National Conference

on

Persistent Organic Pollutants Management

April 20, 2018

The Hans, New Delhi

Report by

Toxics Link

for a toxics-free world

Table of Contents

Annexures

- Agenda
- List of participants
- Presentations

INTRODUCTION:

The Stockholm Convention on Persistent Organic Pollutants was adopted on 22nd May 2001, to "Protect human health and the environment from persistent organic pollutants". India ratified the Stockholm Convention on POPs in 2006 and subsequently came out with the National Implementation Plan (NIP) in 2011 to manage the twelve POPs. However after the NIP2011, sixteen new POPs were listed in the Convention and there are possible ramification for the country on listing of these chemicals as POPs.

The conference began with a glimpse of Stockholm Convention by Ms. Tripti Arora. She mentioned about the objectives of the meeting a) to get an overview on the overall POPs management in the country post national implementation plan 2011. b) to discuss on the possible ramification of the newly listed POPs in Stockholm Convention. c) to share the information among the stakeholders on the newly listed POPs and to present the country situation report on POPs prepared by Toxics Link.

INAUGURAL SESSION:

Image 1 – Tripti Arora, Toxics Link

Mr. Ravi Agarwal, Director, Toxics Link, inaugurated the conference by explaining the organizations' engagements on this issue.

He stated that this issue first came into lime light after Rachel Carson's book **"Silent Spring"**. The book emphasizes on the near extinction of the bald eagle population due to excessive usage of DDT in the agricultural fields.

The intention of the conference is to take a conscious decision for POPs and develop possible strategies to eliminate it. He briefly talked about the following major points:

1. Alternatives for the listed POPs.
2. Development of an action plan in order to stop the existing usage of POPs eg. elimination of lead from decorative paint.
3. Unintentional POPs: India currently has emission standard for dioxins and furans. However we still do not have the regulatory capacity to do it. Capacity for monitoring such emission is also still in its naïve stages.
4. Consumer awareness and labeling: This is mainly for the consumers to make a conscious decision in choosing the product which has information about the POP in the product label.

He pointed out the double standards followed by the same company in different countries. The product which is being sold in the global market has a standard which is remarkably different from the ones being supplied in the developing countries like India. It is intriguing to know what is stopping these

companies to comply with their quality standards in the developing countries as well. His talk was followed by a round of introduction from the participants.

1. Session I: Current Status of POPs management in India

1.1 Implementation of Stockholm Convention in India: Mr. Manoj Kumar Gangeya, Director, MOEF & CC

Mr. Gangeya, director of MOEF & CC talked on the role of MoEF & CC as the nodal agency for global conventions and SAICM. He pointed out that because of the different nature of different conventions; an integrated approach is lacking. Like, Stockholm convention focuses on production, import and export of POPs; Rotterdam Convention focuses on the international trade of hazardous chemicals and pesticides.

Image 2 - Mr. Manoj Kumar Gangeya, MoEF&CC

He highlighted that MOEF & CC has represented in two review committees (POPRC) of Stockholm Convention and threw light on the working of POPRC (a scientific committee representing members from 31 countries who has ratified the treaty). It gives recommendations in the COP after research about the countries seeking exemption for certain POPs with its restricted use only in that country. Exemptions are given only for a maximum of 10 years after taking many factors in consideration. As India ratified Stockholm Convention in 2006, 12 POPs were also ratified along with the treaty. As per annexure A of the convention, India has to work towards banning the dirty dozen in the country. He further talked about the three annexures (A-about elimination, B- about intentionally produced POPs and C- about unintentionally produced POPs) in the Stockholm convention.

He further added that, currently, POPRC is working on the three POPs (PFOA, Dicofol and PFHxS) which are under consideration to be listed in annexure A in 2018. India is a part of this 2018-2022 review. Before the formulation of POPRC, the country has to seek exemption during negotiation in COP meeting. General obligations of the parties who have ratified COP are to make a National Implementation Plan (NIP), Facilitate Information Exchange through National Focal Point (NFP), Conduct national awareness campaign to educate the public, Encourage research and development, Monitoring and Reporting.

He further elaborated on the availability of fund for elimination of POPs from various sectors of the country. UNIDO is the focal agency for funding and UNEP and CPCB are the executive bodies. The GEF fund availed under Stockholm Convention in India are:

Project 1: PCB destruction technology: Fund availed by CPRI Bangalore for having mobile destruction plant for PCBs. It will be commissioned in a month's time. PCB destruction facility is yet to be commissioned in Bhilai Steel Plant within a year and half's time.

Project 2: DDT: This project was executed by National Botanical Research Institute, Hindustan Insecticide Limited and Ministry of Health and Family Welfare to find an alternative to DDT.

Project 3: Biomedical Waste Management: UNIDO funded to implement biomedical waste management in 5 states across the country.

Mr. Gangeya informed that after India ratified Stockholm in 2006, policy regulation on POPs came into force on 5th March 2018 which puts a ban for 7 chemicals listed as POPs. According to these rules, after 2020 there shall not be any PCB contaminated sites in the country.

He further talked about the challenges being faced by the country in implementing these conventions:

- Lack of available information from various stakeholders such as industries, research institutions etc.
- Lack of research on the impact of POPs to public health and environment pertaining to the Indian conditions.
- Lack of awareness and poor participation of the stakeholders.
- Alternates available for POPs might not be economically feasible to implement.
- Industry does not agree with these conventions but with time they'll have to move towards recommended safer alternatives.
- Lack of participation by industries majorly in research and development.

He quoted a case where MOEF & CC had sent a draft paper of COP (Stockholm Convention) to all its stakeholders seeking for recommendations and exemptions. Industries used to approach the Ministry at the end moment seeking for exemption for certain POPs without relevant reasons making it difficult for the Ministry to represent the case in COP.

He further briefed the participants about the possible future activities that India might take in POPs management:

- Ratification of newly listed POPs by Stockholm Convention.
- Upgrading the existing National Implementation Plan.
- Implementation of various rules related to POPs management

He concluded his talk by emphasizing on the need for sustainable management of chemicals. He also pointed out to a need of creating a roadmap involving all the relevant stakeholders for achieving this goal.

1.2 Protect human health and environment from POPs- Mr. Dinabandhu Gouda, Addl Director, CPCB

Mr. Gouda begins his talk with POPs introduction, its characteristics, and its long term persists in the environment. He added that, these POPs has a tendency to get accumulated in the fat tissues as these compounds have high molecular weight. He emphasized that POPs are highly toxic to public health.

Image 3 - Mr. Dinabandhu Gouda, CPCB

Mr. Gouda also touched upon the process of preparation of the National Implementation Plan (NIP). He added that during the preparation of NIP, an inventory of all the POPs were prepared to find out the sectors wise uses of the POPs as well as the amount of substance in use and stockpiles were analyzed. MoEF & CC worked closely with the Central Pollution Control Board, Ministry of Agriculture, Ministry of Chemicals and Fertilizers, Department of Chemical and Petrochemical, Ministry of Power and Ministry of Health and Family Welfare for developing this NIP. He also spoke about the key points of the action plan of NIP.

He then presented a few case studies:

- In 2006, CPCB was assigned a project to destroy Dieldrin, a pesticide stored in Rajasthan. But the project could not be executed due to various reasons. Later, it was decided to be exported and destroyed as India does not have the destroying facility in the country.
- In case of Endosulfan, India was against its ban as it was not banned in United States. But Supreme Court of India banned the production, use and export, import of Endosulfan linking abnormalities caused in the Kasargod district.

He has mentioned that CPCB has a National reference trace organics laboratory developed in collaboration with Indo German bilateral program. The laboratory is first of its kind in India and having state of art facilities and international standards infrastructure facilities for trace organics analysis in various environmental matrices. He further mentioned that out of the 12 dirty dozen POPs, 9 of them are pesticides and are being measured at this facility (except Endrine, Toxaphene and Mirex). Similarly, out of the 16 newly listed POPs, 5 are measured here (Alpha HCH, Beta HCH, Lindane, Pentachlorobenzene and Endosulfan).

He explained the recent developments in POPs. i.e. 7 chemicals out of 16 POPs are prohibited for manufacture. CPCB have also been nominated as the executing agency to carry out the project on "Development and promotion of non alternatives to DDT".

Mr. Gouda stated that CPCB initiated a project on POPs in 2003, to create an inventory and determine emission factors for unintentionally produced POPs viz. Hexachloro Cyclo hexane, Chlorophenols, Chlorobenzene, Chlorinated diphenyl ethers resulting from the manufacture of selected products and to develop strategies and techniques for minimization of unintentionally formed POPs.

He finally made following recommendations and concluded his talk:

- The recovery of Trichlorobenzene from converting Lindane residue to Trichlorobenzenes should be substantially improved.
- The incineration of the residues from Endosulfan production should be stopped at once as the problem is drastically increased rather than being solved.
- Upgradation of national implementation plan (NIP 2011) can be initiated immediately
- Financial resources required to strengthen Infrastructure facilities of CPCB and RD Laboratory.
- Strengthening of SPCBs Laboratories where POPs chemical industries are largely located particularly Gujarat, Maharashtra, and Telangana.
- Increase Awareness among SPCBs on POPs.

Question & Answer

During this session **Dr. Hasan** (Automobile Industry) stated that there is very limited information on the POPs being used in the automobile industry. He further enquired about the status of exemption of commercial deca BDE and also asked about the recent regulations of POPs in the country as 4 out of 7 chemicals which are regulated still in use by automobile sector. After this **Mr. Gangeya** told that ten months ago, during the COP 2017 preparation stakeholder consultation was done by the ministry. Members from automobile industry were also present but they didn't put forward any suggestions on the chemicals present in the automobiles in COP, European countries were seeking exemption for POP usage in aerospace industry. India negotiated based on a correlation with the parts used by the aerospace industry with that of the parts used in the automobile industry. The exemption is generally valid for four years and it is subjected to negotiations.

Image 4 Ravi Aggarwal, Manoj Kumar Gangeya, Dinabandhu Gouda & Satish Sinha

Regarding the recent 7 POPs being eliminated, Stakeholders from all sectors were consulted by the MoEF & CC and the chemical which received objection was removed from the ban list. Even after 3 stakeholders meeting, objections were not raised against any chemical. He also stressed that representatives from the industries can also take part in the negotiations of the COP and put forward their justifications. With proper research background those negotiations would be considered.

Image 5 Bikash Chetry, Toxics Link

During the discussion he outlined that POP review committee 2016 sent the notice seeking for exemptions for Hexachlorobutadine. None of the stakeholders came up seeking for exemptions. Most of the countries that have ratified the treaty have a systematic approach towards eliminating the chemicals but India lacks proper action plan towards the convention. **In response to the queries on PCBs disposal facility in Bhilai, Mr. Gangeya** assured that the static treatment facility will be operational within a time frame of 1 to 1.5 years and the reason for the delay is lack of availability of the funds. UNIDO-GEF provides $(1/6)^{th}$ of the funds to set up the plant. The rest of the funding has to be arranged by MoEF & CC. The installation required for treating the PCB would be fabricated only on demand basis by the European company.

Mr. Satish Sinha, Associate Director, Toxics Link concluded the session by emphasizing on the objective of the meeting which is to create a database on POPs and to understand the country's situation on POPs. He also pointed out to the need of creating a nation vide campaign on POPs.

2. Session II: Industry Perspective on POPs Management in India

2.1 POPs Management- Challenges for India: Mr. Piyush Mohapatra, Toxics Link

Mr. Piyush talked on the Stockholm convention, its importance and the other details about the parties, signatories and provisions under it. He has also focused on list of 28 POPs. Further he explained the role and responsibilities of important stakeholders like CPCB, Ministry of Chemicals and Fertilizers, Ministry of Agriculture and Farmers' Welfare, NEERI, SPCBs, research institutions/NGOs with MoEF & CC as the central authority for sustainable management of POPs in India.

Image 6 - Mr. Piyush Mohapatra, Toxics Link

Mr. Mohapatra presented a timeline of the adoption and implementation of POPs in the Stockholm Convention like the "**Dirty Dozen**" that was banned in 2004; **sixteen** other chemicals were banned subsequently in due course**. Nine** new POPs were included in 2009 but the modifications came into force only in August, 2010. COP 5 added Endosulfan in 2011. Though, India was able to ban Endosulfan only in 2012 with intervention from the Supreme Court. Further, COP 6 banned HBCDD in 2013 and COP 7 banned three other POPs viz., Polychlorinated naphthalenes, Pentachlorophenol and Hexachlorobutadiene in 2015. In 2017, a few more POPs (DecaBDE, short-chain chlorinated paraffins and Hexachlorobutadiene.) were included in the list.

He also reiterated that, India is one of the few countries which opposed the Pentachlorophenol to be included as POPs in the Stockholm convention. Chemicals which are proposed for listing under the convention in future are Dicofols, Pentadecafluorooctanoic acid and Perfluorohexane sulphonic acid. Further, he stated that it was rightly pointed out that there is very little clarity and lack of data on POPs in Indian context.

The challenges faced by India in implementing the guidelines of the Stockholm Convention effectively include lack of an updated database on POPs, safe stockpile management, lack of hotspot mapping initiatives, suitable alternatives and the impact of POPs on human health and environment. Alternatives to banned POPs not only have to be effective performance-wise, they have to be cost effective too, considering that India is a developing country. Epidemiological data needs to be available to the policy makers and in the public domain too.

He concluded his presentation leaving the audience with a trail of thoughts regarding cross-contamination from POPs, restricted use of POPs in food and children's products, the need to fix TDI limits along with the urgent need to raise awareness. While in many countries there are standards for food items and for use of dioxins and furans, India lags behind in this regard.

2.2 Vector control strategy in India: Judicious use & Selection of vector control in India: Dr. Sukhbir Singh, Joint Director, National Vector Borne Disease Control Programme

Dr. Sukhbir enlightened the audience about the Vector Control Programme in India. He spoke at length on Integrated Vector Management (IVM), its key elements and the decision making process. The IVM programme is an evidence-based decision making process to rationalize the use of vector control methods through community engagement initiatives. It has three aspects: chemical control, environmental management and biological control. It makes use of **seven** pesticides one of which is DDT for which India has asked the Stockholm Convention for exemption.

Image 7 - Dr. Sukhbir Singh, NVBDCP

The key elements of IVM are

I. Advocacy, social mobilization and legislation. Collaboration within the health sector and other sectors Integrated approach Evidence based decision making
II. Capacity building

He went on to discuss the decision making process for development and implementation of IVM strategies. It involves analyzing the disease situation, monitoring and evaluation, selection of vector control methods and implementation strategy.

Further, he elaborated on the techniques and strategies for vector control, including indoor spraying, using mosquito nets, outdoor fogging and formulations and doses of larvicides. He also threw light on different spraying and pumping procedures and commonly used larvicides. The approach adopted for implementation of IVM involves source reduction using biological control methods (such as using larvivorous fish), using bio-larvicides, mosquito nets treated with insecticides and personal protective equipment for spray workers, food and household items. Dr. Singh also described the conditions to decide the level of resistance to spraying in vectors.

2.3 Phase out of DecaBDE under the Stockholm Convention: Dr. Rashid Hasan, Advisor, Society of Indian Automobile Manufacturers

Image 8 - Dr. Rashid Hasan, SIAM

Dr. Hasan discussed about the ignorance of chemicals used in the automobile sector in India although POPs are very commonly used as flame retardants in automobiles. The automobile manufacturers are important from the point of view of chemicals because every part of an automobile contains DecaBDE as BFRs. The whole family of polybromodiphenyl ethers is used in the sector. Unfortunately, there is not much literature or data available on these chemicals.

Dr. Hasan emphasized on Polybromodiphenyl ethers, their characteristics, uses and impact on our health and environment. They are used in batteries, wires, foam, speed sensors, underhood insulations, upholstery and a host of other motor ports. PBDEs have been reported to be present in indoor and outdoor air, remote arctic regions, house and office dust, water bodies, food, biota and sewage. Although, Deca-BDE was added to Annexure A in 2017 but India has been exempted for ten years, he claimed.

He has mentioned about International Materials Data System (IMDS) – it's a database of information used internationally, except in India, data is provided by suppliers for use by OEMs through IMDS. It provides details on auto parts, structure and material composition. OEMs contact suppliers to submit IMDS as part of PPAP/internal requirements. The data can even be rejected by OEMs after review. This data is used to analyze the hazardous substance content, recyclability impact analysis, etc. He also mentioned that MoEF & CC banned a few POPs in India in March, 2018,. He stressed on the fact that India has to look for alternatives like Europe, USA and Japan.

He added that, in India, inventorization and reporting of PBDEs is the need of the hour if the industry has to be made aware of the banned POPs and their suitable alternatives. This information would be useful for policy-makers too. For example, there is not enough data on production and use of BDEs in the automotive sector. The information includes the names and addresses of industries or companies responsible for handling BDE containing material, their production and use. These companies need to be informed about the importance of treatment of waste (containing POPs) before disposal. Contaminated sites, clean up processes employed, monitoring and research are also vital information which is required by the stakeholders involved in POPs management.

Further, Mr. Hasan discussed about the recycling of end-of-life vehicles with regards to POPs management. He also suggested that the extent of dismantling/recycling may be quantified and BAT (best available technology)/BEP (best environmental practices) guidelines may be referred to for technologies and approaches.

Mr. Hassan recommended that PBDEs need to be included in India's NIP. NIP (2011) envisaged elimination and restriction strategies only for 12 POPs. Strategies need to be devised for elimination and disposal of PBDEs along with its non-POP alternatives. He also focused on remediation options, strengthening of institutions responsible for implementation of NIP and capacity building for handling PBDEs.

Mr. Hasan went on to deliberate on the challenges faced by the country and by the automobile sector to phase out the use of POPs. He mentioned that, firstly, IMDS needs to be executed in India so that data is available for decision making. Inadequate strategies for elimination of PBDEs from the environment, lack of technical capacity and low awareness among stakeholders are major challenges in India. Furthermore a comprehensive regulatory framework will have to be framed for the purpose of taking informed decisions. A separate department within the MoEF & CC needs to be made for monitoring and implementing the Stockholm Convention in India.

Question & Answer

Image 9 Ravi Aggarwal, Girija Bharat, Paromita Chakraborty

During this session the questions were raised on the availability of the testing laboratories for testing the chemicals in food. Other questions were based on the cost of substitution of BFRs in automobiles and the recycling of hazardous automobile waste, which was answered by respective speakers that, there is no suitable information on this. It was suggested the mandatory use of substitutes of POPs in pollution control systems and safety equipment in vehicles, so that the cost would be taken care of. Another question was based on integrated vector management which should also focus on controlling the growth of weeds due to pesticides. In this regard the presenter clarified that Pesticides and Herbicides fall under the purview of the Ministry of Agriculture. For vector control management, standard protocols are in place for short term, mid-term and long term trials of pesticides. He also spoke about DDT being a pesticide and its use for vector control but not in agriculture. The last two questions were based on alternatives to DDT. In this regard the response was no alternatives to DDT hence exemption for it will again be asked from the Stockholm Convention and if there are any alternative then it would be temporary solution, the presenter added.

3. Session II: Research Perspective on POPs Management in India

3.1 PCBs in Gangetic Basin: Dr Girija Bharat, MU Gama Consultants Pvt. Ltd

Image 10 - Dr Girija Bharat, Mu Gamma Consultant Pvt. Ltd

Dr. Girija started her presentation with the basic introduction of POPs and how do we get exposed to them & the harmful effects caused by them. She then explained as to why India is a hotspot for POPs and how POPs act as cold condensers. She also explained about the semi volatile organic compounds aka SVOC namely PCB, DDT, OCP, PAH & PFAS. She informed that there are 36 pieces of acts for chemicals but no consolidated legislation as such. In 2017, a gazette notification came to address the gap in the law but it's not consolidatory.

She explained that the air in India has high amount of POPs in it, primarily due to agriculture, industrial effluents, electronic wastes and ship breaking industries and cold regions such as the polar areas and mountain glaciers are key target for POP deposition and act as "cold condensers" and effective long term storage compartments. Climate change can potentially lead to re-mobilization of POPs. She then spoke about the study they have conducted on POPs and its climate induced mobilization. The study was conducted from 2011 to 2013.

Further she explained about the sampling and analysis of environmental samples (active water samples from glacier, passive air samples and rain water samples) and the problem faced during the research. Study revealed that the levels of DDT is increasing steadily in air; bulk water and rain water whereas level of PCBs varied under similar conditions. For PAH level high spikes were seen in rain water. Allahabad was found to have the highest content of Hg in methyl mercury form. Fugacity ration: F air/F water was used to find the dominant sources of POPs in different mediums. DDT and PAH dominated source included atmosphere whereas PCB dominated source included melting glaciers. It was also found that in surface water and ground water the level of PFOS was less than significant. The study concluded that special attention is needed for Himalayan region and POPs.

3.2 Informal Electronic Waste Recycling is a potential Source for Toxic Organic compounds in India: Atmospheric Transport Models and Human Health Risk Assessment: Dr. Paromita Chakraborty, SRM University

Dr. Paromita focused on the ewaste and pollution issue, she added that the informal recycling and open burning of e-waste is done to recover precious metals used in the electronic products. Burning is also done to reduce the quantity and size of waste. This causes release of toxins like PCB/PBDE/Dioxin and Furans. These affect us in several ways .They mimic endocrine hormones and interfere with the normal body functioning.

Image 11 - Dr. Paromita Chakraborty, SRM

She then mentioned about a village named Guiyu in China. It was referred to as a toxic village. Nearly 90% of the waste was sent to this village as China is the largest importer of e-waste. This caused severe health effects in the people of the village. The dumping has now been reduced to 70%.

In 2013 a study was done in the West coast of India as it is the largest ship breaking site. This leads to outflow of heavier PCBs from e-waste in the rivers. India is a dumping site for the e-waste of whole world and is only second to China. The various stages of e-waste recycling are: dismantling, segregation, melting, and recovery of metal. A study of 5 cities was done which collect 70% e-waste in India. Active and passive samples were collected. Frozen soil samples and air samples were used. CALUX ASSAY was used and exposure dose responses were checked for air and soil samples. A conversion factor of 0.23 was used. E-waste site and dump site both were used for checking PCB, DIOXINS/FURANS congeners. Low levels in open sites were found whereas in Mandoli, the level so of furans was quite high. Levels of PCBs and Dioxins were also high. PCB-126 was fond to be the most toxic congener.88% PCBs were dioxin like in the e-waste. PCB -126 was not found in the air sampling but seen in metal recovery site as it is not a direct formulation. It is formed due to incomplete combustion of heavier metals. The particle size is as small as 0.25 microns. This leads to serious health concerns.

Human milk samples and placental blood samples study is going on to test for PCBs and dioxins and furans. Delhi, Chennai, Kolkata, Mumbai are the dump sites. In Delhi dump site acid leaching is present.

3.3 Country Situation on POPs: Mr. Piyush Mohapatra, Toxics Link

Mr. Piyush started his session by deliberating on the status of regulation on various POPs in India. He explained that many POPs such as Aldrin, Chlordane, PCBs, DDT, Pentachlorobenzene, Endosulphan etc are banned in the country, whereas the country still needs regulations on PFOS, Alpha and Beta HCH, PCDD, PCDF etc.

He went on to talk about various research studies conducted in the country on POPs. He also spoke briefly about TL –IPEN "Study in eggs and TL –IPEN" Study on Deca BDE and SCCPs.

Question & Answer

During this session the questions were started by enquiring that which precautions were taken in the transportation of environmental samples, Dr. Girija responded that the samples were required to be stored below 5 degree Celsius and it was very challenging to maintain the 3 by 2 box, but thankfully it was carried out properly. Other questions to her were based on the exposure of POPs to the aquatic animals, heavy metals exposure to the Dolphins and the form of mercury found in Allahabad.

Image 12 - Girija Bharat, Paromita Chakraborty, Piyush Mohapatra

She responded that, exposure to aquatic animals could not be quantified because the study couldn't be conducted on animals due to ethical reasons. Human blood sampling and testing have also not been done due to the same reason.

Regarding HM to Dolphin, she mentioned that after Patna, the water quality improved hence Dolphins have come back and also aquatic flora and fauna rejuvenation took place and for last question she answered that the form of mercury she observed in Allahabad was Methyl mercury form which is highly dangerous.

Image 13 - Participant from NEERI Delhi

In addition to this some questions were for Dr. Paromita like which precautions were taken by the labs during extraction of dioxin and furans. For this she responded that Hiyoshi Japan helped them in dioxin and furan extraction procedures and enough precautions were taken in the lab. There was no exposure to the faculty members. There are 85 of them and they have a good chemical vendor and they had access to all the required personal protective equipments.

Another question to her was which TV sets generate more POPs, the old TV or the new one with LCD and LED screen. Her response on this was new ones have more chemicals and heavy metals that's why they generate more POPs. Actually proper recycling

can help in earning money as well as reducing exposure to POPs. It is the need of the hour to develop new ways for recycling the products. Further it was asked that, lithium ion batteries are the future, will it generate more POPs, if so, how much more? On this her response was negative and she added that it is only generated due to incomplete combustion.

The last question to her was based on existing "Guiyu" this is in reference with the first list of POPs and 15 more which were listed or used as pesticides. There is no control as such over the chemicals being used in various sectors. Gujarat happens to be a ship breaking site which has the potential of becoming "Guiyu" like village. There is no data about the impact of such waste on waste collectors. She responded on it differently by putting the example of radioactive dumping in Delhi which is a severe issue but people don't raise question because they are not aware of it. People react only when there is physical manifestation. POPs have a long term effect and their effects take time to show up. Hence e-waste is an alarming problem. Vapi and Silvassa are nearly 100% "Guiyu". Lots of research are going on to avoid "Guiyu" like situations. Thankfully things are changing.

Final Remarks:

Mr. Satish Sinha invited the entire panelist to give closing remarks, while he stressed on the need to take this issue forward.

Image 14 - Satish Sinha, Toxics Link

Dr. Sukhbir offered technical assistance from his department to address the issue further in the country. He also informed the participants that Kala azar and Lymphatic Filariasis are on the verge of elimination by 2020 and hopefully the usage of DDT will be reduced.

Mr. Ajay appreciated the initiative taken by Toxics Link. He quoted that 5 years ago they did a CSR project to find out the labors that died due to pesticides. There is a rising need of contemporary liability and it should be a social responsibility for such issues. Many farmers are not stopped burning their crop residues in Punjab. But when we are promoting non-burning for crop residues, it should also provide them the alternatives. Compositing should also be advocated along with non-burning solutions.

Image 15 - Sukhvir Singh, Satish Sinha, Ajay Tripathi, Himanshu Dhuria

Mr. Himanshu highlighted the importance of such a platform in bringing awareness to everyone. He stated that he works for Green supply chain in Maruti and stressed that POPs must be controlled. As of now there is no firm database to measure the POPs usage by them but they will surely work for it.

During the discussion **Dr. Sukhbir** was enquired the reason for Kala azar and lymphatic filariasis so he

explained that sand fly is the vector for Kala azar which is found more near the alluvial soil. All the 53 districts in UP, Bihar and West Bengal have same soil hence Kala Azar is localized in these areas. Filariasis is more atypical and needs more insect bites. Also, humidity is needed for the survival of the causative organism. He also informed that it has now eliminated in 99 districts in India.

He was further asked that should all the mosquitoes be eliminated. Then he responded as no. Elimination by definition is one per 10000 case detected in general populations. So, no need for all the mosquitoes to die as multiple bites are required for transmission of the disease.

Mr. Sinha finally concluded the event by stating that the Stockholm is an open treaty. Today, we have 28 chemicals and tomorrow we may have more chemicals added to the list. Any country can nominate any chemical. Nations must wake up and the moment a chemical is considered for POPs, they should start working on it. Protecting your health is of paramount importance. To speak of cost arrangement, he said that a matter of preference as people are now willing to spend more money for a mobile and cosmetics of same amount. He added that the organization worked for lead and paints, no one complained about the cost factor. Consumers will not raise the question as why the cost is reduced/raised by some rupees. Hence we just have to work for it. NIP was done in 2011 but what was the action taken after that? Where are the guidelines? A lot of work needs to be done. Only one ministry is allotted to deal with this heap of work with just one person allocated to it. He appreciated the work done by all the researchers and other presenters of the day and closed the event.

Annexures

Agenda of the meeting

NATIONAL CONFERENCE ON PERSISTENT ORGANIC POLLUTANTS MANAGEMENT
THE HANS PLAZA, NEW DELHI
20th APRIL 2018

09.30 am – 10.00 am	REGISTRATION
10.00 am – 11.00 am	INAUGURATION SESSION Mr. Ravi Agarwal – Director, Toxics Link MOEF & CC, New Delhi United Nation Environment Program United Nations Industrial Development Organization Central Pollution Control Board Mr. Satish Sinha – Associate Director, Toxics Link
11.00 am - 11.15 pm	TEA
SESSION 1	Current Status of POPs management in India
11. 15 am – 11.35 am	Toxics Link – Overview of POPs management in India
11.35 am –11.55 am	MoEF & CC - Challenges of POPs management in India
Session 2	Institutional role for POPs Management
11.55 am – 12.20 pm	NEERI, Role of Stockholm Regional Center – Research and role of regional center on Persistent Organic Pollutants Management
12.20 pm – 12.40 pm	Central Power Research Institute – PCBs management in India
12.40 pm – 12.55 pm	Question and Answer
01.00 pm – 02.00 pm	Lunch
SESSION 3	Industry perspective on POPs management in India
02.00 pm - 02.20 pm	HIL Perspective on DDT and Dicofols
02.20 pm – 02.40 pm	Automobile Industry/ Industries Association – Phase out Strategy of DecaBDE and its future in the context of India's commitment to Stockholm Convention
	Research perspectives
02.40 pm - 03.00 pm	1. CPCB – Research studies on POPs in India
03.00 pm - 03.20 pm	2. Dr Girija Bharat, MU Gama Consultants Pvt. Ltd – PCBs in Gangetic Basin
03.20 pm - 03.40 pm	3. Dr Paromita Chakraborty (Associate Professor, SRM University) – Research studies on Dioxins and Furans in e-waste sites
03.40 pm - 04.00 pm	Question and Answer
Session 3	Panel Discussion on POPs Country Situation report
04.00 pm – 05.00 pm	Focal issues for discussion - Gaps in Policy Implementation, Need for second NIP for India, Prioritizing research areas on POPs, Roadmap for New POPs management in India, Regulatory Framework and Challenges for India, Strengthening national implementation plan
05.00 pm	VOTE OF THANKS -High Tea

RSVP:

Mr. Piyush Mohapatra	piyush@toxicslink.org	9873453242
Dr. Prashant Rajankar	prashantrajankar@toxicslink.org	9650745900
Ms. Tripti Arora	tripti@toxicslink.org	9873079587
Mr. Bikash Chetry	bikash@toxicslink.org	9718455885

List of Participants

National Conference on Persistent Organic Pollutants
The Hans, 20th April, 2018

Sl. No.	Name	Organisation	Mobile No.	Email id	Sign
1	DHARMESH BHATT	HEUBACH COLOUR PVT. LTD.	7575003140	dharmesh.bhatt@heubach-india.com	
2	HIMANSHU DHORIA	MARUTI SUZUKI INDIA LIMITED	7651165132	himanshu.dhoria@maruti.co.in	
3	Tushar Parekh	[illegible] Rajkot Gujarat	94277 10897	[illegible]	
4	VIVEK KUMAR	NORWAY EMBASSY	9811511730	kumar_[illegible]@hotmail.com	
5	Smita Agarwal	NEERI, Delhi	9968091517	[illegible]@gmail.com	
6	Dr. Sukhvir Singh	NVBDCP Delhi	9868908031	sukhvir_[illegible]@yahoo.co.in	
7	Dr. Neera Singh	IARI, ND	9868265702	[illegible]@gmail.com	
8	Dr Tirthankar Banerjee	Principal Scientist, ICAR-IARI, New Delhi	8826368882	banerjee.tirthankar@rediffmail.com	

National Conference on Persistent Organic Pollutants
The Hans, 20th April, 2018

Sl. No.	Name	Organisation	Mobile No.	Email id	Sign
9	Keshav [illegible] [illegible]	JNU, SCMM	[illegible]	[illegible]@gmail.com	
10	Dr. Noor A. Khan	NEERI, Delhi	[illegible]	[illegible]	
11	Dr. [illegible]	SRM INSTITUTE OF S. & TECH	[illegible]	[illegible]	
12	DR. Rashid Hasan	SIAM	9891267046	[illegible]	
13	Mahesh Sharma	GVEPS - [illegible] Rajasthan	[illegible]	[illegible]	
14	Saroj [illegible]	MGC, Gurgaon	[illegible]	[illegible]	

National Conference on Persistent Organic Pollutants
The Hans, 20th April, 2018

Sl. No.	Name	Organisation	Mobile No.	Email id	Sign
1	PRANJAL SAXENA	MARUTI SUZUKI	8368812544	pranjal.saxena@maruti.co.in	
2	DINABANDHU GOUDA	CPCB	9868143107	[illegible]	
3	Manoj Kumar Gangeya	NEERI ZRC	—		
4	Ajay Kumar [illegible]	[illegible] Mission Trust	99131-45061	ajay[illegible]@gmail.com	
5	Dr. Suman Gupta	IARI	9811877149	drsumangupta[illegible]@yahoo.co.in	
6	Dr. Abhishek Nandal	IARI	1857074795	abhishek.nandal[illegible]@gmail.com	
7	Dr. Pragati Yadav	Spectro Analytical Labs Ltd.	9871571516	[illegible]@spectro labs.in	

Presentations

Implementation of Stockholm Convention in India

April 20, 2018

M K Gangeya, Director,
Hazardous Substances Management Division
Ministry of Environment, Forest & Climate Change,
New Delhi-110003
Email: m.gangeya@gov.in

Introduction

- Over 100,000 chemicals are currently in use
- Used in various applications: important contributor to GDP and Employment
- Certain chemicals and their waste are hazardous by nature
- ESM of such chemicals and waste is required
- Protecting human health and the environment from hazardous chemicals and wastes
- Multilateral environmental agreements: BRS, Minamata and SAICM

Stockholm Convention on Persistent Organic Pollutants

Objective

To protect the human health and environment from Persistent Organic Pollutants.

Overview

- Entered into force: 17th May, 2004
- Number of Parties: 182
- Date of Ratification of India: 13th January, 2006
- Entry into Force (India): 13th April, 2006

Persistent Organic Pollutants are Carbon-based halogenated compounds that;

- remain intact in the environment for a long time (persistent);
- become widely distributed throughout the environment (long range environmental transport);
- accumulate in fatty tissue of living organisms (bioaccumulative); and
- are toxic to humans and wildlife (toxic).

POPs are listed in Stockholm Convention under;

Annex A: Intentionally produced chemicals to be eliminated.
Annex B: Intentionally produced chemicals with restrictions.
Annex C: Unintentionally produced chemical.

Persistent Organic Pollutant Review committee

- A subsidiary body consists of 31 government- designated experts.
- Review the chemicals proposed for listing under Annex A, B, and C of the Stockholm convention.
- Makes recommendations to Conference of Parties (COP) on the addition of chemicals to Annex.
- India have membership of POPRC from 2018-2022.

Conference of Parties (COP)

- Highest authority of the Convention.
- Oversees the implementation of the Convention including policy issues, programme of work and budget, inclusion of chemicals in Annex, establishes subsidiary bodies.
- Meets every two years .
- Till date, eight meetings of COP took place.

Chemicals may be listed by voting (3/4th majority)

Chemicals covered under the Convention

S. No.	Chemical	Category	Listed under	Adopted when	Status of ratification
1	Aldrin	Pesticide	Annex A (Elimination)	Before COP 1	Yes
2	Chlordane				
3	Dieldrin				
4	Endrin				
5	Heptachlor				
6	Mirex				
7	Toxaphene				
8	Hexachlorobenzene (HCB)	Pesticide/ Industrial Chemical/ By-product	Annex A (Elimination) and Annex C (Unintentional production)		
9	Polychlorinated biphenyls (PCBs)	Industrial Chemical/ By-product	Annex A (Elimination) with specific exemptions and under Annex C (Unintentional production)		
10	DDT	Pesticide	Annex B (Restriction)		
11	Dioxins (PCDD)	By-product	Annex C (Unintentional production)		

Contd...

S. No.	Chemical	Category	Listed under	Adopted when	Status of ratification
12	Furans (PCDF)	By-product	Annex C (Unintentional production)	Before COP 1	Yes
13	Alpha hexachlorocyclohexane (α-HCH)	Pesticide/ By-product	Annex A (Elimination)	COP 4 (4-8 May 2009)	No
14	Beta hexachlorocyclohexane (β-HCH)				
15	Lindane (γ-HCH)	Pesticide			
16	Chlordecone				
17	Hexabromodiphenyl	Industrial chemical			
18	Hexabromodiphenyl ether and heptabromodiphenyl ether (commercial octabromodiphenyl ether)				

Contd...

S. No.	Chemical	Category	Listed under	Adopted when	Status of ratification
19	Pentachlorobenzene	Pesticide/ Industrial chemical/ By-product	Annex A (Elimination) and C (Unintentional production)	COP 4 (4-8 May 2009)	No
20	Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride	Industrial chemical	Annex B (Restriction)		
21	Tetrabromodiphenyl ether and pentabromodiphenyl ether (commercial pentabromodiphenyl ether)		Annex A (Elimination)		

Contd...

S. No.	Chemical	Category	Listed under	Adopted when	Status of ratification
22	Technical endosulfan and its related isomers	Pesticide	Annex A (Elimination)	COP 5 (25-29 May 2011)	No
23	Hexabromocyclododecane (HBCD)	Industrial chemical		COP 6 (28 April-10 May 2013)	
24	Pentachlorophenol, its salts and esters			COP 7 (4-15 May 2015)	
25	Chlorinated naphthalene for listing in Annex A and C			COP-7 (4-15 May 2015)	
26	Hexachloro butadiene (HCBD) for listing in Annex A			COP-7 (4-15 May 2015)	

Chemicals considered during COP-8

Chemical	Uses	Decision
Short Chain Chlorinated Paraffins	Industrial Chemical (*End use plasticizer in PVC articles, flame retardants, secondary plasticizer for PVC Resins, Fluorescent extender in synthetic rubber, Chlorinated rubber, Nitrocellulose, Polystyrene etc.*)	Listed in Annex A with Specific Exemptions
Decabromodiphenyl Ether (Commercial mixture, c-decaBDE)	Industrial Chemical (*End use flame retardant in plastics, polymers/ components, coatings, adhesives, sealants, coatings and inks (End uses in plastics, polymers include housings of computers and TV sets, wires and cables, upholstery, blinds, pipes and tapes)*)	Listed in Annex A with Specific Exemptions
Dicofol and its Isomers	Pesticide (*End use*)	Listed in Annex A

General Obligations

- **Develop a National Implementation Plan (NIP)**
- **Facilitate information exchange through NFP (National Focal Point)**
- **Promote public information, awareness and education**
- **Encourage research, development, monitoring and cooperation**
- **Report to COP**
- **Effectiveness evaluation**
- **Technical assistance & financial mechanism**

National Implementation Plan

- As per Article 7 of the Convention, India has submitted its NIP on POPs in 2011.
- The NIP was prepared under following 6 components and covered the initial 12 POPs

Activity	Agency
Convention implementation infrastructure at National and State levels	MoEF&CC
Measures in relation to management of POP pesticides including DDT, the only POP pesticide currently being produced and used in India	Hindustan Insecticides Ltd.
Measures in relation to polychlorinated biphenyls (PCBs);	Central Power Research Institute
Measures in relation to unintentionally produced POPs	• National Environmental Engineering Research Institute (CSIR-NEERI) • National Institute for Interdisciplinary Science and technology (CSIR-NIIST) • Central Pollution Control Board (CPCB)
Measures in relation to wastes and contaminated sites;	(CSIR-NEERI)
Project Management, monitoring and evaluation	MoEF&CC

"Regulation of Persistent Organic Pollutants Rules, 2018"

Notification issued on 5th March 2018.

The rule prohibits manufacture, trade, use, import and export of following seven chemicals;

- Chlordecone,
- Hexabromobiphenyl,
- Hexabromodiphenyl ether and heptabromodiphenyl ether (commercial octa-BDE), Tetrabromodiphenyl ether and pentabromodiphenyl ether (commercial penta-BDE),
- Pentachlorobenzene,
- Hexabromocyclododecane,
- Hexachlorobutadine.

Environmentally Sound Management and Final Disposal of Polychlorinated Biphenyls (PCBs) in India

Government endorsed US$ 14.5 Million GEF funded project on 'Environmentally Sound Management and Final Disposal of Polychlorinated Biphenyls (PCBs) in India' on February 13th, 2009

- ✓ Project Initiated in March, 2010 after the project document was signed in February, 2010 (UNIDO & MoEF&CC) but the actual implementation started in May, 2012
- ✓ Phase-out and disposal of 7700 tonnes of PCBs in the country during next five years and further inventorization of PCBs

Development and Promotion of Non-POPs Alternative to DDT

- Approved US$ 50 Million (US$ 40 Million as co-financing and US$ 10 million as grant) GEF funded five year (2014-19) project on 'Development and promotion of non-POPs alternatives to DDT' prepared by UNIDO and UNEP

The project has five major outputs:

- DDT situation analysis in different malaria and kala-azar endemic areas/States of India
- Evaluation of viable alternatives, both chemical and non-chemical
- Evaluation of alternative technologies for the production of compounds such as Dicofol where DDT is used as the raw material/intermediate
- Strengthening of regulatory framework and institutional capacity
- DDT phase out strategy

Challenges Faced by MoEF&CC

- Lack of information from stakeholders such as Industries, Research Institutions etc.
- Lack of research data from India on proposed chemicals
- Poor participation of stakeholders in the meetings organised by MoEF&CC
- Awakening of stakeholders on 11th hour about their needs and priorities
- Proactive participation from stakeholders is essential for full proof preparation of COPs and other negotiations

What next

- Ratification of newly listed POPs
- Update the National Implementation Plan
- Implementation of various rules related to POPs management (Ongoing)

Concluding Remarks

- We cannot live without chemicals: so let us manage them in environmentally sound manner
- Collective efforts are required to ensure effective participation of India in BRS Conventions
- More research is needed to help the Ministry in taking informed decisions
- Research Institutes, NGOs, Academia, Industries and other stakeholders need to take responsibility to provide all the necessary technical assistance required by the Ministry


Thank You!

Protect Human Health and the Environment from POPs

Central Pollution Control Board
Delhi

Persistent organic pollutants are carbon-based compounds that:

- remain intact in the environment for a long time;
- become widely distributed throughout the environment;
- accumulate in fatty tissue of living organisms; and
- are toxic to humans

2

Effects on humans

- cancers
- birth defects
- fertility problems,
- disease susceptibility

3

Objectives of Stockholm Convention: (Article 1)

➢ **Protect human health and the environment from persistent organic pollutants (POPs)**

➢ **Elimination of production and use of intentionally produced POPs**

➢ **Minimization of unintentionally produced POPs**

Elimination of intentionally produced POPs (Article 3)

- Production and use of chemicals in Annex A eliminated (e.g., prohibited)
- Currently listed: aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, PCBs, and toxaphene
- Restricted List –DDT(Restrict its production i.e. Annex B)
- Unintentional Production list- PCDD/PCDF(Annex C)
- PCB use in existing equipment exempt up to 2025

5

OLD POPs UNDER STOCKHOLM CONVENTION-12

Chemical	Pesticide	Industrial Chemical	By product	Status
Aldrin	+			Banned
Chlordane	+			Banned
DDT	+			Banned with restricted use
Dieldrin	+			Banned
Endrin	+			Banned
Heptachlor	+			Banned
Mirex	+			Banned
Toxaphene	+			Banned
Hexachlorobenzene		+	+	Banned
PCB		+	+	Regulation issued 2016
Dioxins			+	Standard Notified
Furans			+	

New 16 POPs

	Chemical	Pesticide	Industrial Use	Annex	Status
1	Alpha hexachlorocyclohexane	+		A	Banned
2	Beta hexachlorocyclohexane	+		A	Banned
3	Lindane	+		A	Banned 2011
4	Chlordecone	+		A	Not registered
5	Hexabromobiphenyl		+	A	Used fire retardants
6	Hexabromocyclododecane		+	A	Not manufactured
7	Hexabromodiphenyl ether and heptabromodiphenyl ether		+	A	Used fire retardants
8	Hexachlorobutadiene		+	A	Not manufactured
9	Pentachlorobenzene	+	+	A & C	Not used

New 16 POPs

	Chemical	Pesticide	Industrial Use	Annex	Status
10	Pentachlorophenol and its salts and esters	+		A	
11	Perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOSF)		+	B	used
12	Polychlorinated naphthalenes		+	A & C	Not manufactured
13	Technical endosulfan	+		A	Banned by SC
14	Tetrabromodiphenyl ether and pentabromodiphenyl ether		+	A	Used fire retardants
15	Decabromodiphenyl ether		+	A	-do-
16	Short-chain chlorinated paraffins		+	A	Used

Preparation of NIP

- During the NIP preparation stage, the ground level situation of all 12 POPs has been assessed through proper inventorization, sample collection, analysis and interpretation.

For the development of the NIP, the MoEF worked closely with

- Central Pollution Control Board (CPCB),
- Ministry of Agriculture (MoA)
- Ministry of Chemicals and Fertilizers (MoCF)
- Department of Chemical and Petrochemical
- Ministry of Power
- Ministry of Health and Family Welfare (MoH&FW)

Action Plan of NIP

- Environmentally Sound Management and Disposal of PCBs
- Development and promotion of non POPs alternatives to DDT
- Implementation of the Best Available Technology (BAT)elimination / reduction of unintentional POPs emissions of the priority industry sectors
- preventing releases of Dioxins and Furans due to burning
- production and promotion of bio-botanical neem derived bio-pesticides as viable, eco-friendly, bio-degradable alternatives to POPs pesticides

Action Plan of NIP contd...

- Identification of sites contaminated by POPs chemicals and of remediation process at the potential hotspots
- Inventorization of newly listed POPs
- National POPs monitoring India program and
- Strengthening institutions and capacity building for effective and efficient implementation of the NIP in India.

Facilities at CPCB TOC Laboratory

The development of National Reference Trace Organics laboratory at CPCB in collaboration with Indo-German Bilateral Programme

The laboratory is first of its kind in India and having State of the Art facilities and International Standards infrastructure facilities for Trace Organics Analysis in various Environmental matrices

CPCB is monitoring sample by using USEPA Method no 8081B, 2007

(i) At Present out of 12 POPs only 9 are measured at CPCB (except Endrine, Toxaphene, Mirex)

(ii) Similarly out of 16 new POPs only 5 are measured(Alpha HCH, Beta HCH, Lindane, Pentachlorobenzene and Endosulfan)

Recent Development on POPs

MoA banned on Mirex and HCB in March 27,2014 and Lindane in March 2011

Recently MoEF& CC notified 7 chemicals out of 16 new POPs as for prohibition on manufacturer vide 29.08.2017. These are

1. Chlordecone
2. Hexabromobiphenyl
3. Hexabromocyclododecane
4. Hexabromodiphenyl ether and heptabromodiphenyl ether
5. Hexachlorobutadiene
6. Tetrabromodiphenyl ether and pentabromodiphenyl ether
7. Pentachlorobenzene

MoEF& CC notified vide dated 06.04.2016 for regulation of PCBs i.e prohibition of use of PCBs by 31.12.2025

CPCB has been nominated as executing agency for the Project on "Development and Promotion of non POPs alternatives to DDT"

CPCB initiated the Project of POPs in 2003

- To Inventories and determine emission factors for unintentionally formed POPs viz. Hexachlorocyclohexane, Chlorophenols, Cholorobenzenes, chlorinated diphenyl ethers, resulting from the manufacture of selected products (not mentioned in tool kits)
- To develop strategies / technique for minimisation of unintentionally formed POPs

GENESIS OF THE PROJECT

- M/s Ciba submitted a proposal to MoEF in July 2003.
- Ministry of Environmental & Forests accorded approval on March 26, 2004, with no financial commitment on the part of Government of India.
- M/s Ciba engaged Dr. Harald Schoenberger, a German consultant, to support this programme.
- GtZ support in analysis of samples.
- CPCB Co-ordinated the project

IDENTIFIED PRODUCT/ PROCESSES WHERE POPS ARE UNINTENTIONALLY FORMED

1. **Chlorinated copper phthalocyanines**
2. **Triclosan**
3. **Endosulphan**
4. **Lindane**
5. **Pigment 1 Red 2**
6. **Chlorobenzens & Cyanuric Chloride**

Recommendation in the study

- The recovery of trichlorobenzene from converting Lindane residue to trichlorobenzenes should be substantially improved.
- There is urgent action required to secure the open storage of muck which is simply covered by Tarpaulin.
- The best solution to get rid of the muck is high-temperature incineration and flue gas purification according to state to the art
- The incineration of the residues from endosulfan production should be stopped at once as the problem is drastically increased rather than solved.

Future Action plans

- Upgradation of national implementation plans(NIP 2011) can be initiated immediately
- Financial resources required to strengthen Infrastructure facilities of CPCB and RD Laboratory.
- Strengthening of SPCBs Laboratories where POPs chemical industries are largely located particularly Gujarat, Maharashtra, Telanga.
- Increase Awareness among SPCBs on POPs


Thank you

POPs Management

Challenges for India

Piyush Mahapatra
Toxics Link

About Stockholm Convention

The Stockholm Convention on Persistent Organic Pollutants is a global treaty to protect human health and the environment from chemicals that remain intact in the environment for long periods.

Stockholm Convention, which was adopted in 2001 and entered into force in 2004. There are 182 parties who were part of the Stockholm convention and 152 countries are signatories of the convention. United States, Israel, Italy, Malaysia, Brunei Darussalam, Haiti have not ratified the SC.

- Importance of Stockholm Convention

  As set out in Article 1, Stockholm Convention on Persistent Organic Pollutants was formulated with an objective of "Protecting human health and the environment from persistent organic pollutants"

Provisions of Stockholm Convention

- Prohibit and/or eliminate the production and use, as well as the import and export.
- Annex A allows for the registration of specific exemptions for the production or use of listed POPs, in accordance with that Annex and Article 4, bearing in mind that special rules apply to PCBs.
- Restrict the production and use, as well as the import and export, of the intentionally produced POPs that are listed in Annex B to the Convention
- Reduce or eliminate releases from unintentionally produced POPs that are listed in Annex C to the Convention (Article 5).
- Ensure that stockpiles and wastes consisting of, containing or contaminated with POPs are managed safely and in an environmentally sound manner.
- To target additional POPs.

POPs listed in Convention

Annex A (Elimination)

Chemicals which are listed to be eliminated from production and use are listed under Annex A. But there are specific exemptions for use or productions are listed in the Annex and apply only to Parties that register for them.

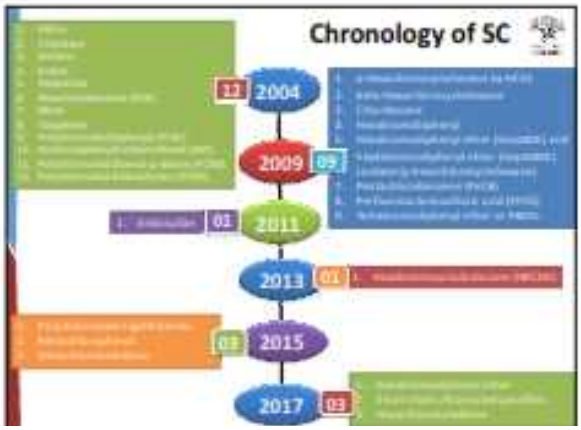
Annex B (Restriction)

Chemicals for which measures are taken to restrict their production and use are listed under Annex B in light of any applicable acceptable purposes and/or specific exemptions listed in the Annex.

Annex C (Unintentional production)

Chemicals which are Unintentional releases are listed under Annex C. with the goal of continuing minimization and, where feasible, ultimate elimination.

Chronology of SC



Stockholm Convention

- There are 28 chemicals both Intentional and Unintentional POPs have been included in SC.
- In 2004 following chemicals have been designated as POPs
  - Aldrin (Annexure-A)
  - Chlordane (Annexure-A)
  - Dieldrin (Annexure-A)
  - Endrin (Annexure-A)
  - Heptachlor (Annexure-A)
  - Hexachlorobenzene (HCB) (Annexure A & C)
  - Mirex (Annexure-A)
  - Toxaphene (Annexure-A)
  - Polychlorinated biphenyls(PCBs) (Annexure C)
  - Dichlorodiphenyltrichloroethane(DDT) (Annex B)
  - Polychlorinated dibenzo-p-dioxins(PCDD) (Annexure C)
  - Polychlorinated dibenzofurans (PCDF) (Annexure C)

Conti...

In 2009, 9 new POPs were included in the list. These modifications have come into force on 26 August 2010.

- α-Hexachlorocyclohexane (α-HCH) (Annexure-A)
- beta-Hexachlorocyclohexane (Annexure-A)
- Chlordecone (Annexure-A)
- Hexabromobiphenyl (Annexure-A)
- Hexabromodiphenyl ether (hexaBDE) and heptabromodiphenyl ether (heptaBDE)
- Lindane (γ-hexachlorocyclohexane) (Annexure-A)
- Pentachlorobenzene (PeCB), (Annexure A and C)
- Perfluorooctanesulfonic acid (PFOS) (Annexure B)
- Tetrabromodiphenyl ether or PBDEs

Fifth Conference of Parties, May, 2011

- Endosulfans was added to the list (Annexure-A)

Sixth Conference of Parties, April–May, 2013

- Hexabromocyclododecane (HBCDD) (Annexure-A)

Cont...

Seventh Conference of Parties in May 2015.

- Polychlorinated naphthalenes (Annexure-A)
- Pentachlorophenol (Annexure –A)
- Hexachlorobutadiene (Annexure A)

Post eighth meeting held from 24 April to 5 May 2017 two POPs were included

- Decabromodiphenyl ether (Annexure A)
- Short-chain chlorinated paraffins (Annexure A)
- Hexachlorobutadiene (Annexure C)

Chemicals which are proposed for listing under the convention are as follows:

- Dicofols
- Pentadecafluorooctanoic acid
- Perfluorohexane sulfonic acid

Challenges from Old POPs

- Polychlorinated biphenyls(PCBs) (Annexure A & C)
- Dichlorodiphenyltrichloroethane(DDT) (Annex B)
- Polychlorinated dibenzo-p-dioxins(PCDD) (Annexure C)
- Polychlorinated dibenzofurans (PCDF) (Annexure C)
- Hexachlorbenzene (Annexure A and C)

New POPs

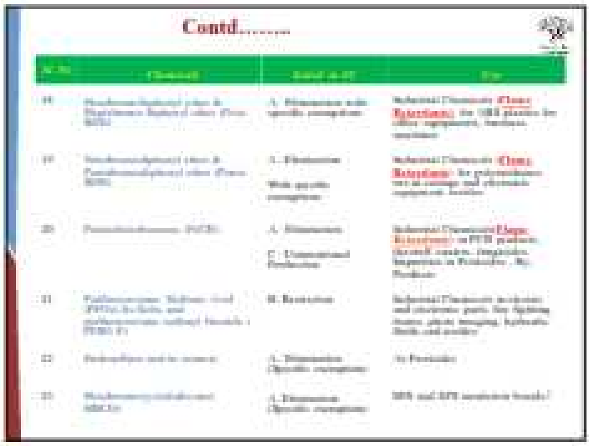
Sl. No.	Chemicals	Listed in SC	Use
13	Alpha Hexachlorocyclohexane (Alpha HCH)	A- Elimination	Pesticide (By Product of Lindane)
14	Beta Hexachlorocyclohexane (Beta HCH)	A- Elimination	Pesticide (By Product of Lindane)
15	Chlordecone	A- Elimination	[illegible]
16	Hexabromobiphenyl (HBB)	A- Elimination	Industrial Chemicals (Flame Retardants) [illegible]
17	Lindane	A- Elimination with specific exemption for pharmaceuticals use	Pesticide (Control of [illegible]) [illegible] pharmaceutical use

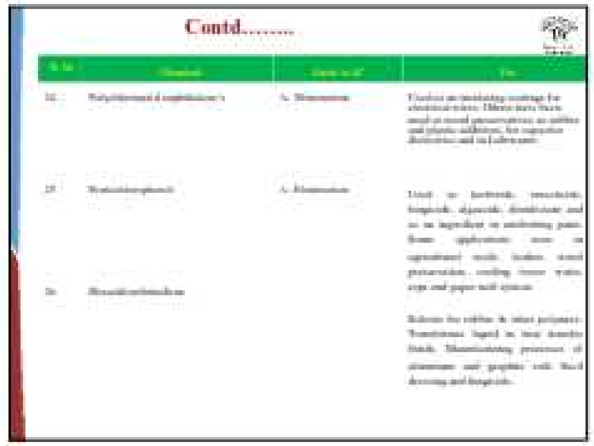
New POPs

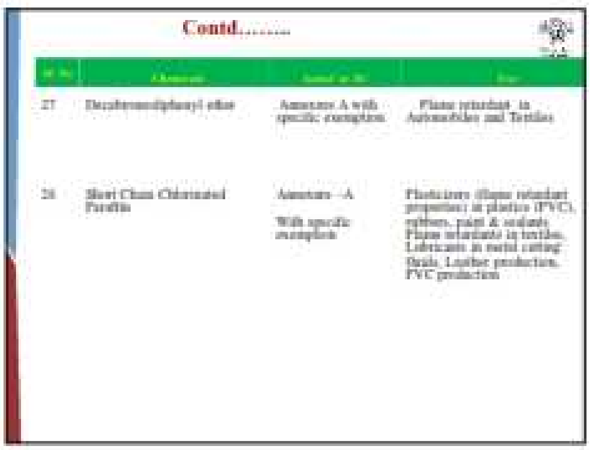
Sl. No.	Chemicals	Listed in SC	Use
13	Alpha Hexachlorocyclohexane (Alpha HCH)	A- Elimination	Pesticide (By Product of Lindane)
14	Beta Hexachlorocyclohexane (Beta HCH)	A- Elimination	Pesticide (By Product of Lindane)
15	Chlordecone	A- Elimination	[illegible]
16	Hexabromobiphenyl (HBB)	A- Elimination	Industrial Chemicals (Flame Retardants) [illegible]
17	Lindane	A- Elimination with specific exemption for pharmaceuticals use	Pesticide (Control of [illegible]) [illegible] pharmaceutical use

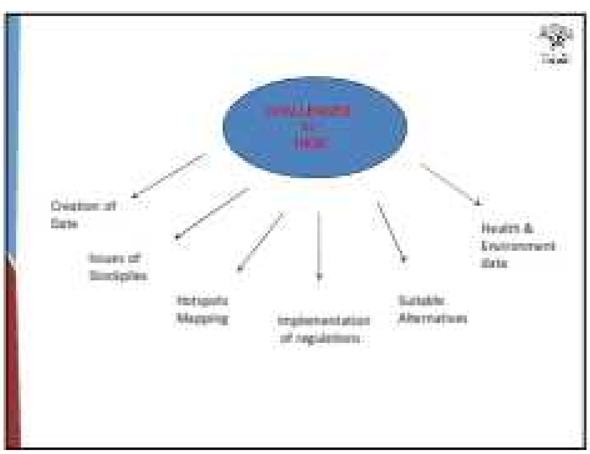
Contd........

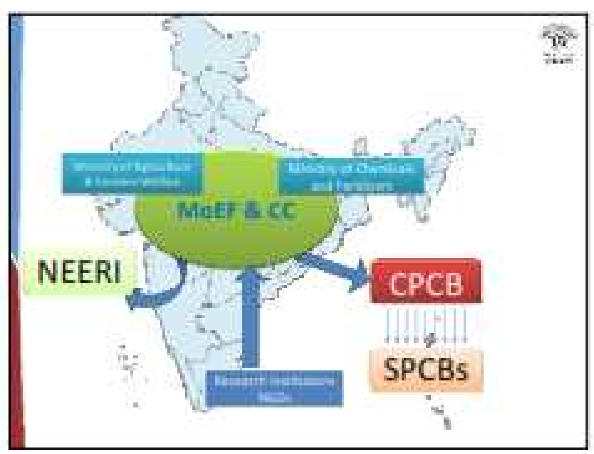
Sl. No.	Chemicals	Listed in SC	Use
18	Hexabromodiphenyl ether & Heptabromo diphenyl ether (Pent BDE)	A- Elimination with specific exemption	Industrial Chemicals (Flame Retardants) [illegible]
19	Tetrabromodiphenyl ether & Pentabromodiphenyl ether (Pent BDE)	A- Elimination With specific exemption	Industrial Chemicals (Flame Retardants) [illegible]
20	Pentachlorobenzene (PeCB)	A- Elimination C- Unintentional Production	Industrial Chemicals (Flame Retardants) [illegible]
21	Perfluorooctane Sulfonic Acid (PFOS) [illegible]	B- Restriction	Industrial Chemicals [illegible]
22	Endosulfans and its isomers	A- Elimination (Specific exemption)	As Pesticides
23	Hexabromocyclododecane (HBCD)	A- Elimination (Specific exemption)	EPS and XPS insulation boards

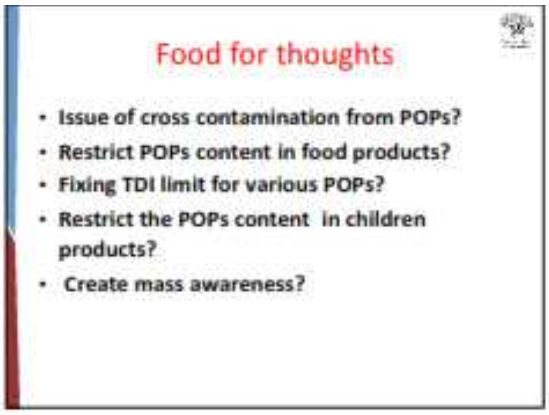

Contd........


Contd........

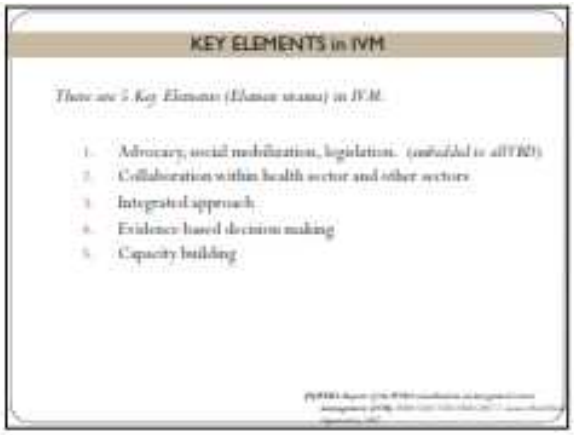

Contd........
27 Decabromodiphenyl ether
Annexure A with specific exemption
Flame retardant in Automobiles and Textiles
28 Short Chain Chlorinated Paraffin
Annexure -A
With specific exemption
Plasticizers (flame retardant properties) in plastics (PVC), rubbers, paint & sealants. Flame retardants in textiles, Lubricants in metal cutting fluids, Leather production, PVC production


Creation of Data
Issues of Stockpiles
Hotspots Mapping
Implementation of regulations
Suitable Alternatives
Health & Environment data

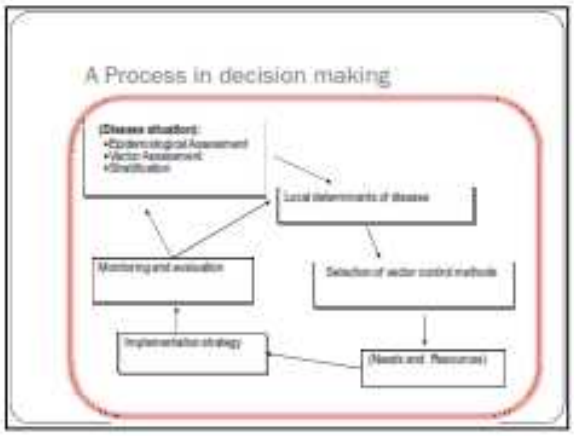

Ministry of Agriculture & Farmers Welfare
Ministry of Chemicals and Fertilizers
MoEF & CC
NEERI
CPCB
SPCBs
Research Institutions


Food for thoughts
• Issue of cross contamination from POPs?
• Restrict POPs content in food products?
• Fixing TDI limit for various POPs?
• Restrict the POPs content in children products?
• Create mass awareness?

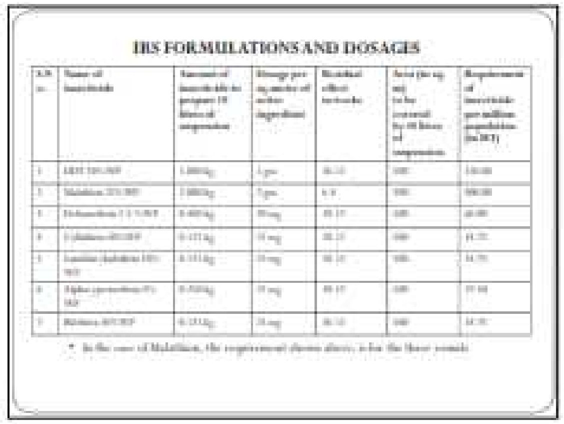

Thanks

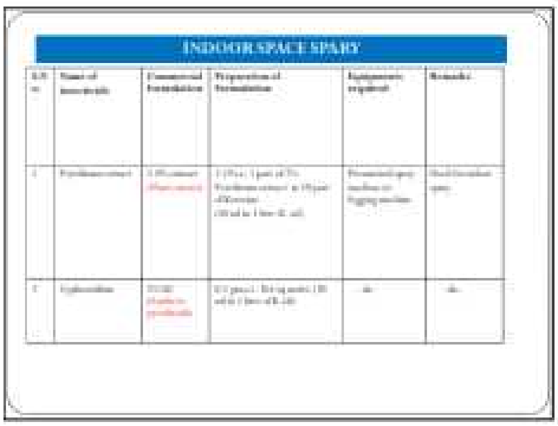


KEY ELEMENT	Description
Advocacy, social mobilization and legislation	Promotion and embedding of IVM principles in the development policies of all relevant agencies, organizations and civil society; establishment or strengthening of regulatory and legislative controls for public health; empowerment of communities
Collaboration within the health sector and with other sectors	Consideration of all options for collaboration within and between public and private sectors; application of the principles of subsidiarity in planning and decision making; strengthening channels of communication among policymakers, sector heads, disease control programme managers and other IVM partners
Integrated approach	Better rational use of available resources through a multi-disease control approach; integration of non-chemical and chemical vector control methods; and integration with other disease control measures
Evidence-based decision-making	Adaptation of strategies and interventions to local ecology, epidemiology and resources, guided by operational research and subject to routine monitoring and evaluation
Capacity-building	Development of essential physical infrastructure, financial resources and adequate human resources at national and local level to manage IVM strategies based on a situation analysis




CONTROL


IRS FORMULATIONS AND DOSAGES


INDOOR SPACE SPARY


OUTDOOR FOGGING


LARVICIDE FORMULATIONS AND DOSAGE


LARVICIDE FORMULATIONS AND DOSAGE

INDOOR RESIDUAL SPRAY

- Vector control is an important strategy for interrupting the transmission of malaria, especially in areas where the incidence is high.
- The reduction in the density of mosquitoes can be achieved through several methods that include indoor residual spraying
- The use of insecticide for reducing population of malaria vectors continues to be the mainstay of the malaria control in the country

The effectiveness of IRS depends on

- Adherence to the specified criteria of the insecticide
- Use of well maintained equipment
- Correct application procedure
- Public acceptance of spraying
- Adequately trained personnel
- Effective supervision.

INDOOR RESIDUAL SPRAY

To control malaria vectors, Indoor Residual spray (IRS) is being carried out with DDT 50% WP, Malathion 25% WP and synthetic Pyrethroid (SP).

- Synthetic Pyrethroids include: Deltamethrin 2.5% WP, Cyfluthrin 50% WP, Lambdacyhalothrin 10% WP, Alphacypermethrin 5% WP and Bifenthrin 10%WP

Indoor Residual spray

The application of an insecticide, having a property of a long residual effect in suspension form which on drying, leaves a crystalline deposit of active ingredient on the sprayed surface.

Effectiveness depends on ....

Anopheline mosquito

- Resting behavior
- Residual efficacy
- Irritability / exito-repellency
- Human customs/ occupation

IMPLEMENTATION OF INTEGRATED VECTOR CONTROL STRATEGIES

- **Integrated Vector Management being promoted and includes**

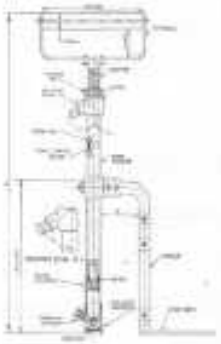
Source Reduction through environmental management

- Biological control: Use of larvivorous fish
- Use of larvicides like Bacillus thuringiensis var israelensis H-14
- Insecticide Treated Nets (ITN)/LLINs
  - Free distribution to the below poverty line population and at subsidized rates to other populations in high risk areas
  - Social marketing initiatives through public private partnership
  - Promotion of insecticide impregnation of commercially owned bed nets
  - Promotion of Long lasting nets
- **Selective Indoor Residual Insecticide Spray**

Spray Technique

- Nozzle distance from spray surface – 18"
- The discharge rate should be 540 to 660 ml per minute.
- To obtain the above discharge rate, the pump man should give 30 to 36 strokes per minute with a 6" plunger movement at a pressure of 10.55 (0.7 kg/sq cm) at the nozzle tip.
- Spraying into a bucket for one minute and measuring the quantity of the suspension in a graduated mug should check the correct discharge rate (600 to 720 ml/minute).
- The nozzle tip should be discarded if the discharge rate exceeds 720 ml per minute.
- **It takes about 1 minutes to spray a house with an average surface area of 150 sq. metres.**

Stirrup pump for IRS



A pump, with foot rest & stirrup, for producing spray.

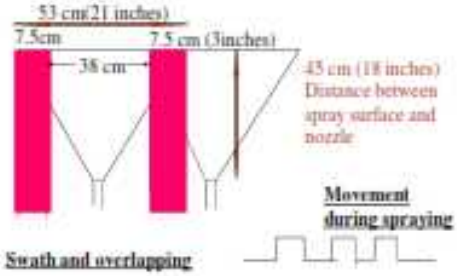
Stroke

The maximum travel of the piston rod in one direction When the handle moves from its lowest possible position to its highest possible position.

Travel Limiting Device

A device for limiting the stroke

Spray Technique



Use of Protective Measures

Personal Protection for Spray workers

- Under ECoR PPE is provided as per norms and supplied alongwith DDT bags with Plastic sheet for covering food & household items from NVBDCP

Stirrup Pump

ADVATAGES

- Stirrup pumps for IRS are used under Programme since inception
- Insecticide spray suspension is thick and requires continuous stirring to avoid settling of insecticide. Stirring is easy in bucket & insecticide is not allowed to settle.
- Spray team and workers are tuned to use stirrup pumps during IRS.
- Pressure is maintain with continuous strokes
- The length of the hose of stirrup pump is usually 5 meter which helps in reaching the long corners of the room.
- Two persons are needed, one to pump and one to direct the spray. The persons directing spray can move freely even in smaller rooms while the pump man is outside the house.
- Washing of pump is easy.

ISSUES

- Two persons are needed per pump hence more Human resource required.

Criterion for Resistance

- 98% - 100% Mortality – Susceptible
- 91% - 97% Mortality - Verification
- < 90% Mortality - Resistant

Spraying with Stirrup Pumps

Hand Compression Pump


ADVATAGES

- One person is needed per pump hence less Human resource

ISSUES

- Carrying pump with 10 ltrs of suspension becomes an issue due to its weight.
- Insecticide spray suspension is thick and requires continuous stirring to avoid settling of insecticide. Stirring in pump is difficult & insecticide settles in pumps.
- Nozzle tips gets choaked & hamper the spray
- Pressure gets diluted which effects the spray dose
- Washing /cleaning of pumps is required during spray which is difficult

Hand Compression Pumps




LARVICIDE FORMULATIONS

- Formulation can be;
  - DT = tablet for direct application
  - GR = granule
  - EC = emulsifiable concentration
  - WG = water-dispersible granule
  - WP = wettable powder




COMMONLY USED LARVICIDES

- Organophosphates or OP;
  - Highly usage - insecticide resistance on the rise.
  - highly toxic to fish, some bird species and it is toxic to bees.
- Alternative insecticides
  - bacterial larvicides,
  - juvenile hormone mimics (insect growth regulators),
  - benzoylureas (insect growth regulators)
  - More specific to mosquito larvae, thus with less side effects on non target organisms.

ORGANOPHOSPHATES

- Commonly used insecticide for larval control in water storage containers
  - Temephos and methoprene at dosages not exceeding 1 mg of active ingredient (ai) per litre (1 ppm),
  - Pyriproxyfen at dosages not exceeding 0.01 mg ai per litre (0.01 ppm)
  - Can be used for treatment of drinking-water?

INSECT GROWTH REGULATORS - IGR

- IGR - chemical compounds prevent mosquito larvae to develop into adults.
- 2 types;
  - juvenile hormone mimics, such as pyriproxyfen, which prevent the development of larvae or pupae into the next stage, and
  - chitin synthesis inhibitors, such as diflubenzuron and novaluron, which disrupt the molting process of larvae.
- The main disadvantage of the use of IGR is their high purchase cost.

BACILLUS THURINGIENSIS ISRAELENSIS (Bti)

- Bti is a bacterium that produces several toxins which are highly specific to killing the larvae of mosquitoes after ingestion. The bacteria damage the gut of the mosquito larvae, causing the larvae to starve to death, especially effective for use in clear water.
- Bti has no effect other groups of insects. It is harmless to fish, mammals and humans at normal dosages.
- The residual activity of Bti in the field is rather low, because it breaks down in the environment.
- Some new formulations are providing a longer residual activity, up to 23 weeks*.

* Becker N. et al. 2010. Bacillus thuringiensis var. israelensis (Bti) Provides Residual Control of Aedes at 9 and 16 Small Containers.

USING SPRAY EQUIPMENT OR MACHINE

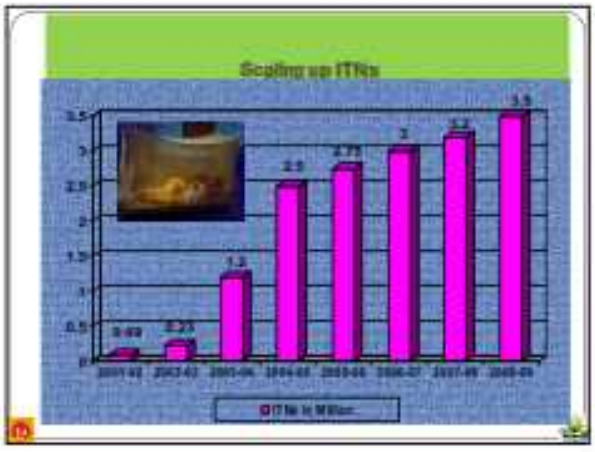
USING SPRAY EQUIPMENT OR MACHINE

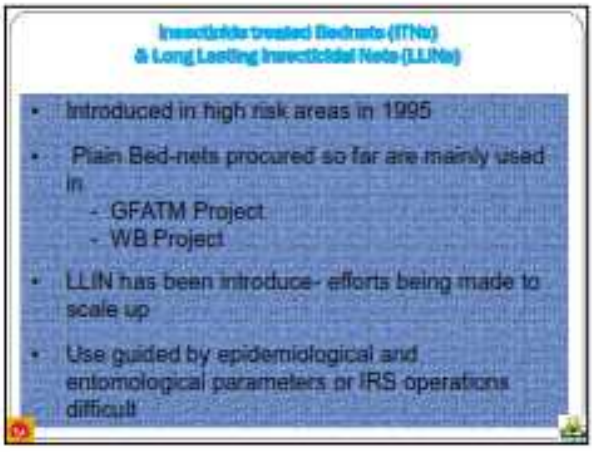
LARVICIDE APPLICATION - BTI


Poecilia reticulata (GUPPY


Scaling up of LLIN
LLIN in Million
LLIN
2008
2010
2011 (Under Process)
Year


INTEGRATED VECTOR MANAGEMENT


Scaling up ITNs


Insecticide treated Bednets (ITNs)
& Long Lasting Insecticidal Nets (LLINs)
Introduced in high risk areas in 1995
Plain Bed-nets procured so far are mainly used in
- GFATM Project
- WB Project
LLIN has been introduce- efforts being made to scale up
Use guided by epidemiological and entomological parameters or IRS operations difficult


THANK YOU

A Presentation on

Phase out of DecaBDE under the Stockholm Convention

Dr. Rashid Hasan, Advisor

Society of Indian Automobile Manufacturers

Structure of Presentation

- About POPs & Polybromo-diphenyl ethers (PBDEs)
- Production and Use of DecaBDE
- Inventorization, Monitoring and Management of PBDEs
- Banning of 7 POPs including PBDEs by GoI in 2017
- Commercial DecaBDE in automotive Sector
- Non-POPs Alternatives of DecaBDE
- PBDEs in National Implementation Plan
- Management of DecaBDE in End of life of Vehicles (ELV)
- Challenges and Way Forward

POPs Evolution

1962 - Rachel Carson's "Silent Spring".

70's & 80's - Many governments take national action.

90's - Work on POPs begun in various forums.

June 1996 - Intergovernmental Forum on Chemical Safety
- > concludes that urgent global action on the 12 POPs was warranted;
- > develops recommendations

February 1997 – UNEP/GC Decision 19/13C
- > Establishes POPs Intergovernmental Negotiating Committee (INC) to develop global POPs treaty

May 2001 - Conference on Stockholm Convention
- > 120 countries participated in the Conference;
- > 92 countries and the EC signed the treaty
- >The Convention was adopted in May 2001

May 17, 2004- Convention enter into force

Polybromo-diphenyl ethers (PBDEs)

- PBDEs (including deca-BDE) are Brominated Flame-Retardants (BFRs)- produced since 1970
- BFRs are very persistent, very bio-accumulative substance
- Pathway through food chain but can occur during its production, use and disposal
- Status of PBDEs:
  - Commercial Pentabromodiphenyl ether (c-PentaBDE) and Octabromodiphenyl ether (c-OctaBDE) production stopped in 2004 in advance countries
  - c-DecaBDE is still produced commercially
  - In May 2017, Deca-BDE added in Annex A
  - GoI is granted specific exemption for 10 yrs

PBDEs: Characteristics & Impact

PBDEs are carbon-based organic compounds characterized by

ADVERSE TOXIC EFFECTS
- > PBDEs are toxic to humans and wildlife.

BIOACCUMULATION
- > PBDEs become widely distributed throughout the ecosystem

PERSISTENCE
- > PBDEs remain intact in the environment for a long time.

LONG-RANGE TRANSPORT
- > PBDEs accumulate in fatty tissue of living organisms.

>PBDEs have Global Impact

PBDEs Have Become Ubiquitous Environment Contaminants

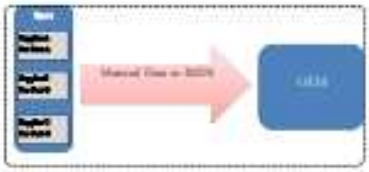
PBDEs are reported in
- Indoor and outdoor air
- Remote Arctic regions (i.e., long-range transport)
- House and office dust
- Rivers and lakes and sediments
- Sewage sludge
- Foods
- Biota (terrestrial and marine mammals, fish, humans)

Use of DecaBDE in Automotive Components

- DecaBDE as flame retardants used worldwide in auto components.
- PBDEs listed in Stockholm Convention, which need to be reached in such automotive components.
- It is also used in powertrain under hood and interior applications like battery main wire, battery wire, exhaust manifolds backing, under-hood insulation, speed sensors, brass fan modules, trim panes, covers, seat belts, seat covers, upholstery etc.

Material Data Collection Process: International Materials Data System (IMDS)

- IMDS is a Materials database obligatory on OEMs
- Accessed via the Internet to collect parts structure and material composition data for vehicle components.



How does IMDS work?

1. OEM's contacts supplier to submit IMDS as part of PPAP/ internal requirements
2. Suppliers enter materials composition of parts into IMDS database (as per customer requirement)
3. Data is transferred along the supply chain:
   OEM←T1←T2←T3.....
4. Customer (i.e. car makers) reviews IMDS data – accepts/rejects the data
5. Data used to analyse hazardous substance content, Recyclability impact analysis etc.

List of POPs Banned in India recently

MoEF&CC banned Persistent Organic Pollutants (POPs) in India in March 2018:

i) Chlordecone;
ii) Hexabromobiphenyl;
iii) Hexabromodiphenyl ether and heptabromodiphenyl ether (commercial octa-BDE);
iv) Tetrabromodiphenyl ether and pentabromodiphenyl ether (commercial penta-BDE);
v) Pentachlorobenzene;
vi) Hexabromocyclododecane and
vii) Hexachlorobutaline

Note: Brominated decaBDE component has got exemption for up to 10 yrs.

Replacement of PBDEs

- A number of non-POP chemical alternatives are already are available in Europe, USA, Japan
- Validation of alternatives for performance, cost-effectiveness

Inventorization and reporting of PBDEs

- Data on **production and use** of POP-BDE- in automotive sector
- The names and addresses of industry/company responsible for handling POP-BDE containing materials
- Details of the treatment of waste before disposal
- Records/profile of site contamination
- Details of the clean-up process of contaminated site(s)
- Information on the monitoring of contaminated sites
- Records of on-going monitoring and research

Recycling of PBDEs from End-of-Life Vehicles (ELVs)

- PBDEs contaminated auto-parts are not recommended for recycling
- BDEs containing ELVs are disposed in landfills/dumps or incinerated
- Recycling of BDEs containing material from ELVs might contaminate the recycled products made from it
- Extent of recycling/separation should be quantified (inventory), and technologies and approaches used should follow BAT/BEP guidelines

Inclusion of PBDEs in India's National Implementation Plan

- NIP-2011 envisages elimination & restriction strategies only for 12 POPs
- Strategies for final elimination & disposal of PBDEs
- Development and promotion of non-POPs alternatives for PBDEs
- Implementation of the best available technology (BAT) and the best environmental practices (BEP) for eliminating PBDEs
- Management of PBDEs & its waste to eliminate from the recycling chain
- Capacity building for handling PBDEs
- Identification of sites contaminated with PBDEs and remediation options
- Strengthening of institutions for effective implementation of the NIP

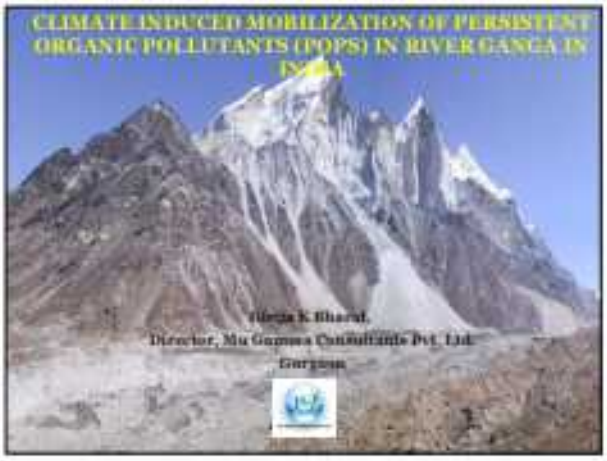
Challenges

- Ensuring implementing International Materials Data System in Automotive Sector (not practiced in India)
- Lack data collection, collation, data analysis for policy decision making
- Inadequate strategies for elimination of PBDEs from the environment
- Lack of technical capacity amongst the stakeholders across the supply chain
- Lack of awareness about Stockholm amongst stakeholders
- Weak compliance and enforcement
- Alternate substances need validation for part's performance, cost-effectiveness etc.
- Lack of information on clean re-cycling technology-BAT/BEP not followed

The Way Forward

- Establish a dedicated Policy, legislative and Regulatory framework
- Prepare database for informed decisions & effective management
- Monitor PBDEs in human population through epidemiological studies.
- Focus on phasing out 16 newly added POPs under the Stockholm Convention
- Involve the public and agriculturists to ensure sustainable use of pesticides
- Undertake capacity building and ensure cross-boundary collaboration
- Establish a separate cell for monitoring and follow-up of POPs in MoEF&CC/CPCB

Thanks



TIMING OF EXPOSURE – A MOST CRITICAL FACTOR

During "fetal programming": permanent changes

During adulthood: homeostasis compensates

During different life stages: different effects

Timing of exposure determines: type and severity of effects

- Exposure during the "programming" period in the fetal stage may result in permanent changes.
- Exposure during adulthood tends to be compensated by homeostasis and may not result in detectable effects.
- Exposure to the same level during different life stages may produce different effects.
- Timing of exposure will determine both the nature and severity of effects.

Body burden of POPs

LIFETIME EXPOSURES

Context

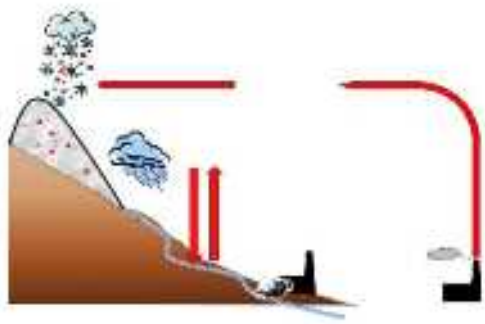
- High Concentrations of POPs has been reported from ambient air in India, primarily due to agriculture, industrial effluents, electronic wastes and ship breaking industries
- Persistent Organic Pollutants (POPs) atmospheric deposition are driven by direct condensation, atmospheric particle deposition and wet depositions. Cold regions such as the polar areas and mountain glaciers are key target for POP deposition behaving as "cold condensers" and effective long term storage compartments. Climate change can potentially lead to re-mobilization of POPs
- Peculiar air masses circulation in the Indian subcontinent and the unique Indian topography promote deposition of pollutants in Himalayan high altitude regions, where both deposition and cold condensation processes address them to incorporation into glaciers.
- Climate Change and its impacts on melting response of Himalayan glaciers, has the potential to increase the POP concentration in river waters of N. India, and its consequential impacts on human populace make this study highly significant.

Context (contd.)

- Glaciers are natural reservoirs of SVOCs emitted during the past decades. Himalayan glaciers receive atmospheric inputs both from long-range atmospheric transport and from the highly-impacted Indian subcontinent and south east of Asia (Kang et al., 2009; Wang et al., 2008).
- Release of SVOCs from glacial meltwater has been investigated through both models and monitoring (Bogdal et al., 2009; Gabrielli et al., 2010; Morselli et al., 2014).
- The predominant glacial origin of these contaminants in the Himalayan reach was demonstrated using air-water fugacity ratios and mass balance analysis.

- Glaciers as an important secondary source of POPs

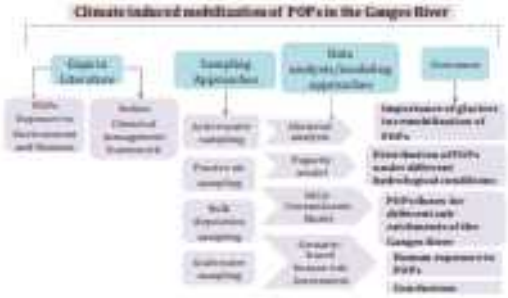
- POPs circulation to remote regions



Objectives

- To monitor SVOCs including POPs (OCPs, PCBs, PAHs, and PFAS) levels and sources in the Ganges river ecosystem under different hydrological conditions
- To correlate the fluxes of pollutants transported in selected sections of the Ganges River with different climatic and hydrological conditions
- To assess the occurrence of a relationship between levels of POPs in the Ganges River ecosystem with the levels of POPs in drinking and irrigation water

Approach



Gaps in literature: Environment and Human exposure

- Common beliefs consider India as a hotspot of POPs contamination
  - No systematic analysis available considering past data
- Available data are highly fragmentary and typically refer to rural or urban areas
  - Information on background environment contamination is scarce
- Data is abundant for legacy contaminants
  - Little information is available on emerging POPs
- Most of the studies were generated by different research groups using different sampling and analytical methods
  - Lack of inter-calibration, which makes it hard to give a country level scenario
- Lack of basin scale or regional scale monitoring
- Monitoring seems to be a sole responsibility of research organizations

Gaps in literature: Environment and Human exposure

Gaps in literature: Chemical management framework

- Fragmentary legislative chemical management framework (a shift in paradigm is evolving lately)
  - Involved various jurisdiction and complex in nature
  - Retrospective approach for chemical management
- Missing a dedicated strategic-framework for the management of priority classes of pollutants
- Lack of investments for analytical and emission reduction technology for "old" and "new" pollutants
- Missing concept of "Public participation and awareness"
- Double standard in Environmental protection level between developed and developing countries

Gaps in literature: Chemical management framework

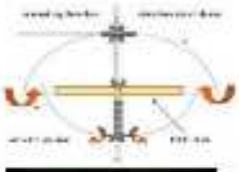
Methodology

- Sampling methods
  - High volume active water sampling

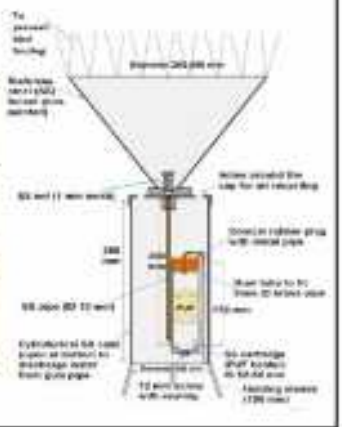
Filter after sampling

Active Sampling of river water

Passive air sampling



Bulk deposition

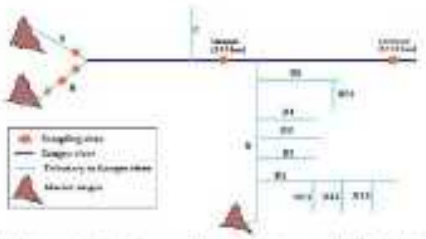


Passive water sampling

Grab water sampling (for polar contaminants, i.e. PFAS)

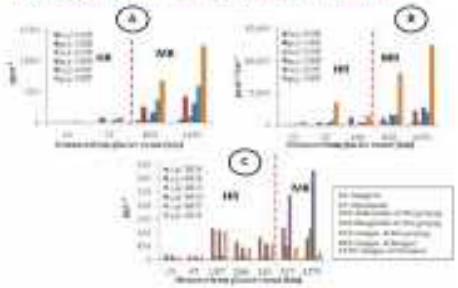
- Analytical methods: Chemical Analysis
  - Extraction
  - Measurement

Selected study area for this study (Gangotri (HR, 19 km), Uttarkashi (HR, 97 km), Devprayag 1 (HR, 200 km) on the Bhagirathi River; Devprayag 2 (HR, 185 km) on the Alaknanda River; Devprayag 3 (HR, 210 km), Kanpur (MR, 855 km), and Varanasi (MR,1270 km) on the main stream of the Ganges.

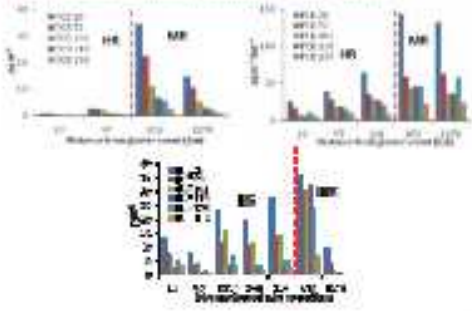


Sketch showing the Ganges River structure and its tributaries in upper Himalayan Reach and middle Gangetic Reach. These tributaries include glacial and snowfed, and rainfed streams. ([A]Alaknanda, [B]Bhagirathi, [C]Ramganga, [D]Yamuna ([D1]Chambal, [D2]Kali, [D3]Parbati, [D4]Banas, [D5]Sind, [D6]Betwa, [D7]Hind, [D8]Ken, [D9]Banger)).

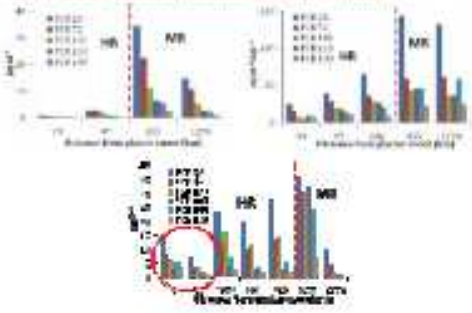
Concentration of DDTs in the upper Himalayan Reaches (A-Air, B-Bulk deposition (Rainwater), C-River Water)



Concentration of PCBs in the upper Himalayan Reaches (A-Air, B-Bulk deposition (Rainwater), C-River Water)



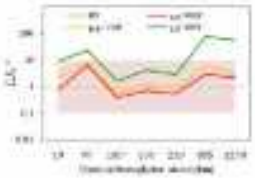
Concentration of PCBs in HR (A-Air, B-Bulk deposition (Rainwater), C-River Water)



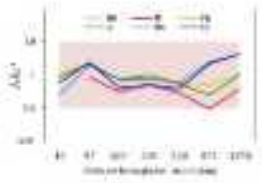
- **Dominant source of SVOCs:**
  - Meltwater or atmosphere?
  - Fugacity concept
    - Fugacity Ratio = f_{air}/f_{water}
    - $f_w = C_w * H$
    - $f_a = C_a * R * T_a$
    - $f_{air} > f_{water}$: atmosphere
    - $f_{air} < f_{water}$: meltwater/water

(Mackay et al., 1991)

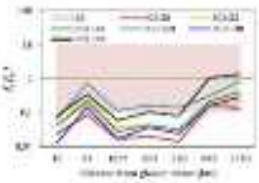
- Dominant source for DDT
  - Atmosphere > reemission from the meltwater



- Dominant source for gaseous PAHs
  - Source is likely to be atmosphere (air and water are at equilibrium)

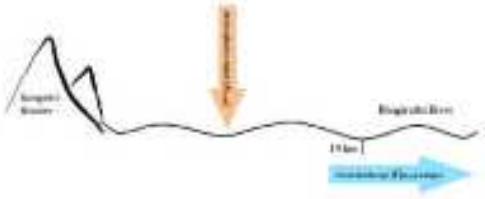


- Dominant source for gaseous PCBs
  - **Different story than DDTs and gaseous PAHs**

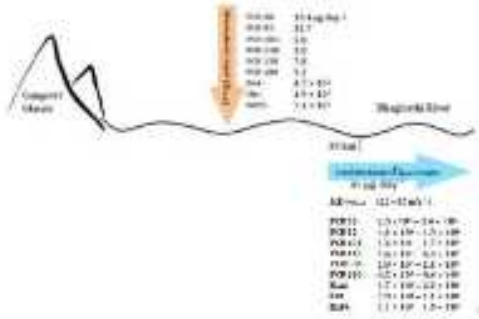


- Concerning PCBs, the observed fa/fw values were typically lower than 0.1 (except for PCB 118 and PCB 180 for which fa/fw ranged between 0.05 and 0.7), which indicated volatilization in the HR and supported the dominant glacial source hypothesis. Despite the generally low concentrations in water, volatilization of PCBs occurred throughout the HR during the period of the campaign, while air-water exchange tended to approach equilibrium (especially for the less soluble compounds namely, PCB 101, PCB 118, PCB 138 and PCB 180) at the lowest sampling point (1270 km)
- The different behavior displayed by PCBs (compared to DDT and gaseous PAHs) was essentially due to the very low atmospheric concentrations observed for this group. Measured atmospheric concentrations were nevertheless consistent with previous data from pristine and semirural areas exposed to background levels and receiving PCBs from long-range atmospheric transport.

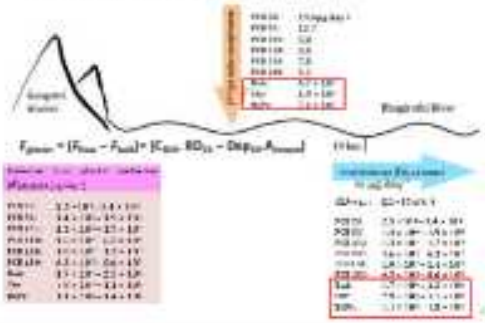
- **Meltwater release of PCBs and particulate PAHs:**
  - Glacier meltwater emission vs. atmospheric deposition



- **Meltwater release of PCBs and particle associated PAHs:**
  - Glacier meltwater emission vs. atmospheric deposition



- **Meltwater release of PCBs and particle associated PAHs:**
  - Glacier meltwater emission vs. atmospheric deposition



Findings

- Water concentrations of DDTs increased significantly downstream (linear regression model, $P < 0.05$).
- In contrast, PCBs and most PAHs (namely: A, Fl, Fln, Py, BaA, Chr, BaPy) did not display a significant trend with distance from the glacier snout (based on linear and quadratic regression models).
- The analyzed PCBs tended to be 2 to 2.5 times higher at the uppermost sampling point (19 km) than at the next sampling point (97 km).
- Similarly, PAHs routinely measured in water in association with suspended particulate matter (namely: BaA and BaPy) tended to have higher concentrations at 19 km compared to any other location in HR and MR.

Results

1. Remobilization of semi-volatile organic contaminants (SVOCs) from a melting Himalayan glacier

Conclusions

- India, in the time of current rapid economic development and a hotspot for POPs and similar bioaccumulative hazardous pollutants, needs an integrated regulation and approach for chemical pollution management with **effective enforcement.**
- Special attention needed for Himalayan Glacier as this study shows meltwater can be an influential secondary source of PCBs and high molecular PAHs in the HR of the Ganges River. It might be the same scenario for toxic metals (Hg, Cd, Pb etc.) and other bioaccumulative substances.
- A large population might be at the health risk as contamination in surface water receiving wastewater effluents is directly reflected in ground/drinking water resources. This relationship was demonstrated both over regional and local scale.

Further studies

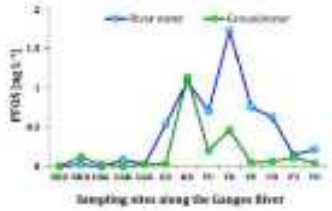
- DDTs
- PCBs
- PFOS
- PAHs
- Pharmaceutical products

- Publications

- Knowledge on emerging POPs such as PFOS (one of the pollutants among perfluoroalkyl substances (PFAS))
  - Widely used in numerous industrial and commercial applications (Buck et al., 2011)
  - Developing countries are now more prone to their environmental and human exposure
    - Delocalisation of their manufacturing units
    - Rapid Socioeconomic transition
    - Feeble environmental regulations
    - Low awareness about their presence and exposure outcomes
  - A very few researches from India (Yeung et al., 2008; Mak et al., 2009; Sun et al., 2009)

- Distribution of PFAS in groundwater/Drinking water from Ganges River basin
  - Out of 21 PFAS, only 14 compounds were frequently detected.
  - Levels and patterns were very similar to those observed in surface water
  - Similar to what was observed in Ganges River water, concentrations of PFDA in groundwater were lower than short-chain PFAS (PFPA, PFHxA, and PFHpA)
    - Indicative of a shift in use to 6:2 fluorotelomer based articles from 8:2 fluorotelomer based articles
  - The observed consistent contamination profile and spatial trends of PFCAs and PFOS indicates that the occurrence of PFAS in groundwater has similar drivers of that in surface water
  - This can be further verified by the distribution patterns of PFOS (mainly of anthropogenic origin) surface and ground water.

- Relationship between groundwater and surface water contamination



Basin scale management is required for Indian Rivers as study shows a tight link between emission and exposure of PFAS and anthropogenic presence in a complex and heterogeneous basin of Ganges River.

Recent publication

Next publication:

Sharma B.M., Bečanová J., Scheringer M., Bharat G.K., Sáňka O., Klánová J., Nizzetto L. Pharmaceuticals, Personal Care Products, and Artificial Sweeteners in surface water and drinking water of the Ganges catchment.

Informal Electronic Waste Recycling is a potential Source for Toxic Organic compounds in India: Atmospheric Transport Models and Human Health Risk Assessment

Paromita Chakraborty, Sakthivel Selvaraj, Balasubramanian Pitchiraj

SRM

Paromita Chakraborty, PHD
Associate Professor
Department of Civil Engineering,
Leading Environmental Science & Technology Research Group
SRM Research Institute, SRM University, India

Outline

E-waste: a global problem?
- Indian Scenario
- Status of Persistent Organic Pollutants -PCDD/Fs and PCBs

Sampling Design
How did we define sampling sites

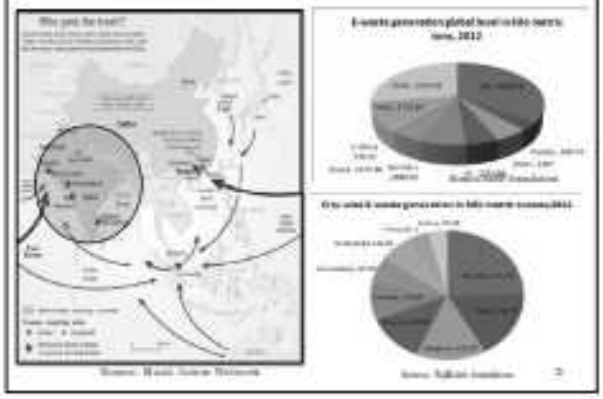
Experimental Set-up
CALUX Assay
Instrumental Analysis

Research Highlights
Soil concentrations
PMF Model and Source Identification
Health Impacts

Electronic waste or E-waste!!!

Estimated Annual Production of E-waste & Major Recycling Sites

Movement of E-waste across the globe



Swachh Bharat for managing E-waste

Informal Recycling and Open burning of E-waste

Informal e-waste recycling in informal recycling sectors involve melting and acid leaching of the e-waste to recover precious metals, but inevitably also make PCBs/PCDD/Fs and other semi-volatile organic substances prone to volatilization

Open burning of e-waste ending in municipal solid waste stream

Emission factors associated with open burning for PCBs/PCDD/Fs could be on the order of 10-20% in terms of masses lost into the atmosphere

Effects on wildlife/humans

- Carcinogenic/ Mutagenic...
- Endocrine Disrupters...

Cancers

Birth defects

Dysfunctional immune, development, and reproductive systems

Fertility problems

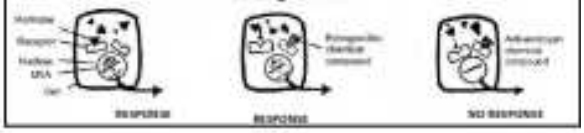
Disease susceptibility

Diminished intelligence

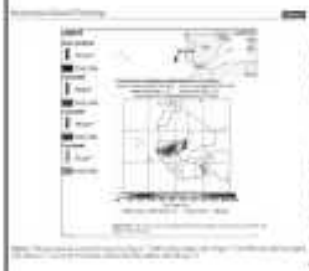
Normal process

Mimicking hormones

Inhibiting hormones



Scenario in Africa



Potential health risk from PCDD/Fs and dl-PCBs to the general population of Ghana because fish is one of their important protein sources.

Ade Kumi et al 2010 Chemosphere

PCBs in dirty silo and obsolete equipment is of concern as potential sources in HUMAN MILK, **and e-waste recycling** with little or no experience in safe handling could be a threat to GHANA.

Asante et al 2011 Environment International

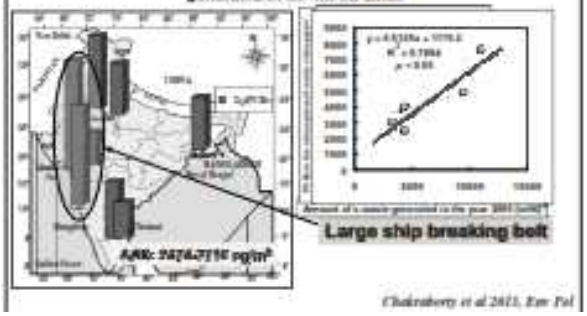
Ghana *et al* 2011 Environ Sci Technol

China

China is the largest importer and recycler of e-waste in the world

E-waste: a newer source

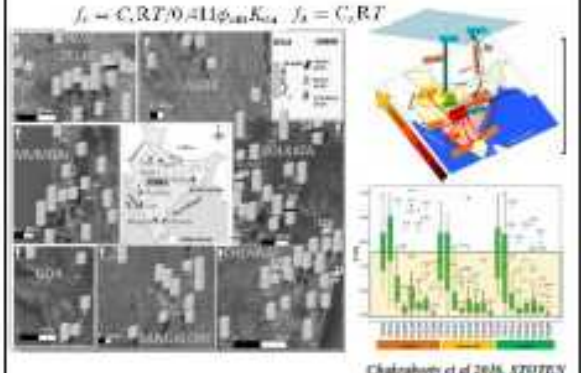
- World's largest ship breaking site is located in the west coast of India
- Significant correlation between atmospheric PCBs and e-waste generated in the-metro cities

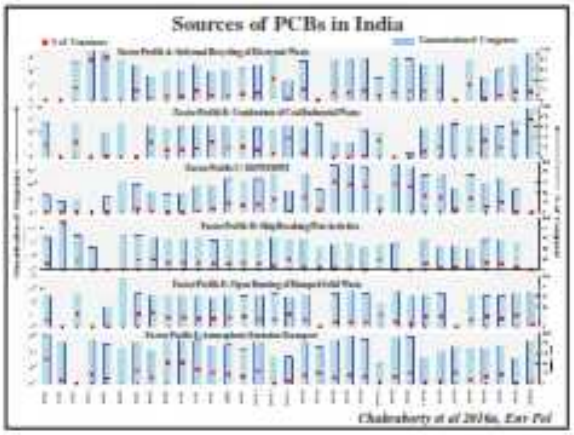


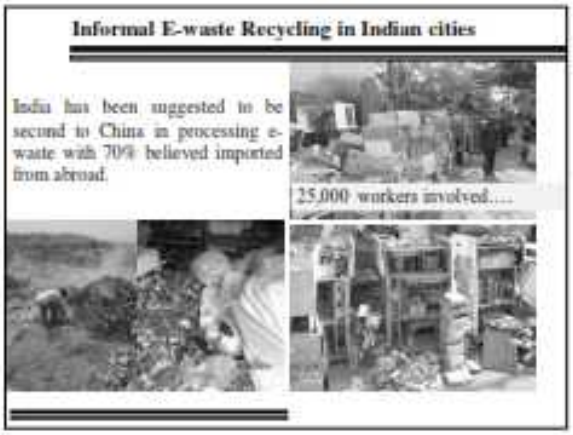
Chakraborty et al 2013, Env Pol

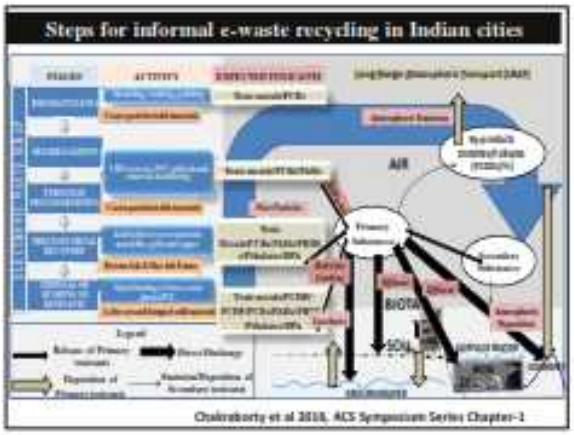
Outflow of heavier PCBs from the E-waste sites

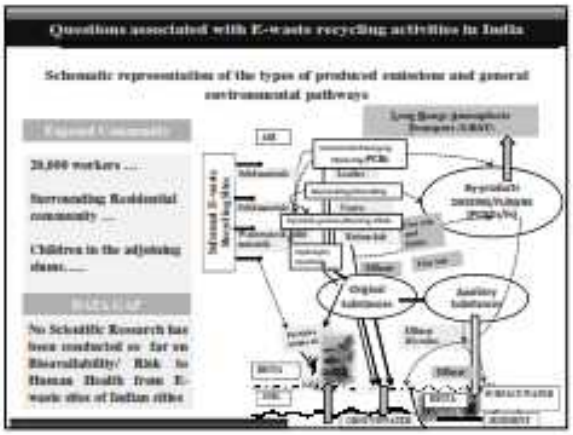
$$f_s = C_s RT/0.41\phi_{oa}K_{oa} \quad f_s = C_s RT$$

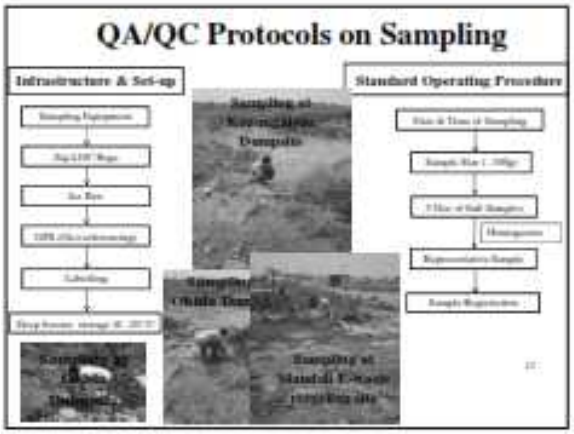


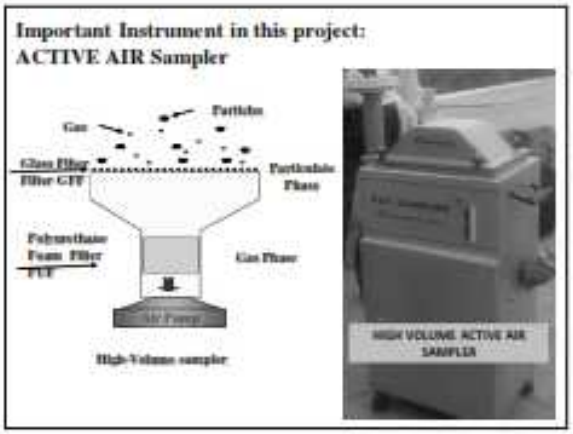

Sources of PCBs in India
Chakraborty et al 2016a, Env Pol

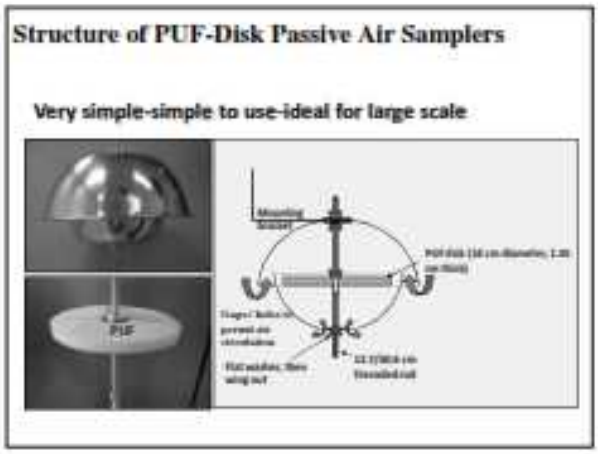

Informal E-waste Recycling in Indian cities
India has been suggested to be second to China in processing e-waste with 70% believed imported from abroad.
25,000 workers involved....

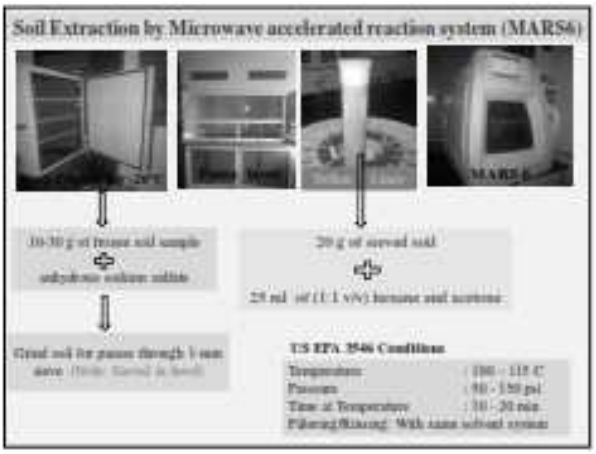

Steps for informal e-waste recycling in Indian cities
AIR
BIOTA
SOIL
Chakraborty et al 2016, ACS Symposium Series Chapter-1

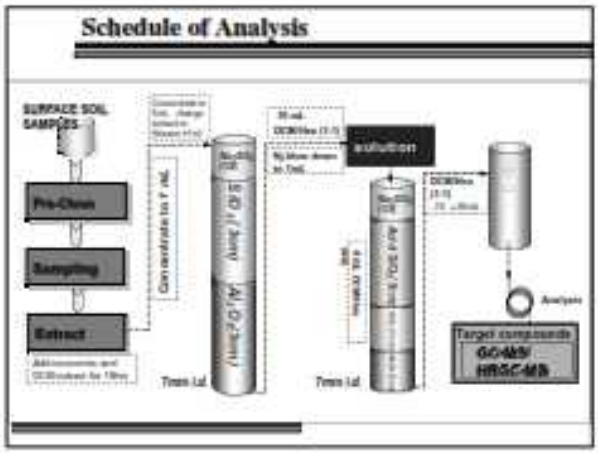

Questions associated with E-waste recycling activities in India
Schematic representation of the types of produced emissions and general environmental pathways
20,000 workers ....
Surrounding Residential community ....
Children in the adjoining slums.....
No Scientific Research has been conducted so far on Bioavailability/ Risk to Human Health from E-waste sites of Indian cities

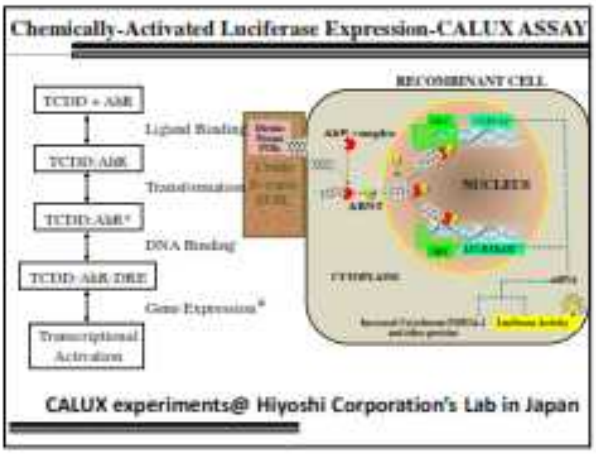

QA/QC Protocols on Sampling
Infrastructure & Set-up
Standard Operating Procedure

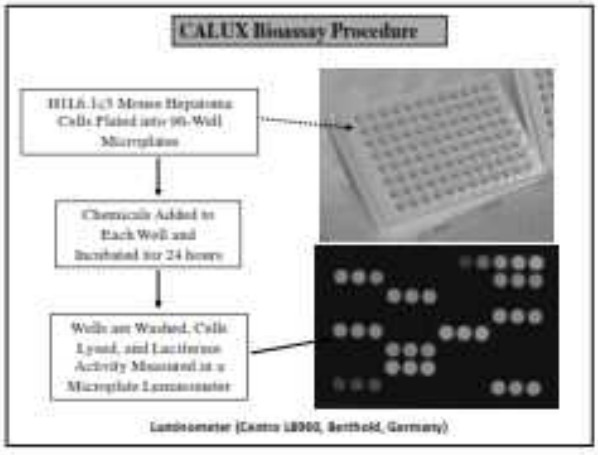

Important Instrument in this project:
ACTIVE AIR Sampler
Gas
Particles
Glass Fiber Filter GFF
Particulate Phase
Polyurethane Foam Filter PUF
Gas Phase
High-Volume sampler
HIGH VOLUME ACTIVE AIR SAMPLER

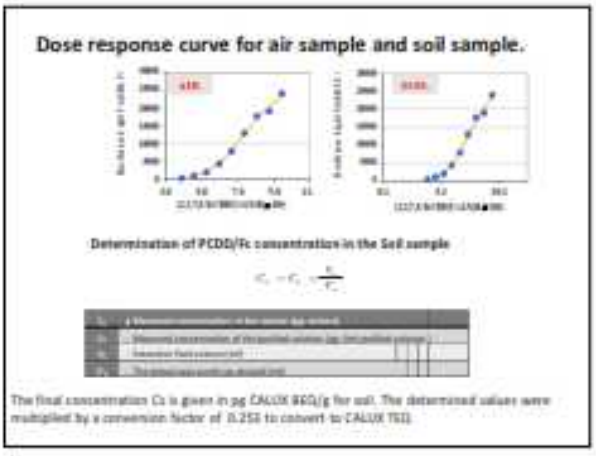




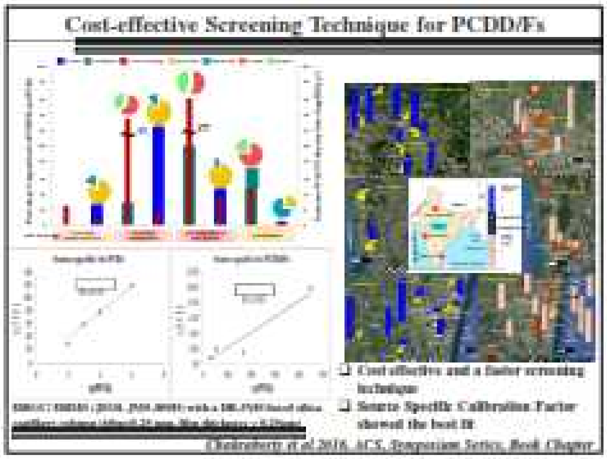


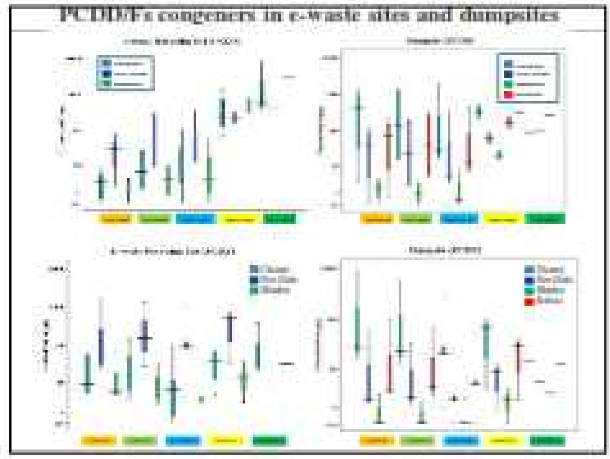


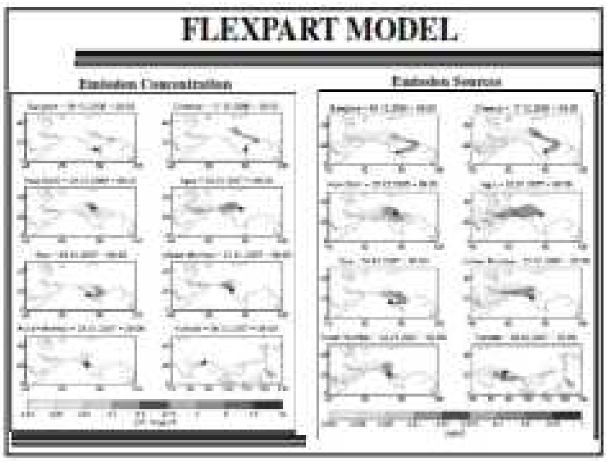


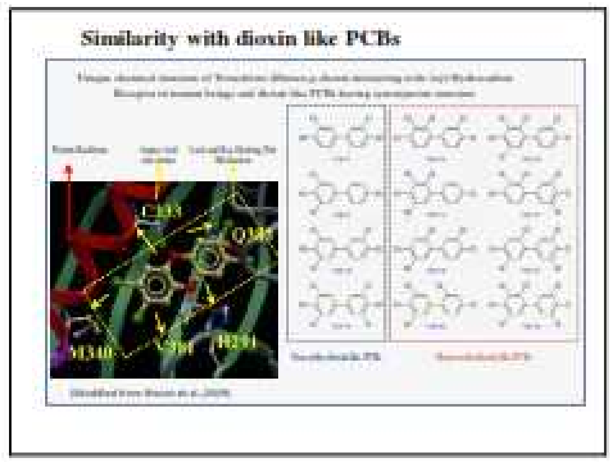


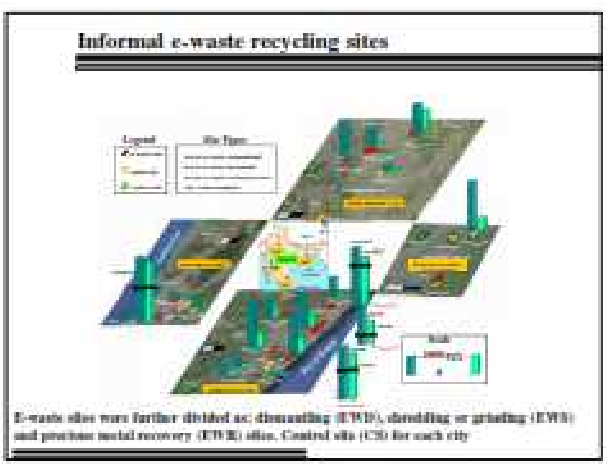
The final concentration Cs is given in pg CALUX BEQ/g for soil. The determined values were multiplied by a conversion factor of 0.252 to convert to CALUX TEQ.

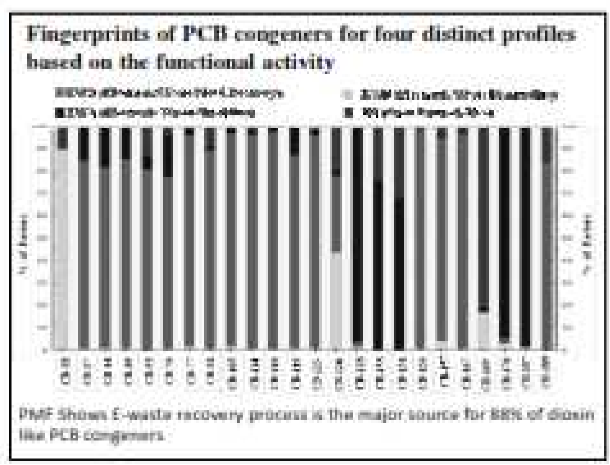

Cost-effective Screening Technique for PCDD/Fs
Cost effective and a faster screening technique
Source Specific Calibration Factor showed the best fit
Chakraborty et al 2018, ACS, Symposium Series, Book Chapter

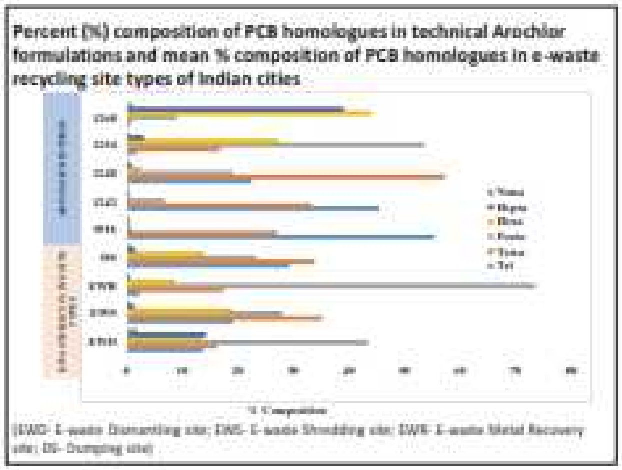

PCDD/Fs congeners in e-waste sites and dumpsites

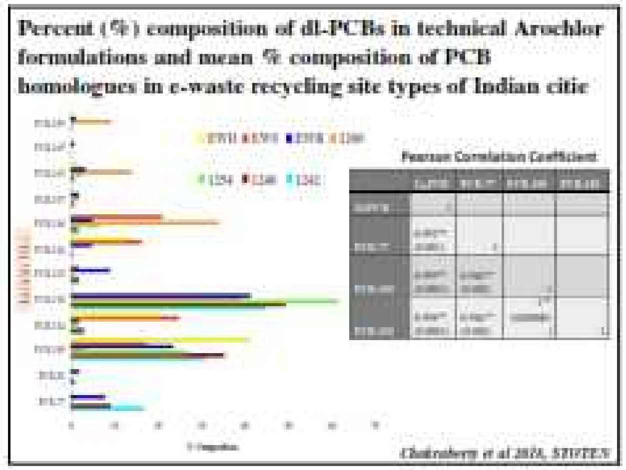

FLEXPART MODEL
Emission Concentration
Emission Sources

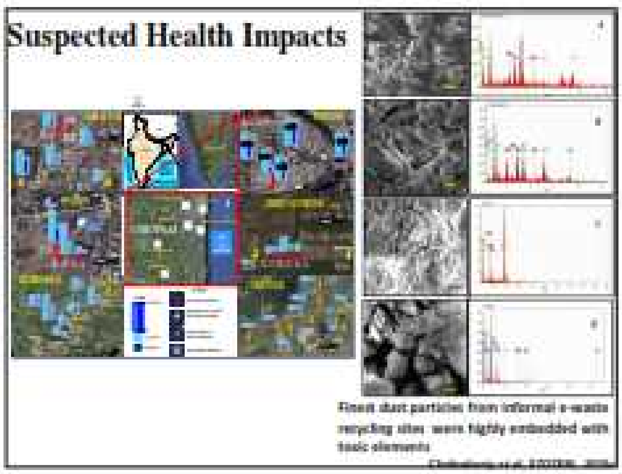

Similarity with dioxin like PCBs

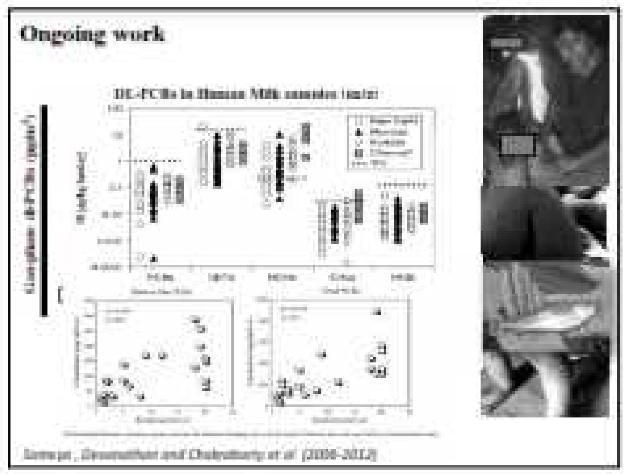

Informal e-waste recycling sites
E-waste sites were further divided as: dismantling (EWD), shredding or grinding (EWS) and precious metal recovery (EWR) sites. Control site (CS) for each city

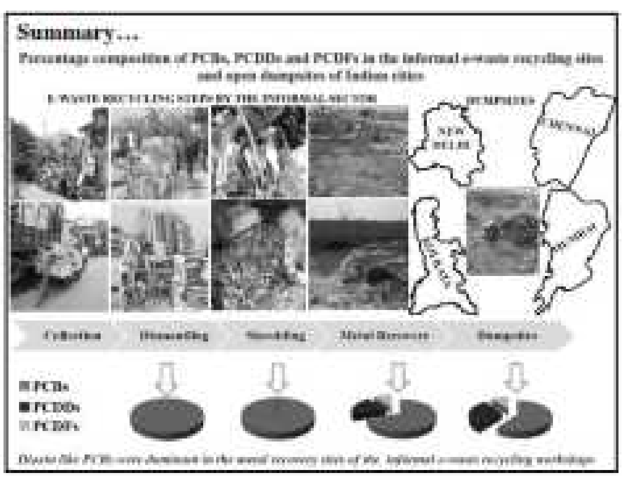

Fingerprints of PCB congeners for four distinct profiles based on the functional activity
PMF Shows E-waste recovery process is the major source for 88% of dioxin like PCB congeners

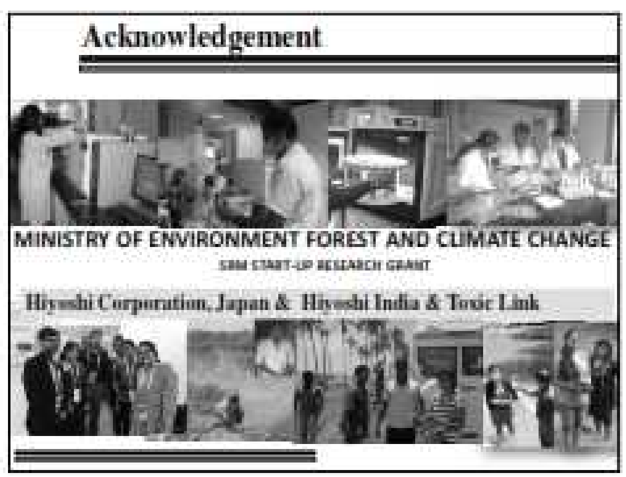

Percent (%) composition of PCB homologues in technical Arochlor formulations and mean % composition of PCB homologues in e-waste recycling site types of Indian cities
(EWD- E-waste Dismantling site; EWS- E-waste Shredding site; EWR- E-waste Metal Recovery site; DS- Dumping site)


Percent (%) composition of dl-PCBs in technical Arochlor formulations and mean % composition of PCB homologues in e-waste recycling site types of Indian citie
Pearson Correlation Coefficient


Suspected Health Impacts
Finest dust particles from informal e-waste recycling sites were highly embedded with toxic elements


Ongoing work
DL-PCBs in Human Milk samples


Summary…
Percentage composition of PCBs, PCDDs and PCDFs in the informal e-waste recycling sites and open dumpsites of Indian cities
E-WASTE RECYCLING STEPS BY THE INFORMAL SECTOR
DUMPSITES
NEW DELHI
Collection
Dismantling
Shredding
Metal Recovery
Dumpsites
PCBs
PCDDs
PCDFs


Acknowledgement
MINISTRY OF ENVIRONMENT FOREST AND CLIMATE CHANGE
SRM START-UP RESEARCH GRANT
Hiyoshi Corporation, Japan & Hiyoshi India & Toxic Link

Country Situation on POPs

Piyush Mohapatra

Toxics Link

Status of regulation of POPs in India

S.No	Chemicals	Usage and status for ban of chemicals	Exemption
1	Aldrin	Pesticides widely used on Corn and Cotton **Banned for manufacture, use and import (20th Sept 1996)**	None
2	Chlordane	Pesticides used on agriculture crops, lawns, garden and a fumigant for termite control **Banned for manufacture, use and import (20th Sept 1996)**	None
3	Dieldrin	Pesticides widely used on Corn and Cotton **Banned for manufacture, use and import (17th July 2001)**	None
4	Endrin	Pesticides used to control insects, rodents and Birds **Banned for manufacture, use and import (15th May 1990)**	None
5	Heptachlor	Insecticides used in household and agricultural use **Banned for manufacture, use and import (20th Sept 1996)**	None
6	Hexachlorobenzene (HCB)	Pesticides and Fungicide used on Seeds also as industrial by products **Never registered as pesticide (April 1997)**	None
7	Mirex	Insecticides and Flame Retardants **Never registered, Banned manufacture, distribute, use and import etc. (27th March 2014)**	None
8	Toxaphene	Insecticides previously widely used on Cotton **Banned for manufacture, use and import (25th July 1989)**	None

Conti..

S.no	Chemicals	Usage	Exemption in India
9	Polychlorinated biphenyls (PCBs)	Used in electrical and industrial equipment **Banned for manufacture, use, import, export (20th April 2016)**	Dielectric fluid in existing electrical transformers and capacitors etc. shall continue to be used till 31st December 2025 (i.e. [illegible])
10	Dichlorodiphenyltrichloroethane (DDT)	Pesticides used for Malaria Control **Banned with restricted use for Vector control (26th May 1989)**	The use of DDT is restricted upto 10,000 MT per annum, except in case of major outbreak but the production of the DDT is continuously decreasing from 2013 - 14 (2864 MT), 2014- 15 (2087 MT), 2015-16 (2079 MT), 2016-17 (2863 MT) (Source: Annual Report 17-18, Ministry of Chemical and Fertilizers)
11	Polychlorinated dibenzo-p-dioxins (PCDD)	Unintentional pollutants by products of incineration and industrial processes	None [illegible]
12	Polychlorinated dibenzofurans (PCDF)	Unintentional pollutants by products of incineration and industrial processes	None [illegible]

	Chemicals	EU	USA	India
13	Alpha Hexachlorocyclohexane (Alpha HCH)	Most countries stop producing	Stop producing in 1970s	No status
14	Beta Hexachlorocyclohexane (Beta HCH)	Banned in 1978	Stop Producing in 1970s	No status
15	Chlordecone	Countries banned in 1980s	Banned in 1977	**Banned for manufacture, use, import, export etc. from 3rd March 2018** Exemption: Use of chemicals for scientific purpose for research and development
16	Hexabromobiphenyl (HBB)	Prohibited in 1980	Restricted in 1977	**Banned for manufacture, use, import, export etc. from 3rd March 2018** Exemption: Use of chemicals for scientific purpose for research and development
17	Lindane (Gamma HCH)	Limited use [illegible]	Banned agricultural/livestock use from 2006	Banned for agricultural use

	Chemicals	EU	USA	India
18	Pentachlorobenzene (PeCB)	Phased out by 2011	Voluntary restrictions 2005	**Banned for manufacture, use, import, export etc. from 3rd March 2018.** Exemption: Use of chemicals for scientific purpose for research and development
19	Perfluorooctane Sulfonic Acid (PFOs) Its Salts and perfluorooctane sulfonyl fluoride (PFSO-F)	Put restrictions in 2006	Put restrictions in 2007	No Status
20	Endosulfan	Banned	Banned	**Banned after SC intervention**
21	HBCDD	Banned with limited use	Info	**Banned for manufacture, use, import, export etc. from 3rd March 2018.** Exemption: Use of chemicals for scientific purpose for research and development

Research Studies on POPs in India

- **Slow Poisoning by slack standards, Consumer Voice 2011.**
  - [illegible]
- **Vegetables, India's poisoned staple. Consumer Voice 2011.**
  - [illegible]
- **Pandey P et al., 2011. Assessment of Organochlorine Pesticide Residues in the Surface Sediments of River Yamuna in Delhi, India. JNU, N. Delhi**
  - [illegible]
- **Bala Krishna M., 2011. Use of pesticides in commercial vegetable cultivation in Khammam, Andhra Pradesh, India. Dhanvanthari Institute of pharmaceutical sciences.**
  - [illegible]

Cont…

- **Kumar B et al., 2011. Distribution of polychlorinated biphenyls in agricultural soils from NCR, Delhi, India. CPCB.**
- **Singh L et al., 2012. Pesticide concentration in water and sediment of River Ganga at selected sites in middle Ganga plain.**
- **Kumar B et al., 2012. Distribution of Polychlorinated Biphenyls in Surface Waters of Various Sources from National Capital Region Delhi India. CPCB.**
- **Kumar B et al.,2012. Dioxin-Like Polychlorinated Biphenyls in River Sediments of Yamuna.CPCB.**

Cont…

- Aslam M et al., 2013. Quantification of Organochlorine Pesticide Residues in the Buffalo Milk Samples of Delhi City, India
- **Kumar B et al., 2014. Distribution of Persistent Organic Pollutants in Urban Aquatic Systems. IIT Roorkee**
- Trouble Brewing: Pesticide residues in tea samples from India. GreenPeace 2014.

Cont..

- Sharma BM et al., 2014. Environment and human exposure to persistent organic pollutants (POPs) in India: a systematic review of recent and historical data.
- **Dineshkumar V et al., 2014. Assessment and Evaluation of Hexachlorocyclohexane(HCH) and Dichlorodiphenyltrichloroethane (DDT) Residues and Extent of DNA Damage in Cattle of Kasargod District, Northern Kerala, India. Kerala Veterinary and Animal Sciences University.**

"TL –IPEN" Study in eggs

Lucknow

Eikor

"TL –IPEN" Study on Deca BDE and SCCPs

Thanks

--END--