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Regional Capacity Building Program for Health Risk Management of Persistent Organic Pollutants (POPs) in South East Asia

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REGIONAL CAPACITY BUILDING PROGRAM FOR HEALTH RISK MANAGEMENT OF PERSISTENT ORGANIC POLLUTANTS (POPs) IN SOUTH EAST ASIA

FINAL REPORT

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LIST OF ACRONYMS

BAT	Best Available Techniques
BEP	Best Environmental Practices
CALUX	Chemically Activated Luciferase Gene Expression
CIDA	Canadian International Development Agency
EDC	Electricite du Cambodge
EDL	Electricte du Laos
EIA	Environmental Impact Assessment
GIS	Geographic Information System
HHRA	Human Health Risk Assessment
HQ	Hazard Quotient
ILCR	Incremental Lifetime Cancer Risk
NC	National Consultant, Hatfield Project Team
NFP	National Focal Point for POPs
NIP	National Implementation Plan
NRE	Ministry of Natural Resources and Environment (Malaysia)
MOE	Ministry of Environment, Cambodia
MONRE	Ministry of Natural Resources and Environment (Thailand, Viet Nam)
Office 33	Office of the National Steering Committee on Overcoming of Toxic Chemicals used by US during the War in Vietnam.
PCBs	Polychlorinated Biphenyls
PCD	Pollution Control Department (Thailand, Viet Nam)
PCDDs	Polychlorinated dibenzodioxins or Dioxins
PCDFs	Polychlorinated dibenzofurans or Furans
PIP	Project Implementation Plan
PTS	Persistent Toxic Substances
POPs	Persistent Organic Pollutants
POPs Project	Regional Capacity Development Program for Management of Health Risks of Persistent Organic Pollutants in South East Asia
QA/QC	Quality Assurance / Quality Control
RA/RM	Risk Assessment/Risk Management
SOPs	Standard Operation Procedures
VEPA	Viet Nam Environment Protection Administration
WREA	Water Resources and Environment Administration (Lao PDR)

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EXECUTIVE SUMMARY

Goals of the POPs Project include enabling officials responsible for POPs management to increase their understanding and use of risk-based approaches for management of POPs and other chemicals; and prioritize POPs interventions to reduce local health impacts, particularly on the poor and most vulnerable. The POPs Project has been successfully completed. All project deliverables are available on the attached POPs Toolkit, and online at www.popstoolkit.com.

The risk assessment component was designed to increase the capacity of key decision makers to understand human health risks associated with POPs. The main lesson learned from the "hot spot" site selection is that National Implementing Agencies need time to educate impacted site operators, and to obtain approval from concerned government agencies. The selected "hot spot" sites had to meet project objectives, national priorities, and address perceived concerns about "potential political, economic and social" implications.

Starting from initial "hot spot" reconnaissance visits in April 2008, the Project Team determined that there were limited POPs data of adequate quality for assessing risk exposure, populations at risk, exposure levels, dose-response assessments, and other project requirements at the proposed sites. The selection and preliminary characterization of the hot spots or suspected "Hot Spot" sites as therefore primarily based on expert opinion and limited technical data.

Existing and supplementary data were used to conduct risk assessments for the selected "hot spot" sites in each of the four countries. The risk assessment component applied existing mainstream risk assessment methodologies - Health Canada's risk assessment approach - to Human Health Risk Assessment (HHRA). This approach allowed for meaningful quantification and comparison of health risks from different POPs based on available data. For preliminary risk assessments, the Project adopted conservative and simplifying assumptions that can be further improved when additional data becomes available.

The risk assessment results for Cambodia, Lao PDR, Malaysia and Thailand sites indicated that there are potential human health risks associated with exposure to PCBs and dioxins/furans for workers, worker's families and local residents. The Malaysian "hot spot" site results indicated a lower potential risk, with hazard quotients significantly lower than other selected "hot spots". Malaysian results indicated lower potential human health concerns (calculated hazard quotient 0.45 for children and 0.26 for adults). Further investigation and monitoring at all sites is recommended.

The risk management component focused on developing an online POPs Toolkit (www.popstoolkit.com) and training government officials and other stakeholders in the use of the system.

The Toolkit was evaluated by users and participants of the Regional and National Workshops through a series of questionnaires and surveys. The evaluations were in general positive; most stated they found the workshops and POPs Toolkit relevant to their

needs. The project was judged by the key stakeholders as a milestone to demonstrate the utility of combining IT and a "traditional" Human Health Risk Approach to enhance capacity building in POPs and other chemical risk assessments and management issues.

Key risk management goals, activities and indicators, as well as management alternatives were developed by the national participants through use of the POPs Toolkit. Given resources constraints, participating countries focused primarily on developing simple and cost-effective management options for their site, such as capacity building, public awareness raising and implementing a health and safety plan and emergency control procedures; more detailed and budget intensive clean-up activities may be considered at a later date.

The **economic valuation** of health impacts from POPs contamination was an important component of the overall human health risk assessment and communication process. Due to a lack of data, it was decided that the economic analysis should use estimates of cost for the selected site risk management options as a starting point. The next step was to determine the health benefits required to make the project economically viable based on different management scenarios, for example, measures targeted at changing human behavior and breaking contamination pathways, and various engineering measures were investigated. A quantitative analysis suggested that breaking potential contamination pathways was critical for making these projects economically viable. This approach could be done cost-effectively at the Cambodian Sambour Electricite du Cambodge Warehouse (SEDCW), Lao PDR's Sok Pa Loung Transformer Repair Workshop (SPL), and Thailand's Municipality Electricity Authority (MEA) sites. For the AHSL site in Malaysia, the implementation of containment measures in addition to the basic prevention measures is justified from an economic standpoint on the basis of quantified human health benefits alone.

A regional cooperation component was implemented to enhance the capacity of the countries to address cross-cutting issues which could not be adequately solved on a national scale, or could result in cost savings. Regional participants appreciated the opportunity to receive training in POPs risk assessment and management.

The Regional Workshop provided a forum for the four POPs Project participating countries, as well as the regional participants, to receive additional training in the application of the POPs Toolkit.

Based on recommendations made at the Regional Workshop, the World Bank approved an addendum to the POPs Project. As per the addendum, technical support was provided to Cambodia and Lao PDR for designing and delivering POPs Public Awareness Posters and for updating the POPs Toolkit.

The following are recommendations that will improve the sustainability of the toolkit:

1. Based on the outcome of discussions with the World Bank and the NFPs, the POPs Toolkit web site will be hosted by Hatfield until a long-term host can be found. Adequate financial resources should be allocated by the World Bank to support the Toolkit regular updates and operation costs.

2. Sustainability and popularization of the POPs Toolkit is linked to outreach and dissemination efforts to be undertaken by the World Bank and participating countries.

3. Many countries experience challenges managing POPs issues, so the results of the HHRA should provide enhanced confidence in decision-making. Some countries need to develop specific regulations on POPs, including action plans to address human health impacts. Attracting investment and improving environmental management have to be jointly pursued, in order to ensure sustainable development.

4. POPs risk assessment and management have to be adapted further to incorporate local issues, and used in a manner sensitive to local conditions, including social, political, economic and policy issues.

5. There is a need for enhanced regional cooperation, as the issues between countries are similar and all could benefit from the lessons learned and experiences of other countries.

6. **Potential Follow-up Activities:**

   a. The POPs Project should be extended to other countries, and additional, regionally relevant case studies developed to demonstrate the Toolkit utility.

   b. The POPs Toolkit content should be updated regularly and the knowledge sharing and discussion board maintained.

   c. Parts of the Toolkit should be translated into national languages and its use should be extended beyond government bodies to Universities and other academic institutions.

   d. Recommend that the Secretariat of the POPs Convention include the POPs Toolkit in its information warehouse.

   e. The POPs Toolkit should be presented as a special side event during the next POPs Conference of the Parties (COP) meeting in Argentina in 2011 to popularize its use, raise awareness and to demonstrate how SE Asian countries have been taking the lead on dealing with POPs issues.

   f. High resolution analyses for DX/FN are costly which limits the number of samples that can be analyzed for inventory and monitoring purposes. Additional support with respect to analytical budgets should be investigated.

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1.0 INTRODUCTION

The Final Report for the *Regional Capacity Building Program for Health Risk Management of Persistent Organic Pollutants (POPs) in South East Asia* (POPs Project) provides a summary of project activities completed as per the Terms of Reference (TOR) (Appendix A1), and some key conclusions and lessons learned.

The POPs Project was developed to complement National Implementation Plans (NIP) for the Stockholm Convention on Persistent Organic Pollutants (POPs). A goal of the POPs Project was to enable officials responsible for POPs management to increase their understanding and use of risk-based approaches for management of POPs and other chemicals, and prioritize POPs interventions to reduce local health impacts.

Funding for the POPs Project was provided by the Canadian International Development Agency's (CIDA) POPs Fund, and was coordinated by the World Bank. Hatfield Consultants Partnership (Hatfield) was commissioned by the World Bank to implement the Project's technical components. Complementary program activities were implemented by national consultants and World Bank staff.

The four countries participating in the POPs Project include Cambodia, Lao PDR, Malaysia, and Thailand. Five additional regional countries participated in project activities including workshops and case study development. These countries included China, Indonesia, Japan, the Philippines and Viet Nam.

Copies of all project deliverables are included on the attached CD ROM which also contains the interactive POPs Toolkit used for training and capacity building activities.

The Project progress and milestone deliverables are provided in the Appendix A2.

2.0 COMPONENT 1: RISK ASSESSMENT

The objective of Component 1, Risk Assessment, was to assess health risks from selected POPs hotspots based on existing and supplementary data, and to increase the capacity of key decision makers to better understand the human health risks associated with POPs and other persistent toxic substances (PTSs). The Project Team, together with the key stakeholders, focused on delivering an objective assessment of POPs health risks from identified contaminants of concern. The assessment was designed to inform decision makers about potential management interventions. The risk assessment component applied a mainstream risk assessment methodology, and provided flexibility in the human health risk assessment (HHRA). This approach allowed for meaningful quantification and comparison of health risks from different POPs while relying on available country data to the extent possible.

2.1 DATA GATHERING

The Hatfield Project Team visited all participating countries during March and April 2008, following the POPs Regional Launch Workshop in Luang Prabang, April 3-5, 2008. The country visits including conducting meetings with the National Focal Points and other key national stakeholders, reviewing available literature, and conducting field visits to the selected "hot spots". Progress Report 1, contained in the attached POPs Toolkit CD, contains additional information about the country visits. The Project Team found that there was limited POPs data for the proposed study sites that was suitable for the assessment of risk exposure, populations at risk, exposure levels, dose-response assessments, and other parameters.

2.2 SELECTION OF HOTSPOT

All four countries selected "hot spots" as illustrative case study sites for POPs human health risk assessments and training of staff. The NFPs for each country selected the case study sites, as follows:

- The Ministry of Environment in Cambodia selected the EDC Sambour transformer and electrical equipment warehouse in Phnom Penh in April 2008;
- The Water Resources and Environment Administration (WREA) in Lao PDR selected the EDL Sok Pa Loung transformer workshop in Vientiane in April 2008;
- The Pollution Control Department (PCD) in Thailand selected the Metropolitan Electricity Authority (MEA) Facility in Samut Prakan in May 2008; and
- The Ministry of Natural Resources and Environment (NRE) in Malaysia selected the Air Hitam Sanitary Landfill in Selangor in August 2008.

The selected "hot spot" sites in Cambodia, Lao PDR and Thailand had a history of dealing with PCB contaminated substances, equipment and waste, and were found to be suitable for the capacity building and human health risk assessment objectives of the project. The "hot spot" selected by the Malaysian National Focal Point, was a sanitary landfill site for domestic waste. While there were no existing data or known waste management practices suggesting the presence of POPs at the AHSL site, the site selection was based on speculative concern for (i) potential POPs wastes which inadvertently may have been deposited at the landfill, (ii) the proximity of residential developments adjacent to the closed landfill; and, (iii) its close proximity to Putrajaya that made it accessible.

The main lesson learned from the "hot spot" selection is that most National Implementing Agencies need an adequate lead time to educate site operators about the project, and to obtain approvals from their concerned government agencies. The time required can be significant due to political and institutional barriers and sensitivities. In some instances, the sites were selected by the National Focal Points based primarily on political and logistical considerations.

2.3 COMPLIMENTARY DATA COLLECTION

Subsequent to the initial "hot spot" site visits in April 2008, the Project Team determined that there were limited POPs data at the proposed "hot spots", specifically with respect to assessing risk exposures, populations at risk, dose-response assessments, and other parameters. Selection and preliminary characterization of potential hot spot sites were therefore primarily based on expert judgments and limited technical data.

The Project Team, with active participation from the NFPs and National Consultants, successfully conducted two field sampling and technical training programs in May 2008 and July/August 2008. Both field missions were designed to accomplish two goals: (1) to consult with, and receive input from, key stakeholders in participating countries on the project work plan and milestones (including the training program and stakeholder identification); and, (2) to provide technical capacity building/on-the-job training to national stakeholders, and to collect supplementary field data.

Additional information is available in Progress Report 2 in the POPs Toolkit, Project Reports section. The Project Team and key national stakeholders determined that the field programs helped both in building capacity of government participants in field sampling and analysis techniques, and in conducting human health risk assessments.

2.4 COMPLIMENTARY DATA ANALYSIS

As specified in the project Standard Operating Procedures (SOPs) (see *Appendix A4* of Progress Report 1 in POPs Toolkit, Project Reports, Progress Report 1 (www.propstoolkit.com), all samples were homogenized in the field and then split into three sub-samples (A, B and C).

All A samples were pre-screened by Hiyoshi Corporation in Japan using CALUX. Upon obtaining the preliminary results from Hiyoshi, the Hatfield Project Team selected 35 B samples and all 25 blood samples for PCB analysis by AXYS in Canada using high resolution GC/MS. The Malaysian NFP contracted ALS Technichem to analyze all fish tissue samples collected from the AHSL site using USEPA method 8270 C and low resolution GC/MS.

The Hatfield Project Team then organized the analytical data into a form appropriate for conducting a risk assessment. The results were reviewed and the risk assessment reports for each selected study site were drafted jointly with the NFPs and other POPs team members in participating countries during the Team's mission from December 1 – 19, 2008.

The key lesson learnt about importing and exporting collected samples was that it was that is required considerable lead time and involved careful planning and monitoring. Different countries have specific requirements for import and/or export of "contaminated waste or samples", and specific procedures for customs clearance. Another important lesson learned was while using different analytical

labs allowed for inter-lab comparisons, it was important to ensure that a common analytical approach including QA/QC (Quality Assurance/Quality Control) was followed to ensure comparability.

2.5 HUMAN HEALTH RISK ASSESSMENT

The Preliminary Risk Assessment Report for each selected study site was prepared, and presentations made to national counterparts during the Project Team's mission to the four participating countries between December 1 - 19, 2008.

The revised Draft Risk Assessment Reports were submitted to the National Focal Points and the World Bank POPs Team for review in early January 2009, prior to the National Training Workshops. Through on-line communication and face-to-face consultation, comments on the draft reports were obtained from all NFPs, the National Consultants and other key stakeholders. The revised draft reports were presented at the National Training Workshops in mid-January 2009 as case studies. Further comments received during the four National Training Workshops were documented (see National Training Workshop Reports in the attached POPs Toolkit CD, [Project Reports]), and incorporated into the Final Draft Risk Assessment Reports.

The four Final Risk Assessment Reports for each of the selected study sites, and the Case Study of the Risk Assessment and Mitigation for the Former Da Nang Airbase (used at the Final Regional Workshop), are presented in the attached POPs Toolkit CD in "Project Reports, and Case Study Sections". The following provides a summary of the findings for the four case studies.

2.5.1 Study Sites

The main characteristics of all four selected study sites are summarized in the Table 2.1.

Table 2.1 Main Characteristics of the Study Sites.

Location	Main Usage	Potential POPs of Concern	Years of Operation	Current POPs Management Plan
SEDCW, Cambodia	Storage and disposal of capacitors and transformers	PCBs, dioxins, furans	1997-Present	Not available.
SPL, Lao PDR	Repair, storage and disposal of capacitors and transformers	PCBs, dioxins, furans	1982 -Present	Not available.
AHSL, Malaysia	Disposal of domestic waste (sanitary landfill)	POPs Pesticide (DTT), PCBs, and other POPs-like.	1995-2006	Closure and Post Closure Plan 2006-2015.
MEA Site, Thailand	Storage and disposal of capacitors and transformers	PCBs; other POPs-like	1958 -Present	Not available, but most of the transformers were de-commissioned and disposed abroad.

The Cambodian, Lao PDR and Thailand sites contained PCB-contaminated transformers, capacitors, and other electrical equipment and waste. The Malaysian site was a sanitary landfill used for domestic waste.

2.5.2 Results of Risk Assessment

Key results from the risk assessment of the four study sites are summarized in Tables 2.2 to 2.5.

Risk assessment results for Cambodia, Lao PDR, Malaysia and Thailand sites indicated that there are potential human health risks resulting from exposure to PCBs and dioxins/furans for workers, worker's families and local residents. Hazard quotients were several times higher than the 0.2 threshold; workshop/warehouse employees had the highest calculated Hazard Quotient (HQ) and highest Incremental Lifetime Cancer Risk (ILCR). The greatest exposure, and greatest contributor to potential risk, was dermal contact with contaminated oils and wastes, followed by the ingestion of contaminated food (fish). The results warrant further investigation because of the possibility of additional exposure/risk from other pathways.

Dioxin and PCB concentrations from the Malaysian site are lower than other selected sites, however, the results suggest potential human health concerns (calculated hazard quotient 0.45 for children and 0.26 for adults, both higher than the 0.2 threshold). Moreover, other contaminants may be present at the site. The site warrants further investigation and monitoring.

At all sites, it is possible that other contaminants (metals, hydrocarbons and POPs chemicals) are present, which may pose additional health risks. These contaminants do not have readily available toxic reference values (TRVs), and were not investigated in the POPs Project.

Table 2.2 Risk Assessment Results for the SEDCW Case Study, Cambodia.

Problem Formulation	Key Questions	Methods
Hazards	Dioxin, furan and PCB concentrations have exceedance factors of 2.6 and 10.2 indicating they are contaminants of concern.	USEPA Risk Based Criteria (RBCs) 2008; CALUX analytical results; WHO 2005 toxicity equivalence factors (TEF).
Receptors	Over 1,438 people (1km radius). Potentially exposed receptors are: i) full time site workers and guards; ii) staff and students of training center/dormitory (adults and children); iii) local residents (adults and children); and iv) biota (especially fish, snails, crabs, and chickens).	Field observations, interviews and GIS analysis.
Pathways	▪ On-site: inhalation, ingestion, dermal contact of waste, soil/dust in warehouse and site compound; ▪ Off-site: wind erosion, surface water transport; car/trucks; and ▪ Ingestion of contaminated fish and wildlife.	Field observations, interviews, and conceptual modeling.
Toxicity Assessment	**Key Questions**	**Methods**
Exposure Assessment	▪ Hazard quotient = 2.66 (>10 times higher than 0.2 threshold) (Health Canada); and ▪ Incremental lifetime cancer risks (ILCR) were all greater than Canadian upper limit of acceptable cancer risk.	Toxicity databases; CALUX and HRGCMS results; Risk Calculation Tool estimating chemical intake rate via environmental media and exposure routes.
Human Tissue	PCB Blood concentrations were generally low. The warehouse was established only 10 years ago. However, three of the 14 blood samples appear to indicate some human health risk.	Blood sampling; HRGCMS analysis; and review of available guidelines/literature.
Risk Estimation	Concentrations of contaminants of concern are also **high** and may pose a human health risk. Children have the highest Hazard Quotient (HQ) = 2.7 and highest ILCR. Results warrant further scrutiny of the site. Other contaminants may be present.	

Table 2.3 Risk Assessment Results for the SPL Case Study Site, Lao PDR.

Problem Formulation	Key Questions	Methods
Hazards	▪ Dioxin, furan and PCB concentrations have exceedance factors of 16.0 and 56.2, significantly greater than 1, indicating contaminants of concern. ▪ Chlorinated pesticides (Dieldrin) (from a fish caught in a pond down-gradient from the workshop) also exceeds the RBC (2.6).	USEPA Risk Based Criteria (RBCs) USEPA 2008; CALUX analytical results; and WHO 2005 toxicity equivalence factors (TEF).
Receptor	▪ Over 2,826 people (1km radius). Potentially exposed receptors are: (i) Full time site workers and guards; (ii) staff and trainees of training center; (iii) local residents and students of nearby schools (adults and children); (iv) 100 families use the recycled transformer oils at home; and (v) biota (fish, snails, crabs, chicken).	Field observations, interviews and GIS analysis.
Pathways	▪ On-site: inhalation, ingestion, dermal contact of waste, soil/dust in warehouse and in site compound; ▪ Off-site: wind erosion, surface water transport; car/trucks; ▪ Domestic use of contaminated oils (inhalation, dermal); and ▪ Ingestion of contaminated fish and wildlife.	Field observation; interviews; and, conceptual models.
Toxicity Assessment	**Key Questions**	**Methods**
Exposure Assessment	▪ Hazard quotient = 38.2, (190 x higher than the 0.2 threshold (Health Canada)); and ▪ Incremental lifetime cancer risks (ILCR) were all greater than Canadian upper limit of acceptable cancer risk.	Toxicity databases; CALUX/ HRGCMS results; Risk calculation tools estimating chemical intake rate via environmental media and exposure routes.
Human Tissue	PCB blood concentrations are significantly (>25 times) higher than the average background concentrations.	Blood sampling, HR GCMS analysis; and, reviews of available guidelines/literature.
Risk Estimation	Concentrations of contaminants of concern are **highest** among four sites and may pose a human health risk. Other contaminants may be present at the site.	

Table 2.4 Risk Assessment Results for the MEA Site, Thailand.

Problem Formulation	Key Questions	Methods
Hazards	▪ Dioxin, furan and PCB concentrations have exceedance factors of 3.1 and 48.2 indicating that they are contaminants of concern. ▪ Dieldrin (from a fish caught in a pond nearby and sediment in river) also exceeded the RBC (by 3.7 and 8.7 respectively).	USEPA Risk Based Criteria (RBCs) USEPA 2008; CALUX analytical results; and WHO 2005 toxicity equivalence factors (TEF).
Receptor	Over **733** people (1km radius). Potentially exposed receptors are: i) full time site workers and guards; ii) local residents and students of nearby schools (adults and children); and, iii) biota (fish).	Field observations, interviews and GIS analysis.
Pathways	▪ On-site: inhalation, ingestion, dermal contact of waste, soil/dust in warehouse and in site compound; ▪ Off-site: wind erosion, surface water transport; car/trucks; and ▪ Ingestion of contaminated fish and wildlife.	Field observation; interviews; and, conceptual models.
Toxicity Assessment	**Key Questions**	**Methods**
Exposure Assessment	▪ Hazard quotient = 33.9 - 58.5; (greatly exceeding the 0.2 threshold (Health Canada); ▪ Incremental lifetime cancer risk (ILCR) was 360 times greater than Canadian acceptable upper limit risk.	Toxicity databases; CALUX/ HRGCMS results; Guidelines, Risk calculation tools estimating chemical intake rate via environmental media and exposure routes.
Risk Estimation	Concentrations of contaminants of concern are high (second highest among the four sites) and may pose a human health risk. Other contaminants may be present at the site.	

Table 2.5 Risk Assessment Results for the AHSL Site, Malaysia.

Problem Formulation	Key Questions	Methods
Hazards	Dioxin, furan and PCB concentrations have exceedance factors of 3.3 and 0.7, respectively, and therefore are considered contaminants of concern.	USEPA RBCs USEPA 2008; CALUX analytical results; and WHO 2005 toxicity equivalence factors (TEF).
Receptor	Over 7,253 people (1km radius). Potentially exposed receptors are: i) full time site workers and guards; ii) local residents and students of nearby schools (adults and children); and, iii) biota (fish).	Field observations, interviews and GIS analysis.
Pathways	▪ On-site: inhalation, ingestion, dermal contact of waste, soil/dust in warehouse and in site compound; ▪ Off-site: wind erosion, surface water transport; car/trucks; and ▪ Ingestion of contaminated fish and wildlife.	Field observation; interview; and, conceptual models.
Toxicity Assessment	**Key Questions**	**Methods**
Exposure Assessment	▪ Hazard quotient = 0.45, which is marginally greater than the 0.2 threshold (Health Canada); ▪ Incremental lifetime cancer risks (ILCR) were all below Canadian upper limit of acceptable cancer risk.	Toxicity databases; CALUX/ HRGCMS results; Guidelines, Risk calculation tools estimating chemical intake rate via environmental media and exposure routes.
Risk Estimation	Concentrations of contaminants of concern are lowest among the four sites, but still may pose human health risk. Other contaminants may be present at the site. Further detailed monitoring may be required.	

3.0 COMPONENT 2: RISK MANAGEMENT

The objective of the health risk management component was to enhance the capacity of the key decision makers to apply the understanding gained from the human health risk assessment (HHRA) to set risk management strategies and identify priority interventions to reduce risks to an acceptable level. This component focused on developing a Health Risk Management Toolkit to guide decision-makers in health risk based management of POPs and POPs-like chemicals, and on training of government officials and other stakeholders in the use of the POPs Toolkit.

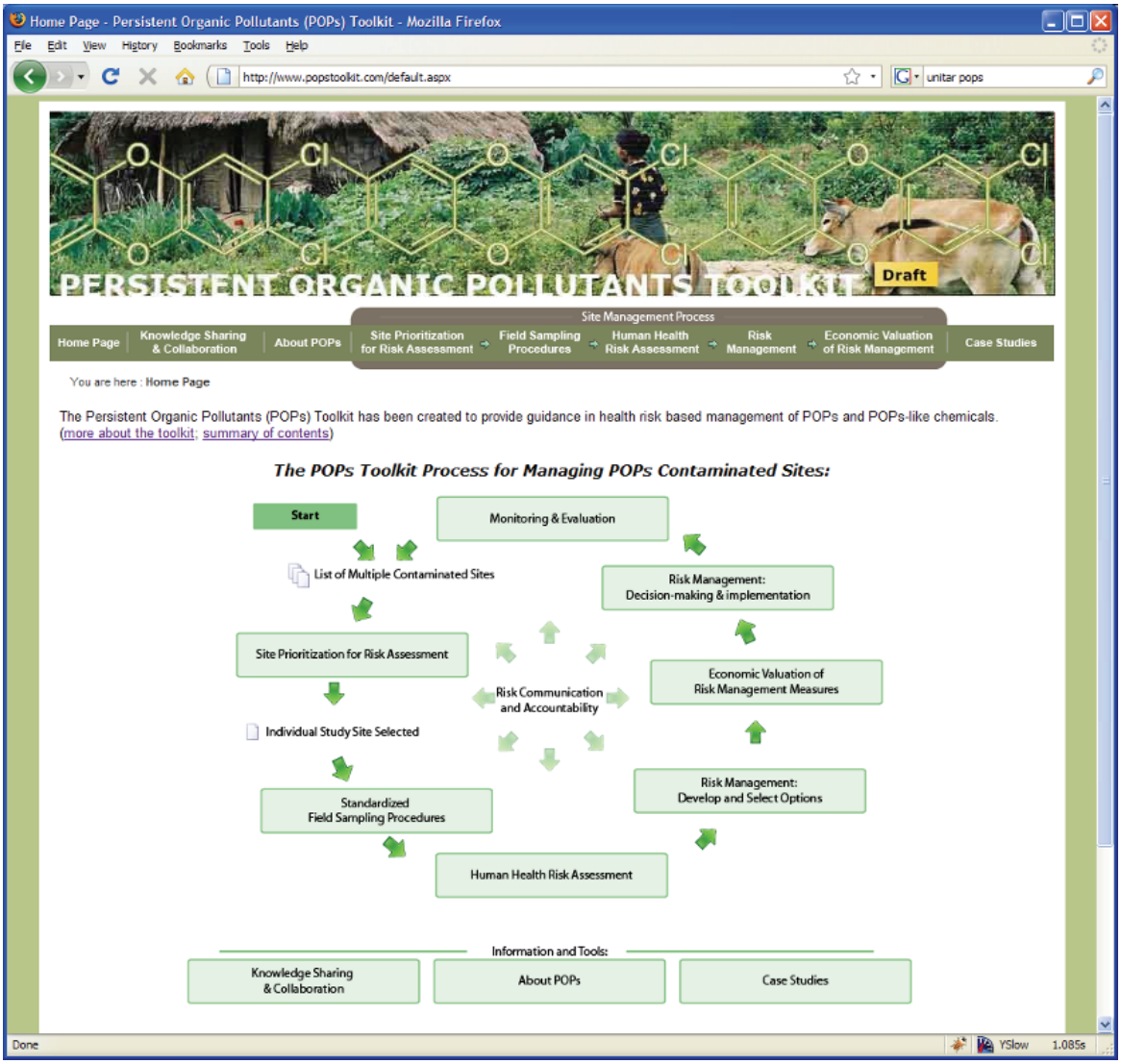
3.1 POPS TOOLKIT

The approach to developing the POPs Toolkit was presented at the Launch Workshop in April 2008. This approach included the creation of a web-based information service that is accessible through any web browser at www.popstoolkit.com.

The web-based Toolkit and training modules were developed to accommodate a variety of educational backgrounds, English language skills, and differing levels of experience in the use of e-learning tools. The navigation, interactivity, and appearance of the applications were developed with the above points in mind.

A screen capture of the interface is presented in Figure 3.1

Figure 3.1 POPs Toolkit Themes and Structure.



For detailed information on the POPs Toolkit development, please refer to the Progress Report 2 in the attached POPs Toolkit CD, in "Project Reports" and Summary Report of the Final Regional Workshop in Appendix A3.

The POPs Toolkit was used as the main source of training material at the National Training Workshop in each country held in January 2009 and the Final Regional Workshop in July 2009 (see Training Workshop report and Final Regional Workshop report in the attached POPs Toolkit CD, in "Project Reports"). The interactive risk assessment and risk management decision-support systems, along with training content and POPs Project reports, included in the training module were presented at the workshops. Comments and evaluations were obtained from the National Training Workshop participants from Cambodia, China, Indonesia, Lao PDR, Malaysia, the Philippines, Thailand and Viet Nam.

Comments received and lessons learned at the National Training Workshops, and consultation with World Bank and POPs Project stakeholders, were taken into consideration during the POPs Toolkit completion process. The final version of the POPs Toolkit is provided as an attachment to this deliverable. The Project Team has consulted with the World Bank to finalize arrangements for the transfer of the POPs Toolkit web version from Hatfield's website to the World Bank's website.

The Toolkit was evaluated by users and participants of the National and Regional workshops through series of questionnaires and surveys. The evaluation was in general very positive; most stated they found the workshops and POPs Toolkit relevant to their needs and work. The toolkit was judged by the participants as a successful demonstration of combining IT and a traditional Human Health Risk Approach for improved capacity building in POPs and other chemical risk assessments and management.

3.1.1 Sustainability of the POPs Toolkit

Based on the outcome of discussions with the World Bank and the NFPs on a long-term sustainability plan of the POPs Toolkit, two options were developed and are discussed below.

1. **Migration of POPs Toolkit to WB and Participating Countries' Website**

   This option would include migrating the POPs Toolkit to the World Bank's website and selected national institutions that have the appropriate mandate and capacity for hosting, updating content, and managing the discussion board. While enhancing the ownership and sustainability of project outputs, this option requires active participation and support by the World Bank and participating countries, as well as proper protocols and procedures to ensure functionality and integrity of the POPs Toolkit.

2. **POPs Toolkit maintained on Hatfield's Web Infrastructure**

   Key stakeholders proposed that the POPs Toolkit remain on Hatfield's web infrastructure until a long-term solution under the first option can be secured. It is estimated that monitoring and updating the site will cost approx. $1,000/year.

   The issues of sustainability and popularization of POPs Toolkit are also linked to the outreach and dissemination efforts to be undertaken by the World Bank and participating countries. A common request from participating countries is translation of the POPs Toolkit into local languages and more training within the participating countries (which will require further funding).

3.2 POPS NATIONAL TRAINING WORKSHOPS

3.2.1 Training Program Development Process

The Draft Training Program was submitted in July 2008. Regular consultations were held with the World Bank team members regarding the training content, format, duration, and the audience, as required in the TOR. In order to ensure participating countries' contributions and ownership, the Hatfield Project Team and World Bank representatives consulted with the National Focal Points and other key national stakeholders in Cambodia, Lao PDR, Malaysia and Thailand through meetings and on-line discussion using the Discussion Board in the POPs Toolkit between July and December 2008. In total, 187 participants from relevant government institutions, universities/research institutes, World Bank and other key stakeholders from eight participating countries (Cambodia, China, Indonesia, Lao PDR, Malaysia, Philippines, Thailand, and Viet Nam) took part in the four National Training Workshops. Training was conducted online through www.popstoolkit.com. Hatfield also prepared a CD-ROM version to address internet connectivity issues.

See Progress Report 2 in the attached POPs Toolkit CD, in the "Project Reports" section, for more information.

3.2.2 Risk Management Options

At the National Training Workshops conducted in the four countries from January 19-31, 2009, the national participants categorized their respective sites as follows:

- Level A - actions are required for Lao PDR SPL site;
- Level B - actions are likely required for Cambodia SEDCW site and Thailand MEA Site; and
- Level C - actions may be required for Malaysia AHSL Site.

Tables 4.1 - 4.3 presents the goals, activities and indicators of risk management options for sites selected by three of the National Workshop participants.

The specific goals, objectives and indicators for the AHSL site in Malaysia were not developed by the National Training Workshop participants, since they believed that they had been adequately defined in the existing AHSL Closure and Post Closure Maintenance Plan (2007-2015).

Lao PDR, Cambodia and Thailand goals, sub-goals and indicators for risk management strategy for their selected "hot spots" were built upon the need to remove at least one of the three elements that constitute the risk (Hazard, pathway and/or receptor). The risk management goals for the Cambodia, Lao PDR and Thailand sites were designed to improve site management and benefit surrounding communities by:

- Reduction of health risks to sensitive groups of people arising from PCB contamination (through addressing receptors' behavior and eliminating pathways); and
- Avoiding or, when avoidance is not feasible, minimizing off-site transfer of PCBs (in oil/waste, soil and sediments).

A series of sub-goals were proposed for implementation. They include:

1. **Addressing Receptors:**

   - To minimize health risk of workers working at the hot spot site;
   - To minimize health risks of residents living within 1km radius of the hot spot site; and
   - To minimize health risks of workers and trainers working elsewhere on the hot spot site compound.

2. **Addressing Hazards and Pathways:**

   - To establish hazardous materials management action plans;
   - Where practical, to avoid or minimize the use of hazardous materials;
   - To prevent uncontrolled releases of PCBs and other hazardous chemicals; and
   - To Implement management controls to address residual risks.

The countries' participants also developed time-bound indicators, such as by 2012 or 2015, reduce daily exposure to PCBs to the lowest acceptable level (i.e., HQ<0.2) or monitor success of implementing specific risk management approaches (to be determined), and proper containment facilities are in place and properly operated and maintained.

All four countries participants proposed the key risk management alternatives. Table 3.1 summarizes the key risk management alternatives recommended by the National Training Workshops participants for their respective study sites.

Table 3.1 Summary of Risk Management Options for Each POPS Project Case Study Site.

SEDCW/Cambodia	SPL/Laos	AHSL/Malaysia	MEA Site/Thailand
Develop and enforce an occupational health and safety plan	Develop and enforce an occupational health and safety plan	Control release of contaminants and implement monitoring programs to ensure spill control	Develop and enforce an occupational health and safety plan
Monitor and verify effectiveness of mitigation strategies	Monitor and verify effectiveness of mitigation strategies	Enhanced monitoring program (fish sampling and analysis; human health assessments & expand environmental monitoring by site operator)	Monitor and verify effectiveness of mitigation strategies
Conduct communication and training programs	Conduct communication and training programs	Implement Health and Safety Plan	Conduct communication and training programs
Undertake measures for controlling and containing PCB hazards	Undertake measures for controlling and containing PCB hazards	More detailed sampling and analysis for POPs and non-POPs chemicals to determine future land use	Undertake measures for controlling PCB hazards and controlling off-site transport of contaminants
Cap the hot spot surface to control erosion of soil by rain and wind, and to reduce off-site transport	Cap the hot spot surface to control erosion of soil by rain and wind, and to reduce off-site transport	Governance and stakeholder participation: involve concerned parties	
Governance – strengthen inter-ministerial coordination unit for POPs, and adopt/enforce laws and regulations	Governance – adopting and enforcing laws and regulations controlling POPs		

Given limited resources and competing priorities, risk management options for both the SEDCW and SPL sites will focus primarily on implementing simple and cost-effective options for the site; more detailed clean-up activities will be considered at a later stage. The emphasis should be on capacity building, public awareness raising and implementing a health and safety plan and emergency control procedures to protect workers and their families from PCB exposure.

3.3 ECONOMIC VALUTION OF THE SELECTED STUDY SITES

3.3.1 Process and Methodology Selection

As per in the TOR, the economic valuation of health impacts from POPs contamination was originally a small, but important part in the overall human health risk assessment and communication. However, during the project implementation process, the economic assessment required significant project resources to implement.

The overall goal of the economic analysis was to develop and implement a simplified economic evaluation process to help decision-makers assess whether implementing risk management measures at POPs-contaminated sites represents a sound allocation of public resources; and, to assess whether the benefits expected from such mitigation measures would, at a minimum, cover the costs.

The draft methodology was submitted to the World Bank for approval together with the Progress Report 1 in June 2008. A Draft Economic Report for Lao PDR Sok Pa Loung EDL Workshop (SPL Site) Study Site was submitted to the World Bank and the Lao PDR National Focal Point for comments in December 2008. Comments were received by the Hatfield Project Team in January 2009. Based on the comments received, it was recognized that additional work was required to meet World Bank's requirements.

Because of the difficulties in establishing a direct link between exposure to POPs and the incidence of certain diseases, it was decided that the revised analysis should use the estimates of cost for the selected site risk management options as a starting point. The next step was to determine the health benefits required to cover these costs and to make the project economically viable. Finally, the analysis estimated the number of Disability Adjusted Life Years (DALYs) to be "saved" per year over the project lifetime so that the project has a Net Present Value (NPV) >0.

The Draft Economic Report for the SPL site was subject to two more rounds of comments from the World Bank and the Lao PDR NFP. Final approval was obtained in May 2009 to use the technical approach and methodology for economic valuation of the SPL Site in Laos and for the other three remaining sites in Cambodia, Malaysia and Thailand. The final draft reports of the economic valuation of all four sites were submitted to the World Bank and all four NFPs for review on June 5, 2009.

All four reports were finalized after incorporating comments, and are presented in the attached POPs Toolkit CD, in the "Project Reports" section.

3.3.2 Result of Economic Valuation

Modifications to the standard Cost-Benefit Analysis (CBA) process were made to overcome data limitations. A modified approach was developed, which calculates the minimum health benefits required to cover the cost of implementing proposed risk management scenarios for POPs hotspots.

This modified approach included the following:

- The cost estimates for the various scenarios are based on assumptions described in Appendix A2 of the Economic Valuation Report presented in attached POPs Toolkit CD, "Project Reports";
- The Disability Adjusted Life Years (DALY) approach was used for the valuation of human health benefits;

- The value of a DALY in Lao PDR, Cambodia, Malaysia and Thailand was estimated by using benefit transfer to convert the value of a DALY in the U.K. and US to the participating countries' situation;

- The DALY estimates were then scaled down to the site specific conditions and expressed in a monetary value reflecting the countries' economy, people's earning power and local prices (benefit transfer). The number of DALYs at the hot spot sites were estimated based on the national DALY rates (per 100,000 people) calculated by the WHO and the number of potential receptors assessed by Hatfield during the risk assessment conducted at the sites; and

- The cost estimates for the risk management scenarios were based on a number of assumptions, including engineering measures that have not been subject to detailed design, and unit prices determined through desktop study. The cost estimates may be refined in future when site-specific and nation-specific input parameters are available.

Tables 3.2 to 3.5 summarize the key results for each study site.

For all sites, Scenario 1 is justified from an economic standpoint on the basis of quantified human health benefits. An investment in either Scenario 2 or Scenario 3 for the Cambodian, Laos and Thai sites is not justified on this basis. However, we have to recognize the existence of other environmental, land use, and existence value benefits that could change the results (but the quantification of which was beyond the scope of this study). For the AHSL site in Malaysia, the implementation of Scenario 2 is justified from an economic standpoint on the basis of quantified human health benefits alone, due to key factors such availability of existing post closure maintenance plan, much higher DALY values, and higher numbers of potentially impact populations around the site.

The quantitative analysis points to the value of investing in POPs risk management measures, particularly in health and safety training and containment. Breaking the contamination pathway is critical; this can be done cost-effectively at the SEDCW, SPL, and MEA sites. Decision makers should also consider that health improvement policies can be pursued regardless of the outcome of the economic assessment. This is often the case in developed countries where uncertainty in the determination of costs and benefits cannot be used as an argument for inaction. Furthermore, there are moral and ethical reasons to insist in investments that improve human health on the grounds that it is in the public interest, independent of direct economic considerations.

Finally, should the decision be made to proceed with risk management policies at the local and national level, attention and studies should focus on ensuring that the proposed measures are designed and implemented in a practical and cost-effective manner.

Table 3.2 Results of the economic analysis, SEDCW Site, Phnom Penh Cambodia.

Scenario	Present Value of Costs (US$)	Benefits Required to Achieve NPV = 0		
		Annual benefit (year 2 to 20)	DALYs to be "saved" per year	Percentage reduction of total DALYs/year
Scenario 1: Implementing , enforcing and monitoring workers/resident health and safety and spill prevention measures	$ 180,474	$ 15,680	3.6	0.6%
Scenario 2: Containment of existing contamination + scenario 1	$1,459,604	$ 126,814	28.8	5.2%
Scenario 3: Disposal of existing contamination + scenario 1	$1,798,699	$ 156,275	35.5	6.4%

Table 3.3 Results of the economic analysis, SPL Site, Lao PDR.

Scenario	Present Value of Costs	Benefits Required to Achieve NPV = 0		
		Annual benefit (year 2 to 20)	DALYs to be "saved" per year	Percentage reduction of total DALYs/year
Scenario 1: Implementing , enforcing and monitoring workers/resident health and safety and spill prevention measures	$192,168	$16,696	3.3	0.3%
Scenario 2: Containment of existing contamination + scenario 1	$521,929	$45,346	9.0	0.8%
Scenario 3: Disposal of existing contamination + scenario 1	$832,930	$72,367	14.3	1.3%

Table 3.4 Results of the economic analysis, AHSL Site, Malaysia.

Scenario	Present Value of Costs	Benefits Required to Achieve NPV = 0		
		Annual benefit (year 2 to 20)	DALYs to be "saved" per year	Percentage reduction of total DALYs/year
Scenario 1: Detailed assessment of possible human health risk	US$ 119,429	US$ 10,376	0.3	0.03%
Scenario 2: Hazard containment and monitoring (+ scenario 1)	US$ 545,515	US$ 47,396	1.3	0.1%

Table 3.5 Results of the economic analysis, MEA Site, Thailand.

Scenario	Present Value of Costs	Benefits Required to Achieve NPV = 0		
		Annual benefit (year 2 to 20)	DALYs to be "saved" per year	Percentage reduction of total DALYs/year
Scenario 1: Implementing , enforcing and monitoring workers/resident health and safety and spill prevention measures	US$ 192,000	US$ 16,653	0.8	0.5%
Scenario 2: Containment of existing contamination + scenario 1	US$ 734,000	US$ 63,741	3.1	2.1%
Scenario 3: Disposal of existing contamination + scenario 1	US$ 652,000	US$ 56,631	2.8	1.8%

4.0 COMPONENT 3: REGIONAL COOPERATION

The objective of this component was to enhance the capacity of the countries to cooperate regionally to address cross-cutting issues, which either could not be adequately solved on a national scale, or could improve cost-effectiveness when addressed at a regional level. Participating countries in the regional cooperation included: Cambodia, China, Indonesia, Japan, Lao PDR, Malaysia, Thailand, The Philippines, and Viet Nam.

4.1 REGIONAL LAUNCHING WORKSHOP

The Regional Launch Workshop was organized by the World Bank in cooperation with the Lao PDR Water Resources and Environment Administration (WREA) in Luang Prabang, Lao PDR, from April 3-5, 2008. The Hatfield Project Team was responsible for preparing the workshop material, delivering presentations, and for facilitating and moderating discussions.

The Regional Workshop was successful in providing a forum for the four POPs Project participating countries (Cambodia, Lao PDR, Malaysia and Thailand), as well as the regional participants (China, Indonesia, Philippines and Viet Nam), to exchange ideas and share experiences regarding POPs and the broader issue of toxic chemical management and hazardous waste problems. Over 40 people attended the workshop, including the representatives from key government agencies of the countries mentioned above, international organizations (UNEP, UNIDO, WHO) and the private sectors (JFE-TFC, and Hiyoshi Corporation, Japan).

The Launch Workshop was successful in raising awareness among the participants about the project and key issues of concern related to hazardous chemical management, as well as information related to the transboundary issues of the hazardous chemical contamination and the need for further capacity building and training in POPs risk assessment and management.

The Regional Launch Workshop Report is presented in the attached POPs Toolkit CD, in the "Project Reports" section.

4.2 REGIONAL PARTICIPATION IN NATIONAL TRAINING WORKSHOPS

Eight government officials from China, Indonesia, the Philippines, and Viet Nam took part in the National Training Workshop organized by the World Bank and the Ministry of Environment of Cambodia in Siem Reap from January 19 – 21, 2009. The Hatfield Project Team was responsible for preparing the training material for the workshops, delivering presentations, and for facilitating and moderating discussions.

The participants in the National Training Workshop were provided with an opportunity for exchanging lessons learned in POPs and other hazardous chemical management experiences among countries. All regional participants appreciated the chance to receive training in POPs risk assessment and management.

4.3 REGIONAL TRAINING AND CLOSURE WORKSHOP

In cooperation with the Pollution Control Department (PCD), Ministry of Natural Resources and Environment (MONRE) of Viet Nam, the World Bank organized the Regional Training and Closure Workshop (Final Workshop) at the Green Plaza Hotel in Da Nang, Viet Nam, from July 22 -24, 2009.

The Regional Workshop was successful in providing a forum for the four POPs Project participating countries (Cambodia, Lao PDR, Malaysia and Thailand), as well as the regional participants (Indonesia, Japan, Philippines and Viet Nam), to receive training in the application of the POPs Toolkit. The Da Nang Airbase, and the Agent Orange dioxin issue, was used as a case study at the workshop. Workshop participants exchanged ideas on the sustainability of the POPs Toolkit and shared experiences regarding POPs and the broader issue of toxic chemical management and hazardous waste problems.

101 people attended the workshop. Participants included representatives from key government agencies (Ministries of Environment, Health, Defense, Agriculture, and government agencies at both national and provincial levels); experts from universities, academic institutions and private companies and mass media.

The participants were asked to complete evaluation forms at the end of the Workshop. Responses were generally positive, with evaluations ranging from good to excellent, regarding both the quality of the workshop (training sessions, site visit, group exercises and panel discussions) and the utility of the POPs Toolkit (technical content and user friendliness).

Most of respondents expressed an interest in attending follow-up training at a more intermediate or advanced level, in particular regarding: (i) economic valuation and cost-benefit analysis; (ii) risk management and risk assessment for POPs decontamination; (iii) contaminated site mitigation; (iv) laboratory analysis and field program capacity building; and (v) training of trainers and user training of the Toolkit at national and local levels.

The participants identified areas of improvement, suggested future actions to ensure sustainability of the toolkit, and recommended follow-up activities:

1. Continued support from the World Bank and governments concerned to sustain the POPs Toolkit;

2. Recommend that the Secretariat of the POPs Convention include the POPs Toolkit in its information database and website;

3. Popularize the POPs toolkit in the Asian region and other parts of the world;

4. Regularly update the content of the POPs Toolkit and maintain the knowledge sharing and discussion board;

5. Introduce the use of the POPs Toolkit to universities and academic institutions; and

6. Increase exchange programs at international events like the Regional Workshops or the National Workshop on POPs related issues to improve international collaboration and transfer of knowledge.

The Summary Report of the Final Workshop is provided in Appendix A2.

5.0 POPS TOOLKIT SUSTAINABILITY PLAN AND POPS PUBLIC AWARENESS RAISING IN LAO PDR AND CAMBODIA

An addendum to the POPs Project was developed based on recommendations made at the Final Regional Workshop organized by the World Bank in Da Nang, Viet Nam from the 22 to 24 July 2009.

The primary objective of this addendum was to provide POPs-related support to the National Focal Points from the Cambodian Ministry of Environment (MOE), and Lao PDR Water Resources and Environment Administration (WREA). This primarily involved production and distribution of *POPs human health risk* public awareness materials at selected POPs hot spot case study sites.

Another objective of the additional work was to support sustainability of the POPs Toolkit and scale up its usage. Support was also provided through the creation and dissemination of awareness materials in target countries and additional training necessary to ensure long-term sustainability and popularization of the POPs Toolkit. All project activities were completed by the end of December, 2009.

5.1 DEVELOPMENT OF AWARENESS RAISING MATERIALS IN LAO

Once risks at the case study site in Lao PDR were identified it was important that WREA be equipped with the necessary tools and training to effectively communicate these risks to the targeted audience. Emphasis was placed on producing posters and brochures, which are still the most popular form of communicating with different audiences on a large scale in Lao PDR. The materials were designed in a way that corresponded with the audience's needs, concerns, and levels of knowledge.

Four posters were developed jointly by the Project Team and designated WREA staff in English and Lao. The posters identified chemicals that pose the greatest risks to human health at selected sites, specifically PCBs and Dioxins. Poster topics included:

- Health risks associated with Dioxins (Agent Orange);
- How to protect my family and myself from (Agent Orange) dioxin exposure;

- Health risks of PCBs; and
- How to protect my family and myself from PCBs exposure?

Examples of all posters are provided in Appendix A 3.1.

5.2 RISK COMMUNICATIONS TRAINING

The Project Team provided training on how to develop awareness raising materials by demonstrating to WREA staff how to design and publish attractive and informative posters. Training took place December 2-4, 2009 in Vientiane and Sekong provinces, Lao PDR. The list of participants is provided in Appendix A3.2.

Figure 5.1 Training in the Design of Awareness Raising Posters in Vientiane and Sekong Lao PDR, 2009.

Risk communicators from WREA were also trained on how to convey messages effectively to a wide range of audiences. Some of the main points addressed in order to achieve this goal were:

- Defining the major messages to convey;
- Determining the types of audiences;
- Understanding the social and political context in which the issue is placed;

- Articulating the message in a way that fits the needs of the audience to obtain technical information in an easy to understand format;
- Composing the whole communications package; and
- Determining the channel of transmission.

The Project Team supported the designated government staff in a pilot study to determine the effectiveness of the awareness materials with a selected audience from the Dioxin Hot Spot site in Sekong Province, Lao PDR on December 4, 2009.

Figure 5.2 Public Awareness Training Session in the Sekong Province Administration Office, Sekong, Lao PDR, 2009.

5.2.1 Future Use of Training Materials and Risk Communication Tools in Lao PDR

WREA plans to use the training and poster templates provided to develop public awareness materials for other POPs and chemical management projects. Projects include: capacity building on the practical use of Best Available Techniques (BAT) and Best Environmental Practices (BEP) and environmentally sound management of POPs wastes and PCBs; the Lao PDR NIP (Stockholm Convention); and, the Green Cross project on the assessment of an Agent Orange dioxin and landmine/unexploded ordnance (UXO) hotspot in Lao PDR.

5.3 DEVELOPMENT OF AWARENESS RAISING MATERIALS IN THE KHMER LANGUAGE

Two posters were developed jointly by the Project Team and designated Department of Pollution Control, MOE officials in both English and Khmer. The identified chemicals that pose the greatest risks to human health at the case study site, and therefore highlighted in these posters, are PCBs. Poster topics are as follows:

- Health risks of PCBs; and
- How to protect my family and myself from PCBs exposure?

Examples of posters are provided in Appendix A3.

The posters can be easily adapted and reproduced to meet the need for awareness raising about other POPs or hazardous chemicals and for other targeted audiences.

5.4 RISK COMMUNICATIONS TRAINING

The Project Team provided training on how to develop awareness raising materials by demonstrating to officials from the Department of Pollution Control, MOE how to design attractive and informative posters. Training took place from December 10-11, 2009 in Phnom Penh, Cambodia. The list of Participants is provided in Appendix A4.1.

Figure 5.3 Training on the Design of Awareness Raising Posters, Phnom Penh, Cambodia, 2009.

Training focused on providing the designated risk communicators from the Department of Pollution Control, MOE with risk communication approaches and methodologies to i) define major messages and target audiences; ii) understand the social and political context; iii) compose a communications package; and, iv) determine the best channels for information transmission/ dissemination.

The Project Team supported the designated government staff in conducting a pilot study to determine the effectiveness of the awareness raising materials in Phnom Penh on December 11, 2009.

Figure 5.4 Public Awareness Material Pilot in Phnom Penh, Cambodia, 2009.

5.4.1 Future Use of Poster Template and Risk Communications

MOE officials agreed that the training would be applicable to the development of additional risk communications materials (posters and brochures) in the future. They plan to use similar materials to raise awareness and communicate risks for the UNDP funded chemical management project, and the Cambodia mercury management project, to name a few. MOE staff also stated that they plan to apply for funding from the Swedish Development Agency (SIDA), and UNITAR to support MOE chemical risk public awareness and training activities in the coming years.

5.5 SUSTAINABILITY OF THE POPS TOOLKIT

The key activities under this component were to support the maintenance of the POPs Toolkit web-page domain, conduct monthly updating of the content and linkages and manage the discussion board.

The Project Team provided marketing support to key national stakeholders responsible for the POPs Toolkits. Technical support was provided to enable proficiency with the relevant tools and training modules found in the POPs Toolkit. The Project Team has initiated communication with the Stockholm

Secretariat about the possibility of including the POPs Toolkit in their information warehouse.

In 2010, the Project Team, World Bank IT staff and web–development specialists will prepare and deliver the final POPs Toolkit CDs and transfer the POPs Toolkit to the World Bank server.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The POPs Project has been successfully completed and the main findings, lessons learned and conclusions are summarized below.

Data availability and the capacity of government officials are key challenges to be overcome in order to improve human health risk assessments and management of POPs and other hazardous chemicals.

The selection of the 'Hot Spot" Sites for detailed risk assessments was time consuming, and their selection was dictated not only by technical criteria, but also by political, economic and social concerns (real and perceived). This finding points to the need for investing more in risk communication and awareness raising about POPs and hazardous chemicals, and potential health and other social/economic implications.

Field programs that were designed to increase stakeholder involvement and consultation, and provide technical capacity building/on-the-job training to national stakeholders were found to be effective for transfer of knowledge to national staff and government officials.

Health Canada's risk assessment approach allowed for meaningful quantification and comparison of health risks from different POPs and other hazardous chemicals while relying on available data. The risk assessment results for Cambodia, Lao PDR, Malaysia and Thailand "hot spot" sites indicated that there may be a high potential human health risk to POPs of concerns and other chemical hazards. The results from the Malaysian "hot spot" site were lower, but potential risks may still be present. The results from preliminary risk assessments warrant further investigation and risk management actions at most of the sites studied.

Some lessons were learned from; Sample handling; import and export of "potentially contaminated samples"; and inter-lab analyses. These activities were time-consuming and required careful planning and monitoring. While using different labs to analyze the samples provided an opportunity for inter-lab comparisons, it requires a common analytical approach and to ensure comparability.

The POPs Toolkit was developed through active involvement of the key stakeholders. The Toolkit was used at the National and Regional Workshops, and evaluated by participants through a series of questionnaires and surveys. The evaluation was generally very positive; most participants stated they found the workshops and POPs Toolkit relevant to their needs and work. It was judged by

key stakeholders as a milestone to demonstrate the utility of combining IT and a traditional Human Health Risk Approach for capacity building in POPs and other chemical risk assessments.

The key national stakeholders recommended future actions to ensure sustainability of the toolkit. Based on discussions with the World Bank and the NFPs on a long-term sustainability plan of the POPs Toolkit, the following options are proposed:

1. Migrating POPs Toolkit to the World Bank's website and the websites of selected national institutions. While enhancing the ownership and sustainability of project outputs, this option requires training and support by the World Bank and participating countries concerned, and protocols and procedures to ensure functionality and integrity of the POPs Toolkit is maintained; and

2. The POPs Toolkit should remain on the Hatfield's website until a long-term solution under the first option is secured. This option would require minimal additional resources.

The issues of sustainability and popularization of the POPs Toolkit is also linked to the outreach and dissemination efforts to be undertaken by the World Bank and participating countries. The most frequent request from participating countries is to translate the POPs Toolkit into local languages, and more training by participating countries.

The countries' participants developed a Risk Management action plan with **S**pecific; **M**easurable; **A**ssignable; **R**ealistic; **T**ime-bound goals, activities and indicators using tools provided in the POPs Toolkit. Given resource constraints, the countries focused on proposing simple and cost-effective options for their sites, such as capacity building, public awareness raising and implementing health and safety plans.

A simplified economic evaluation process was found to be practical in producing an economic valuation of proposed risk management and adaptation measures at selected hot spots to allow for improved allocation of public resources; and, whether the benefits expected from such mitigation measures would, at a minimum, cover the costs. For all sites, Scenario 1 (blocking the hazard pathway and changing human behavior towards POPs) is justified from an economic standpoint. An investment in either Scenario 2 or Scenario 3 for the Cambodian, Laos and Thai sites is not justified on this basis. However, the existence of other environmental, land use, and existence value benefits that could change the results, should be recognized.

The following activities require further follow-up:

The Role of Human Health Risk Assessment (HHRA) and Management in Decision-making. Countries experience challenges managing POPs issues, so the results of the HHRA should provide enhanced confidence in decision-making. Some countries need to develop specific regulations on POPs, including

a special action plan to address human health impacts. Investment and environmental management have to be conducted jointly, in order to ensure sustainable development.

POPs risk assessment and management has to be adapted to local conditions, and the POPs Toolkit should take into account local conditions, including social, political, economic and policy issues.

Regional Cooperation on POPs and other Chemical Issues. Future international events like a Regional Workshop should be organized to improve international collaboration; as this is required to address regional POPs issues. Dioxin, in particular, is an issue of international concern, and countries must work together to address this important problem in the region. An international workshop on the specific issue of Agent Orange and dioxin contamination should be considered, possibly in Laos, Cambodia, Thailand and Viet Nam. In addition, the compilation of information on human health impacts through a regional database would be useful. There is a need for enhanced regional cooperation, as the issues between countries are similar and they can benefit from the lessons learned and experience of other countries.

Future Use of the POPs Toolkit:

1. Ensure sustainability of the POPs Toolkit and scale up its usage. The POPs Project should be extended to other countries, for which additional case studies should be conducted as this exercise is helpful as a demonstration of the Toolkit's utility.

2. The POPs Toolkit content should be updated regularly and the knowledge sharing and discussion board should be maintained (this will require some additional resources).

3. Parts of the Toolkit (perhaps only some critical sections) should be translated into national languages and its use should be extended beyond government bodies to Universities and other academic and research institutions, to facilitate their task of supporting key decision-makers to manage POPs and other chemicals.

4. The Secretariat of the POPs Convention should consider including the POPs Toolkit in its information warehouse (this should be a joint effort from the WB and the participating countries).

5. The POPs Toolkit should be presented at a special side event during the next POPs Conference of the Parties (COP) meeting in Argentina in 2011 to popularize its use, raise awareness and demonstrate how SE Asia has been taking the lead on dealing with POPs issues.

6. Laboratory analyses for DX/FN are costly and require donor support to ensure proper inventories and monitoring programs are implemented.

7.0 CLOSURE

We trust the above information meets your requirements. If you have any questions or comments, please contact the undersigned.

HATFIELD CONSULTANTS:

Approved by: _____ December 22, 2009

Sokhem Pech, (Hon) MA, LLM
Project Manager

Date

Approved by: _____ December 22, 2009

Grant Bruce, M.Sc., P. Chem.
Project Director

Date

APPENDICES

Appendix A1

Revised TOR of the POPs Project

REGIONAL CAPACITY BUILDING PROGRAM FOR RISK MANAGEMENT OF POPS IN SOUTH EAST ASIA

CONSULTANTS' TERMS OF REFERENCE (TOR)

1. INTRODUCTION

1.1 Background

1. This TOR is for an international consulting firm to implement key technical activities planned under the Regional Capacity Building Program for Health Risk Management of Persistent Organic Pollutants (POPs) in South East Asia. Complementary program activities will be implemented by national consultants or World Bank staff.

2. The program, included this assignment, is funded by the Canada International Development Agency through the Canadian POPs Trust Fund established at the World Bank. The countries participating in the program include Cambodia, Lao PDR, Malaysia, and Thailand[1]. These countries are at various stages of adopting the Stockholm Convention (SC), as summarized in Table 1. From among them, Malaysia is yet to ratify the SC. These countries are also at various phases of completion of their National Implementation Plans (NIP) for the Stockholm Convention.

Table 1 – Status of signature/ratification of the Stockholm Convention and progress of NIPs

Country	Signature	Ratification	Implementing Agency for NIP	Date of NIP EA approval	Deadline for NIP submission
Cambodia	May 23, 2001	November 23, 2006	UNEP	March 23, 2003	November 23, 2008
Lao PDR	March 5, 2002	June 20, 2006	UNIDO	April 19, 2002	June 20, 2008
Malaysia	May 16, 2002	---	UNEP	May 11, 2001	No deadline since country has not yet ratified
Thailand	May 22, 2002	January 31, 2005	UNEP	May 6, 2003	May 1, 2007

3. All countries in South East Asia have taken steps to ban or to limit the use of the 12 POPs, as shown in Table A1- Annex 1. However, enforcement of these regulatory measures remains a challenge, and concerns remain over the use and releases of the POPs as pesticides, PCB containing materials, and dioxin and furan emissions.

4. **Pesticides.** Illegal use and trade of banned (and potentially obsolete) POPs has been widely documented in Thailand, Vietnam and Cambodia. Up to 21%, and as much as 69% of the pesticides available in Cambodia reportedly come from Vietnam and Thailand, respectively (EJF 2002). It is well known that a considerable number of people are directly exposed to POPs in their daily activities, among which are pesticide applicators. A 1990 study in Cambodia indicated that 33% out of 241 pesticides available in the market were classified as WHO Class I[2], including chlordane and DDT. 50% of Cambodia's population is under the age of 15 and many are active in agriculture. 48% of Cambodian farmers in the study allowed children to apply pesticides, and in

[1] China as East Asia country with emerging experience in POPs management, is expected participate in the study as a source of practical lessons and technical expertise. Indonesia, the Philippines and Vietnam will also be invited to participate in regional activities under the program.

[2] Highly or extremely hazardous to human health

most cases, no protective gear was worn by the applicators (EJF, 2002). Studies in Cambodia have also suggested that indirect (and in some cases chronic) exposure to POPs caused by environmental pollution occurs as people come in contact with contaminated soils, groundwater and freshwater. A growing concern in the region is contamination of drinking water through the use of the same containers to mix pesticides and to transport drinking water, or through the use of mislabeled and recycled pesticide containers. Direct pollution of water systems has been documented by direct spreading, washing of spraying equipment, of inadequate disposal of obsolete stocks, among others (EJF 2002). Similar issues involving improper use of banned pesticides and the resulting contamination have been reported across the developing world, in countries such as Vietnam, India, Ecuador, Peru and others. These are therefore likely to be typical in the other countries included in this regional program where agriculture is predominant, although at present, limited information is available. In Cambodia, POPs-pesticides residues were found in important food sources: fish and mussels. DDT, in particular, was the most detected compound in both fish and mussel samples tested and was found to be present in higher concentrations in freshwater fish (450 ug/g fat wt) than in marine fish (80 ub/g fat wt), suggesting that DDT use is still prevalent in inland areas surrounding the Mekong and the Tonle Sap River basins.

5. **PCBs.** With regard to PCBs, majority of Sout East Asia countries except Indonesia) have completed inventories (or partial inventories) of their electrical equipment contaminated with PCBs. Appropriate management of this equipment has emerged as an early priority in all the countries, as the volumes of PCB contaminated oils and equipment are significant and local capacity for their handling and disposal is lacking. PCB contaminated equipment if often improperly stored, which leads to instances of reuse of the oils (UNEP 1998). A study conducted by the World Bank in Cambodia in 2001 showed that discarded PCB oils are resold and used, for example, to lubricate sewing machines and other equipment. Reports have also shown high concentrations of PCBs in fish and shell fish in Lao PDR and Thailand, respectively, indicating the growing risks to humans from releases of PCBs to the environment (JHS, 2005).

6. **Dioxins and furans.** Results from preliminary inventories in East Asia showed that the largest source of emissions of dioxins and furans was uncontrolled combustion and incineration of waste (UNEP 1998). Little information is available on the impacts of these emissions on the most vulnerable groups of the population or on the groups at highest risk, such as waste scavengers and people living in the vicinity of waste disposal sites. There are thousands of people involved in the informal waste management sector in the East Asia countries, with 25,000 in Thailand alone. In Cambodia alone, it is estimated that approximately 606,664 g TEQ of dioxin/furans were discharged into the environment every year (Cambodia MOE, 2006) A large percentage of scavengers are women and children (Environmental Monitor, 2003). The risk of exposure of these groups to dioxins and furans, as well as to other POPs is currently unknown.

1.2 National Implementation Plans for the Stockholm Convention

7. **NIPs.** Countries which are Parties to the Convention are required to develop and to implement a National Implementation Plan (NIP) for meeting their obligations under the SC. The guidance for NIP preparation requires that these are prepared using standardized methodology. The NIPs prepared using the methodology, however, have limitations in three areas, namely (i) prioritizing among POPs issues, (ii) managing chemicals beyond POPs, and (iii) harnessing regional cooperation for POPs and other chemicals management. This program is to complement the NIPs by addressing these limitations.

8. **Prioritizing POPs.** NIPs were designed to achieve several objectives, including the objective of prioritizing POPs issues based on country-specific multi-criteria system to identify the most important issues to address.[3] The NIP methodology envisioned that country specific criteria will be designed in the course of NIP preparation to prioritize health and environmental impacts of POPs, and guide the country interventions. The NIPs available to date[4], however, largely focused on evaluations of institutional frameworks for the management of POPs, existing regulations dealing with POPs, partial inventories of POPs sources, and a very broad list of priorities. While NIPs are an essential first step in identifying potential sources of POPs, the prioritization is largely driven by quantity of different POPs in the country, not the risks[5] they represent to human health. Virtually all NIPs propose priority interventions in all three categories of POPs (i.e. pesticides, PCBs, and unintentional combustion products) with little effort to prioritize among or within the three categories. National priorities then became a broad list of actions covering all POPs and topics without reflecting the significance of health risks from different POPs.

9. **Beyond POPs.** Moreover, NIPs were designed to focus exclusively on the 12 POPs listed by the Stockholm Convention, and therefore no consideration was given to any other persistent toxic substances (PTS) that display characteristics similar to POPs[6]. These PTS[7] are not systematically controlled in the region and their use goes largely undetected even though they may pose health risk to people that is comparable to that of POPs. While focusing on POPs is a priority and an obligation of the Parties to the SC, reducing chemicals-related damage to human health in developing countries requires also management of other PTS, especially given that these are commonly found in pesticide markets around the region.[8] Chemical management programs needs to be designed with enough flexibility so that they can be adjusted to incorporate additional hazardous chemicals as their risks to human health and to the environment become better understood. Considering these issues, it is important to develop the capacity to handle not only the 12 POPs but also other PTS and chemicals that are commonly used in the region. The emphasis on utilizing POPs activities to consequently contribute to developing capacity for sound management of chemicals has been also put forth by the GEF Focal Area Strategies and Strategic Programming for GEF-4. (July 25, 2007)

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[3] Interim Guidance for Developing a National Implementation Plan for the Stockholm Convention, Revised December 2004, UNEP, World Bank.

[4] NIPs reviewed and evaluated in the preparation of this concept note include all EAP NIPs available at the time, namely NIPs for Cambodia, China, Indonesia, Lao PDR, the Philippines and Vietnam. The Malysia NIP became available at a later date. Developed country NIPs, namely NIPs for Australia, Canada, and the European Community were included in the evaluation as well.

[5] In this context, risk is defined as a probability of negative health impacts occurring as a result of exposure of human receptors to contaminants. In Canada, USA, and other countries, reference contaminant concentrations are established based on the known contaminant toxicology data, assumptions about exposure, and assumptions about acceptable level of risk. These reference values are then used to quantify risk for particular situation of contaminants, exposure pathways and exposed groups. In the absence of data sufficient for such quantitative risk analysis, other approaches, such as using spatial analysis based on GIS, may be used.

[6] Persistence, bioaccumulation potential and toxicity.

[7] In September 2006, the Environment Canada and Health Canada published a listing of approximately 400 chemicals that display characteristics similar to those of POPs. This listing is the result of years of work analyzing toxicology and pollution data on over 23,000 substances registered in Canada's Domestic Substance List. These 400 chemicals will be regulated under the Canadian Environment Protection Act, and they will become part of the Priority Substance List. Moreover, it is expected that this list of chemicals will be adopted by the EU and regulated under the REACH Program.

[8] Environmental Justice Foundation, 2002

10. **Regional Cooperation.** NIPs are country focused, and their interventions are often sector or sub-sector based. They offer no particular solution to trans-boundary and regional POPs issues that cannot be effectively addressed through national, sub-national and sectoral interventions. This program will encourage regional cooperation to tackle such issues, and capture regional synergies to increase the pace, quality and cost-effectiveness of POPs phaseout. For example, it will encourage regional cooperation to identify answers to common challenges, such as availability of cost-effective disposal options in the region, availability of testing and analytical capacity, acceptability of sampling and testing protocols, methods for removing POPs from contaminated sites, control of regional and illegal trade, identification of barriers to transport of POPs for disposal abroad, etc.

2. PROGRAM OBJECTIVES AND ACTIVITIES

11. **Objective.** Responding to the challenges outlined above, the objective of the program is to enhance the capacity of the government agencies in the South East Asia Region[9] to manage POPs and POPs-like chemicals using health risk-based and regional approach. Improved regional cooperation on broader chemical agenda is a secondary objective of the program.

12. **Outcomes.** The expected outcome of the program is that the officials responsible for POPs management will increase their understanding and use of health risk based approach to management of POPs and other chemicals, and prioritize POPs interventions to reduce local health impacts, especially on the poor and vulnerable.

13. **Activities.** Program objectives will be achieved through a comprehensive capacity building program consisting of three components. Component activities and their results indicators, outputs, and indicative budget are summarized in an activity matrix in Table 5.

14. **Component 1: Risk Assessment**. The objective of this component is to assess health risks from selected POPs hotspots based on existing and supplementary data, and increase the capacity of key decision makers to understand and appreciate these risks. The focus of the component will be on delivering an objective assessment of POPs health risks. The analysis will focus on key contaminants of concern[10] and be used to inform the future decisions about management interventions. The component will apply an existing mainstream risk assessment methodology and adjust it to allow meaningful quantification or comparison of health risks from different POPs while relying to the extent possible on already available country data about POPs hotspots and exposed populations.

15. The component will include **desk review** of literature and assembly of existing data, application of a health **risk assessment** methodology in the limited-data setting of developing countries to a hot spot-level risk assessment analysis, **economic valuation of health impacts** from POPs contamination, and **health risk communication** of the findings to the government officials responsible for POPs management and other stakeholders. The RA will be carried out by a team of international risk assessment experts who will build on existing and recognized approaches such as those developed by the U.S. EPA, Environment Canada and the EU

[9] This includes relevant agencies in the program countries where hotspot risk assessment will be carried out, namely Cambodia, Lao PDR, Malaysia, and Thailand, as well as countries which will be invited to participate in the regional workshops on transboundary POPs issues, namely China, Indonesia, the Philippines, and Vietnam.

[10] Selecting the POPs contaminants of concern for each hotspot will be a part of the consulting assignment. The contaminants will be selected from among 12 POPs as well as similar persistent toxic substances lindane, chlordecone (both are POPs candidates) and endosulfan.

Environment Commission, and local experts familiar with the availability and limitations of data necessary for risk assessment.

16. **Component 2: Risk Management.** The objective of the health risk management component is to enhance the capacity of the key decision makers to apply the understanding gleaned from RA to set risk management strategies and identify priority interventions to reduce risks to an acceptable level. The component will focus on development of a **health risk management toolkit** to guide decision-makers in health risk based management of POPs and POPs-like chemicals. The toolkit will provide guidance on: (i) evaluating health risks from exposure to chemicals in locally relevant sectors based on standardized guidelines; and (ii) developing strategies for the management of these risks, including needs for regulation, monitoring, evaluation of alternatives to prevent, reduce or eliminate exposure, cost and benefits of alternatives, uncertainties and others. The general toolkit will be adjusted for country situation and published in the local language.

17. The component will also include **training** of government officials and other stakeholders (e.g. civil society members) in the use of the health risk management toolkit. The training workshops will encompass development of strategies to manage the risks from POPs that were identified by the risk assessment, and integration of chemical management strategies into ongoing programs in sectors where exposure to POPs and other chemicals is of concern. The training will be complemented by general **public awareness** program to disseminate health risk information to particularly vulnerable populations in support of efforts to reduce their exposure to POPs and POPs-like chemicals (i.e. workers in the agriculture, waste management sectors and their families).

18. **Component 3: Regional Cooperation.** The objective of this component is to enhance the capacity of the countries to draw on regional cooperation when addressing cross-cutting issues which either cannot be adequately solved on a national scale, or can bring higher cost-effectiveness when addressed on a regional level. The component will focus on (i) export/import, and illegal trafficking of POPs, (ii) environmentally sound disposal of PCBs, obsolete POPs pesticides and POPs wastes through coordination between countries with disposal needs and disposal capacities and removal of barriers to trans-boundary transport of hazardous waste for disposal purposes; (iii) identification of readily available laboratory capacities for POPs testing and analysis;[11] and (iv) knowledge networking and information exchange on POPs management[12]; and (v) cooperation on selected sub-regional priority issues, e.g. Agent Orange contamination. East Asia countries, including China, Indonesia, the Phillippines and Vietnam will be invited to participate in the regional workshops addressing these issues.

[11] This activity will draw on the interim findings of the ongoing GEF/UNEP project on Assessment of Existing Capacity and Capacity Building Needs to Analyze POPs in Developing Countries.

[12] The topics will be selected from among the following based on the specific interests of the countries indicated at the launch workshop. The illustrative topics are adoption of best available technology and best environmental practice (BAT/BEP), alternatives to POPs, standards and chemical management regulations and instruments for their enforcement, financial mechanisms for funding POPs elimination and hazardous chemicals management, effective institutional arrangements for chemicals management, dissemination of indigenous studies and data on health impacts of POPs, etc.

CONSULTANTS' SCOPE OF WORK

19. The scope of the work to be carried out under this TOR by the consultants is outlined below:

A - Risk Assessment

Task A1: Data gathering

a. Consultants will collect existing data for their analysis of risk of exposure to the following target chemicals: (i) the twelve POPs covered by the Stockholm Convention; (ii) two organochloride pesticides that are being considered for inclusion in the list of POPs regulated under the Stockholm Convention, namely *lindane* and *chlordecone*; and (iii) *endosulfan*, a widely used organochloride pesticide with POPs-like characteristics. These chemicals are used extensively in the region and may have considerable. Consultants should flag presence of other contaminants of significant concern at the studied sites (hotspots) and suggest target chemicals which need not be considered at a particular hotspot, *e.g.* for pesticides never registered or known to be used the site.

b. Consultants will review existing literature on the status of the target chemicals in each of the participating countries. Documentation to be reviewed will include, but not be limited to: (i) NIPs (or draft NIPs); (ii) UNEP's Regional Assessment of Persistent Toxic Substances; (iii) FAO and WHO reports; (iv) NGO reports (*e.g.* IPEN); (v) reports produced by local universities; (vi) reports from work currently being conducted under other World Bank projects; and (vii) research literature.

c. Consultants will catalog and characterize sources and stockpiles of target chemicals, document current uses and releases, and list known contaminated areas. Regional sources, trends or practices (*e.g.* illegal trade, new uses) will be identified when appropriate.

d. Consultants will compile a list of hot spots for each country, where human and/or environmental exposure to the group of chemicals of interest is expected to be of concern. Hot spots can include pesticide storage sites, waste dumps, industrial complexes, non-point sources (of dioxins and furans), etc. They should release, or have the potential to release, levels of target chemicals significantly higher than internationally accepted maximum emissions standards, or have high exposure rates of human receptors to contaminants.

   - Hot spots will be determined on the basis of results from the desk review **and after consultation with focal points in each country.**
   - The desk review may reveal the existence of hot spots contaminated with a POPs-like chemical not part of the group of 15 chemicals of interest. Consultants should, nonetheless, include them in the list of hot spots / key contaminants for further discussion if they may pose significant risks to humans or the environment.

e. Consultants will prepare a concise progress report that will compile all data gathered in tasks A1. Information on hot spots will be presented for each country, and a separate chapter will include regional-level data and considerations (if any). References and relevant contacts in each country will be provided. The progress report will be reviewed by the Bank and by the four country focal points and feedback will be provided to consultants prior to the start of Task 2.

Task A2: Risk Analysis

a. For each of the four countries of the study, consultants will carry out an assessment of the risks to human health and the environment posed by exposure to chemicals released (or potentially released) by the identified hot spots.

- Risk assessment analyses will be conducted in accordance to the methodology sanctioned by **one** of the following agencies: i) U.S. EPA; ii) Environment Canada; or iii) European Union Environment Commission. Consultants will select one of these methodologies on the basis of their prior experience conducting risk assessments and on the specific characteristics of this program, and indicate in their proposal which methodology they will use and the rationale for the selection. All analyses will be done using the same methodology[13].
- The final methodology used for this program will be proposed in detail by consultants and will be agreed upon by the Bank before the onset of activities. Consultants will develop a proposal that will specifically address the following points:
  - i) **Site selection.** One hot spot will be selected per country out of the list of potential sites during task A1. Justification should be provided for the selection. Detailed risk assessment analyses will be conducted for each site, once government focal points and World Bank have agreed on site selection.
  - ii) **Exposure pathways, populations at risk, exposure levels, dose-response assessments, and other parameters.** For each hot spot, consultants will prepare a list of all parameters that will need to be quantified and they will indicate the methodology that will be used for their quantification (e.g. direct measuring, literature review, assumptions). The methodology for estimating variables that will not be directly measured will be proposed.
  - iii) **Supplementary data collection.** For each hot spot, consultants will indicate what procedures will be utilized for data collection. Specific details on planned site testing, surveys and other data collection activities will be provided. This will include number of samples taken per site, sampling and testing procedures, proposed laboratory facilities where samples will be tested, and quality control measures. All raw data will be provided as annexes to final reports.
  - iv) **Uncertainties.** Consultants will discuss and quantify uncertainties and assumptions affecting the analysis.
  - v) **Presentation of results.** Whenever appropriate, presentation of results from risk assessment analyses will include GIS based maps showing risk zones (regional maps may be used, if relevant).
- Involvement of focal points and other stakeholders from each country in data collection activities, through surveys, interviews workshops, etc., is **required**.

b. *Economic valuation of health risks:* Consultants will estimate the costs to each country of health and other impacts associated to exposure to target chemicals at the evaluated hot spots. Consultants will propose and review the valuation methodology with the World Bank before starting the task (and outline it in their proposal). Consultant will compare these costs to the cost of risk management measures.

[13] FAO has recently completed the Obsolete Pesticide Management System (OPMS), a POPs inventory database under the Africa Stockpile Project, which may be a useful reference for this program.

B - Risk Management

Task B1: Risk Management Measures

a. For each of the hot spots analyzed, consultants will propose:
   - Short-term measures to manage (prevent or reduce) human and environmental risks of chemical exposure (e.g. source containment); and cost estimates for these measures, at the local and regional levels.
   - Long-term solutions for remediation of the hot spot. Recommendations should only consider options that are commercially available and that are applicable in the context of the country where they are being proposed.

Task B2: Risk Management Toolkit

a. Consultants will develop a toolkit that captures the methodology used to conduct the risk assessment and risk management analyses (carried out under task A2). The toolkit will contain a step-by-step approach to evaluating and managing the risks of exposure to target chemicals and will include a list of references and databases. The toolkit should provide decision-makers with a concise and illustrative reference of the procedures to: (i) evaluate the risks from exposure to target chemicals; (ii) communicate the risks to affected people and decision makers; (iii) evaluate potential measures to reduce or eliminate risks; (iv) classify and prioritize risks; (v) select and implement cost-effective management measures; and (vi) establish measures to prevent these risks in the future.
   - Results of the analyses conducted on the hot spots will be presented in the toolkit as case studies. The toolkit will contain four annexes, one per country, where all relevant information on the risk assessment of the hot spots will be included.
   - Toolkits will be the primary training material used during workshops conducted under Task B2. The intended audience for these toolkits consists primarily of government decision makers and environmental managers so the writing style should be chosen accordingly (*e.g.* simple, clear, concise, with references and examples)
   - A draft toolkit will be prepared by consultants and agreed by the Bank
   - Final toolkits must be prepared in English and translated to the local language.

Task B3: Identification of stakeholders

a. Consultants will review existing institutional arrangements in the different countries for the management of chemicals and will identify stakeholders in the various government agencies. Relevant stakeholders will be invited to participate in national and regional training events associated with the program.
   - Most of this information has already been included in the countries' NIPs and consultants are expected to review draw upon it.

b. Given the varying levels of capacity at the government level, for each country, representatives from the private sector, NGOs and academia with interests and/or involved in chemical management should also be identified.

c. For each country, consultants will propose groups of stakeholders that should participate in national and regional training un der the program.

Task B4: Training of stakeholders in risk assessment and risk management

a. Consultants will conduct risk assessment/risk management training workshops in each country, which shall be attended by the identified stakeholders. Training materials will

include, among others: i) major results from data gathering activities and ii) risk management toolkits. Field visits to hot spots should be incorporated in the training, as needed, to better illustrate the use of the toolkit.

- Consultants will propose the content, format, duration and the audience that should participate in the training program. Programs may vary from country to country according to specific national needs. Training proposals must be reviewed and approved by the Bank. Participant lists will be confirmed by countries focal points.
- Consultants will be responsible for preparing the training material for the workshops and for delivering its contents. All logistical arrangements (including field trips to hot spots and printing of training materials), will be funded separately from this assignment. Consultants are expected to coordinate with the national team to ensure that all training materials are ready in time for the workshop.
- Consultants are expected to promote participation of the various stakeholders during workshops and to moderate ensuing discussions. Training sessions should be designed as dynamic interchanges with participants.
- Workshops may be conducted in English, but translation into local languages should be provided.

b. A list of national priorities and of potential management alternatives will be discussed in training workshops and will be compiled for each country.

- Efforts will be made to identify ongoing initiatives in various relevant sectors (*e.g.* agricultural, electrical, waste management), where measures to reduce exposure to POPs and POPs-like chemicals can be introduced.

c. Consultants will prepare final reports from each workshop conducted.

C – Regional Cooperation

Task C1: Input in Regional Workshops

a. Consultants will participate as resource persons at up to three regional workshops planned under the program during 2008. The workshops will be organized by the World Bank (i.e., workshop organization and funding are not a part of this assignment) to promote dialogue and information exchange among East Asian countries on POPs, particularly on transboundary issues that cannot be well addressed at the country level. It is expected that participants will include representatives from Cambodia, Laos PDR, Malaysia, Thailand, Indonesia, the Philippines, Vietnam, China, Korea and Japan. The workshops will foster cooperation on transboundary issues such as:

- Export/import cooperation including illegal trafficking of POPs and some POPs-like chemicals;
- Environmentally sound disposal of PCBs, obsolete POPs pesticides and POPs wastes, through coordination among countries with disposal needs and disposal capacities and removal of barriers to trans-boundary transport of hazardous waste for disposal purposes;
- Identification of readily available laboratory capacities for POPs testing and analysis;
- Knowledge networking and information exchange on POPs management, e.g. adoption of BAT/BEP, alternatives to POPs, standards and chemical management regulations and instruments for their enforcement, financial

mechanism modalities suitable for funding POPs elimination and hazardous chemicals management, optimum institutional arrangements for chemicals management, dissemination of indigenous studies and data on health impacts of POPs, etc.

- Cooperation on selected sub-regional priority issues, e.g Agent Orange contamination.

b. Consultants, at the workshops, will provide overview of their work and update on the implementation status, and deliver presentations directly related to their assignment as requested. The launch workshop is tentatively planned for late January/early February 2008. At the launch workshop, the consultants will introduce the consulting team, principles of RA, methodology they will use, data requirements and anticipated constraints, and the organization of the work for the year. The detailed agenda of the workshops is yet to be determined, and will reflect suggestions from the consultants.

c. Consultants will also prepare brief report from the workshops capturing the essence of the discussion, and key issues and recommendations from the workshop.

3. IMPLEMENTATION PLAN

20. Consultants shall begin work no later than 15 days after the date of effectiveness of the contract. Consultants must propose a clear schedule with critical milestones, and make all possible efforts to meet or complete the work in a shorter duration then the proposed time schedule.

21. It is essential that the consultants complete all work before June 30, 2009. The table below provides a suggested schedule for implementation and timing of deliverables. Consultants will propose their own detailed schedule that reflects the given scope of work.

Table 2 - Proposed implementation schedule for the program

Proposed Implementation Schedule		**2008**				**2009**	
		Q1	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**
Activities	**Description of Activities**	**X**	**X**	**X**	**X**		
A1	Data gathering			**X**	**X**		
A2	Risk analysis			**X**	**X**		
B1	Risk management measures			**X**	**X**		
B2	Risk management toolkit			**X**	**X**		
B3	Identification of stakeholders				**X**	**X**	
B4	Risk assessment and risk management training				**X**	**X**	
C1	Regional workshops participation					**X**	

4. DELIVERABLES

22. The status of deliverables to date (July 31, 2008) as well as changes in the expected dates for completion of deliverables relative to the schedule agreed under the original TOR are summarized in Table 3:

Table 3 – Deliverables and revised deadlines

Report	Due Date	Deliverables	Status	Proposed/ Revised Schedule
1. Project Implementation Plan (PIP) including RBM Framework	27 March 2008	Entire project	100% Complete	On schedule
2. Draft Progress Report 1 + Stakeholder Identification	16 May 2008	*Task A1in TOR*	100% Complete	On schedule
3. Final Progress Report 1	30 May 2008	*Task A1in TOR*	100% Complete	On schedule
4. Paper on Methodology Selection and Outlines	25 May 2008	*Task A2/A in TOR*	100% Complete (In Progress Report 1)	On schedule
5. Detailed Economic Analysis Methodology	July 2008	*Task A2/B in TOR*	100% Complete (In Progress Report 1)	On schedule
6. Standard Operating Procedures (SOP) for Field Sampling and Analysis and Blood Sampling Protocol	May 2008	*Task A2/A/iii in TOR*	100% Complete	On schedule
7. 1st Field Sampling and Training Program	May 2008	*Task A2/A/iii in TOR*	100% Complete (Laos and Cambodia)	On schedule. Additional training provided at request of countries
8. 2nd Field Sampling and Training Program	July – August 2008	*Task A2/A/iii in TOR*	Preparations completed for Thailand, Laos and Cambodia. Malaysia field work schedule to be confirmed.	Delayed, due to approval process in Malaysia and Thailand (partly). Revised schedule: July 28 – August 15, 2008.
9. Blood Sampling Protocol	June 2008	*Task A2/A/iii in TOR*	100% Complete	Additional requirement by countries for blood sample collection.
10. Draft Report(s) on Hot Spot Integrated Risk Assessment for each Hot spot	21 July 2008	*Task A2/A & B in TOR*	Ongoing/requires completion of field sampling and lab analysis	November 28, 2008

Report	Due Date	Deliverables	Status	Proposed/ Revised Schedule
11. Draft Report on Economic Analysis for each Hot spot	25 July 2008	*Task A2/A & B in TOR*	Ongoing/requires completion of draft risk assessment report (#10)	December 1, 2008
12. Final Report on Hot Spot Integrated Risk Assessment for each Hot spot	3 August 2008	*Task A2/A & B in TOR*	On going / requires completion of field sampling and lab analysis	December 12, 2008
13. Final Report on Economic Analysis for each Hot spot	3 August 2008	*Task A2/A & B in TOR*	On going / requires completion of final risk assessment report (#12)	December 19, 2008
14. Paper on Desk Review of Risk Management Alternatives	15 July 2008	*Task B1 in TOR*	100% Complete	July 21, 2008
15. Final Paper on Desk Review of Risk Management Alternatives	8 August 2008	*Task B1 in TOR*	On schedule	August 15, 2008
16. Draft Risk Management Toolkits (POPs Toolkit)	14 July 2008	*Task B2 in TOR*	40% Complete	Structure & table of contents developed. Detailed content is being developed. October 31, 2008
17. Identification of stakeholders	May and July 2008	Task B3	100% Complete July 2008	Included in Progress Report 1– comments received from Cambodia, Thailand and Laos.
18. Final Toolkits to be used in training activities	30 July 2008	Task B2 in TOR		December 19, 2008
19. Draft Training Program	25 July 2008	Task B4 in TOR	100% complete	First draft submitted late June 2008.
20. Final Training Program and Materials	1 August 2008	Task B4 in TOR		September 4, 2008
21. Draft Progress Report	15 September 2008	Task B3 in TOR		December 1, 2008
22. Final Progress Report	30 September 2008	Task B3 in TOR		December 15, 2008
23. Training Evaluation Report (Following	4 training events	Task B4 in TOR		January – February, 2008

Report	Due Date	Deliverables	Status	Proposed/ Revised Schedule
National Workshops)				
24. Regional Workshop Reports and Consultants Presentations	2 regional workshops (April 2008, and originally October 2008)	Task C1 in TOR	50% complete	Launch workshop in April, 2008 (completed) Final Workshop in March/April 2009
25. Draft Final Report	5 November 2008	Whole assignment		May 1, 2009
26. Final Report	10 December 2008	Whole assignment		May 29, 2009

23. All documents and reports will be issued in draft form. Consultants will receive comments on the drafts from the World Bank and, if applicable, from government officials, within 15 days of draft submission. Consultants will have 15 days to issue the final revised version based on the comments received. Final payment is conditional on World Bank acceptance of final draft reports.

24. The Final Report will consist of all the results from studies and reports from workshops carried out under this assignment. The report will consist of a brief main text that highlights the main accomplishments and lessons learned during the assignment. Annexes will include the training materials produced, as well as brief synopsis and evaluation of each workshop conducted under the program.

5. MANAGEMENT AND IMPLEMENTATION AGREEMENTS

25. The World Bank is the implementing agency for this program through its East Asia Sustainable Development Department. For daily matters, consultants will report to Catalina Marulanda, cmarulanda@worldbank.org and Manuel Cocco mcocco@worldbank.org. For strategic matters, consultants will report to Dr. Jitu Shah, Environment Sector Coordinator, jshah@worldbank.org.

26. Consultants will be required to be in periodic communication with government officials and with relevant stakeholders in the four countries of the Program.

- Regular meetings and consultations must be scheduled with designated government focal points and key stakeholders (*e.g.* academia, civil society). Government officials and relevant stakeholders must remain engaged in country program activities to ensure ownership of the program outputs and maximize its capacity development impact. The World Bank will facilitate initial contacts of consultants with the Government representatives; consultants are expected to maintain and enhance these. For each country, consultants must propose a plan for ensuring periodic coordination with focal points, particularly if consultant does not have permanent local presence.
- Comments and feedback from government officials must be incorporated in consultants' final products.

6. CONSULTANTS' PROFILE AND QUALIFICATIONS

27. An international consulting firm will be selected following World Bank procedures for Quality and Cost Based Selection (QCBS). Consultants will be hired under a lump-sum contract, where all costs (e.g. traveling, per diem) are included.

28. Consultants should establish a strong and focused team of specialists that includes a mix of international, regional and local specialists' inputs. The proposed consulting team must have technical competence in risk assessment, risk communication, risk management and environmental fields as well as competence in training. Consultants shall propose and justify the range of disciplines to be included in the team.

29. All key personnel should have at least a Masters degree in the relevant fields with direct relevant experience in the corresponding tasks assigned to them. The experience of the core team will be as follows:

- Project Manager with 15 years of international experience in environmental management and experience in risk management issues.
- Risk Management Specialist with 10 years of international operational experience on risk assessment and risk management.
- Environmental Specialist with 7 years of international operational experience in environmental contamination and chemical management.
- Communications Specialist with 7 years of international experience conducting training and public awareness campaigns.
- Key personnel with responsibilities that require interaction with government officials should be fluent in English. Knowledge of local languages is desirable.

30. Consultants are strongly encouraged to work in conjunction with local consultants to maximize the knowledge transfer and facilitate local capacity development:

- It is desirable that a list of local consultants including CVs, preferably at least one per country, is included as part of the proposed consulting team.
- In case consultants are unable to identify local consultants, they should indicate so in the submitted proposal, and consider requesting assistance from government POPs officials in identifying qualified local persons.

7. LEVEL OF EFFORT AND PAYMENT SCHEDULE

31. The anticipated level of effort is about 40 staff months.

32. The revised schedule of payments is as follows:

- *10% upon contract signing (completed).*
- 40% upon satisfactory completion of second field sampling program (estimated completion date August 15, 2008).
- 30% upon satisfactory completion of remaining elements of Task A and Task B as outlined in Annex 3 (estimated completion date January 30, 2009).
- 20% upon satisfactory completion of Task C as outlined in Annex 3 and delivery of an acceptable Final Report (estimated completion date May 29, 2009).

ANNEX 1

Table 1A – Status of regulation regarding POPs in participating East Asia countries

	Cambodia	Indonesia	Laos	Malaysia	Philippines	Thailand	Vietnam
Aldrin	Banned	Never registered for use	Banned	Banned	Banned	N.A.	Banned
Chlordane	Banned	Banned	Banned	Banned	Restricted	N.A.	Banned
DDT	Banned	Banned	Banned	Banned	Restricted[1]	N.A.	Banned
Dieldrin	Banned	Banned	Banned	Banned	Banned	N.A.	Banned
Endosulphan	Restricted	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Endrin	Banned	Never registered for use	Banned	Withdrawn by company	Banned	Banned	Banned
Heptachlor	Banned	Never registered for use	Banned	Banned	Banned	Banned	Banned
HCB	Banned	Banned	N.A.	Never registered	Restricted	Banned	Banned
Mirex	Restricted	Banned	Banned	Banned	Restricted	Banned	N.A.
Toxaphene	Banned	Banned	Banned	Banned	Banned	Banned	Banned
PCBs	N.A	Ban on import and use	Banned	Ban on import	Import and use is restricted	Ban on import	Restricted use

1) Import of DDT for Malaria vector control is subject to special permit from the Department of Health

Source: UNEP, Regionally Based Assessment of Persistent Toxic Substances, South East Asia and South Pacific, 2002

Appendix A2

Summary of Project Tasks and Achievements

SUMMARY OF PROJECT TASKS AND ACHIEVEMENTS

At the Regional Launch Workshop (held in Luang Prabang, Lao PDR on April 3-5, 2008), participants raised concerns about the proposed original project timeline. The Project TOR (Appendix A1) and original Project Implementation Plan (PIP) provided a project timeline of eight months, which was deemed insufficient to meet the capacity building objectives of the POPs Project.

Some participating countries required more time to obtain approval from their respective governments to implement POPs Project activities, including selection of case study sites. As a result of country requests, the following revisions were made to the project schedule and work plan:

1. Changes to the original design of the project (as outlined in the Scope of Work and PIP), including the need for two sampling trips instead of one; and

2. Delays in obtaining approval to conduct the field sampling program in two countries resulted in modifications to the schedule for subsequent activities, including sample analysis, risk assessment, economic valuation, and the National Training Workshop.

There was a request from the participating countries to extend the project activities to late 2009 to promote stakeholder involvement and to enable technology transfer, hence satisfying the training and capacity building objectives of the POPs Project.

PROJECT MILESTONES

In August 2008, upon receiving approval from CIDA, the World Bank revised the Project TOR and schedule. Changes to the TOR included extending the project end date from December 2008 to June 30, 2009 and adjusting the sequence and timeline of deliverables. In June, 2009 the World Bank decided to extend the project until the end of December 2009 due to the delay in the organization of the Final Regional Workshop. The Final Workshop was scheduled for July 22 - 24, 2009 in Da Nang, Viet Nam.

To date, all activities required in the TOR and additional activities requested by the World Bank and participating countries have been successfully completed. Table A2.1 shows the status of the POPs Project deliverables as of August 21, 2009.

Table A2.1 Status of POPs Project Deliverables.

Report	Tasks in TOR	Date of Submission	Progress as on August 21, 2009
1) Project Implementation Plan (PIP) including RBM Framework	All tasks	On schedule	Completed
2) Draft Progress Report 1 + Stakeholder Identification	Task A1in TOR	On schedule	Completed
3) Final Progress Report 1	Task A1in TOR	On schedule	Completed
4) Paper on Methodology Selection and Outlines	Task A2/A in TOR	On schedule	Completed
5) Detailed Economic Analysis Methodology	Task A2/B in TOR	On schedule	Completed
6) Standard Operation Procedures (SOP) for field sampling and analysis and Blood Sampling Protocol	Task A2/A/iii in TOR	On schedule	Completed
7) 1st Field Sampling and Training	Task A2/A/iii in TOR	Completed	Completed
8) 2nd Field Sampling Program (environmental sampling in Thailand & Malaysia, and Blood Sampling in Cambodia and Lao PDR	Task A2/A/iii in TOR	July 28 – August 15, 2008	Completed
9) Blood Sampling Protocol	Task A2/A/iii in TOR	2 – 8 August, 2008	Completed
10) Draft Report(s) on Risk Assessment for Each Selected Study Site	Task A2/A & B in TOR	November 28, 2008	Completed
11) Draft Report on Economic Analysis for Each Selected Study Site	Task A2/A & B in TOR	December 1, 2008	Completed
12) Final Report on Risk Assessment for Each Selected Study Site	Task A2/A & B in TOR	February 2009 (after training workshop)	Completed
13) Final Report on Economic Analysis for Each Selected Study Site	Task A2/A & B in TOR	Early April 2009	Completed
14) Paper on Desk Review of Risk Management Alternatives	Task B1 in TOR	July 20, 2008	Completed
15) Final Paper on Desk Review of Risk Management Alternatives	Task B1 in TOR	Used at training workshops in January 2009	Completed

Table A2.1 (Cont'd.)

Report	Tasks in TOR	Date of Submission	Progress as on August 21, 2009
16) Draft Risk Management Toolkit (POPs Toolkit)	Task B2 in TOR	October 20, 2008	Launched in late October. Toolkit tour conducted in December 2008 in all 4 countries
17) Identification of Stakeholders	Task B3	July 2008	Completed
18) Final Toolkit to be used in Training Activities	Task B2 in TOR	December 29, 2008	Completed
19) Draft Training Program	Task B4 in TOR	Draft submitted late June 2008. Finalized after 2 rounds of consultation with countries July – Nov 2008	Completed
20) Final Training Program and Materials	Task B4 in TOR	Nov – Dec, 2008	Completed
21) Draft Progress Report 2	Task B3 in TOR	March 2, 2008	Completed
22) Final Progress Report	Task B3 in TOR	March 25, 2008	Completed
23) Training Evaluation Report	Task B4 in TOR	February 2008	Completed
24) Regional Workshop, Reports and Consultants Presentations	Task C1 in TOR	Launch Workshop in April 2008, Final Workshop in July 2009	Completed
25) Draft Final Report	Whole assignment	Early September, 2009	Completed
26) Final Report	Whole assignment	End of December, 2009	Completed

Appendix A3

Summary Report of Final Regional Workshop

Hatfield CONSULTANTS

Canadian International Development Agency | Agence canadienne de développement international

REGIONAL CAPACITY BUILDING PROGRAM FOR HEALTH RISK MANAGEMENT OF PERSISTENT ORGANIC POLLUTANTS (POPs) IN SOUTH EAST ASIA

FINAL REGIONAL POPs WORKSHOP REPORT, DA NANG, VIET NAM

JULY 22 – 24, 2009

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DECEMBER 2009

POP1406.2

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LIST OF ACRONYMS

CALUX	Chemically Activated Luciferase Gene Expression
CCME	Canadian Council of Ministers for the Environment
CIDA	Canadian International Development Agency
GCMS	Gas Chromatography Mass Spectroscopy
GIS	Geographic Information System
HHRA	Human Health Risk Assessment
HPT	Hatfield POPs Project Team
NFP	National Focal Point for POPs
NIP	National Implementation Plan
NRE	Ministry of Natural Resources and Environment
MEA	Metropolitan Energy Authority
MONRE	Ministry of Natural Resources and Environment
PCBs	Polychlorinated Biphenyls
Office 33	Office of the National Steering Committee on Overcoming of Toxic Chemicals used by US during the War in Vietnam
PCD	Pollution Control Department
PF	Problem Formulation
PIP	Project Implementation Plan
POPs	Persistent Organic Pollutants
POPs Project	Regional Capacity Development Program for Management of Health Risks of Persistent Organic Pollutants in South East Asia
RA/RM	Risk Assessment/Risk Management
SOPs	Standard Operation Procedures
VEPA	Viet Nam Environment Protection Administration
USEPA	United States Environmental Protection Agency

ACKNOWLEDGEMENTS

Hatfield Consultants Partnership and the Hatfield POPs Project Team express our sincere thanks to the many individuals who have played significant roles to date in the *Regional Capacity Development Program for Management of Health Risks of Persistent Organic Pollutants (POPs) in South East Asia* (hereafter referred to as the POPs Project).

Special thanks are due to the World Bank Project Task Team, including Dr. Jitendra (Jitu) Shah, Dr. Catalina Marulanda and Manuel Cocco, for their support and assistance with all aspects of project implementation. We would also like to thank the Canadian International Development Agency's (CIDA) POPs Fund, for their financial support for the POPs Project.

We offer our sincere appreciation to the POPs National Focal Points and officials from Cambodia, China, Indonesia, Japan, Lao PDR, Malaysia, Philippines, Thailand, and Viet Nam for their technical contributions and positive collaboration, which ultimately led to the success of project activities completed to date. We would also like to thank all Regional and National Consultants and National Counterpart staff, and all relevant national agencies for their active support and invaluable contributions to the POPs Project.

Special thanks are due to the Pollution Control Department (PCD), Vietnam Environment Administration (VEPA) and Office 33 for hosting the Regional Workshop and organizing the field trip to Da Nang Airbase Case Study Site for the participants. Finally, we would like to thank the Final Regional Workshop participants for their active participation in the Workshop.

1.0 INTRODUCTION

The enclosed report for the *Regional Capacity Building Program for Health Risk Management of Persistent Organic Pollutants (*POPs*) in South East Asia* (POPs Project) provides a brief summary of the Regional Training and Closure Workshop (Final Regional Workshop) which took place in Da Nang, Viet Nam from the 22nd – 24th of July, 2009.

The POPs Project was developed to complement the National Implementation Plans (NIP) for the Stockholm Convention on Persistent Organic Pollutants (POPs). Funding for the POPs Project was provided by the Canadian International Development Agency's (CIDA) POPs Fund, and is coordinated by the World Bank. Hatfield Consultants Partnership (Hatfield) has been commissioned by the World Bank to implement the technical components of the Project. Complementary program activities are also being implemented by national consultants and World Bank staff.

The objective of the program was to enhance the capacity of the government agencies in the South East Asia Region[1] to manage POPs and POPs-like chemicals using health risk-based and regional cooperation approaches. Improved regional cooperation on broader chemical agenda is a secondary objective of the program. The expected outcome of the program was that the officials responsible for POPs management would increase their understanding and use of health risk based approach to management of POPs and other chemicals, and prioritize POPs interventions to reduce local health impacts, especially on the poor and vulnerable.

The Final Regional Workshop was organized by the World Bank and the Pollution Control Department (PCD), Viet Nam Environment Protection Administration (VEPA), Ministry of Natural Resources and Environment (MONRE), in Da Nang. The Office 33 organized the field trip to the Case Study Site at the former Da Nang Airbase. The agenda for the Final Regional Workshop's is provided in ***Appendix A1***. The Hatfield Project Team was responsible for preparing the training materials for the workshops, delivering the presentations, and for facilitating and moderating the discussions.

There were 101 participants present for the Final Regional Workshop. The participants were from various government agencies, organizations, academic institutions and the mass media. The Hatfield Project Team delivered the training and presentation materials, and facilitated the discussion. (Please refer to the List of Participants is in ***Appendix A2***).

[1] This included relevant agencies in the program countries where hotspot risk assessment were carried out, namely Cambodia, Lao PDR, Malaysia, and Thailand, as well as countries which were invited to participate in the regional workshops on transboundary POPs issues, namely China, Indonesia, Japan, the Philippines, and Vietnam.

1.1 OBJECTIVES OF THE FINAL REGIONAL WORKSHOP

The primary objectives of the workshop were as follows:

1. Building capacity for conducting risk assessment and risk management of exposure to POPs through a case study, a site visit and the use of the POPs Toolkit (www.popstoolkit.com); and

2. Enhancing regional cooperation and establishing a network of regional experts on POPs.

The Workshop materials were developed and delivered by the Hatfield Project Team at the Final Regional Workshop to meet the overall objective of the POPs Project.

2.0 OPENING SESSION

Mr. Nguyễn Điểu, Director of the Da Nang Department of Natural Resources and Environment, delivered a welcome address. He welcomed all the participants from the participating countries – Cambodia, Indonesia, Japan, Lao PDR, Malaysia, the Philippines, Thailand, and Viet Nam – the World Bank and the international consultants (Hatfield and Hiyoshi).

Mr. Nguyễn Điểu highlighted the pressing issues associated with the development, use and store of the hazardous chemicals. He expressed appreciation to the World Bank for supporting regional programs to address Persistent Organic Pollutants (POPs), and other persistent chemical substances.

Dr. Lê Kế Sơn, Vice Director General of Viet Nam Environment Protection Agency (VEPA), Ministry of Natural Resources and Environment (MONRE), delivered an opening speech on behalf of the Government of Viet Nam. He warmly welcomed all the participants, the World Bank and the Hatfield Project Team to the Final Regional Workshop. He thanked the World Bank and Canadian International Development Agency (CIDA) for providing technical and financial support and Hatfield for providing technical inputs to the Regional POPs Project for strengthening the countries' capacity in human health risk assessment and management of POPs.

Dr. Shah, on behalf of the World Bank, welcomed all participants and expressed sincere appreciation to the Government of Viet Nam, and Pollution Control Department (PCD), Viet Nam Environmental Protection Administration (VEPA) and Office 33, for hosting the Final Regional Workshop and field visit. He also acknowledged the Canadian Government for funding the POPs Project through CIDA.

Dr. Shah provided a summary of the Project's progress so far, from the Launch Workshop in Luang Prabang in early April 2008 to the present Final Regional Workshop. Dr. Shah highlighted the importance of the POPs project for

improving the capacity of the government officials, decision makers and academic researchers to conduct Human Health Risk Assessment (HHRA). He also expressed appreciation to the Hatfield Project Team for their technical inputs.

Dr. Shah encouraged all participants to take an active role in the Workshop, and to use the POPs Toolkit in the future for HHRA and Risk Management (RM) for POPs and other persistent toxic substances.

Mr. Thomas Boivin, on behalf of the Hatfield Project Team, thanked PCD, VEPA and Office 33, MONRE for hosting the workshop, and all workshop participants for attending the Workshop. Mr. Boivin explained that POPs management involves various disciplines including science/toxicology, social sciences, economics and governance issues, and requires collaboration among concerned government agencies and stakeholders at the national and local levels. Mr. Boivin emphasized that Da Nang was an ideal location for conducting the Regional Workshop to discuss risk assessment and management of POPs, given the rich experiences and scale of the POPs issues (Agent Orange dioxin) present in and around the former Da Nang Airbase. In his closing remarks, Mr. Boivin encouraged the participants to actively participate in the workshop.

Figure 2.1 Opening Session of the POPs Project Final Regional Workshop.

3.0 OVERALL WORKSHOP PROGRAM

The Final Regional Workshop covered the following plenary sessions and facilitated group sessions:

Session 1 - Setting the Stage:

- Key Objectives of the Workshop, and Background on the POPs Project and POPs issues; and
- Presentation of the Final POPs Toolkit.

Session 2 - Sharing Experiences and Lesson Learned from HHRA Using POPs Toolkit:

- Presentation of POPs Project Case Study Results from Cambodia, Lao PDR, Malaysia and Thailand – Experiences Using the POPs Toolkit; and
- Panel Discussion: Experiences Using the POPs Toolkit.

Session 3 - Sharing Experience: POPs Issues and Management in Viet Nam:

- Management of POPs Contaminated Sites in Vietnam;
- Agent Orange Dioxin Issue in Viet Nam; and
- Da Nang Airbase Case Study: Introduction and Background.

Session 4 - Risk Assessment and Management by Applying the POPs Toolkit and Da Nang Case Study

4.1 Da Nang Airbase Risk Assessment I - Hands-on Application of Problem Formulation and Conceptual Exposure Tools:

- Presentation on Problem Formulation and Conceptual Exposure Model;
- Group work: Development of Conceptual Exposure Models for Da Nang Airbase; and
- Debriefing on Field Visit to Da Nang Airbase.

Session 5 - Field Visit: Da Nang Airbase Case Study Site.

Session 4 (continued)

4.2 Da Nang Airbase Risk Assessment II – Risk Assessment of Da Nang Airbase Case Study:

- Introduction to Risk Calculation; and
- Group work: Hands-on Application of Risk Calculation Tools.

4.3 Hands-on Application of Risk Management Options and Economic Valuation Tools:

- Introduction to Risk Management and Economic Analysis;
- Group Discussion: Risk Management Goals and Objectives, and Economic Valuation; and
- Group Presentation: Risk Management and Economic Analysis.

Session 6 - New Technology:

- Presentation by Hiyoshi Corporation on the Application of CALUX for POPs monitoring.

Session 7 - Round-Table Discussion:

- Role of HHRA and Risk Communication;
- Regional Cooperation; and
- Future Use of POPs Toolkit.

Session 8 - Wrap-up and Evaluation of the Toolkit and Workshop.

3.1 SESSION 1: SETTING THE STAGE

3.1.1 Key Objectives of Workshop and Background on POPs Project and POPs Issues

Mr. Thomas Boivin, the Project Director for the POPs Project, presented the objective of the Final Regional Workshop and background and progress of the POPs Project. He encouraged the participants to become familiar with the methodologies, tools and step-by-step process of POPs HHR Assessment and Management. The presentation delivered by Mr. Boivin is provided in the attached POPs Toolkit CD, in the "Project Reports, Final Workshop".

Dr. Jitu Shah, World Bank Project Task Team Leader, encouraged the participants to share their impression and evaluation of the project.

3.1.2 Final POPs Toolkit Presentation

Mr. Boivin presented the final version of the POPs Toolkit. He highlighted the key steps in the development, testing and finalization of the POPs toolkit completed in close collaboration with the World Bank and national stakeholders. Mr. Boivin reviewed the various themes, sub-themes and chapters of the POPs Toolkit and highlighted the main improvements in the POPs Toolkit based on the feedback received from end-users.

The Final POPS Toolkit presentation is provided in the attached POPs Toolkit CD, in the "Project Reports, Final Workshop".

3.2 SESSION 2: SHARING OF EXPERIENCES AND LESSON LEARNED FROM HUMAN HEALTH RISK ASSESSMENT AND MANAGEMENT USING POPS TOOLKIT

3.2.1 Presentation of the POPs Project Case Study Results from Cambodia, Lao PDR, Malaysia and Thailand – Experiences Using the POPs Toolkit

Representatives from Cambodia, Lao PDR, Malaysia and Thailand presented their experiences using the POPs Toolkit for risk assessment and management. The presentations showed that the POPs Toolkit has been used at national and local levels for a wide range of chemicals contamination including POPs.

Figure 3.1 National Presentations on POPs Toolkit Experiences.

The representatives from Cambodia, Lao PDR and Thailand stated that the use of the POPS Toolkit at a national and site-specific level could be enhanced by translating some of the key parts of the CD into local languages. The Malaysian representatives mentioned an interest in using the Toolkit as an educational resource and training tool in universities, and stressed the importance of having a CD-Rom version, as internet can be unreliable. The representatives from Thailand stated that additional training should be envisaged, especially regarding the economic valuation component. The Thai representatives also recommended that the POPs Toolkit be widely disseminated to the international community, and suggested to communicate with UNEP (Stockholm Convention Secretariat) so that it could be presented in a special side event during the next POPs Conference of the Parties (COP) meeting in Argentina in 2011, and in the UNEP POPs Information Warehouse.

3.2.2 Panel Discussion: POPs Project Case Study Results from Cambodia, Lao PDR, Malaysia and Thailand.

The panel discussion was facilitated by the Hatfield Project Team and the World Bank. Some questions raised by various participants included the following:

- Legal implications of the inclusion of the nine new chemicals added to the Stockholm Convention list (Philippines). This question was

considered very interesting and raised the issue of improving local standards and regulations, as well as the issue of human resources, technical and financial capacity.

- Which part of the Toolkit was most difficult to use? (Indonesia). In particular: (i) Human Health Risk Assessment (HHRA) calculations, as they are very complex, but also the broader issue of understanding the social, political and economic contexts associated with reducing risk; (ii) understanding the theory behind RA and helping decision-makers to understand the outputs produced from the Toolkit; (iii) need to use local standards (many times these standards are missing and international guidelines have to be used instead); (iv) economic valuation of POPs impacts and transmitting them to relevant decision makers.

- The Toolkit was very comprehensive, and some of the content was very technical in nature, which raised the question if end-users would be capable of mastering the content? (Viet Nam). The users were mainly regional scientists and toxicology specialists, but the objective was to provide these experts with the tools to communicate with key decision makers and with broader audiences.

Figure 3.2 Round Table Discussion on POPs and POPs Toolkit.

3.3 SESSION 3: SHARING OF EXPERIENCES: POPS ISSUES AND MANAGEMENT IN VIET NAM

Session 3 consisted of sharing of experiences related to POPs issues and management in Viet Nam. The first presentation covered an introduction to POPs issues in Viet Nam by Dr. Nguyễn Anh Tuấn, National Focal Point for Viet Nam, PCD, VEPA, MONRE. Dr. Nguyễn Mỹ Hằng, Office 33, MONRE delivered a presentation on Agent Orange Issues in Viet Nam. Thomas Boivin presented the introduction and background of the Da Nang Airbase Dioxin Assessment and Mitigation program.

The presentations are provided in the attached POPs Toolkit CD, in the "Project Reports/Final Workshop". Key points from the presentations included:

- Management of POPs in Viet Nam focuses on POPs pesticides, PCB, unintentionally produced POPs, and Agent Orange/Dioxin (legacy of war);
- The primary focus in Viet Nam is on the capacity building law and policy development and enforcement, public awareness, and engineering solutions;
- Sharing experiences in information management, including the POPs Site Database, for conducting and recording site inventory and prioritization.

The presentations included the demonstration of a chemical contamination site prioritization database, updates on the status of POPs legal and regulatory framework and the current status of Agent Orange research in Viet Nam, in particular the situation at Dioxin-contaminated hotspots in Da Nang, Bien Hoa and Phu Cat.

Following the presentations, some questions were asked by various participants:

1. How to communicate POPs issues to the general public? Information dissemination seminars, brochures, publications, as well as the mass media to inform people of the dangers of Dioxin contamination (the Vietnamese Government has extensive experience in this area).
2. What interim remediation measures have been most effective? Preventing access to the site, banning fishing and aquaculture, preliminary capping of the most contaminated areas, and water/sediment treatment measures.
3. What has been done concerning the hydrology? Hydrological surveys, including groundwater testing. Some water and sediment containment measures have been implemented, but more needs to be done, as containing seasonal rainfall sedimentation and understanding the potential off-site contamination through groundwater are key issues.

3.3.1 Da Nang Airbase Case Study: Introduction and Background.

Mr. Thomas Boivin introduced the background of the Da Nang Dioxin Risk Assessment and Mitigation Case Study. The presentation and the Case Study are provided in the attached POPs Toolkit CD, in the "Project Reports/Final Workshop".

3.4 FIELD VISIT TO DA NANG AIRBASE

Mr. Phhâm Ngoc Canh, Department of Environment, Ministry of Defense, Viet Nam, led the delegation, and provided a tour of the former Mixing and Loading and Storage Areas (most contaminated sites), the Dioxin Bio-remediation Test Sites,

and the Sediment Containment measures at Sen Lake. The proposed final containment measures, including a landfill in the South West corner of the Airbase, were discussed. Remediation was planned to include two Phases: (i) isolation of the contaminated soils and sediments; and, (ii) treatment using bio-remediation or other methods (to be determined, depending on cost and technical issues).

Figure 3.3 Field visit to former Da Nang Airbase Agent Orange Hot Spot.

3.5 SESSION 4: DA NANG AIRBASE RISK ASSESSMENT I - HANDS-ON APPLICATION OF PROBLEM FORMULATION AND CONCEPTUAL EXPOSURE TOOLS FROM POPS TOOLKIT

Session 4 consisted of a general introduction to the tools and approaches for problem formulation and the conceptual exposure model, as well as group work in applying the tool for developing conceptual exposure models for the Da Nang Case Study site.

3.5.1 Presentation on Problem Formulation and Conceptual Exposure Model

Mike Rankin, Risk Assessment Specialist, introduced the key steps in the Risk Assessment process. Mr. Rankin then explained in detail the objectives and approach to problem formulation, and introduced the problem formulation worksheet and conceptual exposure model development tools.

The presentations are provided in the attached POPs Toolkit CD, in the "Project Reports/Final Workshop".

3.5.2 Group work: Development of Conceptual Exposure Models for Da Nang Airbase

The participants were assigned to five discussion groups to develop conceptual exposure models for the Da Nang Airbase Case Study site by illustrating how contaminant sources, exposure pathways, and receptors were linked together to form a potential health risk. The conceptual exposure models were later used as a basis for developing the mathematical exposure model and estimation of health risks. There was extensive discussion on the models presented, and the participants demonstrated an excellent understanding of the contaminant source, pathways and receptors. Participants were able to discuss the Dioxin contamination at the Airbase, and demonstrated a clear understanding of the contamination problem at the site.

Figure 3.4 Group Discussion and Presentation on Exposure Model.

Key discussion points:

1. Major source of contaminants were contaminated soil and sediments, and the major transport/release mechanism was run-off;

2. Future mitigation plans to eliminate/dispose contaminated sediments from the Lake require a careful plan and execution to avoid triggering new transport/release mechanism – wind erosion and truck transport;

3. Groundwater as a contaminant source was an interesting concept for other soluble persistent chemicals;

4. The Food chain was a complex, but main transport and release mechanism; and

5. The vehicle erosion was identified as another potential exposure pathway.

3.5.3 Da Nang Airbase Risk Assessment II - Hands-on application of risk calculation and risk characterization tools from POPs Toolkit

Session 6 included an introduction to the risk calculation tool, hands-on application of the tool, and a general discussion.

3.5.3.1 Introduction to risk calculation

Mike Rankin introduced the Preliminary Quantitative Risk Assessment (PQRA) tools. The session covered selected risk assessment tools available in the POPs Toolkit for estimating human health risks.

The presentation is provided in the attached POPs Toolkit CD, in the "Project Reports, Final Workshop".

3.5.3.2 Group Work: Hands-on application of Risk Calculation Tool.

The presentation was followed by a 45 minute hands-on application of the PQRA using data from the Da Nang Site Case Study Report to calculate exposure (i.e., dose) via ingestion, inhalation and dermal contact for various groups of receptors – workers and residents (children and adults), and aquatic and terrestrial ecosystems. The estimated doses were then used to calculate expressions of human health risk: (i) Hazard Quotients (HQs) for non-carcinogens; and, (ii) Incremental Lifetime Cancer Risk (ILCRs) for carcinogens.

Figure 3.5 Hands-on Application of Risk Calculation Models.

3.5.4 Da Nang Airbase Risk Management - Hands-on Application of Risk Management Option Development and Economic Valuation Tools From POPs Toolkit

3.5.5 Introduction to Risk Management and Economic Analysis

Sokhem Pech, the POPs Project Manager, Risk Management and Communication Specialist, presented the role of risk management in the overall risk governance framework and outlined major steps and characteristics of successful risk management.

The presentation is provided in the attached POPs Toolkit CD, in the "Project Reports, Final Workshop".

3.5.6 Group Discussion: Risk Management Goals and Objectives

This presentation was followed by a group discussion session to develop the risk management strategy and action plan for the Da Nang site. The participants were assigned to five discussion groups. Participants were provided with a list of discussion topics for presentation on Day 3, including the following:

(i) List key scientific, economic, social, and political factors to be considered in proposing risk management for the site.

(ii) What are the management goals and options for the site?

(iii) What are the potential costs of implementing the proposed risk management options?

(iv) Which risk management measures would be most effective and how best to implement them and why?

The Group Discussion was followed by Group Presentations on their findings and a plenary discussion of the outcomes. The presentations are provided in the attached POPs Toolkit CD, in the "Project Reports, Final Workshop".

Figure 3.6 Group Discussion and Presentation on Risk Management and Economic Analysis.

All of the presenters demonstrated good understanding of establishing overall risk management goals, and the need to address various components of risk (hazard, pathways and receptors). Participants used the POPs Toolkit to help develop their presentations, which demonstrated a good understanding of where to find information for developing risk management measures.

The participants made the following comments regarding the site,: (i) there was a clear need to address hydrology issues, as these were important for determining possible off-site transport routes; (ii) other options must be considered besides landfills, as there were a number of risks associated with digging up the soils/sediments from the contaminated site and moving them to another location (in-situ containment should also be considered); (iii) future land use at the Da Nang Airbase also needed to be considered, as the Government of Viet Nam has planned to expand the airport to meet the projected increase in air traffic flows; (iv) addressing Agent Orange contamination was a complex issue, as it also involved international bilateral relations between the US and Viet Nam, as well as technical issues.

3.6 SESSION 7: NEW TECHNOLOGY: APPLICATION OF CALUX FOR POPS MONITORING

The Representative from Hiyoshi Corporation presented the results of the use of the Chemically Activated Luciferase Gene Expression (CALUX) process for POPs monitoring at the selected study sites in Cambodia, Lao PDR, Malaysia and Thailand.

The presentation is provided in the attached POPs Toolkit CD, in the "Project Reports, Final Workshop".

3.7 SESSION 8: ROUND-TABLE DISCUSSION

At the end of the workshop, a panel group with representatives from each of the seven participating countries was asked to comment on three key items related to the POPs Project. The three key items were: (i) the role of HHRA in decision-making; (ii) regional cooperation on POPs Issues; and (iii) future use of the POPs Toolkit.

Figure 3.7 Panel Discussion on Regional Cooperation and Future of POPs Toolkit and Closing.

The World Bank and the Hatfield Project Team, as well as other participants, added to the panel comments. Outlined below is a brief summary of the key discussion points and the proposed next steps and follow-up activities after the completion of the POPs Project.

a) **Role of HHRA in decision-making**. Countries experience challenges managing POPs issues, so the results of the HHRA could help improve confidence in decision-making. Some countries needed to develop specific regulations on POPs, including a special action plan to address human health impacts. Investment and environmental management should be conducted jointly, in order to ensure sustainable development in the country. The Da Nang Case Study was a good example of the importance of using HHRA for dealing with chemical contamination impacts, and of identifying the main sources, pathways and receptors.

b) **Regional Cooperation on POPs Issues**. Future international events like the Regional Workshops or invitation of regional participants to attend the National Workshop on POPs related issues should be organized to improve international collaboration, as this is a critical component of addressing POPs issues (including AO and Dioxin). Dioxin, in particular, is an issue of international concern, and countries must work together to address this important problem in the region. Consequently, an international workshop on the specific issue of Agent Orange/Dioxin contamination should be considered, especially in Laos, Cambodia, Thailand and Viet Nam. The compilation of information on human health impacts through a Regional database could be very helpful. In summary, there was a strong need for more Regional Cooperation, as the issues between countries were similar; however, it was also acknowledged that each country has unique cultures and specific issues. The POPs HHRA and Risk Management (RM) should be adapted to a local context, and the POPs Toolkit should be used by countries in a manner appropriate to the local situation, taking into account the specific social, political, economic and policy issues.

c) **Future Use of the POPs Toolkit**. The POPs Toolkit should be showcased at the next 4th Conference of the Parties to the Stockholm POPs Convention (COP4) in 2011 to raise awareness and demonstrate how South East Asia has taken the lead on dealing with POPs issues. More training is needed on how to implement RM and RA tools. The World Bank and other donors should organize additional training courses for the application of the Toolkit to expand its usage. The Toolkit should be translated into national languages to improve its usefulness (perhaps only some critical sections should be translated). The Toolkit should also be applied to other toxic chemicals, including unintentionally produced POPs (in particular open burning, which is very important in some countries) and could also be used to assist the Environmental Impact Assessment (EIA) process in some cases. In addition, it's use should be promoted to other line agencies, however, translation into local languages is required for this to be successful. The use of the POPs Toolkit should be expanded to universities and technical institutes in the country, to provide the scientific community with tools to inform decision-makers about POPs-related issues. Hands on experience is

the most effective way to make progress in HHRA, so extensive practice with the Toolkit should be required to develop a regional network of Risk Assessment professionals. Finally, the POPs Project should be extended to other countries, and case studies should be conducted in other countries, as this exercise is very helpful to demonstrate the utility of the Toolkit. Laboratory analyses for DX/FN are costly and require extensive training in order to help with monitoring of POPs, so more support from the donor community should be envisaged.

3.8 SESSION 12: WRAP-UP AND EVALUATION OF THE TOOLKIT AND WORKSHOP

Dr. Jitu Shah, World Bank Project Task Team Leader thanked the participants for their active participation and the host country for hosting the Final Regional Workshop. Dr. Trần Thế Loãn, Deputy Director General of PCD, VEPA, closed the meeting by thanking the World Bank and CIDA for the financial support, all participants and the POPs Project Team for their active contribution to the success of the Final Regional Workshop.

4.0 POPS TOOLKIT AND WORKSHOP EVALUATION

The participants were asked to complete evaluation forms at the end of the Workshop. The POPs Toolkit and Workshop Evaluation forms were administered to the participants by the World Bank Team. The Hatfield Project Team greatly appreciated the feedback provided by all respondents.

Only 26 participants (total N=90) adequately completed the evaluation forms. Responses were generally very positive, with evaluations ranging from good to excellent, regarding both the quality of the workshop (training sessions, site visit, group exercises and panel discussions) and the utility of the toolkit (technical content and user friendliness).

Most of respondents (N=22) expressed an interest in attending follow-up training at a more intermediate or advanced level, in particular regarding: (i) economic valuation and cost-benefit analysis; (ii) risk management & risk assessment for POPs decontamination; (iii) contaminated site mitigation; (iv) laboratory analysis and field program capacity building; and (v) training of trainers and users of toolkits at national/local levels.

In addition to these responses, the participants identified areas of improvement, suggested future actions to ensure sustainability of the toolkit, and recommended follow-up activities. A sample of the comments received included: (i) increased support from the World Bank and governments to sustain the POPs Toolkit; (ii) recommendation to the Secretariat of the POPs Convention to include the POPs Toolkit in its information warehouse (this should be a joint effort from the World Bank and the participating countries); (iii) popularize the POPs Toolkit in the whole Asian region and other parts of the world; (iv) provide regular updates to the POPs Toolkit content and maintain the knowledge sharing and discussion board; and (v) introduce the use of the POPs Toolkit to universities and academic institutions.

5.0 CLOSURE

We trust the above information meets your requirements. If you have any questions or comments, please contact the undersigned.

HATFIELD CONSULTANTS:

Approved by:		December 24, 2009
	Sokhem Pech Project Manager	Date

Approved by:		December 24, 2009
	Grant Bruce Project Director	Date

APPENDICES

Appendix 1

Final Regional Workshop Schedule

REGIONAL CAPACITY BUILDING PROGRAM
FOR RISK MANAGEMENT OF POPS IN SOUTH EAST ASIA

Final Regional Workshop on Human Health Risk Assessment and Management of POPs

AGENDA

Da Nang, Viet Nam, July 22– 24, 2009

Day I: July 22, 2009

Time	Description	Person Responsible
08.00–08.30	Registration	World Bank
08.30–09.00	Official Opening and Welcome Speeches:	PCD, Da Nang DoNRE, VEA, WtB, Hatfield
09.00–09.15	Key Objectives of the Final Regional Workshop & Background on POPs Project	Thomas Boivin Hatfield Consultants
09.15–09.30	Group Photo & Coffee Break	
09.30–10.30	Presentation of the Final POPs Toolkit (www.popstoolkit.com)	Thomas Boivin
10.30–11.50	Country Presentations (20 minutes each): POPs Project Case Study Results from Cambodia, Lao PDR, Malaysia and Thailand – Experiences Using the POPs Toolkit	Representatives from: Cambodia, Malaysia, Lao PDR &Thailand
11.50–12.30	Panel Discussion: POPs Project Case Study Results from Cambodia, Lao PDR, Malaysia and Thailand – Experiences Using the POPs Toolkit	Representatives from: Cambodia, Malaysia, Lao PDR &Thailand
12.30–13.30	Lunch Break	
13.30–14.00	Management of POPs contaminated sites in Vietnam	Dr. Nguyen Anh Tuan , PCD
14.00–14.30	Agent Orange Dioxin Issue in Viet Nam	Dr. Vu Chien Thang, Off. 33
14.30–15.30	Da Nang Airbase Case Study: Introduction and Background	Thomas Boivin
15.30-15.45	Coffee Break	
15.45–17.00	Da Nang Airbase Risk Assessment Using the POPS Toolkit: 1) Problem Formulation; 2) Conceptual Exposure Diagram; and 3) Preparations for Field Visit.	All Participants, Facilitated by Hatfield and World Bank
18.30-20.30	Reception Dinner hosted by the World Bank: ▪ Presentations and Slide Show on the Agent Orange Dioxin Issue in Viet Nam	World Bank

Day II: July 23, 2009

Time	Description	Person Responsible
08.30 – 12.00	Field Visit to Da Nang Airbase	Host Country, Hatfield & World Bank
12.00 – 13.30	Lunch Break	
13.30 – 15.00	Risk Assessment of Da Nang Airbase Case Study: Group Exercise, Part I: 1) Introduction; 2) Risk Calculation Tool: a. Human Health Risk Assessment (Quantitative) b. Environmental / Non-Human Risk Assessment (Qualitative)	All Participants, Facilitated by Hatfield and the World Bank
15.00 - 15.15	Coffee Break	
15:15 – 17.00	Risk Management of Da Nang Airbase Case Study: Group Exercise Part II: 1) Risk Management Decision Making: Develop Goals, Sub-goals (Objectives) and Indicators; 2) Long and Short-listing of Management Options (Selection Criteria and Weighting Factors); 3) Costing and Economic Valuation of Options	All participants, facilitated by Hatfield and the World Bank
18.30 – 20.30	Dinner	

Day III: July 24, 2009

Time	Description	Person Responsible
08.30 – 09.30	Group Presentations on Risk Assessment and Risk Management Options for Da Nang Airbase	Representatives from Each Group
09.30 - 10.00	CALUX testing of POPs contaminated samples – Results from field testing in Cambodia, Lao PDR, Malaysia and Thailand	Hiyoshi Corporation
10.00 – 10.15	Coffee Break	
10.15 – 12.00	Round Table (followed by Group Discussion) on: • Role of Human Health Risk Assessment in Decision-making; • Regional Cooperation on POPs issues; and, • Future Use of POPs Toolkit.	Round Table with representatives from all 8 countries followed by discussion by all participants, facilitated by Hatfield and WB
12.00 – 12.30	• Wrap-up and Closing Ceremony (Certificates of Attendance and Technical Training Evaluation)	Hatfield, World Bank and Host Government

Appendix 2

List of Participants

List of Viet Namese Participants.

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Appendix A4

Public Awareness and POPs Toolkit Sustainability

Appendix A4.1

Public Awareness Posters for Lao PDR

Health Risk of Agent Orange Dioxins

DRAFT

About this Project

The *Assessment of Agent Orange Dioxin and Landmine/Unexploded Ordnance (UXO) Hotspot in Sekong Province, Lao PDR* project is designed to protect the local populations in Sekong Province, Lao PDR, from health effects related to US-Viet Nam war herbicide usage and bombing activities. Funding was provided by the Social, Medical and Educational (SOCMED) component of the Green Cross *Environmental Consequences of Wars and Conflicts Programme*. The Water Resources and Environment Administration (WRERI/WREA) is the implementing agency for this project, with technical support from Hatfield Consultants.

Technical Workshop, Sekong February 3, 2009

What is Agent Orange?

Agent Orange is an herbicide widely used as a defoliant during 1965-1971 in Lao PDR by USA.

Military airplane spraying Herbicide during the war.

The name "Agent Orange" comes from the orange stripe painted on the barrels to identify the contents.

Agent Orange drums at Johnston Island storage site

How do Agent Orange Dioxins enter the environment?

Agent Orange dioxins enter the air, water, and soil while stored and used at Javan Air-base and around Dak Pork.

Leakage and spill during storage and handling of Agent Orange at Javan Military Base

After the war villagers collected the Agent Orange barrels for storing water and food. The Agent Orange dioxin was dumped on land and in streams causing further contamination.

What happens to Agent Orange Dioxins when they enter the environment?

Concentration of Agent Orange dioxins at Javan significantly excess internationally acceptable levels more than 30 years after the war.

Agent Orange dioxins are hazardous to you and your family.

How do Agent Orange Dioxins Enter the Body?

Inhalation, accidental ingestion and dermal contact of Agent Orange dioxin contaminated soil and dust.

Transportation of soils/sediments off-site on truck tires.

Ingestion of potentially contaminated meat and wildlife.

Health Effects of Agent Orange Dioxins

The study shows that human beings who were exposed to Agent Orange dioxin during the Vietnam War experienced significantly higher health risks of the following:

- diabetes;
- non-malignant lung diseases;
- heart conditions (including coronary heart disease, hardening of the arteries or heart attack);
- cancer and leukemia;
- chronic respiratory diseases (such as chronic bronchitis, asthma, emphysema, pleurisy, or tuberculosis); and
- hypertension.

Children born to parents who had been exposed to Agent Orange in Viet Nam.

Contact information

Regional Capacity Building Program for Health Risk Management of Persistent Organic Pollutants (POPs) in South East Asia Program

WREA

Hatfield CONSULTANTS

Canadian International Development Agency | Agence canadienne de développement international

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GREEN CROSS

How to Protect My Family and Myself From Agent Orange Dioxin Exposure

How to Determine and Prevent Exposure to Agent Orange Dioxin?

Identification: Tests can measure Agent Orange dioxin levels in the blood, fat tissue, and breast milk, but it remains expensive.

Treatment: At this time, there is no treatment for Agent Orange dioxin exposure. People with high levels should have a careful exposure history taken and increase efforts to identify and eliminate any current sources of Agent Orange dioxin exposure.

Prevention: The best measure is to prevent exposure to Agent Orange dioxins through:

- Determining the **source** of **contamination** and **reduce exposure** to that source.

- Removing hazardous contamination, or **controlling** access to it.

- Conducting vegetation and capping to minimize off-site transport of Agent Orange dioxin from the Site.

How can Agent Orange Dioxins affect my children?

Children are exposed to Agent Orange dioxins in the same way as are adults. However, for children the potential health effects from exposures during the period from conception to maturity of age is higher because:

Children's intake of Agent Orange dioxins per kilogram of body weight may be greater than that of adults due to their **smaller size**.

Children living near contaminated sites may **accidentally eat** Agent Orange dioxin **contaminated material**, or expose themselves through not washing their hands.

Children may be exposed by **playing with old appliances** or playing at contaminated sites.

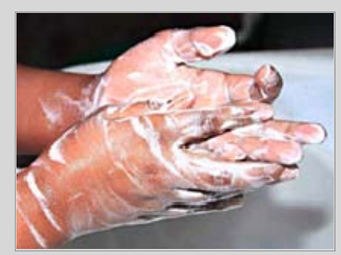
Children may be exposed through transporting the chemicals on clothing or bringing contaminated waste from the sites into their home.

How can families reduce the risk of exposure to Agent Orange Dioxins?

You can reduce the risk simply by:

Avoiding **eating food or wildlife** caught from contaminated sites.

Children should be **discouraged** from **playing in the dirt** in or near the hot spots sites.



Children should **not eat dirt** or dirty food, and always follow careful **hand-washing practices**.

Avoid carrying **contaminated waste** or contaminated products home.

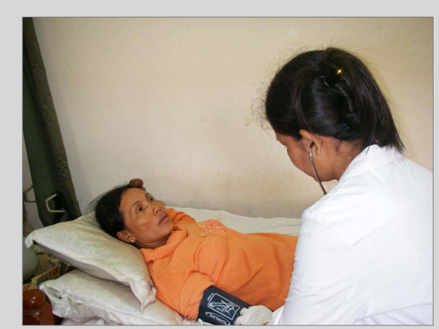
Healthy children are most valuable asset of society and source of family happiness.

Can I breast-feed if I have high level of Agent Orange Dioxin exposure?

Yes. Consult with your medical professional. Agent Orange dioxins detected in breast milk (or blood) are not necessarily an indication that breast-feeding should be stopped. The benefits of breast-feeding outweigh potential risks from low level dioxin exposure.

Can I have baby if I have high level of Agent Orange Dioxin exposure?

Woman with high levels of Agent Orange dioxin exposure should consult medical professional before making this decision.



Regional Capacity Building Program for Health Risk Management of Persistent Organic Pollutants (POPs) in South East Asia Program

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GREEN CROSS

ພວກເຮົາຈະປ້ອງກັນຕົນເອງ ແລະ ສະມະຊິກໃນຄອບຄົວຈາກ ການໄດ້ຮັບ ສານໄດອິກຊິນ/ຝົນເຫລືອງເຂົ້າສູ່ຮ່າງກາຍໄດ້ແນວໃດ?

ພວເຮົາສາມາດກຳນົດແລະ ປ້ອງກັນຜົນກະທົບ ຂອງສານໄດອິກຊິນ/ຝົນເຫລືອງ

ການຈຳແນກ: ການວິໄຈສາມາດບອກໃຫ້ຮູ້ເຖິງລະດັບຄວາມເຂັ້ມຂຸ້ນຂອງສານໄດອິກຊິນ/ຝົນເຫຼືອງ ທີ່ມີຢູ່ໃນເລືອດ, ເນື້ອເຍື່ອໄຂມັນ ແລະ ນຳນົມຄົນ ແຕຄ່າວິໄຈຍັງມີລາຄາແພງ.

ການບຳບັດ: ໃນປະຈຸບັນ, ຍັງບໍ່ມີວິທີການປິ່ນປົວຜູ້ໄດ້ຮັບສານ ໄດອິກຊິນ/ຝົນເຫຼືອງເທື່ອ, ສຳລັບຜູ້ທີ່ມີ ລະດັບ ໄດອອກຊິນ ໃນຮ່າງກາຍສູງຄວນມີການບັນທຶກ ປະຫວັດກ່ຽວກັບການໄດ້ຮັບສານ ໄດອິກຊິນ /ຝົນ ເຫຼືອງຢ່າງລະອຽດ, ແລະ ເພີ່ມຄວາມພະຍາຍາມ ເພື່ອກຳນົດ ແລະ ປັດຖ່າຍ ສານ ໄດອອກຊິນ ອອກຈາກຮ່າງກາຍ.ຫາວິທີປ້ອງກັນຈາກ ແຫຼງທີ່ມາຂອງໄດອິກຊິນ/

ຝົນເຫຼືອງ: ການປ້ອງກັນ: ມາດຕະການທີ່ດີຕະການທີ່ດີທີ່ສຸດແມ່ນ ການປ້ອງກັນ ການໄດ້ຮັບ ສານໄດອິກຊິນເຂົ້າສູ່ຮ່າງກາຍດ້ວຍວິທີ:

- ຈຳກັດຂອບເຂດ ແຫຼງທີ່ມາຂອງການ ປົນ ເປື້ອນ ແລະ ຫຼຸດຜ່ອນການແຜ່ກະຈາຍ ຈາກແຫຼງດັ່ງກ່າວ

ເກັບກູ້ແລະອານະ ໄມເຂດທີ່ມີການປົນ ເປື້ອນ ຫຼື ຄວບຄຸມບໍ່ໃຫ້ຄົນ ແລະ ສັດເຂົ້າໄປ ໃນເຂດດັ່ງກ່າວ.

- ຫຼີກພືດ ປົກຄຸມບ່ອນທີ່ ທີ່ມີການປົນເປື້ອນຂອງສານ ໄດອິກຊິນເພື່ອປ້ອງກັນບໍ່ໃຫ້ສານດັ່ງກ່າວ ເຄື່ອນຍ້າຍໄປຕາມລົມ.

ສານໄດອິກຊິນ/ຝົນເຫລືອງຈະສົ່ງຜົນກະທົບຕໍ່ເດັກນ້ອຍໄດ້ແນວໃດ?

ເດັກນ້ອຍ ທີ່ສາມາດໄດ້ຮັບຜົນກະທົບຈາກສານໄດອິກຊິນເຊັ່ນດຽວກັນກັບຜູ້ໃຫຍ່. ເຖິງແນວໃດກໍ່ຕາມ, ເດັກນ້ອຍທີ່ຢູ່ໃນຊ່ວງໄວ ຈະເລີນເຕີບໂຕ ແມ່ຈະມີຜົນກະທົບສູງກວ່າເນື່ອງຈາກວ່າ: ສານໄດອິກ ຊິນ ທີ່ເຂົ້າສູ່ຮ່າງກາຍຂອງເດັກນ້ອຍ ຄິດ ໄລ່ທຽບໃສ່ ຕົ້ນຖ້ຳໜັກ ໜຶ່ງກິໂລກຣາມ ອາດຈະໄດ້ຮັບຜົນກະທົບ ຫຼາຍກວ່າຜູ້ໃຫຍ່ ເນື່ອງ ຈາກວ່າ: ເນື່ອງຈາກວ່າ ຮ່າງກາຍເດັກນ້ອຍ ມີນ້ຳໜັກໜ້ອຍກ່ວາ ຜູ້ໃຫຍ່

ເດັກນ້ອຍທີ່ດຳລົງຊີວິດ ຢູ່ໃກ້ກັບເຂດທີ່ມີການ ປົນເປື້ອນ

ເດັກນ້ອຍ ທີ່ດຳລົງຊີວິດ ຢູ່ໃກ້ກັບເຂດທີ່ມີການ ປົນເປື້ອນ ອາດຈະໄດ້ຮັບ ສານໄດອິກຊິນ ທີ່ປົນເປື້ອນຈາກການ ກິນ ຫຼື ຈາກການຈັບບາຍ ວັດຖຸສິ່ງຂອງຕ່າງໆ ໂດຍປາດສະຈາກການ ລ້າງມື.

ເດັກນ້ອຍອາດຈະໄດ້ຮັ ບສານໄດອິກຊິນ ເວລາທີ່ ຫຼີ້ນຂອງຫຼີ້ນຢູ່

ເດັກນ້ອຍອາດຈະໄດ້ຮັ ບສານເຄມີທີ່ຕິດມານ ກຳເຄື່ອງນຸ່ງ ຫຼື ປົນເປື້ອນມານຳ ສິ່ງຂອງທີ່ປົນເປື້ອນ ນຳ ສິ່ງຂອງທີ່ນຳມາ ຈາກເຂດທີ່ມີການຕົກ ຄ້າງເຂົ້າ ເຮືອນຂອງ ພວກ ເຂົາເຈົ້າ

ຄອບຄົວພວກເຮົາຈະສາມາດຫລຸດຜ່ອນຄວາມສ່ຽງຈາກສານ ໄດອິກຊິນ ໄດ້ແນວໃດ ?

ພວກເຮົາສາມາດຫລຸດຜ່ອນຄວາມສ່ຽງໄດໂດຍວິທ

ງ່າຍດາຍເຊັ່ນ: ຫຼີກລ້ຽງການກິນອາຫານ ຫຼ ສັດປ່າທີ່ ໄດ້ມາຈາກບ່ອນທີ່ມີການ ປົນເປື້ອນ

ຫ້າມບໍ່ ໃຫ້ເດັກນ້ອຍ ຫຼີ້ນຢູ່ບ່ອນທີ່ມີຝຸ່ນລະ ອອງ ຫຼື ໃກ້ກັບບ່ອນທີ່ມີການ ປົນເປື້ອນສູງ

ຫ້າມບໍ່ ໃຫ້ເດັກນ້ອຍ ກິນອາຫານທີ່ບໍ່ສະອາ ດ ແລະ ໃຫ້ພວກ ເຂົາເຈົ້າລ້າງມືໃຫ້ສະ ອາດຢູ່ສະເໝີ ໂດຍ ສະເພາະແມ່ນກ່ອນກິ ນອາຫານ

ຫຼີກລ້ຽງການນຳເອົາສິ່ ງເສດເຫຼືອທີ່ປົນເປື້ອນ ໄວ້ຢູ່ ເຮືອນ.

ເດັນນ້ອຍມີສຸຂະພາບດີ ແມ່ນສິ່ງທີ່ມີຄ່າທີ່ສຸດ ສັງຄົມ ແລະ ຄອບຄົວມີຄວາມ ເບີກບານ ມ່ວນຊື່ນ

ຖ້າຂ້ອຍໄດ້ຮັບສານໄດອິກຊິນທີ່ຢູ່ໃນປະລິມານສູງ ຂ້ອຍສາມາດລ້ຽງລູກດ້ວຍນຳນົມໄດ້ບໍ?

ທ່ານຈະຕ້ອງໄດ້ໄປປຶກສາແພດ ເຖິງແມ່ນວ່າການລ້ຽງລູດດ້ວຍນຳນົມແມ່ ແມ່ນສິ່ງທີ່ດີທີ່ສຸດກໍ່ຕາມ ທ່ານຕ້ອງຢຸດໃຫ້ນຳນົມລູກທັນທີເມື່ອກວດພົບວ່າມີ ສານໄດອິກຊິນໃນນຳນົມ ຫລືໃນເລືອດ ມີສານຳເອົາອິກຊິນ

ຖ້າຂ້ອຍໄດ້ຮັບສານໄດອິກຊິນທີ່ຢູ່ໃນລະດັບສູງ ຂ້ອຍສາມາດມີລູກໄດ້ບໍ?

ຜູ້ຍິງທີ່ໄດ້ຮັບທີ່ໄດ້ຮັບສານໄດອິກຊິນໃນປະລິມານສູງ ຄວນຈະປຶກສາແພດກ່ອນຕັດສິນໃຈ

Regional Capacity Building Program for Health Risk Management of Persistent Organic Pollutants (POPs) in South East Asia Program

WREA

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Health Risk of PCBs

About this Poster and PCBs

The Regional Capacity Building Program for Health Risk Management of Persistent Organic Pollutants (POPs) in South East Asia is for increasing the national understanding and use of risk-based approaches to manage POPs and other chemicals; and prioritize interventions to reduce local health impacts, particularly on the poor and most vulnerable.

POPs is hazardous organic compounds that are resistant to environmental degradation. They have been observed to persist in the environment, and to have potential significant impacts on human health and the environment.

What is PCBs?

Polychlorinated biphenyls(PCBs) are a group of synthetic chlorinated organic compounds that have been used extensively in a variety of industrial uses, including as dielectrics in transformers and large capacitors, as paint additives, and in plastics.

Consumer products that may contain PCBs include old fluorescent lighting fixtures, electrical devices or, old microscope oil, and old hydraulic oil.

Paint additives

How Do PCBs enter the environment?

PCBs enter the air, water, and soil during their manufacture, transport and use from:

Spills and leaks during the transport, or from transformers, capacitors, or other products containing PCBs during their storage and maintenance.

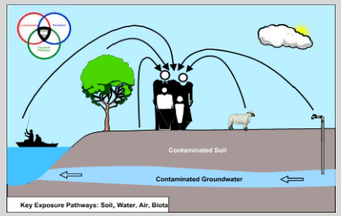
Poorly maintained hazardous waste sites that contain PCBs.

Improper dumping of PCB wastes or PCB-containing products into dumpsite not designed to handle hazardous waste.

Workplace without proper occupational safety and hygiene plan.

What happens to PCBs when they enter the environment?

- Once in the environment, PCBs can easily cycle between air, water, and soil. PCBs are taken up into the bodies of small organisms and fish in water.



•PCBs especially accumulate in fish and marine mammals. Level is highest in animals high up in the food chain.

How Do PCBs Enter the Body?

People can be exposed to PCBs from:

- •Swallowing contaminated food or soil,
- •Breathing dust or air containing PCBs;
- •
- •Absorbing PCBs through the skin.

PCBs enter their bodies primarily through the contaminated fish, meats, and milk they eat.

How do PCBs affect my Health? (1) Skin

Acute toxic effects: People exposed directly to high levels of PCBs, either via the skin, by consumption, or in the air, have experienced irritation of the nose and lungs, skin irritations such as severe acne (chloracne) and rashes, and eye problems

Chloracne

hyper pigmentation of the nails & skin

Health Effects (1) Development Effect

Structural birth defects in humans (Children with birth defects, AFP, Sat Mar 12, 2005)

Women exposed to PCBs before or during pregnancy can give birth to children with significant neurological and motor control problems, including lowered IQ and poor short-term memory.

Health Effects (1) Cancer

PCBs known to cause cancer in animals, and cause cancer in humans. Humans exposed to high levels of PCBs over their lifetimes developed liver and kidney cancer, bladder and urothelial cancers.

.

Little cancer patient (http://www.flickr.com/photos)

Medical test to determine if a person has been exposed to PCBs

Tests can measure PCB levels in the blood, fat tissue, and breast milk, but it is not yet available in country.

Hence the best management measure is to prevent/avoid from being exposed to POPs/PCBs.

Is there treatment available for PCB exposure?

At this time there is no treatment for PCB exposure.
People with high levels should increase efforts to identify and eliminate any current sources of PCB exposure :

Determine hazardous exposures , find out from what source and reduce exposure to that source.

Remove hazardous exposures or control access to it;

Contact information

For more information, please call……..

Regional Capacity Building Program for Health Risk Management of Persistent Organic Pollutants (POPs) in South East Asia Program

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How to Protect My Family and Myself From PCBs Exposure?

How to Determine and Prevent Exposure to Agent Orange Dioxin?

Identification: Tests can measure Agent Orange dioxin levels in the blood, fat tissue, and breast milk, but it remains expensive.

Treatment: At this time, there is no treatment for Agent Orange dioxin exposure. People with high levels should have a careful exposure history taken and increase efforts to identify and eliminate any current sources of Agent Orange dioxin exposure.

Prevention: The best measure is to prevent exposure to POPs/PCBs through:

Determining the **source of contamination** and **reduce exposure** to that source

Prevention and **Mitigation** measures.

Can I have baby if I have high level of Agent Orange Dioxin exposure?

Woman with high level of PCB exposure, should consult medical professional before making this decision.

Can I breast-feed if I have high level of Agent Orange Dioxin exposure?

Yes. Consult with your medical professional. Agent Orange dioxins detected in breast milk (or blood) are not necessarily an indication that breast-feeding should be stopped. The benefits of breast-feeding outweigh potential risks from low level dioxin exposure.

Is it safe to eat fish and other wild life near the site?

Preliminary fish sampling results showed elevated levels of PCBs, pesticides, and some metals from the fish samples near the site. Families can do many things to reduce the possibility of exposure to PCBs from fish and other animals:

Avoid eating fish and other animals from the site or its immediate vicinity;

For fish and animal from the site

- Select younger, smaller fish.
- Remove the skin and fatty tissue.
- Bake or broil the fish, and throw away the fatty juices and drippings.
- Avoid eating the liver and other internal organs of the fish

How can PCBs affect my children?

Children are exposed to PCBs in the same way as are adults. However, for children the potential health effects from exposures during the period from conception to maturity of age is higher due to:

Children's intake of chemical contaminants per kilogram of body weight may be greater than that of adults due to their **smaller size**.

Children living near contaminated sites may **accidentally eat** PCBs **contaminated material**, or expose themselves through not washing their hands.

Children could be exposed to PCBs following transport of the chemical on clothing or bringing contaminated oils and waste from the parent's workplace to the home.

Children may be exposed by **playing with old appliances** or playing at contaminated sites.

Infants will be exposed from eating food that contains PCBs, or born to the PCBs exposed mother.

How can families reduce the risk of exposure to PCBs?

You can reduce the risk simply by:

Avoiding **eating food or wildlife** caught from contaminated sites

Children should be **discouraged** from **playing in the dirt** in or near the hot spots sites.

Children should **not eat dirt** or dirty food, and always follow careful **hand-washing practices.**

Preventing workplace exposure to PCBs.

If you are exposed to PCBs in the workplace, don't carry contaminated clothes or contaminated products home from work.

Healthy children are most valuable asset of society and source of family happiness.

Appendix A4.2

List of Participants in Public Awareness Poster Development in Lao PDR

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Appendix A4-2

List of Participants
Hands-on Application of Public Awareness Poster Design and Development
ERI/WREA, Vientiane and Sekong, December 2 and 4, 2008

No.	Names	Organization	Position	Phone/email
1	Ms. Sisomphan Laungrath	WERI/WREA	Deputy Director General	856 – 021 219003
2	Ms. Setouvanh Phanthavongsa	EQMC, ERI	Acting Director	856- 020 7801116
3	Mr. Khonekeo Kingkhambang	Cabinet, WREA	POPs Team member	856 – 020 770 7423
4	Mr. Phongsavath Yingyong	EQMC, ERI/WREA	Technical staff	

Appendix A4.3

Public Awareness Posters for Cambodia

Regional Capacity Building Program for Health Risk Management of Persistent Organic Pollutants (POPs) in South East Asia Program

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How Do PCBs enter the environment?

PCBs enter the air, water, and soil during their manufacture, transport and use from:

Spills and leaks during the transport, or from transformers, capacitors, or other products containing PCBs during their storage and maintenance.

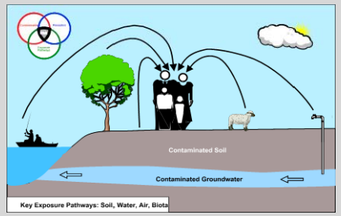
Poorly maintained hazardous waste sites that contain PCBs.

Improper dumping of PCB wastes or PCB-containing products into dumpsite not designed to handle hazardous waste.

Workplace without proper occupational safety and hygiene plan.

What happens to PCBs when they enter the environment?

- Once in the environment, PCBs can easily cycle between air, water, and soil. PCBs are taken up into the bodies of small organisms and fish in water.



•PCBs especially accumulate in fish and marine mammals. Level is highest in animals high up in the food chain.

How Do PCBs Enter the Body?

People can be exposed to PCBs from:

- •Swallowing contaminated food or soil,
- •Breathing dust or air containing PCBs;
- •Absorbing PCBs through the skin.

PCBs enter their bodies primarily through the contaminated fish, meats, and milk they eat.

How do PCBs affect my Health? (1) Skin

Acute toxic effects: People exposed directly to high levels of PCBs, either via the skin, by consumption, or in the air, have experienced irritation of the nose and lungs, skin irritations such as severe acne (chloracne) and rashes, and eye problems

Chloracne

hyper pigmentation of the nails & skin

Health Effects (1) Development Effect

Structural birth defects in humans (Children with birth defects, AFP, Sat Mar 12, 2005)

Women exposed to PCBs before or during pregnancy can give birth to children with significant neurological and motor control problems, including lowered IQ and poor short-term memory.

Health Effects (1) Cancer

PCBs known to cause cancer in animals, and cause cancer in humans. Humans exposed to high levels of PCBs over their lifetimes developed liver and kidney cancer, bladder and urothelial cancers.

.

Little cancer patient (http://www.flickr.com/photos)

Medical test to determine if a person has been exposed to PCBs

Tests can measure PCB levels in the blood, fat tissue, and breast milk, but it is not yet available in country.

Hence the best management measure is to prevent/avoid from being exposed to POPs/PCBs.

Is there treatment available for PCB exposure?

At this time there is no treatment for PCB exposure.
People with high levels should increase efforts to identify and eliminate any current sources of PCB exposure :

Determine hazardous exposures , find out from what source and reduce exposure to that source.

Remove hazardous exposures or control access to it;

Contact information

For more information, please call……..

Regional Capacity Building Program for Health Risk Management of Persistent Organic Pollutants (POPs) in South East Asia Program

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OPTIONAL LOGO HERE

How to Protect My Family and Myself From PCBs Exposure?

How to Determine and Prevent Exposure to Agent Orange Dioxin?

Identification: Tests can measure Agent Orange dioxin levels in the blood, fat tissue, and breast milk, but it remains expensive.

Treatment: At this time, there is no treatment for Agent Orange dioxin exposure. People with high levels should have a careful exposure history taken and increase efforts to identify and eliminate any current sources of Agent Orange dioxin exposure.

Prevention: The best measure is to prevent exposure to POPs/PCBs through:

Determining the **source of contamination** and **reduce exposure** to that source

Prevention and **Mitigation** measures.

Can I have baby if I have high level of Agent Orange Dioxin exposure?

Woman with high level of PCB exposure, should consult medical professional before making this decision.

Can I breast-feed if I have high level of Agent Orange Dioxin exposure?

Yes. Consult with your medical professional. Agent Orange dioxins detected in breast milk (or blood) are not necessarily an indication that breast-feeding should be stopped. The benefits of breast-feeding outweigh potential risks from low level dioxin exposure.

Is it safe to eat fish and other wild life near the site?

Preliminary fish sampling results showed elevated levels of PCBs, pesticides, and some metals from the fish samples near the site. Families can do many things to reduce the possibility of exposure to PCBs from fish and other animals:

Avoid eating fish and other animals from the site or its immediate vicinity;

For fish and animal from the site

- Select younger, smaller fish.
- Remove the skin and fatty tissue.
- Bake or broil the fish, and throw away the fatty juices and drippings.
- Avoid eating the liver and other internal organs of the fish

How can PCBs affect my children?

Children are exposed to PCBs in the same way as are adults. However, for children the potential health effects from exposures during the period from conception to maturity of age is higher due to:

Children's intake of chemical contaminants per kilogram of body weight may be greater than that of adults due to their **smaller size**.

Children living near contaminated sites may **accidentally eat** PCBs **contaminated material**, or expose themselves through not washing their hands.

Children could be exposed to PCBs following transport of the chemical on clothing or bringing contaminated oils and waste from the parent's workplace to the home.

Children may be exposed by **playing with old appliances** or playing at contaminated sites.

Infants will be exposed from eating food that contains PCBs, or born to the PCBs exposed mother.

How can families reduce the risk of exposure to PCBs?

You can reduce the risk simply by:

Avoiding **eating food or wildlife** caught from contaminated sites

Children should be **discouraged** from **playing in the dirt** in or near the hot spots sites.

Children should **not eat dirt** or dirty food, and always follow careful **hand-washing practices.**

Preventing workplace exposure to PCBs.

If you are exposed to PCBs in the workplace, don't carry contaminated clothes or contaminated products home from work.

Healthy children are most valuable asset of society and source of family happiness.

កម្មវិធីពង្រឹងសមត្ថភាពថ្នាក់តំបន់អំពីការគ្រប់គ្រងហានិភ័យផ្នែកសុខភាពនៃសារធាតុបំពុលសរីរាង្គមិនងាយបំបែកធាតុ ប្រចាំតំបន់អាស៊ីអាគ្នេយ៍

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ហានិភ័យនៃសារធាតុប៉ូលីក្លរីណេតប៊ីហ្វេនីល (PCBs) លើសុខភាព

រូបសញ្ញានៅទីនេះ

ព័ត៌មានពីកម្មវិធីគ្រប់គ្រងសារធាតុបំពុលសរីរាង្គមិនងាយបំបែកធាតុ (POPs)

កម្មវិធីពង្រឹងសមត្ថភាពថ្នាក់តំបន់អំពីការគ្រប់គ្រងហានិភ័យផ្នែកសុខភាព នៃសារធាតុបំពុលសរីរាង្គមិនងាយបំបែកធាតុ (POPs) នៅក្នុងតំបន់អាស៊ីអាគ្នេយ៍ ត្រូវបានបង្កើតឡើងដើម្បីបង្កើនឪកាសយល់ដឹងថ្នាក់ជាតិ និងការប្រើប្រាស់នូវវិធីសាស្ត្រដែលផ្តែកលើហានិភ័យ ដើម្បីគ្រប់គ្រងសារធាតុបំពុលសរីរាង្គមិនងាយបំបែកធាតុ (POPs) និង សារធាតុគីមីផ្សេងៗ ទាមទារនូវដំណាក់ចេញនូវវិធានការទប់ស្កាត់ជាអាទិភាព ដើម្បីកាត់បន្ថយផលប៉ះពាល់សុខភាពរបស់ប្រជាជន ជាពិសេសប្រជាជនក្រីក្រ និង អ្នកងាយរងគ្រោះបំផុត ។

(POPs) ជាសារធាតុសរីរាង្គមិនងាយបំបែកធាតុ ដែលបង្ក្រេះថ្នាក់ទៅលើបរិស្ថាន ។ សារធាតុទាំងនេះ ត្រូវបានគេរកឃើញមាននៅក្នុងបរិស្ថាន ដែលប៉ះពាល់យ៉ាងធ្ងន់ធ្ងរទៅលើសុខភាពមនុស្ស និង បរិស្ថាន

តើប៉ូលីក្លរីណេតប៊ីហ្វេនីល (PCBs) គឺជាអ្វី?

ប៉ូលីក្លរីណេតប៊ីហ្វេនីល (Polychlorinated biphenyls - PCBs) គឺជាបណ្តុំសារធាតុសរីរាង្គក្លរីណេត ដែលត្រូវបានគេប្រើប្រាស់យ៉ាងច្រើននៅក្នុងឧស្សាហកម្ម ប្រើជាប្រេងមិនចំលងចរន្តនិងមិនឡើងកំដៅនៅក្នុងត្រង់ស្វូរ និង កង់ដង់អគ្គិសនី (Electric transformers and capacitors) និងប្រើជាសារធាតុបន្ថែម (Additives) ក្នុងការផលិត ថ្នាំលាបពណ៌ ក្រដាសកាបូន និងផលិតផលបិទភ្ជាប់ ។

ត្រង់ស្វូរចាស់ៗ

ប្រេងមិនចំលងចរន្តនិងមិនឡើងកំដៅនៅក្នុងត្រង់ស្វូរ

ផលិតផលប្រើប្រាស់ដែលផ្ទុក PCBs រួមមាន ឧបករណ៍ប៉ិតូ-ភ្លើងចាស់ៗ ឧបករណ៍អេឡិចត្រូនិក ឬ ប្រេងម៉ូទ្រូស្កុប និងប្រេងហ៊ីដ្រូលិកដែលគេលែងប្រើជាដើម ។

សារធាតុបន្ថែម ថ្នាំលាបពណ៌

តើប៉ូលីក្លរីណេតប៊ីហ្វេនីល (PCBs) សាយភាយនៅក្នុងបរិស្ថានយ៉ាងដូចម្តេច ?

PCBs សាយភាយនៅក្នុងខ្យល់អាកាស ទឹក និង ដី នៅកំឡុងពេលនៃការផលិត ការដឹកជញ្ជូន និង ការប្រើប្រាស់របស់ពួកវា តាមរយៈ:

លំហូរ និង ការលេច នៅពេលដឹកជញ្ជូន ឬ លេចចេញពីត្រង់ស្វូរ កង់ដង់អគ្គិសនី ឬពីផលិតផលដែលផ្ទុកសារធាតុ PCBs នៅកំឡុងពេលទុកដាក់ និង ថែទាំរបស់វា ។

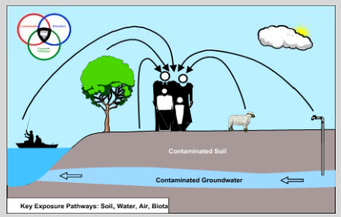
ទីកន្លែងទុកដាក់កាកសំណល់ពុល ផ្ទុកនូវសារធាតុ PCBs

ការចាក់ចោលមិនបានត្រឹមត្រូវនូវកាកសំណល់ PCBs ឬផលិតផលដែលមានផ្ទុកសារធាតុ PCBs ទៅក្នុងទីដាក់កាកសំណល់ដែលមិនមានការរៀបចំទុកដាក់អោយបានល្អ ។

ទីកន្លែងធ្វើការដែលមិនមានការរៀបចំសុវត្ថិភាព និងអនាម័យអោយបានត្រឹមត្រូវ

តើមានអ្វីខ្លះកើតឡើងនៅពេល PCBs សាយភាយនៅក្នុងបរិស្ថាន ?

- ពេលនៅក្នុងបរិស្ថាន PCBs អាចផ្ទាស់ទីជាខ្លះបន្តិចម្តងៗ ងាយស្រួលនៅក្នុងខ្យល់ ទឹក និងដី ។ PCBs អាចជ្រៀតចូលទៅក្នុងខ្លួននៃអង្គធាតុតូចៗ និងត្រីនៅក្នុងទឹកជាដើម ។



- PCBs ប្រមូលផ្ចុំជាពិសេសនៅក្នុងត្រីនិងថនិកសត្វដែលរស់នៅក្នុងទឹក ។ វាមានកំរិតខ្ពស់បំផុតនៅក្នុងសត្វដែលស្ថិតនៅក្នុងចង្វាក់ផលិតកម្មអាហារ ។

តើ PCBs ចូលនៅក្នុងខ្លួនមនុស្សតាមរយៈវៀចណា?

មនុស្សអាចប្រឈមមុខទៅនឹងសារធាតុ PCBs តាមរយៈ

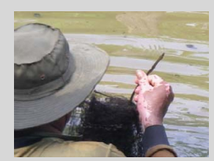
- ទទួលទានអាហារ ឬ ផ្ទៃដីដែលមានសារធាតុ PCBs
- ដកដង្ហើមនឹងខ្យល់ ឬ ស្រូបចូលដីដែលមានសារធាតុ PCBs
- ការជ្រៀតចូលទៅក្នុងខ្លួនមនុស្ស តាមរយៈស្បែក

សារធាតុ PCBs អាចចូលទៅក្នុងខ្លួនមនុស្ស តាមរយៈការទទួលទាន ត្រី សាច់ និង ទឹកដោះគោដែលមិនមានអនាម័យល្អ

តើសារធាតុ PCBs ប៉ះពាល់សុខភាពរបស់ខ្លួយយ៉ាងណា? (១) ស្បែក

ផលប៉ះពាល់ជាពិពុលដ៏ធ្ងន់ធ្ងរ : មនុស្សដែលប្រឈមមុខដោយផ្ទាល់ទៅនឹងកំរិតខ្ពស់នៃសារធាតុ PCBs អាចឆ្លងតាម ៣: ស្បែក ការប្រើប្រាស់ ឬបរិយាកាស ដែលមានអាការៈ រលាកច្រមុះ រលាកសួត និងរលាកស្បែក ដូចជាមានមុនៅលើស្បែកយ៉ាងធ្ងន់ធ្ងរ (មុនខ្ទុះ - chloracne) ក្អួលរមាស់ និងមានបញ្ហានៅលើក្រិកជាដើម ។

មុនខ្ទុះ



រោគពណ្ណរាយនៅលើស្បែកនិងក្រចកយ៉ាងធ្ងន់ធ្ងរ

ផលប៉ះពាល់ផ្នែកសុខភាព (១) ផលប៉ះពាល់លើការចិចណ្តាំនៃសរសៃកោសិកាតម្រងតាម

ភាពទន់ខ្សោយនៃកំណើតសារពាង្គកាយរបស់មនុស្ស
ក្មេងក្មេងមានរាងកាយមិនអីរឹងមាំពីកំណើត (AFP Sat Mar 12, 2005)

ស្ត្រីដែលប្រឈមមុខទៅនឹងសារធាតុ PCBs មុនពេល ឬកំឡុងពេលមានផ្ទៃពោះ អាចសំរាលកូនដែលនឹងមានបញ្ហាធ្ងន់ធ្ងរលើប្រព័ន្ធប្រសាទ និងប្រព័ន្ធគ្រប់គ្រងរាងកាយ ដូចជា បញ្ហាទាប និង ការចងចាំខ្សោយ

ការប៉ះពាល់ទៅលើសុខភាព (១) ជំងឺមហារីក

PCBs ត្រូវបានគេដឹងថា ជាអ្នកបង្កជំងឺមហារីកនៅក្នុងសត្វពាហនៈ និងនៅក្នុងខ្លួនមនុស្ស ។ មនុស្សជាអ្នកប្រឈមខ្ពស់ទៅនឹងសារធាតុ PCBs នៅក្នុងជីវិតរស់នៅរបស់ពួកគេ ដែលវាអាចបង្ករអោយមាន ជំងឺមហារីកថ្នើម ក្រលៀន ប្លោកនោម និងតំរងនោម ។

អ្នកជំងឺមហារីកក្មេងៗ
(http://www.flickr.com/photos)

ការកំណត់ត្រូវផ្នែកចិញ្ចស្រាស្ត្រដើម្បីកំណត់ថ្នាក់ដឺកនៃមនុស្សម្នាក់ៗប្រឈមទៅនឹងសារធាតុ PCBs

ការពិនិត្យអាចធ្វើឡើងដើម្បីវាស់កំរិតសារធាតុ PCBs នៅក្នុងឈាម ទឹកដោះ ប៉ុន្តែការពិនិត្យនេះមិនទាន់មាននៅក្នុងប្រទេសនៅឡើយ ។

ជ្ជូនដំណឹងការណ៍ត្រប់ត្រងដ៏ណាស់ជ្រៅ ជ្ជៀសវាង កុំអោយប្រឈមមុខទៅនឹងសារធាតុ POPs/PCBs ទាំងនោះ ។

តើមានការព្យាបាលមិនបានរួមតែជ្រើសរើសប្រឈមនឹងសារធាតុ PCB ដែរឬទេ ?

នាពេលបច្ចុប្បន្ន មិនមានការព្យាបាលលើការប្រឈមនឹងសារធាតុ PCB នេះទេ ។ អ្នកដែលមានការប្រឈមខ្ពស់ គួរតែបង្កើនកិច្ចប្រើងប្រែង ដើម្បីកំណត់និងបំបាត់ចោលនូវប្រភពដែលប្រឈមទៅនឹងសារធាតុ PCB ទាំងនោះ

កំណត់អោយបាននូវការប្រឈមដ៏ធ្រោះថ្នាក់
រកអោយឃើញនូវប្រភពរបស់វា
និងកាត់បន្ថយការប្រឈមទៅនឹងប្រភពទាំងនោះ

ជ្ជៀសចេញពីការប្រឈមទៅនឹងសារធាតុដ៏ធ្រោះថ្នាក់
ឬគ្រប់គ្រងការចូលទៅជិតនឹង សារធាតុទាំងនោះ

ពត៌មានបន្ថែម

សំរាប់ពត៌មានបន្ថែម សូមទំនាក់ទំនង .....

កម្មវិធីពង្រឹងសមត្ថភាពថ្នាក់តំបន់អំពីការគ្រប់គ្រងហានិភ័យផ្នែកសុខភាពនៃសារធាតុបំពុលសរីរាង្គមិនងាយបំបែកធាតុ ប្រចាំតំបន់អាស៊ីអាគ្នេយ៍

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តើត្រូវការការគ្រួសារនិងខ្លួនរបស់ខ្ញុំពីការប្រឈមនឹងសារធាតុ PCB ដោយវិធីណា?

រូបសញ្ញា នៅទីនេះ

តើត្រូវកំណត់និងបង្ការការប្រឈមនឹងសារធាតុពុលអុកស៊ីតកណ្តាលក្នុងដោយវិធីណា?

ការកំណត់: ការពិនិត្យអាចវាស់កំរិតសារធាតុឌីអុកស៊ីនណាមីកក្រូចនៅក្នុងឈាម ជាលិកាខ្លាញ់ ទឹកដោះ ប៉ុន្តែវាមានតំលៃថ្លៃ ។

ការព្យាបាល: នាពេលបច្ចុប្បន្ន មិនមានការព្យាបាលការប្រឈមនឹងសារធាតុឌីអុកស៊ីនណាមីកក្រូច នេះទេ ។ អ្នកដែលមានការប្រឈមខ្ពស់គួរតែមានការយកចិត្តទុកដាក់ចំពោះការប្រឈម និងបង្កើនការប្រើប្រាស់ដើម្បីកំណត់នឹងបំបាត់ចោលនូវប្រភពសារធាតុឌីអុកស៊ីនណាមីកក្រូចនេះ ។

ការគេចម៉ស្ការ: វិធានការណ៍ដំណូលបំផុត គឺត្រូវទប់ស្កាត់ការប្រឈមនឹងសារធាតុ POPs/PCBs តាមរយៈ:

កំណត់នូវប្រភពចម្លងរោគ និងកាត់បន្ថយការប្រឈមទៅនឹងប្រភពនោះ

វិធានការទប់ស្កាត់និងកាត់បន្ថយ

តើខ្ញុំអាចមានកូនដំណើរ៉ែន ប្រសិនបើខ្ញុំមានការប្រឈមខ្ពស់ទៅនឹងសារធាតុឌីអុកស៊ីនណាមីកក្រូច?

ស្ត្រីដែលមានការប្រឈមខ្ពស់ទៅនឹងសារធាតុឌីអុកស៊ីនណាមីកក្រូច គួរតែពិគ្រោះយោបល់ជាមួយ គ្រូពេទ្យជំនាញ មុនមានធ្វើការសំរេចចិត្ត

តើខ្ញុំអាចមមាំដោះជ៉ះតានរ៉ែន ប្រសិនបើខ្ញុំមានការប្រឈមខ្ពស់ទៅនឹងសារធាតុឌីអុកស៊ីនណាមីកក្រូច?

អ្នកអាចបំបៅដោះបាន ។

ពិគ្រោះយោបល់ជាមួយគ្រូពេទ្យជំនាញរបស់អ្នក ។

សារធាតុឌីអុកស៊ីនណាមីកក្រូចដែលមានក្នុងទឹកដោះ ឬឈាម មិនមែនជាកត្តាចាំបាច់ដែលត្រូវបញ្ឈប់ការបំបៅដោះនោះទេ ។

តើធនធូលធានសាច់ត្រីនិងសត្វទំនាំដែលនេះកែប្រតំបន់សារធាតុពុល មានសុវត្ថិភាពដំណើរ៉ែន?

លទ្ធផលសំណាកត្រីជាបឋម បង្ហាញអោយឃើញថាសំណាកត្រីដែលចិញ្ចឹមនៅកែ្ករតំបន់សារធាតុពុល មានកំរិតកើនឡើងនៃ ារធាតុ PCBs ថ្នាំសំលាប់សត្វល្អិត និងលោហធាតុ

ជៀសវាងការទទួលទានសាច់ត្រីឬសាច់សត្វពីតំបន់ដែលមានសារធាតុពុល ឬតំបន់ដែលនៅជិត

ចំពោះត្រីនិងសត្វពាហនៈពីតំបន់ដែលមានជាតិពុល

- ជ្រើសរើសកូនត្រី និងត្រីតូចៗ
- យកស្រកា ស្បែក និង ជាលិកាខ្លាញ់ចេញ
- ដុត ឬ អាំងត្រី អោយអស់ទឹកនិងខ្លាញ់
- ជៀសវាងការទទួលទានថ្នើម និងគ្រឿងក្នុងផ្សេងៗរបស់ត្រី

តើសារធាតុ PCBs អាចម៉ះពាល់ក្មេងរបស់ខ្ញុំយ៉ាងណា?

កុមារប្រឈមទៅនឹងសារធាតុ PCBs ដូចគ្នាទៅនឹងមនុស្សធំដែរ ។ ទោះបីជាយ៉ាងណាក៏ដោយ វាមានកំរិតខ្ពស់ជាង ចំពោះផលប៉ះពាល់លើសុខភាពជាសក្តានុពល មានចាប់តាំងពីការចាប់កំណើតរហូតដល់វ័យចំណាស់

ការទទួលទានអាហារដែលមានសារធាតុគីមីក្នុងមួយគីឡូក្រាមនៃទំងន់ខ្លួនរបស់កុមារ អាចមានទំហំធំជាងនៃមនុស្សជំនង់ ដោយសារតែ**ទំហំខ្លួនតូចជាងរបស់ពួកគេ**

កុមាររស់នៅកែ្ករតំបន់ដែលមានសារធាតុពុល អាច**ទទួលទាន**របស់ដែលផ្ទុកសារធាតុ PCBs **ដោយងែងៗ** ឬអាចប្រឈមដោយខ្លួនពួកគេផ្ទាល់តាមរយៈការមិនបានលាងដៃអោយបានស្អាត

កុមារអាចប្រឈមនឹងសារធាតុ PCBs ដោយសារការជញ្ជូន សារធាតុគីមីដែលប្រឡាក់និងសំលៀកបំពាក់ ឬ ការយកប្រេងនិង កាកសំណល់កម្ទាក់ពីកន្លែងធ្វើការ មកកាន់ផ្ទះរបស់ឪពុកម្តាយពួកគេ

កុមារអាចប្រឈមនឹងសារធាតុទាំងនោះដោយ**ការលេងនិងសំភារៈចាស់ៗ** ឬលេងនៅក្នុងតំបន់ដែលកម្ទាក់

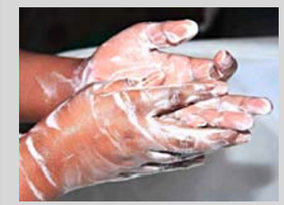
កុមារនឹងប្រឈមសារធាតុពុលដោយសារការទទួលទានអាហារដែលមានសារធាតុ PCBs ឬដោយសារការចាប់កំណើតពីម្តាយដែលប្រឈមនឹងសារធាតុ PCBs

តើគ្រួសារអាចកាត់បន្ថយហានិភ័យប្រឈមនឹងសារធាតុ PCBs ដោយវិធីណា?

អ្នកអាចកាត់បន្ថយហានិភ័យយ៉ាងសាមញ្ញតាមរយៈ:

ជៀសវាងការទទួលទានអាហារ ឬ សត្វត្រៃ ដែលចាប់បានពីតំបន់ដែលមានជាតិពុល

កុមារគួរតែត្រូវបានគេហាមកុំអោយលេងនឹងភក់ ឬ លេងនៅកែ្ករតំបន់ដែលមានជាតិពុលច្រើន



កុមារមិនគួរ**ទទួលទានធ្យូ** ឬអាហារ កង្វក់ ហើយគួរតែ**អនុវត្តលាងដៃដោយយកចិត្តទុកដាក់**

បង្ការកន្លែងធ្វើការកុំអោយប្រឈមទៅនឹងសារធាតុ PCBs

ប្រសិនបើអ្នកប្រឈមទៅនឹងសារធាតុ PCBs នៅកន្លែងធ្វើការ អ្នកមិនត្រូវបិទភ្ជាប់សំលៀកបំពាក់កម្ទាក់ ឬ យកផ្ទះលិតផ្ទះលកម្ទាក់ពីកន្លែងធ្វើការទៅផ្ទះ

កុមារមានសុខភាពល្អគឺជាទ្រព្យដ៏មានតំលៃបំផុតរបស់សង្គមនិងជាប្រភពនៃសុភមង្គលរបស់គ្រួសារ

Appendix A4.4

List of Participants in Public Awareness Poster Development in Cambodia

Hatfield CONSULTANTS

Canadian International Development Agency | Agence canadienne de développement international

Appendix A4.4

List of Participants
Hands-On Application in Public Awareness Poster Design and Development

Phnom Penh, Cambodia, December 10 and 11, 2009

No.	Names	Organization	Phone
1	Mr. Roath Sith	National Consultant, Project Team	+855 (0) 11 956831, (0) 17362874 roathsith@gmail.com
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3	Mr. Chhek Roth	Deputy Chief, Office of Laboratory, MOE	+ 855 - 012 929150
4	Mr. Chap Yuthy	Vice Chief of Water and Soil Quality Management Office	+855 12 940 279
5	Mr. Chin Sothun	Vice Chief of Office, Solid Waste and Hazardous Substance Management Office	+ 855 11 959 876
6	Mr. Sarun Sambo	Chief of Office, Solid Waste and Hazardous Substance Management Office, and Manager of Mercury Management Project	+855 12 869637

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