

# **Institutional Strengthening of the Solid Waste Management Authority and the Department of the Environment in Solid Waste Management**

## **TECHNICAL GUIDELINES FOR THE SITING, DESIGN, CONSTRUCTION, OPERATIONS, MAINTENANCE, CLOSURE AND POST CLOSURE OF HAZARDOUS WASTE FACILITIES**

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## 1.0 HAZARDOUS WASTES MANAGEMENT

### 1.1 Introduction:

Hazardous wastes are generally defined as substances that pose significant risk to individuals or environmental safety. Their transport, treatment and disposal are generally more regulated than non-hazardous wastes. A hazardous substance generally has one or more of these characteristics<sup>1</sup>:

- Explosive
- Flammable
- Liable to spontaneous combustion
- Emitting flammable gases when in contact with water
- Oxidizing
- Organic peroxides
- Poisonous
- Infectious substances
- Corrosive
- Liberating toxic gases when in contact with air or water
- Toxic
- Ecotoxic.

Since hazardous wastes can have important negative effects on people or the environment, and because many countries sought to dispose of their hazardous waste outside of their borders, the United Nations Environment Programme (UNEP) has created a convention, the Basel Convention, to protect human health and the environment against the adverse effects resulting from the generation, management, transboundary movements and disposal of hazardous and other wastes. Also, the Convention places an obligation on its Parties to ensure that hazardous and other wastes are managed and disposed of in an environmentally sound manner.

In this regard, Parties are expected to minimize the quantities that are trans-shipped across borders, to treat and dispose of wastes as close as possible to their place of generation and to prevent or minimize the generation of wastes at source. Strong controls must therefore be applied from the moment of generation of a hazardous waste to its storage, transport, treatment, reuse, recycling, recovery and final disposal. The

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<sup>1</sup> Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.

Convention is therefore seen as the definitive instrument which regulates not only the international transport of hazardous wastes, but also its generation.

Examples of wastes regulated by the Basel Convention are as follows:

- Biomedical and healthcare wastes
- Used oils
- Used lead acid batteries
- Persistent Organic Pollutant wastes (POPs wastes), chemicals and pesticides that persist for many years in the environment.
- Polychlorinated Biphenyls (PCBs), compounds used in industry as heat exchange fluids, in electric transformers and capacitors, and as additives in paint, carbonless copy paper, sealants and plastics.
- Thousands of chemical wastes generated by industries and other consumers

Notwithstanding the examples of hazardous provided above, biomedical and healthcare wastes as well as used oils are generally classified as Special Wastes and as such, are not addressed in this report. Likewise, Electronic (“e-waste”) and Port Waste which are beginning to feature highly in discussions of hazardous waste are dealt with as Special Waste. Given the fact that Medical Waste, POPs and Port Waste are under the jurisdiction of other Ministries it is the obligation of the respective authorities to develop the appropriate guidelines.

In this regard guidelines on the disposal of medical waste have been prepared by the Ministry of Health. This was followed by a draft Public Health Act which sought to revise the public health legislation and included a regulatory framework for medical waste. The disposal of pesticides is a matter for the Pesticides Control Board under the Pesticides Control Act. International waste (Port Waste) falls under various jurisdictions. Waste arriving by air is governed by the Airports Authority Act, and waste by sea is regulated by the Port Authority Act but would also be subject to the MARPOL Convention. However, legislation to implement the MARPOL Convention has not yet been enacted.

In respect of the other examples of hazardous waste, the treatment methods outlined below, together with the hazardous waste regulations and the guidelines proposed should go a long way in ensuring that these wastes are managed and disposed in an environmentally sound manner.

## 1.2 Treatment Methods

Given the specific, but varied nature of hazardous waste, any set of guidelines developed to address their treatment and disposal must be adapted to the hazardous wastes received. For example, used motor oil can be reprocessed and used in furnaces or power plants. Oil drilling wastewater can be treated with a biological treatment before being discharged into the environment. The following treatment methods (Physical, Thermal, Chemical and Biological) can be applied to specific hazardous wastes to extract their chemical components, to reduce their reactivity or to transform them into more stable compounds.

### ■ Physical Treatments

○ Air purification	○ Filtration
○ Adsorption	○ Precipitation
○ Centrifugation	○ Magnetic separation
○ Dialysis	○ Osmosis
○ Distillation	○ Sedimentation
○ Evaporation	○ Freeze crystallization
○ Solidification/Stabilization	

### ■ Thermal Treatment

○ Incineration
○ Pyrolysis
○ Calcinations
○ Molten salt
○ Plasma destruction
○ Supercritical fluid oxidation

### ■ Chemical Treatment

○ Catalysis	○ Microwave discharge
○ Chemical dechlorination	○ Neutralization
○ Chlorinolysis	○ Oxidation
○ Dissolution	○ Ozonation
○ Electrolysis	○ Photolysis
○ Ion exchange	○ Reduction

■ **Biological Treatment**

○ Activated sludge
○ Aerated lagoon
○ Anaerobic digestion
○ Enzyme treatment
○ Trickling filter

Treated hazardous waste can sometimes be reused by the generator or landfilled in controlled cells. The disposal of non-treated hazardous wastes in landfills can sometimes be done. However, this should be authorized only if the wastes are not highly reactive and cannot be treated at a reasonable cost since it is difficult to ensure the long term safety of non-stabilized wastes that can remain reactive for numerous years without treatment. Moreover, some wastes are incompatible and can induce fire, explosion or toxic gases when mixed together. Therefore, if these wastes were to be inadvertently landfilled in the same cell, they could lead to health hazards for the workers.

Since the nature of hazardous wastes varies tremendously, it is difficult, even impossible, to develop technical regulations regarding treatment and disposal that can be applied to all hazardous wastes. For example, a treatment that can be successfully used to transform a hazardous waste into less dangerous compounds may have little to no effect on another hazardous waste. For this reason, hazardous wastes regulations are often based on performance. It is the responsibility of the generator to devise a way to respect the objectives defined in the regulation.

**2. BELIZE’S EXISTING REGULATIONS**

Belize is a signatory to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, developed by UNEP to regulate the exportation and importation of hazardous wastes from adhering countries. In compliance with this Convention, and in-keeping with plans for the overall improvements to management of solid waste in Belize, the government promulgated the Hazardous Waste Regulations.

The existing Hazardous Waste Regulations adopted in 2009 defines hazardous wastes and regulates *the storage, transportation, treatment and land disposal*. The existing regulation forms a solid groundwork which adequately implements the Basel convention requirements.

## 2.1 Hazardous Waste Regulations

The Hazardous Waste Regulations 2009 (S.I. 100 of 2009) are divided into 9 parts. Part 1 contains various definitions including the definition of “hazardous waste”, “waste”, and “hazardous waste management facility”. Hazardous Waste is defined as “...any material or substance characterized as being toxic, corrosive, flammable, reactive, explosive, infectious, or pathogenic that may pose a threat to the environmental and human health.” By section 3 the Regulations apply to all hazardous waste unless specifically exempted. Under section 4 the Regulations will not apply to the following types of wastes:

- a) household waste while in the possession of the householder or while un-segregated in a municipal management system;
- b) waste generated by farmers in growing or harvesting crops or raising animals;
- c) waste produce by a generation where such waste does not exceed 5 kilograms or 5 liters at any one time;
- d) domestic sewage;
- e) waste resulting from emergency spill clean-up during an emergency.

Part II of the Regulations relate to the hazardous waste management facility and requires the keeping of records (regulation 5), the location of the hazardous waste facility (regulation 6). Under regulation 6, a hazardous waste facility cannot be established, constructed or operated in the following locations:

- 100 year flood plan;
- 100 meters of any land subject to slope failure
- within a wetland area
- in a recharge area of an unconfined area
- within a minimum of 1 ½ mile radius of any human settlement
- within 300 meters of any mass-intermittent water course.

By regulation 7, a person who operates a hazardous waste management facility shall provide financial assurance to cover the cost of reclamation, inventory removal, closure and 20 years past closure care which shall be annually adjusted for inflation. Regulation 9 provides for financial assurance including bonds and guarantees (Regulation 9).

Part III deals with the storage of hazardous waste. Regulation 10 establishes storage facility standards and requires that storage shall be in a manner that will not cause an adverse effect to the environment. Regulation 11 requires that all hazardous waste facilities shall be sited, designed, operated and constructed as approved by the Chief

Environmental Officer but this is only applicable to storage facilities established after these Regulations came into effect.

Part IV deals with the transportation of hazardous waste. Regulation 12 sets out several duties on a transporter of hazardous waste. These duties impose wide ranging responsibilities on the transporter of hazardous waste including the requirement for having present the hazardous waste manifest that all activities (collection, transportation and delivery) shall be carried out without any harm to public health and the environment, and properly identifying all vehicles carrying hazardous waste. Certain prohibitions are also imposed on the transporter (Regulation 13) including being prohibited from accepting hazardous waste without having previous acceptance of the treatment of final disposal plant where it will be received.

Part V addresses the issue of the treatment of hazardous waste. By regulation 14 all facilities for the treatment or final disposal of hazardous waste shall be sited, designed, constructed and operated as approved by the Chief Environmental Officer.

Part VI regulates land disposal of hazardous waste. Regulation 15 prohibits the disposal of liquid solid waste in a landfill.

Regulation 16 provides that the Chief Environmental Officer shall not approve the disposal of solid hazardous wastes (not otherwise prohibited from disposal in a landfill) unless the landfill is provided with at least:

- two liners of which one is a synthetic liner;
- a leachate collection and removal system;
- a groundwater monitoring system;
- a leak detection system between the two liners.

By regulation 16(2) the Chief Environmental Officer shall not approve the disposal of hazardous waste unless certain very stringent conditions (see Regulation 16(2)(a) to (i)) are met.

Part VII addressed landfill disposal prohibitions. By Regulation 18 the generator of a hazardous waste shall be responsible for determining if this hazardous waste is restricted from landfill disposal under the Regulations. Regulation 19 goes on (Regulation 19(a) to (i)) to prohibit the landfill disposal of certain hazardous waste. Regulation 20 provides for a ban on the importation of hazardous waste without the written permission of the Department of the Environment.



Part VIII deals with the requirement for waste classification. By regulation 26 any person generating hazardous waste is responsible for classifying each hazardous waste in a manner approved by the Chief Environmental Officer. Part IX relates to investigations offences and penalties.

Although, the existing regulation is satisfactory, the following section seeks to identify areas in which modifications may be required, either to the Regulations or to the Environmental Compliance, to facilitate its application.

## **2.2 Proposed Measures for Strengthening the HW Management Regime**

Since the threats posed by hazardous wastes may vary due to the nature of the wastes, and given the fact that protocols for ensuring that the health and environmental hazards are reduced to a minimum can also vary, it is imperative that the DOE develop particular guidelines on a case-by-case basis. These specific guidelines could then be included in any Environmental Compliance Plan (ECP) issued by the DOE.

Some of these guidelines could, for example, include guidelines in respect of storage and handling of hazardous waste by the generator, stressing the responsibility of the generator and limiting the amount of time hazardous wastes can be stored directly at the production site.

The generator should be responsible for any environmental or public safety hazard resulting from the generation of these hazardous wastes.

Hazardous wastes should be handled, treated and disposed of as to minimize the risks to the environment and to the public safety. The generator should devise a management plan for every hazardous waste produced. That Management Plan should state the nature of the waste, as well as the planned treatments and final disposal. Each management plan should be subject to DOE approval before its application.

## **3. SITING, DESIGN, OPERATIONS AND CLOSURE OF HAZARDOUS WASTES FACILITIES**

### **3.1 Siting of Hazardous Waste Facilities**

The following proposed sitting criteria are complementary to the ones already included in the existing regulations. They are proposed to help government's officials analyze future sites. The procurement of the suggested geotechnical data may be difficult due to the existing laboratory capacity of Belize. However, since each of the proposed data can help pinpoint potential environmental risks and since hazardous wastes pose a

specific threat to the environment, extensive on site and laboratory testing should be done.

Prior to the installation of a hazardous waste landfill, the following information concerning the hydrogeological characteristics of the site should be provided to the DOE:

- Site geology/geohydrology;
- Depth to aquifers;
- Presence of fractures and faults, joints, solution cavities;
- Present and potential aquifer use;
- Aquifer recharge;
- Proximity to sensitive receptors;
- Aquifers hydraulic characteristics;
- Hydraulic conductivity;
- Transmissivity;
- Storage coefficient;
- Head distribution;
- Cation/anion exchange capacity

In addition to the hydrological characteristics stated above, the CEO should reserve the right to request supplementary information in order to assess the acceptability of the site.

Siting of the facility should take into account air quality problems which might arise from the operation of the hazardous wastes management. A complete study of the potential problems and their remediation should be transmitted to government officials.

A hazardous waste facility should not be sited in locations where it might occupy or threaten the known habitat of an endangered or threatened plant, insect, fish or wildlife species.

A hazardous waste facility should be sited as to prevent the destruction or the degradation of designated by the CEO for their exceptional characteristics (historic, cultural or natural sites and landmarks).

Setback distances should be determined for each facility based on the type and the quantity of hazardous wastes handled and the type of facility (treatment, storage or final disposal). The applicant should demonstrate, to the satisfaction of the DOE, that the

construction and the exploitation of the suggested hazardous wastes facility do not pose a threat to the environment.

### 3.2 Design of Hazardous Waste Facilities

Design criteria for Hazardous Wastes Facilities depend on the types and quantities of hazardous wastes and on the type of facility (treatment or final disposal). The DOE should reserve the right to determine such criteria for each project.

When determining design criteria, the DOE should aim to :

- Ensure no hazardous waste is released in the environment under normal operating conditions
- Avoid facility deterioration and potential hazards due to hazardous wastes mixing
- Minimize emissions of pollutants during treatment
- Minimize health and environmental hazards under extreme weather conditions
- Ensure the long term efficiency of final disposal facilities.

In order to determine the design criteria, an environmental assessment study should be done for each planned facility. It should contain the following elements:

- the types and the quantity of hazardous wastes accepted at the planned facility
- the type of facility
- the potential hazards to health and environment
- the proposed location of the planned facility
- the description of the proposed site and its surroundings
- the proposed mitigations to avoid any destruction or degradation of the surroundings.

#### 3.2.1 Design of Facilities Storing Hazardous Liquid Wastes

Facilities dealing with hazardous liquid wastes should be designed to contain a spill and to prevent spill to the environment. Wastes should be kept in tanks or containers that are totally leak-tight. The tanks and containers containing hazardous wastes should be kept on an area lined with a synthetic liner (asphalt, concrete, etc.).

The material of the synthetic liner should be chosen with respect to the nature of the waste that will be stored on the lined area and special care should be taken to prevent any chemical degradation affecting the ability of the liner to retain the waste in case of a spill.

The synthetic liner should be inspected at least twice a year and any damage posing a threat to the ability of the liner to retain the waste should be immediately repaired. An inspection report should be produced for each inspection and should be kept at the facility.

The lined area should be able to contain a spill. The volume to contain should be the larger of these two:

- 125% of the volume of the largest tank used at the facility;
- 25% of the total volume of the tanks and containers that can be used at any time on the lined area.

### 3.2.2 Storage of Hazardous Liquid Wastes

Hazardous liquid wastes should be stored in leak-tight containers or tanks. The containers and tanks should be inspected monthly to identify any signs of defect such as corrosion, dent, etc. as these defects can weaken the containers. Any defective container should be immediately emptied and discarded.

### 3.3 Landfill Design

The Hazardous Waste Regulations provides that a landfill receiving hazardous must be designed with two liners of which at least one is a synthetic liner. To further diminish the risks posed by leakage, a landfill should be installed on a site where:

- Local soil is homogeneous and has a layer of at least 6 meters thick with a hydraulic conductivity of no more than  $1 \times 10^{-7}$  cm/s for landfills with only one synthetic layer;
- Local soil is homogeneous and has a layer of 3 to 6 meters thick with a hydraulic conductivity of no more than  $1 \times 10^{-7}$  cm/s for landfills with two synthetic layers.

### 3.4 Operation of Hazardous Wastes Facilities

#### 3.4.1 Environmental Monitoring

Due to the nature of hazardous wastes and their potential threats to the health and the environment, the environmental monitoring of the air, surface water and ground water quality is an important part of the management of a hazardous wastes facility.

The parameters to be measured should be specific to each facility and should be based on the nature of the wastes handled at this facility. The environmental assessment should provide the necessary information to determine the parameters to be measured.

### **3.5 Construction of Hazardous Wastes Facilities**

A quality insurance plan should be developed during the design of a hazardous waste facility to ensure that it is constructed in compliance with the given specifications. A quality insurance report should be transmitted to the DOE after the construction stating the results of every quality tests performed and assessing the ability of the facility to perform according to the regulations. The detailed content of this report should be described in the authorization documents.

### **3.6 Closure and Post-Closure**

Closure and Post-Closure activities and duration should be determined in a case-by-case basis based on the nature of the wastes handled at the facility. The design of a hazardous wastes facility should ensure the long-term efficiency of the health and environmental protection methods. These methods should be applied as long as there is a potential risk to the population or to the environment. Contingency plans should address any potential failure or malfunction.

The closure and post-closure plan should be subject to the approbation by the DOE prior to the construction of the hazardous wastes facility. The cost of the closure and post-closure plan should be determined during the design phase of the project and the hazardous wastes facility owner should provide a financial plan warranting the availability of the money. This warranty can be under the form of a trust or a security bond. The cost of the closure and post-closure plan should be revised each year and adjustments to the financial warranty should be made if necessary.

Treatment facilities, where no hazardous wastes remain on site at the closure date, should provide an environmental study realized by an independent source demonstrating that no health hazard or environmental hazard can be caused by the facility before being relieved of their environmental monitoring.