Appendix A2

Cost Breakdown and Unit Cost for the Risk Management Scenarios

SCENARIO 1: DETAILED ASSESSMENT OF POSSIBLE HUMAN HEALTH RISK

Item	Description	Source / Comment	Quantification	Value	Timing	Year 1
1	**Enhanced monitoring program**					
1.1	Human health assessment	A detailed human health assessment should be conducted on the AHSL site to determine the potential health impacts related to exposure to POPs and other chemicals originating from the site. The assessment will require : a survey of up to 100 people (among site staff and local residents) to determine level and pathways of exposure; blood sampling of people considered most at risk; and an analysis of the data collected through these 2 steps. The assessment (including reporting of key findings) is assumed to require 2 people for 10 days. *Cost is estimated as*: *# of blood analysis * unit cost of a blood analysis + # of consultant days * unit cost of consultant days*	• # of national consultant days • # of blood analysis	20 45	Reccuring	62,000
1.2	Soil and sediment analysis (including sludge from treatment ponds)	A detailed sampling program of soil and sediment should be conducted at the site to determine with greater accuracy the level of contamination (by POPs and possibly other chemicals) in this medium. The analyses should cover some or all of the following parameters: • POPs and Persistent Toxic Substances (PSTs): i) lipid analysis; ii) PCBs 1668A; iii) WHO PCBs; iv) dioxin and Furan (PCDD/PCDF); v) organochlorine pesticides (OC pesticides); vi) toxaphene; vii) polybrominated diphenyl ethers (PBDEs); and viii) polyfluorinated chemicals (PFCs); and • Non-POPs substances such as metals, solvents, petroleum hydrocarbons etc. *Cost is estimated as: # of soil and sediment analysis * unit cost of soil and sediment analysis*	• # of soil/sediment analysis	20	Reccuring	28,000
1.3	Fish tissue analysis	To ensure that food quality has not been impacted, fish samples should be collected from streams and ponds near the site and analyzed using HR-GCMS for chemical contaminants. The analyses should cover some or all of the following parameters: • POPs and Persistent Toxic Substances (PSTs): i) lipid analysis; ii) PCBs 1668A; iii) WHO PCBs; iv) dioxin and Furan (PCDD/PCDF); v) organochlorine pesticides (OC pesticides); vi) toxaphene; vii) polybrominated diphenyl ethers (PBDEs); and viii) polyfluorinated chemicals (PFCs); and • Non-POPs substances such as metals, solvents, petroleum hydrocarbons etc. *Cost is estimated as: # of fish tissue analysis * unit cost of fish tissue analysis*	• # of fish tissue analysis	10	Reccuring	14,000
1.4	Groundwater analysis	A detailed sampling program of groundwater should be conducted at the site to determine with greater accuracy the level of contamination (by POPs and possibly other chemicals) in this medium. *Cost is estimated as: # of groundwater analysis * unit cost of groundwater analysis*	• # of groundwater analysis	5	Reccuring	10,000
2	**Contingency, Technical Support, Project management**		• % of overhead	**10%**	Recurring	11,400

SCENARIO 2 : HAZARD CONTAINMENT AND MONITORING

Item	Description	Source / Comment	Quantification	Value	Timing	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
1	**Control potential chemical hazards**																								
1.1	Disposal of contaminated sludge	The contaminated sludge needs to be regularly removed from the treatment ponds and disposed of, for example by disposal at an authorized landfill or any other mean, based on technology availability, nature of the sludge contamination, etc. *Cost is estimated as: Volume of sludge * unit cost of treatmen*	• Annual volume of sludge (t)	1	Reccurring		1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480	1,480
1.2	Improve drainage system on the site	Improvements to the site drainage sistem are required to prevent sediments from migrating off -s ite during rainfall/flood events.They may include the creation of settling ponds, catch basins, and silt fences. The improved drainage system will require regular maintenance work, the cost of which is estimated to be 10% of the initial investment costs (yearly). *The drainage improvements cannot be costed out in detail without a preliminary design. Therefore a global budget of US$ 25,000 is allocated to it as an estimate.*	• Unit	N/A	Reccurring		25,000	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
1.3	Revegetate the landfill surface	Revegetation is aimed to control erosion of soil surfaces by rain and wind erosion. This measure is included in the Landfill Closure and Post Closure Management plan and is therefore not considered as a cost item in this scenario.	N/A	N/A	Initial																				
2	**Monitoring of health and environment**																								
2.1	Human health assessment	Should the landfill be proved to pose a risk to human health, regular human health assessment should be conducted on the AHSL site in accordance with Malaysian regulations (i.e every 5 years) to determine the potential health impacts related to exposure to POPs and other chemicals originating from the site. The assessment will require : a survey of up to 100 people (among site staff and local residents) to determine level and pathways of exposure; blood sampling of people considered most at risk; and an analysis of the data collected through these 2 steps. The assessment (including reporting of key findings) is assumed to require 2 people for 10 days. *Cost is estimated as: # of blood analysis * unit cost of a blood analysis + # of consultant days * unit cost of consultant days*	• Frequency of assessment • # of national consultant days • # of blood sampling	1 / 5 years 20 45	Reccuring		62,000					62,000					62,000					62,000			
2.2	Soil and sediment monitoring	Should the landfill be proved to pose a risk to human health, a monitoring program of soil and sediment should be implemented at the site to determine with the evolution of level of contamination (by POPs and possibly other chemicals) in this medium. Monitoring will be conducted at the same frequency than the health assessment. *Cost is estimated as: # of soil and sediment analysis * unit cost of soil and sediment analysis*	• # of soil/sediment samples • Frequency of soil/sediment sampling (per year)	20 1/5 years	Reccuring		28,000					28000					28000					28000			
2	**Monitoring of health and environment Cont'd.**																								
2.3	Fish monitoring	Should the landfill be proved to pose a risk to human health, fish monitoring program should be implemented at the site to determine the evolution of level of contamination (by POPs, dixoxin and possibly other chemicals) in fish tissue. Monitoring will be conducted at the same frequency than the health assessment. *Cost is estimated as: # of fish tissue analysis * unit cost of fish tissue analysis*	• # of fish samples • Frequency of fish sampling	10 1/5 years	Reccuring		14,000					14,000					14,000					14,000			
2.4	Groundwater monitoring	Should the landfill be proved to pose a risk to human health, a groundwater monitoring program should be implemented at the site to determine the evolution of level of contamination (by POPs, and possibly other chemicals) in fish tissue. Monitoring will be conducted at the same frequency than the health assessment. *Cost is estimated as: # of groundwater analysis * unit cost of groundwater analysis*	• # of groundwater samples • Frequency of groundwater sampling (per year)	5 1/year	Reccuring		10,000					10,000					10,000					10,000			
2.5	Air quality monitoring	Should the landfill be proved to pose a risk to human health and if risks through inhalation of contaminated particles are predicted, an air quality monitoring program should be implemented at the site to determine the evolution of level of contamination (by POPs and possibly other chemicals) in air, environmental samples and/or fish tissue. Monitoring will be conducted at the same frequency as the health assessment. *Cost is estimated as: # of air quality analysis * unit cost of air quality analysis*	• # of air quality samples • Frequency of air quality sampling (per year)	5 1/5year	Reccuring		9,000					9,000					9,000					9,000			
3	**Contingency, Technical Support, Project management**		• % of overhead	**10%**	Recurring	0	14,948	398	398	398	398	12,698	398	398	398	398	12,698	398	398	398	398	12,698	398	398	398

Note: All the costs are scheduled from year 2 and the following, considering that a preliminary assessment will be conducted in year 1 to determine whether or not the health risk at the site require the implementation of this scenario.

UNIT COSTS - MALAYSIA

Description	Unit	Value (US $)*	
Blood tests	Unit	1200	Include cost of sample collection + analysis
Soil/sediment test	Unit	1400	Include cost of sample collection + analysis
Fish tissue test	Unit	1400	Include cost of sample collection + analysis
Groundwater testing	Unit	2000	Include cost of sample collection + analysis
Air quality testing	Unit	1800	Include cost of sample collection + analysis
National consultants	days	400	The average rate for Laotian consultant is retained to be around US$400 based on local contacts
Disposal of contaminated sludge	per ton	1480	Source: UNEP, Inventory of World-Wide PCB detsruction capacity (p.53). A unit price equal to 80% of the higher estimate in the range has been taken as a conservative assumption.

*As estimated by Hatfield/World Bank