



Environmental Guidelines on Solid Waste Management in Kingdom of Cambodia

Preparing by: Ministry of Environment of Cambodia and COMPED-Cambodian Education and waste Management Organization

Under Project: Capacity Building and Reinforcement Policy in Cambodia in the Field of Solid Waste Management.

Support by: the European Union (Asia Pro Eco Programme)

The understanding of Excellency Dr. Mok Mareth

Now with the economic development and increasing people the requirement using equipment for their every day living is increased too, these are the reasons of the environmental issue and because of the people through out their solid waste around the country (provinces and cities) that it is negatively effect to the public health and environment. By understanding of this issue, the Royal of Cambodian government has cared and put out some measures as: preparing regulations for ensuring proper solid waste management with environmental safety, capacity building of skill staffs, educating people to understand the negative effectiveness of waste that will happen to themselves, the proper way of waste disposal with environmental sanitation and encouraging the involved institutions and private companies to behave regulations.

This environmental guideline has been gotten by trying very hard of Ministry of Environment and COMPED organization partner, this environmental guideline on Solid Waste Management in Royal Cambodia is fully detail that can be encouraged to behave the ready prepared regulations and it is an important base to help the involved institutions especially province-city authorities and private sectors to improve their Solid Waste Management which is facing the problems and make it better in the future.

This environmental guideline has been showed the technical mark of solid waste management as:

- Establishing Solid Waste Management Plan for province-city authorities and private sectors with short, medium and long term.
- Preparing, operating, maintenance and closing landfill.
- Methodology and condition of composting.
- Medical Waste Management which is hazardous waste.
- Showing the characteristic and method for educating public people.

By observing with usefulness of this environmental guideline, the Ministry of Environment is strongly support the meaning of this guideline and hope that it will help the waste owners' obligation as the involved institutions and other private sectors have managed their waste with environmental safety.

Phnom Penh, 9th, February, 2006

Senior-minister
Minister of Ministry of Environment

Dr. Mok Mareth

Remarks

The environmental guideline on Solid Waste Management in Royal Cambodia is established by Capacity Building and Policy Reinforcement in Cambodia in the field of Waste Management that sponsored by EU under the Asia Pro Eco Programme.

The purpose of this project is cooperated with the Ministry of Environment to establish and apply the environmental management guideline and capacity building on environment to public people.

To be reached the above purpose, the project is prepared a number of implemental programmers as training on Solid Waste Management and drafted the environmental guideline on Solid Waste Management that coordinated by COMPED organization and the international experts provided the consultation of technique and the participants are always have been gotten the advices from the Ministry of Environment.

The above guideline is established according to the laws and regulations. In the environmental guideline has provided a number of technical recommendations that have written in annex which is always required update for according to the real situation.

I hope that this guideline will help some parts in application of laws and regulations with perfection and effectiveness.

We are also deeply thanks the Excellency Senior-minister and Mister of Ministry of Environment that always supports the environmental programmes.

Phnom Penh, 1st February, 2006

Director of Cambodian Education and
Waste Management Organization
(COMPED)

Chau Kim Heng

Prepared by:

Group 1. Guideline of Solid Waste Management Plan

<i>Mr. Chin Sothonn</i>	<i>Department of Pollution Control, Ministry of Environment,</i>
<i>Mr. Sok Vuthea</i>	<i>Department of Environmental Education and Communication, Ministry of Environment</i>
<i>Mr. Khuon Dara</i>	<i>Environmental Department of Municipality, Chief of Environment Agent Office of Toul Kok District</i>
<i>Mr. May Vannak</i>	<i>Environmental Department of Municipality, Officer</i>
<i>Mr. Lim Ken</i>	<i>Environmental Department of Municipality, Chief of Environment Agent Office of Cam Kar Mon District</i>
<i>Mr. Pheng Virak</i>	<i>Environmental Department of Kandal Province, Environment Pollution Control Officer</i>

Group 2. Landfill Ordinance

<i>Mr. Sourn Punlork</i>	<i>Department of Pollution Control, Ministry of Environment; Officer</i>
<i>Mr. Ou Sophorn</i>	<i>Department of Environmental Impact Assessment; Officer</i>
<i>Mr. Heang Nhor</i>	<i>Environmental Department of Municipality; Deputy Chief of Pollution and Information Environment Office</i>
<i>Mr. Khuy Kuyney</i>	<i>Environmental Department of Municipality; Officer</i>
<i>Mr. Thor Sopheap</i>	<i>Environmental Department of Kandal Province; Vice Chief Environmental Pollution Control Office</i>
<i>Mr. Om Sophorn</i>	<i>Phnom Penh Waste Management; Staff</i>

Group 3. Composting Ordinance

<i>Mr. Ngeth Bol</i>	<i>Department of Pollution Control, Ministry of Environment</i>
<i>Mr. Pum Oeur</i>	<i>Environmental Department of Municipality Phnom Penh</i>
<i>Mr. Pech Y</i>	<i>Environmental Department of Municipality Phnom Penh</i>
<i>Mr. Iem Sitha</i>	<i>Environmental Department of Municipality Phnom Penh</i>
<i>Mr. Tit Sophanara</i>	<i>Environmental Department of Kandal Province</i>
<i>Mr. Bo Sokhan</i>	<i>Community Sanitation and Recycling Organisation (CSARO)</i>

Group 4. Guideline of Medical Waste Management

<i>Mr. Ly Huoth</i>	<i>Department of Planning and Legal Affairs, Deputy of Administration Office</i>
<i>Mr. Sar Song</i>	<i>Environmental Department of Municipality, Chief of Pollution and Information Environment Office</i>
<i>Mr. Uong Bunal</i>	<i>Environmental Department of Municipality, Deputy Chief of Pollution and Information Environment Office</i>
<i>Mr. Chim La</i>	<i>Environmental Department of Kandal Province, Vice Chief Environmental Pollution Control Office</i>

Mr. Sarun Sambo *Department of Pollution Control, Ministry of Environment, Vice Chief Office*

Mr. Som Seiharath *Ministry of Health, Staff*

Group 5. Guideline of Environmental Education

Mr. Ou Vitou *Department of Pollution of Control, Ministry of Environment, Officer*

Mr. Yin Bunnang *Department of Environmental Education and Communication, Vice Chief of Education and Training Environment Office*

Mr. Ly Long *Environmental Department of Municipality, Chief of Environment Agent Office of Reu Sey District*

Mr. Huy Phalvudy *Environmental Department of Kandal Province, Vice Chief Office of EIA*

Mr. Kok Sothea *Royal University of Phnom Penh, Staff*

Technical Advisors

- Bauhaus Universität Weimar (European project applicant)
- Scuola Agraria del Parco di de Monza (European project partner)
- KNOTEN WEIMAR GmbH, Germany
- Thüringer Ministerium für Landwirtschaft, Naturschutz und Umwelt, Germany
- Bioverwertung & Recycling GmbH Erfurt, Germany

I Introduction

1 The goals and purposes of the guidelines

Goals and purposes of the environmental guidelines on solid waste management to ensure the protection of the public health, environment and the conservation of bio-diversity by avoiding polluting by solid waste.

To reach the above purposes of the guidelines the following goals have to be achieved

- encourage/push to carry out the principle for the avoidance/reduction of waste amount, reuse, recycling and the disposal of waste in a proper technical manner and safe way,
- encourage/push to all citizens and members of the public from different levels to understand and to be familiar with the importance of environmental and natural resources protection for present, future generations and environmental sustainable development.
- encourage/push that proper waste management plan to a sustainable development of the Country, protecting its natural asset and concurrently creating jobs

2 Related laws according to the solid waste management

2.1 The law on the environmental protection and natural resources management

Article 13: The reduction and control of air soil water pollution and disturb of voice, vibration and hazardous waste that have defined in sub-decree through the Ministry of environment requests.

2.2 The sub-decree No 36 on the solid waste management.

Article 1: The purpose of this sub-decree is to regulate the solid waste management with proper technical manner and safe way in order to ensure the protection of public health environmental quality and the conservation of bio-diversity.

Article 4: The Ministry of Environment shall establish guidelines on disposal, collection, transport, storage, and recycling, minimizing amount of waste and dumping of household waste in province and cities in order to ensure the management of waste with safe way.

The authorities of the provinces and cities shall establish the waste management plan in their province and city for short, medium and long-term.

Article 11: The Ministry of Environment shall establish guidelines on the management of hazardous waste to ensure the safe management.

2.3 The declaration (Prakas) No. 80 of the Ministry of Interior and the Ministry of Environment on garbage solid waste management in provinces-cities of the Kingdom of Cambodia.

Article 1: The purpose of this declaration is to improve the responsibility of an authority and involved institutions for mental and efficient implementation on solid waste management in provinces and cities of the Kingdom of Cambodia, which under

administer by themselves, in order to ensure to protect the human health, environmental quality, beauty and bio-diversity.

Article 2: This declaration shall be applied to all activities that related to collection, temporary storage, transport, recycling, dumping of garbage and all types of solid waste in provinces and cities of the Kingdom of Cambodia.

3 Extent of the guideline

This guideline applies to all activities related to discarding, storage, collection, transport, recycling, treatment, composting and disposal of all kinds of solid waste.

II Definition

Unless otherwise stated, the technical terms or expression herein shall be interpreted or referred to as follows:

Solid waste – SW: solid waste refers to solid objects, solid substances, materials or refuse which are useless, are intended to be disposed of, or require to be disposed of;

Non hazardous solid waste - NHSW: means waste, that doesn't represent danger for human health, animals or plants respectively like general waste from households, markets, public places, restaurants, guesthouses, hotels, parks, commercial facilities, etc. - see annex I.

Hazardous solid waste - HSW: hazardous waste refers to radioactivity substances, explosive substances, toxic substances, inflammable substances, pathogenic substances, irritating substances, corrosive substances, oxidizing substances, or other chemical substances which may cause the danger to human (health) and animal or damage plants, public property and the environment. The hazardous waste may be generated from dwelling houses, industries, agricultural activities, business and service activities, mining,....etc. The type of hazardous waste is listed in the Annex of this sub-decree no 36 ANRK.BK dated 27, April 1999. on the solid waste management.

Municipal solid waste: MSW is mainly constituted of household waste and household like waste discarded from dwellings, public buildings, factories, markets, hotels, business buildings, restaurants, transport facilities, recreation sites, etc;

Household waste: household waste is part of solid waste predominantly from private household.

Medical waste-MW: refers to waste, which is generated from all medical facilities and activities.

Market waste: waste generated from markets.

Slaughterhouse waste: waste generated from slaughterhouses.

Agriculture waste: waste generated from planting or harvesting of crops, trimming or pruning of plants, and wastes or run-off materials from farms or fields.

Garden waste: refers to lawn mowing, leaves, branch/twigs of trees, etc.

Industrial waste: waste generated in industries, factories, etc.

Construction & demolition waste: construction debris, excavated materials and road/bridge construction debris, etc.

Laboratory waste: waste in laboratories.

Street sweeping: waste generated during street cleaning.

Kitchen waste: food scraps from preparation of meals and related leftovers after meals, such as vegetable, fruit, meat, fish, bones, skins, feathers, egg shells, including pieces of paper and cardboard made dirty because of contact with the food (e.g. wrapping materials).

Bio-waste: refers to kitchen waste (food scraps) be it of animal or vegetal origin and green waste, which can be biodegraded.

Biodegradable waste: means any waste that is capable of undergoing anaerobic or aerobic decomposition, such as food left-over, green waste, paper and paperboard.

Packaging waste: waste arising from used packaging, disposed of by final users or waste producers.

Recyclable waste: waste materials that can be reused or processed into intermediate or new products.

Sewage Sludge: refers to solid or semi-solid material generated by sedimentation or biological treatment at municipal or similar industrial wastewater treatment plants including sludge that has been de-watered or dried or treated in any other form.

Landfill: means a waste disposal facility for disposal of waste not capable of further processing/recycling, onto land or into land.

Landfill leachate: means any liquid percolating through the deposited waste and emitted from as well as contained within a landfill.

Landfill gas: all gases, which are generated from the landfilled waste through spontaneous or induced decomposition.

Contaminated water: all water at a disposal facility that got in contact with waste.

Compost: refers to the final product of composting. It is basically a soil improver (or a peat substitute in potting mixes) but also provides for a supply of nutrients, thereby replacing chemical fertilizer in croplands, it makes soil fertile and improves the soil structure, biological functions and bio-diversity and water retention capacity.

Composting: biological transformation process under proper aerobic conditions, that partly degrades and partly transforms organic matter into humus-like substances; the process evolves through a thermophilic phase (whereby sanitization of materials is ensured) and leads to a stabilised material, where residual fermentation is reduced to the least. Composting takes place in presence of oxygen.

Digestate: solid or semi-solid residues after anaerobic digestion.

Anaerobic digestion: biological transformation process taking place in the absence of oxygen that generates biogas (including methane) and a residue that may be used as a feedstock for a subsequent composting step. or used directly in crops

State of the art: means proper technical approach and/or technology at present.

Waste treatment facilities: means sites hosting any physical, thermal, chemical or biological processes, including sorting, that change the characteristics of the waste in order to reduce its volume or hazardous nature, facilitate its handling or enhance recycling/recovery.

Dumping areas: located on the landfill with underground installation in which waste can be deposited without limit of time.

Intermediate storage area: intermediate storage shall be understood to be a fixed waste management installation in which waste is received, prepared for treatment, assembled for further management or stored.

Storage area: storage area shall be understood to be that part of a waste management installation where waste materials, treatment chemicals or residual material are stored for a limited period.

Entrance area: an entrance area shall be understood to be an area within a waste management installation at which waste is delivered, sorted by weight or volume and identified.

Working areas: working areas shall be understood as areas within the operating site of the waste management installations in which waste materials are handled. The working areas may be located at the entrance, in storage areas or in the treatment area of a waste management installation.

III Guideline on solid waste management plan

1 The purpose

This guideline is intended to enhance waste management plan in order to initiatives of preventing/reducing amount of waste, reusing, recycling and storing waste in a safe way.

2 Preparation of a solid waste management plan (SWMP)

- [1] Those responsible for devising a plan for the management of all types of waste are:
 - [a] The authorities of the provinces or cities shall establish the solid waste management plan (master plan) in their provinces or cities for medium and long-term.
 - [b] In order to contribute to ensuring the effectiveness of solid waste management drive, such private institutions as factories, enterprises, hospitals, polyclinics, health centres, supermarkets, universities, guesthouses and hotels shall also have their own short, medium and long-term waste management plans in place, which has to be made consistent with strategies for implementing concepts of the general waste management plan.
- [2] Duty of SWMP establishment
To draw up the SWMP, the entities described in point 1, b above must
 - [a] establish a SWMP for every 5 years and submit it to the ministry of environment and to the local authorities through environmental department .
 - [b] send the report of their last year solid waste management in which the type and amount of waste and waste flows are mentioned, to the ministry of environment and to the local authorities at the beginning of the following year.
 - [c] send reports about the implementation of their 5 year solid waste management plan to their environmental department and authorities of province and/or city for verification and evaluation.
- [3] Local authorities with relatively small population should preferably seek co-ordination with bordering provinces or city as far as sites for waste treatment and disposal are concerned.

3 Content and form for preparing the solid waste management plan

3.1 Content of the solid waste management plan

In the solid waste management plan for either a short or medium or long-term, the following have to be included,

- [1] Data concerning kind and quantity of the hazardous and non-hazardous solid waste as appeared in annex I,
- [2] The description of planned measures for avoiding the generation of waste, reducing waste amount, reusing, recycling and disposal of waste in a safe way,
- [3] In case there is a self disposal site, reports on the data of disposal site which responses to the landfill ordinance must be sent to respective environmental authority of province or cities for approval,

- [4] Explanations for any shortcomings in waste disposal, especially according to the existing facilities.
- [5] The exportation of solid waste from the Kingdom of Cambodia to the other countries shall be consistent with the sub-decree No. 36. The exportation of the hazardous waste shall be consistent with the provisions and principles of 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their disposal, which came into force on May 05, 1992.

3.2 Type, Quantity and source of waste

- [1] Those responsible for developing solid waste management plan have to report on:
 - [a] type and amount of hazardous and non hazardous solid waste as prescribed in annex I,
 - [b] source of the generated waste referring to the above mentioned waste,
 - [c] date of waste generation.
- [2] Quantities of waste are to be indicated in tonnes.

3.3 Whereabouts of waste:

- [1] Those responsible for designing solid waste management plan must establish waste handling, storage, transportation and disposal procedures in a way that they will not cause any harm to human and animal health and to the quality of natural surroundings by using sites which are proper to certain practices state-of-the-art as appeared in annex II,
- [2] The waste disposal site has to include the following data:
 - [a] The owner or manager of the waste disposal site,
 - [b] Address and kind of landfill,
 - [c] Permission to operate the landfill,
- [3] Solid waste management plan designers must apply procedures for the avoidance/reduction of waste amount, reuse and recycling under annex III in a way that they will not affect people's health and the environment,
- [4] In case of any exportation of solid waste beyond the kingdom of Cambodia, the item No. [5] of the bullet point 3.1 hereof shall apply.

3.4 Measures

- [1] Solid waste management plan producer shall explain every step of measures and give clear reasons for the introduction of principles of avoidance and/or reduction, reuse, recycling and storage of solid waste in a safe way,
- [2] As far as a self disposal site is concerned, the waste manager has to build the disposal site in compliance with the landfill ordinance.

3.5 Proper form of solid waste management plan

Procedures for designing a solid waste management plan shall:

- [1] use the form in annex IV for drawing up solid waste management plan,
- [2] all entries in the documents must be made legibly in Khmer language with pressure typewriter or computer.

3.6 Merger of solid waste management plans

Those who are required to prepare a solid waste management plan are allowed to merge solid waste management plan into a common one on request if:

- [a] they essentially produce wastes, which are to be assigned to the similar of waste categories,
- [b] activities are carried out in the same communities, and
- [c] wastes are from comparable origin economic range sources.

3.7 Necessity information for set-up of solid waste management plan

The provincial or city authorities have to know the following important information, to be able to set up solid waste management plan for superior areas like communes.

- [1] Infrastructure of generation waste areas like population number and evolution, economical evolution and traffic structure.
- [2] Waste management structure like administration, collection and transport, disposal and measure of waste avoidance/reduce reuse and recycling.

IV

Landfill Ordinance

1 The purposes

- [1] to reduce as far as possible negative effects of waste on the environment by the disposal of waste on landfills;
- [2] to preserve of groundwater, surface water, atmosphere quality and to reduce emission of greenhouse gases;
- [3] to reduce the quantities of the waste and the negatives properties of the waste like leachate and landfill gas by taking appropriate treatment measures and separation of waste;
- [4] to ensure that waste is not harmful to the human, natural and animal health during the operating phase and after closure of landfills as well as
- [5] to provide information and technical recommendation about the constructing and operating of landfills and disposal of waste, its closing and follow-up management in order to ensure the safety and the health of the public and environment protection.

2 Type of Landfill

Given the current condition in Cambodia the landfills can be divided in three different types:

- [1] Basic standard landfill - BSL: intended for disposal of non hazardous solid waste (NHSW), see annex V. It is possible to construct it with basic technical standard (but avoiding any effect to the environment) and only in non industrial regions,
- [2] Sanitary landfill - SL: is for disposal of non-hazardous solid waste (NHSW), see annex V. It should be constructed in each capital city of the provinces, cities and industrial regions.
- [3] Hazardous waste landfill - HWL: is for disposal of hazardous solid waste (HSW) only, see annex V.

3 Requirements of landfill

3.1 General conditions of landfills

Landfills are divided in three different classes, see point 2 above. Basic Standard landfill (BSL) represents minimum requirements that has to be controlled and permitted. Sanitary landfill (SL) and hazardous waste landfill represent state-of-the-art landfill requirements. Steps for extension of permission from BSL to SL should be smooth and should be determined by competent and provincial-city authority after evaluation. Further the competent provincial or city authority is responsible for controlling of construction of landfill.

3.2 Necessary requirements of a basic standard landfill (BSL) are

- [1] Location of the BSL has to be hedged to avoid spreading of waste and unauthorized access; trees should be planted inside the fence,
- [2] Installation of flat bottom area covering the whole landfill area, that is at least 0.5 m higher than the surrounding area consisting of a landfill lining system as required in annex VI, slope to at least one side after settlement (elevation in the centre during construction) at least 1 % as required in annex VI,
- [3] The access road system to landfill has to be constructed in a manner that all kinds of waste transportation vehicles during all seasons are able to use it,

- [4] Management office is located at the entrance of the landfill. Management office includes storehouse, toilet, personal safety tools, extinguishers, controlling and monitoring equipment.
- [5] Installation of a residual waste (dumping area),
- [6] Installation of a leachate pond on the deepest level of the landfill, as required in annex VI,
- [7] The information of waste amount and/or volume, as required in annex VI, has to be estimated by a trained person,
- [8] Admittance of scavengers should be subject to permission,
- [9] Open fire shall be avoided and/or excluded,
- [10] Waste has to be dispose in a steady manner, as recommended in annex VI.

3.3 Necessity requirement of a SL are:

- [1] Implementation like BSL in point [1], [3], [4], [5], [8], [9] and [10] of 3.2 as well as in additional:
- [2] Bottom layer after state-of-the-art technology see annex VI,
- [3] Installation of a landfill leachate and treatment system, recommended landfill gas collection and treatment system, see annex VI,
- [4] Weighbridge has to be installed to define the amount of waste for disposal,
- [5] If possible, it is optional pre-treatment of waste (e.g. low-tech, on-site passively aerated aerobic decomposition systems) to reduce the leachate and waste amount and to get a stabilized material.

4 Permit for establishment of a landfill

The competent body and the provincial or municipal authorities shall conduct study and evaluation of effect on the environment before issuing permission for construction and operation of the landfill. The permission applicants shall be required:

- [1] to submit application forms attached with identity of the applicant and of the operator when they are different entities,
- [2] to describe the types and total quantity of waste to be deposited,
- [3] to describe the proposed capacity of the disposal site,
- [4] to describe certain features of the site, including its hydro-geological and geological characteristics as well as techniques to be installed,
- [5] to show the proposed methods for pollution prevention and reduction,
- [6] to describe the proposed operation, monitoring and control plan, as recommended in annex VI.

5 Non-acceptable waste for basic standard and/or sanitary landfill

- [1] Because composting is recommended as an effective measure to reduce the waste amount so the bio-waste can be diverted to the composting plant as much as possible. Not later than 5 years after entry into force of this ordinance the biodegradable waste going to the landfill must be reduced to 90% of the total amount of the latest official waste analysis result.
Not later than 10 years after entry into force of this ordinance the biodegradable waste going to the landfill must reduced to 70% of the total amount of the latest official waste analysis result.

Two years before the 10 years as achieved the environmental provincial-city authority shall re-examine the above target, on the basis of the report from authorised contractors,

- [2] Liquid waste and paste like consistency waste,
- [3] Waste with unknown hazardous effects like waste from the laboratories,
- [4] Dead bodies of humans and animals,
- [5] Vehicle tires (from bikes, motorbikes, cars),
- [6] Electronic waste is not permitted to be disposed of at the basic standard landfill (BSL), even scraps after it has been subject to recycling. There must be a temporary storage at the BSL when the amount is small before being diverted to sanitary landfill,
- [7] Untreated medical waste category B and C, see annex X
- [8] Explosive and inflammable waste.

6 Conditions for selecting the location of landfill

- [1] Location of a landfill should be chosen in relation to an existing or designated settlement area and national roads; an effort should be made to provide a protective distance of at least 500 m separating such areas from the landfill body. The selection location of hazardous waste landfill needs the decision of the ministry of environment and the involved institutions. The distance is at least 1000 m from the national road and from settlement,
- [2] All kinds of landfills have to be constructed at least 1000 m far away from:
 - recreation places,
 - streams, lakes and rivers,
 - memorials and national patrimonies (nature and culture)
- [3] At least 5000 m away from airports,
- [4] Landfills must not be installed in pits from which it is not possible to discharge leachate into drainage shafts located outside the landfill area,
- [5] Areas subject to flooding should be avoided
- [6] Landfills should be selected in areas with geographical and hydrological favourable conditions, as required in annex VI.
- [7] To avoid a negative impact on groundwater quality, the bottoms of sanitary and hazardous waste landfills have to be built with artificial barriers and layers. Geological condition has to be studied based on the example of annex VI, during the construction of the landfill.

7 Landfill gas and leachate collection system

- [1] for sanitary landfill and hazardous waste landfill, the landfill gas collection and treatment system shall be installed properly after state-of-the-art, see annex VI as recommendation,
- [2] the slope of sealing layer surface and the leachate pond have to consider requirements for basic standard landfill as recommended in annex VI,
- [3] for sanitary and hazardous waste landfills, the leachate collection and treatment system has to be installed properly after state-of-the-art, as recommended in annex VI.

8 Landfill operation

8.1 Structural organisation

- [1] Separated also in terms of personnel from the other organisational units, landfills should consider at least one organisational unit that is responsible for "control". This "control" unit shall, in particular, be responsible for checking incoming delivery.
- [2] The structural organisation of the landfill must be presented in an organisation chart indicating the tasks of the various organisational units. The persons responsible and their representatives must be named. The organisation chart shall form part of the operating manual specified as recommended in annex VI. It shall be presented to the provincial or city authority upon request.

8.2 Management of input material at BSL, SL and HL

- [1] All input material should be accompanied by a document, which contains the origin of the waste, visual control at the gate, determining the quantity in units of weight; also in units of volume insofar as this is appropriate and recorded. This document is the source for future plans. These documents have to be reported quarterly to the environmental provincial or city authority,
- [2] All activities on landfill have to be permanently monitored, controlled and documented as required in annex VI,
- [3] For the hazardous waste, the delivery has to be strictly controlled before being allowed in the landfill, by checking all of the documents and recording its origin, owner and collection and transportation company as well as toxicity if possible and type of waste to avoid falsifications.
- [4] In case that hazardous waste is deceitfully disposed of at the basic standard or sanitary landfills, this hazardous waste has to be seized and kept in a safe place, and to be reported immediately to the environmental provincial-city authority. The environmental provincial-city authority in turn shall decide to which hazardous landfill the waste has to be sent,
- [5] The operators of either the basic standard or sanitary landfill shall be the subject to face sanction or prosecution before the law, if he/she is found guilty of allowing the disposal of hazardous waste in the landfill.

8.3 Staffs on BSL, SL and HL

- [1] **General Condition:** to operate the landfill, there must at all times be sufficient personnel with the required qualifications and responsibility. All personnel shall undergo specific job training and further education.
- [2] **Supervisory personnel:**
 - [a] the supervisory and/or management personnel and all heads of sections in the waste disposal installations and management of landfill shall be reliable and technically qualified and they must have appropriate practical experience in the operation and management of the site,
 - [b] The management personnel shall be responsible for regularly providing the other personnel with instruction and information.
- [3] **Other personnel:** Other personnel must be technically reliable and skilled. This technical skill may be based for example on formal qualifications in such areas as

community services and landfill operation and waste disposal, on many years of practical experience or on comparable training.

8.4 Groundwater control

- [1] To ensure the groundwater quality, the role of the environmental provincial-city authority is to monitor and control groundwater quality by conducting analyses in a licensed laboratory two times per year. The landfill manager has to pay for his analysing process.
- [2] Landfill manager has to write a report about the existing and possible negative environmental effects to the environmental provincial-city authority.
- [3] The instructions for monitoring and controlling groundwater quality, appears in Annex VI as recommendation.

9 Control and monitoring

9.1 During operation

- [1] Jam of waste transportation vehicles has to be avoided,
- [2] Establishment of inventory,
- [3] Control waste quantities and composition,
- [4] Control of groundwater quality to avoid contamination by landfill leachate,
- [5] Preparing the disposal places in the landfill in order to dispose waste easily and compact waste at each layer.
- [6] The landfill leachate has to be monitored and controlled by the following to the annex II of sub-decree on water pollution control.

9.2 After closure of the landfill

Emission and percolation of leachate shall be controlled, and measures taken, if necessary, see Annex VI as recommendation.

10 Final closure and after closing landfill management

10.1 Final closure

Final closure of landfill at the longest time is 6 months after the landfill is no longer in use, and the following work shall be done:

- [1] Compacting the last disposed waste layer on the landfill,
- [2] Covering waste with soil and compacting it at least 1.5 m thick so that grass or plant can be planted, and so that percolation of rain water through the waste may be avoided, see annex VI as recommendation
- [3] Leachate and landfill gas has to be controlled 2 times a year till it can be sure, that no leachate and landfill gas has negative affect to environment any more.
- [4] Maintain the function of fencing.

10.2 Re-cultivation

The landfill manager has to plant grass or plant on the cover of landfill also to avoid infiltration of the rainfall

V

Composting Ordinance

1 The purposes

- [1] Reducing the waste amount to be disposed of and to increase landfill life by processing bio-waste into compost at the composting plant.
- [2] Reducing the amount of landfill leachate and biogas and therefore support the environmental protection.
- [3] Promoting source separation of bio-waste from other waste, in order to have cleaner materials and reduce potential hazards in compost.
- [4] Improving the quality of agricultural soils by using compost to enhance the environmental role and functions of soil.

2 Acceptable Feedstock

2.1 General conditions

Waste may only be composted if it can be biological transformed and does not contain substances in concentrations that may cause hazards for the human, plants or animals health and quality of soil and water, during composting or after application.

2.2 Bio-waste

Bio-wastes can be from the following source:

- [1] Kitchen waste, as waste of vegetable, fruit, meat, egg shell, pieces of paper and cardboard.
- [2] Market waste, as waste of vegetable, fruit and other green waste.
- [3] Garden waste, as grass, leaves, branch of trees etc.
- [4] Agricultural waste, crop residues, stems, straw, dung etc..
- [5] Waste from slaughterhouses only healthy animal parts or waste of slaughterhouses are acceptable, competence authorities have to prove and control this circumstance.
- [6] Sewage Sludge, if they fulfil requirements set out in point 2.1 under the general condition.
- [7] Paper and cardboard should primarily be considered for recycling of paper. Small quantities (may be added to bio-waste, in order to absorb excess moisture, improve process management. High-gloss paper and waste wallpaper must not be used as feedstock for composting in any case.
- [8] Digestate from anaerobic digestion, if it fulfils requirements set out in point 2.1 under the general condition.

2.3 Acceptance of new and/or further types

Other biodegradable materials not mentioned above may be added to the mixture provided that:

- [1] They are capable of undergoing microbial degradation, or of enhancing degradation of other materials,
- [2] They do not exceed maximum allowable concentrations of potentially toxic elements as defined in Annex VII,
- [3] Their by-products do not show any harmful effect to the soil, plants, human beings, animals, etc.

2.4 Acceptable sludge

Sludge, including digestate, can be used as an input feedstock, but it has to be in strict conformity to the composting ordinance, and analysed about potentially hazardous substances as defined in Annex VII. A maximum percentage of sludge of 35 % (dry basis) is allowed.

3 Non compostable and/or acceptable Feedstock

- [1] General conditions: Materials not explicitly listed in point 2.2 or approved pursuant to procedures of point 2.3 thereof, can not be composted.
- [2] The below described material is not allowed to use as feedstock for composting:
 - Sludge which contains more pollutants than maximum allowable concentrations, see annex VII,
 - Ashes from waste incinerators (hospitals, industrial incinerators),
 - Glass, plastic, rubber, metals, etc. is not allowed to compost because it is non-biodegradable; due to mistakes normally incurred, although in a minor percentage of the population, in separate collection, such materials may anyway be allowed in very limited amounts as "impurities" in biowaste coming from separate collection, provided that sorting systems at the compost site are able to sort them out before or after composting .

4 Compost production

4.1 Conditions for compost production

In order to be considered not as a waste any more, but as a product beneficial to soil and agriculture, and subsequently in order to be used only according to good agronomic practice, compost should have a good quality and hygiene, should be beneficial to farmlands and crops and should not be hazardous to the human and animal health, plants and soil quality.

Digestate may be used as a product just according to good agronomic practice (and with no further permit for its application) only after having been composted.

4.2 Condition of composting

The following requirements to be fulfilled for compost to be considered as a product are established:

- [1] The moisture of compost has to be not more than 45%
- [2] The concentration of heavy metal in the compost has not to exceed maximum allowable concentrations established in annex VIII.
- [3] Compost has to supply organic matter and other nutrients (whose contents should be tested and declared, although no threshold content is given) improving soil quality plant growth.
- [4] In order to take care of the quality of the end product compost should be analysed regularly at an approved laboratory.
- [5] In order to ensure thorough sanitisation of the composted product from human, animal and plant pathogens, the composting process should show temperatures for the whole mixed material in each heap for at least:
 - [a] 55°C over a period of two weeks, with no or minimum interruption or

- [b] 65°C over a period of one week, with no or minimum interruption.
- [6] Viable seeds and propagules of weeds should not be present in the compost – In order to provide for that, sanitisation requirements (time and temperature) established at previous point [6] shall be fulfilled.
- [7] Compost should be practically free of contraries like plastic, rubber, metal, glass and stones...
 - [a] the total content of contraries (excluding stones) > 2 mm shall not exceed 1.5 % by weight (dry matter basis).
 - [b] Stones > 5mm shall not exceed 5 % in the dry substance,
- [8] Further requirements can be found in Annex IX as recommendations.

5 Requirements of composting sites

In order to fulfil requirements of the composting process (e.g. proper process conditions, sanitisation, etc.) and of the end product the following conditions should be fulfilled:

- [1] The composting plant should have enough staffs with the ability and skill for the work and hygiene (personal protection devices: the bare minimum is gloves, and dust masks to be used at least at dust-producing process steps such as turning and screening),
- [2] Control and documentation of the input feedstock about amount and type and source; a visual assessment should be performed on each batch being delivered to the compost site; periodical analyses should be carried out so as to investigate concentrations of potential pollutants in sludge and other organic waste, depending on its source,
- [3] in order to reduce occurrence of odour nuisance, waste, with high degradability (e.g. food waste) should be composted at earliest possibility,
- [4] To ensure, that the composting process is going on well, the temperature should be measured and recorded every day. In order to ensure sanitisation, a temperature of 55°C should be kept in each batch for at least two weeks with no or minimum interruption or 65°C over a period of one week,
- [5] The period of composting process time is depending on the intended maturity degree and application, on the mixture of material and technical equipment. Normally the period of composting process time is about 2 months to 6 months; longest process times are for low-tech composting of garden waste, whereas shortest times are for production of "fresh" compost (e.g. for application in horticulture) from mixtures including sludge and food waste,
- [6] Depending on location, types of materials processed and capacity, if odour treatment has to be provided, this should be done by means of proper management (minimisation of occurrence) and/or treatment systems for exhaust air (sucking systems and odour treatment devices such as scrubbers and bio-filters). However, in case of open-air operations, timing of most odorous operations (such as turning) should be chosen appropriately with reference to weather and wind conditions in order to reduce occurrence of nuisance for the populations nearby,
- [7] During the work the date, amount, kind and transport company of input waste should be recorded in a book, see Annex VI as recommendation.

6 Composting Plant

6.1 Location of composting Plant

- [1] In order to minimise disturbance of people by diffusing odour and noise, new installed composting plants should preferably be located at least 500 m from residential areas or future residential area as defined in planning procedures.
Possible exceptions may be considered for small capacities (e.g. less than 3.000 tonnes input/year) and materials with low biodegradability as plain garden waste.
In no case the location of the composting plant can be established at less than 200 m from dwellings so that release of dust to dwellings nearby and related health issues be avoided. This is not applicable of course in smallest scale, privately operated sites as home composting heaps and bins or very small self-composting sites by private gardeners. Release of dust to neighboring dwellings should anyway be avoided
Owner and operator of compost plant should install facilities to avoid and/or reduce to maximum emissions of odour, dust and noise for locations nearest to dwellings,
- [2] It is forbidden to build the composting plant near water supply source; a buffer zone of at least 200 m is needed, and the forbidden area may be enlarged by environmental provincial-city authority depending on hydrological and geological site conditions. It is forbidden to build composting sites in areas subject to flooding,
- [3] It is forbidden to build the composting plant near resort areas; a buffer zone of at least 500 m is needed,
- [4] The composting plant should have an access road not subject to seasonal availability, a composting process area, a storage area, a leachate and/or contaminated water collection and storage system driving wastewater to a tank/pool or to the sewerage line, and an office; this latter may be established also off-site, provided that good coordination of control procedures on delivery are anyway ensured.

6.2 Design of the composting plant

- [1] The manager of the composting plant must consider the size of its composting plant and the average amount of input bio waste per year in order to organise easily the processes at the composting plant and avoid long time waste storage, which may cause the development of odour and leachate. Only garden waste, with low biodegradability, may be stockpiled for a long time in order to "buffer" seasonal fluctuations of quantities; grass should anyway be preferably mixed up with wooden materials right away, in order to prevent compaction and related release of odours,
- [2] The composting plant should have an access road, a place for treatment process, a refining area, a place to store the composted product, and a leachate collection system. The Management office must be located at the entrance of the composting plant for easy control of input material; a fence should be included for proper site control.
- [3] In order to avoid infiltration of leachate to ground water, to ensure a product free from impurities as stones, gravels, sand and enable problem free work of machinery and transportation in dry and rainy season the whole composting plant has to be paved with the material which has least infiltration (e.g asphalt or concrete). An exemption from paving is possible for sites treating plain garden waste with a maximum capacity of 1000 tonnes input/year. 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

- [4] In the case of a paved surface, a leachate and contaminate water collection system should be build so that this waste water flows in a properly designed waste water tank. It must be avoided that this rainwater and leachate mixture flows into the soil or into surface water of rivers or lakes etc., only rain from roofs and non-contaminated rain water may be discharged into soil or surface waters,
- [5] Leachate waters may be recycled into the process or sent for wastewater treatment,
- [6] A basin should be built with proper technique in agreement with the environmental provincial-city authority; this should be sealed at the bottom in order to avoid the infiltration of leachate to the ground water source. The role of this basin is to stock the rainwater and leachate which flows through the composting plant. The size of basins should be designed to retain waters depending on frequency of their withdrawal to be sent for treatment or to be recycled into the process. Examples for proper tank/pool size are given in annex IX,
- [7] In case of discharge of rainfall from roofs and non-contaminated rain water, a system for clear separation of such streams from leachate should be established.

7 Permitting of compost plants

With the exception of home composting, after enacting this ordinance all established compost plants should have permission. The permission shall include the following provisions:

- [1] Input materials (quality, source and quantity by type according to the composting plant capacity),
- [2] Additional requirements for plant construction in addition to what is included in the project proposal (e.g. additional leachate tanks, additional equipment for process management or odour treatment, monitoring equipment, etc.),
- [3] Additional technical provisions for process management (e.g. particular care in management of odorous operations – such as recycling of leachate and compost turning - in the case of critical location),
- [4] A clear statement that the end product, in case it meets the requirements of the Annex VIII may be used and marketed with no further licensing procedure.

VI

Guideline of medical waste management

1 Goal

- [1] The goal of this guideline is to manage medical waste with proper technique and safety to ensure the protection of public health, environmental quality and the conservation of biological species.
- [2] This guideline is extended to the implementation of every activity as generation, discharge, separation storage at source, collection, treatment (recycling, burning, disinfection), transportation and final disposal of all kinds of medical waste.

2 Source of medical waste

- [1] Hospitals, laboratories, health centre, poly clinics, clinics, doctor's surgeries etc.,
- [2] Pharmaceutical factories/enterprises, pharmacies,
- [3] Households, veterinarian clinics, farms, such as waste of medicines and equipments after treatment.

3 Categories of medical waste

- [1] Medical waste is divided into three categories, see annex X:
Category A: is non hazardous solid waste.
Category B: non and infectious sharp waste.
Category C: Infectious waste, that is dangerous for the patients, medical staffs and other people,
- [2] **Category A:** is non hazardous solid waste, like waste from kitchens, offices and bedrooms or off-duty staff rooms. It does not require to be strictly managed as it does not cause any serious hazardous to the patients, medical staffs or other people in case it is not mixed with any kinds of infectious waste (annex X),
- [3] **Category B:** Any sharp waste which may causes danger by cutting or injuring and which infectious to patients, medical staffs or other people (annex X),
- [4] **Category C:** Waste, that is highly dangerous and infectious to the patients, medical staffs and public health directly or indirectly. It demands strict measures for the protection from infection during activities such as separation at source, collection, storage, treatment (disinfection, burning, recycling) transportation and final disposal of the medical waste (annex X).

4 Medical waste management

4.1 Separation at source

There are three kinds of plastic bags or rubbish bins for separating at source of medical waste.

- [1] Waste category A: as it is the general non-hazardous solid waste, it has to be separated and put into green plastic bags or rubbish bins and black bag for non-organic wastes with certain marks. At every place where waste is generated, it has to be emptied and send to the temporary storage at least once a day.
- [2] Waste category B: sharp waste has to be separated from the waste category A and C and be put in boxes or yellow safe-rubbish bins tagged with a special symbol. Full boxes have to be sent to stove or to temporary safety storage.

- [3] Waste category C: dangerous waste has to be separated from waste category A and B and be putted into red plastic bags or red rubbish bins and the safety has to be ensured (tearing and watertight). The waste category C has to be sent first to disinfection/sterilisation unit or to stove for burning or to temporary storage. If there is no stove available the waste has to be sent to the treatment facility where safe treatment is secured.

4.2 Safe temporary storage

All kinds of medical waste have to be stored temporary at safe places in order to prevent any health risks for staffs, patients and other peoples.

- [1] **Waste category A:** bags for organic and non-organic wastes should be stored separated from the waste category B and C.
- [2] **Waste category B and C:** have to
- [a] be stored at safe places (with roof and wall around, it should be locked),
 - [b] ensure the quality and safety of the packaging equipment (rubbish bin with cover and not easy tearing or breaking),
 - [c] have temporary storage place or room separated by walls in two sections to store the two different categories B (only sharps) and C,
 - [d] fix the storage duration of waste category B according its amount,
 - [e] ensure that the waste category C be stored in a possibly cool place no longer than 48 hours.

5 Regularly monitoring of medical waste

5.1 Duty of the owners of waste category B and C

- [1] The owner must report about each type and amount of waste to the transportation company, using a set of form of five sheets (see Annex XI),
- [2] The waste owner shall kept one sheet of the forms that he/she signs with waste transportable company and the second sheet has to be use for reporting to the competent authority about handing over of waste or otherwise treatment or disposal facility and final treatment.

5.2 Duty of the transportation company

- [1] It shall ensure the quality and safety of transportation facilities and post symbols of danger on its transport means. The transportation company should keep the form that it signs by the waste owner during transportation and has to be sent one exemplar to the competent authority.
- [2] Its shall definitely set the transportation time,
- [3] Its shall check for the type of waste before accepting,
- [4] Only the transportation company who has a license of transportation of dangerous goods from the responsible authority is allowed to transport medical waste,
- [5] After handing over of the waste to the addressee, the transport company shall have the addressee sign the forms, and keep one copy of the form and handing over the other two copies to the addressee.

5.3 Duty of the addressee

- [1] The addressee has to be a company with treatment facility for final disposal of medical waste.
- [2] The addressee has to have duty to verify the report and the rough draft made between the waste owner and the transportation company,
- [3] The addressee has the duty to report in due time to the environmental provincial-city authority by attaching the form described of annex XI,
- [4] The addressee must report immediately with lettering to the environmental provincial-city authority in case of irregularities are detected,
- [5] The addressee has the duty to properly store medical wastes as prescribed in point 7 regarding final disposal.

6 Treatment of medical waste for category B and C

- [1] Incineration: Waste that is incinerated in a proper manner can be disposed of on a basic standard and/or sanitary landfill,
- [2] Disinfection: Waste that is disinfected can be disposed of on a hazardous landfill,
- [3] Sterilization: Waste that will be reused and/or recycled has to be sterilised in a proper manner.

7 Final disposal of medical waste

Waste for general disposal on landfills should be conform to waste category as informed in number [1] to [4] .

- [1] Waste category A should be delivered by the non-hazardous waste collection and Transport Company to the basic standard and/or sanitary landfill to be disposed of there,
- [2] Waste category B is not permitted to be disposed of on sanitary landfill before treatment.
- [3] Waste category C should be disposed of on hazardous landfill with proper technique feature of landfill after disinfection.
- [4] Waste category C can be dispose of on sanitary landfill after incineration.

8 Capacity building and training

- [1] Physicians and managers as well as chief nurses shall receive general training in medical waste management concept and mobilisation,
- [2] Nurses, hospital staffs, health centre staffs and health centre hygienists shall receive regular education on separation at source and general awareness,
- [3] Hospital drivers, operators of waste treatment facility shall receive education on separation at source and technical equipment training,
- [4] Collectors and transport /collection workers and drivers shall undergo training,
- [5] Landfill manager, landfill owners and all staffs shall train how to operate landfills.

VII

Guideline on environmental education

1 The purposes

- [1] Familiarize all citizens and members of the public from different levels with the importance of environmental protection and natural resources conservation for present, future generations,
- [2] Arouse environmental awareness among people so that they may be able to take part in environmental protection in their daily activities and the change of local and global environment, and to join in discussions to find solutions to the environmental issues in their community.

2 Principles of environmental education

- [1] giving the public major notions of the necessity of environmental protection and natural resource conservation,
- [2] making the public well aware of the advantage of natural environment as a base for building socio-cultural environment for development which is consistent with of custom and tradition, religious belief and existence of human society,
- [3] recognising the need of tapping natural resources for proper and sustainable use (forest, mines, biodiversity, all wild species, land, water, air, etc),
- [4] showing the connection between natural environment, social and culture environment and human environment as well as national economy development,
- [5] keeping the public informed of the environmental issues in the world at large that may affect the existence of human beings, animals and plants,
- [6] giving the chance to share ideas and inputs in the effective formulation of environmental policy,
- [7] showing impacts on the environment resulting from the exploitation of natural resources in the region and the world over for consumption and production purposes with less or no attention to ensuring a environmental sustainability,
- [8] highlighting the importance of carrying on some traditional practices which are closely linked with the nature in undertaking development without causing negative impacts on the environment,
- [9] making us well aware of and taking into account economic development and environmental effect,
- [10] for trainers and environment educators, broad pedagogical and environmental knowledge is a must,

3 Target

- [1] Environmental education should initially begin with parents at home, kindergartens, schools, vocational schools, universities, pagodas, Buddhist schools, community, civil societies environmental education institute and other educational establishments.
- [2] teachers, trainers and environmental educators.

4 Environmental education plan

The environmental education plan shall help inculcate the awareness of waste management, avoidance and production of waste, reduction, reuse, recycling and storage of solid waste in

safe manner and abilities to carry out composting in communities and at home (home composting).

4.1 Contents of environmental education

Contents of environmental education should be integrated into education curriculum in kindergartens, schools, vocational schools, universities, pagodas, Buddhist schools and other educational institutions.

- [1] Environmental education in the Kindergartens
 - [a] Get children to develop the practice of disposing waste and refuse into rubbish bins and able to identify types of wastes like plastic bags, paper, metal (can, iron) etc.,
 - [b] Help children to develop the practice of keeping clean and hygienic before and after eating washing their hands,
 - [c] Help familiarize children with all kinds of animal and plant species in the country and other living creatures all over the world by showing pictures, drawings, video and zoo visits.
- [2] Environmental education at schools:
 - [a] Integrating environmental education into curriculum,
 - [b] Providing knowledge about natural resources,
 - [c] Providing knowledge about the nature and type of waste, its storage and its harm to the environment and living condition,
 - [d] Providing knowledge about environmental pollution (water, soil, air, noise and vibration disturbance),
 - [e] Learning about the different biological species in each area.
- [3] Environmental education at vocational schools:
Conduct environmental training on effects resulting from professional and job, performance and on preventive measures.
- [4] Environmental education at universities:
Every university should have an environmental science program for students.

4.2 Environmental education activities

- [1] The Ministry of Environment shall co-operate with the Ministry of Education, Youth and Sports to organise environmental education and awareness programmes,
- [2] Environmental knowledge has to be upgraded for teachers, trainers and environmental educators,
- [3] Environmental research/experiment on environmental protection shall be conducted at universities,
- [4] Establishment and implementation of environmental education for all institutions (state, private) and civil society,
- [5] Encouragement for voluntary participation in environmental education,
- [6] Support for environmental education at the communities,
- [7] Publicity of environmental laws and regulations among people of all walks,
- [8] Companies, factories, enterprises and other institutions have to organise environmental education for their staffs,
- [9] Civil society and media play an important role in environmental education.

4.3 Environmental education formats

To ensure fruitful result, the environmental education shall be carried out in the following formats:

- [1] Training courses
- [2] Seminars and workshops
- [3] Publications (posters, magazines...)
- [4] TV spots
- [5] Demonstrations