ANNEXES

Annex I: Solid waste categories

No	Sources and kind of waste
1	**Waste from the Household**
	- Kitchen waste, all kinds of waste that come from cooking activity - Plastic, it happened from all activities as wrapping - Textile, from sewing activities, as cleaning cloth - Old clothing, which can not use anymore - Metal* - Glass, like glass bottles, broken glass, mirror, - Paper, from the wrapping activity, newspaper etc. - Cardboard - Wood without conterminous paint, like furniture - Wood with conterminous paint* - Leather, like shoes, belts, handbags and other product made from leather etc. - Rubber, ring rubber, inner tube of tires, tires and other things that made of rubber, - Flashlight batteries* - Batteries* - Electricity equipment* - Electronic equipment* - Green waste, like vegetable or yard waste etc. - Ceramic, as plates, bowls, dishes, cups, tea ports, - Unsed Medicine* - Other household waste which not nominate above,
2	**Market Waste**
	- Plastic - Metal*, - Glass, as glass bottles, broken glass, pane, mirror, - Paper - Cardboard - Leather, broken equipment which made of leather as shoes, belts, handbags, - Rubber - Flashlight batteries* - Batteries* - Electricity equipment* - Electronic equipment* - Green waste - Ceramic - Waste of meat and born are from meat selling activity, - Sludge is from toilet tanks - Other household waste which not nominate above

No	Sources and kind of waste
3	**Waste from Restaurants, Hotels, Guesthouse, Enjoyable Places and Holy Places**
	- Kitchen waste, - Waste look like kitchen waste, - Green waste, - Plastic, - Metal*, - Glass, as drinking bottles, water glass, mirror, - Paper, tissue, chopsticks cover, - Cloth, as tablecloths, hankies, - Cardboard - Ash , - Rubber, - Electricity equipment* - Electronic equipment* - Ceramic, as plates, bowls, dishes, cups, tea ports, - Sludge is from toilet tanks - Wood without conterminous paint, - Wood with conterminous paint*, - Flashlight batteries* - Batteries* - Other waste which not nominate above.
4	**Waste from Hospital, Policlinic Clinic and Health Centre**
	- Waste look like kitchen waste that remained from the eating of patients - Sharp waste*, needles, scalpel blades, - Contagious waste*, see the medical waste guideline annex I - Waste which contain radioactive substance* - drug waste* - Other medical waste*: See Annex I of medical waste guideline
5	**Administrative Building and School Waste**
	- Waste look like kitchen waste that remained from the eating of staffs, - Plastic, - Rubber, - Paper, - Cardboard, - Electricity equipment* - Electronic waste* - Wood: broken tables, cupboards, chairs that are not conterminous paint, - Wood: broken tables, cupboards, chairs with conterminous paint* - Metal: broken tables, chairs that made of metal, - Glass, - Ceramic - Other waste which not nominate above

No	Sources and kind of waste
6	**Waste Repairing and/or Washing of Vehicle Services and Electronic Repairing Services**
	- Metal*, - Rubber, as old tires, - Plastic, - Spraying paint* - Batteries* - Glass, as vehicle glass, TV screen etc. - Electronic equipment* - Electricity equipment* - Sludge is from vehicle washing activity, - Cloth is from vehicle cleaning activity, - Cloth* is from vehicle cleaning activity which is conterminous vehicle oil, - Plastic - Other waste which not nominate above
7	**Slaughterhouse waste**
	- Dung after animals were slaughtered, - Animals' hair after animals were slaughtered, - Waste of born and meat that people don't eat, - Sludge: After cleaning activity, - Metal* - Ash: After boiling water, - Other waste which not nominate above
8	**Agricultural Waste**
	- Wood, as sawdust and tree branches, - Dung is from feedstock (feeding animal places), - Dead animals, - Medical* happened from the curing activities, - plastic, - Green waste, - Animal food waste, - Sludge happened from washing animals and stables for animals, - Metal, Happened from the agricultural activity as agricultural machines, - Containers* which contained pesticide, - Rubber, - Other waste which not nominate above
9	**Industrial waste**
	- Textil - Leather from shoes making factories etc. - Plastic rest from raw material packing, - Paper, from offices, printing plate cutting cloths, packing, - Cardboard from packing, - Metal* Spare parts of machinery,

No	Sources and kind of waste
	- Sludge from treatment tanks* , - Waste of containers which contained chemical substance*, - Paint waste* : From publishing synthetic textile, - Glue* from shoes production, - Hard plastic: axle of fiber, - Electronic equipments* - Electricity equipments* - Glass like bottles, broken bottles from drinking factories, fish sauce and soy sauce handicrafts, - Waste from soft drink or alcohol manufacturing as tuberous beans and alcohol residues - Waste look like kitchen waste - Other waste which not nominate above.
10	**Construction Waste.**
	- Plastic, - Wood, - Wood with paint* - Pieces of stone that remained from building, - Excavated dirt, - Cardboard: From packing, - Metal* - Ceramic - Paint* - Cement* - Lime* - Glue* -Glass - Electricity equipment* as electricity wire, lamps, - Hard plastic: As plastic tube, - Other waste which not nominate above
11	**Laboratory waste**
	- Glass* - Chemical substance* - Sample* - Metal* - Electricity equipment* - Electronic equipment* - Rubber* - Clothes* - Radioactive instrument* - Other waste which not nominate above
12	**Waste on the roads.**
	- Plastic, - paper, - cardboard, - Metal*,

No	Sources and kind of waste
	- Wood, - Green waste, - Soil, stone, - Glass, - Dead animals, - Dung, - Other waste which not nominate above
13	**Park waste**
	- Plastic, - paper, - cardboard, - Metal*, - Wood, - Green waste, - soil, stone, - Glass, - Dead animals, - Dung, - Other waste which not nominate above

Annex II: Disposal facilities

- Disposal on basic standard landfill
- Disposal on sanitary landfill
- Disposal on hazardous landfill
- Incinerate in the technique incinerator (only medical waste)

Annex III: Facilities of utilisation of waste:

- Material Recovery (recycling, composting)
- Reuse
- Recycling

Annex IV: Form:

[1] First page (title page)

- Solid Waste management master plan
- Date
- Name of solid waste management master plan Institution.

[2] Form Responsible Declaration with

- Name of institution
- Name and role of SWMP maker
- Address.

[3] Form of WMMP

Type of waste	Sources	Flowing	Amount in ton		
			2005	2006	---
1. Kitchen waste 2. Papers 3. Medical - - - -	Household Office Hospital	Landfill Recycling Burning	100 35 5	75 25 12	

[4] Form notification of acceptance with

- Information of the waste disposal
- Data to the waste disposal facility,
- Data to the disposal procedure

[5] Form of self-disposal with

- data for operation planning
- at the same time representation of the disposal ways for self disposal

[6] Form self-disposal

- supplement with the supplementary of information on the representation of the disposal ways for self-disposal with further waste

Annex V: Solid waste categories assigned to landfill categories

No	Sources and kind of waste	BSL	SL	HL
1	**Waste from the Household**			
	- Kitchen waste, all kinds of waste that come from cooking activity	×	×	
	- Plastic, it happened from all activities as wrapping	×	×	
	- Textile, from sewing activities, as cleaning cloth	×	×	
	- Old clothing, which can not use anymore	×	×	
	- Metal*			×
	- Glass, like glass bottles, broken glass, mirror,	×	×	
	- Paper, from the wrapping activity, newspaper etc.	×	×	
	- Cardboard	×	×	
	- Wood without conterminous paint, like furniture	×	×	
	- Wood with conterminous paint*			×
	- Leather, like shoes, belts, handbags and other product made from leather etc.	×	×	
	- Rubber, ring rubber, inner tube of tires, tires and other things that made of rubber,	×	×	
	- Flashlight batteries*			×
	- Batteries*			×
	- Electricity equipment*			×
	- Electronic equipment*			×
	- Green waste, like vegetable or yard waste etc.	×	×	
	- Ceramic, as plates, bowls, dishes, cups, tea ports,	×	×	
	- Unused Medicine*			×
	- Other household waste which not nominate above,	×	×	×
2	**Market Waste**			
	- Plastic	×	×	
	- Metal*,			×
	- Glass, as glass bottles, broken glass, pane, mirror,	×	×	
	- Paper	×	×	
	- Cardboard	×	×	
	- Leather, broken equipment which made of leather as shoes, belts, handbags,	×	×	
	- Rubber	×	×	
	- Flashlight batteries*			×
	- Batteries*			×
	- Electricity equipment*			×
	- Electronic equipment*			×
	- Green waste	×	×	
	- Ceramic	×	×	
	- Waste of meat and born are from meat selling activity,	×	×	
	- Sludge is from toilet tanks	×	×	
	- Other household waste which not nominate above	×	×	×

No	Sources and kind of waste	BSL	SL	HL
3	**Waste from Restaurants, Hotels, Guesthouse, Enjoyable Places and Holy Places**			
	- Kitchen waste,	×	×	
	- Waste look like kitchen waste,	×	×	
	- Green waste,	×	×	
	- Plastic,	×	×	
	- Metal*,			×
	- Glass, as drinking bottles, water glass, mirror,	×	×	
	- Paper, tissue, chopsticks cover,	×	×	
	- Cloth, as tablecloths, hankies,	×	×	
	- Cardboard	×	×	
	- Ash ,	×	×	
	- Rubber,	×	×	
	- Electricity equipment*			×
	- Electronic equipment*			×
	- Ceramic, as plates, bowls, dishes, cups, tea ports,	×	×	
	- Sludge is from toilet tanks	×	×	
	- Wood without conterminous paint,	×	×	
	- Wood with conterminous paint*,			×
	- Flashlight batteries*			×
	- Batteries*			×
	- Other waste which not nominate above.	×	×	×
4	**Waste from Hospital, Policlinic Clinic and Health Centre**			
	- Waste look like kitchen waste that remained from the eating of patients	×	×	
	- Sharp waste*, needles, scalpel blades,			×
	- Contagious waste*, see the medical waste guideline annex I			×
	- Waste which contain radioactive substance*			×
	- drug waste*			×
	- Other medical waste*: See Annex I of medical waste guideline	×	×	×
5	**Administrative Building and School Waste**			
	- Waste look like kitchen waste that remained from the eating of staffs,	×	×	
	- Plastic,	×	×	
	- Rubber,	×	×	
	- Paper,	×	×	
	- Cardboard,	×	×	
	- Electricity equipment*			×
	- Electronic waste*			×
	- Wood: broken tables, cupboards, chairs that are not conterminous paint,	×	×	
	- Wood: broken tables, cupboards, chairs with conterminous paint*			×
	- Metal: broken tables, chairs that made of metal,			×
	- Glass,	×	×	
	- Ceramic	×	×	
	- Other waste which not nominate above	×	×	×

No	Sources and kind of waste	BSL	SL	HL
6	**Waste Repairing and/or Washing of Vehicle Services and Electronic Repairing Services**			
	- Metal*,			×
	- Rubber, as old tires,	×	×	
	- Plastic,	×	×	
	- Spraying paint*			×
	- Batteries*			×
	- Glass, as vehicle glass, TV screen etc.	×	×	
	- Electronic equipment*			×
	- Electricity equipment*			×
	- Sludge is from vehicle washing activity,	×	×	
	- Cloth is from vehicle cleaning activity,	×	×	
	- Cloth* is from vehicle cleaning activity which is conterminous vehicle oil,			×
	- Plastic	×	×	
	- Other waste which not nominate above	×	×	×
7	**Slaughterhouse waste**			
	- Dung after animals were slaughtered,	×	×	
	- Animals' hair after animals were slaughtered,	×	×	
	- Waste of born and meat that people don't eat,	×	×	
	- Sludge: After cleaning activity,	×	×	
	- Metal*			×
	- Ash: After boiling water,	×	×	
	- Other waste which not nominate above	×	×	×
8	**Agricultural Waste**			
	- Wood, as sawdust and tree branches,	×	×	
	- Dung is from feedstock (feeding animal places),	×	×	
	- Dead animals,	×	×	
	- Medical* happened from the curing activities,			×
	- plastic,	×	×	
	- Green waste,	×	×	
	- Animal food waste,	×	×	
	- Sludge happened from washing animals and stables for animals,	×	×	
	- Metal, Happened from the agricultural activity as agricultural machines,			×
	- Containers* which contained pesticide,			×
	- Rubber,	×	×	
	- Other waste which not nominate above	×	×	×
9	**Industrial waste**			
	- Textile	×	×	
	- Leather from shoes making factories etc.	×	×	
	- Plastic rest from raw material packing,	×	×	
	- Paper, from offices, printing plate cutting cloths, packing,	×	×	
	- Cardboard from packing,	×	×	
	- Metal* Spare parts of machinery,			×

No	Sources and kind of waste	BSL	SL	HL
	- Sludge from treatment tanks* ,			×
	- Waste of containers which contained chemical substance*,			×
	- Paint waste* : From publishing synthetic textile,			×
	- Glue* from shoes production,			×
	- Hard plastic: axle of fibre,	×	×	
	- Electronic equipments*			×
	- Electricity equipments*			×
	- Glass like bottles, broken bottles from drinking factories, fish sauce and soy sauce handicrafts,	×	×	
	- Waste from soft drink or alcohol manufacturing as tuberous beans and alcohol residues	×	×	
	- Waste look like kitchen waste	×	×	
	- Other waste which not nominate above.	×	×	×
10	**Construction Waste.**			
	- Plastic,	×	×	
	- Wood,	×	×	
	- Wood with paint*			×
	- Pieces of stone that remained from building,	×	×	
	- Excavated dirt,	×	×	
	- Cardboard: From packing,	×	×	
	- Metal*			×
	- Ceramic	×	×	
	- Paint*			×
	- Cement*			×
	- Lime*			×
	- Glue*			×
	-Glass	×	×	
	- Electricity equipment* as electricity wire, lamps,			×
	- Hard plastic: As plastic tube,	×	×	
	- Other waste which not nominate above	×	×	×
11	**Laboratory waste**			
	- Glass*			×
	- Chemical substance*			×
	- Sample*			×
	- Metal*			×
	- Electricity equipment*			×
	- Electronic equipment*			×
	- Rubber*			×
	- Clothes*			×
	- Radioactive instrument*			×
	- Other waste which not nominate above	×	×	×
12	**Waste on the roads.**			
	- Plastic,	×	×	
	- paper,	×	×	

No	Sources and kind of waste	BSL	SL	HL
	- cardboard,	×	×	
	- Metal*,			×
	- Wood,	×	×	
	- Green waste,	×	×	
	- Soil, stone,	×	×	
	- Glass,	×	×	
	- Dead animals,	×	×	
	- Dung,	×	×	
	- Other waste which not nominate above	×	×	×
13	**Park waste**			
	- Plastic,	×	×	
	- paper,	×	×	
	- cardboard,	×	×	
	- Metal*,			×
	- Wood,	×	×	
	- Green waste,	×	×	
	- soil, stone,	×	×	
	- Glass,	×	×	
	- Dead animals,	×	×	
	- Dung,	×	×	
	- Other waste which not nominate above	×	×	×
	Notice: Waste with star symbol (*)it means hazardous waste and other it means is not hazardous waste.			

Annex VI: Technical notes

A. Recommendations, requirements and obligations on the organisation and personnel, information and documentation, as well as operation

Recommendations, Requirements or Obligations	Type of landfill		
	Basic Standard Landfill (BSL)	Sanitary Landfill (SL)	Hazardous Waste Landfill (HWL)
1. Information and documentation **1.1 Working regulations**	Landfill operator shall be required to draw up a set of working regulations before putting any such facility into operation. To improve the operation these regulations shall be updated from time to time. The working regulations shall: a) Clearly describe safety procedures and disciplines at work, and submitted to the responsible authority, b) Provide for the procedures of operation and the waste management facilities, and be understandable and applicable, c) Be displayed at a prominent position, especially in the entrance area, d) Clearly highlight the handling measures of all waste types.		
1.2 Operating manual	Landfill operator shall draw up an operating manual prior to putting any such facility into operation. It must be updated. In the operating manual must define clearly: a) The operating measures, maintenance measures as well as preservation duties. They shall be co-ordinated with alert schedules and action plans, b) The tasks of personnel and responsibilities as under 8.1 of the landfill ordinance, and work instructions, inspection and maintenance measures as well as information, documentation.		

Recommendations, Requirements or Obligations	Type of landfill		
	Basic Standard Landfill (BSL)	**Sanitary Landfill (SL)**	**Hazardous Waste Landfill (HWL)**
1.3 Operating journal	Landfill operator shall set up an operating journal before operation as verification of proper operation. The operation journal is setting up for all data of significance to the landfill operation like a). data on wastes accepted: determining the quantity in units of weight; also in units of volume insofar as this is appropriate , types and their whereabouts, b). results of material-related monitoring and inspections of wastes accepted, c). malfunctions, including the possible causes and remedial action taken, d). operating times and downtimes. e). nature and scope of structural and maintenance measures. Any other verifications demanded by the responsible authority as well as their results must also be recorded in the operating journal. The operating journal must be a). examined at regular intervals by the head of the control organisation unit. It must be set up in such a way that it is indelible and protected against unauthorised access. b). possible at any time to inspect the operating journal and present readable text. c). kept for a while until after no effect is detected after the landfill closure with consent from the responsible authority. The operating journal must be presented to the competent authority on request.		
1.4 Obligations to give information to the authorities	Landfill operator shall draw up overview of landfill management within a period of three months and annual report containing specific data and shall present them to the responsible authority. Malfunctions leading to a significant divergence from proper operation, in particular to a standstill of the facility, must be reported immediately to the responsible authority.		
2 Operation			

Recommendations, Requirements or Obligations	Type of landfill		
	Basic Standard Landfill (BSL)	**Sanitary Landfill (SL)**	**Hazardous Waste Landfill (HWL)**
2.1 Control analysis	An incoming inspection must be performed when waste is delivered. Incoming inspection is to involve: a) ascertaining the type of waste, b) performing visual checks, in addition, it shall also be possible to conduct a control analysis by responsible staff, c) visual inspection must be performed in a proper time without alerting to the transport company in advance, d) the landfilling area personnel must check for appearance of consistency, colour and odour. If there are discrepancies exist between accompanying papers and delivered waste In this case, a control analysis must be performed on the parameters and distinguishing character of waste. The data specified in letters a) to d) must be recorded in the operating journal.		

B. General and basic requirements on landfills

<table>
<tr><th rowspan="2">Recommendations, Requirements or Obligations</th><th colspan="3">Type of landfill</th></tr>
<tr><th>Basic Standard Landfill (BSL)</th><th>Sanitary Landfill (SL)</th><th>Hazardous Waste Landfill (HWL)</th></tr>
<tr><td>1. General principle</td><td colspan="3">Landfills must at least comprise an entrance area, working areas (like storage area, receiving area, interim storage area, office, transfer sites, etc.) and a landfilling area, each of which must be set up separately from the other areas.
The entrance area must have
a) parking space for delivery vehicles,
b) weigh-bridge with reception office,
c) sampling bay.
The area must be provided with at least the following:
Materials and equipment for the combating of fires and facilities for collecting extinguishing media.
All facility areas capable of accumulating contaminated water must be sealed in such a way that the underlying stratum and adjoining areas are prevented from becoming contaminated.
Landfills must be operated in such a way that by compressing wastes to the maximum possible extent full utilisation is made of the available landfill volume.</td></tr>
<tr><td>2. Interim storage areas</td><td></td><td colspan="2">On sanitary landfills, a separate interim storage area must be installed outside the landfilling area. It must be kept clear for wastes necessitating a decision on the ultimate mode of disposal. The area must be rated in such a way that it is capable of accommodating a volume of waste of at least 300 m³.</td></tr>
</table>

Recommendations, Requirements or Obligations	Type of landfill		
	Basic Standard Landfill (BSL)	**Sanitary Landfill (SL)**	**Hazardous Waste Landfill (HWL)**
3. Location	Landfills must not be installed: a) in (karst - ist eine Region mit Klüften) regions and areas with heavily faulted substrata particularly permeable to water, b) provisionally secured or water protection areas, c) flood zone or it can be a flood zone, d) in the area of nature reserves and in the areas for forest protection. For the area of a proposed site, attention must be paid to the following: f) geological, hydro-geological and geotechnical conditions and in the downstream groundwater collection area, g) location in areas subject to the risk of earthquake, h) location in areas in which landslides and sinkholes have not come to rest and of discontinued mining area, landfill formation level must be arranged in such a way that after the substratum has finished settling under the load of the landfill, it comes to rest at least 1 metre above the highest expected groundwater surface or groundwater pressure area in the case of free or confined groundwater. The scope of geological, pedological and hydrogeological investigations depends on the site-specific conditions. In each case, it must be defined in such a way that a sufficiently accurate description of the substratum is possible down to significant depths. The substratum must be of such rigidity that it is capable of adsorbing strain from the landfill in such a way that no damage is caused to the landfill base lining system and the stability of the landfill body is not jeopardised.		

C. Basic technical installation of landfill lining system

Recommendations, Requirements or Obligations	Type of landfill		
	Basic Standard Landfill (BSL)	**Sanitary Landfill (SL)**	**Hazardous Waste Landfill (HWL)**
1. General	As recommended, a landfill lining system is to be planned and constructed in accordance with picture 1 and 2 on in this annex. A responsible contractor must be appointed for constructing the lining system of a landfill or of a construction phase. Settlements and deformations in the seal-bearing surface and lining systems must be calculated and monitored during the operational phase (e.g. by measuring deformation around the drainage pipes if existing).		
2. Landfill base lining systems	A landfill lining system must be arranged on the landfill formation level and on the sloping areas. Vertical penetrations through the lining system shall not be permitted. Under the landfill formation level a geological barrier is recommended, that: • is the natural substratum extending as far as the landfill formation level beneath and surrounding a landfill which, on the basis of its properties and dimensions, extensively prevents the spread of pollution. • shall be in all cases comprise naturally arranged, slightly permeable, unconsolidated or consolidated rock and exhibiting a high pollution retention capacity extending beyond the area of the landfill. • shall be as homogeneous as possible. Landfill lining system must be constructed bottom-up		

Recommendations, Requirements or Obligations	Type of landfill		
	Basic Standard Landfill (BSL)	**Sanitary Landfill (SL)**	**Hazardous Waste Landfill (HWL)**
	• recommended geological barrier of ≥ 50 cm thickness with k < 1 x 10^{-8} • landfill plane • required mineral sealing -clay - layer (at least of 2 layers) ≥ 50 cm thickness with k < 1 x 10^{-7} m/s , • the surface of the sealing layer must exhibit a longitudinal gradient of ≥1 %, • required drainage layer ≥ 50 cm. See figure 1 of the annex	• Recommended geological barrier of ≥ 100 cm thickness with k < 1 x 10^{-8} • Landfill plane • Mineral sealing - Clay - layer (at least 3 layers) ≥ 75 cm with k < 1 x 10^{-9} • Synthetic sealing liner > 2,5 mm • The surface of sealing liner must exhibit a gradient of ≥ 1% • Protective layer • Drainage layer ≥ 30 cm • Perforated drainage pipe See Figure 2 The landfill base lining system is to be constructed as described below or comprise an equivalent system. A permeability coefficient of k ≤1 x 10^{-9} m/s at i = 30 (laboratory value of undisturbed sample taken from the seal) must be observed. An appropriate asphalt sealing liner of 2 x 6 cm (total 12 cm) thickness can be installed in alternative to synthetic sealing liner.	• Required geological barrier (synthetic construction of conditions also possible) of ≥ 300 cm thickness with k < 1 x 10^{-9} • Landfill plane • Mineral sealing - Clay - layer (at least 3 layers) ≥ 75 cm • Synthetic sealing liner > 2,5 mm • The surface of sealing liner must exhibit a gradient of ≥ 1% • Protective layer • Drainage layer ≥ 50 cm • Perforated drainage pipe See Figure 2 A permeability coefficient of k ≤1 x 10^{-9} m/s at i = 30 (laboratory value of undisturbed sample taken from the seal) must be observed.

<table>
<tr><th rowspan="2">Recommendations, Requirements or Obligations</th><th colspan="3">Type of landfill</th></tr>
<tr><th>Basic Standard Landfill (BSL)</th><th>Sanitary Landfill (SL)</th><th>Hazardous Waste Landfill (HWL)</th></tr>
<tr><td></td><td colspan="3">Perforated pipes (collectors), additionally capable of being rinsed and monitored, must be provided for the collection and discharge of leachate. The leachate must be channelled by means of free flow into drainage shafts that are to be installed outside the landfilling area.
Once the sealing bearing surface has finished settling, the surface of the sealing layer must exhibit a transverse gradient of ≥ 3 % and a longitudinal gradient of ≥1 %.
The drainage material must be placed in blanket form and exhibit a permeability coefficient of recommended no less than k = 1 x 10^{-3} m/s.</td></tr>
<tr><td rowspan="3">3. Landfill surface lining systems</td><td colspan="3">A surface lining system must be applied to the landfill body after a landfill section has been filled. If required by the intended and permissible mode of subsequent utilisation, the re-cultivation layer may be substituted by a cover layer tailored to the relevant usage and having an equivalent protective effect on the lining system.
The individual elements shall be subject to the following requirements:
a) The sealing-bearing surface must comprise a compressed equalising layer of homogeneous, non-cohesive material. Thickness must not be less than 0.5 m. Final settlement in the seal bearing surface must leave a gradient of ≥5 %.</td></tr>
<tr><td>b) landfill gas collection system is not required,
c) installation of a mineral sealing - clay - layer with a thickness of at least ≥ 25 cm</td><td colspan="2">b). Installing gas collection system horizontally in compressed layer covering the waste.
c). Mineral sealing -clay - layer of a thickness of at least 50 cm with a permeability coefficient of no less than k = 1 x 10^{-9} m/s , On top of the layer is a plastic layer of at least 2.5 mm. Another layer is needed to protect the plastic layer .</td></tr>
<tr><td colspan="3">c). The drainage layer must be constructed in a thickness of d ≥ 0.3 m. The drainage material must be placed in blanket form and exhibit a permeability coefficient of no less than k = 1 x 10^{-3} m/s,
d). The re-cultivation layer must comprise a layer of tillable soil of at least 1 m in thickness and be planted with suitable vegetation. It must be placed in such a way that the seal is protected against the effects of roots growth. The vegetation must provide adequate protection against wind or water erosion. In observing the meteorological data and in applying good water management practice, the vegetation must furthermore be selected in such a way that it minimises infiltration of precipitation water into the drainage system.</td></tr>
</table>

D. Basic technical installation of landfill leachate and gas collection

<table>
<tr><th rowspan="2">Recommendations, Requirements or Obligations</th><th colspan="3">Type of landfill</th></tr>
<tr><th>BSL</th><th>SL</th><th>HSL</th></tr>
<tr><td rowspan="2">1. Leachate collection and treatment</td><td colspan="3">Leachate collection should be installed with state-off-the-art standard, and the leachate treatment facility must be installed and operated in the form of a waste-water treatment plant in observance of the conditions waste water management.
Planning for suitable leachate-treatment processes should take into account that leachate conditions and amounts and can vary, and the treatment procedure and the run-off value for the leachate treatment plant have to be referred to law.</td></tr>
<tr><td>The collected leachate shall be accumulated in a trench and leaded to concentration pond.
An non-ventilated waste-water pond (oxidation pond) represent minimum recommendation for treatment,
The sealing of ponds is to install in a manner that underlying stratum and adjoining areas are prevented from becoming contaminated, e. g. by using plastic liner.
the ponds shall be deep 1,0 -1,5 m,
the high precipitation amount on the pond area and retention period shall be considered during designing.</td><td colspan="2">The following statements may be considered from experience:
• no single process is equally effective for treating all pollutant groups,
• When process steps are combined, particular care must be taken to ensure that cleansing effectiveness of individual procedures is not reduced through the presence of substances in the leachate.
• when leachate-treatment processes are selected, provision must be made for leachate disposal after the landfill is no longer in operation.</td></tr>
</table>

Recommendations, Requirements or Obligations	Type of landfill		
	BSL	**SL**	**HSL**
2. Gas collection and treatment/utilisation	A gas collection and treatment/utilisation system is not required	Gas can only be collected satisfactorily with the aid of active degassing. • Degassing must be commenced while the landfill is in operation. The degassing plant must be ready for operation at the latest six months after landfilling begins. Optimum gas collection will only be guaranteed by a combination of active degassing (base/surface sealing) as well as system monitoring and maintenance, • The time history of landfill gas development must be sufficiently known before it is possible to rate the gas collection system and gas treatment facility. The gas quantities are generally computed on the basis of forecast models, in the case of existing landfills, the results must be verified by field trials.	

Recommendations, Requirements or Obligations	Type of landfill		
	BSL	**SL**	**HSL**
2.1 Collection system and its general requirements		The prime objective of degassing is to prevent pollutant emissions as well as to avert dangers and nuisance from landfill gas. Gas collection systems comprise a number of collection elements (collectors)- also differing in type – which are used jointly for landfill degassing. • It must always be possible to reliably drain collection elements of water. Water in the collection elements will render them partially or fully ineffective. Since water must also be expected in all areas of the landfill body in which gas flows, it must be possible to discharge the water in respect of the collection elements. • Collection systems must be operationally reliable and require little maintenance. Consequently, freely draining collection elements and drainage elements exhibit greater operational reliability than such in which water must be removed by means of pumping. • Collection systems must not impair the sealing systems. Particularly in the case of collection systems with vertical collection elements there is a danger that in the event of settlements taking place in the landfill body, the base and surface sealing systems could be subject to strain from the rigid collection elements. Appropriate measures must be taken in this respect to prevent any harmful strain.	

Recommendations, Requirements or Obligations	Type of landfill		
	BSL	SL	HSL
		• Collection systems must be reliably sealed against the inlet of air. The inlet of air may lead to the Generation of explosive mixtures. Collection elements still in the process of construction must, in the same way as completed elements, be protected against the admission of air. • The material from which the collection systems are made must be capable of permanently withstanding any anticipated physical, chemical and biological strain. Physical strain is mainly the result of load in conjunction with high temperatures (up to approx. 70°C). Exposure to chemicals must be expected from gas and leachate constituents, biological strain possibly from waste-decomposing micro-organisms. • The formation and Arrangement of collection elements must also permit the active degassing of the operating area. For this purpose, the pipes must be routed in such a way that they permit unimpeded landfill operations and reliably prevent the penetration of air. • The leachate draining systems must not be used for the purpose of active degassing.	

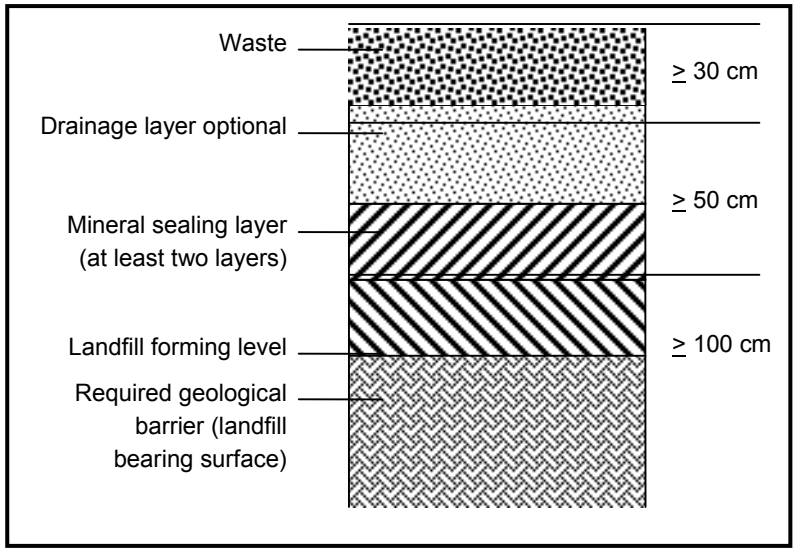
Recommendations, Requirements or Obligations	Type of landfill		
	BSL	SL	HSL
2.2 Collection elements, types and arrangements		Degassing collection systems can be: • single-point • vertical, blanket-type and linear-shaped • horizontal, blanket-type and linear-shaped as well as • combinations of horizontal and vertical collection elements. <u>Simple-point collection elements</u> • The degassing chambers are installed after the landfill body or the landfilling grid section is closed. Degassing chambers in general filled with coarse material which, after closing the landfill. Such chambers are difficult to drain. Therefore, they should only be provided in exceptional cases. <u>Vertical, blanket-typed collection elements</u> • Drainage walls of coarse material (also suitable waste) in the landfill body which are constructed as the landfill is filled. If these are envisaged for reasons of drainage planning, they may also be used for degassing. While they are being constructed, the relevant surface must be strictly closed in order to permit active degassing without penetration of air.	
		<u>Vertical, linear-shaped collection elements</u> A drainage pipe of nominal diameter > 200 mm must be built up as the shaft is being constructed. The shaft filling material is subject to the same requirements as those applicable to gravel and crushed-stone columns.	

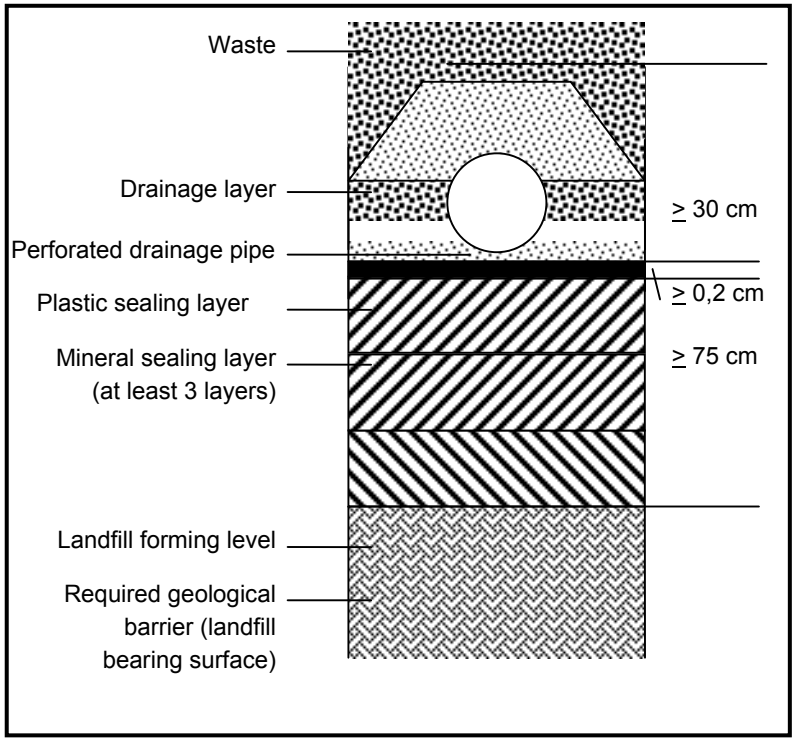
Recommendations, Requirements or Obligations	Type of landfill		
	BSL	SL	HSL
		Gravel or crushed-stone columns must be founded on a cushion of fine-grade refuse or other equalising material. The cushion thickness shall correspond to 10 - 15 % of the final height, however at least 2 m. The following requirements are placed on the column material: Grain size ≥16/32, carbonate content ≤ 10 % by weight. A minimum space of 2 m from the surface seal is to be maintained. Drainage may take place by means of trenchings running at an angle to the landfill base or via permeable foundation material.- <u>Horizontal, blanket-type collection elements</u> Gas drainage layers in the landfill body may be constructed of suitable waste material. Attention must be paid to ensuring an adequate angle of inclination (> 5 %). <u>Horizontal, linear-shaped collection elements</u> The efficacy of gravel sheathed drainage lines in the landfill body is particularly jeopardised by leachate blockages after varying degrees of settlement (subsidence). Adequate initial gradients (> 7 %), vertical drainage facilities in the landfill body and controllable lines affording the possibility of cleaning are necessary precautions to ensure long-term operational reliability. The drainage lines must be constructed of heat-resistant plastic materials with a nominal diameter > 250 mm. The requirements on drain material shall correspond to those applicable to gravel and crushed-stone columns. If only horizontal linear-shaped collection elements are employed in the construction of a collection system, such elements must be arranged with a horizontal spacing of approx. 30 m and vertical spacing of approx. 5-10 m. <u>Combination of horizontal and vertical collection elements.</u> Adding horizontal collection elements represents one possibility of enlarging the catchment area of vertical collection elements. Example these may be employed for degassing horizontal drainage lines converging onto a gravel column.	

Recommendations, Requirements or Obligations	Type of landfill		
	BSL	SL	HSL
2.3 Gas collection control and its general requirements		The prime task of gas collection and control facilities are: - to enable the gas collectors to catch the accruing landfill gas in such a way as to prevent any major migration from the landfill. - The air component of landfill gas must, however, be minimised. For this purpose, a finely adjustable suction extraction line must be provided at each collector. It must be possible to attain a vacuum of p = 3 kPa (30 mbar) at each collector head in any operating status. The velocity of gas in the receiver lines is to be less than 10 m/s.	
2.4 Collection and control system		**General** The line network is subject to physical, chemical and biological strain. Allowance must be made for these factors when rating the facility, constructing the pipe system as well as in selecting the materials. Tension and deformations in the pipe network will be caused by settlement of the landfill body and exposure to temperature. • In order to avoid the formation of troughs, all gas and condensate pipes in areas subject to settlement must be installed below ground at a gradient of at least 5 % or above ground at gradient of at least 2.5 %. • The horizontal and vertical movements of collectors must be absorbed at all times by flexible connections. • Central stations must and substations should be erected on ground exhibiting an adequate load-bearing capacity. • The aspects of safety, particularly in the area of central stations, may require the use of materials affording particular properties (compressive strength, electrical conductance, heat resistance etc.).	

Recommendations, Requirements or Obligations	Type of landfill		
	BSL	SL	HSL
		In order to enhance operational reliability and minimise pressure loss, pipe inside diameters should be ≥100 mm. **Receiving systems** Gas collectors may be linked to the central stations directly or via intermediate receivers. When connected individually, the gas collectors are linked directly to the central station. When connected in groups, individual gas collectors are collated into substations, and linked with the central stations. **Control systems** Control must take place by monitoring the quantity and quality of gas and comparison with a specific range of values. Manually monitored control variables must be determined at least once a week.	
2.4 Condensate separation		The water-vapour saturated landfill gas precipitates condensate in the pipe system. It must undergo regular examination. The volume of water occurring when the gas cools down from 55°C to 20°C must be regarded as the basis for rating the condensate volume. Suitable measures must be employed to ensure that no air can be sucked into the pipe. The condensate must be managed in accordance with means available in the state of-the-art. In many cases, it may be managed together with the leachate.	

Recommendations, Requirements or Obligations	Type of landfill		
	BSL	SL	HSL
2.5 Monitoring the efficiency of degasing		The discharge of gas from the landfill surface must be prevented and landfill gas must be prevented from migrating into the area surrounding the landfill, or at least be minimised. **Open landfills or landfill sections** In addition to the weekly degassing efficiency check performed by the landfill operator, an external check must be carried out every three months by an expert body and the efficiency of active degassing of open landfills or landfill sections must be monitored every six months at the landfill foot. **Finally covered and sealed landfills or landfill sections** The efficiency of active degassing must be monitored every six months by expert body. Freedom from landfill gas in the vegetation layer of the landfill cover and in the area surrounding the landfill shall be checked.	


Waste
≥ 30 cm
Drainage layer optional
≥ 50 cm
Mineral sealing layer
(at least two layers)
Landfill forming level
≥ 100 cm
Required geological
barrier (landfill
bearing surface)


Waste
Drainage layer
≥ 30 cm
Perforated drainage pipe
≥ 0,2 cm
Plastic sealing layer
Mineral sealing layer
(at least 3 layers)
≥ 75 cm
Landfill forming level
Required geological
barrier (landfill
bearing surface)

Annex VII: Limit values for sludge to be composted

Parameter	Limit value (mg/kg d.m.)
Cadmium	≤ 20
Chromium	≤ 1000
Mercury	≤ 16
Nickel	≤ 300
Lead	≤ 750
Copper	≤ 1000
Zinc	≤ 2500

Annex VIII: Heavy metal concentrations in the compost

Heavy Metal	Suggested concentrations for standardised compost in Cambodia (mg/kg)
Cadmium	≤ 1,5
Chromium	≤ 150
Mercury	≤ 1
Nickel	≤ 100
Lead	≤ 150
Copper	≤ 230
Zinc	≤ 400

Annex IX: Technical requirements for facilities for biological treatment

1 Biological treatments

There are two main purposes of biological treatments:

- Treatment of mixed or residual waste (waste stabilisation) to be landfilled, in order to achieve biological stability before landfilling, thereby reducing production and release of leachate and methane from landfills
- Treatment of bio-waste (composting) in order to produce a compost to be used in farmlands, gardening, landscaping, etc..

In this annex, recommendations are given for composting facilities.

1.1 Treating facility conditions of different bio-waste

All kinds of bio-waste do not contain the same water content or fermentable levels. Some waste carries high water content and rapid fermentation and digestion (as food waste, sludge, etc.) and some has low water content and fermentable levels (as garden waste).
For good composting process, including minimisation of disamenities, the following is therefore recommended:

- In order to avoid odour nuisance, highly fermentable input waste (like sludge, food waste etc.), needs to be stored for comparatively short time periods; normally 2 days and 5 days at the longest.

- sites should be provided with an enclosed treatment area to host the following steps:
    - delivery of waste
    - processing until the 4th week
- The obligation concerning enclosed processing does not apply to the following conditions:
    - facilities treating only vegetable waste like wooden scraps and garden waste
    - facilities fulfilling the following requirements referred to distance from dwellings and treatment capacity
        - Capacity less than 1.000 tonnes/year and located more than 500 meters away from human dwellings,
        - Capacity less than 3.000 tonnes/year and located more than 1.000 meters away from human dwellings,
        - Capacity less than 6.000 tonnes/year and located more than 1.000 meters away from human dwellings, in case static pile process systems are adopted for early composting steps ; in this case, anyway, the delivery and pre-treatment areas must be in enclosed structures anyway.

1.2 Composting process management

For successful composting, the managers have to consider one of the following processing systems:

- forced aeration should be adopted, by blowing or sucking air, appropriate sizing of the blowing fans to supply a minimum of 15 m3/hour per ton of fresh matter. In case of discontinuous forced aeration, fan switch-off time lasting no more than 30 minutes.
- only when processing vegetable/garden waste, or with small windrows and piles, (maximum height 150-200 cm), passively aerated piles may be adopted; passive aeration may be facilitated through pipes
- maximum height of heaps in active composting phase is 2,5 meters for static systems and 3.0 meters for dynamic systems.
- in case of processes adopting static piles, at least 50% bulking materials (garden waste and wooden scraps) has to be included in the input mixture
- process control instruments should be adopted (at least temperature probes),
- wetting systems should be installed, at least in the active composting phase,

1.3 Wastewater Management

The wastewater management facilities must be provided in the whole operational areas of the composting site. The bottom of the all operational areas like tipping area, storage area, pre-treatment area, ACT area, curing area and post-treatment area have to be paved so that wastewater do not leak into the groundwater. Sites treating up to 1000 tonnes/year of garden waste and wooden scraps may be exempted from paving; in this case a drainage

layer of wooden chips is anyway recommended to avoid mud and prevent stones and other mineral materials from being included in compost.

In case of paving, the following should be considered for the management of wastewater and proper design of storage systems.

1.3.1 Leachate from ACT

Leachate from ACT and the tipping area must better be recycled into the process itself, rather than being sent to a water treatment plant.
In facilities with an enclosed processing area, recycling of leachates on the heaps must be performed only in enclosed areas, because of its potential generation of odour nuisance.
A storage tank must be adopted; the following formula must be used for the calculation of the tank capacity:

$$C = R \times Q \times T : 1000$$

In which:

- C = Storage needed (Cubic metres)
- R = Leachate production coefficient (lt/tonne.day)
    - Usually $2 < R < 5$ with lowest numbers referring to aerated systems
- Q = Biowaste in ACT at any single time
- T = Time (days) elapsing between one emptying and the next

1.3.2 Leachate from outdoor processing/curing stage

This wastewater should be recycled onto the heaps in the ACT phase. In order to calculate the storage tank capacity the following may be used

$$Q = S * (P:1000) / 30,$$

where:

- Q = Storage needed (cubic meters)
- S = Curing surface area (square meters)
- P = Mean yearly total rainfall (mm/year)

So the rule of the thumb is: around 1 m3/ 30 m2 per each meter rainfall.

1.3.3 Rainfall

Rainfall on outdoor transit areas (excluding curing) should have a separation of the “first rain” and the “second rain”.
First rain can be recycled in the process, both in the ACT and the curing phase, second rain can be discharged into the groundwater or channels/rivers.
For the calculation of first water storage need, the formula is:

$$C = (S \times P) /(1000)$$

Where:

- C = Storage needed (cubic meters)
- S = Surface area (square meters)
- P = First rain (mm) = 5

Rainfall from roofs may be discharged into the groundwater or in channels/rivers.

1.3.4 Contaminated water

These waters must be discharged to a wastewater treatment unit or in accordance with liquid waste management regulations.

1.3.5 Water from machine washing

They can be discharged according to liquid waste management regulations.

1.4 Exhaust air management

- In order to secure the minimisation of odour emissions and environmental nuisances, wherever there is an obligation for enclosed processing, there must be air suction and collection to an odour abatement unit,
- The abatement unit should be comprised of a bio-filter at least
- The bio-filter should be designed according to the following requirements:
    - specific load: 100 Nm3/m3.hr or less
    - retention time: 36” or more
    - height: between 120 and 200 cm
    - modularity: at least 3 modules independently detachable (so that other modules keep working while one is on maintenance)

1.5 Health issues

In order to prevent biological risk due to airborne pathogens and dust, workers involved in turning, shredding and screening must be provided with proper masks or machines with enclosed working cabins.

Annex X: Medical waste categories:

No.	Kind and Name of Waste	Waste Categories		
		A	B	C
1	**Waste look like household waste**			
	Food waste	x		
	Newspaper waste	x		
	Other letter waste	x		
	Other document waste	x		
	Package waste	x		
	Carton	x		
	Plastic bags	x		
	Food package waste	x		
	Cans	x		
	green waste	x		
2	**Sharp waste**			
	Syringes		x	
	Injection needles		x	
	Scavein		x	
	Catheters		x	
	Sewing wound needles		x	
	Scalpel blades		x	
	Other sharp instruments that could causes a cut or puncture.		x	
3	**Waste from wards; operating and maternity services**			
	Dirty operation clothes			x
	-Cotton wool			x
	-Plasters and bandage			x
	-Cleaning wound bandage			x
	-Gloves			x
	-blood			x
	-urine			x
	-Stool			x
	-Organ			x
	-Part of Limbs			x
	-Placenta			x
	-Embryos and dead babies			x
	-Human biopsy material			x
	-Urinal pots			x
	-Stoma bags			x
4	**Waste from laboratories**			
	-Pathology			x
	-Blood			x

	-Blood bags			x
	-Microbiology			x
	-Histology			x
5	**Pharmaceutical waste**			
	-Expired drugs			x
	-Expired drugs that have been returned from wards			x
	-Vaccines			x
	-serum			x
	-Cytotoxic drugs			x
6	**Radioactive waste**			
	Radioactive waste includes solid, liquid and gaseous waste that used in the research activities for defining disease reasons with the medicine service, and radioactive instrument.			x
7	**Chemical waste**			
	Chemical waste includes solid, liquid and gaseous waste that use in the research activities for defining disease reasons with the medicine service, and chemical instrument.			x
	-Chemical poisonous substances			x
	-Acid and base substances			x
	-Flammable substances			x
	-Reactive materials			x

Annex XI: Consignment note for the carriage and disposal of medical waste

Serial No.....

Reference:.....

	Wasteproducer	Collector and Transport Company	Receiver
Name of Company			
Contacperson			
Addess			
Tel:			
Fax:			
E-mail:			

Description of Wastes

Nr.	Description of Kind of Waste	Quanntity of Waste in tonnen	Waste Category		
			A	B	C
1					
2					
3					
4					
5					
6					
7					
8					
9					

	Waste Producer	Waster Coollector and Transport	Receiver
Date	.....	.....	.....
Signature:	.....	.....	.....
Name and Position:	.....	.....	.....