guidelines, soil with concentrations higher than 10 ppm should be disposed in an environmentally sound manner. However, concentrations less than 10 ppm can be considered as non-contaminated for purposes of transboundary transport. Levels of 2.5 ppm are used in several European Countries for indicating levels of PCBs in wastes that should be irreversibly transformed or destroyed to eliminate POPs characteristics.
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In another analysis, samples taken from Hambantota Coastal zone show negative results for PCBs. Sediment samples taken in 2000 from the Colombo harbour indicate the presence of PCBs in sediments. A sample of shrimps analysed in 2002 did not indicate the presence of PCB. Another analysis done in 2003 on shark liver oil, shrimps and gherkins also has shown negative results.

Disposal of PCB Waste

PCB waste is treated and disposed of in the following ways:[10]

- Incineration - in controlled units at a sustained temperature of 1100ºC, used for liquid waste from manufacturing process, transformers and large capacitors, solid waste from manufacturing process, and miscellaneous solid waste, such as waste from manufacture of small capacitors, contaminated rags, sawdust, fuller's earth, etc.
- Heat treatment – some PCBs are destroyed during scrap melting at very high temperatures, but some escape into the atmosphere
- Landfills – includes small capacitor scraps from use in starter circuits, fractional horsepower electric motor application, domestic refuse, contaminated rags, paper, sawdust
- Recovery – by clarification and vacuum distillation process, from large transformer applications and large capacitors, excess fluid is drained off for recovery and incineration
- Others – such as storage in isolation, etc.

It is recommended that PCB waste be handled and disposed of by[11]:

- Labelling – products and wastes should be clearly labelled about the need for adequate disposal
- Storage and containment – must be adequately sealed, labelled, and stored in heavy-duty containers, not in standard drums
- Handling – transfer of liquid PCBs must be conducted appropriately, and strict precautions should be taken to ensure that no PCBs enter the sewage system or watercourse from old dump yards or storage places

However none of these are being practiced in Sri Lanka.

[10] PARIVESH – Polychlorinated Biphenyls (PCBs), Central Pollution Control Board of Ministry of Environment and Forests, December 2001, pages 23-24.
[11] PARIVESH – Polychlorinated Biphenyls (PCBs), Central Pollution Control Board of Ministry of Environment and Forests, December 2001, pages 23-24.

7 LAWS CURRENTLY REGULATING POPS

Sri Lanka has the following legal provision regulating POPs. Some of them are general environmental provisions and are not directly related to POPs.

7.1. Constitutional provisions

Chapter VI on Directive Principles of State Policy and Fundamental Duties:

- Article 27(14) "The State shall protect, preserve and improve the environment for the benefit of the community"
- Article 28(f) "To protect nature and conserve its riches"

7.2. National Environmental Act

Under Part IV B- Environmental Quality of the No. 47 of 1980 (Amended by Act No.56 of 1988 and Act No. 53 of 2000)

- 23 H. Pollution of inland waters of Sri Lanka
- 23 M. Restriction, regulation and control of pollution of the soil

7.3. Control of Pesticide Act

Prior to 1962, pesticides were more or less freely imported into the country. With the changing import policies in the late 1970s, pesticides were imported on open general licences even including prohibited products such as DDT and endrin by unscrupulous traders. With the gradual involvement by the Department of Agriculture, recognizing the need to exercise control over the use of pesticides since the early 1960s, an effective regulatory mechanism was brought into action in 1983 through the Control of Pesticides Act No. 33 of 1980.

The Registrar of Pesticides is the national authority for implementing the laws and regulations under the Control of Pesticides Act No. 33 of 1980 and hence conformation to international conventions in relation to pesticides such as POPs, PIC, etc. which would be carried out as a routine measure. With the strengthening of infrastructure, Sri Lanka would be able to effectively implement POPs negotiations as well as present candidate POPs pesticides.

The post registration activities are an inherent part of Sections 20-22 of the Control of Pesticides Act, which enables the regulatory process to safeguard food quality, human health and the environment against pesticides. These activities would enable a full evaluation of risks associated with the use of pesticides in the field and to take necessary regulatory action.

Legal provisions are provided by the Act for licensing of traders, appointment of authorized officers, specifying the functions and powers to seize pesticides in outlets conducting activities contrary to the legal provisions and regulations. All traders engaged in the storing, selling or offering for sale any pesticides are required to obtain a certification for sale from an Authorized Officer. As a mandatory requirement for the issuance of a licence, applicants for dealership are required to undergo one-day training on the principles of pesticides safety, identification of pesticides and awareness on the registration system conducted by the officers of the Office of the Registrar of Pesticides. Awareness and legal binding thus created would expect to minimize unscrupulous trade practices and thereby adverse impacts due to pesticides.

7.4. National Policy

Sri Lanka has a national policy implemented in 1995 that no pesticide formulation of WHO hazard class Ia/Ib are marketed for regular pest control purposes in agriculture. Accordingly, some of the formulations of insecticides such as endosulfan, chlorpyrifos, carbosulfan, and quinalphos (Annex IV), which are falling into the WHO hazard class Ib, have been banned. All pesticides should be subjected to a comprehensive bio-efficacy testing procedure prior to submission of application for registration. The registration package should consist of original reports on all related chemical, physical, biological, toxicological and environmental data. For commodity products the reports are required from accredited laboratories with GLP compliance. No "me too" registrations are allowed thus registered products are constantly subjected to latest international developments either at the time of re-registration after every three years or as and when necessary.

8. NGOS AND POPS

8.1. Narrative on general awareness on POPs

Though POPs is a subject matter under science curricula in the schools, it is not widely known in the civil society and there is no concern about its impacts. The population engaged in the agricultural or the industrial sector especially lacks awareness of POPs and their impacts.

8.2 Narrative on NGO capacity on POPs

Although the majority of environmental organisations are aware of the issue only a few NGOs really have the knowledge. Among many other reasons, it is not a popular subject matter for many environmental NGOs to raise funds. Farmer organisations, trade unions or the development NGOs simply do not touch this subject as it is taken as a technical subject requiring sound scientific background. Only a few NGOs in Sri Lanka may have the expertise to educate the civil society and engage in the debate and scientific forums on this subject. Further, there is no adequate information in Singhalese or Tamil languages to educate the people. This also is a major bottleneck.

8.3 Current level of NGO communication and coordination on POPs

Prior to the engagement with the International POPs Elimination Network (IPEN) on IPEP in 2004, NGOs have been working with Pesticide Action Network, GAIA, Greenpeace, Health Care without Harm and others for over a decade. They had organised some events and workshops on the issue of POPs. Besides these isolated cases of engagement on the issue there was no organised networking at the national level.

8.4 POPs information produced and disseminated by NGOs before IPEP

Other than very basic information on POPs and that too in a limited way, no information was produced and disseminated by the NGOs prior to IPEP.

8.5 NGOs involvement in the NIP process

There has been no NGO participation in the NIP preparation in Sri Lanka. The civil society inputs to the NIP preparation process are lacking. No consultations were held with the civil society group on the issue. Most of the Task teams are only comprised of the Government officers. Some technical experts, other than the government, also participated in the task teams.

8.6 NGOs currently active on POPs

There are over 300 environmental NGOs registered under the Central Environmental Authority. There is no exact information available on the total number of NGOs in the country. As per some estimates it could be as many as 40,000 NGOs active in all sectors.

In comparison, the number of NGOs actively engaged with the issue of POPS is only four namely Centre for Environmental Justice, Green movement, Sri Lanka environment Exploration Society and Sewa Lanka Foundation. Around 10 more NGOs have shown interest in working on POPs issues following the awareness and capacity building initiatives under IPEP.

9. EFFORTS TO DEAL WITH POPS

At the Government level, the Pesticide Registrar and the Ministry of Environment currently deals with the issue of POPs. Since the ban imposed on the POPs pesticide, the Pesticide Registrar claims that no legal import of POPs pesticides is taking place. They also refute charges of any illegal import.

The POPs Unit of the Ministry of Environment and Natural Resources is responsible for monitoring the POPs situation in the country. It coordinates with other agencies to make plans for the POPs elimination in the country. No effort has been made to raise awareness on the issue in the country.

There are no corporate sector plans to deal with the issue.

The NGO efforts have been largely an outcome of IPEP. A lot though is desired to be done.

10. STATE OF STOCKHOLM CONVENTION RATIFICATION AND THE NATIONAL IMPLEMENTATION PLAN

The Country ratified the Stockholm Convention on 22 December 2005.

The government of Sri Lanka has taken steps under the Convention. Article 7 of the Convention requires Parties to prepare and transmit a National Implementation Plan (NIP) within two years from its entry into force that set priorities for initiating future activities.

Sri Lanka received GEF capacity building support for enabling activities to strengthen its ability to implement a systematic and participatory process for the preparation of the NIP. Being the focal point of the Convention, the Ministry of Environment and Natural Resources is now operating a POPs Unit. The process of developing the NIP has been divided into five phases.

These are:
Step 1: Determination of coordinating mechanism and organization of process
Step 2: Establishment of POPs inventory and assessment of national infrastructure and capacity
Step 3: Assessment of priorities and determination of objectives
Step 4: Formulation of a National Implementation Plan (NIP)
Step 5: Endorsement of NIP by stakeholders

The POPs Unit has established seven task teams in 2003 to address the principle tasks. These teams are working on POPs management, POPs monitoring, Socio-economic aspects of POPs, POPs information system and awareness-raising, POPs pesticides and Industrial chemicals, PCBs-containing equipment, Unintended POPs production and Task team on stockpiles, wastes and contaminated sites.

The scope of work for each team includes review of the Stockholm Convention provisions relevant to their scope of work; Elaborate detailed work plans, time tables and budgets to be approved by the technical advisory committee; Identify capacity building needs; identify the baseline information; assessment of gaps; set priorities; and elaborate strategies/action plans etc.

According to the project plan a Technical Advisory Panel (5 resource people) will assist the National Project Coordinator and National Coordinating Committee (NCC) will facilitate coordination between shareholder organizations.

The project is likely to commence at the end of 2005.

11. PUBLIC AWARENESS ACTIVITIES

The awareness activities so far have been taken up at the initiatives of the civil society groups. On the occasion of the Earth Day on 22 April 2005, the Centre for Environmental Justice, Green Movement of Sri Lanka, Sri Lanka Environmental Explorers Society with the technical and financial support form the POPs Unit of the Ministry of Environmental and Natural Resources and Pesticide Registrar office, organised an awareness week to highlight the POPs issues among the masses. These included an hour long radio programme at the Sri Lanka Broadcasting

Corporation (SLBC) and a workshop on POPs at the Sri Lanka Association for the Advancement of Science. There have been awareness workshops with different sections, including the civil society groups.

CEJ has published an information kit on POPs in the local language and distributed it widely. This includes a POPs handbook, a poster, a key tag, and stickers.

The POPs Unit of the Ministry also organised awareness programmes for the journalist and others. The POPs Unit claims that they had series of awareness and training workshops and seminars for the relevant agencies and other stakeholder groups. Unit has also prepared several reading materials on POPs. They have also produced two newsletters.

However the efforts are not enough and a lot desires to be done. The civil society largely faces financial constraints in taking up awareness activities on a larger scale.

12. KEY ISSUES

Some of the key issues identified are;

1. There is a possibility of POP pesticides being classified under different HS Codes other than 38.08 designated for pesticides and brought under license.

2. Lack of information on environmental levels of POP in various environmental compartments and sites where they were used in the past.

3. Lack of facilities to monitor the import of POPs including possible false declarations by the importer.

4. Absence of facilities for safe disposal of outdated stocks of POPs.

5. Lack of effective information dissemination system leading to poor awareness on present status on POP among all the sectors including scientific community.

6. Absence of a proper system to monitor serious human health and environmental adverse effects of POPs under the local conditions and use practices; which would also hinder identification of potential candidate POPs.

13. RECOMMENDATIONS

General Recommendations:

- The available data and information, with the gaps filled will help to draw up an effective management plan for POPs.

- As a social and environmental security measure, regardless of whether and how POPs affects human and wildlife (where a highly organized scientific investigation is required for assessing the risks of POPs in the areas of human health and environmental effects), an important way to protect human health and the environment against anticipated toxic effects is to test environmental concentrations and to relate them with epidemiological significance for their relevance with health and environmental effects. Therefore, monitoring and surveillance of these chemicals in environmental compartments is a necessary step for the protection of health of human beings, wildlife and the environment.

- It is expected to urgently arrest any illegal importation of POPs. Awareness-raising among importers, Ports authority, Customs, Import Controller on accurate documentation, regulation and monitoring is further envisaged.

- It is vital to strengthen the analytical capabilities of the regulatory authorities so that routine testing of quality standards are carried out for commodity products to ensure the safety.

- Public awareness campaigns and programs, information dissemination through printed and electronic media should be exploited as much as possible in order to achieve the necessary levels of awareness on POPs among the public. Varied levels of awareness among stakeholders would create confusion in the minds of the public which disrupt the way in which they can get to know the exact situation on pesticides, especially POPs.

- Involvement of all stakeholders in the National Implementation Planning process including NGOs and civil society organisations.

- Implementation of the National Waste Management Strategy drafted in 1996.

- Promotion of Best Available Techniques and Best Environmental Practices to reduce POPs emissions.

Legislature:

- Banning of all POP pesticides, of which the uses are already cancelled through a Gazette Notification under the provisions of the Control of Pesticides Act No. 33 of 1980.

- All POPs pesticides imported as pure chemicals for research and academic purposes should be subject to licensing: Joint responsibility should be held by Registrar of Pesticides & Department of Customs;

- Revision of existing HS codes to ensure accurate identification of chemical consignments with respect to POP.

- Necessary legal structure to be formulated to reship all unidentified and/or unclaimed chemical consignments held at entry points by the consignee or in case of absence of the consignee, by the shipping agent.

Administrative measures:

- Disposal of existing stocks of POPs.

- Development of infrastructure at concerned departments for compliance monitoring programs with respect to contamination/adulteration of chemical products with POPs.

- Surveillance on environment compartments (air, sediments, water, soil, and biological) and food products for presence of POP and candidate POPs.

- Establishment of MRLs for Sri Lanka and devising methods to minimize the residue levels in agricultural commodities.

- Surveillance on adverse effects of POPs on the environment and human health under the local conditions by;

    - Establishment of a proper surveillance and reporting system (social and scientific) within the health sector on chronic health effects from exposure to POPs.
    - Establishment of complimentary analytical programs to study the fate of such chemicals in the environmental compartments for the establishment of correlations between presence and their health effects.

- Development of a coordinating system by establishing a network among the health, agriculture, industry and environmental sector research groups through a designated focal point for coordination, information collection and sharing and policy decisions for prevention of POPs related adverse effects.

Awareness-Raising:

- Awareness on relevant responsibilities and issues for all stakeholders.

- Public awareness campaigns and programs through printed and electronic media in order to achieve the necessary levels of awareness on POP pesticides/candidate POP pesticides.

13. ALTERNATIVES TO POPS

Integrated Pest Management (IPM)

To circumvent the problems caused by pests and use of pesticides for their control, the strategic approach to pest control, known as Integrated Pest Management (IPM) is practiced in Sri Lanka.

IPM involves a careful integration of a number of available pest control techniques that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and safe for human health and the environment. Not only does it involve minimizing the use of pesticides, it also involves a wide range of other practices aimed at growing a healthy crop.

FAO's experience has shown that

- IPM increases the sustainability of farming systems.
- It improves social stability because it is institutionalised at the level of the farming community and local government.
- IPM programmes are economically sustainable as they reduce farmers' dependence on procured inputs.
- IPM addresses far more than purely pest management. It offers an entry point to improve the farming system as a whole. -e.g. healthier crops through better use of fertilizers.
- The farmers' field school concept can be used to address other farming situations and extension problems.

The government of Sri Lanka has a long-standing commitment to IPM. In the policy statement of the President of Sri Lanka it was declared that "the dependency on chemical fertilizers and agro-chemicals will be progressively reduced through soil fertility improvement measures, adoption of integrated pest management and other agronomic practices".

Sri Lanka has a very successful IPM program in rice spread all over the country, initially sponsored by FAO from 1984-2001. The success was made possible by right policy decisions of the governments with regard to pest management coupled with the availability of relevant technologies and institutional arrangements which has facilitated the efforts of control on pesticide use (Administration Report, Department of Agriculture, 2002, 2002)

Integrated Vector Management (IVM)

IVM uses the same concepts as IPM of combining methods/products and strategies with an optimal mix adapted to the local situation, however introduction of IVM is at a very early stage compared to IPM activities

14. RESOURCES ON POPS

- Intergovernmental Forum on Chemical Safety (**IFCS**) - http://www.who.int/ifcs/index.htm (not formally accepted by the UN or other international organizations)
- Inter-Organization Programme for the Sound Management of Chemicals (**IOMC**) - http://www.who.int/iomc/en/ (members include UNEP, WHO, ILO, OECD, UNIDO, and FAO)
- United Nations Development Programme (**UNDP**) - http://www.undp.org/
- United Nations Industrial Development Organization (**UNIDO**) - http://www.unido.org/
- United Nations Environmental Programme (**UNEP**) - http://www.unep.org/

- **Stockholm Convention** - http://www.pops.int/
  (full text - http://www.pops.int/documents/convtext/convtext_en.pdf)
- **Visit www**.ejustice.lk for more reports.
- **IPEN**: http://www.ipen.org
- **IPEP**: http://www.oztoxics.org/ipepweb/
- **IPEP South Asia:** http://ipep.toxicslink.org
- **Toxics Link:** http://www.toxicslink.org

CREDITS:

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Annexure 1: Inventory of outdated pesticide stocks in Sri Lanka (sites, containers, quantities, formulations, etc.)

No	Site/Store Affected	Common Name	Commercial Name	Toxicity Group (WHO)	Type of Container	Condition of Container	Number of Containers	Quantity (kg)	Quantity (l)	Year Manufactured Batch Lot No	Country Manufacturer, Donor, Source
1	Kolonnawa	quinalphos	Quinalphos	II	glass bottles	good	-	-	1,812	1990	India
2	Kolonnawa	parathion	Parathion	II	glass bottles	good	-	-	4.5	1980	USA
3	*Kolonnawa*	*dicofol*	*Kelthane*	*II*	*bottles*	*good*	-	-	*196*	*1980*	*USA/India*
4	Kolonnawa	methamidophos	Methamidophos	Ib	glass bottles	good	-	-	11	1990	Singapore
5	Colombo	carbosulfan	Marshal	II	glass bottles	good	-	0	11	1980	USA
6	Colombo	carbosulfan	Marshal	II	bottles	good	87		15	1994	Unknown
7	Colombo	carbosulfan	Marshal	II		good	3,003	300		1992	Unknown
8	Kolonnawa	monocrotophos	Monocrotophos	Ib	glass bottles	good	-	-	12	1990	Singapore
9	Kolonnawa	dimethoate	Dimethoate	II	glass bottles	good	-	-	107	1990	Singapore
10	Colombo	dimethoate	Dimethoate	II		good	89	0	615	1998	Unknown
11	Kolonnawa	fenthion	Fenthion	II	glass bottles	good	-	-	8	1995	Germany
12	Kolonnawa	carbofuran	Carbofuran	II	drums	good	200	-	40,000	1978	Korea
13	Kolonnawa	propachlor	Propachlor	?	paper packs	good	-	234	-	1980	USA
14	Colombo	carbofuran	Carbofuran	I		good	-	45,000	-	1985	Unknown
15	Kolonnawa	folpet	Folpet	II	paper packs	good	-	186	-	1980	USA
16	Colombo	maneb	Harcozeb	IV		good	-	1,395	-	1980	Unknown
17	Colombo	sulphur	Sulphur	IV	paper packs	good	-	9,011	-	1990	Italy
18	Colombo	sulphur	Sulphur	IV	paper packs	good	-	6,109	-	1980	Holland
19	Colombo	sulphur	Sulphur	IV	paper packs	good	1,392	4,888	-	1995	Unknown
20	Colombo	coc	Cobox	III	paper packs	good	-	25	-	1990	Holland/USA
21	Colombo	propanil	Stam-F	III	glass bottles	good	-	-	80	1980	Italy/Germany
22	Colombo	propanil	Stam-F	III	drum	good	2	-	280	1980	Unknown
23	Colombo	MCPA	Agroxone	III		good	-	-	3,040	1980	England
24	Colombo	MCPA	Agroxone	III	bottles	good	71	-	22	1995	Unknown
25	Colombo	MCPA	Agroxone	III	drum	good	1	-	200	Unknown	Unknown
26	Colombo	alachlor	Lasso	III	drum	good	1	-	44	1980	Thailand
27	Colombo	alachlor	Lasso	III	glass bottles	good	-	-	30	1996	USA
28	Colombo	methiram	Unknown	II	glass bottles	good	-	-	817	1995	Unknown
29	Ekala	etofenprox	Trebon	IV	bottles	good	5	-	2	1996	Japan

30 Ekala	benomyl	Benor	III	paper packs	good		1	0.1	-	Unknown	Spain
31 Ekala	mancozeb	Harcozeb	III	packets	good		1,024	4,600	-	1997	South africa
32 Ekala	pretilachlor	Sofit	III	glass bottles	-		40	-	16	1998	Switzerland
33 Ekala	metalachlor	Dual	III	glass bottles	good		136	-	55	1994	Switzerland
34 Colombo	chlorpyrifos	Vitashield	II	bottles	-		806	-	165	1997	Unknown
35 Colombo	fenobucarb	Keedan	II	bottles	-		27	-	5.6	1998	Unknown
36 Colombo	metaldehyde	Meta	III		-	-		1.75	-	1997	Unknown
37 Colombo	captan	Captan	IV	packets	-		9,330	2,600	-	1992	Unknown
38 Kelaniya	chlorothalonil	Daconil	III	glass bottles	-		4,067	-	857	1998	Japan
39 Colombo	mancozeb+oxadixyl	Unknown	?	packets	-		673	146	-	1996	Unknown
40 Colombo	chlorothalonil	Daconil	IV		-	-		-	800	1998	Unknown
41 Colombo	sethoxydim	Target-S	III		-	-		-	760	1998	Unknown
42 Colombo	buprofezin	Applaud		packets	-		6,566	507	-	1996	Unknown
43 Colombo	pirimiphos methyl	Actellic	III	bottles	-		720	-	3,023	1997	Unknown
44 Colombo	pirimiphos methyl	Actellic	III	packets	-		281	1,232	-	1997	Unknown
45 Colombo	chlorfluazuron	Atabron	IV	bottles	-		180	-	20	1995	Unknown
46 Colombo	carbaryl	Sevin	II	bottles	-		1,506	-	353	1998	Unknown
47 Colombo	fipronyl	Regent	II	bottles	-		216	-	30	1997	Unknown
48 Colombo	phosalone	Zolone		bottles	-		11,912	-	2,961	1998	Unknown
49 Colombo	phosalone	Zolone	IV	barrels	-		22	-	4,400	1998	Unknown
50 Colombo	copperoxide	Perenox	II	packets	-		2,830	566	0	1995	Unknown
51 Colombo	flutolanil	Moncut	III	packets	-		602	51	-	1998	Unknown
52 Colombo	oxyfluorfen	Goal	III	bottles	-		229	-	38	1996	Unknown
53 Colombo	diuron	Diuron	III	packets	-		12	104	-	Unknown	Unknown
54 Colombo	napropamide	Unknown	?	packets	-		220	110	-	1990	Unknown
55 Colombo	2,4-D	Unknown	III	packets	-		2	80	-	Unknown	Unknown
56 Colombo	brodifacoum	Klerat	III	packets	-		22	10	-	1996	Unknown
57 Colombo	propineb	Antracol	III	packets	-	-		6,000	-	1985	Unknown
58 Colombo	permethrin	Unknown	?	drums	-		1	-	200	1990	Unknown
59 Colombo	permethrin	Unknown	?	bottles	-		184	-	27	Unknown	Unknown
60 Colombo	*endosulfan*	*Thiokil*	*II*	*bottles*	-		*1,195*	-	*428*	*1995*	*Unknown*
61 Polonnaruwa	fenthion	Lebaycid	II	bottles	-		55	-	10.4	Unknown	Unknown
62 Polonnaruwa	***aldrin***	***Aldrin***	***Ib***	***bottles***	-		***8***	-	***18***	***1995***	***Unknown***
62 Polonnaruwa	propoxur	Unden	III	bottles	-		156	-	56.4	Unknown	Unknown

63	Polonnaruwa	propoxur	Unden	III	packets	-	17	34	-	Unknown	Unknown
64	Polonnaruwa	fenobucarb	Unknown	II	bottles	-	85	-	28.6	Unknown	Unknown
65	Polonnaruwa	monocrotophos	Monocron	Ib	bottles	-	47	-	15.2	Unknown	Unknown
66	Polonnaruwa	carbosulfan	Marshal	II	bottles	-	13	-	2.2	Unknown	Unknown
67	Polonnaruwa	chlorpyrifos	Dursban	II	bottles	-	154	-	45	Unknown	Unknown
68	Polonnaruwa	dimethoate	Unknown	II	bottles	-	71	-	27.2	Unknown	Unknown
69	***Polonnaruwa***	***DDT***	***DDT***	***II***	***packs***	***-***	***23***	***10***	***-***	***1995***	***Unknown***
69	Polonnaruwa	diazinon	Diodin	III	packets	-	5	10	-	Unknown	Unknown
70	Polonnaruwa	carbofuran	Unknown	II	packets	-	211	422	-	Unknown	Unknown
71	Polonnaruwa	pirimiphos-methyl	Actellic	II	bottles	-	43	-	9.1	Unknown	Unknown
72	Polonnaruwa	carbaryl	Sevin	II	packets	-	5	10	-	Unknown	Unknown
73	Polonnaruwa	MCPA	Hedonal	III	bottles	-	162	-	77	Unknown	Unknown
74	Polonnaruwa	propanil	Unknown	III	bottles	-	466	-	401	Unknown	Unknown
75	Polonnaruwa	fenoxaprop-p-ethyl	Whipsuper	?	bottles	-	40	-	46	Unknown	Unknown
76	Polonnaruwa	paraquat	Gramoxone	II	bottles	-	28	-	11.2	Unknown	Unknown
77	Polonnaruwa	butachlor+propanil	Unknown		bottles	-	49	-	24.5	Unknown	Unknown
78	Polonnaruwa	oxyfluorfen	Unknown	III	bottles	-	10	-	2	Unknown	Unknown
79	Polonnaruwa	alachlor	Unknown	III	bottles	-	26	-	5.6	Unknown	Unknown
80	Polonnaruwa	propineb	Unknown	?	packets	-	5	0.5	-	Unknown	Unknown
81	Polonnaruwa	sulphur	Unknown	IV	packets	-	25	12.5	-	Unknown	Unknown
82	Polonnaruwa	captan	Unknown	IV	packets	-	134	41.2	-	Unknown	Unknown
83	Polonnaruwa	mancozeb	Unknown	III	packets	-	12	2.4	-	Unknown	Unknown
84	Dematagoda	mancozeb	Blitox	III	bags	-	425	10,625	-	Unknown	Unknown
85	Dematagoda	mancozeb	Blitox	III	packets	-	3,094	2,340	-	Unknown	Unknown
86	Dematagoda	chlorpyrifos	Lorsban	II	bottles	-	3,990	-	1,410	Unknown	Unknown
87	Dematagoda	thiram	Rootone-F	III	packets	-	2,463	216	-	Unknown	Unknown
88	Dematagoda	sulphur	Super six	IV	bottles	-	1,642	-	364	Unknown	Unknown
89	Dematagoda	propagite	Omite 57 E	III	bottles	-	106	-	42.4	Unknown	Unknown
90	Dematagoda	fenobucarb	Keedan	II	bottles	-	48	-	4.8	Unknown	Unknown
91	*Dematagoda*	*endosulfan*	*Anglosulfan*	*II*	*bottles*	-	*384*	-	*22.8*	*Unknown*	*Unknown*
92	Dematagoda	dimethoate	Dimitox	II	bottles	-	1,375	-	264	Unknown	Unknown
93	Dematagoda	phenthoate	Enthosan	II	bottles	-	11	-	4.4	Unknown	Unknown
94	Dematagoda	propanil	Weedex	III	bottles	-	5	-	2	Unknown	Unknown
95	Dematagoda	paraquat	Gramoxone	II	bottles	-	12	-	2.4	Unknown	Unknown

96	Dematagoda	copper hydroxide	Kocide	IV	packets	-	40	-	8	Unknown	Unknown
97	Kelaniya	quinalphos	Ekalux	II	alu bottles	good	982	-	194	1997	India
98	*Kelaniya*	*endosulfan*	*Thionex*	*II*	*glass bottles*	*good*	*53*	*-*	*9.8*	*1998*	*Unknown*
99	Kelaniya	formithion	Anthio	II	glass bottles	good	7,114	-	2,806	1997	Unknown
100	Kelaniya	oxyfluorfen	Galigan	III	glass bottles	good	64	-	64	1998	Israel
101	Ekala	chlorpyrifos	Pyrimack	II	glass bottles	-	107	-	21.8	1997	Israel
102	Ekala	chlorpyrifos	Mackfos	II	glass bottles	-	115	-	21	1996	Israel
103	*Ekala*	*endosulfan*	*Endomack*	*II*	*glass bottles*	*-*	*22*	*-*	*4.8*	*1998*	*Israel*
104	Ekala	phenthoate	Mackso 50% EC	II	glass bottles	-	37	-	8.8	1998	Singapore
105	Ekala	phenthoate	Mackso 5% dust	II	paper packs	-	9	6.5	-	1996	Japan
106	Ekala	BPMC	Mackcarb	II	glass bottles	-	21	-	4.5	1997	Singapore
107	Ekala	dimethoate	Mackthoate	II	glass bottles	-	34	-	2.9	1997	Singapore
108	Ekala	carbosulfan	Master	II	glass bottles	-	53	-	10.6	1998	Malaysia
109	Ekala	carbaryl	Sevin	II	cardboard pack	-	90	9.45	-	1997	France
110	Ekala	diazinon	Surya 5% G	II	LDPE bags	-	44	25	-	1996	Korea
111	Ekala	carbofuran	Unknown	II	alu foil bags	-	9	15	-	1996	Malaysia
112	Ekala	acephate	Apollo	II	LDPE bags	-	16	1.6	-	1997	India
113	Ekala	sulphur	Macksul	IV	alu foil bags	-	73	36.5	-	1996	France
114	Ekala	carbendazim	Mackdazim	IV	cardboard pack	-	12	18	-	Unknown	Unknown
115	Ekala	mancozeb	Mackzeb	IV	alu foil bags	-	168	68.8	-	Unknown	Unknown
116	Ekala	captan	Unknown	IV	cardboard pack	-	693	153	-	1998	Israel
117	Ekala	alachlor	Mackchlor	III	glass bottles	-	18	-	4.5	1998	Israel
118	Ekala	MCPA	M60	III	glass bottles	-	17	-	4.7	1998	UK
119	Ekala	MCPA	M power	III	glass bottles	-	45	-	14.4	1997	UK
120	Ekala	glyphosate	Weedol	IV	glass bottles	-	17	-	6	1998	Malaysia
121	Ekala	sethoxydim	Target S	III	glass bottles	-	421	-	147.35	1998	Japan
122	Ekala	propanil	Marunil	III	plastic bottles	-	103	-	88	1997	USA
123	Kelaniya	sethoxydim	Nabu-S	III	drum	-	3	-	600	1998	Japan
Total							73440	97213.3	68362.5		

Pieces of containers = 73,440 Combined total in kg/litres= 165,575 Grand total in tonnes = 166

Notes: Formulation categories referred here EC=Emulsifiable Concentrate SL=Soluble Concentrate WP=Wettable Powder WG=Dispersible Micro Granule GR=Granules DP=Dustable Powder EW=Water-in-Emulsion RB=Ready Bait SC=Suspension Concentrate DF=Dry Flowable

WHO Recommended toxicity classification referred here Class Ia: Extremely hazardous Ib: Highly hazardous II: Moderately hazardous III: Slightly hazardous IV: Unlikely to present acute hazards in normal use