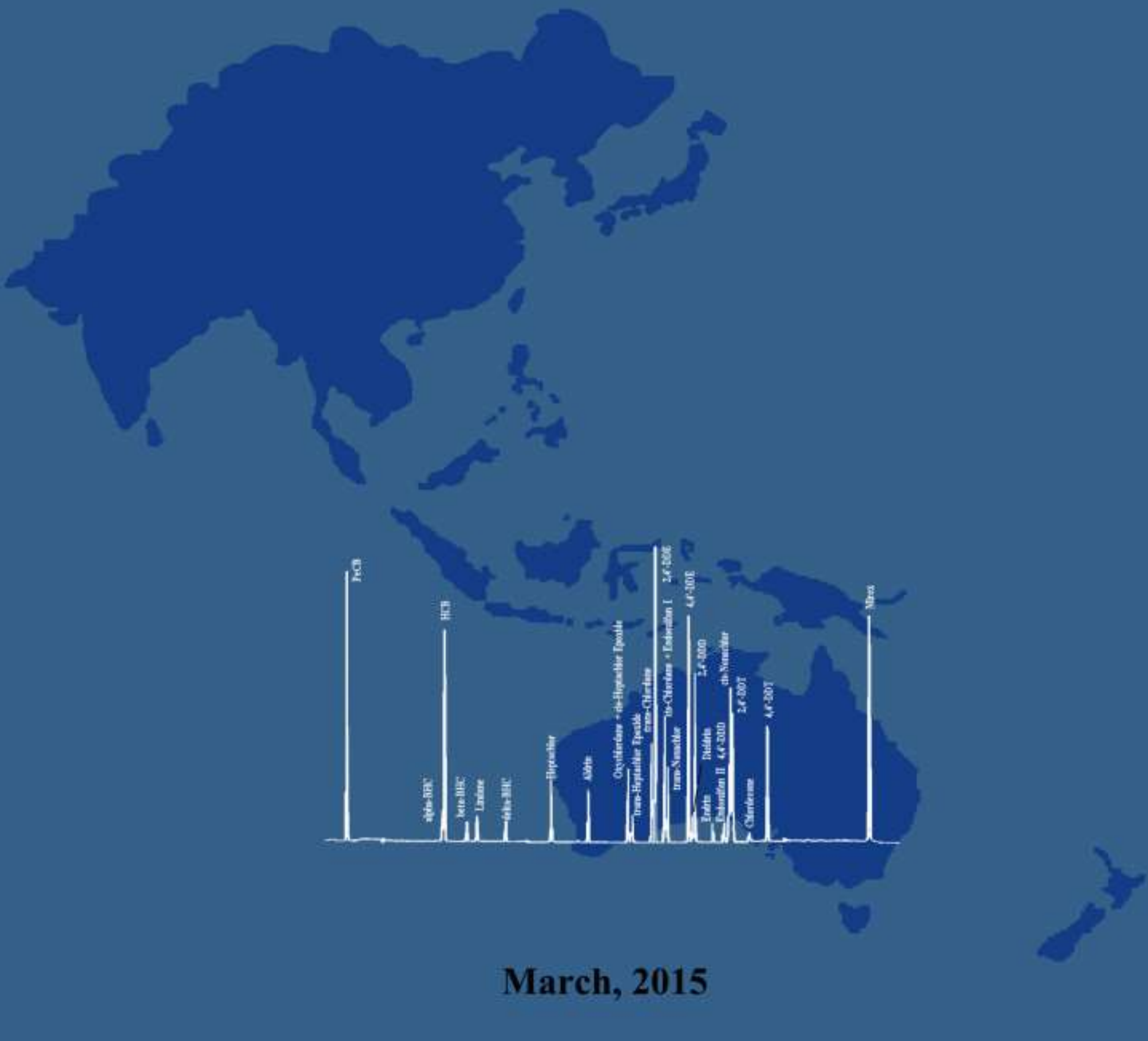
UNEP

STOCKHOLM CONVENTION

Protecting human health and the environment from persistent organic pollutants

The 2nd POPs MONITORING REPORT ASIA-PACIFIC REGION

GLOBAL MONITORING PLAN UNDER THE STOCKHOLM CONVENTION



March, 2015

GLOBAL MONITORING PLAN
FOR PERSISTENT ORGANIC POLLUTANTS

UNDER THE STOCKHOLM CONVENTION ARTICLE 16 ON EFFECTIVENESS EVALUATION

SECOND REGIONAL MONITORING REPORT

ASIA-PACIFIC REGION

MARCH 2015

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

ROG members of the region

- China: Mr. Minghui Zheng
- Fiji: Mr. William Aarlbersberg
- India: Mr. Bharat Singh
- Japan: Mr. Yasuyuki Shibata
- Qatar: Ms. Hala Sulutan Saif Al-Easa
- Syria: Mr. Fouad Elok

Initial report drafters

Mr. Noriyasu Nagai, Japan NUS Co. Ltd., Japan

Ms. Hiroko Arataki, Japan NUS Co. Ltd., Japan

Mr. Takahiro Aoyama, Japan NUS Co. Ltd., Japan

Mr. Shalveen Raj, University of the South Pacific, Fiji

Final report drafter

Mr. Zongwei Cai, Hong Kong Baptist University, Hong Kong SAR, China

The worldwide implementation of the second phase of the Global Monitoring Plan was made possible thanks to the generous contributions to the Stockholm Convention Voluntary Trust Fund from the Governments of Japan, Norway, Sweden, and through the European Commission’s Thematic Programme for Environment and Sustainable Management of Natural Resources, including Energy (ENRTP).

Air monitoring activities are implemented in the Asia Pacific Region in cooperation with strategic partners: the Global Atmospheric Passive Sampling (GAPS) Network, and POPs Monitoring Project in East Asian Countries.

The human milk survey draws on the collaboration between the Secretariat of the Stockholm Convention, the United Nations Environment Programme (UNEP) Division of Technology, Industry and Economics (DTIE) Chemicals Branch and the World Health Organization (WHO). The State Institute for Chemical and Veterinary Analysis of Food (CVUA), Freiburg, Germany, is acknowledged for the analytical work related to human milk samples. The MTM Research Centre, Örebro University, Sweden, is acknowledged for the analysis and provision of data on perfluorinated chemicals in human milk. Thanks are also expressed to the national coordinators of the joint WHO/UNEP exposure study for the work to collect and process the human milk samples.

Further, the contribution of the projects to support POPs monitoring activities in regions, funded through the Global Environment Fund (GEF), the Strategic Approach to International Chemicals Management (SAICM), and others, including UNEP Project “Supporting the POPs Global Monitoring Plan in the Pacific Islands Region”, UNEP/ GEF project “Establishing the Tools and Methods to Include New POPs into the Global Monitoring Plan”, Environmental Monitoring and Governance in Asian Coastal Hydrosphere is greatly acknowledged.

PREFACE

Persistent organic pollutants (POPs) are a group of chemicals that have toxic properties, resist degradation in the environment, bioaccumulate through food chains and are transported long distances through moving air masses, water currents and migratory species, within and across international boundaries. POPs belong to three main groups, however some of the chemicals fit into more than one of these three general categories:

- pesticides used in agricultural applications[*]
- industrial chemicals used in various applications[†]
- chemicals generated unintentionally as a result of incomplete combustion and/or chemical reactions[‡].

Twelve POPs were initially listed in the Stockholm Convention (shown in bold font in footnotes 1–3). In general, these 'legacy' POPs were first produced and/or used several decades ago, their persistence, bioaccumulative properties and potential for long-range transport are well studied, and they have been globally banned or restricted since 2004. In 2009, nine more substances were added to the Convention (chemicals with an asterisk in footnotes 1–3). Two additional chemicals were listed in 2011 and in 2013 (two and three asterisks in footnotes 1–3 respectively).

Article 16 of the Stockholm Convention requires the Conference of the Parties to evaluate periodically whether the Convention is an effective tool in achieving the objective of protecting human health and the environment from persistent organic pollutants. This evaluation is based on comparable and consistent monitoring data on the presence of POPs in the environment and in humans, as well as information from the national reports under Article 15 and non-compliance information under Article 17. The global monitoring plan for POPs, which has been put in place under the Convention, is a key component of the effectiveness evaluation and provides a harmonized framework to identify changes in concentrations of POPs over time, as well as information on their regional and global environmental transport.

The present monitoring report is synthesizing information from the first and second phase of the global monitoring plan and presents the current findings on POPs concentrations in the Asia-Pacific Region. While the first monitoring report, presented at the fourth meeting of the Conference of the Parties, provided information on the baseline concentrations of the 12 legacy POPs, this second monitoring report, to be submitted to the seventh meeting of the Conference of the Parties in 2015, provides first indications as to the changes in concentrations of the chemicals initially listed in the Convention, as well as baseline information on the newly listed POPs.

---

[*] **aldrin**, **chlordane**, chlordecone*, **dichlorodiphenyltrichloroethane (DDT)**, **dieldrin**, endosulfan**, **endrin**, **heptachlor**, **hexachlorobenzene (HCB)**, gamma-hexachlorocyclohexane (γ-HCH, lindane)* and by-products of lindane [alpha-hexachlorocyclohexane (α -HCH)* and beta-hexachlorocyclohexane (β -HCH)*], **mirex**, **toxaphene**.

[†] tetra- and pentabromodiphenyl ethers (PBDEs)*, hexa- and heptabromodiphenyl ethers (PBDEs)*, hexabromocyclododecane*** (HBCD), hexabromobiphenyl (HBB)*, perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOS-F)*, pentachlorobenzene (PeCBz)*, **polychlorinated biphenyls (PCBs)**.

[‡] **hexachlorobenzene (HCB)**, pentachlorobenzene (PeCBz)*, **polychlorinated biphenyls (PCBs)** and **polychlorinated dibenzo-*p*-dioxins (PCDDs) and dibenzofurans (PCDFs)**.

ABBREVIATIONS AND ACRONYMS

ACP	Arctic Contamination Potential
ADI	Acceptable Daily Intake
ALRT	Atmospheric Long Range Transport
AMAP	Arctic Monitoring and Assessment Programme
ANCOVA	Analysis of Covariance
ANOVA	Analysis of Variance
APEs	Alkylphenol Ethoxylates
BCF	Bioconcentration Factor
BHC	Benzenehexachloride
CEE	Central and Eastern Europe
CEP	Caspian Environment Programme
CRM	Certified Reference Material
CIS	Commonwealth of Independent States
COP	Conference of the Parties
CTD	Characteristic Travel Distance
CV	Coefficient of Variation
DDD/DDE	Metabolites of DDT
DDT	Dichlorodiphenyltrichloroethane
dl-PCBs	Dioxin-like PCBs
EDCs	Endocrine Disrupting Chemicals
EMAN	Ecological Monitoring and Assessment Network
EMEP	Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe
EPER	European Pollutant Emission Register
ERL	Effects Range Low
ERM	Effects Range Median
EROD	7-ethoxyresorufin-O-deethylase
EUSES	European Union System for the Evaluation of Substances
FAO	Food and Agriculture Organisation of the United Nations
FERTIMEX	Fertilizantes Mexicianos, S.A.
GAPS	Global Atmospheric Passive Sampling Survey
GEF	Global Environment Facility
GEMS	Global Environment Monitoring System
GLBTS	Great Lakes Bi-national Toxics Strategy
GMP	Global Monitoring Plan
HCB	Hexachlorobenzene
HELCOM	Helsinki Commission/The Baltic Marine Environment Protection Commission
HCHs	Hexachlorocyclohexanes
HIPS	High Impact Polystyrene
HPLC	High Performance Liquid Chromatography
HRGC	High Resolution Gas Chromatography (capillary column)
HRMS	High Resolution Mass Spectrometer
HBB	Hexabromobiphenyl
IADN	Integrated Atmospheric Deposition Network
IARC	International Agency for Research on Cancer
ICES	International Council for the Exploration of the Sea
IFCS	Intergovernmental Forum on Chemical Safety
IMO	International Maritime Organisation
INSPQ	Centre de Toxicologie du Québec

INFOCAP	Information Exchange Network on Capacity Building for the Sound Management of Chemicals
IPPC	Integrated Pollution Prevention and Control
I-TEQ	International Toxic Equivalent
K_{AW}	Air/Water Partition Coefficient
K_{OA}	Octanol/Air Partition Coefficient
K_{OW}	Octanol/Water Partition Coefficient
LC_{50}	Median Lethal Concentration
LD_{50}	Median Lethal Dose
LOAEL	Lowest Observable Adverse Effect Level
LOD	Limit of Detection
LOQ	Limit of Quantification
LRT	Long Range Transport
LRTAP	Long Range Transboundary Air Pollution
LRTP	Long Range Transport Potential
MDL	Method Detection Limit
MEDPOL	Mediterranean Pollution Monitoring and Research Programme
MEA	Multi Lateral Environmental Agreements
MRL	Maximum Residue Limit
MSCE	Meteorological Synthesizing Centre-East
NAFTA	North American Free Trade Agreement
NARAPs	North American Regional Action Plans
ND	Not detected
NGOs	Non-Governmental Organisations
NHATS	National Human Adipose Tissue Survey
NIS	Newly Independent States
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No Observable Adverse Effect Level
NOEL	No Observable Effect Level
NWT	Northwest Territories
OCs	Organochlorines
OCPs	Organochlorine Pesticides
OECD	Organisation for Economic Co-operation and Development
OPs	Organophosphates
OSPAR	Commission for the Protection of the Marine Environment of the North-East Atlantic
PAHs	Polycyclic aromatic hydrocarbons
PBDEs	Polybrominated diphenyl ethers
PCBs	Polychlorinated biphenyls
PCDDs	Polychlorinated dibenzo- p-dioxins
PCDFs	Polychlorinated dibenzofurans
PCP	Pentachlorophenol
PeCBz	Pentachlorobenzene
PFOS	Perfluorooctane sulfonate
PIC	Prior Informed Consent
POPs	Persistent Organic Pollutants
PRTRs	Pollutant Release and Transfer Registers
PTS	Persistent Toxic Substances
PUF	Polyurethane Foam
PVC	Polyvinylchloride
QA/QC	Quality Assurance and Quality Control Regimes
REACH	Registration, Evaluation and Authorisation of CHemicals
RECETOX	Research Centre for Environmental Chemistry and Ecotoxicology, Czech Republic

RENPAP	Regional Network on Pesticide Production in Asia and Pacific
ROGs	Regional Organization Groups for the Global Monitoring Plan
ROPME	Regional Organisation for the Protection of the Marine Environment
ROWA	Regional Organisation of West Asia
SAICM	Strategic Approach to International Chemicals Management
SCCPs	Short-chain chlorinated paraffins
SOP	Standard Operating Procedure
SPM	Suspended particulate matter
SPREP	South Pacific Regional Environment Programme
t	Tonnes
TBBPA	Tetrabromobisphenol A
TCDD	Tetrachlorodibenzo-*p*-dioxin
TEL	Tetraethyllead
TEQ	Toxic Equivalent
TOMPS	Toxic Organic Micropollutants Survey
TPT	Triphenyltin
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organisation
WFD	Water Framework Directive
WHO	World Health Organisation
WMO	World Meteorological Organization
XAD	Styrene/divinylbenzene-co-polymer Resin

GLOSSARY OF TERMS

Activity	Any programme or other activity or project that generates data or information on the levels of POPs in the environment or in humans that can contribute to the effectiveness evaluation under Article 16 of the Stockholm Convention
Core matrices	These are the matrices identified by the Conference of the Parties to the Stockholm Convention at its second meeting as core for the first evaluation: A = ambient air; M = (human) mother's milk and/or B = human blood
CTD	The characteristic travel distance– defined as the "half-distance" for a substance present in a mobile phase
Intercomparisons	Participation in national and international intercalibration activities such as ring-tests, laboratory performance testing schemes, etc
LOD	Limit of detection. Definition: The lowest concentration at which a compound can be detected; it is defined as that corresponding to a signal three times the noise.
<LOD	Result below the limit of detection
LOQ	Limit of quantification. Definition: The lowest concentration that can quantitatively be determined is three times higher than LOD.
<LOQ	Result below limit of quantification. Compounds found at levels between LOD and LOQ can be reported as present, or possibly as being present at an estimated concentration, but in the latter case the result has to be clearly marked as being below LOQ.
MDL	Method detection limit. The MDL considers the whole method including sampling, sample treatment and instrumental analysis. It is determined by the background amounts on field blanks.
Phase I	Activities to support the Article 16 effectiveness evaluation that will be conducted by the Conference of the Parties at its fourth meeting, information collected between 2000 and 2008.
Phase II	Activities to support the Article 16 effectiveness evaluation that will be conducted by the Conference of the Parties at its seventh meeting, information collected between 2009 and 2013.

EXECUTIVE SUMMARY

Overview of the region

Asia-Pacific Region is located in tropical, sub-tropical temperate and sub-arctic climate area, with many countries under the strong influence of the monsoon climate. The region is characterized by huge agricultural and industrial activities to support large number of people, about 60% of the world population. Many countries in the Region have historically used POPs, *e.g.* DDT for vector control and PCB for industrial use. Some POPs substances are still used as a specific exemption in agricultures, fisheries and industries. In this Region, there are 62 countries/states, out of which 48 countries are either of ratification, acceptance, approval or accession to the Stockholm Convention on POPs. Most countries in the Region are developing countries or countries with their economies in transition.

Description of contributing programs

In the Asia-Pacific Region, several international and national POPs monitoring programmes on air and human milk are available. For the air, passive sampling was conducted in Fiji in collaboration with RECETOX since 2006 until now. In POPs Monitoring Project in East Asian Countries which is initiated by Japan, sampling was operated in eleven countries (Cambodia, Indonesia, Japan, Republic of Korea, Lao PDR, Malaysia, Mongolia, Philippines, Singapore, Thailand and Vietnam). Starting from 2007, some national POPs monitoring program have been carried out in the region. For example, China (including Hong Kong SAR and Macao SAR) and Japan, some national ambient POPs air monitoring programmes have been performed. For human milk, Fiji, Kiribati, Marshall Islands, Niue, Palau, Samoa, Solomon Islands and Tuvalu have participated in Global Monitoring Plan in the Pacific Islands Region. China (including Hong Kong SAR and Macao SAR) and Japan also have some national POPs monitoring programmes on human milk and/or blood. “Environmental Monitoring and Governance in the Asian Coastal Hydrospher” has been conducted by United Nations University which focuses to analyse the level of PFOS in water in some South Asian countries (Korea, Philippines and Thailand).

It should be noted that only a few countries in the Region reported the POPs data. Some countries have been collecting POPs data for longer and more intensively than others, but most countries have not.

The data was mainly collected over the period between 2007 and 2014. However, some earlier data related to the historical importance were presented and briefly described. The data was submitted through focal point of each Party and evaluated by the ROG members based on the information on analytical procedure, QA/QC protocol, etc. In addition to data on core media, the monitoring data on non-core media, such as water, soil and biota, were also collected as supplementary data and briefly discussed.

In the newly established monitoring programs, the methods for sampling and analysis of POPs in the air and human samples were conducted in principle in accordance with “Guidance on the Global Monitoring Plan for Persistent Organic Pollutants”. However, for the data reported and published earlier, various methods for sampling and analysis of POPs have been applied. Most POPs analyses described in the report involved series of QA/QC programs. Due to the difference of analytical procedures, however, the criteria of QA/QC and data validation from various countries were quite different.

Main findings

This Regional report provides adequate monitoring data for POPs in ambient air and human milk from some part of the region. Comprehensive spatial and temporal data on POPs monitoring are only available in a small number of countries in the Region, *e.g.* China and Japan. Some countries are currently developing their programs on the monitoring and inventories, while others still lack of capacity for POPs monitoring. Because monitoring data do not exist in most countries to enable the assessment of long-range transport of POPs in the Region, substantial effort will be needed to fill the data and technical gaps in the Region.

A) Classical POPs; Temporal trend

Temporal trend of POPs level is based on the data from 1^{st} and 2^{nd} phase Asia-Pacific Regional Monitoring Report. The concentration of POPs in the environment is expected to decrease after the establishment of relevant regulations. However, reports shown that the reduction trend is seemed to become insignificant and evaluation of temporal trend will become difficult. The concentration of initial POPs has become smaller since many countries have already regulated the use of initial POPs. On the other hand, for the new POPs the significant changes in the environmental levels are expected to be seen after the implementation of regulation.

Air

The levels of most of the initial POPs in background air in China have been reduced significantly since 2008. Also, results have shown that higher POPs levels have been detected in urban area than rural area in China. Only *cis*-chlordane, *o,p'*-DDT, *o,p'*-DDE, heptachlor have shown a statistically significant reducing tendency in cold season in Japan. Higher levels of POPs in ambient air have been detected in warm season than cold season. Also, overall reduction tendency was observed for the concentrations of dioxin in ambient air.

In East Asian POPs air monitoring programme, high volume air sampling data at Hedo, Okinawa, showed a clear decreasing trend of DDTs, during the recent four years. This might reflect a possible decrease of new DDT input to the sampling region in the period.

Human tissue

Different types of POPs show different temporal trends in human milk and/or blood in Japan. Higher levels of PCDD/PCDF and *dl*-PCB have been detected in human milk collected from urban area than rural area. Higher levels of chlordane, DDT and HCB have been measured recently, indicating that Japanese are continuously exposed to these chemicals. However, the levels of dieldrin, heptachlor, PCB, HCHs, and PFOS have been slightly reduced in Japanese people. For PCDD/PCDF and *dl*-PCB in Japanese, the concentration remained approximately at the same level. Fiji and Kiribati have also shown the reducing tendency on the levels of POPs in human tissues.

Other media

The concentrations of dioxins in sediment core were approximately unchanged from 1998 to 2012 in Japan.

B) Challenges with new POPs

Air

Japan has already focused on analysing the new POPs including chlordecone, endosulfan, HBB, HCHs, PeCBz, PBDEs, and PFOS in ambient air throughout the nation (35 to 37 sites) since 2010. Republic of Korea has been monitoring HCHs in air at a regional background site, Jeju Island, from 2009 continuously.

Human tissue

In addition to PCB and DDT, β-HCH levels have been reported in human milk from primiparous women in Osaka, Japan from 1972, and PBDE and HBCD levels in human milk back to 1973 were revealed. In addition to human milk, 7 new POPs (chlordecone, endosulfan, HBB, HCHs, PBDEs, PeCBz and PFOS) in human blood have also been analysed by the Japan Ministry of Environment since 2011.

Other media

Reduction tendency have been observed for the PFOS and PFOA in sediment core. The highest level of PFOS was detected in 1986 while highest concentration of PFOA was detected in 2004 in Japan. Seven types of new POPs, including chlordane, endosulfan, HBB, HCHs, PBDEs, PeCBz, and PFOS have been analysed in water, sediment and biota. Samples were collected throughout the nation of Japan.

Measurements of POPs in air

In the Pacific and East Asian subregions, there are some monitoring data on ambient air for the effectiveness evaluation. On the other hand, such data sets are lacking in South and West Asian subregions.

In China, 11 background sampling sites, 3 rural and 3 urban sampling sites were selected and PM_{10} high volume sampling was carried out to analyze dioxins and other POPs. In Hong Kong SAR and Macao SAR, 2 to 6 sites were selected for the monitoring of some POPs (dioxins and total PCB) in ambient air which has been conducted from 2008 – 2014.

Fiji, Kiribati, Niue, Palau, Samoa, Solomon Island and Tuvalu have conducted a study on the application of passive samplers for the determination of POPs in ambient air in 2010.

Japan has been monitoring POPs in the air by high volume sampler throughout the nation (22 to 37 sites) since 1997 for dioxins, and since 2002 for other POPs. Japan has also participated in POPs Monitoring Project in East Asian Countries. Air sample is collected and analysed every month at Cape Hedo (Okinawa Island) since 2009. Before then, background air monitoring was conducted by using high volume sampler at Hateruma Island since 2004.

Republic of Korea has been monitoring POPs in air using a high volume sampler at Goisan and Taean since 2006. Republic of Korea conducted background air monitoring at a regional background site, Jeju Island, every month from 2009 until now as part of POPs Monitoring Project in East Asian Countries. Republic of Korea also conducted nation wide POPs monitoring recently, and data will be submitted after finalization process.

The POPs Monitoring Project in East Asian Countries has also monitored POPs (9 pesticides) in the air by high volume sampler in Indonesia, Japan, Republic of Korea, Lao PDR, Malaysia, Mongolia, Philippines, and Vietnam since 2009 to 2013.

Generally, the reported levels of POPs in the air were on the averaged high side when compared with concentrations in other parts of the world. The reported data provide relevant information of POPs in some countries. However, some POPs were not-detected either because of the levels were really low or the detection limits of analytical method were not low enough, which may provide difficulty for future comparison. Also, some data were collected in particular period of the year as a snap shot, and more data will be necessary for the discussion of the long-range transport.

Measurements of POPs in human milk/blood

For many countries in the Region, there is generally even less information available on the levels of POPs in the human tissues than those of air.

In China, human milk survey has been performed in 2011, covering fourteen provinces and 110 samples. Department of Health of Hong Kong SAR of China has also conducted analysis of POPs in 50 human milk samples.

Fiji, Kiribati, Marshall Islands, Niue, Palau, Samoa, Solomon Islands and Tuvalu have participated in the POPs Global monitoring plan in the Pacific Island Region, which was conducted in 2011 and focused on the monitoring of POPs in human milk.

In Japan, more than 100 samples have been analysed for the POPs in human milk. Human milk samples was collected from 1972 to 2006 in Osaka Prefecture and Fukuoka Prefecture. The Ministry of the Environment reported the results of monitoring POPs in human blood from 2007 and 2012.

For human samples, the data are lacking over the region. More data are needed to provide information for future evaluation. Trend data in Japan, however, showed clear decline of dioxins, PCB and other POPs levels in recent decades.

Measurements of POPs in water

PFOS has been analysed in water collected from China (including Hong Kong SAR and Macao SAR), Japan, Republic of Korea, Philippines and Thailand. The concentration of PFOS in water was found ranging from ND to 47 ng/L in China. On the other hand, higher concentration of PFOS (up to 730 ng/L) was found in water sample collected in Japan and also in other Asian countries; up to several thousands ng/L levels of PFOS were detected and reported in industrial areas and in waste water in the region.

Levels of POPs in other media

Japan have been continuously monitored POPs in water, ground-water, sediment, soil and biota. For example, 36 to 49 sampling sites have been selected and analysed for the POPs in water since 2002. The Japan Ministry of Environment has already put a lot of effort on analysis of dioxins in water and ground-water since 1998. PCB has been firstly analysed in the bottom sediment of marine water in inner bay since 1974. Until now, some monitoring programmes have been conducted and focused on the level of POPs in sediment and soil. Biota such as Japanese field mouse, raccoon dog, finless porpoise, striped dolphins, melon-headed whales and skipjack tuna, as well as food, livestock products and marine products in Japan have been analysed for the level of POPs by individual research groups or by Japan Ministry of Environment. Moreover, Ministry of Health, Labour and Welfare, Japan, has conducted a survey on daily intake of dioxins.

Long-range transport of POPs

Only limited number of studies, including back trajectory analyses of air monitoring data in East Asian Monitoring Program were conducted. Due to the unsufficient number of long-term regional monitoring programs or studies on POPs, therefore, it is not easy to carry out investigation and evaluation of long-term transport.

Data gaps

In the 2nd phase Asia Pacific Regional Monitoring Report, countries located at Pacific region have participated in the monitoring program and submitted data for accessing POPs levels among the region. Although a few countries have participated in the monitoring program, it is still not enough for us to obtain a full spectrum of the POPs level among the region. It is encouraged that more countries especially located in central Asia should put more effort on it.

There is limited data on the levels of new POPs in core media. Therefore, the temporal trend is not yet established for some original POPs and most of the new POPs. It is important to maintain and continue the analyses in a certain time periods for the newer POPs.

China and Japan have been continuously monitoring POPs throughout the nation with well-established programs and facilities, however, for the other countries in Asia and Pacific Region, only limited facilities for POPs monitoring and inventory is provided, especially for dioxins analysis and hence, limited number of POPs studies were performed. In addition, some of the specialists cannot meet the requirements of the knowledge and techniques of POPs analysis, for example, insufficient quality control and data validation was observed.

Conclusions and recommendations

Monitoring data on ambient air were reported for the effectiveness evaluation of POPs levels in the East Asian and Pacific sub-region. However, no or limited data are provided from South and West Asian sub-region, resulting that not much information on the POPs concentration is available in that particular region. However, studies on POPs in human tissues are lacking over the region (except China and Japan). Therefore, more data are needed to provide the information of POPs in human tissues for future evaluation.

Since some new POPs have been formally listed in Stockholm convention, the measurement of these new POPs are included in 2nd phase monitoring report. For example, the measurement of PFOS in water is well documented throughout different countries. However, more effort should be put in the measurement of new POPs in our environment as there is only limited data available.

In order to have a better evaluation on the POPs level in future, more regional/subregional programmes, that are similar to POPs Monitoring Project in East Asian or POPs Global Monitoring Plan in the Pacific Island region, have to be established.

The following areas are the key elements for the capacity building/enhancement needs for the development of POPs analysis: human capacity, inter-calibration tests, strengthening skills for sampling and analysis infrastructure strengthening of existing laboratories for analyzing the core media, QA/QC, and financial assistance to establish long-term, self-sustainable laboratories.

POPs analysis laboratories within Asia and Pacific Region should implement robust and validated methods which are according to international scientific standards. By adopting the suitable analytical method to their circumstances and prove the capabilities with successful participation in international comparison studies. Also, it is noticed that POPs data are only provided by few countries in this region. Therefore, capacity building have to be set as the top priorities for most of POPs laboratories in the region. Based on the above actions, POPs analysis laboratories within Asia and Pacific Region are easily to support the implementation of the Stockholm Convention in countries and acquire the relevant scientific knowledge on POPs analysis in relevant matrices accurately.

Countries were also encouraged to seek opportunities for sharing regional monitoring data and for developing multi-country approaches and joint programmes to secure international funding. Additionally, countries were encouraged to work with neighbouring countries to produce sub-regional data.

It is suggested that in order to fill gaps and cover needs, further financial and technical supports on POPs monitoring should be provided according to articles 12 and 13 of the Convention.

A) Capacity building needs

It is recommended that capacity building for POPs monitoring programs be located at a top priority for most countries. Hence, the levels of POPs in Asian and Pacific Region are easily and well established by the validated and qualified data provided by different countries. In particular, analytical instruments and analytical methods for POPs analysis are required to improve to meet the international standards, which includes trained personnel, analytical facilities and funding to maintain and routine operation of POPs analyses. To maintain or improve the analytical capability for POPs needs, good quality assurance and quality control among laboratories, including the regular use of reference standards and/or certified reference materials, training programs, inter-laboratory comparison exercise, and the identification of reference laboratories within the region for specific POPs, should be achieved.

B) Future programmes

Some laboratories form this region participated in first round (2000/2011) and second round (2012/2013) of bi-ennial interlaboratory assessment on persistent organic pollutants coordinated by Chemicals Branch, United Nations Environment Programme. It is recommended more laboratories in the region to participate interlaboratory assessments to improve the analytical capability and QA/QC for POPs monitoring.

National POPs monitoring programs which carried out by China and Japan have to be continued to provide background POPs levels for future evaluation. Moreover, regional POPs monitoring programs, such as East Asian POPs Monitoring Program and POPs Global Monitoring Plan in the Pacific Island Region should be also continued for regional comparison and temporal trend analysis. It is noticed that some of the data in this report were obtained from one time point. It is suggested that sample analyses should be kept continue for future evaluation.

The monitoring of new POPs should be kept going in order to obtain the temporal trend information. Also, the governmental agencies within the region should set target priority to identify POP-like chemicals as this information is useful to the evaluation and assessment of candidate POPs.

1 INTRODUCTION

The present monitoring report synthesizes information from the first and second phase of the global monitoring plan and presents the current findings on POPs concentrations in the Asia-Pacific Region. While the first monitoring report, presented at the fourth meeting of the Conference of the Parties in May 2009, provided information on the baseline concentrations of the 12 legacy POPs, this second monitoring report, to be submitted to the seventh meeting of the Conference of the Parties in May 2015, provides first indications as to the changes in concentrations of the chemicals initially listed in the Convention, as well as baseline information on the newly listed POPs.

At its sixth meeting in May 2013, the Conference of the Parties, by decision SC-6/23 on the global monitoring plan for effectiveness evaluation, adopted the amended global monitoring plan for persistent organic pollutants (UNEP/POPS/COP.6/INF/31/Add.1) and the amended implementation plan for the global monitoring plan (UNEP/POPS/COP.6/INF/31/Add.2). It also adopted the Guidance on the Global Monitoring Plan for Persistent Organic Pollutants (UNEP/POPS/COP.6/INF/31), which has been updated to address the sampling and analysis of the newly listed POPs, providing a useful basis for monitoring of these chemicals in the second phase of the global monitoring plan, as well as for harmonized data collection, storage and handling.

The global coordination group met four times over the period 2011–2014 in order to oversee and guide implementation of the second phase of the global monitoring plan, with particular emphasis on addressing the sampling and analysis of the newly listed POPs, harmonizing data collection, storage and handling, addressing the needs for ensuring sustainability of ongoing monitoring activities and for further capacity strengthening to fill the existing data gaps, as well as improving data comparability within and across monitoring programmes.

Long term viability of existing monitoring programmes (air and human bio-monitoring) is essential to ensure that changes in concentrations over time can be investigated. National air monitoring activities having contributed data to the first monitoring reports continued during the second phase, and new programmes have been identified to support the development of the second reports. Likewise, the continued operation of global and regional air monitoring programmes was a major pillar in the second phase. For the new monitoring activities, collaboration with strategic partners has ensured cost-effective generation of data and use of harmonized protocols for POPs monitoring. The implementation of the second phase of the UNEP/WHO human milk survey is another important pillar of the global monitoring plan, providing useful long-term results showing how human exposure to POPs changed over time as measures are implemented to enforce the Convention.

Enhanced comparability within and across monitoring programmes to evaluate changes in levels over time and the regional and global transport of POPs was an equally important milestone in the second phase. QA/QC practices have been and continue to be essential for ensuring comparability, along with inter-laboratory exercises and intercalibration studies. Efforts continue to be directed at ensuring comparability within and across programmes, providing for evaluation of changes in concentrations of POPs over time and enabling regional comparisons.

Considering the global dimension of the monitoring plan under the Stockholm Convention, air, and human milk and/or blood have been established as core matrices as they provide information on the sources of POPs, environmental transport and the levels of exposure in human populations. The listing of new POPs in the Convention brought additional challenges in the implementation of the global monitoring plan. Perfluorooctane sulfonic acid (PFOS) and its salts do not follow the "classical" pattern of partitioning into fatty tissues, but instead bind preferentially to proteins in the plasma and are hydrophilic. Water has thus been added to the list of core matrices for these particular substances. This report also provides first results as to the concentrations of such chemicals in water.

During the second phase of the global monitoring plan, harmonized data handling was enabled and appropriate support was given to the collection, processing, storing and presentation of monitoring data in regions with limited capacity. A global monitoring plan data warehouse supports data collection and assists the regional organization groups and the global coordination group in producing the regional and global monitoring reports, the effectiveness evaluation. The global monitoring plan data warehouse also constitutes a publicly available repository of valuable information that can serve as a useful resource for policy makers and researchers worldwide.

2 DESCRIPTION OF THE REGION

2.1 Overall composition of the region

2.1.1 General features

Asia-Pacific Region is one of the five United Nation regions (Figure 2.1–1). The region is constituted by the countries listed below. As sub-regional arrangements, Table 2.1–1 shows the sub-region and the countries contained.

Table 2.1–1 Countries in the Asia-Pacific Region

Afghanistan	Kuwait	Samoa
Bahrain	Kyrgyzstan	Saudi Arabia
Bangladesh	Lao People's Democratic Republic	Singapore
Bhutan	Lebanon	Solomon Islands
Brunei Darussalam	Malaysia	Sri Lanka
Cambodia	Maldives	Syrian Arab Republic
China	Marshall Islands	Tajikistan
Cyprus	Micronesia (Federated States of)	Thailand
Cook Islands	Mongolia	Tokelau
Fiji	Myanmar	Timor-Leste
India	Nauru	Tonga
Indonesia	Nepal	Turkey
Iran (Islamic Republic of)	Niue	Turkmenistan
Iraq	Oman	Tuvalu
Japan	Pakistan	United Arab Emirates
Jordan	Palau (Republic of)	Uzbekistan
Kazakhstan	Palestine	Vanuatu
Kiribati	Papua New Guinea	Vietnam
Korea (DPRK)	Philippines	Yemen
Korea (Republic of)	Qatar	

Note: Underline shows countries that are either of ratification, acceptance, approval or accession to the Convention, but signature or succession to signature only. (as of June 24, 2014)

The feature of Asia-Pacific Region is as described below.

- ■ The region is located between 55 deg N to 30 deg S, and 35 deg E to 155 deg W.
- ■ The region covers 23 % of the world land area[1], and is inhabited by 60 % (approx. 4.2 billion)[2] of the world population. The region includes the two "billion" countries, China and India, either of which alone has the population size of other regions.
- ■ The region makes up about 39 % of world total GDP (PPP)[3].
- ■ In Asia-Pacific Region, there are 62 countries/states, out of which 49 are either of ratification, acceptance, approval or accession to the Convention.

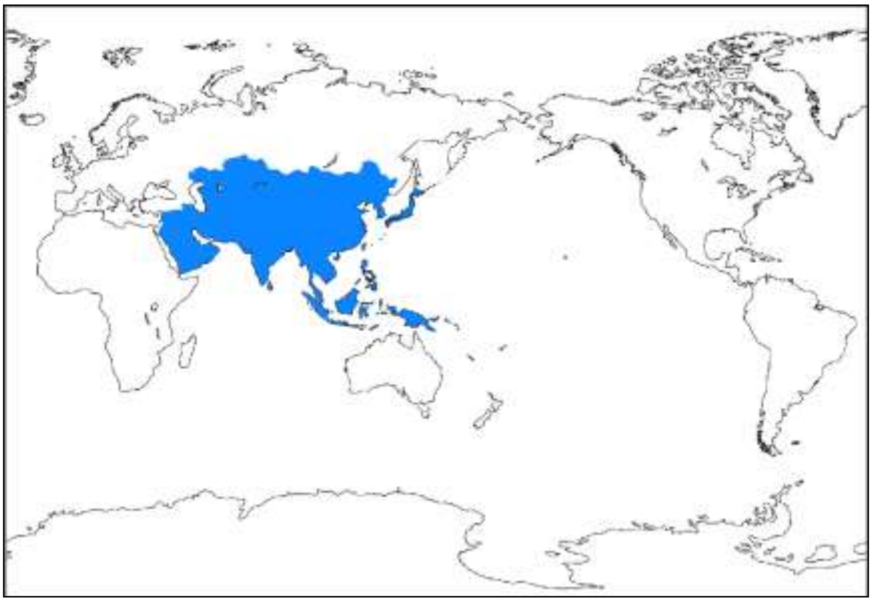


Figure 2.1–1 Map showing the Asia-Pacific Region[4]

2.1.2 Natural environment

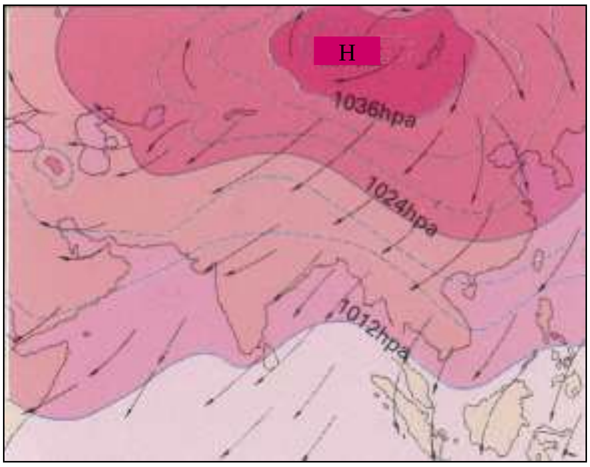
(1) Climate of the region

- The air circulation in the region is governed by Hadley cell (equatorial to 30 degrees north or south), or Ferrel cell (30 to 60 degrees in both hemisphere).
- Near equator, the wind is easterlies (Trade wind), converging to the equator where ascending air gives much rain to support tropical rain forest (Intertropical Convergence Zone; ITCZ).
- Around 30 deg N and S, there are dry downward flow, making arid in the area (Figure 2.1–2).
- The areas higher than 30 deg is controlled by Ferrel cell with strong westerly wind at around 30 to 40 degrees especially in winter season.

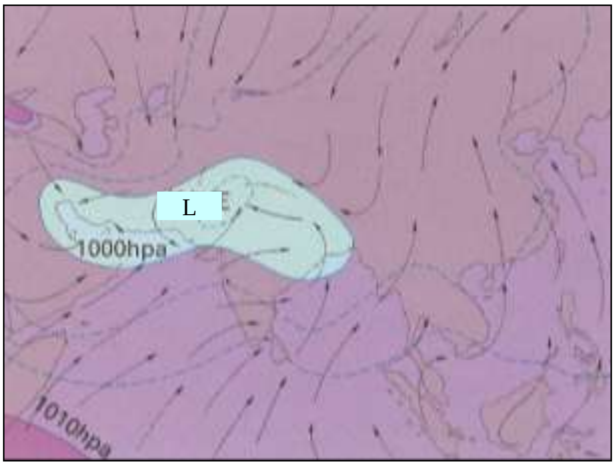
This general pattern is modulated by the geographical characteristics of the region, especially by the presence of Tibetan Plateau and Western Pacific Warm Pool (WPWP), which cause “Monsoon” climatic pattern in Southern and South Eastern Asia, and huge precipitation in South Eastern Asia.

Figure 2.1–2 Satellite map of Asia-Pacific Region[4]

(a) Seasonal change of the wind direction



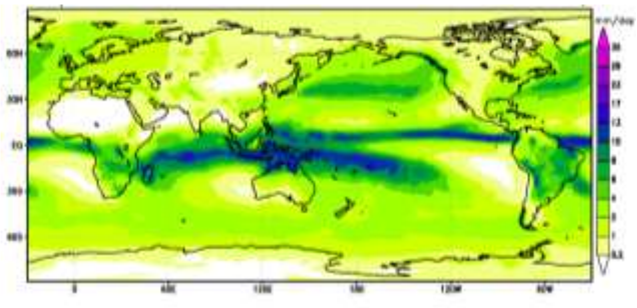
(A) Wind from high pressure in north Asia causes northeast monsoon in the winter



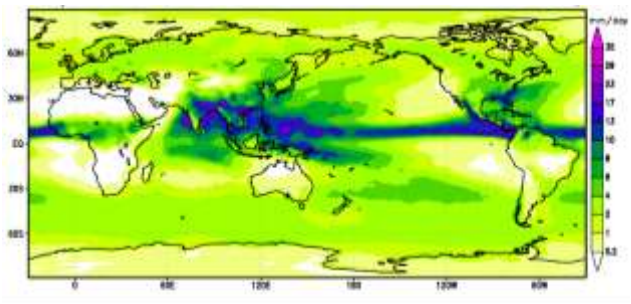
(B) Wind to low pressure caused by heating of the air above land occurs southeast monsoon in the summer

Figure 2.1–3 Summer and winter monsoon circulation.

(b) Seasonal change of the regional precipitation caused by monsoon



(A) January



(B) July

Figure 2.1–4 World precipitation of the summer and winter[5]

2.1.3 POPs in Asia-Pacific region

Asia-Pacific region has many characteristic features which tend to cause pollution by POPs. Although many of intentional POPs are now banned or restricted in many countries in the region, they once had been used extensively to support agricultural or industrial activities in order to support huge population and economy as well as to control malaria and pests particularly in tropical areas. In addition to these intentional production and usages, unintentional production of POPs in chemical reactions or incineration, high temperature processes in industries and waste treatment has been contaminating the environment and human beings. Thus POPs has been of major concern in the region.

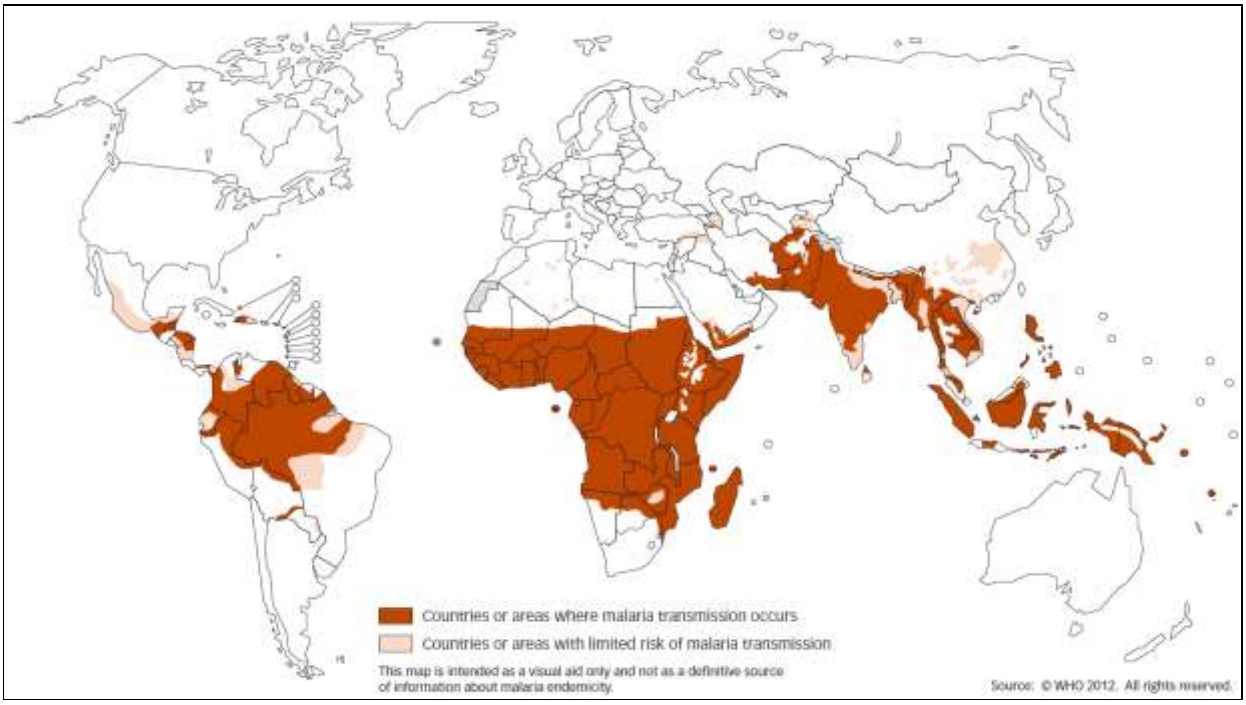


Figure 2.1–5 Distribution of malaria risk areas in the world[6]

2.2 Historical and current sources

For each POPs, information on regulation and purpose of use, production and importation for the countries in this region was organized based on the NIP, Regionally Based Assessment of Persistent Toxic Substances (published by UNEP, 2002), etc.

2.2.1 Exemption of the Convention

Parties of the Stockholm Convention reported their specific exemption to the Convention. Following information is based on the registered information on special exemption from the Stockholm Convention website[7].

Table 2.2–1 Register of specific exemptions for the Stockholm Convention in the countries within Asia-Pacific region

A) Chemicals listed in Annex A

Chemical	Activity	Party	Purpose(s) of use/ production	Estimated quantity of use/ production	Reason(s) for exemption	Duration of the exemption(s), if less than five years	Remarks
Hexabromodiphenyl ether and heptabromodiphenyl ether	Use	Iran	Use	Not known as yet	Country data not yet established	5 years as of 26 August 2010	Country data not yet established
		Japan	Recycling Automobile Shredder Residues (ASR) to Refuse Paper and plastic Fuel (RPF). Recycling ASR to Recycled Sound-Proofing	N/A	Recycling of ASR is an obligation for automobile manufacturers and importers under the Law for the Recycling of End-of-Life Vehicles. It is necessary to enable recycling of ASR to maintain appropriate management system of End-of-Life Vehicles. Recycling of ASR is operated in		It is difficult to estimate the quantity of annual use of the chemicals listed above, because of uncertainties and lack of information of their use to automobile parts and the specific

Chemical	Activity	Party	Purpose(s) of use/ production	Estimated quantity of use/ production	Reason(s) for exemption	Duration of the exemption(s), if less than five years	Remarks
			Products (RSPP). Recycling plastics from used specific home appliances (air conditioner, television sets, refrigerator, freezer, washing machine and clothes dryer) and personal computers to constriction material and daily necessities such as hangers and bookends.		environmentally sound manner under the law. Recycling used specific home appliances is an obligation for home appliance manufacturers and importers under the Home Appliance Recycle law. It is necessary to enable recycling of plastics from used specific home appliances to maintain appropriate management system of the used specific home appliances and establish a sound material recycle society. Recycling of such plastics is operated in environmentally sound manner under the law. Recycling used personal computers is an obligation for personal computer manufacturers and importers under the law for the Promotion of Effective Utilization of Resources. It is necessary to enable recycling of plastics from used computers to maintain appropriate management system of the used personal computers and establish a sound material recycle society. Recycling of such plastics is operated in environmentally sound manner under the law.		home appliances in the past. Approximately 500,000 tons of ASR which might contain the chemical listed above is recycled annually. Approximately 128,000 tons of plastics from used specific hove appliances which might contain the chemicals listed above are recycled annually. Approximately 5,892 tons of used personal computers are collected annually. On average, the weight of plastics which might contain the chemicals listed above is approximately 15% of total weight of personal computers.
Lindane	Use	China, People's Republic of	Adjuvant therapeutic drug to control head lice and to treat scabies.	No information.	Currently in use without appropriate alternatives and transition will take some time.		Applicable to Hong Kong SAR and Macau SAR of China.
		Sri Lanka	Human health pharmaceutical (for Pediculosis and Scabies)	137 Kg	No alternative	Specific exemptions are sought for the purposes given until suitable alternatives are made	Use of lindane on head lice is restricted in Sri Lanka due to the possibility of developing resistance
Technical endosulfan and its related isomers	Production and use	China, People's Republic of	Cotton - cotton bollworm; Tobacco - Aphids, oriental tobacco budworm.	-	No suitable alternatives available for now, a period of time is required until suitable alternatives are made by production sector.		The register of specific exemptions is also applicable to the Hong Kong Special Administrative Region and the Macao Special Administrative Region of the People's Republic of China.
Tetrabromodiphenyl ether and pentabromodiphenyl	Use	Iran	Use	Not known as yet	Country data not yet established	5 years as of 26 August 2010	Country data not yet established

Chemical	Activity	Party	Purpose(s) of use/ production	Estimated quantity of use/ production	Reason(s) for exemption	Duration of the exemption(s), if less than five years	Remarks
ether	Use	Japan	Recycling Automobile Shredder Residues (ASR) to Refuse Paper and plastic Fuel(RPF). Recycling ASR to Recycled Sound-Proofing Products (RSPP). Recycling plastics from used specific home appliances (air conditioner, television sets, refrigerator, freezer, washing machine and clothes dryer) and personal computers to constriction material and daily necessities such as hangers and bookends	N/A	Recycling of ASR is an obligation for automobile manufacturers and importers under the Law for the Recycling of End-of-Life Vehicles. It is necessary to enable recycling of ASR to maintain appropriate management system of End-of-Life Vehicles. Recycling of ASR is operated in environmentally sound manner under the law. Recycling used specific home appliances is an obligation for home appliance manufacturers and importers under the Home Appliance Recycle law. It is necessary to enable recycling of plastics from used specific home appliances to maintain appropriate management system of the used specific home appliances and establish a sound material recycle society. Recycling of such plastics is operated in environmentally sound manner under the law. Recycling used personal computers is an obligation for personal computer manufacturers and importers under the law for the Promotion of Effective Utilization of Resources. It is necessary to enable recycling of plastics from used computers to maintain appropriate management system of the used personal computers and establish a sound material recycle society. Recycling of such plastics is operated in environmentally sound manner under the law.		It is difficult to estimate the quantity of annual use of the chemicals listed above, because of uncertainties and lack of information of their use to automobile parts and the specific home appliances in the past. Approximately 500,000 tons of ASR which might contain the chemical listed above is recycled annually. Approximately 128,000 tons of plastics from used specific hove appliances which might contain the chemicals listed above are recycled annually. Approximately 5,892 tons of used personal computers are collected annually. On average, the weight of plastics which might contain the chemicals listed above is approximately 15% of total weight of personal computers.
		Vietnam	Recycling	To be updated	Recycling of articles that contain or may contain tetrabromodiphenyl ether and pentabromodiphenyl ether, and the use and final disposal of articles manufactured from recycled materials that contain or may contain tetrabromodiphenyl ether and pentabromodiphenyl ether are still exist.	Five years	Vietnam is in the process of PBDE inventory and development of methodology to control the recycling activities of PBDE materials.

B) Chemicals listed in Annex B

Chemical	Activity	Party	Purpose(s) of use/ production	Estimated quantity of use/ production	Reason(s) for exemption	Duration of the exemption(s), if less than five years	Remarks[1]
Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride	Production and use	China, People's Republic of	· Photo masks in the semiconductor and liquid crystal display (LCD) industries; · Metal plating (hard metal plating); · Metal plating (decorative plating); · Insecticides for control of red imported fire ants and termites; · Chemically driven oil production.	-	Currently in use without appropriate alternatives and transition will take some time.		Applicable to Hong Kong SAR and Macau SAR of China.
		Vietnam	· Photo masks in the semiconductor and liquid crystal display (LCD) industries; · Metal plating (hard metal plating); · Metal plating (decorative plating); · Electric and electronic parts for some colour printers and colour copy machines. · Insecticides for control of red imported fire ants and termites; · Chemically driven oil production; · Carpets; · Leather and apparel; · Textiles and upholstery; · Paper and packaging; · Coatings and coating additives; · Rubber and plastics.	-	Still in use	Five years	Vietnam is in the process of PFOS inventory.
	Use	Iran	· Metal plating (hard metal plating); · Metal plating (decorative plating); · Chemically driven oil production; · Carpets; · Leather and apparel; · Textiles and upholstery; · Paper and packaging; · Coatings and coating additives; · Rubber and plastics	-	Country data not yet established	5 years as of 26 August 2010	

Table 2.2–2 DDT register pursuant to paragraph 1 of Part II of Annex B of the Stockholm Convention

Party	Production notification (x = received)	Use notification (x = received)	Date of notification	Comments
India	X	X	27 October 2006	Malaria(Anopheles culicifacies ,An fluviatilis, An. Minimus, An. Dirus) Kala-azar(Sandfly) M/s Hindustan Insecticide Limited (HIL) is the sole manufacturer of DDT in the country .
Marshall Islands		X	22 May 2004	Acceptable purpose: Disease vector control in accordance with Part II of Annex B (Malaria / Other related illnesses)
Yemen, Republic of		X	29 March 2005	1.) Yemen has banned the use of DDT for agriculture since 1990, but Yemen is still using DDT for disease vector control (Malaria); 2.) Yemen is now making efforts to replace DDT with other safe chemicals, but Yemen needs some support to fulfil its plans and to make its efforts succeed.

Table 2.2–3 Register of PFOS, its salts and PFOSF pursuant to paragraph 1 of part III of annex B of the Stockholm Convention

Party	Production notification (x = received)	Use notification (x = received)	Acceptable purpose activities	Chemical name of the precursor (if relevant)	Remarks
China, People's Republic of	X	X	· Photo-imaging · Photo-resist and anti-reflective coatings for semi-conductors · Etching agent for compound semi-conductors and ceramic filters · Aviation hydraulic fluids · Metal plating (hard metal plating) only in closed-loop systems · Certain medical devices (such as ethylene tetrafluoroethylene copolymer (ETFE) layers and radio-opaque ETFE production, in-vitro diagnostic medical devices, and CCD colour filters) · Fire-fighting foam		Applicable to Hong Kong SAR and Macau SAR of China
Japan	X	X	· Photo-imaging; · Photo-resistant and anti-reflective coatings for semi-conductors; · Etching agent for compound semi-conductors and ceramic filters; · Certain medical devices	Perfluotooctane-1-sulfonyl fluoride (PFOS-F, CAS No. 307-.35-7)	
Vietnam	X	X	· Photo-imaging; · Photo-resist and anti-reflective coatings for semi-conductors; · Etching agent for compound semi-conductors and ceramic filters; · Aviation hydraulic fluids; · Metal plating (hard metal plating) only in closed-loop systems; · Certain medical devices (such as ethylene tetrafluoroethylene copolymer (ETFE) layers and radio-opaque ETFE production, in-vitro diagnostic medical devices, and CCD colour filters); · Fire-fighting foam; · Insect baits for control of leaf-cutting ants from Atta spp. and Acromyrmex spp.	· Perfluorooctane sulfonic acid (CAS No: 1763-23-1); · Potassium perfluorooctane sulfonate (CAS no. 2795-39-3); · Lithium perfluorooctane sulfonate (CAS no. 29457-72-5); · Ammonium perfluorooctane sulfonate (CAS no. 29081-56-9); · Diethanol-ammonium perfluorooctane sulfonate (CAS no. 70225-14-8); · Tetraethyl-ammonium perfluorooctane sulfonate (CAS no. 56773-42-3); · Didecyldimethyl-ammonium perfluorooctane sulfonate (CAS no. 251099-16-8) · Perfluorooctane sulfonyl fluoride (CAS No: 307-35-7).	Vietnam is in the process of PFOS inventory and will update information when available.

Table 2.2–4 Listing notifications of articles in use pursuant to Note (ii) of Annex A and Note (ii) of Annex B of the Stockholm Convention

Party	Chemical	Article in use	Date of notification
Japan	Chlordane	Termiticide in structures of houses where Chlordane occurs as a constituent	8/30/2002
	Heptachlor	Termiticide in structures of houses where Heptachlor occurs as a constituent	8/30/2002
	PFOS, its salts and PFOSF	· Photo imaging • Photo resistant and anti-reflective coatings for semi-conductors • Etching agent for compound semi-conductors and ceramic filters • Fire-fighting foam • Certain medical devices	9/2/2010

2.2.2 Agricultural use and regulations

The information on agricultural use and regulations on POP substances from PTS reports[8], NIPs[9], Proceedings of the Workshop on Environmental Monitoring of Persistent Organic Pollutants (POPs) in East Asian Countries[10] and information submitted from countries in the region are shown below (also see Annex A).

(1) Aldrin

In Indonesia and Mongolia, Aldrin was not historically used for agricultural and pest control purpose, and China used Aldrin only for experimental purpose. Currently, most of the countries in Asia-Pacific Region (e.g. Cambodia, China, Japan, Jordan, Lebanon, Mongolia, Nepal, Philippines, Singapore, Thailand, and Vietnam) have banned Aldrin for agricultural and pest control uses.

(2) Chlordane

In Mongolia, Chlordane was not historically used for agricultural and pest control purpose. According to NIP of Lao People’s Democratic Republic (2010), chlordane is still being illegally used by local farmers for agricultural purpose in Lao People’s Democratic Republic, but in very small quantity. Japan has already banned the use of Chlordane, but Japan registered that Chlordane can be found as termiticide in structures of houses.

Recently, most of the countries in this region (e.g. Cambodia, China, Japan, Jordan, Lebanon, Mongolia, Nepal, Philippines, Singapore, Thailand and Vietnam) have banned the use of Chlordane for pest control and agricultural purpose.

(3) DDT

India, Marshal Islands, and Yemen are still using DDT for vector control as an acceptable purpose to the Convention. According to NIP of Korea (DPRK) 2008, Korea (DPRK) has not registered to the Convention, but still using DDT for vector control and insecticide. According to NIP of Lao People’s Democratic Republic 2010, DDT is still being illegally used by local farmers for agricultural purpose in Lao People’s Democratic Republic, but in very small quantity. China used to register DDT for vector control use and dicofol production, and Myanmar used to register DDT for vector control use. But both countries withdrew the register in 2014 and 2012, respectively. According to the withdrawal notification, China decided to further the cease of use of DDT for vector control use and dicofol production and Myanmar imports the alternative insecticides such as malathion and alphacybermethrine instead of DDT. Currently, most of the countries in this region (e.g. Bahrain, Bhutan, Cambodia, Japan, Jordan, Kuwait, Lebanon, Mongolia, Nepal, Oman, Pakistan, Qatar, Saudi Arabia, Singapore, Sri Lanka, Thailand, UAE and Vietnam) have banned DDT for agricultural and pest control uses.

(4) Dieldrin

In Mongolia and Uzbekistan, Dieldrin was not historically used for agricultural and pest control purpose Currently, most of the countries in this region (e.g. Bahrain, Cambodia, Iraq, Japan, Jordan, Kuwait, Lebanon, Mongolia, Nepal, Oman, Pakistan, Philippines, Qatar, Saudi Arabia, Singapore, Sri Lanka, Thailand, UAE and Vietnam) have banned Dieldrin for agricultural and pest control uses.

(5) Endrin

In China, Indonesia, Kazakhstan, Kyrgyzstan and Mongolia, Endrin was not historically used for agricultural and pest control purpose. Currently, most of the countries in this region (e.g. Cambodia, Japan, Jordan, Lebanon, Mongolia, Nepal, Philippines, Singapore, Thailand and Vietnam) have banned Endrin for agricultural and pest control uses.

(6) Heptachlor

In Indonesia and Mongolia, Heptachlor was not historically used for agricultural and pest control purpose. China and Japan have already banned the use of Heptachlor. Japan registered that Heptachlor can be found in structures of the houses, because Heptachlor is a component of technical chlordane which had been used as a termiticide.

Currently, most of the countries in this region (e.g. Cambodia, Japan, Jordan, Lebanon, Nepal, Philippines, Singapore, Thailand and Vietnam) have banned Heptachlor for agricultural and pest control uses.

(7) HCB

In Indonesia, Malaysia, Mongolia, Philippines, Thailand, and Uzbekistan, HCB was not historically used for agricultural and pest control purpose. According to NIP of Korea (DPRK) (2008), Korea (DPRK) has not registered to the Convention, but still using HCB as pesticide for seed treatment in agriculture. Currently, most of the countries in this region (e.g. Cambodia, China, Japan, Lebanon, Singapore and Vietnam) have banned the use of HCB for agricultural and pest control uses.

(8) Mirex

In India, Iran, Japan, Kazakhstan, Kyrgyzstan, Mongolia, Nepal, Philippines, Sri Lanka, Tajikistan, Thailand, and Uzbekistan, Mirex was not historically used for agricultural and pest control purpose.

Currently, most of the countries in this region (e.g. Bahrain, Bangladesh, Cambodia, China, Japan, Kazakhstan, Kyrgyzstan, Kuwait, Lebanon, Nepal, Oman, Pakistan, Qatar, Saudi Arabia, Singapore, Thailand, UAE and Vietnam) have banned the use of Mirex for agricultural and pest control uses.

(9) Toxaphene

In Japan, Sri Lanka, and Uzbekistan, Toxaphene was not historically used for agricultural and pest control purpose. Currently, most of the countries in this region (e.g. Cambodia, China, Japan, Mongolia, Lebanon, Nepal, Philippines Singapore and Vietnam) have banned the use of Toxaphene for agricultural and pest control uses.

(10) Chlordecone

In Japan Chlordecone has never been registered domestically as agricultural chemicals, and there is no record of manufacture and import. It was designated as Class I Specified Chemical Substance in April 2010 under the Chemical Substances Control Law, and its manufacture, import and use are virtually prohibited.

(11) Lindane, α-HCH, and β-HCH

China and Sri Lanka registered Lindane to the Convention for adjuvant therapeutic drug to control head lice and to treat scabies.

In Japan Lindane, α-HCH, and β-HCH were used as agricultural chemicals and also as insecticides for termite control. While the registration expired in 1971 under the Agricultural Chemicals Regulation Law, they were still used as insecticides for termite control and wood treatment agents. Lindane, α-HCH, and β-HCH were designated as Class I Specified Chemical Substance in April 2010 under the Chemical Substances Control Law and their manufacture, import and use are virtually prohibited. Also, as for Lindane related to agricultural use, its use and other activities have been already regulated since the 1970s under the Agricultural Chemicals Regulation Law.

(12) PFOS, its salts and PFOSF

China and Vietnam registered PFOS, its salts and PFOSF to the Convention for insecticides for control of red imported fire ants and termites.

(13) PeCBz

In Japan PeCBz has never been registered domestically as agricultural chemicals, while it has been applied for agricultural use in other Asia-Pacific countries in the past.

(14) Technical endosulfan and its related isomers

China registered technical endosulfan and its related isomers to the Convention for production and pest control use. In Japan its registration as insecticide expired in 2010 under the Agricultural Chemicals Regulation Law, and its distribution and use have been prohibited since April 2012 based on the law. And also in Japan, endosulfan was designated as Class I Specified Chemical Substance in May 2014 under the Chemical Substances Control Law and their manufacture, import and use are virtually prohibited.

2.2.3 Industrial use and regulations

The information on industrial use and regulations from PTS reports[8] and NIPs[9] in each POPs are shown below (also see Annex A).

(1) DDT

In China and India, DDT was used and/or produced as intermediate for the Dicofol production. However the specific exemption expired in May 2009 for both countries.

At 17 May 2009, there were no Parties registered for the specific exemptions for intermediate in production of dicofol which is listed in Annex B pertaining to DDT. Therefore, in accordance with paragraph 9 of Article 4 of the Conventions, no new registrations may be made with respect to exemptions for intermediate in production of dicofol.

(2) HCB

According to NIP of Korea (DPRK) (2008), Korea (DPRK) has not registered to the Convention, but still using HCB for the production of pentachlorophenol (PCP), an herbicide, and chloro-butoxy-benzene (CBB), a plasticizer. On the other hand, Japan, Singapore, and Vietnam have banned HCB for the industrial use.

(3) PCB

In Indonesia, there is no regulation on PCB. China has regulation on PCB pollution control. The treatment of PCB containing electric equipment is being carried out in China. In Jordan, there is no regulation on handling, disposal and banning of PCB, but recent regulation banned importing and using oils containing PCB more than 0.005% of PCB by weight.

Japan has banned PCB for use, production and importation since 1974. For PCB stockpiles which were stored until now, efforts have been made to properly dispose PCB wastes in accordance with the PCB Special Measures Law, enacted in 2001. In June, 2014, Basic Plan for Proper Treatment of PCB Waste based on PCB Special Measures Law was revised taking previous treatment condition and problems into consideration. Through the implementation of the revised plan, goal of 2025 for phasing out the use of equipment containing PCB set by Stockholm Convention is assumed to be accomplished.

According to NIP of Korea (DPRK) (2008), Korea (DPRK) has not registered to the Convention, but still using PCB for the production of electric equipment, machinery, insulating paints, etc.

Lebanon banned the entry of PCB products into the country and also banned PCB for industrial use. In Philippines, Chemical Control Order provides guidelines for the phase out of the use, sale, and importation of PCB electrical equipment. Under the same Order, responsibilities and liabilities for the improper management and handling of PCB and its wastes has been established.

In Tajikistan, there is no system for regulation of their use, utilization and destruction for PCB. On the other hand, Singapore and Thailand banned the use of PCB for industrial uses.

(4) Tetrabromodiphenyl ether, Pentabromodiphenyl ether

Iran, Japan and Vietnam registered tetrabromodiphenyl ether and pentabromodiphenyl ether to the Convention for use. In Japan and Vietnam, purpose of use is for recycling. However in Japan, tetrabrodiphenyl ether and pentabrodiphenyl ether were designated in April 2010 as Class I Specified Chemical Substance under the Chemical Substances Control Law, and their manufacture, import and use are virtually prohibited.

(5) Hexabromodiphenyl ether, Heptabromodiphenyl ether

Iran and Japan registered hexabromodiphenyl ether and heptabromodiphenyl ether to the Convention for use. In Japan purpose of use is for recycling. However in Japan, hexabromodiphenyl ether and heptabrodiphenyl ether were designated in April 2010 as Class I Specified Chemical Substance under the Chemical Substances Control Law, and their manufacture, import and use are virtually prohibited.

(6) Hexabromobiphenyl

In Japan, hexabromobiphenyl was used as fire retardants for plastic products. It was designated as Class I Specified Chemical Substance in April 2010 under the Chemical Substances Control Law, and their manufacture, import and use are virtually prohibited.

(7) Hexabrocyclododecane

In Japan, hexabrocyclododecane was used as a fire retardant. It was designated as Class I Specified Chemical Substance in May 2014 under the Chemical Substances Control Law, and their manufacture, import and use are virtually prohibited.

(8) PFOS, its salts and PFOSF

China, Iran and Vietnam registered PFOS, its salts and PFOSF to the Convention for use or use and production for purposes such as metal plating, chemically driven oil production, and etc.

In Japan, PFOS, its salts and PFOSF were designated as Class I Specified Chemical Substance in April 2010 under the Chemical Substances Control Law and their manufacture, import and use are virtually prohibited. However, some uses of PFOS or its salts are approved based on the premise of stringent controls. Japan registered that PFOS, its salts and PFOSF can be found in photo imaging, photo resistant and anti-reflective coatings for semi-conductors, etching agent for compound semi-conductors and ceramic filters, fire-fighting foam, and certain medical devices.

(9) PeCBz

In Japan, PeCBz was used as a fire retardant. It was designated as Class I Specified Chemical Substance in April 2010 under the Chemical Substances Control Law, and its manufacture, import and use are virtually prohibited.

2.2.4 Unintentional production

Information on the inventory of the following POPs formed and released unintentionally from anthropogenic sources is listed below (also see Annex B).

(1) PCDD, PCDF, and *dl*-PCB

In Japan, PCDD, PCDF and *dl*-PCB are categorized as dioxins under the Dioxins Law. Measures against dioxins have mainly focused upon controlling releases from waste incinerators etc. Releases (estimate) in 2012 were 136 – 138 g-TEQ per annum, which represents a decline of approximately 98% from the level of releases in 1997 (7,680 – 8,135 g-TEQ per annum).

In Republic of Korea, methods have been developed for classifying the sources of Dioxins emission and calculation of the emission quantity since 2001. Dioxins emissions from waste incinerators have decreased continuously compared to the 2001 due to constant control measures, such as the progressive strengthening of emission standards.

In other parties to the Stockholm Convention in the Asia-Pacific Region, information on emission inventory of PCDD, PCDF, and *dl*-PCB for single year is organized in their NIP. Detail is shown in Annex B.

(2) HCB

Ministry of the Environment, Japan organized the emission inventory of HCB for 2002, 2006, and 2009. It was estimated that HCB release reduced by approximately 40% from 2002 to 2009 (see Annex B).

In Republic of Korea and Sri Lanka, information on emission inventory of HCB for single year is organized in their NIP. Detail is shown in Annex B.

(3) PCB

Ministry of the Environment, Japan organized the emission inventory of PCB for 2002, 2006, and 2009. While it was estimated that PCB releases from the Part III source categories listed in Annex C of the convention reduced by approximately 30% from 2002 to 2009, emissions increased from cement kilns, secondary zinc production and waste incinerators. For this reason, it was estimated that the total emissions remained almost the same (see Annex B).

In Republic of Korea, information on emission inventory of *dl*-PCB for 2001 is organized in their NIP. Detail is shown in Annex B.

(4) PeCBz

Ministry of the Environment, Japan organized the emission inventory of PeCBz for 2009. Detail is shown in Annex B.

3 ORGANIZATION OF REGIONAL IMPLEMENTATION

3.1 Preparatory workshops

To facilitate Regional Monitoring Report for Asia-Pacific Region, the three meetings were held for this region (Table 3.1–1). At each workshop, ROG members discussed structure of the report, selection of data, capacity building, etc.

Work plans and time tables to finalize the regional monitoring report are summarized in Table 3.1–2.

Table 3.1–1 Preparatory workshops for regional monitoring report in Asia-Pacific region

	Meeting of the Coordination Group and Regional Organization Groups for the Global Monitoring Plan for Persistent Organic Pollutants under the Stockholm Convention	**Meeting of the Coordination Group and Regional Organization Groups under the Global Monitoring Plan for Persistent Organic Pollutants**	**Asia-Pacific Regional Organization Groups**
Date	October 10th - 12th 2012	September 17th - 20th 2013	September 25th - 26th 2014
Location	Geneva, Switzerland	Brno, Czech Republic	Beijing, China
Objective	To discuss about agreements on data warehouse and regional agreements, for the preparation of 2nd phase Regional Monitoring Report (RMR) and Global Monitoring Report.	To discuss about agreements on finalization of data warehouse and regional agreements for the preparation of 2nd phase Regional Monitoring Report and Global Monitoring Report.	To review on the data and decide the data to be included in the regional report; to discuss on and finalize the detail structure of the report; and to discuss the mechanism for further review and revision of the report.
Items dealt	Agreements on revision of GMP guidance, data reporting format in GMP and global data warehouse, and information gathering and preparation of report at regional level.	Monitoring implementation status in 2nd phase GMP, data handling in Data Warehouse, and schedule for the preparation of Regional Monitoring Report.	Agreements on the structure of the report, procedure for the finalization of the report, and additional data that may be available that might be included in the report.
Remarks	Since ROG member from Syria became unable to contribute to the preparation of RMR, it was decided to nominate new ROG member, or ROG member from Qatar will handle task of Syria also. As it was in the last time, consultant from Japan will be the initial author and professor from China will be the principle author.	Since ROG member from Syria became unable to contribute to the preparation of RMR, it was decided that ROG member from Qatar will handle task of Syria also.	Data included in the report must be collected through focal point of each country.

Table 3.1–2 Work plans and time tables to finalize the regional monitoring report

Work plan	Time table
Submission of sub-regional reports	August 31, 2014
ROG meeting to discuss the modifications on the draft regional report	September 25-26, 2014
ROGs finalize the first draft of the regional monitoring report	October, 2014
Draft regional monitoring report send to national focal point for comments	January, 2015
ROGs to revise the regional report according to comments	February, 2015
Adoption of the regional monitoring report and submission to Secretariat	March 6, 2015

3.2 Establishment and responsibilities of the regional organization group

As the result of discussion at the ROG Workshop described in 3.1, five regional organization group members took responsibility for the countries within their sub-region for collecting data and preparing the second regional monitoring report.

Table 3.2–1 Sub-regional framework of responsibilities in ROG members

ROG Member	Selected member of contries within the sub-region		
Qatar	● Bahrain ● Iraq ● Jordan ● Kuwait	● Lebanon ● Oman ● Palestine ● Saudi Arabia	● Turkey ● United Arab Emirates ● Yemen
India	● Afghanistan ● Bangladesh ● Bhutan	● Iran ● Maldives ● Nepal	● Pakistan ● Sri Lanka
China	● Korea (DPRK) ● Lao People’s Democratic Republic ● Mongolia	● Vietnam ● Kazakhstan ● Kyrgyzstan	● Tajikistan ● Turkmenistan ● Uzbekistan
Japan	● Brunei Darussalam ● Cambodia ● Indonesia	● Korea (Republic of) ● Malaysia ● Myanmar	● Philippines ● Singapore ● Thailand
Fiji	● Samoa ● Cook Islands ● Kiribati ● Micronesia (Federated States of) ● Marshall Islands	● Nauru ● Niue ● Palau (Republic of) ● Papua New Guinea ● Samoa ● Solomon Islands	● Tokelau ● Tonga ● Tuvalu ● Vanuatu

Table 3.2–2 ROG members for sub-regions

Country	Member
China	Mr. Minghui Zheng
Fiji	Mr. William Aarlbersberg
India	Mr. Bharat Singh
Japan	Mr. Yasuyuki Shibata
Qatar	Ms. Hala Sulutan Saif Al-Easa
Syria	Mr. Fouad Elok

3.3 Agreement on a basic framework to provide comparable information

The ROG members have agreed, at the preparation of the first regional monitoring report, that data submitted in the regional report should include information regarding QA/QC, such as LOD, blank testing, recovery, accuracy, precision, etc. Information of sampling (location, method, procedure) and analytical method should be provided. Moreover, the source of data should be provided.

3.4 Regionally developed and executed implementation plans

The existing sub-regional initiative of POPs Monitoring Project in East Asian Countries, conducted by Ministry of the Environment, Japan, comprises of two parts: (1) organizing workshops to discuss and guide the project; and (2) providing technical assistance for background field monitoring of POPs in air (e.g. sampling, high resolution GC/MS analysis, data validation, QA/QC). For the project of Background Air Monitoring of POPs in East Asian Countries from 2004–2007 and 2009–2013, ten countries (Cambodia, Indonesia, Japan, Republic of Korea, Lao PDR, Malaysia, Mongolia, Philippines, Thailand and Vietnam) have reported the result of the monitoring. Republic of Korea also took initiative to implement information warehouse and Analysis Training of POPs in East Asian Countries.

Organized human milk monitoring programmes have been implemented by WHO since 1987. WHO organized and completed five rounds of exposure studies in 1987–1988, 1992–1993, 2000–2001, 2005–2007 and 2008–2012 on levels of specific POPs in human milk, and new round has begun since 2013. The main objectives of these studies were: 1) to produce more reliable and comparable data on concentrations of POPs in human milk for further improvement of health risk assessment in infants, 2) to provide an overview of exposure levels in various countries and geographical areas, 3) to determine trends in exposure levels.

UNEP Project “Supporting the POPs Global Monitoring Plan in the Pacific Islands Region” and UNEP/GEF project “Establishing the Tools and Methods to Include New POPs into the Global Monitoring Plan,” are also relevant activity in Asia-Pacific Region.

Institute for Sustainability and Peace at United Nations University (UNU-ISP) has been conducting a capacity building initiative that provides ten developing Asian countries with the scientific knowledge and technology to monitor pollutants in the environment to better manage chemical pollutants (project called “Environmental Monitoring and Governance in the Asian Coastal Hydrosphere”). In the current phase (Phase VI, 2012–2015); the project focuses on perfluorochemicals (PFCs), which were listed (as PFOS and its salts, and PFOSF) in May 2009 in Annex B of the Stockholm Convention.

3.5 Information gathering strategy

ROG agreed that data submission from each country for second phase regional monitoring report should follow criteria in Chapter 6 of the GMP guidance document or electronically through the reporting system, and also decided that ROG will work out a template for data submission at ROG meeting in October 2013. Strategy on how the information should be received/obtained was agreed as described below:

1. Data should be uploaded by national focal points.
2. Data from global or inter-regional monitoring projects will be considered including in regional report after get permission from focal points.
3. ROG members contact the national focal points for the sub-region he/she is responsible for. ROG coordinator will gather information from each ROG member.

All the data will be submitted to the data warehouse arranged by the secretariat of the Stockholm Convention and will be used together with the data of the first phase of the GMP for Effectiveness Evaluation in the future.

There is also a way to get information by analyzing samples stored in the sample bank to obtain the concentrations of POPs in the past. The sample banking programmes in Japan and Republic of Korea are shown in Table 3.5–1. In Republic of Korea and China, the sample banking system is now under development.

Table 3.5–1 Sample banking in Japan and Republic of Korea

States	Programmes	Organization	Media	Storage
Japan	Time Capsule Program for Environmental Specimens[11]	National Institute for Environmental Studies	Bivalves, Fish, Others (atmospheric, human milk, marine reptile)	Liquid nitrogen vapor (–150 ℃) Freezer (–60 ℃)
	Environmental Specimen Bank for Global Monitoring (*es*-BANK) [12,13]	Ehime University, Center for Marine Environmental Studies	Wildlife species & organs, Atmospheric sample, Sediment, *etc*.	Liquid nitrogen vapor (–150 ℃), *etc.*
	Kyoto University Human Specimen Bank for Biological Monitoring[14]	Kyoto University	Food, human blood, human milk, urine	Freezer (–20 ℃)
Republic of Korea	National Environmental Specimen Bank	National Institute of Environmental Research	Leave & branch, Fish, Bivalves, egg, Human sample (blood, blood serum, plasma, urine, colostrum, placenta)	Liquid nitrogen vapor (–150 ℃)
			Human blood, urine	Freezer (–80 ℃)

3.6 Strategy for using information from existing programmes

Information used for the second regional monitoring report is submitted by national focal points, in principle. Data from global or inter-regional monitoring projects, such as Background Air

Monitoring of POPs in East Asian Countries, should consider including in the report after obtaining permission from each of the focal points.

3.7 Preparation of the monitoring reports

The drafting team for the preparation of the second regional monitoring report is consisted of ROG members and consultants. The drafting team worked and completed the first draft of the regional report accordingly. The first draft regional report was sent to all national focal points in the region for the comments. ROG members received comments from sub-regional countries on the first draft of the regional report. Discussions among the ROG members and drafting team were conducted for the modifications on the first draft regional report and to finalize the report.

4 METHODS FOR SAMPLING, ANALYSIS AND HANDLING OF DATA

Various methods for sampling and analysis for POPs monitoring have been applied in countries of Asia-Pacific region (Table 4–1, Table 4–2, Table 4–3, and Table 4–4). However, in the recent background monitoring, the sampling, analysis and data handling were conducted in principle in accordance with "Guidance on the Global Monitoring Plan for Persistent Organic Pollutants[15]".

The primary data of POPs level in core matrices, i.e. air, human tissues, and water for PFOS, are analyzed and handled according to the Guidance document so that they will have sufficient quality and level of details. They are consistent and comparable over time and relevant to the objectives of the effectiveness evaluation of the Stockholm Convention.

It is agreed among the ROG of Asia Pacific Region that any data included in the report need to be agreed from the focal point of relevant country.

Table 4–1 Sampling and Analytical Method, and QA/QC for monitoring programmes (core media: Air)

Sampling	Analytical Method	Chemicals	QA/QC	Country
• High Volume sampler	• HRGC/HRMS or GC/LRMS	• PCDD, PCDF, PCB, HCB, DDT, Chlordane, Heptaclor, Aldrin, Endrin, Dieldrin, Mirex, Toxaphene, PFOS, Tetra/Penta-BDE, Hexa/Hepta-BDE, HexBB, Endosulfan, α-/β-/γ-HCH, PeCBz	• Yes	• China • Indonesia • Japan • Republic of Korea • Lao PDR • Malaysia • Mongolia • Philippines • Vietnam
			• No	-
	• LCMS/MS	• PFOS, HBCD, Chlordecone	• Yes	• Japan
			• No	-
• Passive sampler	• HRGC/HRMS or GC/MS	• PCDD, PCDF, PCB, HCB, DDT, Chlordane, Heptaclor, Aldrin, Endrin, Dieldrin, Mirex, Toxaphene, PFOS, Tetra/Penta-BDE, Hexa/Hepta-BDE, HexBB, Endosulfan, α-/β-/γ-HCH, PeCBz	• Yes	• Fiji, Kiribati, Niue, Palau, Samoa, Solomon Islands, Tuvalu
			• No	-
	• LCMS/MS	• PFOS, HBCD, Chlordecone	• Yes	• Fiji, Kiribati, Niue, Palau, Samoa, Solomon Islands, Tuvalu
			• No	-
	• GC-ECD	• Aldrin, α-HCH, β-HCH, γ-HCH Chlordane, DDT, Dieldrin, Endosulfan, Endrin, Heptachlor, HCB, Mirex, PeCBz, PCB-indicator, Toxaphene	• Yes	• Fiji, Kiribati, Niue, Palau, Samoa, Solomon Islands, Tuvalu
			• No	-

Table 4–2 Sampling and Analytical Method, and QA/QC for monitoring programmes (core media: Human Milk)

Sampling	Analytical Method	Chemicals	QA/QC	Country
• WHO Protocol	• HRGC-HRMS	• PCDD, PCDF, PCB	• Yes	• China • Fiji, Kiribati, Marshall Islands, Niue, Palau, Samoa, Solomon Islands, Tuvalu
			• No	-
	• GC-ECD	• Aldrin,α-HCH, β-HCH, Chlordane, DDT, Dieldrin, Endosulfan, Endrin, γ-HCH, Heptachlor, HBB, HCB, Mirex, PeCBz, Toxaphene	• Yes	• Fiji, Kiribati, Marshall Islands, Niue, Palau, Samoa, Solomon Islands, Tuvalu
			• No	-
• Other Protocol	• GC/MS	• Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, Mirex, Hexachlorobenzene, and Toxaphene, Tetra/Penta-BDE, Hexa/Hepta-BDE	• Yes	• Japan
			• No	-
	• GC/ECD	• PCB	• Yes	• Japan
			• No	-

Table 4–3 Sampling and Analytical Method, and QA/QC for monitoring programmes (core media: Human Blood)

Sampling	Analytical Method	Chemicals	QA/QC	Country
• Unpooled	• HRGC/HRMS or MS-NCI	• PCDD, PCDF, PCB, HCB, DDT, Chlordane, Heptaclor, Aldrin, Endrin, Dieldrin, Mirex, Toxaphene, PFOS, Tetra/Penta-BDE, Hexa/Hepta-BDE, HexBB, Endosulfan, α-/β-/γ-HCH, PeCBz	• Yes	• Japan
			• No	-
	• LCMS-MS	• PFOS, HBCD, Chlordecone	• Yes	• Japan
			• No	-

Table 4–4 Sampling and Analytical Method, and QA/QC for monitoring programmes (core media: PFOS(Water))

Sampling	Analytical Method	Chemicals	QA/QC	Country
• Collected with Water Sampler (eg. Niskin sampler)	• LCMS-MS	• PFOS	• Yes	• China • Japan
			• No	-
• Collected in other ways	• LCMS-MS	• PFOS	• Yes	• Japan
			• No	-

5 RESULTS AND DISCUSSION

5.1 Results

Information on POPs concentration collected through the monitoring programmes and methods described in the previous chapters is organized in the following section.

5.1.1 Ambient air

In the Asia-Pacific Region, several international and national POPs air monitoring programmes are available. In POPs Monitoring Project in East Asian Countries, sampling was operated in eight countries between FY2009–2013 (see Table 5.1.1–1). In Japan some national ambient POPs air monitoring programmes are performed (see Table 5.1.1–2). Detailed information on air concentration in the region is shown in Annex D.

Table 5.1.1–1 Summary for regional air monitoring programmes which was collected after 1st Asia-Pacific Regional Monitoring Report

Sampling	Country	Period	Location	Number of site/sample (/year)	POPs	Remarks
Active	Indonesia, Japan, Republic of Korea, Lao PDR, Malaysia, Mongolia, Philippines, Vietnam,	FY2009-2013	Background	1-4 sites 1-20 samples (in FY 2009-2013)	Aldrin, Chlordane, DDT, Dieldrin, Endrin, HCB, Heptachlor, Mirex, , Toxaphene, HCHs, PeCBz	POPs Monitoring Project in East Asian Countries; Ministry of the Environment[16]
Passive	Fiji	2013	Nausori	1 site	Chlordecone, Endosulfan, HBB, HBCDs, HCHs, PBDEs, PeCBz, PFOS	Establishing the Tools and Methods to Include Nine New POPs into the Global Monitoring Plan
	Fiji, Kiribati, Niue, Palau, Samoa, Solomon Islands, Tuvalu	2010	Background	1-3 sites	Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, HCB, Mirex, Toxaphene; PCB, PCDD/PCDF	Supporting the POPs Global Monitoring Plan in the Pacific Islands Region

Table 5.1.1–2 Summary for national air monitoring programmes which was collected after 1st Asia-Pacific Regional Monitoring Report

Sampling	Country	Period	Location	Number of site/sample (/year)	POPs	Remarks
Active	China	FY2008-2014	Background, urban and rural in mainland	17 sites	PCDD/PCDF, *dl*-PCB, Aldrin, Chlordane, DDT, Dieldrin, Endrin, HCB, Heptachlor, Mirex, PCB, Toxaphene	Ministry of the Environment China
		FY2008-2014	Hong Kong	2 sites	Dioxins, Furans, PCB, HCB, DDT, Chlordane, Heptaclor, Aldrin, Endrin, Dieldrin, Mirex, Toxaphene, PFOS,	Hong Kong SAR Environmental Protection Department
		FY2010-2013	Macao	6 sites	Dioxins, Furans, PCB, HCB, DDT, Chlordane, Heptaclor, Aldrin, Endrin, Dieldrin, Mirex, Toxaphene, PFOS	Macao SAR Environmental Protection Department
	Japan	FY2007-2011	Throughout the nation	689-740 sites (in FY 2007-2011)	PCDD/PCDF, *dl*-PCB	Ministry of the Environment[17]
		FY2006-2012	Throughout the nation	22-37 sites	Aldrin, Chlordane, DDT, Dieldrin, Endrin, HCB, Heptachlor, Mirex, PCB, Toxaphene	From FY2003, monitoring was conducted twice a year (warm and cold intervals); Ministry of the Environment[18]
		FY2009-2012	Throughout the nation	25-37 sites	Chlordecone, Endosulfan, HBB, HBCDs, HCHs, PBDEs, PeCBz, PFOS	
	Republic of Korea	2009-2012, continue	Jeju island	Regional background site	Aldrin, Dieldrin, Endrin, DDT, Chlordane, Heptachlor, Mirex, HCH	NIER/Ministry of Environment

(1) Aldrin

China is monitoring Aldrin in the air at 11 background, 3 rural, 3 urban sampling sites in mainland and 2 to 6 sites in Hong Kong SAR and Macao SAR. The concentrations range from 2008 to 2014 were below the detection limit in the most sampling sites. The detailed result is shown in Annex D.

Japan is continuously monitoring Aldrin in the air throughout the nation (22 to 37 sites) since FY2002[18]. With high volume air sampler using quartz fiber filer, polyurethane foam, and active carbon fiber felt combination, however, Aldrin recovery was found to be very poor and the reported data was thought to be not reliable. The concentration range from FY2006 to FY2012 was between nd (detection limit was 0.02 – 0.05 pg/m^3) and 19 pg/m^3. POPs Monitoring Project in East Asian Countries is also monitoring Aldrin in the air at Cape Hedo (Okinawa Island), which is background site, since 2009[16]. The concentration range from 2009 to 2012 was between 0.02 and 0.39 pg/m^3. The detailed result is shown in Annex D.

Republic of Korea is continuously monitoring Aldrin in background air at Jeju Island from 2009. All the data was reported below detection limit.

POPs Monitoring Project in East Asian Countries is also monitoring Aldrin in the air at Indonesia, Lao People's Democratic Republic, Malaysia, Mongolia, Philippines, and Vietnam from 2009 to 2013[16]. The concentration varies with the countries (<0.03 – 11 pg/m^3). The detailed result is shown in Annex D.

Aldrin has been monitored in air in seven countries in the Pacific in 2010. Only Fiji and Samoa had values greater than the LOQ with concentration range of 1.4 – 6.9 pg/m^3. In 2006 monitoring at three sites in Fiji, Aldrin was not detected. Detailed results are shown in Annex D.

(2) Chlordane

China is monitoring Chlordane in the air at 11 background, 3 rural, 3 urban sampling sites in mainland and 2 to 6 sites in Hong Kong SAR and Macao SAR. The concentrations range from 2008 to 2014 were below the detection limit in the most sampling sites. The detailed result is shown in Annex D.

Japan is continuously monitoring Chlordane in the air throughout the nation (22 to 37 sites) since FY2002[18]. For cis-Chlordane, the concentration range from FY2006 to FY2012 was between <0.51 and 1100 pg/m^3. POPs Monitoring Project in East Asian Countries is also monitoring Chlordane in the air at Cape Hedo (Okinawa Island), which is background site, since 2009[16]. The concentration range of cis-Chlordane from 2009 to 2012 was between 0.69 and 17.5 pg/m^3. The detailed result is shown in Annex D.

Republic of Korea is monitoring Chlordane every month in background air at Jeju Island from 2009 until present. The yearly averages of total chlordanes range between 3.1 to 5.5 pg/m^3 while individual data of cis-Chlordane ranges between 0.31 to 9.3 pg/m^3 during 2009 to 2012. The detailed result is shown in Annex D.

POPs Monitoring Project in East Asian Countries is also monitoring Chlordane in the air at Indonesia, Lao People's Democratic Republic, Malaysia, Mongolia, Philippines, and Vietnam from 2009 to 2013[16]. The concentration varies with the countries (e.g. cis-Chlordane: 0.41 – 9.9 pg/m^3). The detailed result is shown in Annex D.

Seven countries in the Pacific region have monitored Chlordane in air in 2010. The results varied with different countries for both cis- and trans-Chlordane. The concentration range was from less than the limit of quantification to 9.7 pg/m^3 for cis-chlordane. For trans-chlordane, the concentration range was from less than the limit of quantification to 25.9 pg/m^3. In 2006 monitoring at three sites in Fiji, Chlordane was not detected. Detailed results are shown in Annex D.

(3) DDT

China is monitoring DDT in the air at 11 background, 3 rural, 3 urban sampling sites in mainland and 2 to 6 sites in Hong Kong SAR and Macao SAR. The concentrations range from 2008 to 2014 were ND – 201 pg/m^3. The detailed result is shown in Annex D.

Japan is continuously monitoring DDT in the air throughout the nation (22 to 37 sites) since FY2002[18]. The concentration range from FY2006 to FY2012 was between 0.20 and 56 pg/m^3. POPs Monitoring Project in East Asian Countries is also monitoring DDT in the air at Cape Hedo (Okinawa Island), which is background site, since 2009[16]. The concentration range from 2009 to 2012 was between 0.2 and 3.7 pg/m^3, and showed a clear decreasing trend of both total DDT levels (sum of six isomers, including p,p'- and o,p'-DDTs, DDEs, DDDs) and the ratios of DDT (sum of p,p'- and o,p'-DDT) vs total DDTs during the recent four years as shown in the Figure (see Tables

D.2-3 ~ D.2-7 in the Annex for the original data). This might reflect a possible decrease of new DDT input to the sampling region in the period.

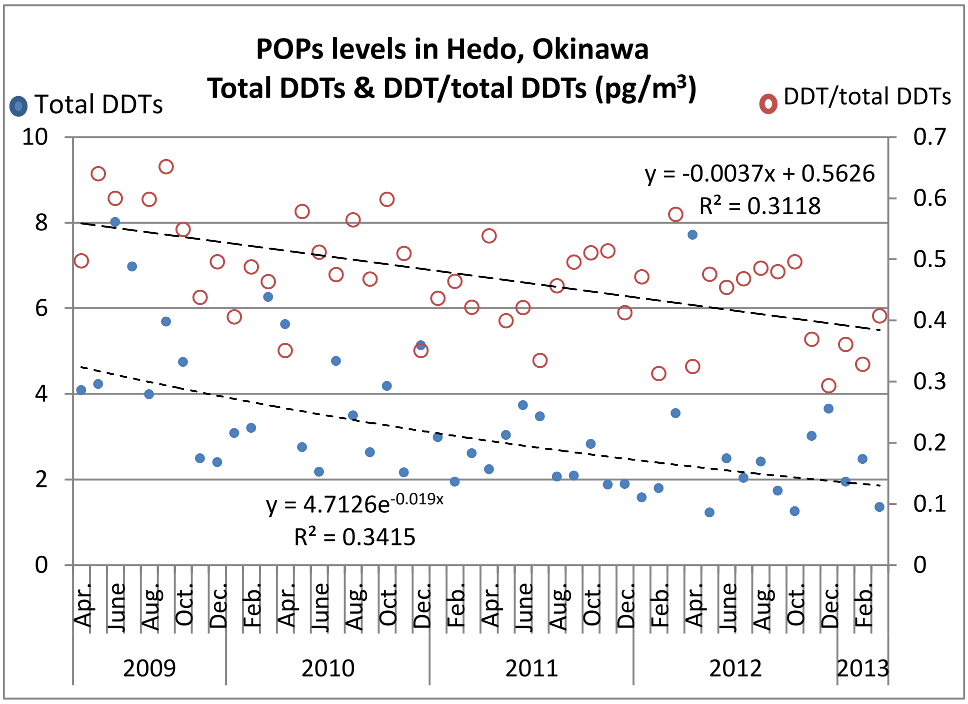


Figure 5.1.1–1 Changes in monthly total DDT levels and the ratios between DDT and total DDTs in Hedo, Okinawa

Total DDTs: sum of six isomers, i.e., p,p'- amd o,p'-DDTs, DDEs and DDDs

DDT: sum of p,p'-DDT and o,p'-DDT

Republic of Korea is monitoring DDT every month in background air at Jeju Island from 2009 until present. The yearly averages of total DDTs range 5.3 to 11 pg/m^3 during 2009 to 2012. The detailed result is shown in Annex D.

POPs Monitoring Project in East Asian Countries is also monitoring DDT in the air at Indonesia, Lao People's Democratic Republic, Malaysia, Mongolia, Philippines, and Vietnam from 2009 to 2013[16]. The concentration varies with the countries (0.44 – 50 pg/m^3). The detailed result is shown in Annex D.

Seven countries in the Pacific region have monitored DDT in air in 2010. The results varied in different countries with the concentration range from less than the limit of quantification to 1558.7 pg/m^3. In 2006 monitoring at three sites in Fiji, the concentration of DDT ranged from not detected to 24.8 pg/m^3. Detailed results are shown in Annex D.

(4) Dieldrin

China is monitoring Dieldrin in the air at 11 background, 3 rural, 3 urban sampling sites in mainland and 2 to 6 sites in Hong Kong SAR and Macao SAR. The concentrations range from 2008 to 2014 were below the detection limit in the most sampling sites. The detailed result is shown in Annex D.

Japan is continuously monitoring Dieldrin in the air throughout the nation (22 to 37 sites) since FY2002[18]. The concentration range from FY2006 to FY2012 was between 0.52 and 310 pg/m^3. POPs Monitoring Project in East Asian Countries is also monitoring Dieldrin in the air at Cape

Hedo (Okinawa Island), which is background site, since 2009 [16]. The concentration range from 2009 to 2012 was between 0.3 and 5.0 pg/m^3. The detailed result is shown in Annex D.

Republic of Korea is monitoring Dieldrin every month in background air at Jeju Island from 2009 until present. The concentration ranges from 0.21 to 3.4 with average 0.98 pg/m^3 during 2009 to 2012. The detailed result is shown in Annex D.

POPs Monitoring Project in East Asian Countries is also monitoring Dieldrin in the air at Indonesia, Lao People's Democratic Republic, Malaysia, Mongolia, Philippines, and Vietnam from 2009 to 2013[16]. The concentration varies with the countries (<0.04 – 6.5 pg/m^3). The detailed result is shown in Annex D.

Seven countries in the Pacific region have monitored Dieldrin in air in 2010. The results varied in different countries with the concentration range from less than the limit of quantification to 2501.0 pg/m^3. In 2006 monitoring at three sites in Fiji, Dieldrin was not detected. Detailed results are shown in Annex D.

(5) Endrin

China is monitoring Endrin in the air at 11 background, 3 rural, 3 urban sampling sites in mainland and 2 to 6 sites in Hong Kong SAR and Macao SAR. The concentrations range from 2008 to 2014 were below the detection limit in the most sampling sites. The detailed result is shown in Annex D.

Japan is continuously monitoring Endrin in the air throughout the nation (22 to 37 sites) since FY2002[18]. The concentration range from FY2006 to FY2012 was between nd (detection limit: 0.04 – 0.10 pg/m^3) and 6.3 pg/m^3. POPs Monitoring Project in East Asian Countries is also monitoring Endrin in the air at Cape Hedo (Okinawa Island), which is background site, since 2009[21]. The concentration range from 2009 to 2012 was between 0.03 and 0.04 pg/m^3. The detailed result is shown in Annex D.

Republic of Korea is monitoring Endrin every month in background air at Jeju Island from 2009 until present. The concentration ranges from 0.02 to 2.4 with average 0.39 pg/m^3 during 2009 to 2012. The detailed result is shown in Annex D.

POPs Monitoring Project in East Asian Countries is also monitoring Endrin in the air at Indonesia, Lao People's Democratic Republic, Malaysia, Mongolia, Philippines, and Vietnam from 2009 to 2013[21]. The concentration varies with the countries (<0.04 – 0.96 pg/m^3). The detailed result is shown in Annex D.

Seven countries in the Pacific region have monitored Endrin in air in 2010. The results varied in different countries with the concentration range from less than the limit of quantification to 76.9 pg/m^3. In 2006 monitoring at three sites in Fiji, Endrin was not detected. Detailed results are shown in Annex D.

(6) Heptachlor

China is monitoring Heptachlor in the air at 11 background, 3 rural, 3 urban sampling sites in mainland and 2 to 6 sites in Hong Kong SAR and Macao SAR. The concentrations range from 2008 to 2014 were below the detection limit in the most sampling sites. The detailed result is shown in Annex D.

Japan is continuously monitoring Heptachlor in the air throughout the nation (22 to 37 sites) since FY2002[18]. The concentration range from FY2006 to FY2012 was between <0.14 and 190 pg/m^3. POPs Monitoring Project in East Asian Countries is also monitoring Heptachlor in the air at

Cape Hedo (Okinawa Island), which is background site, since 2009[16]. The concentration range from 2009 to 2012 was between 0.19 and 3.5 pg/m^3. The detailed result is shown in Annex D.

Republic of Korea is monitoring Heptachlor every month in background air at Jeju Island from 2009 until present. The concentration ranges from 0.91 to 1.0 with average 1.0 pg/m^3 during 2009 to 2012. The detailed result is shown in Annex D.

POPs Monitoring Project in East Asian Countries is also monitoring Heptachlor in the air at Indonesia, Lao People's Democratic Republic, Malaysia, Mongolia, Philippines, and Vietnam from 2009 to 2013[16]. The concentration varies with the countries (0.09 – 6.0 pg/m^3). The detailed result is shown in Annex D.

Seven countries in the Pacific region have monitored Heptachlor in air in 2010. Only Fiji had values greater than the limit of quantification with concentration range of 0.5 – 1.7 pg/m^3. In 2006 monitoring at three sites in Fiji, Heptachlor was not detected. Detailed results are shown in Annex D.

(7) HCB

China is monitoring HCB in the air at 11 background, 3 rural, 3 urban sampling sites in mainland and 2 to 6 sites in Hong Kong SAR and Macao SAR. The concentrations range from 2008 to 2014 were 0.7 – 565 pg/m^3. The detailed result is shown in Annex D.

Japan is continuously monitoring HCB in the air throughout the nation (22 to 37 sites) since FY2002[18]. The concentration range from FY2006 to FY2012 was between 8.2 and 380 pg/m^3. POPs Monitoring Project in East Asian Countries is also monitoring HCB in the air at Cape Hedo (Okinawa Island), which is background site, since 2009[16]. The concentration range from 2009 to 2012 was between 67 and 250 pg/m^3. The detailed result is shown in Annex D.

POPs Monitoring Project in East Asian Countries is also monitoring HCB in the air at Indonesia, Lao People's Democratic Republic, Malaysia, Mongolia, Philippines, and Vietnam from 2009 to 2013[16]. The concentration varies with the countries (66 – 387 pg/m^3). The detailed result is shown in Annex D.

Seven countries in the Pacific region have monitored HCB in air in 2010. The results varied in different countries with the concentration range from 8 – 22.0 pg/m^3. In 2006 monitoring at three sites in Fiji, the concentration range of HCB was 3.5 – 16.9 pg/m^3. Detailed results are shown in Annex D.

(8) Mirex

China is monitoring Mirex in the air at 11 background, 3 rural, 3 urban sampling sites in mainland and 2 to 6 sites in Hong Kong SAR and Macao SAR. The concentrations range from 2008 to 2014 were below the detection limit in the most sampling sites. The detailed result is shown in Annex D.

Japan is continuously monitoring Mirex in the air throughout the nation (22 to 37 sites) since FY2002[18]. The concentration range from FY2006 to FY2009 and FY2011 was between <0.04 and 2.1 pg/m^3. POPs Monitoring Project in East Asian Countries is also monitoring Mirex in the air at Cape Hedo (Okinawa Island), which is background site, since 2009[16]. The concentration range from 2009 to 2012 was between 0.06 and 0.58 pg/m^3. The detailed result is shown in Annex D.

Republic of Korea is monitoring Mirex every month in background air at Jeju Island from 2009 until present. The concentration ranges from 0.01 to 0.48 with average 0.16 pg/m^3 during 2009 to 2012. The detailed result is shown in Annex D.

POPs Monitoring Project in East Asian Countries is also monitoring Mirex in the air at Indonesia, Lao People's Democratic Republic, Malaysia, Mongolia, Philippines, and Vietnam from 2009 to 2013[16]. The concentration varies with the countries (0.06 – 1.5 pg/m^3). The detailed result is shown in Annex D.

Seven countries in the Pacific region have monitored Mirex in air in 2010. All countries, except Fiji had values less than the limit of quantification. Concentration range for Fiji was from less than the limit of quantification to 0.8 pg/m^3. In 2006 monitoring at three sites in Fiji, Mirex was not detected. Detailed results are shown in Annex D.

(9) Toxaphene

China is monitoring Toxaphene in the air at 11 background, 3 rural, 3 urban sampling sites in mainland and 2 to 6 sites in Hong Kong SAR and Macao SAR. The concentrations range from 2008 to 2014 were below the detection limit in all the sites. The detailed result is shown in Annex D.

Japan is continuously monitoring Toxaphene in the air throughout the nation (22 to 37 sites) since FY2002[18]. For Parlar-26, the concentration range from FY2006 to FY2009 was between nd (detection limit: 0.08 – 0.6 pg/m^3) and 0.58 pg/m^3. POPs Monitoring Project in East Asian Countries is also monitoring Toxaphene in the air at Cape Hedo (Okinawa Island), which is background site, since 2009[16]. The concentration range of Parlar-26 from 2009 to 2012 was between nd (detection limit: 0.08 – 0.2 pg/m^3) and 0.3 pg/m^3. The detailed result is shown in Annex D.

POPs Monitoring Project in East Asian Countries is also monitoring Toxaphene in the air at Indonesia, Lao People's Democratic Republic, Malaysia, Mongolia, Philippines, and Vietnam from 2009 to 2013[16]. The concentration varies with the countries (e.g. Parlar-26: <0.07 – 0.19 pg/m^3). The detailed result is shown in Annex D.

Seven countries in the Pacific region have monitored Toxaphene in air in 2010. Toxaphene was not detected in the Pacific countries. In 2006 monitoring at three sites in Fiji, Toxaphene was also not detected. Detailed results are shown in Annex D.

(10) PCB

China is monitoring PCB in the air at 11 background, 3 rural, 3 urban sampling sites in mainland and 2 to 6 sites in Hong Kong SAR and Macao SAR. The marker PCB concentrations in the air samples from the 11 background areas, three urban areas, and three rural areas were 5.20 – 44.9 pg/m^3, 55.1 – 90.6 pg/m^3 and 4.62 – 10.3 pg/m^3, respectively. The detailed result is shown in Annex D.

Japan is continuously monitoring PCB in the air throughout the nation (22 to 37 sites) since FY2002[18]. The concentration range from FY2006 to FY2012 was between 16 and 1500 pg/m^3 (as sum of all PCB congeners). The detailed result is shown in Annex D. PCB concentration in the air in Japan from 1974, right after when the use of PCB was banned, to early 2000s is also reported by Nakano et al.(2008)[19]. The concentration level was 100 ng/m^3 in 1974, however after 1988, the concentration level remained at low level of approximately 1 ng/m^3. (Figure 5.1.1–2)

Seven countries in the Pacific region have monitored PCB in air in 2010. The results varied in different countries with the concentration range from less than the limit of quantification to 18.5 pg/m^3. In 2006 monitoring at three sites in Fiji, the concentration of PCB ranged from less than the limit of quantification to 7.4 pg/m^3. Detailed results are shown in Annex D.

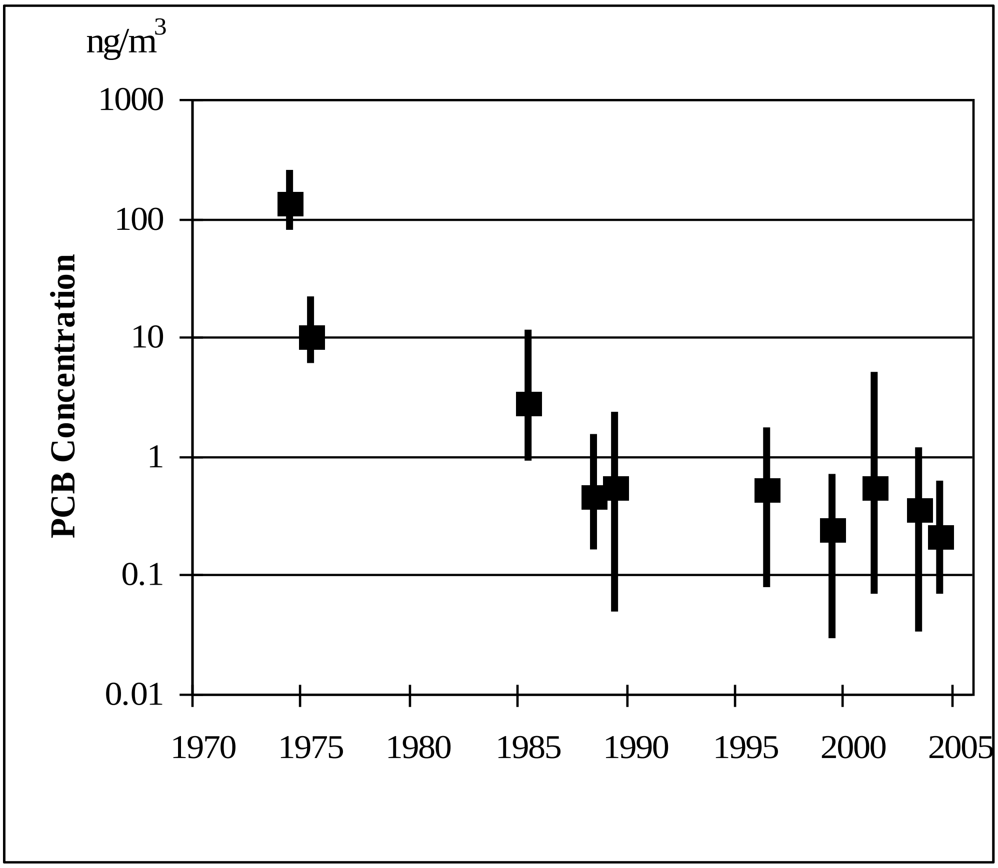


Figure 5.1.1–2 Time trends of PCB concentrations in ambient air (Japan)

(11) PCDD/PCDF and *dl*-PCB

China is monitoring PCDD/PCDF and *dl*-PCB in the air at 11 background, 3 rural, 3 urban sampling sites in mainland and 2 to 6 sites in Hong Kong SAR and Macao SAR. The PCDD/PCDF concentrations in the background air samples ranged from 0.84 to 63.3 WHO-TEQ fg/m^3 (WHO-TEQ is the TEQ calculated using World Health Organization (WHO) toxic equivalency factors (TEF)), and the mean was 16.1 WHO-TEQ fg/m^3. The PCDD/PCDF concentrations in the air samples from the three urban and three rural sampling sites were 91.3 – 202 WHO-TEQ fg/m^3 and 9.45 – 42.7 WHO-TEQ fg/m^3, respectively, and the means were 164 WHO-TEQ fg/m^3 and 22.2 WHO-TEQ fg/m^3, respectively. The detailed result is shown in Annex D.

The *dl*-PCB concentrations in the background air samples were 0.03 – 3.19 WHO-TEQ fg/m^3. The *dl*-PCB concentrations in the air samples from the three urban and three rural areas were 6.84 – 14.2 WHO-TEQ fg/m^3 and 0.93 – 3.73 WHO-TEQ fg/m^3, respectively, and the means were 10.2 WHO-TEQ fg/m^3 and 2.14 WHO-TEQ fg/m^3, respectively. The detailed result is shown in Annex D.

Japan is continuously monitoring PCDD/PCDF and *dl*-PCB in the air throughout the nation (68 to 979 sites) since 1997[17] (see Table 5.1.1–3).

Seven countries in the Pacific region have monitored PCDD/PCDF and *dl*-PCB in air in 2010. pg/m^3. *dl*-PCB was only detected in Fiji and Samoa with concentration range from not detected (ND) to 6168.1 fg/m^3**.** For PCDD, the concentration ranged from not detected to 175.5 fg/m^3. PCDF concentration ranged from not detected to 21.3 fg/m^3. In 2006 monitoring at three sites in Fiji, PCDF, PCDD and *dl*-PCB were not detected, except for PCB 118 which had a concentration range of 643.0 to 5608.0 fg/m^3. Detailed results are shown in Annex D.

Table 5.1.1–3 PCDD/PCDF and *dl*-PCB concentrations in air from general sampling sites in Japan

FY	1997	1998	1999	2000	2001	2002
Average (pg-TEQ/m^3)	0.55	0.23	0.18	0.15	0.13	0.093
Range (pg-TEQ/m^3)	0.010 - 1.4	0.0 - 0.96	0.0065 - 1.1	0.0073 - 1.0	0.0090 - 1.7	0.0066 - 0.84
(Number of sites)	(68)	(458)	(463)	(920)	(979)	(966)

FY	2003	2004	2005	2006	2007	2008
Average (pg-TEQ/m^3)	0.068	0.059	0.052	0.050	0.041	0.036
Range (pg-TEQ/m^3)	0.0066 - 0.72	0.0083 - 0.55	0.0039 - 0.61	0.0053 - 0.40	0.0042 - 0.58	0.0032 - 0.26
(Number of sites)	(913)	(892)	(825)	(763)	(740)	(721)

FY	2009	2010	2011	2012
Average (pg-TEQ/m^3)	0.032	0.032	0.028	0.027
Range (pg-TEQ/m^3)	0.0049 - 0.37	0.0054 - 0.32	0.0051 - 0.45	0.0047 - 0.58
(Number of sites)	(712)	(691)	(689)	(676)

Note 1: I-TEF(1988) had been used for the calculation of toxicity equivalent until FY 1998, WHO-TEF(1998) has been used from FY 1999 to FY 2007, and WHO-TEF(2006) has been used after FY 2008.

Note 2: In principle, before FY 1998, the toxicity equivalent is calculated as zero, when the measured value of each isomer is below the minimum determination limit. After FY 1999, the toxicity equivalent is calculated by using the value of 1/2 of the detection limit, when the measured value of each isomer is below the detection limit.

(12) Chlordecone

Japan is continuously monitoring Chlordecone in the air throughout the nation (35 to 37 sites) in FY2010 and FY2011[18]. Chlordecone was not detected (detection limit: 0.02 pg/m^3) from the air in FY2010 and FY2011.

(13) Endosulfan

Endosulfan has been monitored in air in Fiji in 2013 at a single site. α-Endosulfan and Endosulfan sulfate had values less than the limit of quantification while β-Endosulfan had a concentration of 0.2 pg/m^3. Results are shown in Annex D.

Japan is continuously monitoring Endosulfan in the air throughout the nation (35 to 37 sites) in FY2011 and FY2012[18]. The concentration range of α-Endosulfan in FY2011 and FY2012 was between ND (detection limit: 4.0 – 5.3 pg/m^3) and 190 pg/m^3. The detailed result is shown in Annex D.

(14) HBB

HBB has been monitored in air in Fiji in 2013 at a single site. The concentration of HBB was 0.4 pg/m^3. Results are shown in Annex D.

Japan is continuously monitoring HBB in the air throughout the nation (35 to 37 sites) in FY2010 and FY2011[18]. HBB was not detected (detection limit: 0.1 pg/m^3) from the air in FY2010 and FY2011.

(15) HBCDs

HBCDs have been monitored in air in Fiji in 2013 at a single site. All concentration values were less than the limit of quantification. Results are shown in Annex D.

Japan is continuously monitoring HBCDs in the air throughout the nation (36 sites) in FY2012[18]. The concentration range in FY2012 was between <0.8 and 440 pg/m^3. The detailed result is shown in Annex D.

(16) HCHs

Japan is continuously monitoring HCHs in the air throughout the nation (35 to 37 sites) since 2009[18]. The concentration range of α-HCH from FY2009 to FY2012 was between 6.5 and 680 pg/m^3. POPs Monitoring Project in East Asian Countries is also monitoring HCHs in the air at Cape Hedo (Okinawa Island), which is background site, since 2009[16]. The concentration range of α-HCH from 2009 to 2012 was between 6 and 30 pg/m^3. The detailed result is shown in Annex D.

Republic of Korea is monitoring HCHs every month in background air at Jeju Island from 2011 until present. The concentration ranges from 12 to 15 with average 13 pg/m^3 during 2011 to 2012. The detailed result is shown in Annex D.

POPs Monitoring Project in East Asian Countries is also monitoring HCHs in the air at Indonesia, Lao People's Democratic Republic, Malaysia, Mongolia, Philippines, and Vietnam from 2009 to 2013[16]. The concentration varies with the countries (e.g. α-HCH: 4.9 – 58 pg/m^3). The detailed result is shown in Annex D.

Seven countries in the Pacific region have monitored HCHs in air in 2010. Fiji also monitored HCHs at a single site in 2013. α-HCH was only detected in Fiji with concentration range of less than the limit of quantification to 3.5 pg/m^3. β-HCH was not detected while γ-HCH had a concentration range of less than the limit of quantification to 177.9 pg/m^3. Detailed results are shown in Annex D.

(17) PBDEs

PBDEs has been monitored in air in Fiji in 2013 at a single site. Concentration values for the PBDEs ranged from less than the limit of quantification to 26.3 pg/m^3. Results are shown in Annex D.

Japan is continuously monitoring PBDEs in the air throughout the nation (35 to 37 sites) since FY2009[18]. The concentration range of TeBDE from FY2009 to FY2012 was between nd (detection limit: 0.07 – 0.1 pg/m^3) and 50 pg/m^3. The detailed result is shown in Annex D.

(18) PeCBz

PeCBz has been monitored in air in Fiji in 2013 at a single site. The concentration of PeCBz was 0.5 pg/m^3. Results are shown in Annex D.

Japan is continuously monitoring PeCBz in the air throughout the nation (25 to 37 sites) in FY2007 and FY2009 to FY2012[18]. The concentration range from FY2007 to FY2012 was between 5.0 and 310 pg/m^3. POPs Monitoring Project in East Asian Countries is also monitoring PeCBz in the air at Cape Hedo (Okinawa Island), which is background site, since 2010[16]. The concentration range from 2010 to 2012 was between 1.2 and 109 pg/m^3. The detailed result is shown in Annex D.

POPs Monitoring Project in East Asian Countries is also monitoring PeCBz in the air at Indonesia, Lao People's Democratic Republic, Malaysia, Mongolia, Philippines, and Vietnam from 2009 to 2013[16]. The concentration varies with the countries (38 – 295 pg/m^3). The detailed result is shown in Annex D.

(19) PFOS

PFOS has been monitored in air in Fiji in 2013 at a single site. The concentration range for PFOS was between 12.5 – 433.1 pg/m^3. Results are shown in Annex D.

Japan is continuously monitoring PFOS in the air throughout the nation (35 to 37 sites) since FY2010[18]. The concentration range of PFOS from FY2010 to FY2012 was between 0.9 and 15 pg/m^3. The detailed result is shown in Annex D.

5.1.2 Human tissues (milk and blood)

5.1.2.1 Milk

In the Asia-Pacific Region, several international and national POPs human milk monitoring programmes are available (see Table 5.1.2–1 and Table 5.1.2–2).

In Japan, POPs monitoring programme on human milk was performed in Osaka Prefecture (see Table 5.1.2–2). Also POPs concentrations in human milk in Japan were reported in several research papers (Kunisue et al., 2006 and Kakimoto et al., 2008).

Table 5.1.2–1 Summary for regional human milk monitoring programmes

Country	period	location	number of samples/sites (/year)	POPs	Remarks
Fiji, Kiribati, Marshall Islands, Niue, Palau, Samoa, Solomon Islands and Tuvalu	2011	-	-	Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, HCB, Mirex, Toxaphene; PCB, PCDD/PCDF	Supporting the POPs Global Monitoring Plan in the Pacific Islands Region
Fiji	2006	Vunisea (rural), Valelevu (urban)	-	Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, HCB, Mirex, Toxaphene, PCB, PCDD, PCDF	Fourth round of WHO Human Milk Survey
	2002	-	-	PCDD/PCDF, *dl*-PCB	Third round of WHO Human Milk Survey
Kiribati	2006	-	-	Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, HCB, Mirex, Toxaphene, PCB, PCDD, PCDF	Fourth round of WHO Human Milk Survey
Tonga	2008	-	-	Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, HCB, Mirex, Toxaphene, PCB, PCDD, PCDF	Fifth round of WHO Human Milk Survey

Table 5.1.2–2 Summary for national human milk monitoring programmes

Country	period	location	number of samples/sites (/year)	POPs	Remarks
China	2011	14 provinces in mainland	110 samples/province	PCB, PCDD/PCDF	China National Center for Food Safety Risk Assessment
	2009	Hong Kong SAR	50 samples	Aldrin, chlordane dieldrin, DDT endosulfan, endrin, heptachlor,HCB.PeCBz , HCH, toxaphene congeners PCB, dioxins, furans and mirex	Hong Kong SAR The Department of Health
Japan	FY1972-2008	Osaka Prefecture	9-61 samples	Chlordane, DDT, Dieldrin, HCB, Heptachlor, PCB, HCHs, PBDEs	Osaka Prefecture[19]
	FY1973-2006	Osaka Prefecture	13-35 samples	HBCDs	Kakimoto et al. (2006) [20]
	2001-2004	Fukuoka Prefecture	7-13 samples	DDT, HCB, PCDD/PCDF, *dl*-PCB, HCH	Kunisue et al. (2006) [21]

(1) Aldrin

There is a report of human milk monitoring on Aldrin in 2009 in Hong Kong SAR, China. The concentrations were below detection limit.

Monitoring of Aldrin in Human milk was conducted in eight countries in the Pacific in 2011. For Aldrin, all the countries had values less than the limit of quantification. In 2002 monitoring in Fiji, Aldrin was not detected while its concentration was less than the limit of quantification in 2006. The concentration of Aldrin was less than the limit of quantification in Kiribati (2006) and Tonga (2008). Detailed results are shown in Annex E.

(2) Chlordane

There is a report of human milk monitoring on Chlordane in 2009 in Hong Kong SAR, China. The concentrations were 1.3 – 10.5 ng/g fat.

There is a report of human milk monitoring on Chlordane from FY 1986 to FY 2008 in Osaka, Japan[19]. The target was human milk from the primiparous women. Total Chlordanes (sum of oxychlordane, trans-nonachlor, and cis-nonachlor) was detected between 51.7 and 119.6 ng/g fat. Also concentrations of chlordane between 2001 and 2004 in breast milk collected from Japanese women in Fukuoka Prefecture are reported by Kunisue et al. (2006)[21]. Detail is shown in Annex E.

Monitoring of Chlordane in Human milk was conducted in eight countries in the Pacific in 2011. All countries had a value less than the limit of quantification with only Fiji showing a concentration of 1.0 ng/g fat for Oxy-Chlordane. In 2002 monitoring in Fiji, the concentration of Oxy-Chlordane was 3 ng/g fat while it was 1.7 ng/g fat in 2006. The concentration of Oxy-Chlordane was 1.5 ng/g fat in Kiribati (2006) and 1.2 ng/g fat in Tonga (2008). Detailed results are shown in Annex E.

(3) DDT

There is a report of human milk monitoring on DDT in 2009 in Hong Kong SAR, China. The total DDT concentration in the pooled sample was 759.9 ng/g fat.

There is report of monitoring on DDTs (*p,p'*-DDE, *p,p'*-DDD, *p,p'*-DDT, *o,p'*-DDT) in human milk from primiparous women from FY 1972 – FY 2008 (excluding FY 1983 – FY 1985) in Osaka, Japan[19]. The concentration range of DDTs was between 122 – 4,000 ng/g fat. The detailed result is shown in Annex E. Also concentrations of DDT between 2001 and 2004 in breast milk collected from Japanese women in Fukuoka Prefecture are reported by Kunisue et al. (2006) [21]. Detail is shown in Annex E.

Monitoring of DDT in Human milk was conducted in eight countries in the Pacific in 2011. Concentration values for DDT ranged from less than the limit of quantification to 3863.9 ng/g fat. In Fiji, DDT concentration ranged from less than the limit of quantification to 986.6 ng/g fat in 2002 and 546.3 ng/g fat in 2006. DDT concentration ranged from less than the limit of quantification to 140.1 ng/g fat in Kiribati (2006) and to 664.0 ng/g fat in Tonga (2008). Detailed results are shown in Annex E.

(4) Dieldrin

There is a report of human milk monitoring on Dieldrin in 2009 in Hong Kong SAR, China. The concentrations were 0.6 – 3.0 ng/g fat.

There is report of monitoring on Dieldrin in human milk from primiparous women from FY 1973 – FY 1982, FY 2004, and FY 2005 in Osaka, Japan[19]. The concentration range of Dieldrin was between 2.5 – 93 ng/g fat. The detailed result is shown in Annex E.

Monitoring of Dieldrin in Human milk was conducted in eight countries in the Pacific in 2011. Concentration values for Dieldrin ranged from less than the limit of quantification to 3.7 ng/g fat. In 2002 monitoring in Fiji, the concentration of Dieldrin was 3.6 ng/g fat and 2.2 ng/g fat in 2006. The concentration of Dieldrin was 1.6 ng/g fat in Kiribati (2006) and 2.2 ng/g fat in Tonga (2008). Detailed results are shown in Annex E.

(5) Endrin

There is a report of human milk monitoring on Endrin in 2009 in Hong Kong SAR, China. The concentrations were below detection limit.

Monitoring of Endrin in Human milk was conducted in eight countries in the Pacific in 2011. Concentration values for Endrin was below the limit of quantification for all countries. The concentration of Endrin was less than the limit of quantification in Fiji (2002 and 2006), Kiribati (2006) and Tonga (2008). Detailed results are shown in Annex E.

(6) Heptachlor

There is a report of human milk monitoring on Heptachlor in 2009 in Hong Kong SAR, China. The concentrations were below detection limit.

There is report of monitoring on Heptachlor epoxide in human milk from primiparous women from FY 1986 – FY 2005 in Osaka, Japan[19]. The concentration range of Heptachlor epoxide was between 2.3 – 34.6 ng/g fat. The detailed result is shown in Annex E.

Monitoring of Heptachlor in Human milk was conducted in eight countries in the Pacific in 2011. Concentration values for Heptachlor ranged from less than the limit of quantification to 0.9 ng/g fat. Heptachlor was either not detected or the concentration was less than the limit of quantification in Fiji (2002 and 2006) and Kiribati (2006). The concentration of heptachlor in Tonga in 2008 ranged from less than the limit of quantification to 0.3 ng/g fat. Detailed results are shown in Annex E.

(7) HCB

There is a report of human milk monitoring on HCB in 2009 in Hong Kong SAR, China. The concentration in the pooled sample was 21.0 ng/g fat.

There is report of monitoring on HCB in human milk from primiparous women from FY 1980 – FY 2008 (excluding FY 1983 – FY 1985) in Osaka, Japan[19]. The concentration range of HCB was between 7.1 – 79 ng/g fat. The detailed result is shown in Annex E. Also concentrations of HCB between 2001 and 2004 in breast milk collected from Japanese women in Fukuoka Prefecture are reported by Kunisue et al. (2006) [21]. Detail is shown in Annex E.

Monitoring of HCB in Human milk was conducted in eight countries in the Pacific in 2011. Concentration values for HCB ranged from 3.6 – 15.9 ng/g fat. In 2002 monitoring in Fiji, the concentration of HCB was 3.6 ng/g fat and 3.1 ng/g fat in 2006. The concentration of HCB was 3.2 ng/g fat in Kiribati (2006) and 5.7 ng/g fat in Tonga (2008). Detailed results are shown in Annex E.

(8) Mirex

There is a report of human milk monitoring on Mirex in 2009 in Hong Kong SAR, China The concentration in the pooled sample was 1.3 ng/g fat.

Monitoring of Mirex in Human milk was conducted in eight countries in the Pacific in 2011. Concentration values for Mirex ranged from not detected to 1.6 ng/g fat. In 2002 monitoring in Fiji, Mirex was not detected while its concentration was less than the limit of concentration in 2006. The concentration of Mirex was less than the limit of quantification in Kiribati (2006) and Tonga (2008). Detailed results are shown in Annex E.

(9) Toxaphene

There is a report of human milk monitoring on Toxaphene in 2009 in Hong Kong SAR, China The concentration in the pooled sample was 1.6 ng/g fat.

Monitoring of Toxaphene in Human milk was conducted in eight countries in the Pacific in 2011. Concentration values for Toxaphene ranged from less than the limit of quantification to 0.7 ng/g fat. The concentration value for Toxaphene was less than the limit of quantification in Fiji (2002 and 2006) and Tonga (2008). Toxaphene concentration ranged from less than the limit of quantification to 0.9 ng/g fat in Kiribati (2006). Detailed results are shown in Annex E.

(10) PCB

There is a report of human milk monitoring on PCB in 2009 in Hong Kong SAR, China. The concentration in the pooled sample was 21.1 ng/g fat.

There is report of monitoring on PCB in human milk from primiparous women from FY 1972 – FY 2008 in Osaka, Japan[19]. The concentration range of PCB was between 97 – 1,510 ng/g fat basis. The detailed result is shown in Annex E.

Monitoring of PCB in Human milk was conducted in eight countries in the Pacific in 2011. Concentration values for PCB ranged from 4.0 – 16.2 ng/g fat. In Fiji, PCB concentration was between 0.4 – 5.9 ng/g fat in 2002 and 0.2 – 4.9 ng/g fat in 2006. PCB concentration ranged from 0.2 – 4.2 ng/g fat in Kiribati (2006) and 0.2 – 3.1 ng/g fat in Tonga (2008). Detailed results are shown in Annex E.

(11) PCDD/PCDF and *dl*-PCB

There is a report of human milk monitoring on PCDD/PCDF in 2009 in Hong Kong SAR, China. The level of dioxins and furans expressed as WHO-PCDD/PCDF-TEQ was 6.56 pg/g. The levels of *dl*-PCB expressed as WHO-PCB-TEQ was 3.28 pg/g. The levels of total PCDD, PCDF and *dl*-PCB expressed as WHO-PCDD/PCDF-PCB-TEQ was 9.84 pg/g. In mainland of China, The PCDD/PCDF concentrations in the pooled samples from the cities were 6.63 ± 3.18 pg WHO-TEQ/g fat (calculated using WHO-TEF1998 values), and the PCDD/PCDF concentrations in the pooled samples from the rural areas were 5.99 ± 2.20 pg WHO-TEQ/g fat (calculated using WHO-TEF1998 values).

In Fiji, *dl*-PCB concentration was from less than the limit of quantification to 1748.5 pg/g fat in 2002 and to 1704.0 pg/g fat in 2006. *dl*-PCB concentration ranged from less than the limit of quantification to 2477.0 pg/g fat in Kiribati (2006) and to 1417.1 pg/g fat in Tonga (2008). PCDD concentration was between 0.7 – 40.7 pg/g fat and 1.5 – 76.5 pg/g fat in Fiji in 2002 and 2006 respectively. In Kiribati (2006), the concentration of PCDD was between 0.7 – 66.1 pg/g fat while in Tonga (2008), the range was 0.5 – 27.0 pg/g fat. PCDF concentration in Fiji ranged from less than the limit of quantification to 1.3 pg/g fat in 2002 and to 1.2 pg/g fat in 2006. The concentration of PCDF was from less than the limit of quantification to 1.7 pg/g fat in Kiribati (2006) and to 1.7 pg/g fat in Tonga (2008). Detailed results are shown in Annex E.

In Japan, concentrations of PCDD/PCDF and *dl*-PCB between 2001 and 2004 in breast milk collected from women in Fukuoka Prefecture are reported by Kunisue et al. (2006)[21]. Detail is shown in Annex E.

Eight countries in the Pacific region have monitored PCDD/PCDF and *dl*-PCB in Human Milk in 2011. *dl*-PCB concentration range was from less than the limit of quantification to 2607.5 pg/g fat**.** For PCDD, the concentration ranged from 0.2 – 115.5 pg/g fat while the PCDF concentration ranged from less than the limit of quantification to 3.4 pg/g fat.

(12) HCHs

There is a report of human milk monitoring on HCHs in 2009 in Hong Kong SAR, China. The concentration in the pooled sample was 233 ng/g fat.

There is report of monitoring on β-HCHs in human milk from primiparous women from FY 1972 – FY 2008 (excluding FY 1983 – FY 1985) in Osaka, Japan[19]. The concentration range of β-HCHs was between 83 – 5,430 ng/g fat. The detailed result is shown in Annex E. Also concentrations of HCHs between 2001 and 2004 in breast milk collected from Japanese women in Fukuoka Prefecture are reported by Kunisue et al. (2006) [21]. Detail is shown in Annex E.

(13) PBDEs

There is report of monitoring on PBDEs in human milk from primiparous women in FY 2007 and FY 2008 in Osaka, Japan[19]. The concentrations of PBDEs in FY 2007 and FY 2008 were 1.06 and 1.59 ng/g fat basis, respectively.

(14) HBCDs

In Japan, concentrations of HBCDs between 1973 and 2006 in the breast milk collected from women in Osaka Prefecture are reported by Kakimoto et al. (2008)[20]. Detail is shown in Annex E.

(15) PFOS

Monitoring of PFOS in human milk for 26 countries was conducted by UNEP/WHO between 2008 and 2012. For the 4 countries in the Asia-Pacific region, the levels of PFOS in Fiji (2011), India (2009), Indonesia (2011) and Syria (2009) were 4.5, 2, 13 and 4.5 ng/L, respectively.

5.1.2.2 Blood

In Japan, national monitoring programme on human blood is performed (see Table 5.1.2–3). Also POPs concentrations in human blood in Japan were reported in several research papers (Harada et al., 2004 and Kishi et al., 2013).

Table 5.1.2–3 Summary for national human blood monitoring programmes which was collected after 1st Asia-Pacific Regional Monitoring Report

country	period	location	number of samples/sites	POPs	Remarks
Japan	FY2007-2012	For FY2007-2010: 5 regions 15 district For FY2011-2012: 2 regions 3 district	259-291 samples	PCDD/PCDF, *dl*-PCB, PFOS	Ministry of the Environment[22]
	FY2011	2 regions 3 district	84-282 samples	Aldrin, Chlordane, DDT, Dieldrin, Endrin, HCB, Heptachlor, Mirex, PCB, Toxaphene, Chlordecone, Endosulfan, HBB, HBCDs, HCHs, PBDEs, PeCBz	
	2003, 2005, 2007, 2009, 2011	Hokkaido	30 samples	PFOS	Kishi et al. (2012)[23]

(1) Aldrin

There is a report from Ministry of Environment, Japan which is monitoring Aldrin in human blood in Japan in FY2011[22]. Aldrin was not detected from human blood in Japan in FY2011 (detection limit: 0.06 pg/g fat).

(2) Chlordane

There is a report from Ministry of Environment, Japan which is monitoring Chlordanes in human blood in Japan in FY2011[22]. The concentration range of cis-Chlordane was between <0.04 and 800 pg/g fat. The detailed result is shown in Annex F.

(3) DDT

There is a report from Ministry of Environment, Japan which is monitoring DDTs in human blood in Japan in FY2011[22]. The concentration range of p,p'-DDT was between 1,100 and 29,000 pg/g fat. The detailed result is shown in Annex F.

(4) Dieldrin

There is a report from Ministry of Environment, Japan which is monitoring Dieldrin in human blood in Japan in FY2011[22]. The concentration range of Dieldrin was between 1,300 and 40,000 pg/g fat. The detailed result is shown in Annex F.

(5) Endrin

There is a report from Ministry of Environment, Japan which is monitoring Endrin in human blood in Japan in FY2011[22]. Endrin was not detected from human blood in Japan in FY2011 (detection limit: 0.06 pg/g fat).

(6) Heptachlor

There is a report from Ministry of Environment, Japan which is monitoring Heptachlor in human blood in Japan in FY2011[22]. The concentration range of cis-Heptachlor epoxide was between 600 and 6,500 pg/g fat. The detailed result is shown in Annex F.

(7) HCB

There is a report from Ministry of Environment, Japan which is monitoring HCB in human blood in Japan in FY2011[22]. The concentration range of HCB was between 3,400 and 39,000 pg/g fat. The detailed result is shown in Annex F.

(8) Mirex

There is a report from Ministry of Environment, Japan which is monitoring Mirex in human blood in Japan in FY2011[22]. The concentration range of Mirex was between 400 and 6,600 pg/g fat. The detailed result is shown in Annex F.

(9) Toxaphene

There is a report from Ministry of Environment, Japan which is monitoring Toxaphene in human blood in Japan in FY2011 [22]. For parlar-26 the concentration range was between ND (detection limit: 0.033 – 0.26 pg/g fat) and 3,500 pg/g fat. The detailed result is shown in Annex F.

(10) PCB

There is a report from Ministry of Environment, Japan which is monitoring PCB in human blood in Japan in FY2011[22]. The concentration range of PCB was between 31,000 and 1,400,000 pg/g fat. The detailed result is shown in Annex F.

(11) PCDD/PCDF and *dl*-PCB

There is a report from Ministry of Environment, Japan which is monitoring PCDD/PCDF and *dl*-PCB in human blood in Japan since 2002[22]. The concentration range of PCDD/PCDF and *dl*-PCB from 2007 to 2012 was between 0.10 and 130 pg-TEQ/g fat. The detailed result is shown in Annex F.

(12) Chlordecone

There is a report from Ministry of Environment, Japan which is monitoring Chlordecone in human blood in Japan in FY2011[22]. The concentration range of Chlordecone was between <0.002 and 1.0 ng/g fat. The detailed result is shown in Annex F.

(13) Endosulfan

There is a report from Ministry of Environment, Japan which is monitoring Endosulfan in human blood in Japan in FY2011[22]. The concentration range of Endosulfan was between <1 and 3,700 pg/g fat. The detailed result is shown in Annex F.

(14) HBB

There is a report from Ministry of Environment, Japan which is monitoring HBB in human blood in Japan in FY2011[22]. The concentration range of HBB was between <0.02 and 700 pg/g fat. The detailed result is shown in Annex F.

(15) HBCDs

There is a report from Ministry of Environment, Japan which is monitoring HBCDs in human blood in Japan in FY2011[22]. The concentration range of HBCDs was between <0.065 and 10 ng/g fat. The detailed result is shown in Annex F.

(16) HCHs

There is a report from Ministry of Environment, Japan which is monitoring HCHs in human blood in Japan in FY2011[22]. The concentration range of α-HCHs was between <0.03 and 1,200 pg/g fat. The detailed result is shown in Annex F.

(17) PBDEs

There is a report from Ministry of Environment, Japan which is monitoring PBDEs in human blood in Japan in FY2011[22]. The concentration range of PBDEs was between 500 and 8,600 pg/g fat. The detailed result is shown in Annex F.

(18) PeCBz

There is a report from Ministry of Environment, Japan which is monitoring PeCBz in human blood in Japan in FY2011[22]. The concentration range of PeCBz was between 40 and 1,500 pg/g fat. The detailed result is shown in Annex F.

(19) PFOS

There is a report from Ministry of Environment, Japan which is monitoring PFOS in human blood in Japan in FY2011[22]. The concentration range of PFOS was between 0.73 and 150 ng/mL. The detailed result is shown in Annex E. Also information on PFOS concentration in human serum is available[23]. Detail is shown in Annex F.

5.1.3 Water

In the Asia-Pacific Region, several POPs monitoring programmes for PFOS in water are available (see Table 5.1.3–1).

Table 5.1.3–1 Summary for national water monitoring programmes

country	period	Location	number of samples/sites	POPs	Remarks
China	2013	Coastal waters and lake in mainland China	16 sites	PFOS	Ministry of the Environment
	2011	Hong Kong	10 sites	PFOS	The Department of Environment, Hong Kong SAR
	2013	Macao	8-14 sites	PFOS	The Department of Environment, Macao SAR
Japan	FY2009-2012	Throughout the nation	48-49 sites/year	PFOS	Ministry of the Environment[18]
	FY2012	East China Sea	6 sites	PFOS	Ministry of the Environment[24]
	2002-2004	Pacific and Atlantic ocean	2-14 samples/sea area	PFOS	Yamashita et al. (2005)[25]
Republic of Korea	2013-2014	Rivers and lakes	27 sites	PFOS	UNU project
Philippines	2013	Rivers and reservoirs	9 sites	PFOS	UNU project
Thailand	2013	Rivers, canals and coastal seawater	50 sites	PFOS	UNU project
	2006-2009	Rivers and drinking water, waste water	13-25 samples/site 29 rivers and118 waste water sites	PFOS	Boontanon et al., J. Environ. Eng, 139, 588 (2013)

China is monitoring PFOS in the water at 10 sites of two coastal waters and 6 sites of two lakes in mainland in 2013. The concentrations of PFOS were ND – 47ng/L in the water. PFOS concentration in marine water surrounding Hong Kong SAR was monitored by Hong Kong Environmental Protection Department. Detail is shown in Annex G.

Japan is continuously monitoring PFOS in the water throughout the nation (48 to 49 sites) since 2009[18]. The concentration range from 2009 to 2012 was between 0.02 and 230 ng/L. PFOS concentration in marine water surrounding Japan in monitored in another project [24]. Detail is shown in Annex G. Also information on PFOS concentrations in sea water is reported in Yamashita et al. (2005). Detail is shown in Annex G.

United Nations University has been conducting capacity building program "Environmental Monitoring and Governance in the Asian Coastal Hydrosphere" in which PFOS monitoring in East/South Asian countries were conducted. Data from Republic of Korea, Philippines and Thailand were submitted through the focal point of the countries, and are compiled in this report. The PFOS concentrations in rivers and lakes, reservoirs range from 0.12 to 33 ng/L in Republic of Korea, 0.39 to 4.2 ng/L in Philippines, and from ND to 54 ng/L in Thailand, with averages of 4.9, 1,7, and 13 ng/L, respectively. PFOS concentrations in coastal seawater in Thailand ranges from ND to 17 ng/L in general, and from ND to 730 ng/L in industrial areas, respectively. In addition, two published papers were submitted through the focal point of Thailand, and the data on environmental water levels are included in this report. In the report, PFOS concentrations in mainstreams and tributaries of Chao Phraya river range from 0.25 to 8.5 ng/L with average 1.7 ng/L. The average concentration of PFOS in waste water was 260 ng/L with maximum 6200 ng/L.

5.1.4 Other media

5.1.4.1 Water

Japan is continuously monitoring POPs in the water throughout the nation (36 to 49 sites) since FY2002[18]. Concentrations of following POPs are measured in the monitoring survey: Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, HCB, Mirex, Toxaphene, PCB, Chlordecone, Endosulfan, HBB, HBCD, HCHs, PeCBz and PBDEs. There is another program from Ministry of Environment, Japan which is monitoring PCDD/PCDF and *dl*-PCB in public water in Japan throughout the nation (204 to 2213 sites) since FY 1998 (for FY 2007 to FY 2011 monitoring sites are 689 to 740) [17]. Also, concentration of PCB, PCDD/PCDF, *dl*-PCB, HCHs, and PFOS in marine water surrounding Japan is reported [24]. Detail is shown in Annex H.

5.1.4.2 Ground-water

There is a program from Ministry of Environment, Japan which is monitoring PCDD/PCDF and *dl*-PCB in ground-water in Japan throughout the nation (188 to 1479 sites) since FY 1998 (for FY 2007 to FY 2011, monitoring sites are 538 to 759) [17]. Detail is shown in Annex H.

5.1.4.3 Bottom sediment in water

Japan is continuously monitoring POPs in the bottom sediment in water throughout the nation (49 to 64 sites) since FY 2002 (Chemicals in the environment) [18]. Concentrations of following POPs are measured in the monitoring project: Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, HCB, Mirex, Toxaphene, PCB, Chlordecone, Endosulfan, HBB, HBCD, HCHs, PBDEs, PeCBz and PFOS. There is another program by Ministry of Environment, Japan which is monitoring PCDD/PCDF and *dl*-PCB in bottom sediment in water in Japan throughout the nation (205 to 1836 sites) since 1998 (for 2007 to 2011 monitoring sites are 1316 to 1505) [17]. Also, concentration of PCB, PCDD/PCDF, *dl*-PCB, HCHs, Endosulfan, HBCDs, PBDEs and PFOS in sediment from marine environment surrounding Japan is reported[24]. Japan Coast Guard is continuously monitoring PCB in the bottom sediment marine water in inner bay since 1974[26]. Detail is shown in Annex H. 3.

5.1.4.4 Soil

Japan is continuously monitoring PCDD/PCDF and *dl*-PCB in the soil throughout the nation (286 to 3735 sites) since 1998[17]. Detail is shown in Annex H. 4.

5.1.4.5 Biota

Japan is continuously monitoring POPs concentration in fish, shellfish, and birds throughout the nation[18]. Concentrations of following POPs are measured in the monitoring project: Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, HCB, Mirex, Toxaphene, Chlordecone, Endosulfan, HBB, HBCD, HCHs, PBDEs, PeCBz and PFOS. Information on seabass from Tokyo Bay and Osaka Bay is shown in Annex H.5. Survey on accumulation and exposure of dioxins is also conducted by Ministry of Environment, Japan since 1998[22]. PCDD/PCDF and *dl*-PCB were analyzed for common cormorant, common cormorant, large Japanese field mouse, raccoon dog and finless porpoise. The result is shown in Annex H. Concentration of PCB, PCDD/PCDF, and *dl*-PCB in marine biota (mussels, benthic sharks, squids, cods and crustaceans) is reported since 1998[24]. Detail is shown in Annex H.5. Also concentrations of POPs in marine mammals (e.g. striped dolphins and melon-headed whales) and fish (skipjack tuna) are reported in several research papers (Isobe et al., 2009[27]; Hart et al., 2008[28]; Kajiwara et al., 2008[29]; Ueno et al. 2004[30] and 2006[31]). Detail is shown in Annex H.5.

5.1.4.6 Food

Concentration of dioxins from food, livestock products and marine products in Japan is reported in surveys conducted by Ministry of Environment, Japan[22] and Ministry of Agriculture, Forestry and Fisheries, Japan[32]. Survey on daily intake of dioxins is conducted with grants from Ministry of Health, Labour and Welfare, Japan[33]. Detail is shown in Annex H.6.

5.2 Review and Discussion

Temporal trend of POPs level is discussed in this section based on the data from 1st and 2nd phase Asia-Pacific Regional Monitoring Report. Generally speaking, concentration of chemical substance in the environment is expected to decrease after the establishment of relevant regulations. Especially POPs in the ambient air are considered to show sensitive reaction to the change in the emission source. Whereas after certain period of time passing after the establishment of regulation, the reduction trend in environment is seemed to become insignificant and evaluation of temporal trend will become difficult. For initial POPs, it has been a while since many countries have already regulated its use, and the changes in the concentration level in the environment has become smaller (eg. in Japan, use of PCB has been regulated since 1972, and while significant reduction tendency was seen from the 1970s to the 1980s, change in concentration level became smaller after the 1990s. See Figure 5.1.1–2). On the other hand, for the new POPs, significant change in environmental concentration is expected to be seen after the implementation of regulation. In this section, based on the data gathered in the 1st phase and 2nd phase of GMP, the result of the analyzed trend will be organized for each core media. As major Result of example of analysis on temporal trend of initial POPs in Japan, the monitoring project for long period, change in the concentration for long time clarified through the analysis of sediment core, and detail analysis of the *recent 10 years* will be shown. Also, data on reduction of dioxin concentration in around year 2000, when many countries in Asia regulated its use, will be shown. For details of statistical analysis method in Japan and discussion on temporal trend of other media, see Annex I.

5.2.1 Ambient air

(1) Aldrin

As results of the inter-annual trend analysis from FY 2002 to FY 2009 throughout Japan, statistically significant tendency was not observed for Aldrin in the ambient air[18].

(2) Chlordane

As results of the inter-annual trend analysis from FY 2002 to FY 2012 throughout Japan, reduction tendency was identified as statistically significant for Chlordane (cis-Chlordane, trans-Chlordane, Oxychlordane, cis-nonachlor, trans-nonachlor) in the ambient air in the warm season. For cis-Chlordane, reduction tendency was identified as statistically significant in cold season also[18].

(3) DDT

As results of the inter-annual trend analysis from FY 2002 to FY 2010 throughout Japan, reduction tendency was identified as statistically significant for *o,p'*-DDT, *p,p'*-DDE, *o,p'*-DDE and *o,p'*-DDD in the ambient air in the warm season. For *o,p'*-DDT and *o,p'*-DDE, reduction tendency was identified as statistically significant in cold season also[18].

(4) Dieldrin

As results of the inter-annual trend analysis from FY 2002 to FY 2011 throughout Japan, statistically significant tendency was not observed for Dieldrin in the ambient air[18].

(5) Endrin

As results of the inter-annual trend analysis from FY 2002 to FY 2011 throughout Japan, statistically significant tendency was not observed for Endrin in the ambient air[18].

(6) Heptachlor

As results of the inter-annual trend analysis from FY 2002 to FY 2012 throughout Japan, reduction tendency was identified as statistically significant for Heptachlor in the ambient air in the warm season and cold season[18].

(7) HCB

As results of the inter-annual trend analysis from FY 2002 to FY 2012 throughout Japan, statistically significant tendency was not observed for HCB in the ambient air[18].

(8) Mirex

As results of the inter-annual trend analysis from FY 2002 to FY 2012 throughout Japan, statistically significant tendency was not observed for Mirex in the ambient air[18].

(9) PCB

In Japan, the air level of PCB was 100 ng/m^3 in 1974, and dropped to about one tenth within a few years. The air concentration declined to about 1 ng/m^3 in 1988 and has been fluctuating around this level since then. For recent years, as results of the inter-annual trend analysis from FY 2002 to FY 2012 throughout Japan, statistically significant tendency was not observed for PCB in the ambient air[18].

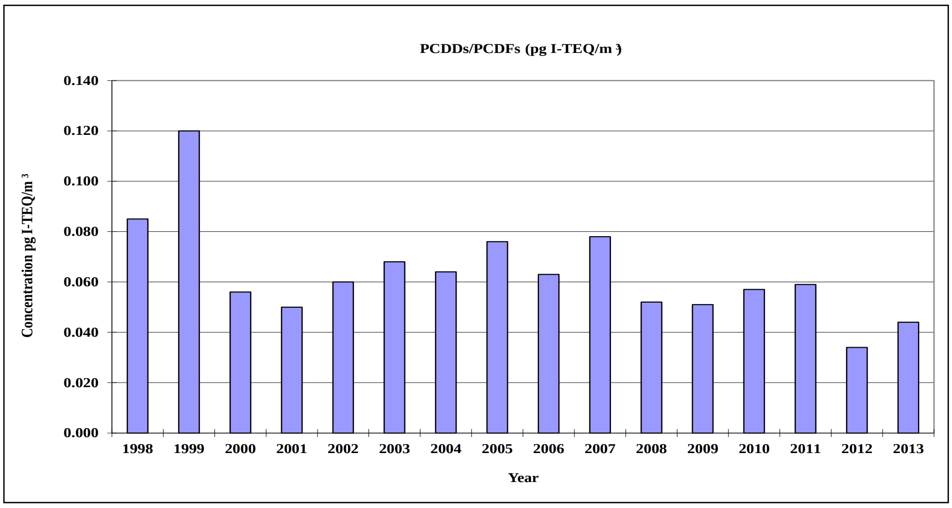
(10) PCDD/PCDF and *dl*-PCB

Although only PCDD and PCDF concentration was measured before 1998, calculation method for TEQ was not the same, and different points were selected for the survey, overall reduction tendency was observed for concentrations of dioxins in the ambient air measured throughout Japan generally showed decreasing trend. Furthermore, by comparing the data for sites with continuing survey, concentrations of dioxins in the ambient air showed decreasing trend.

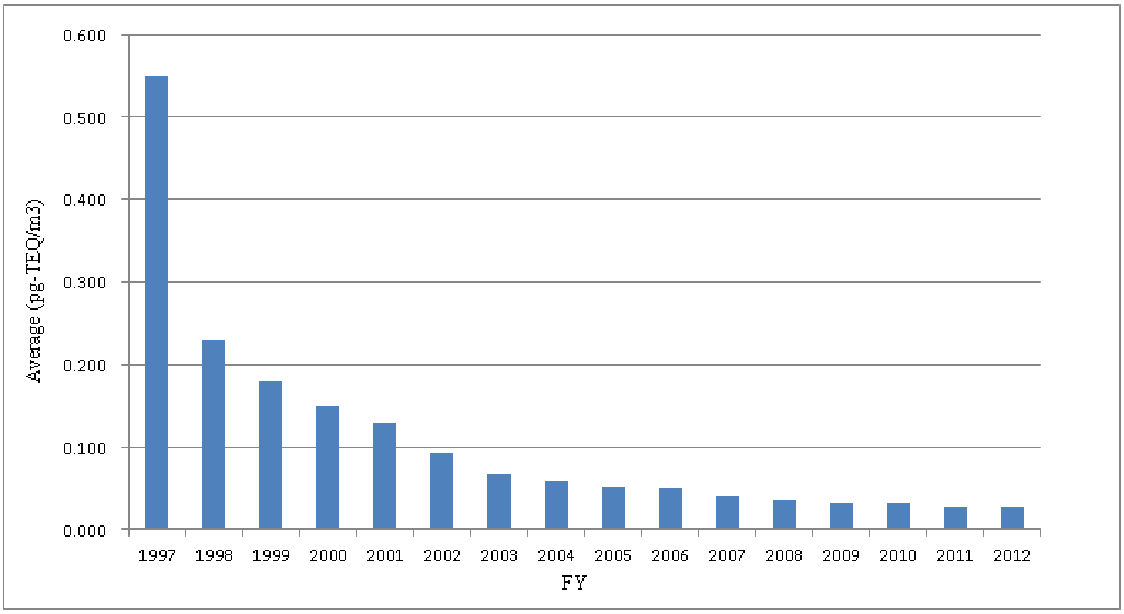
Information on monitoring data in Hong Kong.

The temporal trend of dioxins concentration in Hong Kong SAR, China and Japan is shown in the below figure for comparison.

Hong Kong SAR, China



Japan



Reference: Ministry of the Environment[17]
Note: The value of the graph is corresponding to Table 5.1.1–3

Figure 5.2.1–1 Trends of dioxins concentrations in air in Hong Kong and Japan

5.2.2 Human tissues (milk and/or blood)

(1) Chlordane

Based on the result from Human milk survey in Osaka, Japan, the average concentration of Chlordane varied in survey years and significant inter-annual trend was not observed. Also, the concentrations of chlordane in human breast milk from primiparae were comparable to or slightly higher than the data obtained during 1998, indicating that the levels of these contaminants in Japanese human breast milk have not decreased since 1998 and Japanese are continuously exposed to these chemicals, presumably via fish intake (Kunisue et al., 2006).

(2) DDT

Based on the result from Human milk survey in Osaka, Japan, reduction tendency was observed for average concentration of DDTs from 1972 to the first half of 1990s. After latter half of 1990s, the concentration remained approximately at the same level. Also, the concentrations of DDTs in human breast milk from primiparae were comparable to or slightly higher than the data obtained during 1998, indicating that the levels of these contaminants in Japanese human breast milk have not decreased since 1998 and Japanese are continuously exposed to these chemicals, presumably via fish intake (Kunisue et al., 2006).

(3) Dieldrin

Based on the result from Human milk survey in Osaka, Japan, reduction tendency was observed for average concentration of Dieldrin from 1973 to the first half of 1982. Although the survey was not conducted from 1983 to 2003, concentration in 2004 and 2005 was approximately 10% compared to 1982.

(4) Heptachlor

Based on the result from Human milk survey in Osaka, Japan, slight reduction tendency was observed for average concentration of Heptachlor epoxide since 1986, the year survey started.

(5) HCB

Based on the result from Human milk survey in Osaka, Japan, reduction tendency was observed for average concentration of HCB from 1980 to the first half of 1990s. After latter half of 1990s the concentration remained approximately at the same level. Also, the concentrations of HCB in human breast milk from primiparae were comparable to or slightly higher than the data obtained during 1998, indicating that the levels of these contaminants in Japanese human breast milk have not decreased since 1998 and Japanese are continuously exposed to these chemicals, presumably via fish intake (Kunisue et al., 2006).

(6) PCB

Based on the result from Human milk survey in Osaka, Japan, reduction tendency was observed for average concentration of PCB from 1972 to around 1990s. After 1990s the concentration remained approximately at the same level.

(7) PCDD/PCDF and *dl*-PCB

Although participants’ condition, such as age, was different among survey years and it is difficult to compare simply, but the concentration remained approximately at the same level for PCDD/PCDF and *dl*-PCB measured throughout the nation.

Also, the concentrations of PCDD/PCDF and *dl*-PCB in human breast milk from primiparae were comparable to or slightly higher than the data obtained during 1998, indicating that the levels of these contaminants in Japanese human breast milk have not decreased since 1998 and Japanese are continuously exposed to these chemicals, presumably via fish intake (Kunisue et al., 2006).

(8) HCHs

Based on the result from Human milk survey in Osaka, Japan, reduction tendency was observed for average concentration of β-HCH from 1972 to the first half of 1990s. After the latter half of 1990s the concentration remained approximately at the same level.

(9) HBCDs

According to Kakimoto et al. (2008), the concentration of HBCDs was below the detection limit in the samples collected between 1973 and 1983 and increased in those collected since 1988. Time trend of HBCD appeared to be related to technical HBCD consumption level in Japan.

(10) PFOS

In Kyoto, Japan, historical serum samples collected from females demonstrated that PFOS concentrations have increased by factor of 3 over the past 25 years (Harada et al., 2004). In other hand, PFOS concentrations in blood of pregnant woman in Hokkaido, Japan showed that concentrations have decreased from 2003 to 2011 (Kishi et al. 2012).

5.2.3 Water

Data on PFOS concentrations in water was gathered for base line in this report. Analysis of temporal trend is future work due to insufficient data at this phase.

5.2.4 Other media (sediment core)

5.2.4.1 PCDD/PCDF and *dl*-PCB

The vertical distribution of PCDD, PCDF and *dl*-PCB in a sediment core was investigated to elucidate historical trends of these chemicals discharged into Sendai Bay, Japan (Okumura et al., 2004)[34]. The concentration was 410 pg/g dw in sediments deposited in the mid-1930s, and 3870 pg/g dw in those deposited in the mid-1980s. Fluxes increased from the mid-1930s and then reached a maximum in the mid-1980s. The period for which the maximum concentrations of 1,3,6,8+1,3,7,9-TeCDD, OCDD, and *dl*-PCB were measured in the sediment core (mid-1980s) did not correspond to the time of maximum use of CNP (1975), PCP (1970), or PCB (1970) products, but lagged behind by more than 10 years.

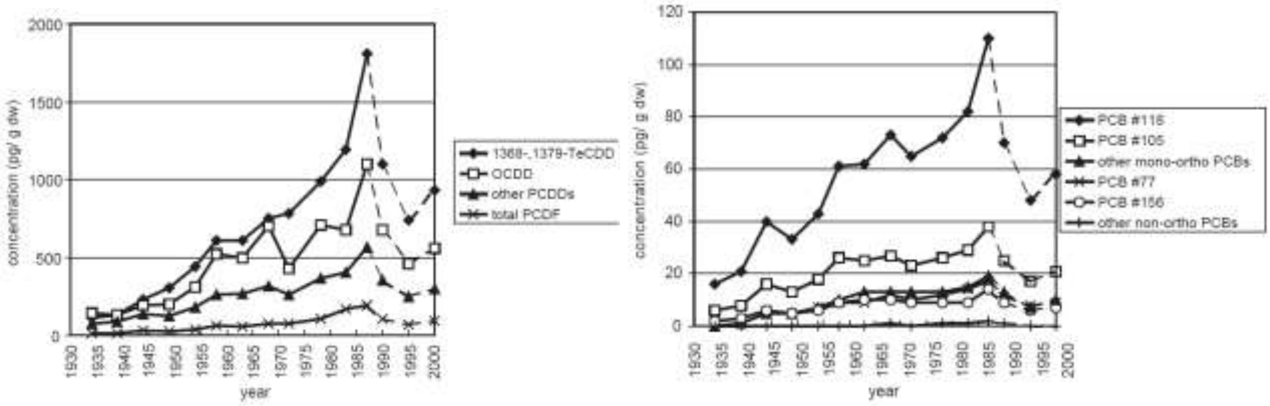


Figure 5.2.4–1 Changes in PCDD/F and *dl*-PCB concentrations with time in Sendai Bay, Japan

Concentrations of dioxins in bottom sediment throughout the nation remained approximately at the same level from 1998 to 2012.

5.2.4.2 PFOS

Core sediment sample was collected to estimate the historic PFCs contamination in East China Sea (Kunacheva et al., 2012)[35]. PFOS concentration ranged from not detected (ND) – 4,265 pg/g dry wt (Geomean = 281 pg/g). PFOA was in the ranged of ND – 1,164 pg/g dry wt (Geomean = 126 pg/g). PFOS was found higher in the sediment than PFOA. PFOS was likely to attach to the sediment and sludge more than PFOA as reported in the literature8. PFOS was detected the highest concentration in 1986, while PFOA was detected in the highest concentration in 2004.

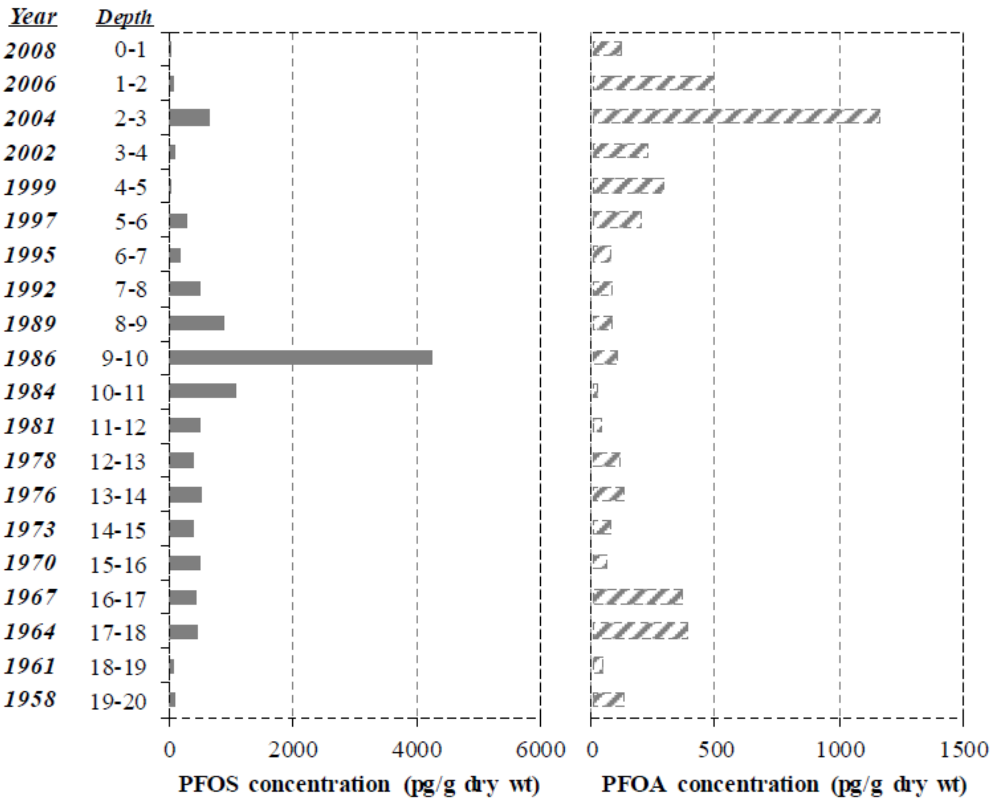


Figure 5.2.4–2 PFOS and PFOA concentrations in core sediment sample collected in East China Sea

5.3 Long-range transport

All POPs (12 initial POPs and new POPs) listed in Annex A, B and/or C under Stockholm Convention have potential for long range transport. The substances released in the Asia-Pacific Region may transport via air or water, and reach far away from the emission source (e.g. Arctic). There are some ways to understand the environmental movement of the listed chemicals, and examples are described in Guidance on the Global Monitoring Plan for Persistent Organic Pollutants[15]. These include:

- GMP data can be assessed using information on long-range transport potential (LRTP; e.g. characteristic transport distances (CTD) values) for the various POPs. CTD for some POPs discharged in air and water are described in Table 5.3–1. According to the CTD values, some substances mainly transport by air (the “flyers”), and others transport by water (the “swimmers”).

- Back trajectory analysis (relatively simple in terms of data and infrastructure support). This can be extended to generate probability density maps for better interpretation of trend data with respect to advection inputs for GMP sites.

- Using regional- and global-scale models (more complex and demanding in terms of input data, although a range of models are available); GMP data can be used to initialize models and evaluate transport pathways on a regional and trans-regional (trans-continental scale). This is a specialized and resource demanding technique that may be difficult to implement.

- As a further option the regional organisation groups could set up a small team of experts to prepare a report or reports, based upon published literature and / or the data derived from the air monitoring component of the GMP. With this approach, interpretive techniques such as modelling and back trajectory analysis would be a part of the reports reviewed by the experts, and not directly a component of the GMP.

Table 5.3–1 Characteristic travel distances (CTDs, km) for air and water for selected POPs[15]

Chemical	CTD (air)	CTD (water)
Hexachlorobenzene	230,000	700
Pentachlorobenzene	120,000	200
Octabrominated Diphenyl ethers	22,000	360
PCB (tetra homolog)	17,000	340
α-HCH	7,800	830
PCB (tri homolog)	5,100	190
γ-HCH	4,200	220
BDE-99	3,700	540
DDT	3,600	490
β-HCH	3,100	430
Hexabromobiphenyl	3,000	540
Toxaphene	2,800	1,600
Short-chain chlorinated paraffins	1,800	230
2,3,7,8-TCDD	1,600	130
Dieldrin	1,100	580
Chlordane	1,100	300
Chlordecone	710	1,700
Aldrin	100	130
PFOS	10	63,000

HCH – Hexachlorocyclohexane; PCB-polychlorinated biphenyl;
DDT – dichlorodiphenyltrichloroethane; TCDD – tetrachlorodibenzodioxin;
PFOS– Perfluorooctane sulfonate.

In Asia-Pacific Region, there are few studies on models or trajectory analysis on POPs. Examples for the studies on trajectory analysis in Asia-Pacific Region are shown in Annex J.

6 CONCLUSIONS AND RECOMMENDATIONS

Highlights of collected regional data on POPs levels in air and human milk/blood

In the Asia-Pacific Region, several international and national POPs monitoring programs on air and human milk/blood are available. For the air, passive sampling was conducted in the POPs Global Monitoring Plan in the Pacific Island Region including Fiji, Kiribati, Niue, Palau, Samoa, Solomon Island and Tuvalu. In POPs Monitoring Project in East Asian Countries sampling was operated in eight countries (Indonesia, Japan, Republic of Korea, Lao PDR, Malaysia, Mongolia, Philippines, and Vietnam). In China and Japan, national POPs monitoring programs in ambient air are performed. For human milk, a regional POPs monitoring program was carried out in Pacific Island Region including Fiji, Kiribati, Niue, Palau, Samoa, Solomon Island and Tuvalu. China (including Hong Kong SAR) and Japan also conducted national POPs monitoring programs to analyze the level of POPs in human milk. Only Japan have conducted monitoring programs to investigate the level of POPs in human blood.

It should be noted that only a few countries in the Region reported the POPs data. Some countries have been collecting POPs data for longer and more intensively than others, but most countries have not.

Generally, averaged high levels of POPs in ambient air were observed when compared to the concentration in other parts of the world. Monitoring data of POPs were reported by some countries in Asian and Pacific region. However, some of the POPs have not been quantitated in studies. It might be due to the analytical methods to analyze POPs were not sensitive enough to detect ultra-trace level of contaminants, and hence it is difficult for further comparison. Snap shot samples were collection in a random time of year. It is encouraged that more data (higher sampling frequencies, more sampling points) should be gathered on the basis of the discussion of long-range transport and temporal trend of POPs.

For human samples, POPs data are still lacking over the region. Much more data are needed to provide the exposure information on POPs in human for further evaluation. By comparing 1st and 2nd Asia-Pacific Regional Monitoring Report for POPs, a reduction trend of initial POPs is observed for the sediment core, especially for the analysis of the dioxin in recent 10 years. The reduction of dioxin level in around 2000 because many countries in Asia started to regulate its use.

In China, POPs monitoring is convinced that its framework, as one of the existing sub-regional initiatives that contribute to the effectiveness evaluation of the Stockholm Convention, will provide background data on the media considered to be essential, and will contribute to further operation of the global monitoring program. China has performed a relatively wide scope of analysis of POPs in the ambient air and human tissue in 2008 to 2014. Ambient air samples were collected over the nation including Hong Kong SAR and Macao SAR, while human milk samples were collected from 15 provinces and metropolises including Hong Kong SAR for the investigation of the concentration of POPs.

Monitoring of POPs in the ambient air has been considered one of the important regular toxic air pollutant monitoring programs. Measurement of POPs including dioxins and total PCB have been starting from mid-1997 until now. There is no regular monitoring program of organo-chlorine pesticides (OC pesticides) in Hong Kong SAR because of no significant and large-scale uses of OC pesticides have been recorded in Hong Kong. However, investigations of OC pesticides are on project basis.

In Asia-Pacific Region, there are few more studies on models or trajectory analysis on POPs Examples for the studies on trajectory analysis in Asia-Pacific Region are shown in Annex J. More effort should put on the studies on trajectory analysis to indicate the possibilities of long-range transportation of POPs.

After the pilot study on the application of passive samplers for the determination of POPs concentrations in ambient air from June 2006 to May 2007 and POPs Monitoring Study between the Research Centre for Environmental Chemistry and Ecotoxicology (RECETOX) of the Czech Republic and the Institute of Applied Sciences of the University of the South Pacific in Fiji, further studies on the level of POPs in ambient air and human tissues were conducted. A regional study, POPs Global Monitoring Plan in the Pacific Islands Region, was performed to investigate the concentration of POPs in ambient air and human milk within Fiji, Kiribati, Marshall Islands (human milk only), Niue, Palau, Samoa, Solomon Island and Tuvalu. The obtained results show the POPs concentrations in air for all sampling countries. Also, when compared to the previous result, a reducing trend on the level of POPs have been observed in human milk samples collected from Fiji and Kiribati.

Japan has already started different POPs monitoring programs throughout whole nation since 2002 until now. Japan has been participating in POPs Monitoring Project in East Asian Countries from 2002. Ambient air samples have been collected at Cape Hedo (Okinawa Island) as a background site for the mentioned studies. The POPs Monitoring Project in East Asian Countries is also monitoring POPs in the air at Indonesia, Republic of Korea, Lao PDR, Malaysia, Mongolia, Philippines, and Vietnam since 2009. Apart from the regional study, some studies on the level of POPs in Japan ambient air have been carried out throughout the nation by the Ministry of Environment, Japan from 2002 and data collected after the 1st regional report are included in this report. Research studies have been conducted by researchers to explore the level of POPs in human tissues, for example, human breast milk and human blood. Human breast milk have been collected for Osaka Prefecture from 1972 until 2008. National studies on the concentration of POPs in human blood started since 2003.

In the Asia-Pacific Region, limited POPs monitoring programs on human blood are available. The POPs monitoring on human blood for several sites in Japan were operated for several years between 1977 and 2012.

The information of some of the New POPs are firstly included in the 2nd Monitoring Report after they are formally listed as POPs under Stockholm Convention. Their levels are not included in the 1st monitoring report so that it is important that for the future assessments to obtain the temporal trends of the new POPs. Also, please be aware that the properties of some new POPs (e.g. PFOS) might not be the same as conventional POPs. Therefore, the sampling and analytical procedures should be modified in order to have an adequate analysis.

Highlights of Summary of evidence of temporal trends and long-range transport

Temporal trends are determined based on the data from 1st and 2nd phase of Asia-Pacific Regional Monitoring report. The levels of initial POPs are reducing, but not as significant as before. For the new POPs, since only few data are focused on the levels of new POPs, so the significant change on the levels can be seen after the regulations were implemented. Since there is only limited number of studies, therefore, it is not easily for us to investigate and evaluate long range transport of POPs. Studies should be conducted more thoroughly on the analysis of temporal trends and long-range transport of POPs within the region.

In East Asian POPs air monitoring programme, high volume air sampling data at Hedo, Okinawa, showed a clear decreasing trend of DDTs, during the recent four years. This might reflect a possible decrease of new DDT input to the sampling region in the period.

Existing barriers and recommendations

New POPs analyses have only been carried out in some of the countries within the region, for example, Japan and China. The reason might be due to the analytical facilities or techniques are not well developed in some countries. It is recommended that knowledge and technologies should be shared and transferred within the region.

Some countries within the region have taken the advices mentioned in the 1st monitoring report and conducted POPs analyses in core media. However, the overall POPs information in the region are still lacking. In Asian and Pacific Region, most countries are developing countries or countries with their economies in transition. As a result, many countries in this region do not have enough funding for the technology development and transfer. Therefore, facilities for POPs analysis and monitoring are limited, especially for dioxins analysis. In addition, the techniques and knowledge of specialists in the region cannot meet the standard of up-to-date research skills and data analyses on POPs. In some cases, there is also insufficient monitoring of POPs, lack of programs on the emission control and lack of quality control. Since most countries in the region do not have POPs data, therefore, it is not able to access the long-range transport of POPs in the region. It is recommended the monitoring of initial POPs and new POPs should be conducted for a longer time period in order to obtain the temporal trend effectively. More effort should be made to fill the data and technical gap on the POPs analysis in the region. Also, regional and international cooperation are highly recommended to tackle the problems mentioned above.

Country representatives and ROG members assessed the capacity needed to monitor POPs in the regional counties through collection of information. China and Japan have comparatively well-established POPs monitoring systems within the Region, other countries in the region basically still lack capacity. Fiji started the air monitoring with passive sampling method more recently, but the monitoring highly depends on collaboration and Fiji as well as it sub-regional countries have no facility for POPs inventory programs. The capacity lack is also identified in India, Qatar and most of other countries in the region. The difficulties involved in the lack of POPs monitoring capacity for most countries within the Region include lack of funds and advanced technology as well as insufficient knowledge and training of special personnel.

Thus, it is highly recommended for most countries in the region to start working on POPs monitoring programs as the top priority. In the region, more validated data on the POPs level are needed in order to get a whole picture of background level of POPs within the region. In particular, more resources are necessary for improving the analytical facilities and methods for the determination of POPs. In addition to analytical facilities and methods, more trained personnel should be employed for the daily operation of the instruments. To maintain or improve the analytical capability for POPs needs, good QA/QC among laboratories, including the regular use of reference standards and/or certified reference materials, training programs, inter-laboratory comparison exercise, and the identification of reference laboratories within the region for specific POPs, should be achieved.

It is highly recommended that by the ROG members of the region to continue collecting data of POPs concentration. It is noted that more data on the sources and the level of POPs are needed. It is important that representatives of different countries to meet at a regular time interval to update the POPs information and improve regional communication. It is highly recommended that financial assistance should be actively sought from international funding agencies such as the World Bank and GEF for supporting technology transfer for studies into PTS and related activities. Countries in the region should be encouraged to participate in ongoing efforts to promote the implementation of the Convention. In particular, countries in the region should be encouraged to provide data of POPs and to participate in the inventory activities. Analytical capability for the POPs monitoring may be enhanced through existing mechanisms of collaborations and with seeking funds from national and international organizations.

Countries in the region can be encouraged to take better advantage of activities being conducted by the co-operative mechanism of UNEP/WHO for human milk monitoring program of POPs. The effort of UNEP/WHO program of analysis of PCDD/PCDF and *dl*-PCB in human milk could be expanded to include other POPs, and more countries should be encouraged to participate in the program.

7 REFERENCES

1 The World Bank, Data & Research, Data, Key Development Data & Statistics. http://www.worldbank.org/ (Accessed June 2014); Cook Islands, Nauru, Niue, Palestine, Pitcairn Islands, Tokelau, Wallis and Futuna are not available.

2 United Nations Statistics Division, United Nations Demographic Yearbook 2012, http://unstats.un.org/unsd/demographic/products/dyb/default.htm (accessed June 2014)

3 International Monetary Fund, World Economic Outlook Database, April 2014 Edition (http://www.imf.org/external/pubs/ft/weo/2014/01/weodata/index.aspx; access on June 2014)

4 Map Machine, National Geographic Society (http://plasma.nationalgeographic.com/mapmachine/; access on Mar. 2008)

5 JRA-25 Atlas; http://ds.data.jma.go.jp/gmd/jra/atlas/jpn/atlas-top.htm (accessed June 2014)

6 World Health Organization (2013) Malaria control in humanitarian emergencies: an inter-agency field handbook. 2nd ed. (http://www.who.int/malaria/publications/atoz/9789241548656/en/; Accessed on July 2014)

7 Registers (http://chm.pops.int/Implementation/Exemptions/Overview/tabid/789/Default.aspx; access on July 2014)

8 UNEP Chemicals (2002) Regionally Based Assessment of Persistent Toxic Substances

(Central & Northeast Asia, Indian Ocean, South East Asia & South Pacific, Pacific Islands and Mediterranean Region; http://www.chem.unep.ch/Pts/regreports/regreports.htm)

9 National Implementation Plans transmitted pursuant to Article 7(b) of the Stockholm Convention (http://chm.pops.int/Implementation/NIPs/NIPSubmissions/tabid/253/Default.aspx; access on July 2014)

10 Ministry of the Environment, Japan. (2002-2005) Proceedings of the Workshop on Environmental Monitoring of Persistent Organic Pollutants (POPs) in East Asian Countries.

11 National Institute for Environmental Studies, "Time Capsule Program for Environmental Specimens" (https://www.nies.go.jp/timecaps1/indexE.htm; Accessed on July 2014)

12 Center for Marine Environmental Studies, Ehime University, "Environmental Specimen Bank for Global Monitoring" (http://esbank-ehime.com/dnn/; Accessed on July 2014)

13 Tanabe S. and Ramu K. "Environmental Specimen Bank (es-BANK) of Ehime University, Japan –Current Status and Future Perspectives–" In: *Interdisciplinary Studies on Environmental Chemistry –Environmental Specimen Bank: Exploring Possibility of Setting-up ESBs in Developing Countries*, Eds., Isobe T., Nomiyama K., Subramanian A. and Tanabe S., TERRAPUB, 2010, pp. 1-5.

14 Department of Health and Environmental Sciences, Kyoto University, "Kyoto University Human Specimen Bank for Biological Monitoring" (http://hes.med.kyoto-u.ac.jp/kuhsb/index.html (only in Japanese); Accessed on July 2014)

15 UNEP (2013) Guidance on the Global Monitoring Plan for Persistent Organic Pollutants; January 2013

16 POPs Monitoring Project in East Asian Countries, Background Air Monitoring of Persistent Organic Pollutants in East Asian Countries 2009-2013.

17 Ministry of the Environment, Japan. "Environmental Survey of Dioxins." (Summary of result for FY1997-2009: http://www.env.go.jp/en/headline/headline.php?serial=1500; Full report (only in Japanese): http://www.env.go.jp/chemi/dioxin/report.html; Accessed on July 2014)

[18] Ministry of the Environment, Japan. “Chemicals in the Environment.” (http://www.env.go.jp/chemi/kurohon/en/index.html; Accessed on July 2014)

[19] Konishi, Y., Kakimoto, K., Akutsu, K., Obana, H. (2009) Surveillance of Persistent Organic Pollutants in Human Breast Milk (19 th report) – Development of POPs simplified assay and the final report of monitoring study-. (http://www.iph.pref.osaka.jp/report/syoho/H21/05k.pdf; Accessed on July 2014)

[20] Kakimoto K., Akutsu K., Konishi Y., Tanaka Y. (2008) Time trend of hexabromocyclododecane in the breast milk of Japanese women. *Chemosphere*, 71, 1110-1114.

[21] Kunisue T., Muraoka M., Ohtake M., Sudaryanto A., Minh NH., Ueno D., Higaki Y., Ochi M., Tsydenova O., Kamikawa S., Tonegi T., Nakamura Y., Shimomura H., Nagayama J., Tanabe S. (2006) Contamination status of persistent organochlorines in human breast milk from Japan: Recent levels and temporal trend. *Chemosphere*, 64, 1601-1608.

[22] Ministry of the Environment, Japan. “Survey on accumulation and exposure of Dioxins.” (http://www.env.go.jp/chemi/dioxin/chosa/yasei.html (only in Japanese); Accessed on July 2014)

[23] Kishi R. et al., (2013). Temporal trend of Concentrations of PFCs in maternal plasma: FY2003-2011 *Health and Labour Sciences Research Grants (Research Project on Risk of Chemical Substances)*, 27-39.

[24] Ministry of the Environment, Japan. “Marine Environmental Monitoring Survey.” (Full report: http://www.env.go.jp/water/kaiyo/monitoring.html (only in Japanese); Summary report for 1998-2007: http://www.env.go.jp/water/kaiyo/monitoring/status_report.html (available both in English and Japanese); Accessed on July 2014)

[25] Yamashita N., Kannan K., Taniyasu S., Horii Y., Petrick G., Gamo T. (2005) A global survey of perfluorinated acids in oceans. *Marine Pollution Bulletin*, 51, 658-668.

[26] Japan Coast Guard. “Marine Pollution Survey.” (Full report: http://www.env.go.jp/water/kaiyo/monitoring.html; Accessed on July 2014)

[27] Isobe T, Ochi Y, Ramu K, Yamamoto T, Tajima Y, Kamada TK, Amano M, Miyazaki N, Takahashi S, Tanabe S (2009). Organohalogen contaminants in striped dolphins (Stenella coeruleoalba) from Japan: Present contamination status, body distribution and temporal trends (1978–2003). *Marine Pollution Bulletin*, 58, 396-401.

[28] Hart K, Kannan K, Isobe T, Takahashi S, Yamada TK, Miyazaki N, Tanabe S (2008). Time Trends and Transplacental Transfer of Perfluorinated Compounds in Melon-Headed Whales Stranded Along the Japanese Coast in 1982, 2001/2002, and 2006. *Environ. Sci. Technol.*, 42, 7132-7137.

[29] Kajiwara N, Kamikawa S, Amano M, Hayano A, Yamada TK, Miyazaki N, Tanabe S (2008). Polybrominated diphenyl ethers (PBDEs) and organochlorines in melon-headed whales, Peponocephala electra, mass stranded along the Japanese coasts: Maternal transfer and temporal trend. *Environmental Pollution*, 156, 106-114.

[30] Ueno D, Kajiwara N, Tanaka H, Subramanian A, Fillman G, Lam PKS, Zheng GJ, Muchitar M, Razak H, Prudente M, Chung KH, Tanabe S (2004). Global Pollution Monitoring of Polybrominated Diphenyl Ethers Using Skipjack Tuna as a Bioindicator. *Environ. Sci. Technol.*, 38, 2312-2316.

[31] Ueno D, Alaee M, Marvin C, Muir DCG, Macinnis G, Reiner E, Crozier P, Furdui VI, Subramanian A, Fillman G, Lam PKS, Zheng GJ, Muchtar M, Razak H, Prudente M, Chung KH, Tanabe S (2006). Distribution and transportability of hexabromocyclododecane (HBCD) in the Asia-Pacific region using skipjack tuna as a bioindicator. *Environtal Pollution*, 144, 238-247.

[32] Ministry of Agriculture, Forestry and Fisheries, Japan. "Survey on Dioxins in Livestock and Marine Products." http://www.maff.go.jp/j/press/syouan/tikusui/131205.html (only in Japanese)

[33] Ministry of Health, Labour and Welfare, Japan. "Survey on daily intakes of dioxins via food." http://www.mhlw.go.jp/topics/bukyoku/iyaku/syoku-anzen/dioxin/sessyu12/index.html (only in Japanese)

[34] Okumura, Y., Yamashita, Y., Kohno, Y., Nagasaka, H. (2004) Historical trends of PCDD/Fs and CO-PCBs in a sediment core collected in Sendai Bay, Japan *Water Research*, 38, 511–3522.

[35] Kunacheva C, Tanaka S, Fujii S, Shimizu J, Takahashi S, Shivakoti BR. (2012) Distribution of Perfluorinated Compounds in Sea Water and Sediment in East China Sea. *Organohalogen Compounds*, 74, 255–258.