6.0 PATH FORWARD TO RISK MANAGEMENT

From the risk assessment, the site can be placed into one of five categories of risk management priority, namely:

- Level A – action is required;
- Level B - action likely required;
- Level C - action may potentially be required;
- Level N - remedial action not needed; and
- Level I - insufficient data.

It is challenging to categorize a contaminated site based only on a screening level risk assessment. The risk assessment performed as part of this case-study only examined a specific group of contaminants (i.e., POPS, not non-POPS or metals for example) and was based on a limited number of samples. However, for training purposes, it may be reasonable to categorize the SEDCW site as a **Level B - actions likely required.**

The SEDCW Case Study site is a concern because of:

- The preliminary quantitative risk assessment suggested that the human health risk level is high, and the concentration of PCBs in the environment samples;
- Risk was expected to evolve with time if proper risk management actions are not undertaken now. The greatest concern was for health of the workers, families and local ecology, as oil leakage from rusted transformer increasingly release into the environment;
- The potential risk also increases with rapid population growth, and land use changes occurring in the area; and
- Responsibility/liability that it might pose to the owners (e.g. cost of remediation, reputation and relation with community, and affected parties such as workers at the site, nearby property owners.

6.1 EXISTING MANAGEMENT PLAN

Risk management for contaminated sites is a balancing act of many diverse factors such as social, economic, political, legal, technical, and scientific issues. Any remediation strategy should comply with legal/regulatory obligations, address public/stakeholder concerns and suggestions, and ensure auditing and monitoring mechanisms are included.

It is understood that there are currently no specific actions undertaken by the concerned authority to mitigate potential PCB exposure at the site. At the National Training Workshop which took place in Siem Reap, Cambodia from January 19th to 21st, 2009, the national participants used the case study for developing risk management goals, sub-goals (objectives), and indicators. The Workshop participants also reviewed the proposed long-list and short-list of management options for the site (using the POPs toolkit). During the risk management group discussion and plenary session, the Workshop discussed the following key topics:

- Setting Risk Reduction Goals for the Site;
- Reviewing Proposed Management Measures; and
- Costing Preferred RM Options.

The national participants concluded that:

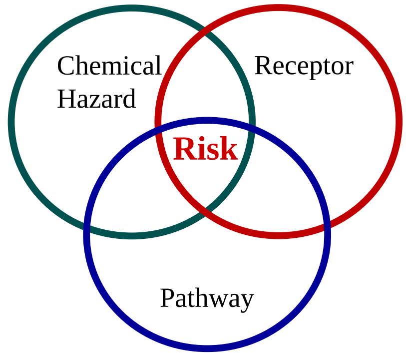
- Risk is expected to evolve with time if proper risk management actions are not undertaken now. The greatest concern is for health of the workers, families and local ecology. Without treatment and proper prevention, contaminated substance releases into the environment are expected to increase. The potential risk also increases with rapid population growth, and land use changes occurring in the area; and
- Given the limited resources, the risk management options should focus primarily on eliminating the pathways connecting the chemical hazards to the receptors.

The following section provides the key recommendations for the risk management of the SEDCW site.

6.2 SETTING RISK REDUCTION GOALS FOR THE SITE

From the risk assessment above, it is clear that all three elements needed for a human health risk (from PCBs), are present at the site: chemical hazards, receptors and pathways linking hazard and receptors. Consequently, goals, sub-goals (objectives), and indicators have to be developed by taking into account the need to address three elements of risk – hazard, pathway and receptors.

Figure 6.1 Risk and its major components at SEDCW study site.



6.2.1 Goals

The SEDCW case study site mitigation strategy must help to contribute to the achievement of the overall national poverty eradication strategy for Cambodia. It is apparent that any disabilities or premature deaths of the principal income-earners and other family members, as well the loss of other sources of food and income (salary and potential devaluation of property), will impact the ability of the country to meet its goal of poverty eradication.

The five to ten-year goals for the site should be to support the site management and surrounding community for:

1. More effective reduction in health risks to sensitive groups of people arising from PCB contamination through primarily eliminating the pathways; and
2. Avoiding or, when avoidance is not feasible, minimizing uncontrolled releases of PCB hazardous materials or accidents (including explosions and fires) during their handling, storage and use (i.e., addressing chemical hazards and pathways).

6.2.2 Sub-goals and Indicators

The SEDCW site's mitigation plan should contain the following sub-goals, which help to reduce human health risk from PCBs and avoid and minimize the uncontrolled release of PCBs.

Sub-goals associated with **Goal one** (to reduce health risks to sensitive groups of people arising from PCB contamination):

- Sub-goal 1-1: To minimize health risks of workers in the transformer repair workshop and their families;

- Sub-goal 1-2: To minimize health risks of residents living within 1km radius of the SEDCW site; and
- Sub-goal 1-3: To minimize health risks of workers and trainers working elsewhere on the EDC compound.

Sub-goals associated with **Goal two** (to avoid or, when avoidance is not feasible, minimize uncontrolled releases of PCB hazardous materials or accidents during their handling, storage and use).

- Sub-goal 2-1: To establish hazardous materials management action plans to address potential chemical hazards, exposure pathways and potential receptors identified through human health risk assessment;
- Sub-goal 2-2: Where practical, to avoid or minimize the use of hazardous materials (for example, replacing PCBs in electrical equipment by non-PCB substitutes and/or employing measures to prevent PCB contamination of non-PCB oils and equipment);
- Sub-goal 2-3: To prevent uncontrolled releases of PCBs and other hazardous chemicals to the environment or uncontrolled reactions that might result in fire or explosion; and
- Sub-goal 2-4: To implement management controls (procedures, inspections, communications, training, and drills) to address residual risks that have not been (or cannot be) prevented or controlled through appropriate risk management measures.

6.2.3 Proposed Indicators

Once sub-goals (objectives) are set, the indicators are developed to help the concerned managers to assess the progress and success of the site mitigation strategic plan and project (Table 6.1).

Table 6.1 Goals, sub-goals and indicators for the SEDCW study site, Phnom Penh, Cambodia.

Goal 1	Sub goals		Indicator
To reduce health risks to sensitive groups of people arising from PCB contamination	1.1	To minimize health risk of workers working in the SEDCW site	By year 2012, reduce daily exposure to PCBs to the lowest acceptable level (i.e., HQ<0.2) <u>or</u> monitor success of implementing specific risk management approaches (to be determined).
	1.2	To minimize health risks of residents living within 1km radius of the SEDCW site.	By year 2012, reduce daily exposure to PCBs to the lowest acceptable level (i.e., HQ<0.2) <u>or</u> monitor success of implementing specific risk management approaches (to be determined).
	1.3.	To minimize health risks of workers and trainers working elsewhere on the EDC compound.	By 2012, reduce daily exposure to PCBs to the lowest acceptable level (i.e., HQ<0.2) <u>or</u> monitor success of implementing specific risk management approaches (to be determined).

Table 6.1 Cont'd.

Goal 2	Sub goals	Indicator
To avoid or, when avoidance is not feasible, minimize uncontrolled releases of PCB hazardous materials or accidents (including explosion and fire) during their handling, storage and use.	2.1. To establish hazardous materials management action plans to address potential chemical hazards, exposure pathways and potential receptors identified through human health risk assessment.	By year 2012, the national hazardous materials management priorities plan is in place and effectively enforced.
	2.2. Where practical, to avoid or minimize the use of hazardous materials (for example, replacing PCBs in electrical equipment by non-PCB substitutes and/or employing measures to prevent PCB contamination of non-PCB oils and equipment);	By year 2012, PCB oil or PCB contaminated oils are no longer in use in all transformers and capacitors.
	2.3. To prevent uncontrolled releases of PCBs and other hazardous chemicals to the environment or uncontrolled reactions that might result in fire or explosion.	By 2012, proper containment facilities are in place and properly operated and maintained.
	2.4. To Implement management controls (procedures, inspections, communications, training, and drills) to address residual risks that have not been (or cannot be) prevented or controlled through appropriate risk management measures.	By 2012, management control activities – procedures, inspections, communication, training and drills – are conducted regularly.

6.3 PROPOSED MANAGEMENT MEASURES

There are numerous technical approaches and policy instruments that can be used to reduce risks. In most cases, there will be more than one way to achieve a particular risk reduction goal. A combination of several different approaches may end up being the most effective to manage unacceptable risks at contaminated sites. For example, a voluntary agreement may need to be underpinned by regulation. Hence the risk management approaches for the SEDCW site can include regulatory controls, engineering options, economic instruments, codes of practice (and technical standards), information programs (and other government initiatives), and voluntary initiatives.

Table 6.2 below shows the Risk Management Options retained from the qualitative screening. During the qualitative screening, each management option is weighed against various **balancing factors**. Balancing factors may include: i) Effectiveness; ii) Long term Reliability; iii) Ease of Implementation; iv) Implementation risk; and v) Cost (cost for implementation, and cost for operation and maintenance).

Table 6.2 Risk Management Options retained from the qualitative screening, SEDCW Site, Phnom Penh, Cambodia.

Intervention types		Balancing Factors					Short listing
Technology	**Process Options**	**Effectiveness**	**Long term reliability**	**Implement-ability**	**Associated Risk**	**Cost**	**Preferred Level**
Work place safety regulation	Define & implement permitted maintenance requirements	High	High	Medium	Low	Low	Low
	Provide protection equipment, first aids & sanitary facilities (with special emphasis on internal compliance and enforcement on the use of PPE.)	High	High	Medium	Low	Medium	High
	Provide proper work environment & shower stations	High	High	Medium	Low	Medium	High
Control on entries	Define & strictly enforce hot work spaces (cautionary signs and enforcement)	High	High	High	Low	Medium	High
Control hunting	Discourage hunting & fishing in or near hot spot	High	High	Challenging but doable	Low	Low	Low
	Educate on safe cooking & eating habits	High	High	Challenging	Low	Low	Low
Monitoring	Record & verify effectiveness of safety regulations	High	High	Medium	Low	Medium	High
	Investigate exposure incidents	High	High	Medium	Low	Medium	Medium
Training & communication	Prepare staff to recognize and respond to PCB hazards	High	High	High	Low	Medium	High
Poster & meeting	Raise awareness about PCB effects, and how to manage them	High	High	High	Low	Medium	High

Table 6.2 Cont'd.

Intervention types		Balancing Factors					Short listing
Technology	**Process Options**	**Effectiveness**	**Long term reliability**	**Implement-ability**	**Associated Risk**	**Cost**	**Preferred Level**
Mass media		High	High	Doable	Low	Medium	Medium
In situ storage	Store PCBs/ transformers in separate containment facilities	High – reduce chance, but contamination	Medium	Easy	Medium	High	High to medium
Decontaminatio n	Replace PCB oil by non-PCB substitutes	High	High	Technically challenging	High	Medium	High
	Destroy transformers, recycle metallic components	High	High	Very challenging	High	High	Low
Release prevention	Spill control, prevention & countermeasure procedures	High	High	Moderately easy	Low	Medium	Medium
Incineration *ex situ*	PCB oils and waste wrapped, transported and destroyed ex situ	High	High	Very challenging	Medium	Very high	Medium
Dust/ run-off control	Capping surface & controlling contaminant from getting into drainage or stream	High	High	Moderately easy	Medium	High	Medium
Hazard waste landfill	Dispose soils/waste in permitted landfills	Medium	High	Impossible, due to lack of such facility in country	High	Medium	Low
Solid waste landfill	Dispose soils/waste in permitted landfills	High	High	---"----	---"----	Medium	Low
Demolition waste landfill	Dispose soils/waste in permitted landfills	High	High	---"----	---"----	Low	Low
Governance	Strengthen and support existing coordination unit to implement NIP	High	High	Challenging	Medium	High	High
	Law and regulation controlling PCBs.	High	High	Challenging but doable	Medium	Medium	High

6.4 RECOMMENDING RISK MANAGEMENT ALTERNATIVES

The following are the key risk management alternatives recommended by the participants of the National Training Workshop (Siem Reap, Cambodia, 19-21 January 2009):

1. Develop and enforce an occupational health and safety plan:

   1.1 Introduce preventive and protective measures (provide and enforce the use of specific personal protection equipment (PPE), first aid and sanitary facilities in workplace);

   1.2. Develop and enforce safe operating and materials handling procedures, safe work practices, basic emergency and decontamination procedures;

   1.3. Create a hazard communication and training program to prepare workers and other EDC center staff to recognize and respond to workplace PCBs and other chemical hazards;

   1.4. Ensure integrity of workplace improvements (surface, structures and installations; facilities for showering and changing into and out of street and work clothes; and clean eating areas); and

   1.5. Define and enforce "restricted entry" into contaminated areas without proper protection or authorization.

2. Monitor and verify effectiveness of mitigation strategies:

   2.1 Regular inspection and testing of all safety features and hazard control measures, including the use and condition of personal protective equipment;

   2.2. Periodic monitoring of environment and human health conditions at the site; and

   2.3 Investigate and report occupational accidents (injuries and near misses) and dangerous occurrences and incidents (occupational disease).

3. Hazard Communication and Training:

   3.1. Provide Training - basic PCB hazard awareness, site specific hazards, safe work practices, emergency procedures, and prevention/mitigation measures;

   3.2. Help SEDCW conduct training and working sessions on PCBs risk management – support the development and implementation of health and safety plans, risk management plans for the site, and health and environmental monitoring for the staff and the site;

3.3. Raise awareness of PCBs impacts, and how to manage them among the local community, other key government institutions and private sectors dealing with potential POPs issues; and

3.4. Communicate hazards through labeling and Color Codes.

4. Measures for Controlling PCB Hazards:

   4.1. Build a secured containment facility to safely store contaminated transformers and oils on site;

   4.2. Conduct test-based inventory of PCB contaminated equipment and oils;

   4.3. Move and store PCB contaminated equipment and oils in a separate containment facility for controlling accidental release into critical environment; and

   4.4. Provide proper area signage following proper standards, signage should be easy to understand, and label equipment, containers and piping systems.

5. Capping the hot spot surface to control erosion of soil surfaces in the hot spot by rain and wind erosion and off-site transport.

6. Governance – strengthen inter-ministerial coordination unit for POPs, and adopt/enforce law & regulation controlling the use, storage and disposal of PCBs and contaminated equipment/waste.

Given the limited resources and competing priorities, the risk management for the site should focus primarily on a clusters of simple and implementable risk management options for the site - Simple options can be implemented easily, and more detailed clean-up operations follow later. Primary focus should be on the elimination of the pathway that connects chemical hazards to the receptors and change in human behavior. Experiences from other countries show that the change in human behavior changes remarkably the risk level. Hence, the emphasis of the risk management should be on capacity building, public awareness and putting in place and enforcing health and safety plan and other emergence prevention and control procedures.

6.5 IMPLEMENTATION PLANNING

The detailed Risk Management action plan must include implementation plans by addressing:

How – Under what legal mandate will the activity(ies) be undertaken and with what resources?

When – Realistic timeframe for the actions; and key milestones?

By whom – Ministry, agency, or stakeholder groups to be involved?

Potential funding – Government, POPs Trust Fund, International Organizations, other NGOs, and Charity.

The detailed Risk Management action plan must include indicators of success for each action chosen, for instance:

- Similar to most developing countries, monitoring and evaluation remains the weakest link in the whole Risk Management process. Hence, it is very important to monitor and evaluate the implementation of management measures – activities and tasks - to check any deviation from the plans and the reasons for this.

- An evaluation on their effectiveness as measured against the baseline situation and in light of the risk reduction goal; whether the current strategy/options should be continued, and if not, recommendations for additional measures.

- The results from monitoring and evaluation should be communicated to stakeholders as part of a public accountability process.

6.6 RISK COMMUNICATION

Risk Communication is an important part of the risk management framework. Its main purpose is to:

1. Sensitize and mainstream identified POPs health risk management (RM) options into national political agendas and national development planning; and

2. Foster national political support and securing financial commitments to ensure their effectiveness and sustainability.

Risk communication is needed to address the following major challenges (Hatfield 2008):

- To explain the concept of probability;

- To explain the difference between risk (context dependent) and hazard (property bound);

- To deal with cancer and other illnesses that trigger additional fears and concerns;

- To cope with long-term effects;

- To improve literacy in risk-based thinking, including the development of priority lists;
- To provide an understanding of synergistic effects with other lifestyle factors;
- To address the problem of remaining uncertainties;
- To improve the credibility of the agencies and institutions that provide risk information (which is crucial in situations in which personal experience is lacking and people depend on neutral and disinterested information);
- To cope with the diversity of stakeholders and parties in the risk management phase; and
- To cope with inter-cultural differences within pluralist societies and between different nations and cultures.

Some suggested approaches for conveying results of risk assessment to policy makers:

- Demonstrate linkage between POPs human health risk affects and the government's strategy for poverty alleviation; and
- Show cost-benefit (economic, social and political cost and benefit) of human health risk management.

The policy makers responsible for the governance of environmental and human health risks often have to make decisions within the context of uncertainty. They must balance risks and err on the side of precaution. They require clear-cut answers to questions of risk so they can create a solid platform on which to base a decision (Hatfield 2008).

Some suggested approaches for conveying results of risk assessment to workers and near-by community include: training, meeting and poster sessions focusing on making them recognize and respond to workplace PCBs and other chemical hazards. Topics could include the following: What are PCBs? How do PCBs enter the environment? What happens to PCBs when they enter the environment? How do PCBs enter the human body? How do PCBs affect human health? How can PCBs affect my children and family? How can my family reduce the risk of exposure to PCBs?