Appendix A2

Cost Breakdown and Unit Cost for the Risk Management Scenarios

SCENARIO 1: IMPLEMENTATION, ENFORCEMENT AND MONITORING OF WORKERS HEALTH AND SAFETY AND SPILL PREVENTION MEASURES

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	**Raise awareness**																								
1.1	Organize workshops with local population	Three meetings will be scheduled in the first year – one for SEDCW site staff, one with local community, and a third one for decision-makers and private sectors dealing with PCBs and POPs. One workshop per year will be organized in the next 5 years. *Cost is estimated as: # of workshops * unit cost of a workshop*	• # and frequency of workshops	3 during year 1 1 / year in the next 5 years	Reccurring	3,000	1,000	1,000	1,000	1,000	1,000														
1.2	Produce and diffuse awareness raising material	Awareness kits including posters, leaflets, etc. should be available on and around the site, and distributed to the workers and the workshop attendees *Cost is estimated as: # of workshop * unit cost of a kit*	• # of risk awareness kits produced	500	Initial	5,000																			
2	**Develop a Health and Safety / Spill Prevention Plan**																								
2.1	Consultation and working session	The development of the Health and Safety Plan will be based on consultation with local authorities, site managers and employees to ensure that the objectives of the plan are widely shared and adequate procedures are defined. Consultations will be conducted by local Health and Safety consultants. *Cost is estimated as: duration of consultation * # of people consulted * (labour cost of site employee + labour cost of local consultants)*	• Duration of consultation • # of people consulted	0.5 20	Initial	1,600																			
2.2	Development of initial plan	The plan must be developed by local Health and Safety consultants who are knowledgeable of the site operations and local regulations. In addition, international consultants may provide input regarding POPs standards and generic Health and Safety management systems. *Cost is estimated as : (# of international consultant days * labour cost of international consultant) + (# of national consultant days * labour cost of national consultant)*	• # of international consultants days • # of national consultants days	10 40	Initial	16,000																			
2.3	Plan revisions	*Cost is estimated as : # of national consultant days * labour cost of national consultant*	• Frequency of plan revisions (/year) • # of national consultants days	1 5	Recurring		750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
3	**Train the personnel**																								
3.1	Initial training	The training is designed for the staff directly involved in the handling of the transformers and other chemical hazards in the warehouse (22 employees + 3 full time security guards). The staff must be trained to implement the measures of the Health and Safety plan, including use of protective equipment, safe handling and storage of contaminated material, spill prevention, etc. Training sessions will last 2 days and be held by local Health and Safety consultants. *Cost is estimated in the first year as : (# of employee to be trained * duration of training)* labour cost of employees + duration of training * labour cost of national consultant.* In the following year, only new employees need to be trained, the number of which is calculated using the turnover rate.	• # of people to be trained • Employee turnover • Duration of initial training (days)	25 2% 2	Recurring	800	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310

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
3.2	Training updates	Regular training updates must be provided to communicate about plan updates, incidents and accidents that occurred, etc. Training update sessions will last half a day and be held by the a Health and Safety consultant.. Cost is estimated as: *(# of employee to be trained * duration of training)* labour cost of employees + duration of training * labour cost of national*	• # of people to be trained • Frequency of training updates (/year) • Duration of training updates (days)	25 1 0.5	Recurring		200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
4	**Implement the Health and Safety Plan**																								
4.1	Provide personal protection equipment	Personal protection equipment must be provided to staff involved with the PCBs contaminated equipment in the warehouse and storage area. Extra equipment must be available for vistors coming on site. A personal protection equipment kit includes coveralls, gloves, boots/overboots, face shields, etc *Cost is estimated as: # of kits * unit cost of a kit.*	• # of kits • Percentage of kits to be replaced (yearly)	25 5%	Initial + reccuring	2,500	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125
4.2	Label hazardous materials and contaminated areas	Labelling is necessary to ensure that all the hazardous material and contaminated areas are signaled, and may include: color-coded containers, signs, etc. *Cost is estimated as: # of items to be labeled * unit cost of labeling an item*	• # of items to be labeled • Additional items to be labeled yearly	200 20	Initial Reccuring	1,000	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
4.3	Test transformers before handling	Old transformers received at the site should be systematically tested before handling, so that safety procedure be implemented should they prove contaminated. CLOR-N-OIL tests are adequate for this purpose. *Cost is estimated as: # of tests * unit cost of a test*	• # of tests (CLOR N OIL)	10	Reccuring	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
4.4	Implement Health and Safety procedures	Health and Safety procedures include, but are not limited to: use of personal protective equipment, safe handling and storage of contaminated material (e.g use of proper labels), no access to restricted areas, adequate cleaning of surfaces, installations and vehicles to avoid accumulation of hazardous compounds etc. *Cost is estimated as: ((# of employees at the warehouse * average time dedicated to procedures by employees at the warehouse + # of employees on site * average time dedicated to procedures by employees on site)) * labour costs of employee * number of worksday per year (240)*	• # of employees at the site • average time dedicated to procedures by employees at the workshop (% of workday) • # of other employees on site • average time dedicated to procedures by other employees on the site (% of workday)	22 5% 60 1%	Recurring	4,080	4,080	4,080	4,080	4,080	4,080	4,080	4,080	4,080	4,080	4,080	4,080	4,080	4,080	4,080	4,080	4,080	4,080	4,080	4,080
4.7	Implement spill response procedures	Spill response procedures are critical to ensure that no further contamination of the site (or new contamination, should the site be cleaned-up) occur. It involves the emergency response to the spill (e.g placement of sorbent pillows) and the cleanup of the spill area. *Cost is estimated as: (# of spills * average time dedicated to clean-up procedures by employees at the workshop + # of employees on site * average time dedicated to procedures by employees on site) * labour costs of employee * number of worksday per year (240).*	• # of spills / months • Average time dedicated to clean up (days)	1 1	Recurring	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120

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
5	**Ensure integrity of workplace structure**																								
5.1	Provide facilities for showering and changing into and out of street and work clothes; and clean eating areas where workers are not exposed to hazardous or noxious substances	The facility must include showers, lockers and changing rooms. *Precise cost cannot be provided without specifications being developed. Therefore, a global, conservative budget of US$ 2500 is allocated to this item.*	• Unit	-	Initial	2,500																			
5.2	Define “restricted entry” into contaminated area without proper protection and authorization	Safe locks must be installed, as well as an "accreditation system", to keep employees movement in and arount contaminated areas to a minimum. *Precise cost cannot be provided before specifications are developed. Therefore, a global, conservative budget of US$ 500 is allocated to this item.*	• Unit	-	Initial	500																			
6	**Monitoring**																								
6.1	Monitoring of the health and safety plan implementation	Monitoring of the Health and Safety plan implementation includes: recurring inspections/audits of health and safety features and procedures; of spill control equipment and procedures; and investigation, reporting and recording of occupational accidents/incidents; and spills or near misses. *Cost is estimated as: national consultant days * labour cost of national consultant*	• Average time (in days) dedicated each month to monitoring by the Health and safety specialist	1	Recurring		1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
6.2	Environmental monitoring - Soil testing	Regular (yearly) control of the extent of contamination on the site is needed to ensure that it does not extend or worsen . CLOR-N-SOIL type tests can be used to perform this assessment, about 10 tests are needed yearly to cover the whole site. *Cost is estimated as: number of tests * unit cost of a test*	• # of tests	10	Recurring		150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
6.3	Blood testing	Regular control of workers exposure is needed to monitor the effects of the health and safety policy. Given high cost of blood analysis, the next blood sampling campaign should be at least 5 years after the risk management assessment was undertaken (blood sampling was done in 2008) i.e. by 2014, then every 10 years. To provide valuable statistics, a minimum of 20 employees should be tested. *Cost is estimated as: number of blood sampling * unit cost of a blood sampling*	• # of sampling	20	Recurring					20,000					20,000										20,000
7	**Contingency, Technical Support, Project management**		• % of overhead	**10%**	Recurring	3,720	874	874	874	2,874	874	774	774	774	2,774	774	774	774	774	774	774	774	774	774	2,774

SCENARIO 2 : CONTAINMENT OF EXISTING CONTAMINATION

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	**Implementation, enforcement and monitoring of workers health and safety and spill prevention measures**		**Measures described in Scenario 1**	**TOTAL**		**3,720**	**874**	**874**	**874**	**2,874**	**874**	**774**	**774**	**774**	**2,774**	**774**	**774**	**774**	**774**	**774**	**774**	**774**	**774**	**774**	**2,774**
2	**Design of containment plan**																								
2.1	Develop a detailed containment plan	A detailed study must be conducted to specify the containment infrastructure/equipment needs and specifications. This study could be carried out through an international consulting contract. *Cost is estimated as : # of international consultant days * labour cost of international consultant*	• # of international consultant days	30	Initial	30,000																			
2.2	Conduct test based inventory of PCBs contaminated transformers and oil	Based on site visits and the National Inventory report (2004), the number of olds transformers on site is estimated to be around 235, and 153 (about 66%) of them were assumed to be PCBs contaminated. CLOR N OIL type tests will be performed to identify which of these transformers may be contaminated. *Cost is estimated as: # of tests * unit cost of a test*	• # of tests (CLOR N OIL)	235	Initial	2,350																			
2.3	Conduct detailed soil analysis	Soil analysis are required to define in greater detail the amount of contaminated soil to be disposed of. CALUX tests will be performed at additional locations to refine the preliminary delineation of contamination established during the initial sampling. A total of 30 tests of each type is assumed to be required, based on site investigations. *Cost is estimated as: # of tests * unit cost of a test*	• # of tests (CALUX)	30	Initial	12,000																			
3	**Provide secured containment infrastructure and equipment**																								
3.1	Provide secured drums	Contaminated oil must be stored in safe, watertight drums. The amount of contaminated oil is based on the estimation of the number of contaminated transformers on site (153) and the volume of oil contained in a transformer (286 L) (see site description). In addition, an estimated 10 transformers containing PCBs will be processed on the site each year (see site description). Standard drums with a capacity of 55 US gallons (208 L) are considered for the estimate. *Cost is estimated as : # of drums* unit cost of a drum*	• # of drums required initially • # of additional drums required yearly	210 14	Initial Reccurring	21,049	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376	1,376
3.2	Build a secured containment facility	The facility to be used to store contaminated transformers and oil drums must meet detailed specifications, including: safe access, watertight ground and walls, drains, etc. It is assumed that an existing facility on the site may be transformed to meet these specifications (so that no land purchasee would be required to build a brand new facility). *The corresponding cost cannot be estimated in detail without a preliminary design, therefore a global budget of US$ 150,000 is allocated to it.*	• Unit		Initial	150,000																			
3.3	Move and store PCB contaminated equipment and oil in containment facility	Contaminated oil from transformers must be drained into safe drums. The drums must then be sealed and moved to the containment facility, along with contaminated transformers, using safe handling procedures. This activity is estimated to US$ 12,000 including the location of equipment (e.g forklift) and the labour. It is expected that the safe storage procedure would be in the future included in the Health and Safety management plan, therefore no recurring costs are included after year 1.	-		Initial	12,000																			
3.4	Cap and pave the most contaminated areas that are not paved yet (storage area)	An engineering design study is required to define a detailed scope (earthworks, capping material to be used, etc.) for the capping and paving operations. Therefore the budget allocated to this item is only a high-level estimate at this stage. *Cost is estimated as: area to be capped and paved * unit cost of capping and paving*	• Extent of the area requiring capping (m2)	5250	Initial	262,500																			
3.5	Improve drainage and sediment control system on the site	The purpose of drainage improvements is to prevent contaminated soil/dust, as well as the contaminated water coming from the warehouse and storage area from entering the drainage system. Improvements may include the creation of settling ponds or catch basins to collect contaminated water, the installation of oil/water separators or other treatment features, the installation of silt fences along drainage channels, etc. *The drainage improvements cannot be costed out in detail without a preliminary design. Because contamination level in the drainage system were found to be low, and the drainage system is not very extended, a limited budget of US$ 10,000 is expected to be sufficient to conduct the required enhancements.*	• Unit		Initial	10,000																			
4	**Monitor and maintain containment infrastructure**																								
4.1	Monitoring and maintenance of contaminated transformers and oil containement measures	Monitoring and maintenance includes the investigation of potential leakages at the secured facility, drum replacement, building maintenance (locks, drains, etc.), etc. It is estimated to amount yearly to 5% of the investment costs 2.1, 2.2, and 2.3.	• % of capital costs	5%	Recurring		9,152	9,152	9,152	9,152	9,152	9,152	9,152	9,152	9,152	9,152	9,152	9,152	9,152	9,152	9,152	9,152	9,152	9,152	9,152
4.2	Conduct soil/sediment analysis	Regular monitoring of contamination will be required to ensure that the containment measure are efficient. Level of contamination are expected to be lower than initially after the containment measures are implemented, so CALUX tests will be preferred to CLOR N SOIL tests. Monitoring will be yearly performed around the warehouse compound, in the drainage system and at the entrance road. *Cost is estimated as # of analysis * unit cost of an analysis*	• Number of analysis	3	Recurring		1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
4.3	Pavements and drainage system maintenance	Maintenance activities will include: cleaning of catch basin, potholes filling, etc. Without detailed design, costs can only be estimated as a fraction of the infrastructure costs but their are expected to be fairly low (because of the limited contamination entering the drainage system) . It is assumed to amount yearly to about 1% of the investment costs 2.4 and 2.5	• % of capital costs	1%	Recurring		2,725	2,725	2,725	2,725	2,725	2,725	2,725	2,725	2,725	2,725	2,725	2,725	2,725	2,725	2,725	2,725	2,725	2,725	2,725	2,725
5	**Contingency, Technical Support, Project management**		• % of overhead	**10%**	Recurring	49,990	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1,445

SCENARIO 3: DISPOSAL OF EXISTING CONTAMINATION

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	**Implementation, enforcement and monitoring of workers health and safety and spill prevention measures**		**Measures described in Scenario 1**	**TOTAL**		**3,720**	**874**	**874**	**874**	**2,874**	**874**	**774**	**774**	**774**	**2,774**	**774**	**774**	**774**	**774**	**774**	**774**	**774**	**774**	**774**	**2,774**
2	**Design of disposal plan**																								
2.1	Develop a disposal plan	A study must be conducted to develop a detailed scope for the clean-up operations, including: definition and implementation of initial analysis, planning of earth works, identification of disposal options, packaging and shipping of contaminated material. This study could be carried out through an international consulting contract. *Cost is estimated as : # of international consultant days * labour cost of international consultant)*	• # of international consultant days	30	Initial	30,000																			
2.2	Conduct test based inventory of PCBs contaminated transformers/ oil	Based on site visits and the National Inventory report (2004), the number of olds transformers on site is estimated to be around 235, and 153 (about 66%) of them were assumed to be PCBs contaminated. CLOR N OIL type tests will be performed to identify which of these transformers may be contaminated. *Cost is estimated as: # of tests * unit cost of a test*	• # of tests (CLOR N OIL)	235	Initial	2,350																			
2.3	Conduct detailed soil analysis	Soil analysis are required to define in greater detail the amount of contaminatec soil to be disposed of. CALUX tests will be performed at additional locations to refine the preliminary delineation of contamination established during the initial sampling. A total of 50 tests of each type is assumed to be required, based on site investigations. *Cost is estimated as: # of tests * unit cost of a test*	• # of detailed tests (CALUX)	30	Initial	12,000																			
3	**Implementation of disposal**																								
3.1	Disposal of contaminated transformers	Based on 2004 inventory, the number of contaminated transformers on site is estimated to be about 153; the weight of a transformer is 341 kg based on specifications. *Cost is estimated as: quantity of transformers * unit cost of transformer disposal*	• Quantity of transformer (tons)	52	Initial	125,215																			
3.2	Disposal of contaminated oil	A transformer contains about 286 L of oil based on specifications. An average density of 1.369 is retained for PCB oil (source: UNEP) *Cost is estimated as: quantity of oil * unit cost of oil disposal*	• Quantity of oil (tons)	60	Initial	177,568																			

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
3.3	Disposal of contaminated soil from the open-air storage area	The contaminated area around the workshop is about 100 m*150 m. About 25% of this area is expected to be contaminated based on site observations. A 10 cm deep layer of soil will be removed in these areas. Density is assumed to be 1.6 t / m3 (average value found in literature). Contaminated dust from the warehouse floor, walls and ceiling must also be removed and disposed of in priority; the corresponding quantity of material is considered "included" in the estimate provided for this item. *Cost is estimated as: quantity of soil * unit cost of soil disposal*	• Quantity of contaminated soil (tons)	210	Initial	310,800																			
3.4	Disposal of contaminated soil from the road	Although the road is paved, there is contaminated dust on its top and edges that needs to be removed. The dust is considered to form in average a 1 cm thick layer on a 200m*2m area. Density is assumed to be 1.6 t / m3 (average value found in literature) *Cost is estimated as: quantity of soil * unit cost of soil disposal*	• Quantity of contaminated soil (tons)	6	Initial	9,472																			
3.5	Packaging and shipping	Contaminated material is expected to be disposed of in European or North American facilities. The cost of packaging, loading, shipping operation cannot be estimated in detail at this stage without further studies, it is assumed at this stage to amount to 25% of the cost of disposal, that is of cost items 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8.	• % of overhead	25%	Initial	155,764																			
4	**Contingency, Technical Support, Project management**		• % of overhead	**10%**	Initial	82,317	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0