

## 6.0 PATH FORWARD TO RISK MANAGEMENT

Once a contaminated site risk assessment has been completed, the site can generally be placed into one of five categories, namely:

- Class 1 - action required;
- Class 2 - action likely required;
- Class 3 - action may be required;
- Class N - remedial action not needed; and
- Class I - insufficient data.

In some instances it may be challenging to categorize a contaminated site based only on a screening level risk assessment, and refinement to a detailed level of assessment may be warranted. 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, the AHSL site may be classified as a Class 3 site - action may be required. Before risk management options are considered, additional risk assessment is recommended to determine if there are any human health risks at the site.

At the National Training Workshop which took place at NRE in Putrajaya on 22-23 January 2009, the national participants agreed that potential risk management measures must be considered within the context of the existing Landfill Closure and Post Closure Maintenance Plan (LCPCMP) (January 2007 - December 2011), described in part below.

### 6.1 EXISTING MANAGEMENT PLANS

#### 6.1.1 Landfill Closure and Post Closure Maintenance Plan (LCPCMP)

AHSL was formally closed on January 1, 2007 under LEVEL 4 : HIGH CLOSURE LEVEL. Engineered components accompanying the closure included:

- A landfill capping system;
- A leachate treatment pond;
- A landfill gas management & clean development mechanism (CDM);
- An environmental monitoring program (non POPs parameters); and
- A landscaping plan.

The AHSL 2007-2011 Landfill Closure and Post Closure Maintenance Plan (LCPCMP) is in place and is being professionally implemented by Worldwide Landfills (Worldwide Landfills 2007). The LCPCMP reflects a variety of good closure practices, although additional scrutiny of possible human health exposure scenarios may be warranted to reduce potential future liabilities:

- Potential risks to human health arising once the site opens to the general public after decommissioning;
- Potential risks to human and ecological health from contaminants not addressed in this risk assessment (i.e., non-POPs substances such as metals, solvents, petroleum hydrocarbons etc.)
- Responsibility/liability that the closed landfill may pose to the owners (e.g. cost of remediation, reputation and relations with the local community, and affected parties such as workers at the site, nearby property owners).

### **6.1.2 Proposed Future Land Use Plan by Worldwide Landfill**

At the end of 2011, the existing landfill may potentially be developed into a multi-purpose park. However, a proposal has not yet been submitted to the authorities concerned. If submitted and later approved, the potential land uses of the site could include:

- Outdoor recreational activities; and
- Educational activities/mini museum;

Development components include:

- Administration building; Mini museum; Open plaza; Kick-about;
- Obstacle course, cycling track; wall climbing;
- Walking/jogging trails; Look-out tower, kite flying ground;
- Go-kart; remote control airplane ground; and
- Skate park, remote control car track, fishing pond, paintball ground.

Worldwide Landfills is expected to manage the AHSL site in accordance with the 'Guidelines for Safe Closure and Rehabilitation of Municipal Solid Waste (MSW). Consequently, Worldwide Landfills will have to propose plans for developing AHSL into a multipurpose park. The park would be freely accessible to all people, but may offer restricted hours of access (Worldwide Landfills, 2007). The intent of securing alternative land use for closed landfills with risk management as part of the strategy is consistent with practices in other countries.

## 6.2 ADDITIONAL FACTORS

The long-term management plan for the site will need to consider a number of factors related to the potential of contaminant-mediated impacts. A risk management plan must consider the magnitude and spatial extent of risk, the cost and technical feasibility of different potential risk management options, stakeholder relationships and constraints related to governance. Two issues which should be considered during risk management discussions and are closely related to the risk assessment are:

**a) *Will there be a risk in the future not accounted for in the present risk assessment?***

As the closed landfill ages and weathers, the potential exists for new environmental scenarios and concerns to arise. A confounding factor is future construction and land use at the site. Human activities have the potential to create or enhance existing environmental concerns. As a result, it may be prudent to consider changes to the future monitoring program. This may include:

- Increases to the number of variables assessed in soils and sediment;
- The addition of an annual fish tissue assessment to the monitoring program;
- The addition of fish health or benthic community indices to the monitoring program; and
- The creation of site-specific, enforceable water quality objectives for discharges of water from the AHSL site.

**b) *What level of risk is acceptable?***

Solid waste management is a necessary civic service. The incidence of communicable diseases in industrial countries dropped significantly once solid waste management practices were instituted on a municipal level (Wilson and Nair 1992). Considering this benefit, a small but tolerable risk to human health and environmental receptors may be considered acceptable to the general public. The risk may be considered even more palatable if it is shown that the local government (and Worldwide Landfills) are taking reasonable steps to avoid or reduce potential human health impacts.

Risk perception and risk communication will have to be considered to ensure acceptance by the general public. Key facets to risk perception and risk communication could include:

- Putting the potential risks reported in the risk assessment document into context. For instance, comparing potential risks calculated in the risk assessment to risks considered acceptable by the general public (i.e., smoking, driving a car, etc);

- Defining the geographical extent of potential risks;
- Communicating the steps that are being taken at the landfill to mitigate risks; and
- Providing a cost-benefit analysis of all internationally accepted and proven approaches for managing solid waste within a Malaysian context. The general public should understand that all modern solid waste management technologies (landfills, incineration and composting) have associated environmental limitations.

### 6.3 CONSIDERATION OF RISK MANAGEMENT ALTERNATIVES

The participants at a group discussion and plenary session on risk management (January 23, 2009) discussed the following key discussion topics:

- 1 - What are the potential risks associated with the AHSL site, if any?
- 2 - What are the management options for the site?
- 3 - What additional monitoring should be conducted?
- 4 - What are the potential costs of implementing management and monitoring requirements?

The participants came up with a list of risk management alternatives which could be considered if the site was found to pose unacceptable human health risks. However at this time, additional risk assessment work needs to be conducted to determine if human health risks are present. Until additional risk assessment work is performed risk management activities should be put on hold. Furthermore, it must be noted that some of the risk management alternatives provided below would only be considered if predicted human health risks were high.

The followings are the risk management alternatives identified by the participants.

1. Measures for controlling potential chemical hazards:
  - Put in place engineering measures to control the release of contaminants and implement monitoring/inspection programs to ensure that spill control infrastructures are maintained;
  - Build a secured containment facility to safely contain the treatment pond sludge (and/or sediments from streams/ditches) if a human health impact is indicated;
  - Put into place measures to prevent leachate pond leakage if the underground lining fails;
  - Cap and re-vegetate the landfill surface to control erosion of soil surfaces by rain and wind erosion;

- Use settling ponds, catch basins, and silt fences to prevent sediments from migrating off site during rainfall/flood events.
2. An enhanced monitoring program:
    - Leachate may flow into recreation ponds or streams resulting in impacts to resident fish. To ensure that food quality has not been impacted, fish samples should be collected from the nearby streams and ponds and analyzed for chemical contaminants;
    - Human health assessments should be conducted on the AHSL site at a frequency as required by Malaysian regulations (i.e., once every 6 months or 5 years);
    - Expand environmental monitoring by World Wide (operator of the site):
      - i. Biota, soil and sediment sampling for dioxin and other POPs test (Once a year);
      - ii. Groundwater monitoring; and
      - iii. Air quality monitoring, if human health risks from the inhalation of contaminated particles are predicted.
  3. Health and Safety Plan:
    - Annual medical assessments of AHSL staff and nearby residents. Assessments should include the analysis of blood if POPs-related human health risks are a concern.
  4. Future land use measures:
    - Supplemental selective sampling for POPs and certain non-POPs (i.e., metals, solvents, petroleum hydrocarbons) is needed to determine if contaminants are contained appropriately as the landfill ages;
    - Consider if the site could be converted back into forest reserve (i.e., plant trees). Smaller plants may be planted if compromising the landfill cap is a concern;
    - Governance and stakeholder participation: involve concerned stakeholders such as the Ministry of Local Housing in important meetings and discussions of site management.
  5. Budgeting for the site management, consider the following costs:
    - Cost of reducing risk arising from the contaminant;
    - Cost of environmental monitoring;
      - i. Cost of sampling and lab analysis;
      - ii. Cost of health monitoring (for workers, and residents).
    - Cost of maintenance of the site; and
    - Cost of enforcement.