

The 3rd Workshop on Reduction of Unintentional POPs in East Asian Countries

Report

October 2009

**Dioxins Control Office
Environmental Management Bureau
Ministry of the Environment, Japan**

Contents

1.Introduction	P. 1
2.Outline of the Workshop	P. 2
3.Program	P. 3
4.Participants	P. 7
5. Overview of Each Session	
Opening Session	P. 8
Session I	P. 12
Session II	P. 19
Session III	P. 23
Closing Session	P. 30

1. Introduction

The Stockholm Convention on Persistent Organic Pollutants, with its goal of a continuous minimization and, where feasible, ultimate elimination of unintentionally produced persistent organic pollutants (unintentional POPs), requires parties to reduce their total releases of unintentional POPs from anthropogenic sources. In addition, the Parties are required to provide the technical support consultation that will enable developing countries to develop and enhance their capacity to fulfill their obligation under the Convention.

Together with the promotion of reducing unintentional POPs through the facilitation of Best Available Techniques/Best Environmental Practices (BAT/BEP) in our country, we will hold “the 3rd Workshop on Reduction of Unintentional POPs in East Asian Countries”, with the purpose of considering the measures and information sharing on the reduction of unintentional POPs in East Asian Countries, including Japan.



**The 3rd Workshop on Reduction of Unintentional POPs
in East Asian Countries
1st - 2nd October 2009**

2. Outline of the Workshop

Title:

The 3rd Workshop on Reduction of Unintentional POPs in East Asian Countries

Organizer:

Ministry of the Environment, Japan (MOEJ)

Date:

1st-2nd October 2009.

Venue:

Mita Kaigisho, Tokyo, Japan

Participating countries/ organizations:

(East Asian Countries)

Cambodia, China, Indonesia, Lao People's Democratic Republic, Malaysia, Mongolia, Republic of Korea, Singapore, Thailand, Viet Nam, and Japan

(Invited countries/ organizations)

Germany, U.S.A., United Nations Environment Program (UNEP),
United Nations Industrial Development Organization (UNIDO)

Topics:

Unintentional POPs inventories in East Asian Countries
Monitoring and measures of new POPs and other compounds
Effective measures for reduction of unintentional POPs

3. Program

DAY 1 (Thursday, October 1, 2009)

10:00-10:30 REGISTRATION

10:30-11:40 OPENING SESSION

Chair: Prof. Shin-ichi Sakai (Kyoto University, Japan)

Opening Remarks

Mr. Osami Sagisaka (Ministry of the Environment, Japan)

Keynote Speech

“Release Inventories for Unintentional POPs: Current Status”

Dr. Heidelore Fiedler (UNEP)

“ISO25101”PFOS/PFOA” to survey the global distribution of PFOS and related chemicals in the environment”

Dr. Nobuyoshi Yamashita

(National Institute of Advanced Industrial Science and Technology, Japan)

Photo Session

11:40-12:50 LUNCH BREAK

12:50-15:10 SESSION I Unintentional POPs inventories in East Asian Countries

Co-Chair: Dr. Yasuyuki Shibata

(National Institute for Environmental Studies, Japan)

Dr. Heidelore Fiedler (UNEP)

12:50-13:40 1)“Inventories of each country”

12:50-13:00 -Cambodia

Mr. Phet Pichhara (Ministry of Environment, Cambodia)

13:00-13:10 -Indonesia

Mr. Syaiful Bahri (The State Ministry of Environment, Indonesia)

13:10-13:20 -Lao PDR

Mr. Khonekeo Kingkhambang

(Water Resources and Environment Administration, Lao PDR)

- 13:20-13:30 -Mongolia
Mr. Altangadas Bayanjargal
(National Chemicals Management Council, Mongolia)
- 13:30-13:40 -Singapore
Ms. Ong Puay Son
(National Environment Agency, Singapore)
- 13:40-14:00 2) “Unintentional POPs inventories in East Asian Countries”
Prof. Shin-ichi Sakai¹, Ms. Shizuko Ota² and Mr. Yoshiyuki Kondo²
(¹Kyoto University¹, ²Ministry of the Environment, Japan)
- 14:00-14:15 3) “Measurement methods of POPs from Open and Uncontrolled Burning”
Dr. Brain K. Gullett and Dr. Chun W. Lee
(United States Environmental Protection Agency, USA)
- 14:15-14:25 4) “The relationship between ambient and emission sources on POPs in Republic of KOREA”
Ms. Eunyoungh Kim
(Environmental Management Corporation, Republic of Korea)
- 14:25-14:40 5) “Monitoring Data and Environmental Fate/Exposure model”
Dr. Yasuhiro Hirai (Kyoto University, Japan)
- 14:40-15:10 6) Discussion
- 15:10-15:30 COFFEE BREAK**
- 15:30-17:00 SESSION II Monitoring and measures of new POPs and other compounds**
Co-Chair: Prof. Shinsuke Tanabe (Ehime University, Japan)
Dr. Tran The Loan (Vietnam Environmental Administration)
- 15:30-15:45 1) “Contamination Status and Distribution of Emerging POPs and Related Compounds in Asia-Pacific Region”
Dr. Shin Takahashi¹, Dr. Kurunthachalam Kannan² and Prof. Shinsuke Tanabe¹ (¹Ehime University, Japan ²State University of New York, USA)

- 15:45-16:00 2) “Contamination of PBDEs in cat fish and feeds from Mekong River Delta”
Dr. Nguyen Hung Minh, Dr. Vu Duc Nam and Dr. Tran The Loan
(Vietnam Environmental Administration)
- 16:00-16:15 3) “Endosulfan in Agricultural soil in Thailand”
Dr. Patana Anurakpongsatorn (Kasetsart University, Thailand)
- 16:15-16:30 4) “Initiatives on brominated flame retardants (BFR) and related compounds”
Dr. Hidetaka Takigami
(National Institute for Environmental Studies, Japan)
- 16:30-17:00 5) Discussion

DAY 2 (Friday, October 2, 2009)

- 10:00-12:15 **SESSION III Effective measures for reduction of unintentional POPs**
Co-Chair: Prof. Masatoshi Morita (Ehime University, Japan)
Prof. Gang Yu (Tsinghua University, China)
- 10:00-10:15 1) “Environmentally Sound Management of POPs Wastes under Basel Convention Technical Guidelines and Japanese Endeavour to POPs Stockpile Treatment”
Dr. Yukio Noma (National Institute for Environmental Studies, Japan)
- 10:15-10:25 2) “Situation of introducing of BAT and BEP in Power plants and Industrial boilers of Thailand”
Ms. Chalalai Rungraung
(Ministry of Natural Resources and Environment, Thailand)
- 10:25-10:35 3) “Control of Dioxin and Furan and Measures to Reduce Releases from Unintentional Production in Malaysia”
Ms. Rohani Jusoh
(Department of Environment, Malaysia)
- 10:35-10:50 4) “Sources and Reduction Measures of New POPs Pentachlorobenzene (PeCB)”
Prof. Gang Yu and Dr. Yang Yang (Tsinghua University, China)
- 10:50-11:10 5) “Experiences on the Reduction of PCDD/F in IPPC Installations in the European Union”
Dr. Roland Weber¹ and Dr. Harald Schoenberger²

(¹POPs Environmental Consulting, Germany ²European Commission)

- 11:10-11:25 6) "Quality Control for Dioxin Analysis"
Dr. Toru Matsumura (IDEA Consultants, Inc., Japan)
- 11:25-11:45 7) "Simultaneous Reduction of Dioxins and CO₂ Emissions in Fossil fuel-fired Utilities"
Dr. Mohamed Eisa (UNIDO)
- 11:45-12:15 8) Discussion

12:15-14:30 LUNCH BREAK

14:30-15:30 CLOSING SESSION

Chair: Prof. Shin-ichi Sakai (Kyoto University, Japan)

Chairperson's Summary

Closing Remarks

4. Participants

Country/Organization	Name	Position and Organization
Cambodia	Mr. Pichhara Phet	Chief, Technology Research and Environmental Management Office Department of Environment Pollution Control, Ministry of Environment
	Mr. Nareth Heng	Director, Department of Environment Pollution Control, Ministry of Environment
China	Prof. Gang Yu	Dean and Professor, Department of Environmental Science and Engineering Tsinghua University
Indonesia	Dr. Syaiful Bahri	Head, Division of Hazardous Waste Process, The State Ministry of Environment
	Mr. Aep Purnama	Head of Division of Manufacture Industry, Assistant Deputy for Hazardous Substances and Hazardous Waste Management of Manufacture and Agro Industry, Ministry of Environment
Republic of Korea	Dr. Byung-Hoon Kim	Deputy Director, Chemical Management Division, Ministry of Environment
	Ms. Suejin Kim	Researcher, National Institute of Environmental Research
	Ms. Eun Young Kim	Assistant Manager, Environmental Management Corporation
	Dr. Kyoung-Sim Kim	Assistant Manager, Korea Environment & Resources Corporation
	Mr. Hyung-Suk Kim	Manager, Environmental Research & Analysis Center Environmental Management Corporation
	Mr. Joong-Kyu Kim	Team Manager, Environmental Research & Analysis Center Environmental Management Corporation
Lao Peoples' Democratic Republic	Mr. Khonekeo Kingkhambang	Official, Water Resources and Environment Administration
	Ms. Setouvanh Phanthavongsa	Acting Director, Environment Quality and Hazardous Chemical Center Water Resources and Environment Administration
	Ms. Darounny Vilaythong	Deputy Director, Planning and Cooperation Center Water Resources and Environment Administration
Malaysia	Ms. Rohani Jusoh	Environment Control Officer, Department of Environment
Mongolia	Mr. Purevdorj Battulga	Project Officer, Ministry of Nature, Environment & Tourism
	Mr. Altangadas Bayanjargal	Officer, National Chemicals Management Council
Singapore	Ms. Puay Son Ong	Engineer, National Environment Agency
Thailand	Dr. Patana Anurakpongsatorn	Associate Professor, Department of Environmental Science, Faculty of Science Kasetsart University
	Ms. Chalalai Rungraung	Environmental Scientist, Pollution Control Department, Ministry of Natural Resources and Environment
Vietnam	Dr. Vu Duc Nam	Scientific Researcher, Dioxin Laboratory, Vietnam Environmental Administration
	Dr. Tran The Loan	Vice-Chief, Pollution Control Department, Vietnam Environmental Administration
UNEP	Dr. Heidelore Fiedler	Scientific Affairs Officer, UNEP Chemicals Branch, DTIE
UNIDO	Dr. Mohamed Eisa	Unit Chief and Deputy to the Director, Stockholm Convention Unit, UNIDO
Germany	Dr. Roland Weber	POPs Environmental Consulting
USA	Dr. Chun Wai Lee	Senior Research Scientist, Office of Research and Development, National Risk Management Research Laboratory U. S. Environmental Protection Agency
Japan	Prof. Shinichi Sakai	Professor, Environment Preservation Center, Kyoto University
	Dr. Yasuyuki Shibata	Director, Environmental Chemistry Division National Institute for Environmental Studies
	Prof. Shinsuke Tanabe	Professor, Center for Marine Environmental Studies, Ehime University
	Prof. Masatoshi Morita	Associate Dean and Professor, Faculty of Agriculture, Ehime University
	Dr. Nobuyoshi Yamashita	Senior Research Scientist, Potential Pollutants Group Research Institute for Environmental Management Technology National Institute of Advanced Industrial Science and Technology
	Dr. Yasuhiro Hirai	Associate Professor, Environment Preservation Center, Kyoto University
	Dr. Shin Takahashi	Associate Professor, Center for Marine Environmental Studies, Ehime University
	Dr. Hidetaka Takigami	Chief, Material and Substance management section Research Center for Material Cycles and Waste Management National Institute for Environmental Studies
	Dr. Yukio Noma	Deputy Director, Research Center for Material Cycles and Waste Management National Institute for Environmental Studies
	Dr. Toru Matsumura	Executive Director and Chief of Environmental Risk Research Center Institute of Environmental Ecology, IDEA Consultants, Inc.
	Mr. Masao Takeuchi	Leader, Combustion Control Group, Energy Technology Research Institute National Institute of Advanced Industrial Science and Technology
	Dr. Hidetoshi Kuramochi	Senior Researcher, Research Center for Material Cycles and Waste Management National Institute for Environmental Studies
	Mr. Osami Sagisaka	Director General, Environmental Management Bureau, Ministry of the Environment
	Mr. Yoshiyuki Kondo	Director, Dioxins Control Office, Environmental Management Bureau Ministry of the Environment
	Ms. Shizuko Ota	Deputy Director, Dioxins Control Office, Environmental Management Bureau Ministry of the Environment
	Ms. Mimi Nameki	Deputy Director, Dioxins Control Office, Environmental Management Bureau Ministry of the Environment
	Mr. Takeshi Morigaki	Dioxins Control Office, Environmental Management Bureau, Ministry of the Environment
	Ms. Masae Harimoto	Dioxins Control Office, Environmental Management Bureau, Ministry of the Environment
Ms. Hironi Yokokawa	Dioxins Control Office, Environmental Management Bureau, Ministry of the Environment	

5. Overview of Each Session

Opening Session

Chair: Prof. Shin-ichi Sakai, Kyoto University, Japan

The opening session started with an opening remark from **Mr. Osami Sagisaka**, Director-General of the Environment Management Bureau, Ministry of the Environment, Japan. In his speech, he introduced that Japan has succeeded in 96% reduction of dioxins, which were one of unintentional POPs, in ten years. In addition, he mentioned that the sharing such experiences among countries of this region will be very fruitful to learn from each other.



The first keynote speech

Title: "Release Inventories for Unintentional POPs: Current Status"

Speaker: Dr. Heidelore Fiedler, UNEP Chemicals Branch

Dr. Heidelore Fiedler gave a summary of the decisions of the COP4 of the Stockholm Convention. Topics decided at COP4 were the addition of nine new POPs to the convention with pentachlorobenzene listed as an unintentional POP in annex C. Pentachlorobenzene is also listed in annex A.

The focus of the lecture was the development of national emission



inventories and the process to revise the present Toolkit methodology. She presented results of 24 countries that used own methods for the estimation. The total amount of polychlorinated dibenzodioxins and polychlorinated dibenzofurans (PCDDs/PCDFs) released was 5,000 g TEQ per year with a per capita emission of 16.5 μg TEQ per year and person. These inventories and the average per capita emission is not based on

Toolkit methodology (and therefore only in exceptional cases includes releases to water, product or in residues) but on own measured data or other sources of information. She reported on the process for the revision and improvement of the UNEP Standardized Toolkit. This work is undertaken jointly with the Secretariat of the Stockholm Convention and through annual meetings of a Toolkit Expert Group. So far, the Toolkit has been used by many developing countries and inventories have been compiled from 58 countries, which gave total air emissions of 17,500 g TEQ per year and total emissions to all five vectors of 35,000 g TEQ per year; corresponding to 25 µg TEQ per capita and year. Among the sources, categories 3 (power generation and domestic heating) and category 6 (open burning of biomass and waste) are the most important sources in developing countries. Therefore, the Toolkit Expert Group addressed these two source categories as a priority. For the field samplings in China and Mexico, high-volume sampling equipment was developed to allow capture of the smokes from open burnings of waste in the field. The results from the field burns ranged from 19 to 892 ng TEQ per kg of waste burned and are at the higher end of the emission factors in the Toolkit. The data will be discussed at the 4th meeting of the Toolkit Expert Group in December 2009 with the objective to decide on a new emission factor for the next version of the Toolkit. The results of the China/Mexico project support the conclusions on best environmental practices as shown in the Best Available Techniques/Best Environmental Practices (BAT/BEP) Guidance from the Stockholm Convention such as minimizing the amount of waste burned in the open, providing sufficient air, preventing smoldering during the combustion. No recommendation on materials present in the waste could be given.

During the discussion, Mr. Phet, Cambodia, asked for emission factors when human dead bodies are burned in the open, a practice that occurs in the country. Dr. Fiedler replied that such situation is a very special case and has not yet been studied but it can be assumed that the emission factor may be at the higher end of the range measured in this project. If there were a need, a measurement could be undertaken in the future because the sampling and analytical methods have been developed.

Prof. Sakai, Japan, asked for the procedure to incorporate new information into the Toolkit. Dr. Fiedler responded that the Toolkit Expert Group is tasked to screen new information from the open literature and elsewhere for use in the review process; a new task group on ferrous and non-ferrous metals has been established and will report back to the group as well as the tasks groups on brick kilns and simple stoves.

Ms. Jusoh, Malaysia asked if the field sampler is commercially available. Dr. Fiedler responded that it is not commercially available but is quite easily to be assembled (it is described in the project); the equipment used in this project has been build at the United States Environmental Protection Agency (US-EPA).

The second keynote speech

Title: “ISO25101”PFOS/PFOA” to survey the global distribution of PFOS and related chemicals in the environment”

Speaker: Dr. Nobuyoshi Yamashita, National Institute of Advanced Industrial Science and Technology, Japan

Dr. Nobuyoshi Yamashita, he described the addition of perfluorooctane sulfonic acid (PFOS) and perfluorooctane sulfonyl fluoride (PFOSF) in the Appendix B at COP4, the establishment of the analysis method, and the global scale transport of perfluorochemicals (PFCs) in the environment.

Firstly, he showed the different groups of PFCs and the characteristics of the PFC structure. He explained that PFCs have become internationally a subject of control at the Stockholm Convention, EU/PFOS/EC122, REACH (2007) and the Canadian Environmental Protection Act of 1999. He also talked about the Persistent Organic Pollutants Review Committee (POPRC) discussion at the Stockholm Convention and showed the global transport from industrial countries of PFCs, which are used in various products. On the other hand, he pointed out the possibility that accurate information on PFOS, perfluorooctanoic acid (PFOA) may be missing without the establishment of an official analysis method is necessary. He then introduced the summary of “The first International Organization for Standardization (ISO) Method for PFOS and PFOA - ISO25101”, using Solid Phase Extraction and Liquid Chromatography/Mass/Mass Spectrometry (LC/MSMS) of PFOS/PFOA in water.



Secondly, in regards to the global transport of PFCs in the water environment, he reported on the 3 dimensional movement of PFCs in the ocean from the results of the sampling study conducted on various parts of the world. From the pattern of the vertical profile of PFCs in the ocean, he elucidated the transport pathway of PFCs. Based on research results, he pointed out that with regards to the long-range transport of POPs, it should be considered that while transport of compounds such as polychlorinated biphenyl (PCB) can be explained by the known route called the “grasshopper effect” with the atmospheric flow, there are also compounds such as PFCs with long-range transport routes using the ocean current water media.

During the discussion, Dr. Kim, Korea, asked for the status and future regulatory framework of PFOS in Japan. Dr. Yamashita replied that after the recommendation

offered by the Organisation for Economic Co-operation and Development (OECD) in 2003, it was started to monitoring on PFCs in 2004, and it will be regulated within the framework of relevant laws within 2009.

Dr. Fiedler asked for the reliability of measurement data using ISO method before standardized, Dr. Yamashita replied it was difficult to compare the measurement data of before and after standardization. In addition, Dr. Fiedler asked for the necessity of amendment of sampling method for Global POPs monitoring, Dr. Yamashita proposed to compare of trend of distribution of surface water and air.



Session I Unintentional POPs inventories in East Asian Countries

Co-Chair: **Dr. Yasuyuki Shibata**, National Institute for Environmental Studies, Japan
Dr. Heidelore Fiedler, UNEP Chemicals Branch

In session I, unintentional POPs release inventories in the East Asian countries were presented.



1) “Inventories of each country”

- Cambodia

“Unintentional POPs in Cambodia”

Speaker: **Mr. Phet Pichhara**, Ministry of Environment, Kingdom of Cambodia

Mr. Phet Pichhara showed that uncontrolled combustion was the main source of unintentional POPs and that in order to reduce the emission, it is necessary to shift from existing open dumping systems to controlled disposal fields.



Indonesia

“Unintentional POPs in Indonesia”

Speaker: Mr. Syaiful Bahri, State Ministry of Environment, Republic of Indonesia

Mr. Syaiful Bahri gave a summary of National Implementation Plan (NIP) and also explained the application of the decomposition rate standard in waste incinerators as a unintentional POP measure. He also explained that the absence of laboratories for analysis and the need for awareness raising of unintentional POPs as its problems.



- Lao PDR

“Unintentional POPs in Lao PDR”

Speaker: Mr. Khonekeo Kingkhambang, Water Resources and Environment Administration, Lao People's Democratic Republic

Mr. Khonekeo Kingkhambang presented the topic on the importance of metal industry particularly metal refining using scraps as a source of unintentional POPs, and also showed the results of POPs monitoring. For unintentional POPs reduction, policy and technical issues were also described. The importance of hazardous waste control, establishment of monitoring systems and facilitation of raising awareness were given as issues regarding unintentional POPs reduction.



Mongolia

“Major resources Dioxins/Furans and measures in the National Implementation Plan Mongolia”

Speaker: Mr. Altangadas Bayanjargal, National Chemicals Management Council, Mongolia

Mr. Altangadas Bayanjargal presented the results of their survey on the emission of dioxins from incinerators of hospital wastes as a major source of unintentional POPs. He mentioned that Mongolia will carry forward measures on treatment facilities of hazardous wastes including medical wastes. Completion of its inventory is also planned.



- Singapore

“3rd Workshop on Reduction of Unintentional POPs in East Asian Countries”

Speaker: Ms. Ong Puay Son, National Environment Agency, Republic of Singapore

Ms. Ong Puay Son presented the status of their efforts to establish an unintentional POPs inventory and showed that they were aware that their amount of emission was low. It is reported that emissions to environment are mainly from municipal solid waste and hazardous solid waste incineration, iron and steel production (one industry), and household accidental fires.



2) “Unintentional POPs inventories in East Asian Countries”

Speaker: Prof. Shin-ichi Sakai, Kyoto University, Japan,

Prof. Shin-ichi Sakai presented a draft inventory of total emissions in the East Asian countries. Using this inventory, estimated amounts of emission were presented. The amounts of emission were estimated about category 1 (waste incineration), 2 (metal production) and 6 (uncontrolled combustion) considered to be main sources of unintentional POPs in the region. He mentioned that characteristics of sources and measures to reduce unintentional POPs from the sources need to be studied by comparisons of emission data reported in inventories and emission data estimated from statistical activity data. He also pointed out that the necessity of promoting cooperation in the region and sharing information on integrated inventory in the East Asian countries in order to reducing unintentional POPs in effective and efficient manner.



3) “Measurement methods of POPs from Open and Uncontrolled Burning”

Speaker: Dr. Chun W. Lee, United States Environmental Protection Agency, USA

In response to Dr. Fiedler’s keynote lecture, Dr. Chun W. Lee introduced the efforts being made on a project to determine emission factors for waste open burning sources. For the project, a newly sampling system was developed and evaluated at two waste dump sites for measuring high dioxins emission waste open burning sources. He mentioned that chlorinated and brominated dioxin emission factors were calculated using carbon balance of the wastes. The relationship between combustion quality, as indicated by the ratio of CO/CO₂ (%) measured by continuous emission monitors, and the amount of dioxins emitted per unit weight of carbon in the wastes burned (ng TEQ/kg C) during sampling was presented.



4)“The relationship between ambient and emission sources on POPs in Republic of Korea”

Speaker: Ms. Eunyoung Kim, Environmental Management Corporation, Republic of Korea

Ms. Eunyoung Kim reported the status of regulations on dioxins and furans and showed the results of an investigation on the relationship between the amount of emission of dioxins of industrial cities in major regions of the country and the concentration of PCDDs/PCDFs in the ambient air. It was shown that in some areas, no correlation was found between the amount of emission of PCDDs/PCDFs and their concentration in Korea’s ambient air.



5)“Monitoring Data and Environmental Fate/Exposure model”

Speaker: Dr. Yasuhiro Hirai, Kyoto University, Japan

Dr. Yasuhiro Hirai reported the establishment and analysis of the Environment Fate/Exposure Model of unintentional POPs. By his Environmental Fate Model, PCB emission from PCB containing products and the amount of PCB generation from the thermal processes were estimated. By his Exposure Model, the emission, fate and exposure of dioxins originating from waste incinerators and impurities of pesticides were studied. He mentioned that from monitoring data and the Environmental Fate Model, monitoring data can be matched with the emission inventory and hidden sources can be identified. He also mentioned that the Environmental fate and exposure model is a useful tool to compare the importance of emission to different media and is also beneficial in human health protection since emission data can be converted to exposure data.



6) Discussion

To the presentation by Dr. Hirai, Japan, Dr. Weber, Germany asked Dr. Hirai about exposure routes by pentachlorophenol (PCP) contamination of waste woods. Dr. Hirai mentioned that the exposure routes via milk contamination by PCP preservative in waste woods was not considered, and it may be taken in human body via soils for PCP in rice fields.

To the presentation by Prof. Sakai, Japan, Ms. Jusoh, Malaysia asked Prof. Sakai about source of the emission factor, calculation method of annual release on category 1 and areas of forest fire for integrated inventory. He explained that the emission factor was quoted on Toolkit, and that the emission amount and activity were quoted on published documents. In addition, the areas of forest fire greatly differed between ground data and satellite data because of the difference on measurement method.

To the presentation by Dr. Lee, USA, Ms. Jusoh also asked Dr. Lee about sampling from open burning. He replied that heat influence and other chemical responses should be avoided. Dr. Lee asked Dr. Fiedler, UNEP the reason of high emission amount shown in power generation category and she replied with three facts; high emission amounts accumulated from amounts of small power generation, high emission factor of high-chlorinated carbon, and high emission amounts produced during use of biomass. Moreover, Dr. Lee pointed out that it will be significant to take measure against mercury from coal-fired boilers particularly in the USA and China.

To the presentation by Mr. Bahri, Indonesia, Dr. Fiedler asked Mr. Bahri the reasons of high emission by way of industrial products. She also asked whether products from pulp and textile industries account for high ratio. Mr. Bahri agreed as she stated.

To the presentation by Dr. Lee, Dr. Weber asked Dr. Lee which chemical shows higher concentration ration during open burning of urban garbage, brominated dioxins or brominated furans. Dr. Lee stated that its sources are probably electrical appliances and products used with flame retardant, and that what is actually happening is needed to know by measuring PCDDs/PCDFs and PBDDs/PBDFs.

Summary of Session I

In Session I, the characteristics of sources were found from the emission inventories in the East Asian countries. The importance of unintentional POPs reduction strategies according to the characteristic of the source in each country or region was suggested. With regards to the Toolkit that is presently being used, it was pointed out that emission inventory of each country should be revised in the future in accordance with the revision of the emission factors on which knowledge has been accumulated. From now on, to obtain environmental data through monitoring and to verify the

emission inventories by comparison of the environment data will be important. The presentation made by Korea indicated that its monitoring data does not always match with its number of factories. The effectiveness and its status of establishment of Environment fate and exposure model, which can integrate emission inventories, environmental data and human exposure, were presented.

From these presentations, in order to reduce unintentional POPs effectively following issues are regarded as necessary. Firstly, each country must not fail to revise its estimation of emission according to its source characteristics. Secondly, emission inventories should be verified by monitoring data which are expected to become abundant in the future. Thirdly, priority of countermeasures should be decided according to the latest emission inventories. In parallel to those activities, many countries pointed out urgent importance of establishment of unintentional POPs monitoring system for both emission sources and environment.

It is essential to carefully follow the revision of the Toolkit and to obtain activity data of some of the sources. In addition, establishment of unintentional POPs analyze system in each county as well as use and establishment of environment/fate model as a verification tool of distribution of sources and environmental monitoring data are also important. Moreover, sharing integrated inventory of the East Asian region will be effective not only as an evaluation tool for effectiveness of BAT/BEP introduction, but also as a important tool to investigate how we can effectively introduce BAT/BEP in the East Asian countries.

Session II Monitoring and measures of new POPs and other compounds

Co-Chair: Prof. Shinsuke Tanabe, Ehime University, Japan

Dr. Tran The Loan, Vietnam Environmental Administration, Socialist Republic of Vietnam

In Session II, the efforts of each country regarding the new POPs that were adopted in the COP4 and the nominated chemical were reported.



1)“Contamination Status and Distribution of Emerging POPs and Related Compounds in Asia-Pacific Region”

Speaker: Dr. Shin Takahashi, Ehime University, Japan,

Dr. Shin Takahashi focused on emerging POPs including brominated flame retardants (BFRs) and PFCs used in chemicals including surfactants and surface protectors. Through his monitoring results in Asia-Pacific region using mussels and skipjack tunas as bioindicators, he found high levels of bioaccumulation in the bioindicators collected around newly developed industrial areas. Furthermore, he pointed out increasing trends of contamination by BFRs and PFCs in recent years based on retrospective monitoring results on archived samples of marine mammals. Particularly, rapid increasing trend of hexabromocyclododecanes (HBCDs) and change of composition of PFCs to the longer chained forms were noted.



2) "Contamination of PBDEs in cat fish and feeds from Mekong River Delta"

Speaker: Dr. Vu Duc Nam, Vietnam Environmental Administration, Socialist Republic of Vietnam

Dr. Vu Duc Nam reported on the results of a detailed survey on POPs in the Mekong River and its estuaries. River mud coming from the cities contained high concentrations of PCB and DDT, and results suggest PCB inputs from urban areas. However, accumulation of DDT in recent years was not observed. In addition, concentrations of both compounds were found to be decreasing with time. Toxicity assessment suggested that POPs coming from cities present high risk to aquatic organisms.



3) "Endosulfan in Agricultural soil in Thailand"

Speaker: Dr. Patana Anurakpongsatorn, Kasetsart University, Kingdom of Thailand

Dr. Patana Anurakpongsatorn reported on the results of her research on the behavior of endosulfan, nominated as a new POPs, in farm soil. The experiment was conducted to investigate the movement pathway of endosulfan sprayed on legumes and uptaken by kales grown in lysimeters. Results showed that endosulfan lasted in the soil but levels of residual endosulfan in the kales were not high and that endosulfan was not detected in the seepage water that leaked from the lysimeter.



4) "Initiatives on brominated flame retardants (BFR) and related compounds"

Speaker: Dr. Hidetaka Takigami, National Institute for Environmental Studies, Japan

Dr. Hidetaka Takigami presented occurrence, sources and control of brominated flame retardants (BFRs) during indoor product use in our daily life. BFRs such as polybrominated diphenyl ethers (PBDEs) and HBCDs have been used in plastic parts of electric and electronic products, and textiles. They have a possibility to be released to indoor air and dust from the products, resulting in significant human exposure. In the presentation, indoor occurrence such as PBDE concentrations and patterns, its spatial localization and distribution between air and dust were mentioned. Information on BFR sources was also introduced by showing BFR transfer from TV plastic parts to interior dust, BFR emission survey using model rooms and experimental chambers. Finally, he mentioned effects of end-of-pipe countermeasures using air cleaner and ventilation on the reduction of indoor concentrations, and perspectives and present situations on substitution of BFRs.



5) Discussion

To the presentation by Dr. Takahashi, Japan, Dr. Shibata, Japan pointed that further analysis will be necessary for biological concentration factors of perfluorononanoate (PFNA) and perfluoroundecanoic acid (PFUnDA) and Dr. Fiedler, UNEP asked regarding the recent trend of biological concentration of legacy POPs was made. Dr. Takahashi replied the concentration trend of the legacy POPs in biological samples vary depending on locations and animal species.

To the presentation by Dr. Nam, Vietnam, Prof. Sakai, Japan asked that a possibility of BFR sources in textile industries, plastics manufacturing plants and second plants and materials of fish feed.

To the presentation by Dr. Anurakpongsatorn, Thailand, Prof. Tanabe, Japan asked that the amount of endosulfan used, the availability of environmental and biological contamination data in neighboring countries, how to conduct lysimeter experiments.

To the presentation by Dr. Takigami, Japan, Prof. Yu, China asked that whether or not he conducted sampling from electrical appliance manufacturing plants and Japan has an environmental standard regarding BFRs. Dr. Takigami replied that Japanese Government has been conducting the plant investigation and so far found out that emission amount from manufacturing processes of BFRs and resins is quite high, and

the environmental standards have not been developed yet. Dr. Weber, Germany asked that whether or not there are any standards for flame retardant in public facilities where he conducted investigation, Dr. Takigami replied that no such standards for furniture are available at this moment, but they need to pass the flame retardancy test. For that purpose, each product needs to include certain percentages of flame retardants. In addition, followed by a question related to the interpretation of results from the photodegradation experiments of PBDFs and others by Dr. Fiedler, Prof. Sakai commented and asked that a possibility of unintentional production of PBDFs will be a significant matter as well as its possibility in a life span of plastics. Dr. Takigami replied that there is the possibility of its unintentional production during each of BFR manufacturing, product use under natural sunlight, plastic shredding and material recycling processes and open burning.

Summary of Session II

Environmental and biotic contamination of legacy and emerging POPs (BFRs, PFCs, etc.) was widely found in Asian countries, even in the Mekong River Delta, Vietnam and higher levels of PBDEs in the East China Sea suggest the shift of significant emission sources to the developing countries with high economic growth rate, while elevated levels of HBCDs and PFCs were in developed nations. Occurrence of HBCDs in open sea biota with significant concentrations implies possible long range transport of HBCDs and increasing temporal trends of BFRs and PFCs contamination were apparent in Eastern Asian waters, suggesting rising consumer demands in Asia in the past decade.

Endosulfan is an emerging issue in Thailand. High persistency of this pesticide was found in soil in the lysimeter experiment. The environmental contamination and behavior of Endosulfan is of still a concern in Asian developing countries. PBDEs were detected in indoor dust at high concentrations and electric appliances such as television sets and personal computers were suspected as major sources. Intake of indoor dust might be a significant pathway for human exposure of some emerging POPs and POPs candidates including unintentionally produced PBDD/DFs.

Further collaborative studies, technical support and human/intellectual exchange are recommended to identify the unintentional POPs in the Asian environment and to trace their emission sources and ecological and human risk.

Session III Effective measures for reduction of unintentional POPs

Co-Chair: Prof. Masatoshi Morita, Ehime University, Japan

Prof. Gang Yu, Tsinghua University, China

In Session III, presentations centered on the BAT for major sources of unintentional POPs mainly.



1) "Environmentally Sound Management of POPs Wastes under Basel

Convention Technical Guidelines and Japanese Endeavour to POPs Stockpile Treatment"

Speaker: Dr. Yukio Noma, National Institute for Environmental Studies, Japan

Dr. Yukio Noma introduced general technical guidelines for the environmentally sound management of POPs wastes, especially focusing on three important issues, low POP content, levels of destruction and irreversible transformation, and destruction technologies, which were adopted on the Basel Convention. Technology for destruction should be operated in accordance with BAT/BEP as developed under the Stockholm convention. He introduced Japanese experiences in the PCB degradation methods authorized to destroy stockpiles and on-going destruction plants. He also referred to other POPs pesticides treatment project.



2) "Situation of introducing of BAT and BEP in Power plants and Industrial boilers of Thailand"

Speaker: Ms. Chalalai Rungraung, Ministry of Natural Resources and Environment, Kingdom of Thailand

Ms. Chalalai Rungraung reported the situation of BAT/BEP application on electricity generator facilities and industrial boilers, which are the 4th largest in the country in terms of the amount of emission of unintentional POPs. In Thailand, biomass and coal are used as fuel in these facilities. In such facilities, BAT application began in 2008. Presently, the database of such facilities is being established and the translation of BAT/BEP guideline has been completed. Henceforth, emission concentrations of dioxins in such facilities will be monitored. The results of monitoring in the aforementioned facilities using biogases, chaff and coal as fuel were introduced. Plans have been drawn to apply measures against dioxins in power plants and industrial boilers from 2011 to 2012.



3) "Control of Dioxin and Furan and Measures to Reduce Releases from Unintentional Production in Malaysia"

Speaker: Ms. Rohani Jusoh, Department of Environment, Malaysia

Ms. Rohani Jusoh reported studies by task teams to forces to national profile and assessment of POPs management infrastructure, Pesticide production and use assessment, PCB and unintentional POPs assessment, Socio-economic Analysis of POPs use and awareness raising on POPs. Analysis of PCDDs/PCDFs emission indicated that waste incineration is the largest source. The emission concentration of dioxins in newly built city waste and sewage sludge incinerators was set to be controlled below 0.1ng TEQ /Nm³. Action plan and long and short term activities were summarized, and BAT will be applied to reach this goal.



4) "Sources and Reduction Measures of New POPs Pentachlorobenzene (PeCB)"

Speaker: Prof. Gang Yu, Tsinghua University, People's Republic of China

Prof. Gang Yu presented the sources and reduction measures regarding Pentachlorobenzene (PeCB), which was added as an unintentional POPs at COP4. Chemical industries, incinerations, biological decomposition and subsidiary production were considered sources of PeCB. Spillage of insulating oil, pentachloronitrobenzene manufacturing, usage of disinfecting agents and flame retardants are sources from industrial systems. Use of pesticides, aluminum casting and recovery of bronze are sources of secondary production. Dominant sources are from burning of waste, coal, and biomass. Production during the dechlorination process of hexachlorobenzene (HCB) can be another source. According to the literature, emission from combustion process was 72%. PeCB is no longer produced for commercial purpose, there is a potential for release from unintentional sources. Some methods can be developed to eliminate PeCB as well as HCB, such as photodegradation, electroreduction, biodegradation and metal-catalyzed dechlorination.



5) "Experiences on the Reduction of PCDD/F in IPPC Installations in the European Union"

Speaker: Dr. Roland Weber, POPs Environmental Consulting, Germany

Dr. Roland Weber gave a summary on the European Integrated Pollution Prevention and Control (IPPC) process and the related permitting process. He emphasized that IPPC is a key approach of the EU to implement Stockholm Convention requirements for PCDDs/PCDFs reduction in industrial installations. He emphasized that BAT/BEP implementation via



PCDDs/PCDFs has the difficulty that a facility is only monitored 0.1% of the time of a year, that even in industrial countries mostly only air emission is measured and that a more comprehensive monitoring concept of facilities is necessary based on key emission parameters which can be continuously monitored and related monitoring standards. In this context he mentioned the option of continuously supervising dioxins emission by continuous sampling and explained that currently an European standard is developed.

For two case studies – Electric Arc Furnace and sinter plants – he detailed examples of BAT for PCDDs/PCDFs reduction. For both case studies he showed that PCDDs/PCDFs are only one of a wide range of critical pollutants and emphasized that these releases need to be addressed in an integrated way. For both cases he explained that PCDDs/PCDFs reduction can in some areas be achieved along with improvement of energy efficiency (e.g. responsible operation) while in other situations not (e.g. preheating of scrap). As a possible future outlook for waste incineration technology he showed that optimized combustion control with SO₂ recirculation can reach the emission limit of 0.1 ng TEQ/Nm³ already in the raw gas along with NO_x levels below 100 ppm and at the same time improve energy efficiency due to prolonged boiler lifetime by suppression of corrosion.

6) "Quality Control for Dioxin Analysis"

Speaker: Dr. Toru Matsumura, IDEA Consultants, Inc., Japan

Dr. Toru Matsumura introduced Accreditation program for Testing Laboratories of Dioxin Analyses in Japan. Three major schemes working include ISO/International Electrotechnical Commission (IEC) 17025, MLAP (Specified Measurement Laboratory Accreditation Program) and the one by Ministry of the Environment. The numbers of laboratories accredited are 23, 122 and 74 based on ISO/IEC 17025, MLAP and Ministry of the Environment, respectively. Official Analytical Methods for PCDDs/PCDFs/Dioxin Like-PCBs have been set for industrial effluent gas (Japanese Industrial Standard), Waste Material, Environmental Water, Wild Animal, etc. (Ministry of the Environment), Food, Human Blood and Breast Milk, Work place environment (Ministry of Health, Labour and Welfare) and Agriculture Items (Ministry of Agriculture, Forestry and Fisheries). To cope to increasing demand in Asian countries, a co-operative program for precise determination of these pollutants is to be projected. A case of partnership Project with China and Japan (the New Energy and Industrial Technology Development Organization (NEDO), the Sino-Japan Friendship Centre for Environmental Protection, Tsinghua University) was introduced.



7) "Simultaneous Reduction of Dioxins and CO₂ Emissions in Fossil fuel-fired Utilities"

Speaker: Dr. Mohamed Eisa, Stockholm Convention Unit, UNIDO

Dr. Mohamed Eisa explained the summary and scheme of a forum for BAT applications being pursued by UNIDO on industrial sector especially in East and South East Asia (ESEA). In the BAT regional project of UNIDO and funded by the Global Environment Facility (GEF), it was found and concluded* Fossil fuel-fired utility and Industrial Boiler is a priority sector for Lao PDR, Mongolia, Philippines, Cambodia, Indonesia and Thailand. The NIP data reported by these participating countries has shown that 265.5 g TEQ/year is the total unintentional POPs releases. Need for common rules for PCDDs/PCDFs inventories has been highlighted because the UNEP Toolkit and the BAT/BEP guidelines does not address small industrial boilers which are using different types and not standardized mixture of fuels in the region. The regional project on reduction and elimination of unintentionally produced POPs has considered specific features of industry, common practices in the region and related socio-economic considerations including dynamic synergy of CO₂ reduction and energy efficiency. In the analysis of power boilers and a 10 t/h steam –generating industrial boilers, a linkage between energy efficiency and reduction in CO₂ and dioxin emissions has been established. More BAT/BEP measures are need corresponding to the new unintentional POPs that has been added at COP4 decisions, are also referred to as a future work necessary for research and technology transfer in the region.



8) Discussion

To the presentation by Prof. Yu, China, Prof. Sakai, Japan asked regarding relationships between the effectiveness of emission control device for PeCB and the final emission concentration level. In addition, Prof. Sakai remarked that each country might give different priorities to control PeCB sources. Dr. Weber, Germany commented that a considerable emission of PeCB come most probably from the production of chlorinated organics (e.g. tetrachloroethene, trichlorethene, vinylchloridemonomer for polyvinyl chloride (PVC) production) which can have for single factories 10,000 tons of "HCB waste" deposited or stored (e.g. Orica Sydney/Australia or factory in Kalush/Ukraine) when not appropriate destruction capacity is present. These 10,000s of tons of "HCB waste" certainly contain a share of

PeCB. Dr. Fiedler, UNEP added her opinion that although many countries have shown interests in inventories of PeCB, HCB, and PCB, it will take some more time to make those inventories.

To the presentation by Dr. Noma, Japan, Mr. Kingkhabang, Laos PDR asked Dr. Noma about current status of PCB treatment in Japan and acceptability of overseas PCB. His answer was that Japan was decomposing PCB by chemical process and will not accept PCB from outside countries.

PCDDs/PCDFs emission factor under biomass power generation presented by Ms. Rungraung, Thailand attracted strong interests from the participants as beneficial information.

Dr. Matsumura, Japan in his presentation on PCDDs/PCDFs monitoring system in Japan referred that each ministry or agency have adopted different analysis methods, and harmonized method and international analytical quality control were necessary. Dr. Fiedler also pointed out similar challenges we have to tackle with.

Summary of Session III

In Session III, several countries reported the new information on emission factor and possible emission source for unintentional POPs. PCDDs/PCDFs emission from bio-mass burning and small-size energy plant seemed important. A new POPs material, pentachlorobenzene, was analysed from both intentional use and unintentional emission. Also reported in the session were the trend of BAP/BEP application in the region countries and action plans in near future. Dioxin emission control seems moving to 0.1 ng TEQ/m³ for newly built municipal incinerator in Asia.

Safe disposal technique which greatly contributed to the progress of PCB disposal in Japan was reported. The technique was adopted in the Basel technical guideline. In the East Asian countries under rapid industrial progress introduced BAT application and chemical treatment techniques. In these developments, it is expected that ultra-small amounts of target compounds could be measured accurately and controlled properly.

The BAT and efforts presented in this session are of great interest to the East Asian countries of which economy is growing at a rapid pace. On the other hand, while BEP guarantees high performance, it requires certain level of skills for its operation. Moreover, for such high performance facilities, a monitoring system that can verify a stable environmental capacity is indispensable. In this sense, quality control on dioxins measurement or the setting up of continuous sample collecting device for dioxins will have a greater role in the future.

BAT application for effective unintentional POPs measures in the reports talked on

co-beneficial technologies, which along with the reduction of dioxins also reduce the release of other environmental pollutants and green house gas (GHG) into the environment. The reduction of synergistic environment load would be the general scenario and that should be an extremely important viewpoint for the East Asian countries. Specifically, measures on the GHG issue and reduction in emission of environmental pollutants are two inseparable issues, technologies that will address these are the key for the East Asian countries to attain a sound economic growth and at the same time coexist with the environment.



Closing Session

Chair: Prof. Shin-ichi Sakai, Kyoto University, Japan

In the session, the participants had exchanges of opinions on the result in the workshop, and the following chairman's summary was developed. In addition, the Ministry of Environment, Japan proposed that the 4th workshop will be scheduled in the fall of 2010.



**The 3rd Workshop on Reduction of Unintentional POPs
in East Asian Countries**

Oct. 1-2 2009 Mita Kaigisho, Tokyo, Japan

Chairman's Summary

(Chairman: Prof. Shinichi Sakai, Kyoto University, Japan)

The 3rd Workshop on Reduction Unintentional POPs in East Asian Countries was held in Tokyo, Japan, on 1st-2nd October 2009. The workshop was attended by administrative officers and experts from 11 East Asian countries (Kingdom of Cambodia, People's Republic of China, Republic of Indonesia, Japan, Republic of Korea, Lao People's Democratic Republic, Malaysia, Mongolia, Republic of Singapore, Kingdom of Thailand and Socialist Republic of Vietnam), USA, Federal Republic of Germany, UNEP and UNIDO, as well as observers.

Earlier this year, COP4 of the Stockholm Convention was held in Geneva and nine new POPs were approved, which was a significant step forward for the POPs control scheme. In that sense, during this workshop we had many reports that focused on new POPs information in addition to the introduction of Dioxin/unintentional POPs inventories and reduction efforts. When we look at the total environmental policy that is centered for the Stockholm Convention on unintentional POPs in East Asian countries, we believe that this workshop had the following 3 conclusions.

- o First is the integration of source inventories, BAT/BEP and monitoring information.
- o Second is the comprehensive effort of Dioxin/unintentional POPs reduction that also takes into consideration greenhouse gas (GHG) reduction and other environmental and human protection benefits.
- o Last not least are the efforts on new POPs entering the Stockholm Convention.

Total annual releases amount of PCDD/Fs in East Asian countries were estimated to be approximately 22 kg TEQ by compiling each National Implementation Plan (NIP) and inventories reported in this workshop. Unit release was 10.4 μ g TEQ/(person*a), it is in the same order of 25 μ g TEQ/ (person*a) which is an average value for countries that used the toolkit provided by UNEP to estimate their national inventories.

It is desirable to revise the emission inventories of each country, specifically the challenge of revising the emission factors, and a better understanding of the amount of activities. Sharing the information of these tasks in a database, which could be used as a reference for verification, the integrated emission inventory for all East Asian countries is also important.

Monitoring is essential in order to investigate the emission characteristics of different sources, and it is desirable to maintain an analysis capacity in the home country. In the analysis of dioxins, quality control through data verification and analysis protocol is indispensable, and launching a shared information scheme in the East Asian region can also be effective.

Reducing emissions of GHG, particulate matter, mercury and other heavy metals may have the co-benefit of control and reduction of unintentional POPs. Similarly, most technologies that applied as BAT measures for reducing dioxins are also effective for the reduction of other environmental pollutants. Moreover, if the additional measures taken also have GHG reduction effect, then the effectiveness of these comprehensive measures will increase. We should not also forget that depending on the nature of the source, approach that managing the amount of activities is also important in order to achieve co-benefit. With regards to the dominant sources in East Asian countries, such as waste incineration and uncontrolled combustion, it should be recognized that parallel to the application of BAT/BEP, the reduction in activities is also effective.

Although new POPs are not necessarily unintentional POPs, it has at least the characteristics of POPs. Monitoring and measures similar to unintentional POPs will be needed for chemical compounds that entered the environment unintentionally with the progress of industrialization. It is important to widely share in East Asian countries the monitoring information presented by each country. Furthermore, if a trend of identifying the source and the application of BAT becomes established, effective measures and policies can be enforced.