

7.0 SUMMARY

This report presents the results of a screening level risk assessment for human health associated with exposure of persistent organic pollutants. The report is part of the *Regional Capacity Building Program for Health Risk Management of Persistent Organic Pollutants (POPs) in South East Asia* (POPs Project). The risk assessment has been performed on a case study site, the Air Hitam Sanitary Landfill, Selangor, Malaysia (AHSL). In support of the capacity building program and the present risk assessment, the following major activities were performed:

- A. Technical seminar and environmental samples collection at the Air Hitam Sanitary Landfill (AHSL), Malaysia from August 16 - 22, 2008 :
 - **A Stakeholders Meeting:** - National Focal Points (NRE), Senior Management of Key Government Agencies, World Wide Landfills and National Consultants to discuss the POPs project, including the training program and stakeholder identification and the goal of the field program;
 - **A Training Seminar** on sample collection, sample handling and analysis followed by the hands-on demonstration at the study sites for the government officials;
 - **A Site Reconnaissance:** to select and map potential sampling locations, to discuss the sampling plan and to liaise with local stakeholders (site management and local community members);
 - **Fieldwork:** to collect environmental and biological samples with the support of NCs, NRE personnels and LESTARI/UKM students; and
 - **Fieldwork Demobilization:** to (a) prepare samples for shipping (i.e., sample labeling, storage, shipping and the completion of export formalities), (b) complete and archive important documents (i.e., chain of custody forms, survey and field forms, and (c) properly clean/decontaminate and store field equipment.

- B. Selection by NRE in consultation with major stakeholders of AHSL as POPs case study site. 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, and (ii) the proximity of residential developments adjacent to the closed landfill.

- C. Site investigation completed by Hatfield on August 21st, 2008, with chemical analyses of samples subsequently provided by Hiyoshi on October 4th, 2008 and Axys on January 13th, 2009.
- D. Completion by Hatfield of initial draft screening human health risk assessment was presented and discussed at the POPs Toolkit consultation/training meeting organized by NRE and LESTARI on December 1st and 2nd, 2008, and further rounds of consultation/collaboration with NRE and National Consultants thereafter, to incorporate site-specific information on various exposure assumptions and site practices.
- E. Provision of a risk assessment training workshop (January 22nd-23rd, 2009) given by Hatfield and WB to Malaysians, with specific discussion of the present AHSL case study.

Key results from the risk assessment of AHSL case study are:

1. Problem Formulation

- The problem formulation indicated that all the components required for a human health risk were present: chemical hazards, receptors and pathways linking the hazards and receptors.
- The chemical hazards identified were PCDD/Fs and PCBs. These chemicals were measured at concentrations marginally greater (up to 3.3 times) than the applicable USEPA environmental quality guidelines.
- The receptors identified at the site were both ecological receptors (fish and terrestrial animals) and humans (workers and residents of local homes).
- Key exposure pathways identified were associated with leachate treatment pond effluent and the sludge material that collects at the edges of the leachate treatment pond. Contaminants in the treatment pond may be subject to the following exposure scenarios
 1. workers may come into contact with contaminants during handling of dried leachate sludge;
 2. dried sludge may be subject to wind erosion, followed by exposure to workers and local residents; and
 3. discharges of effluent from the leachate treatment pond may contain contaminants that accumulate in the aquatic food chain, people eating local fish may be exposed to unacceptable concentrations of contaminants.

2. Exposure Assessment

- The risk assessment model indicated that exposure to contaminated fish might be the predominant route of exposure for PCBs. However, low resolution chemical analysis was conducted on the fish tissue samples and PCB concentrations in tissue were below the analytical detection limit. Consequently the method detection limit, a large concentration, was used in the calculation of total PCB exposure.
- The fish tissue analysis conducted did not include PCDD/Fs, consequently an estimation of dietary exposure for these contaminants could not be made.

3. Hazard Assessment

- Toxicity reference values (TRVs) were selected in order to calculate a numerical expression of potential human health risk. The chemicals of potential concern were treated both as carcinogens (PCB + dioxin/furan TEQs) and non-carcinogens (Total PCBs and PCB + dioxin/furan TEQs).

4. Risk Characterization

- Of the 12 samples collected at the AHSL site, only the sludge collected at the edges of leachate treatment pond exceeded environmental quality guidelines. Normally, this sample would not be considered as part of a human health risk assessment for a contaminated site. However, two potential exposure scenarios associated with dried sludge were identified in the problem formulation.
- The absence of high resolution analysis of fish tissue made it impossible to rule out the potential of human health risks. However, the data collected thus far do not suggest that AHSL is a POPs hotspot.
- The risk assessment results indicated that the contribution of the other potential exposure pathways (other than the consumption of local fish) to the overall potential risk would be negligible for dioxin/furan +PCB TEQ exposure.
- The risk assessment results indicated that PCBs (based on concentrations of total PCBs) are unlikely to pose significant human health risks.

5. General Conclusions

- The data collected thus far and the scenarios assessed suggest human health risks from POPs is generally low and acceptable. However the exposure pathway via fish accumulation of POPs and consumption by humans may warrant further assessment to resolve uncertainties in this specific risk pathway.

- The risk assessment presented in this report focuses on POPs and therefore does not address potential risks from non-POPs substances such as metals, solvents and petroleum hydrocarbons. Accordingly, a final risk management plan should also incorporate knowledge on non-POPs substances.
- Notwithstanding low risk, good environmental and risk management practices require that POPs substances are managed in ways that contain the material within a safe and stable location and without exposure pathways to receptors, and without uncontrolled release in to the environment.