Egyptian Pollution Abatement Project

Hazardous Waste Inspection Manual

October 2002

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List of Acronyms

DDT	p,p'-Dichlorodiphenyltrichloroethane
EDTA	Ethylenediamine Tetra acetic acid
EEAA	Egyptian Environmental Affairs Agency
EMS	Environmental Management System
EPAP	Environmental Pollution Abatement Project
ER	Executive Regulations
EU	European Union
GIM	General Inspection Manual
HS	Hazardous Substances
HW	Hazardous Waste
MSDS	Material Safety Data Sheets
OECD	Organization for Economic Co-operation and Development
PCBs	Polychlorinated Biphenyls
PET	Polyethylene Terephthalate
PVC	Polyvinyl Chloride
US EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds

Preface

Hazardous waste management is a growing concern for the Egyptian Government. Law 4/1994 for the Environment and its Executive Regulations (ER) specify the necessary requirements to be implemented by the industries generating hazardous waste for the safe handling of such waste throughout the different stages of its management. Industrial inspection aims at verifying compliance of the industrial sector with the regulatory requirements, leading to the promotion of compliance and/or enforcement. This would result in protecting the environment and public health from potential adverse effects of industrial activities

Within this framework, this manual is developed with the overall purpose of providing assistance to the inspection teams of the Egyptian Environmental Affairs Agency (EEAA) in carrying out industrial inspections concerning hazardous waste. In this regard, the manual introduces detailed procedures for carrying such inspections. Issues of particular importance are also addressed by the manual, including the definition and identification of hazardous waste.

1. Introduction

1.1 Background

Within the overall context of environmental management and protection, inspection is regarded as tool which can lead to the enforcement of the environmental legislation. In this respect, industrial inspection aims at ensuring the compliance of the industrial sector to pertinent legal requirements resulting in protecting the surrounding environment as well as public health from the potential adverse effects of industrial activities. In addition, inspection activities could be used to encourage and motivate industrial establishments to adopt measures aimed at improving their environmental performance, by identifying areas and/or opportunities for improvement.

In respect to hazardous waste (HW) management, industrial inspection is carried out with two main objectives. The first objective entails the verification that this type of waste is properly managed within the establishments it is generated (i.e. verify the handling of HW in the establishments). The proper management of HW would ensure that adverse impacts of this type of waste on public health and the environment are minimized. The second objective is to verify the effectiveness of HW management (i.e. verifying that all HW generated within an establishment is captured by the management system, and thus properly handled). HW management is considered effective when no HW generated escapes from the management system.

1.2 Purpose and Objective of the Manual

Law 4/1994 and its Executive Regulations specify the necessary procedures to be implemented by hazardous waste generators in order to ensure the proper management of their waste. In this respect, and within an industrial context, this manual is developed with the overall purpose of providing assistance to the inspection teams of the Egyptian Environmental Affairs Agency (EEAA) in carrying out industrial inspections, enforcing the legal requirements in this regard, and ensuring the compliance of industries to the hazardous waste management stipulations of Law 4 and the ER.

Within this framework, this manual addresses the legal requirements pertaining to HW management, and which would be subject to inspection. Issues of particular importance to the success of HW inspection are also addressed by the manual, including the definition and identification of hazardous waste.

1.3 The Manual in Relation to the General Inspection Manual (GIM) and other Sector Inspection Manuals

This manual addresses inspection of HW management activities in industrial establishments. This is carried out within the overall industrial inspection process, thus forming an integral part of it. In this regard, the contents of this document should not be considered separately from the General Inspection Manual (GIM) and other sector inspection manuals, but must be used within their framework. Thus, the inspection procedures for hazardous waste management within an industrial establishment shall follow the framework for

general inspection, as described in the GIM, and other sector inspection manuals. This means that the following activities are to be carried out:

- Examining the documents related to hazardous waste management at the opening meeting with the company representatives
- Conducting field inspection, staff interviews, sampling procedures, etc., as per the GIM, and other sector inspection manuals.
- Finally, results of the hazardous waste inspection are conveyed to the company representatives during the closing meeting and the findings and recommendations incorporated in the inspection technical report.

1.4 Hazardous Waste Handling Licenses

According to Law 4/1994 and its ER, handling of HW is prohibited without a handling license issued by the competent authority, which is the Ministry of Industry. The handling license requires the applicant to provide of detailed description for all HW management procedures and practices intended to be carried out for ensuring proper management of such waste.

Hazardous waste handling permits present one component of the hazardous waste management system addressed by Law 4 and the ER, for which the environmental inspector needs to ensure compliance to. In this respect, the responsibilities of the inspection team entail ensuring the existence of hazardous waste handling license (s), if the industrial establishment is carrying out on-site HW treatment and/or disposal or off-site HW transportation. Moreover, the inspection team must also verify the suitability of the hazardous waste management practices implemented by the industrial establishment, and their compliance to the requirements stipulated in the ER.

In this regard, it is important to note that currently, the National Hazardous Waste Permitting System is under adoption. Therefore, the absence of the handling license(s) at establishments carrying out on-site HW treatment and/or disposal or off-site transportation is not to be considered as a violation to the legal requirements until the full operationalization permitting system.

1.5 Manual Outline

The manual consists of four main sections described as follows:

Section I **Introduction**
This section introduces the needs leading to the preparation of this manual and its objective.

Section II **Background**
This section illustrates the essential background information deemed necessary for the inspection team to carry out the inspection process effectively. This information includes potential health and environmental impacts of hazardous waste, identification of hazardous waste within the industrial context and the possible options for hazardous waste minimization.

More specifically, this section encompasses the following issues:

- Impacts of hazardous waste
  The adverse health and environmental impacts of improper handling of hazardous waste are briefly outlined.

- Definition of "waste" and "hazardous waste"
  The definition of waste within the industrial context is illustrated and the definition of hazardous waste presented.

- Identification of hazardous waste
  Hazardous waste identification issues are briefly presented and discussed. Examples of hazardous streams and constituents generated from the various industrial sectors are provided. Hazardous waste subject to inspection at industrial establishments is also identified.

- Hazardous Waste Minimization
  This section is intended to provide the inspection team with background information on the concept of hazardous waste minimization as well as the different alternatives for implementing waste minimization programs.

Section III Hazardous Waste Management

The legal framework for hazardous waste in Egypt is presented and the requirements to be implemented by the industrial establishments for hazardous waste management are discussed. These encompass:

- HW permitting;
- Source reduction of HW;
- on-site storage;
- on-site treatment; and
- HW transportation and final disposal;

Section IV Inspection activities

This section illustrates in detail the HW inspection process as would be carried out by the inspection team, starting from pre-inspection planning through the field visit and the post-inspection phase. The process focuses on the inspection activities of waste management procedures at different units and utilities within the establishment.

2. Background

This section aims at providing the inspection team with essential background information concerning hazardous waste. Such information is deemed essential for an effective inspection.

2.1 Impacts of Hazardous Waste

2.1.1 Common Routes of Transport to the Environment and Human Exposure

The routes of transport of hazardous waste can be either direct, such as direct human contact, the direct discharge into an environmental medium (air, water, soil), or indirect such as atmospheric deposition of wind born particulates to surface waters. The potential routes of exposure to hazardous waste are illustrated in figure (1) below.

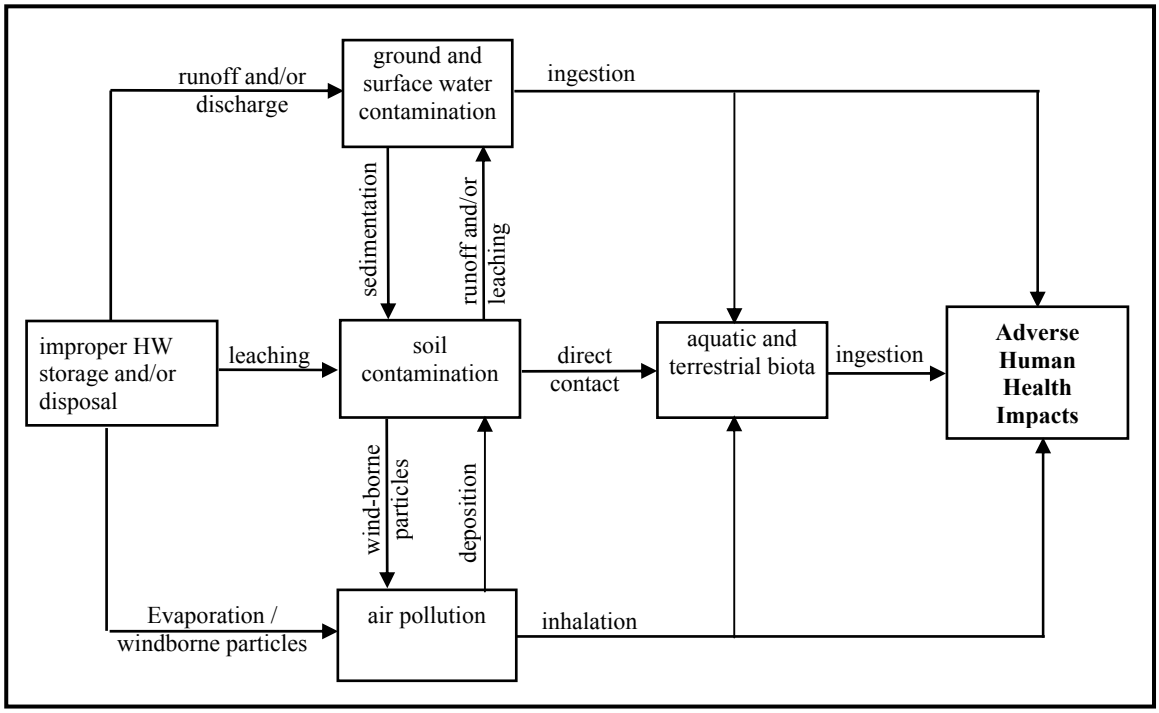

Figure (1): Routes of Transport of Hazardous Waste[1]

2.1.2 Health Impacts of Industrial Hazardous Waste

Hazardous waste generated from the different industrial sectors can result in severe health and environmental impacts. For example, many hazardous waste constituents have been identified as occupational carcinogens, such as benzene and chromium VI. Lead in metal sludges can cause neurological dysfunction in adults and children or malfunction of the kidneys and the nervous system. Table (1) below describes the adverse impacts of some of the most commonly generated hazardous waste in Egypt. The most likely sources of such waste are also presented.

1 Based on The Safe Disposal of Hazardous Wastes: The Special Needs and Problems of Developing Countries, Vol.I, World Bank Publication (1989).

Table (1): Adverse Health and Environmental Impacts of Common Industrial Hazardous Waste in Egypt

Hazardous Waste	Health /Environmental Impact	Generating Industrial Sector
Waste xylene	• eyes and mucous membranes irritation, • disturbances of liver and kidney function	pulp and paper, textile, paints
Waste benzene	• cancer • blood disorder • skin irritation	paints, paper, leather
Peroxides waste	• eye and skin irritation • lung irritation • irritation and inflammation of nose, throat and respiratory tract	pulp and paper, textile
Waste containing lead	• neurological dysfunction in adults and children • high blood pressure in adults • affects blood chemistry, kidney and nervous system • accumulates in some shellfish such as mussels.	lead smelting, inorganic chemical industry, iron and steel, pigments, paint
Waste containing cadmium	• causes cancer • kidney damage • de-calcification of bone tissues • toxic to human	textile, leather, inorganic chemical industry, iron and steel, wood preserving, dyes and pigments
Waste containing chromium VI	• causes cancer • chronic irritation of the respiratory tract	metal finishing, leather/ fur, textile, paper printing, tanning, steel, chemicals manufacturing
Waste containing arsenic	• can cause cancer • skin, eye and respiratory irritations • accumulates in aquatic organisms	pigments, paints, wood preserving, inorganic chemicals, lead metallurgy
Waste containing cyanide	• toxic, can cause prompt death due to respiratory arrest • can cause blindness, and damages to optic nerves and retina • affects the central nervous system • toxic to animals and aquatic organisms	dyes and pigments, metal treatment and coating
Waste sulphuric acid	• irritating to skin, eyes and mucous membrane	textile, inorganic chemicals, printing inks, secondary lead smelting, metal treatment
Waste sodium hydroxide	• irritating to the upper respiratory system • causes skin irritation	textile, metal treatment
Waste halogenated solvents (e.g. dichloromethane)	• probable human carcinogen • affects central nervous system, liver, kidney or respiratory system	organic chemical industry, textile, pesticide, dyes and pigments, paint, inks

2.2 Definition of Industrial "Waste"

Having a working definition for hazardous waste, to be commonly used by both industrial establishments and industrial inspectors, is deemed essential for the success of hazardous waste management. The common definition would assist and facilitate the communication process between the two parties and prevent future conflicts and misunderstandings. Within this context, it is important to first define what constitutes "waste" within the industrial context, which would then be the base for hazardous waste identification.

Industrial waste is determined as solid, liquid and/or gaseous materials which the holder (generator) discards or intends to discard (because such materials do not have subsequent on-site use in the form they are generated in), or is required to discard (because the use of such materials is illegal).
This can encompass the following[2]:

- Materials spilled, lost or having undergone other mis-happenings
- Residues of industrial processes (e.g. slag, still bottoms, etc.)
- Residues from pollution abatement processes (e.g. scrubber sludge, baghouse dust, spent filters, etc.).
- Substances that no longer perform satisfactorily (e.g. contaminated acids, contaminated solvents, exhausted tempering salts, etc.)
- Unusable parts (e.g. reject batteries, exhausted catalysts, etc.)
- Any materials, substances or products the use of which has been banned by legislation.
- Any material that is disposed of, involving burning and incineration, accumulation, storage or treatment, prior to disposal.

At this stage, it is important for the inspection team to be able to recognize which materials are intended for discarding by the industrial establishment and hence considered waste. One way to recognize waste is simply to interview the concerned personnel, and require information about the intended handling alternatives for the material at hand, whether disposal, treatment, on-site recycling[3] etc.

When interviewing concerned personnel the following points which can be raised by the inspection team to establish a distinction between materials which are intended for discarding and are therefore considered waste and those which are not:

- What are typical wastes generated from the process(es)?
- Is this material used as input material in a process(es) in the establishment? In which process(es) is it used?
- Does it require processing or treatment prior to being used as input material?

[2] Reference: Council Directive 91/156/EEC amending Directive 75/442/EEC on Waste

[3] A material is recycled if it is recovered or reused. Recovery is processing the material to recover or regenerate a usable product (e.g. regeneration of spent solvents). Reuse is the direct utilization of the material, without treatment, as an ingredient in an industrial process to make a product (e.g, distillation bottoms from one process used as input in another process). (Ref: US EPA, Definition of Solid Waste and Hazardous Waste Recycling, 1999).

2.3 Definition of "Hazardous Waste"

Hazardous waste is waste having possible adverse impacts to human health and the environment as a result of physico-chemical and/or biological properties rendering it dangerous. According to Law 4/1994 hazardous waste is defined as:

> *"Waste of activities and processes or its ashes which retain the properties of hazardous substances and have no subsequent original or alternative uses, like clinical waste from medical treatments or the waste resulting from the manufacture of any pharmaceutical products, drugs, organic solvents, printing fluids, dyes and painting materials".*

If the industrial waste exhibits one or more of the hazardous properties described below, then it is considered hazardous waste In this respect, hazardous waste can be in form of liquids, solids or sludge.

2.4 Hazardous Characteristics

The characteristics rendering waste hazardous encompass the following:

- ***Flammable***: capable of burning or causing fire. It describes :
  - waste liquids that give off flammable vapors at a temperature of 60.5^0C.
  - solid wastes which under transport conditions are readily combustible or may cause or contribute to fire through friction.
  - waste which is liable to spontaneous heating under normal conditions and then being liable to catch fire.
  - waste which in contact with water are liable to become spontaneously flammable or give flammable gases in dangerous quantities.

  Examples include waste organic solvents such as ethyl ether, methanol, acetone, toluene, benzene and kerosene.

- ***Corrosive***: able to corrode materials (e.g steel) by chemical reaction as a result of extreme acidic or basic properties and is capable of causing severe damage when in contact with living tissues.
  Examples include waste caustic soda (sodium hydroxide) and waste acids such as sulphuric acid, nitric acid, hydrochloric acid, etc.

- ***Reactive***: undergoes violent reactions with air and/or water. It describes waste that:
  - is normally unstable and undergoes violent change without detonating
  - is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure
  - forms potentially explosive mixture with water
  - When mixed with water, generates toxic gases, vapors, or fumes in a quantity sufficient to present danger to human or environment.

Examples include wastes containing alkali and alkaline earth metals and phosphorus pentachloride.

- ***Oxidizing***: waste giving rise to highly exothermic[4] reactions when in contact with other substances, particularly flammable substances and may, by yielding oxygen, cause or contribute to the combustion of other materials.
  Examples include waste nitric acid and peroxide-containing waste.

- ***Irritant***: non-corrosive wastes which, through immediate, prolonged or repeated contact with the skin or mucous membranes can cause inflammation or other skin symptoms.
  Examples include waste chemicals such as tetra chlorobenzene, triethyl amine and acetic acid.

- ***Toxic***: waste containing substances which are poisonous. It describes:
  - waste which, if inhaled or ingested, or penetrates the skin may involve delayed or chronic effects including carcinogenity
  - poisonous waste which may cause death or serious injury if swallowed or inhaled or contacted the skin.

  Examples include wastes containing cyanide, chromium VI, arsenic, cadmium, lead, and other heavy metals, in a dispersible form[5].

For example, scrap metal waste containing lead is not hazardous because the lead is not in a dispersible form. However, waste containing soluble lead salts, or waste lead in the form of fine powder/small particles, are in a dispersible form. They would therefore be considered as hazardous waste.

- ***Harmful***: waste containing substances and preparations which, if inhaled or ingested or penetrates the skin, may involve limited health risks.
  Examples include waste xylene, pyridine, styrene, lubricant oils and emulsions.

- ***Ecotoxic***: waste, which may have toxic effects on biotic systems and which, if released, may present immediate or delayed environmental adverse impacts by means of bioaccumulation and/or toxic effects on one or more sectors of the environment.
  Examples include PCB[6] waste, DDT[7] waste and some waste pesticides.

[4] Generating large amounts of heat.
[5] Dispersible form is one which can be easily scattered in the surrounding environment, either as a result of being soluble, in the form of sludge, colloids, emulsions, etc., or in the form of fine powder/small particles.
[6] Polychlorinated Biphenyls
[7] p,p'-Dichlorodiphenyltrichloroethane

- ***Carcinogenic*:** waste which, if inhaled or ingested or penetrates the skin, may induce cancer in man or increase its incidence.
  Examples include waste benzene.

- ***Teratogenic*:** waste containing substances and preparations which, if inhaled or taken internally or penetrate the skin, may induce non-hereditary genetic deformations, or increase their incidence.
  Examples include waste containing ethylene thiourea, tetra ethyl lead, lead alkylates.

- ***Mutagenic*:** waste containing substances and preparations, which if inhaled or taken internally or penetrates the skin may induce hereditary inherent deformations, or increase their incidence.
  Examples include waste containing vinyl chlorides, DDT, aldrin and dieldrine and methyl methanesulfonate

2.5 Hazardous Waste Identification Internationally

Quantifying the hazardous characteristics presents an important parameter for the determination if a waste is hazardous or non-hazardous. Two of the main systems for hazardous waste identification are that of the European Union (EU) and that of the US Environmental Protection Agency (US EPA). In determining whether a waste is considered hazardous or non-hazardous, these systems are based on determining threshold concentrations for the hazardous characteristics. If the waste exhibits hazardous characteristic at a quantity above such thresholds, it is then considered to be hazardous.

Generally, EU legislations consider waste as hazardous if the total concentration of one or more hazardous constituents equals to or exceeds set concentrations. In this regard, the legislation has set analytical methods[8] for the determination of physicochemical, toxicological and ecotoxicological properties of hazardous waste such as flammability, explosive properties, oxidizing properties, toxicity, teratogenity, mutagenity, etc. These test methods are based on those recognized and recommended by competent international bodies, in particular OECD[9]. As an important methodology, leaching test procedures for the characterization of waste are under standardization work in Europe. When such methods are not feasible, national standards or scientific consensus methods can be adopted.

The US EPA legislations, consider waste as hazardous if the hazardous characteristic it exhibits exceeds the quantified limit set in the legislation, determined using identified test methods. The toxicity characteristic is, on the other hand, measured based on both the concentration of the toxic constituents in the waste, as in EU legislation, and the leachability of these constituents from the waste to the surroundings.

[8] The test methods are determined by Commission Directives 79/831/EEC and 84/449/EEC amending the Council Directive 67/584/EEC on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labeling of dangerous substances.

[9] Organization for Economic Co-operation and Development

2.6 Means for Hazardous Waste Identification

Precise identification of hazardous waste is considered a key parameter for a successful hazardous waste inspection process. Improper determination of the hazardous waste can result in:

- Including part of the non-hazardous waste within the hazardous waste inspection system. This would increase the amount of waste to be handled by the management system, thus increasing the burden on the establishment in implementing this system.

Or:

- Having part of the hazardous waste escaping from the management system, which would result in potential adverse environmental and health impacts. In such cases the hazardous waste management process would not be effective and would not be achieve its goals.

Within this context, this section aims at providing the inspection team with possible means for proper identification of HW generated at industrial establishments.

2.6.1 Sector Inspection Manuals

The sector specific inspection manuals can be a useful source for obtaining background information about the industrial sector at hand and determining hazardous waste generated. These manuals provide detailed information on various industrial processes including the different types of likely generated hazardous waste. Manuals have thus been developed for the Textile, Metallurgical, Pulp and Paper, Motor Vehicles, and Food and Beverages sectors**.** Other sector inspection manuals under development are for the of Fertilizers, Paints, Ceramics and Cement, and Oil and Soap and Detergents.

2.6.2 Hazardous Waste Classification System

The industrial establishments are responsible for identifying the hazardous waste generated from the different processes to be able to comply with the requirements of Law 4/1994 and avoid potential risks to the workforce and surrounding environment. In this regard, a ***National Hazardous Waste Classification System*** is currently under adoption and operationalization in Egypt by different competent government ministries and authorities in coordination with EEAA[10].

Hazardous waste classification entails the application of approved standard criteria for the identification of HW on the basis of common agreed-upon characteristics. According to the proposed national classification system, HW is classified on the basis of four main characteristics ***Ignitability, Corrosiveness, Reactivity*** and ***Toxicity***.

In this context, listings for HW, by source and type, were developed in order to facilitate the identification of such waste: List **S** including special waste such as medical waste, radioactive waste, asbestos, waste oil and empty containers; List **F** including waste from non-specific

[10] Guidelines for the Classification, Characterization, and Coding of the Egyptian Hazardous Waste.

industrial sources such as solvents, sludges from wastewater treatment, etc.; List **K** including waste generated from specific industrial processes; List **P** including waste containing acutely hazardous materials; List **U** including waste containing discarded toxic off-specification materials.

In addition, the six line ministries[11] concerned with HW management have developed lists including HW generated within their scope of competence. Within the industrial sector, the Ministry of Industry developed such a list for wastes generated from different activities in this sector. Annex (I) presents the draft list of the Ministry of Industry.

Figure (2) below shows the main categories of hazardous waste classification

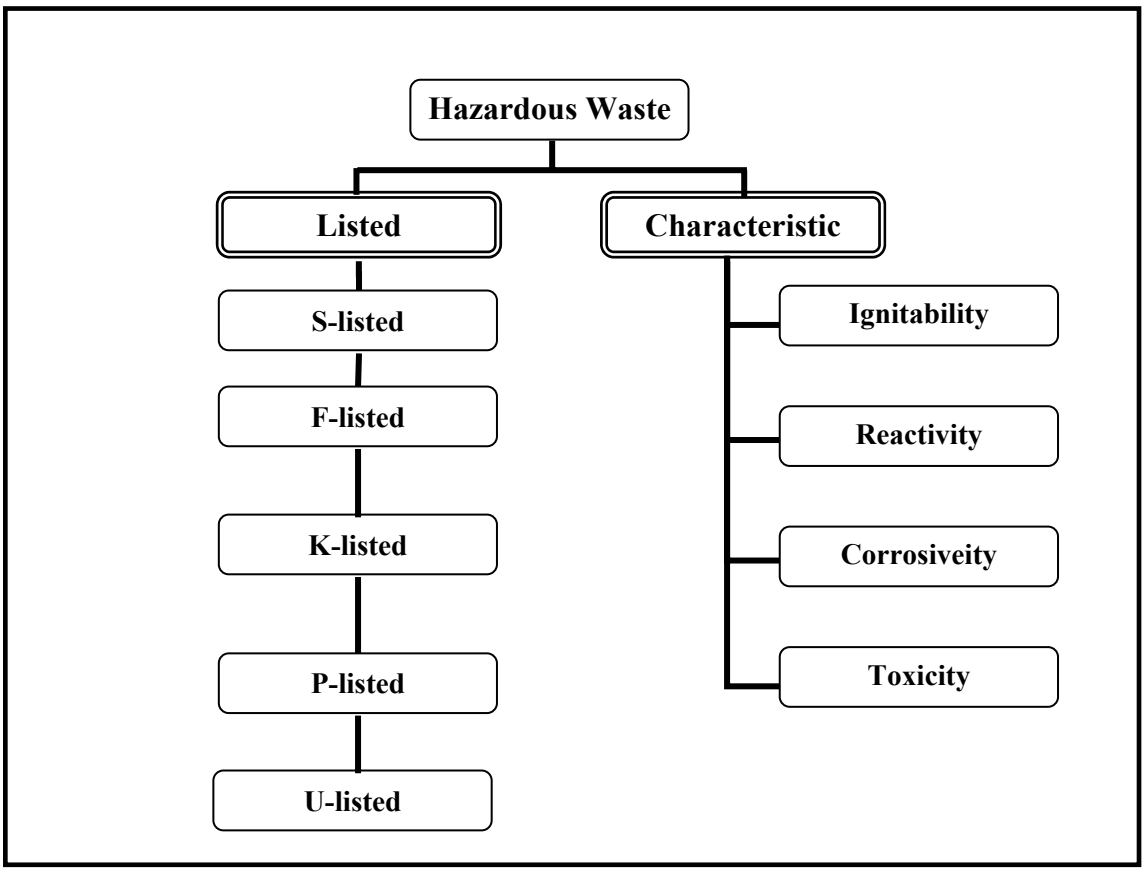

Figure (2): The Main Categories for HW Classification

Within this context, Annex (II) presents the master flowchart used for the classification of HW in the National HW Classification System. Further details and the listings of HW, together with the laboratory tests and criteria for determining the hazardous characteristics, can be found in the EEAA document titled "Guidelines for the Classification, Characterization and Coding of the Egyptian Hazardous Waste"[12].

2.6.3 Hazardous Substances as Input Materials

[11] Ministry of Industry, Health, Electricity, Interior, Petroleum and Agriculture.
[12] Refer to the General Department of Hazardous Substances and Wastes in EEAA.

In addition to hazardous waste lists, knowledge of hazardous input materials to the industrial process could provide useful guidance to the inspection team in foreseeing the types of hazardous waste likely to be generated. In this respect, a list of the used input materials should be inquired from the representatives of industrial establishment at the opening meeting according to the procedures prescribed in the GIM and other sector specific manuals.

The input materials can be identified as hazardous through the use of the Material Safety Data Sheets (MSDS). Material Safety Data Sheets provide the necessary information to understand and deal with the potential hazards associated with a particular substance. They also give clear descriptions of the most important hazards associated with the substance particularly with regards to human health, the environment, and/or property. Furthermore, MSDS indicate the appropriate methods for the safe disposal of the surplus and/or the waste resulting from foreseeable use of the substance, as well as any contaminated packing material and other hazardous waste.. In case MSDS are not available, the inspection team can advise the establishment to obtain the MSDS for each input material used, from the different international and domestic chemical suppliers.

> It is important for the inspection team to realize that the use of hazardous input materials does not necessarily result in the generation of hazardous waste. Furthermore, and more importantly, HW can be generated from processes not using hazardous input materials. In this respect, knowledge of hazardous input materials provides a useful **guidance** to the inspection team to **possible** HW generation.
> This is particularly significant for establishments claiming that that they do not generate HW. For such cases, the inspection team can verify the truth of such claims by its knowledge of the industrial process, hazardous input materials used, and simple materials balances.

2.6.4 Hazardous Substances Lists

In addition to MSDS, the Hazardous Substances List prepared by the Ministry of Industry could also be used as means for foreseeing potential hazardous waste generation. In this respect, the Hazardous Substances Information Management System, located at EEAA, can prove a useful tool for accessing extensive information regarding the hazardous substances categorized on the Ministry of Industry Hazardous Substances Lists, as well as about 1800 substances.

2.6.5 Examples of Industrial Hazardous Waste

Annex (III) illustrates industrial sectors and processes most commonly generating hazardous waste and the likely generated types of waste.

2.6.6 How to Carry out Hazardous Waste Identification?

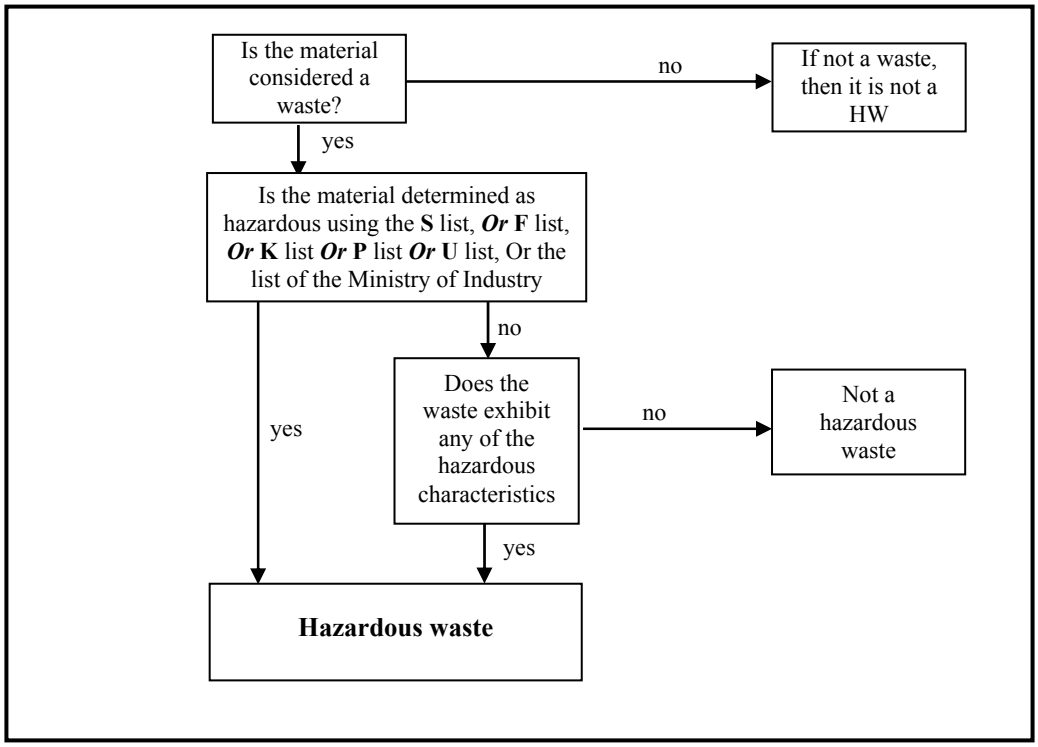

Figure (3): Identification of Hazardous Waste

1. Identify if the material is waste, intended for discarding. Suitable ways to obtain the information can be through interviews with the concerned personnel as well as through available background information concerning the industrial processes and the likely generated waste. If the material is not intended for discarding, it is not waste.
2. Verify if the waste is identified as hazardous waste according to the lists of the National hazardous Waste Classification System, or if it exhibits a hazardous characteristics (knowledge of hazardous input materials could provide useful guidance here).
3. If the waste is listed waste, or exhibits any of the hazardous characteristics, then it is considered hazardous waste.
4. If the waste is not listed waste, and does not exhibit hazardous properties, then it is not hazardous waste. It is considered non-hazardous solid or liquid waste.

Figure (3) above is a schematic presentation of hazardous waste identification process.

2.7 Industrial Hazardous Waste Subject to Inspection in Egypt

Industrial hazardous waste entails materials generated from processes within an industrial establishment which exhibit hazardous characteristics and which are intended for discarding, i.e. with no subsequent on-site use in the form they are generated. Such materials would therefore be considered hazardous waste and are subject to the enforcement of hazardous waste legislation, and

consequently environmental inspections. This is schematically illustrated in figure (4) below.

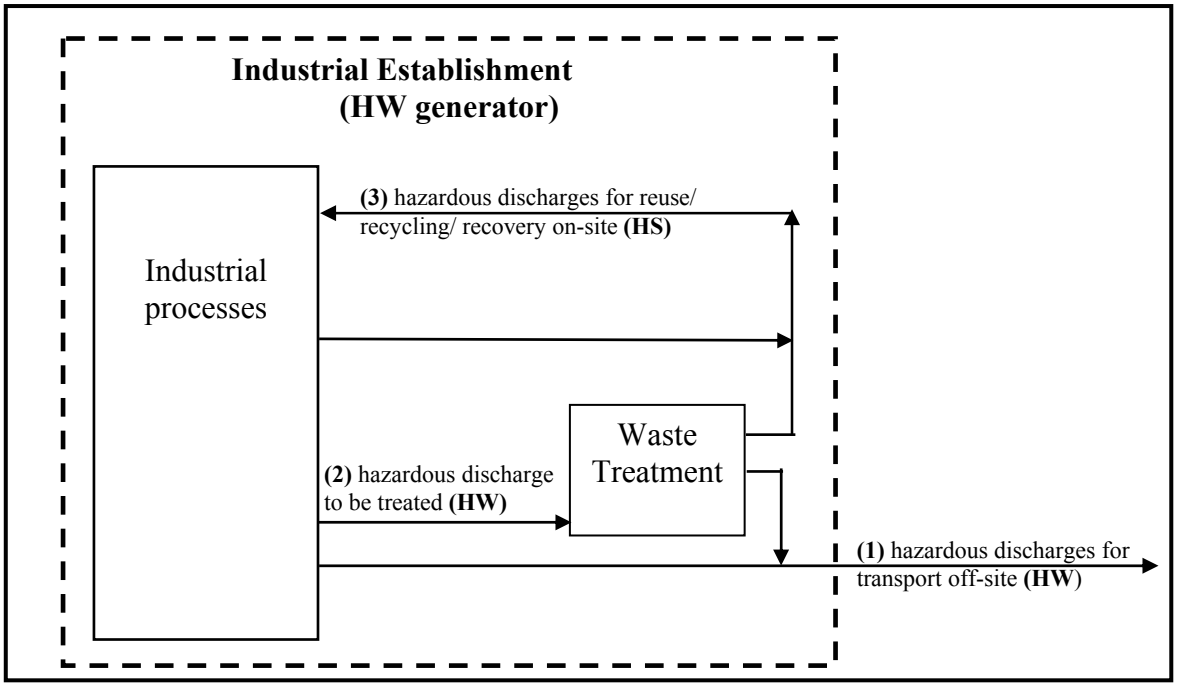

Figure (4): Industrial Discharges Subject to Hazardous Waste Inspection

In this figure, discharges (1) are hazardous waste because they have no subsequent on-site use in the form they are generated in, and are intended for discard by the generator. Discarding is carried out by delivery to either a transporting entity with a hazardous waste permit, or delivery to entities licensed for recycling, treatment and/or disposal of hazardous waste. Discharges (2) have no subsequent on-site use in the form they are generated in, and have to undergo treatment[13]. Discharges (3), however, are not discarded by the generator, as they have subsequent on-site use in the form they are generated in (either from the industrial process, or the treatment process). In this respect, they are considered as hazardous input materials[14].

2.8 Hazardous Waste Minimization

Waste minimization occupies the highest levels of the waste management hierarchy. It entails improving existing technologies, and introducing cleaner production and pollution prevention measures. Waste recycling and reuse come at the next level down this hierarchy. At a lower level of the hierarchy comes treatment. The lowest level of the hierarchy comprises final safe disposal of the treated waste. Waste management hierarchy is presented in figure (5) below.

[13] Waste treatment is any process that changes the physical, chemical or biological character of the waste, to make it less of an environmental threat. Treatment can neutralize the waste, recover energy or material resources from the waste, render the waste less hazardous, or make the waste safer to transport, store, or dispose of. (Ref. US EPA, Office of Solid Waste).

[14] These would be subject to articles 29 and 33of Law 4/1994, and articles 25, 26, 27, 31 and 32 of the ER.

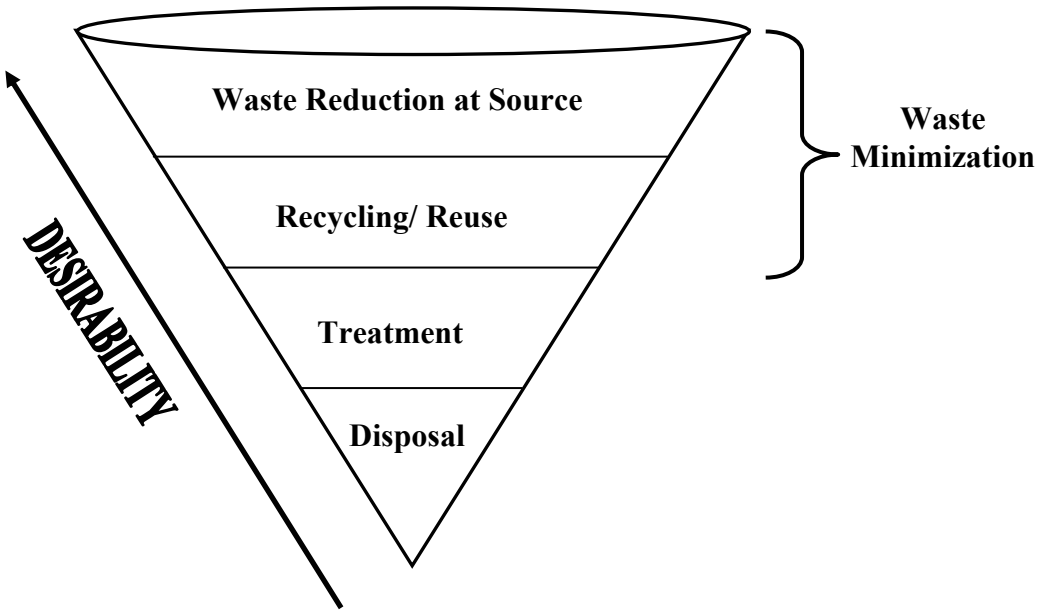

Figure (5): Waste Management Hierarchy

2.8.1 Options for Hazardous Waste Minimization

1. Source Reduction

Source reduction is the use of materials, processes, or practices that reduce or eliminate the generation of wastes at the source. Source reduction involves product change and source control.

a. Product change

Product change encompasses the replacement of a product with another one suitable for the same end use, with the generation of less or no hazardous waste. Examples for product change include:

- Batteries can be redesigned such that the toxic constituents, for example mercury and cadmium, are reduced or eliminated.
- Using PET (Polyethylene Terephthalate) instead of PVC (Polyvinyl Chloride) in pipes and plastic manufacturing

b. Source control

Source control encompasses input material substitution, re-engineering production processes and/or improving procedural practices.

- Input material changes

  Input material changes involve replacing the hazardous input materials with less or non-hazardous substitutes. Examples for input materials substitution include:

- The use of non-toxic, non-carcinogenic dyes with no heavy metal content in the textile industries
- The use of water-base inks and pigments instead of the solvent-base ones.

- Technology/ process changes
  Technology/process changes involve improving or modifying the existing technologies used in production processes. Process modification ranges from eliminating leaks from the existing equipment, to installing of new advanced equipment. Modification of equipment and process automation are also means for waste minimization.
- Process control/optimization
  Process control and optimization would most likely result in the generation of less waste.
- Good housekeeping
  Good housekeeping includes the periodic maintenance, continuous checkup, leak detection plans, efficient hazardous waste segregation from other non-hazardous waste streams. It also involves raising the environmental awareness of all workers and employees, as well as their continuous training.

2. Reuse/Recycle/Recovery

It encompasses:

a. Reuse

Is the direct use of the waste, in an industrial process in the form it is generated, , without the need for pretreatment or modification.

Examples for waste reuse:

- Reuse of solvents for equipment cleaning
- Reuse for acidic and alkali solution
- Reuse of ferric chloride waste from manufacture of titanium oxide as wastewater conditioner
- Reuse of chromium solutions in tanneries

b. Recycling

This entails pretreatment of waste so that it can be used as raw material in the process it is originated from, or in other processes.

Examples for waste recycling:

- Recovery of a secondary material for a separate end use such as the recovery of a metal from sludge
- Removal of impurities from a waste to obtain relatively purer substances which can be reused

c. Recovery or reclamation

It involves recovering and treating "waste" byproducts to be used as raw materials in the same or another process. Examples for waste recycling:

Examples for waste reclamation:

- Distillation of solvent wastes
- Dechcloronation of halogenated solvent wastes

Figure (5) below schematically presents the different options of waste minimization

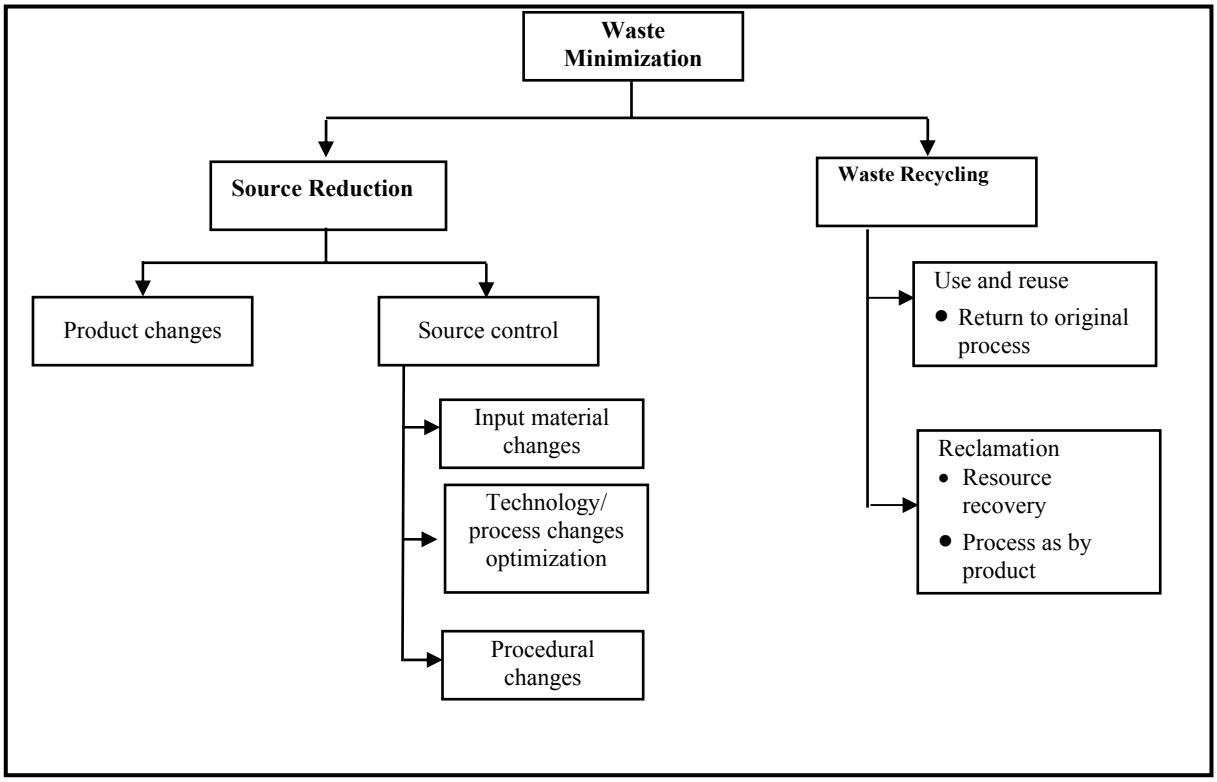

Figure (6): Waste Minimization Options

3. Hazardous Waste Management

Law 4/1994 for the Environment and its Executive Regulations (ER) determine the legal measures that should be implemented by hazardous waste generators to ensure the safe handling and proper management of such waste. In this regard, Law 4/1994 stipulates that the Environmental Affairs Agency is to be concerned with verifying the compliance of the industrial establishment with the legal requirements and regulations, through the environmental register.

The following table (2) summarizes the requirements of Law 4/1994 and its ER to be implemented by an industrial establishment generating hazardous waste. This is followed by a brief presentation of these requirements emphasizing the role of the inspection team in confirming the compliance of the establishment to these requirements.

Table (2): Legal Requirements for Hazardous Waste Management

Regulatory requirement	Description
HW handling[15] permits *(articles 25, 26, 27 - ER)*	– Permits for handling HW must be obtained from the licensing authority, Ministry of Industry. – The industrial establishment must meet the permitting conditions to be granted the handling permit. – The permit would be issued for a maximum period of five years which can be renewed. – The permit can be suspended by the granting body in cases of violations or based on recommendations from EEAA.
Reduction of HW at source *(article 28.1 - ER)*	– HW should be reduced quantitatively and qualitatively[16]. – Industrial establishments should strive to implement waste minimization options to reduce the generation of HW.
Identification of HW*(article 28.1 - ER)*	– Industrial establishments must have complete description of the types and quantities of the generated HW. – For identification, the establishments are to use the HW list of the Ministry of Industry.
HW segregation *(article 26.8 - ER)*	– HW must be separated from other types of non-hazardous waste – The different types of HW must not be mixed together in order to avoid any undesired harmful interaction.

[15] Handling of a material is defined in Law 4/1994 as " any [activity] that leads to the movement of materials, with the intention of collection, transporting, storing, treating, or using them".

[16] Quantitative reduction means reducing the amounts of generated HW. Qualitative reduction means reducing the degree of hazard of the generated waste, i.e. making it less hazardous.

Regulatory requirement	Description
On-site storage of HW *(article 28.2 A, B, C, E - ER)*	*Storage areas:* – HW should be stored in specifically designated areas. – Safety condition must be set for these storage areas. – Emergency plans must exist in order to confront any likely accidents. *Storage containers:* – HW storage containers must be made of suitable materials and be properly sealed to avoid any leakages or spills into the surroundings. – Clear signs must be inscribed on the containers indicating the waste in the containers and the associated hazard, in case of improper handling of the waste.
On-site treatment of HW *(article 28.1 C - ER)*	– In case of HW treatment on-site, EEAA is to approve the treatment operation and the technical specifications of the treatment units and their operational programs.
Collection and transportation of HW *(articles 28.2 D, 28.3 - ER)*	The following issues are addressed: – Need for transporting entity to be licensed for the activity – HW collection schedule. – Safety equipment and labeling of HW transport vehicles. – Vehicle maintenance and upkeep – Vehicle routing – Training of drivers of HW transport vehicles.
Disposal of HW *(article 28.5 - ER)*	The following issues are addressed: – Location and capacity of disposal sites. – Specifications of the sites. – The utilities which must be available at the sites. – Safety and operational equipment which must be available at the site.
HW register *(article 33 - ER)*	– The HW register should be established including information about the types and quantities of the generated waste and methods of its disposal.
Training and awareness *(article 31-ER)*	– Personnel handling HW should be aware of the hazard associated with such waste – Training on proper HW handling should be provided to all concerned employees

3.1 Hazardous Waste Handling Licences

Industrial establishments carrying out on-site treatment of HW and/or on-site disposal of HW, or off-site HW transportation must apply for hazardous waste handling license from the Ministry of Industry. To be granted the license, the establishment must meet the licensing conditions stipulated in article 26 of the ER of Law 4/1994, encompassing detailed information about the types and quantities of the generated waste and the intended procedures for its management.

Currently, the National HW Permitting System is under adoption and operationalization, therefore the absence of HW license(s) would not be considered as a violation. However, once the licensing system is fully operational, the inspection team would be responsible for:

1. Verifying the existence of the licenses for cases of HW on-site treatment and/or disposal or off-site HW transportation by the generating establishment.
2. Verifying the implementation of the license conditions, in agreement with the stipulations of Law 4 and the ER as well as other relevant guidelines
3. Verifying that **all** types of hazardous waste undergoing on-site treatment and/or disposal and off-site transportation (by the establishment), are covered by the licenses of the industrial establishment.

Annex (IV) provides details of the information to be submitted for acquiring hazardous waste handling permits as well as possible cases for permit suspension.

3.2 Source Reduction of Hazardous Waste

Industrial establishments are to strive to reduce the generation of hazardous waste at source. This can be achieved through various waste minimization alternatives, as presented in section 2.8. In this respect, the inspection team is responsible for:

1. Taking note of any waste minimization program/schemes in place or indicate that none is available.
2. Discussing the importance and benefits of waste minimization, drawing attention to potential waste minimization opportunities and possibly referring the establishment to appropriate support.

3.3 Identification of Hazardous Waste

A complete description of the generated hazardous waste must be prepared by the industrial establishment, indicating quantities and composition. This information is to be included in the HW register.

It is important to point out that the proper identification of hazardous waste is the essence of any inspection, as other HW management practices depend on it.

In this regard, the inspection team is responsible for:

1. Verifying that **all** generated hazardous waste is determined for proper management.

2. Verifying that generated HW is properly identified
3. Verifying that identified HW is properly registered (refer to section 3.9 below).

The tools and sources of information presented in sections 2.2 to 2.6 of this manual, would assist the inspection team in this task.

The inspection team should be aware that HW can be generated from different sources which can be sometimes overlooked or forgotten by the industrial establishment. This may result in that part of the generated HW would not be registered. The sources of HW include:

- Normal process situation
- Periodical operations such as cleaning of equipment, tanks or separation units
- Occasional events such as fouling of stored chemicals and spills

In this regard the inspection team should draw the attention of the establishments to such sources to avoid future violations.

3.4 Hazardous Waste Segregation

Hazardous waste must be separated at source from other types of non-hazardous waste. Besides, the different types of hazardous waste must not be mixed together in order to avoid any undesired harmful interaction between them. Proper segregation would facilitate inspection of successive hazardous waste management phases, such as storage, treatment and disposal. In this respect, Annex (V) gives examples of compatibility of selected hazardous waste and the likely outcome of mixing different hazardous wastes. It is important to note that HW segregation also applies to liquid hazardous streams.

The inspection team is responsible for:

1. Verifying the proper waste segregation at the different production units and utilities.

3.5 On-site Storage of Hazardous Waste

Storage areas

Hazardous waste should be properly stored on-site. The storage areas should be away from public places in order to prevent any harm to the public or those persons exposed to the waste, and should be of adequate size for the waste quantities to be stored. Access to the storage should be prohibited for unauthorized personnel. In addition, HW storage practices must minimize possibilities of contamination of soil and groundwater. More specific information regarding HW storage is provided in the EEAA HW storage guidelines[17].

Storage containers

Hazardous waste storage containers must be of inert materials which do not react with the waste. The containers must be labeled with clear signs

[17] These are currently being finalized at the General Department of Hazardous Substances and Wastes at EEAA.

indicating their content, the handling requirements and the associated hazards if improperly handled.

In this respect, the inspection team is responsible for:

1. Verifying that all storage requirements are consistent with the stipulations of Law 4/1994 and its ER.

Annex (VI) presents the main storage requirements and the hazardous signs.

3.6 On-site Treatment of Hazardous Waste

In case of on-site treatment, a HW handling license issued from the Ministry of Industry should be available. In addition, EEAA is to approve the treatment operations, the technical specifications of the treatment units and their operational programs.

The inspection team is responsible for:

1. Verifying the existence of EEAA approval.
2. Verifying the existence a handling license for on-site treatment
3. Verifying that the treatment process abides by the details and conditions set in the approval.

Description and areas of application of common treatment methods are summarized in Annex (VII). When on-site treatment is not feasible, generated hazardous waste is transported to appropriate off-site treatment facilities[18].

> The inspection team must be aware of existing off-site HW treatment facilities and services. This would be significant for directing/guiding the industrial establishments to possible facilities and services.

3.7 Collection and Transportation of Hazardous Waste

Collection and transportation of HW on-site is usually carried out by the industrial establishment. On the other hand, HW transportation off-site can be carried out either by the establishment (generator), or by a different entity (specialized transportation body, or recipient of the waste for recycling, treatment and /or disposal).

Off-site HW transportation by the generator

For off-site HW transportation by the generating industrial establishment, the establishment should have a HW transportation license. In addition, the vehicles used in these operations must meet the requirements stated in ER of Law 4/1994, and detailed in the HW Transportation Guidelines of EEAA[19].. Moreover, the establishment is responsible for ensuring the delivery of this waste to entities with licenses for HW recycling, treatment, and/or disposal.

In this context, the inspection team is responsible for:

[18] An off-site treatment facility is currently under establishment in the Alexandria area by the Hazardous Waste Management Project, funded by the Finnish Government.

[19] Hazardous Waste Transportation Guidelines, available at the General Department of Hazardous Substances and Wastes, EEAA.

1. Verifying that the collection schedule for HW does not allow this waste to accumulate for long periods of time.
2. Verifying that the vehicles used in transportation meet the legal requirements.
3. Verifying that the transportation operations are carried out in agreement with the stipulations of Law 4 and its ER, as well as other procedural conditions set by EEAA in the HW Transportation Guidelines.
4. For HW transport off-site, verifying that the HW transported by the establishment is delivered to licensed entities (for storage, treatment or disposal).
5. Verifying that types and quantities of HW transported and delivered off-site are in agreement with information kept in the HW register.

Once the permitting system becomes fully operational, the inspection team would be responsible for:

6. Verifying that the establishment is licensed for HW transport.

Annex (VIII) summarizes the requirements for HW transportation, as per the stipulations of Law 4 and the ER

HW collection and transportation by entities other than the generator

For HW transported off-site by entities other than the generating industrial establishment, and once the permitting system becomes operational, this establishment is responsible for ensuring that the transporting entity has a license for HW transportation.

In this context the inspection team is responsible for:

1. Verifying that the collection schedule for HW does not allow this waste to accumulate for long periods of time
2. Verifying that the types and quantities of HW thus delivered, are in agreement with information kept in the HW register

Once the permitting system becomes fully operational, the inspection team would be responsible for:

3. Verifying that the entity receiving the waste is licensed for HW transportation.

3.8 Disposal of Hazardous Waste

Requirements of Law 4 and the ER for HW disposal sites would only be pertinent to inspections if establishments disposing of their HW on-site, either by incineration or landfilling.

In such cases, the inspection team would be responsible for:

1. Verifying that the disposal site meets the requirements specified in Law 4 and ER
2. Verifying that HW disposed of, are in agreement with information kept in the register

Once the permitting system becomes fully operational, the inspection team would be responsible for:

3. Verifying the existence of a license for on-site disposal

Annex (IX) presents the legal requirements for HW disposal sites.

3.9 Hazardous Waste Register

Industrial establishments handling hazardous waste are to keep a register of the generated waste, with details of types and quantities of this waste, as well as the methods of disposal and the parties who receive this waste.

The inspection team is responsible for:

1. Verifying the availability of such register and that it is consistent with the requirements of article 33 of the ER
2. Verifying that the information the register includes is in agreement with reality.

Annex (X) presents a proposed model for the hazardous waste register.

Within this context, HW tracking within the industrial establishment is an issue significant to proper on-site management of this type of waste. This entails tracking the waste from the points of generation up to its on-site disposal, if any, or transport off-site. It can best be achieved through the record keeping for the movement of waste from one unit of the establishment to the other. In this respect, any production unit, or utility, would have a record of the waste generated (types and quantities), and its delivery to other units or utilities within the establishment, or in case of transport off-site, its delivery to transportation operators. Such records would assist the establishment of keeping track of its HW, ensuring its proper management (waste "leaking" out of the management system would be detected), and would assist the inspection team in their responsibilities.

> HW tracking within the industrial establishment is not a requirement of Law 4 and the ER. However, tracking HW (keeping records of amounts, types, and destination of HW generated/handled, at each of the production and utility units in the establishment) would prove a useful tool for the generator to ensure that **all** generated waste is properly managed, and would also assist inspectors in tracking inconsistencies between registered information and the actual situation in the establishment.

3.10 Training and Awareness

The industrial establishments must ensure that the personnel involved in hazardous waste handling are aware of the risks associated with improper handling of such waste and that they receive continuous training on proper safety procedures of the different types of this waste.

In this respect, the inspection team is responsible for:

1. Verifying that personnel concerned with HW handling at the various stages of its management within the establishment are aware of risks involved and versed in safe handling procedures.

4. Hazardous Waste Inspection

As discussed above in section 1, this manual is prepared with the purpose of providing assistance to EEAA inspection teams carrying out industrial inspections and ensuring compliance of the industries to the hazardous waste regulations. This manual, as a cross-cutting one, is to be used within the framework set by the General Inspection Manual (GIM) and other sector specific manuals, with concern to inspections of HW-related activities and operations.

4.1 Role of Inspection in relation to Hazardous Waste Handling Licenses

According to the ER of Law 4, detailed information related to the intended practices for hazardous waste management must be provided to the license granting authority by the industrial establishment. In this respect, the role of. inspection is to verify the implementation of such practices, any other licensing conditions, as well as the compliance to the requirements of Law 4 and its ER in this regard.

Within this context, the suitability of the HW management practices to the designated activities within the establishment needs to be verified during the inspection. The implementation of these practices and their compliance to the stipulations of Law 4 and the ER must also be verified. This is particularly significant during the first inspection visit. Subsequent visits would mainly entail a follow-up on the continued implementation of the suitable HW management practices, verified during the first visit.

> The inspection team is required, at the first visit to consider the suitability of the HW management practices to the designated activities within the establishment as well as the implementation of these practices. At follow-up visits, the inspection team is to ensure that the industrial establishment is following/ maintaining proper HW management practices.

4.2 Planning the Inspection

HW inspection is to be carried out within the framework of the general inspection procedures, as discussed in the GIM and the sector specific manuals.

4.2.1 Background Information and Data Collection

Before carrying out the inspection, the inspection team is responsible for gathering information pertaining to potential hazardous waste generated by the industrial activities. This requires familiarity with the industrial processes, the products, mass balance for the used input materials and the likely generated

waste as well as the possible opportunities for waste minimization in the establishment. The required information can be obtained from various sources such as the environmental inspectorate database or the different sector inspection manuals. The compliance history of the industrial establishment as well as previous cases of violations should also be reviewed by the inspection team before carrying out the field visit. Such violations, although probably not directly concerned with hazardous waste management, can give a preliminary insight to potential problems in the establishment. In addition, it can provide an indication on the compliance status of the establishment and its attitude towards environmental compliance.

> If the industrial establishment is likely to generate radioactive waste, the inspection team is to ensure that the National Center for Nuclear Safety and Radiation Control is notified of such waste, as for the center is the national authority responsible for management and disposal of this type of waste

4.2.2 Inspection Checklist and Equipment

The inspection checklist is one of the important documents included in the development of the inspection plan[20] for an industrial establishment, as described in the GIM, and other sector inspection manuals. In addition, checklists can be considered a means of documenting violations or supplying background material to judge potential violations. Within this context, this manual provides a HW management checklist, addressing in detail HW management practices to be inspected within an industrial establishment.
In addition to using checklists, safety and other equipment such as cameras and sampling instruments might also be needed for the inspection process.
Annex (XI) provides checklist for hazardous waste inspection.

4.2.3 Scheduling

Managing time is an important factor for a successful inspection process. In this respect, and as mentioned in the GIM and other sector inspection manuals, the overall field inspection process would require around three hours. Within this time period, it is important to allocate sufficient time for HW management practices and when necessary conduct meetings with concerned key personnel.

4.3 Field Inspection of Hazardous Waste Management

After planning the inspection, the team conducts field inspection in order to determine the compliance status of the industrial establishment as well as the effectiveness of the implemented hazardous waste management procedures.
The inspection process entails the following:

- *Document review:* entails hazardous waste permit(s), hazardous waste register, EEAA approval documents for on-site hazardous waste treatment where applicable, contracts with parties licensed to receive

[20] As presented in the GIM, the industrial inspection plan includes the type, purpose and objectives of the inspection, number of inspectors, responsibilities of different team members and the background documents required.

hazardous waste, waste delivery documents to these parties, and the emergency plan of the establishment.

- *HW generating units:* entails verifying the identification of hazardous waste at the different units, the process of hazardous waste segregation as well as the implemented waste minimization options if available and/or possible.
- *Utilities for HW management:* including on-site hazardous waste treatment units, on-site waste storage, hazardous waste transport vehicles, and on-site disposal.

4.3.1 Opening Meeting[21] and Document Review

The inspection team should inspect the availability of the required hazardous waste management documents at the opening meeting with the establishment representatives. These documents encompass the following:

- *Hazardous waste handling license(s)*: The availability and validity of the license should be checked for the case of on-site treatment and/or disposal or off-site HW transportation by the generating establishment. However, since the permitting system is currently under adoption and not yet fully operational, the absence of HW handling license (s) would not present a violation.
- *Hazardous waste register*: The inspection team should check the availability of the register and verify that it is consistent with the requirements stipulated in the ER of law 4/1994.
- *Approval for on-site treatment*: In case of treatment of HW on-site, the inspection team should check the availability of EEAA approval to treatment operations. This should be addressing the treatment method, the technical specification of the treatment units and their operational programs.
- Agreements with permitted entities to receive hazardous waste for off-site transport, recycle, treatment and/or disposal, together with details of these permits (numbers, validity, etc.).
- HW delivery documents to these entities.
- For cases where the establishments transport their HW (off-site), the inspection team should check the availability and validity of a transportation license and the routing of the transport vehicles.
- The emergency plan for dealing with unexpected incidents.
- HW training records of concerned personnel, particularly drivers of HW transport vehicles, where applicable.
- In case radioactive waste is generated from the establishment, the inspection team is to verify the notification of the National Center for Nuclear Safety and Radiation Control.

[21] According to the GIM, the purpose of the opening meeting is to outline the inspection objectives gather general information and require provision of the necessary documents.

The inspection team could be faced with situations where HW generating establishments do not identify themselves as such (due to various reasons, such as a lack of awareness and capacities to identify some of the generated waste as hazardous, or unwillingness to admit HW generation to escape from responsibility of complying to legislation). In these cases, most, if not all, documents discussed above might not be available. If the inspection team believes that such establishments are likely to generate HW (form previous inspection records, or background information about the industrial sector, etc.), field inspection would primarily aim at defining whether HW is likely to be generated or not.

The inspection team has to ensure the soundness and correctness of the above mentioned documents. This is achieved through field inspection. Field inspection entails inspecting hazardous waste management practices at the different production units and utilities generating hazardous waste, and the utilities concerned with HW management.

4.3.2 Inspection of Units Generating Hazardous Waste

1. Hazardous waste identification and quantification:

a. *Confirm that hazardous waste generated at the different production units is properly identified*. In doing so,

- Rely on information about the likely generated HW provided in sector inspection manuals,
- Rely on the tools presented in sections 2.2 to 2.6 of this manual.
- Waste sampling and analysis[22] can also be carried out if necessary.

Waste analysis can be carried out for example for checking proper identification, segregation of hazardous waste or for ensuring proper storage of incompatible wastes.

b. *Verify that these types and quantities are consistent with those stated in the hazardous waste register.*

- This is carried out by comparing the types and quantities of the generated waste with the types and quantities stated in the register. In this respect, the inspection team would be aware of types and quantities of generated wastes through the mass balance it carried out prior to the inspection visit (please refer to section 4.2.1 above).

22 In case there is need for conducting analyses, the sampling process should be conducted according to the sampling procedures identified in the GIM. For example, the inspection team may take samples and carry out analyses to ensure proper identification and segregation of HW.

2. Hazardous waste segregation:

a. *Verify that generated HW is segregated from one another as well as from other types of generated non-hazardous waste.*
   - Visually inspect the HW generating unit
   - Ask the concerned personnel about the course of generated wastes.
   - If such wastes accumulate at the production unit, visually inspect the accumulation areas and/or collection containers. Different HW types must be collected in separate containers, each with a label indicating the content. For soundness of containers used and labeling, refer to point 2 in section 4.4.2 below.

3. Accumulation of hazardous waste at the generating units:

a. *Check that HW collection containers are of adequate capacity for volumes generated* ***and are in good condition***.
   - At no point in time should the waste be spilling from the collection containers.

b. *Verify that HW does not accumulate for long periods at the generating units before its transfer to the designated HW storage area(s) in the establishment.*
   - This is carried out by inquiring, from concerned personnel, about the frequency of transfer of the waste from the collection containers to storage.
   - If HW storage/collection containers are found at the production unit, verify that clear labels are inscribed on the containers indicating the start date of collection, as per the requirements for HW storage (please refer to point 2 of section 4.4.3 below)
   - Visually check the date on the label. It should not be more than a week.

4. Hazardous waste minimization:

a. *Identify any implemented minimization options*.
   - This is through interviews with concerned production managers.

b. *Highlight potential waste minimization opportunities*.
   - This is based on background information gathered prior to inspection.
   - Potential waste minimization opportunities should be discussed in more detailed during the closing meeting. Refer to section 4.4. below.

5. Awareness, training and implementation of the emergency plan:

a. *Examine the awareness of the employees regarding proper HW handling procedures, and actions in cases of emergency*.
   - This is carried out by interviewing staff members, and comparing the obtained information with the training

records of the establishment and the emergency plan, checked during the opening meeting.

4.3.3 Inspection of Utilities Concerned with HW Management

In addition to inspecting units where HW is generated, utilities where HW is handled are to also be inspected. These utilities encompass.

1. On-site hazardous waste treatment units:

In cases of hazardous waste treatment on-site, the inspection team is to:

a. *Verify that the treatment process is consistent with the provisions of EEAA approval*. This is carried out by:
   - Interviewing of concerned personnel regarding the treatment process (type of treatment, main components and processes, types and quantities of input materials used, types and quantities of output materials and wastes)
   - Relying on background information regarding treatment methods. In this regard, basic information is provided in Annex (VII) for guidance.

b. *Note down the quantities and types of treated HW, and the processes they originate from within the establishment*.
   - This is carried out by interviewing the concerned personnel.
   - If storage containers of treated HW are at the treatment unit, check their labels for type of waste and waste volumes for quantities.

c. *Verify if HW is generated from the treatment process.* This is carried out by:
   - Interviewing the concerned personnel regarding the treatment process (type of treatment, main components and processes, types and quantities of input materials used, types and quantities of output materials and wastes)
   - Relying on background information regarding treatment methods. In this regard, basic information is provided in Annex (VII) for guidance.

d. *Examine the awareness of the employees regarding proper HW handling procedures, and actions in cases of emergency*.
   - This is carried out by interviewing staff members, and comparing the obtained information with the training records of the establishment, checked during the opening meeting.

If HW is generated from the treatment process, then apply points 1 to 4 of section 4.3.2 above.

2. On-site hazardous waste storage:

a. *Confirm the existence of specifically designated HW storage area(s) in the establishment. This is carried out by*:
   - Asking the concerned personnel
   - Visiting this area

b. *Verify that the storage area meets the legal requirements for storage stipulated in Law 4/1994 and its ER*.

- This is carried out by visually inspecting the area.

c. *Verify that HW containers meet the requirements of Law 4/1994 and its ER, and that they are not leaking*.
   - This is carried out by visual inspection of the containers.

d. *Verify that the containers are clearly labeled indicating the waste content and the associated hazard if improperly handled.*
   - This is carried out by visual inspection of the containers.

e. *Check the suitability of the storage area and storage operations for the types and quantities of the waste stored, by*:
   - Verifying the storage conditions on the label of storage containers within the area. Compare these conditions with actual ones (e.g. storage temperature, ventilation, etc.)
   - Observing and interviewing concerned personnel about storage operations, assessing their suitability, using the HW storage guidelines prepared in this regard.
   - Verifying that incompatible wastes are not stored together. Background information about HW compatibility is given in Annex (V).

f. *Note down the quantities and types of stored HW, and the units they originate from within the establishment*.
   - This is carried out by interviewing concerned personnel.
   - Check the labels of containers for type of waste and volumes for quantities.

g. *Check the consistency of types and quantities of stored waste with information in the register, for types and quantities of generated wastes, and types and quantities of waste transported off-site. No discrepancies should be found*.
   - This is carried out by checking the HW register, information gathered during present or previous inspection visits, and information of the HW delivery documents (either to a permitted transporter, or HW treatment and/or disposal facility, or an establishment permitted for HW handling, in cases of waste recycling off-site).

h. *Examine the awareness of the employees regarding proper HW handling procedures, and actions in cases of emergency.*

- This is carried out by interviewing staff members, and comparing the obtained information with the training records of the establishment, checked during the opening meeting.

3. On-site hazardous waste disposal:

In cases of hazardous waste disposal on-site, the inspection team is to:

a. *Confirm the existence of specifically designated HW disposal area in the establishment*. This is carried out by:
   - Asking the concerned personnel
   - Visiting this area

b. *Note down the quantities and types of disposed HW and verify that HW disposed of is consistent with information in the register.*
   - This is carried out by interviewing concerned personnel.
   - If records are kept at the site regarding disposed waste, compare the records with the information in the register regarding types and amounts.
   - Waste sampling and analysis can also be carried out if necessary.

Once the permitting system is fully operational, the inspection team would be able to:

c. *Verify that the disposal process is consistent with the provisions of disposal permit and that the disposal site is meeting the legal requirements of Law 4 and the ER (given in Annex IX).* This is carried out by:
   - Interviewing of concerned personnel
   - Visually inspecting the area

4. Hazardous waste transport vehicles

In case of off-site HW transport by the generating establishment, the inspection team is to inspect the vehicles used for transportation.

a. *Verify that the vehicles meet the requirements of Law 4/1994 and its ER*. This is carried out by
   - Visual inspection of the vehicles
   - Interviewing concerned personnel at the garages with regards to cleaning the vehicles after transport.
   - Background information can be obtained from the HW transportation guidelines, currently under preparation, as well as the legal requirements, given in Annex (VIII).

b. *Verify that the vehicles are properly signed indicating the type of waste transported and the associated hazards*.
   - This is carried out by visually inspecting the vehicle.

c. *Confirm that the drivers of these vehicles are receiving proper training to take necessary action in case of emergency*.
   - This is carried out by interviewing the drivers, comparing the obtained information with the training records of the establishment, checked during the opening meeting

4.3.4 Utilities For Special Consideration

These are utilities within the industrial establishment which would be generating HW, and which can easily be overlooked by the inspection team.

1. Workshops and garages

The inspection team should note that considerable amounts of hazardous waste are handled at the workshops and garages, for example used oils, grease, water/oil mixtures, oily rags etc. Therefore, it is necessary to inspect the HW management measures at these utilities, following the procedures set in section 4.4.2 above.

2. *Laboratories*
   Laboratories present another utility where HW typically is generated. Quantities of such waste might not be large, but the diversity of chemical waste emphasizes the importance to be given to laboratories during inspection. Important issues to keep in mind are concerned with waste and outdated chemicals, as well as empty containers and bottles of such chemicals.
3. *Industrial wastewater treatment plants*
   Depending on the industrial activity, sludge resulting from industrial wastewater treatment may contain substantial concentrations of heavy metals, and possibly other hazardous constituents, which render it a hazardous waste requiring proper management within the establishment, and inspection aiming at ensuring that the stipulations of Law 4 and the ER are met in this regard.
4. *Storage of chemicals/HS substances*
   Chemical storage can be considered a potential sources of HW generation. Expired operation chemicals, fouled hazardous input substances or damaged chemical containers should be handled as HW. Therefore it is important to inspect chemical storage to ensure proper management of generated waste chemicals.
5. *Incineration*
   Ashes from incineration processes can present a potential source of HW if they are contaminated with hazardous constituents such as heavy metals. The inspection team should verify proper management of such ashes.
6. *Storage Tanks*
   Tank bottoms of fuel tanks or other tanks storing HS or HW are regarded as potential sources for HW for which the inspection team should check its proper management.

4.3.5 Closing Meeting

At the closing meeting, the team can inquire about issues which need to be clarified, resolve any outstanding questions and verify information including any issues that are uncovered during the field inspection. Besides, the primary findings of the inspection process are documented including obvious violations not requiring laboratory analysis. The inspection record is then prepared to document the comments of the inspection team.

For cases where inconsistencies are detected between the information of the HW register, and the actually implemented practices, primarily with regards to HW quantities and types, the inspection team should recommend that HW tracking (refer to section 3.9) is to be applied in the establishment through record keeping at different units and utilities. The implementation of this recommendation, and the verification of its effectiveness in addressing discrepancies in HW types and quantities, would then be checked during follow-up inspection visits.

Moreover, the closing meeting is an opportunity to present and discuss possible HW minimization options, which the inspection team concluded from the field visit, and which the industrial establishment should consider for implementation. During this presentation, the inspection team can also guide the establishment to available sources of technical and/or financial support.

4.4 Hazardous Waste Inspection Report

Within the overall environmental inspection report, the inspection team should assess the compliance status of the establishment with respect to hazardous waste management and stating the violations detected, together with the law article being breached.

Figure (7) below summarizes the stages of hazardous waste inspection process with reference to the General Inspection Manual.

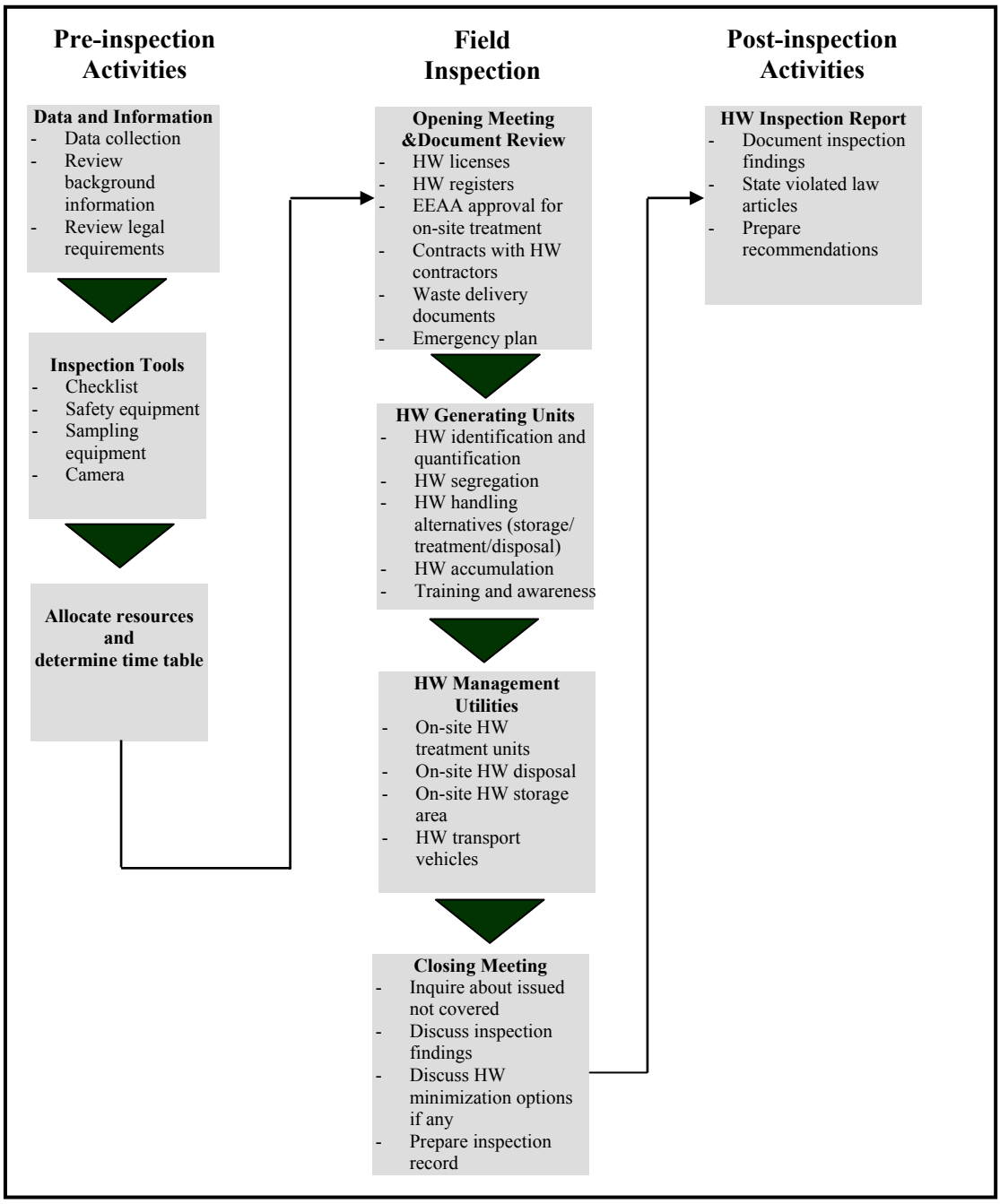

Figure (7): Hazardous Waste Inspection Process

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Annex I
Draft Hazardous Waste List of Ministry of Industry

Draft List of Hazardous Waste subject to the Legal Requirements of Law 4/1994 and its ER within the Industrial Sector

Hazardous Wastes prohibited from importation, and transit through the Arab Republic of Egypt

Metal and meta-bearing wastes:

1. Metal wastes and waste consisting of alloys of any of the following :
   - Antimony
   - Arsenic
   - Beryllium
   - Cadmium
   - Lead
   - Mercury
   - Selenium
   - Tellurium
   - Thallium

   excluding such wastes specifically listed on list B, entry 2.

2. *Waste having as constituents or contaminants any of the following, except for bulky waste from the metallurgical sector (metal sheets, sections, bars, etc…)*
   - Antimony; antimony compounds
   - Beryllium; beryllium compounds
   - Cadmium; cadmium compounds
   - Lead; lead compounds
   - Selenium; selenium compounds
   - Tellurium; tellurium compounds

3. Wastes having as constituents or contaminants any of the following:
   - Arsenic; arsenic compounds
   - Mercury; mercury compounds
   - Thallium; thallium compounds

4. Wastes having as constituents any of the following:
   - Metal carbonyls
   - Hexavalent chromium compounds

5. Galvanic sludges

6. Waste liquors from the pickling of metals

7. Leaching residues from zinc processing, dust and sludges, such as jarosite, hematite, etc.

8. Waste zinc residues, containing lead and cadmium in concentrations sufficient to exhibit hazardous characteristics listed in the attached annex.

9. Ashes from the incineration of insulated copper wire

10. Dusts and residues from gas cleaning systems of copper smelters

11. Spent electrolytic solutions from copper elctrorefining and electrowinning operations

12. Waste sludges, excluding anode slimes, from electrolyte purification systems in copper electrorefining and electrowinning

13. Spent etching solutions containing dissolved copper

14. Waste cupric chloride and copper cyanide catalysts

15. Lead from waste acid batteries, whole or pulverized.

16. Unsorted waste batteries

17. Waste electrical and/or electronic assemblies or scrap containing components such as accumulators, batteries, mercury-switches, glass from cathode-ray tubes and other activated glass, PCB-capacitors, or contaminated with constituents contained in this list to an extent rendering them hazardous following the criteria presented in the attached annex.

Waste containing principally inorganic constituents, which may contain metals and organic materials:

18. Glass waste from cathode-ray tubes and other activated glass

19. Waste inorganic fluorine compounds in the form of liquids or sludges, but excluding such waste specified on list B

20. Waste catalysts, including waste liquid catalysts and those containing hazardous heavy metals

21. Waste asbestos (dusts and fibers)

Wastes containing principally organic constituents, which may contain metals and inorganic materials:

22. Waste from the production or processing of petroleum coke and bitumen

23. Waste mineral oils unfit for their originally intended use

24. Wastes that contain, consist of, or are contaminated with leaded anti-knock compound sludges

25. Waste thermal (heat transfer) fluids

26. Wastes from the **production**, **formulation** and **use** of resins, latex, plasticizers, glues/adhesives

27. Waste nitrocellulose

28. Waste phenols, phenol compounds, including chlorophenol in the form of liquids or sludges

29. Waste ethers, excluding those specified on list B

30. Waste leather dust, ash, sludges and flours when containing hexavalent chromium compounds or biocides

31. Waste paring and other waste of leather or of composition leather not suitable for the manufacture of leather articles, containing hexavalent chromium compounds or biocides

32. Fellmongery wastes containing hexavalent chromium compounds or biocides or infectious substances

33. Fluff-light fraction from shredding

34. Waste organic phosphorus compounds

35. Waste non-halogenated organic solvents

36. Waste halogenated organic solvents

37. Waste halogenated or unhalogenated non-aqueous distillation residues arising from organic solvent recovery operations

38. Wastes arising from the production of aliphatic halogenated hydrocarbons (such as chloromethane, dichloro-ethane, vinyl chloride, vinylidene chloride, allyl chloride and epichlorhydrin)

39. Wastes, substances and articles containing, consisting of, or contaminated with polychlorinated biphenyl (PCB), polychlorinated

terphenyl (PCT) polychlorinated naphthalene (PCN) or polybrominated biphenyl (PBB), or any other polybrominated analogues of these compounds, at a concentration level of 50 mg/kg or more.

40. Waste tarry residues (excluding asphalt cements) arising from refining, distillation and any pyrolitic treatment of organic materials

Wastes which may contain wither inorganic or organic constituents:

41. Wastes from the **production** and **preparation** of pharmaceutical products, but excluding such wastes specified on list B

42. Waste from the **production** and **formulation** of biocides and phytopharmaceuticals

43. Wastes from the **manufacture**, **formulation** and **use** of wood-preserving chemicals.

44. Wastes that contain, consist of, or are contaminated with, any of the following:
    - Inorganic cyanides
    - Organic cyanides

45. Waste oils/water, hydrocarbons/water mixtures, emulsions

46. Wastes from the **production**, **formulation** and **use** of inks, dyes, pigments, paints, lacquers, varnish

47. Waste acidic or basic solutions with a pH lower than 2 and higher than 11.5

48. Wastes from industrial pollution control devices from cleaning of industrial off-gases, but excluding such waste specified on list B

49. Wastes that contain, consist of, or are contaminated with any of the following:
    - Any congener of polychlorinated dibenzo-furan
    - Any congener of polychlorinated dibenzo-dioxin

50. Wastes that contain, consist of, or are contaminated with peroxides.

51. Waste packages and containers containing residues of hazardous wastes on this list, or hazardous substances specified on the Ministry of Industry list

52. Waste consisting of, or containing, off specification or outdated chemicals corresponding to the hazardous substances specified on the Ministry of Industry list

53. Waste chemical substances arising from research and development which are not identified, and/or are new, and whose effects on human health and/or environment are not known

54. Spent activated carbon

55. Waste containing, and/or consisting of Chlorofluorocarbons (CFCs)

56. Waste assemblies or scrap resulting from electricity generating activities, containing, or contaminated with, oils, polychlorinated biphenyls (PCB), and polychlorinated terphenyl (PCT).

57. Wastes of Tellurium and Selenium in elementary metallic form, including powders

58. Metal-bearing wastes arising from melting, smelting and refining of metals:
    - Zinc skimmings
    - Aluminium skimmings

59. Slags from copper processing or refining containing arsenic, lead or cadmium

60. Calcium fluoride sludge

61. Bauxite residue ("red mud")

62. Precious-metal-bearing residues in solid form, which contain traces of inorganic cyanides

63. Precious-metal ash from the incineration of photographic film

64. Waste photographic film containing silver halides and metallic silver

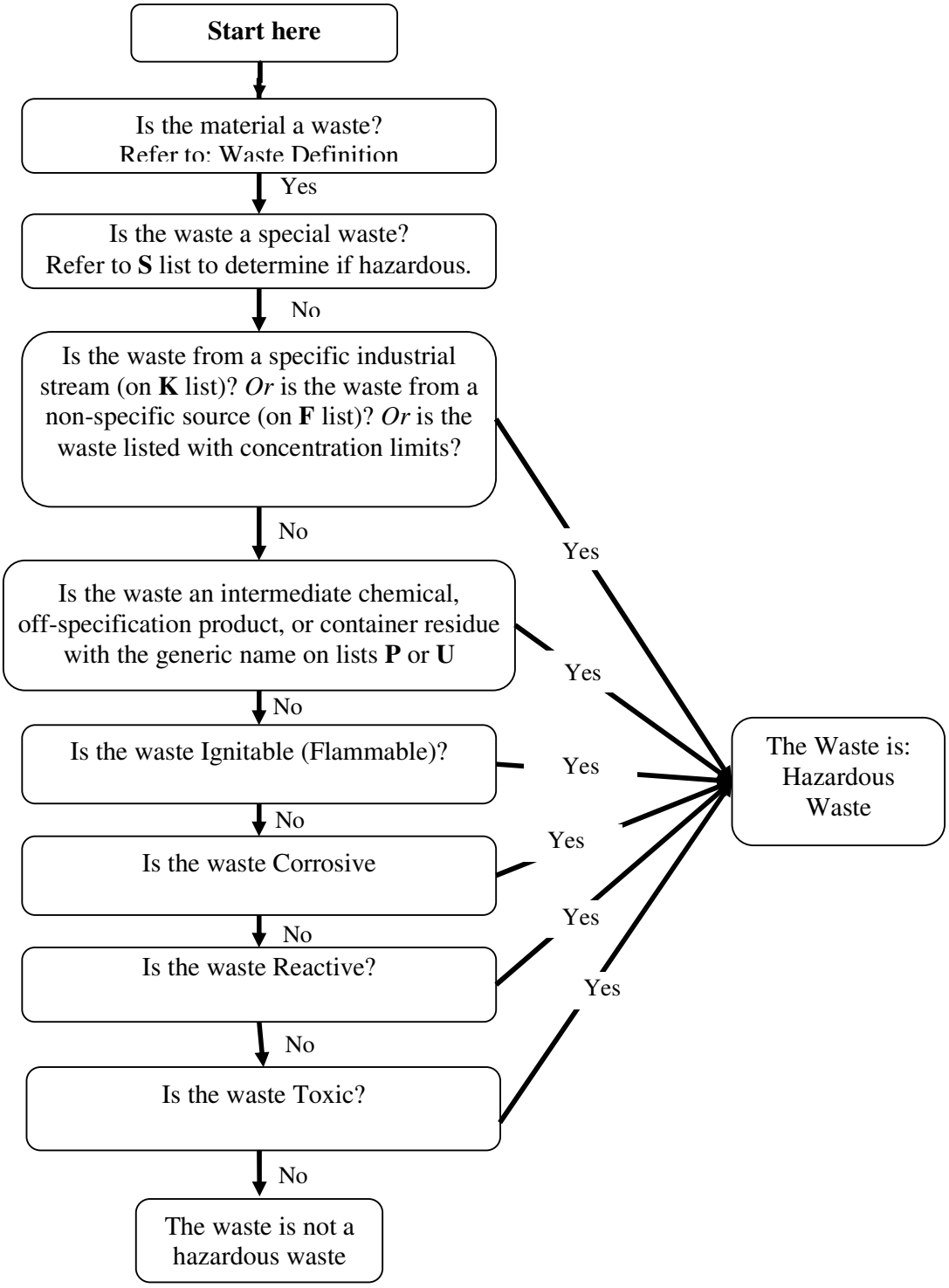
65. Waste photographic paper containing silver halides and metallic silver

66. Solid plastic waste:
    Scrap plastic of non-halogenated polymers and co-polymers (not completely polymerised, and/or post consumer wastes)

67. Waste PVC

Annex II
Master Flow Chart For Hazardous Waste Identification

Master Flow Chart For HW Identification*



* Details of the charts and lists referred to in this master chart are found in the Guidelines for the Classification and Coding of the Egyptian Hazardous Wastes, prepared by EEAA, and available from the General Department of Hazardous Substances and Wastes of EEAA.

Annex III
Examples of Industrial Sectors and Processes Generating Hazardous Waste

Common Examples of Industrial Activities And Processes Generating Hazardous Waste

Industrial Activity	Waste Type	Generating Process
Pulp and paper	- Sludges contaminated with chlorinated organic compounds, dioxins, furans and chlorophenols, peroxides	- Bleaching processes
	- Sludges containing organic solvents (eg. xylene, benzene, etc.) and heavy metals (eg. chromium VI)	- Treatment of de-inking effluents from paper recycling
	- Wastewater containing sodium hydroxide and sodium sulfide	- Delignification process
Leather and fur	- Waste containing solvents such as ethers	- Leather degreasing
	- Pickling liquor containing chromium	- Tanning process
	- Sludges containing chromium	- Wastewater treatment plant (WWTP)
	- Tanned leather contaminated with chromium	- Finishing process
Textile	- Waste containing organic halogenated solvents (eg. dichloromethane) and non-halogenated solvents (eg. xylene, toluene, etc)	- Finishing process
	- Wastes containing peroxides, sodium hypochloride, chlorine	- Bleaching processes
	- Highly alkaline effluents	- Scouring process
	- Waste dye stuff and pigments), containing azodyes, heavy metals (Cd, Cr)	- Storage - Dyeing and printing
	- Sludges containing cadmium, arsenic, lead, hexavalent chromium, arsenic, mercury, halogenated organic solvents	- Wastewater treatment plant (WWTP)

Industrial Activity	Waste Type	Generating Process
Chlor-alkali	- Chlorinated hydrocarbon liquid waste	- Electrolytic processes
	- Flue gases, containing traces of chlorinated hydrocarbons	- Incineration of the chlorinated hydrocarbon liquid waste
	- Chlorine off-gases	- Electrolytic processes Chlorine plant
	- Liquid acidic waste (spent acids)	- Drying of wet chlorine
	- Alkaline effluents	- Caustic soda processing
Iron and steel	- Sludge containing heavy metals eg. lead and cadmium	- Process of off-gases treatment, of electrical arc furnaces
	- Skimmed oil - Sludges containing oil	- Spent cooling water (machinery cooling water) treatment
	- Slags containing heavy metals	- Melting process (furnace sludge)
Pesticide	- Waste, containing organophosphorous compounds (organophosphorous pesticides, thiophosphates)	- Manufacturing processes residues
	- Halogenated organic solvents, washing solutions, and mother liquors	- Equipment cleaning and washing (storage tanks, vessels
	- Sludges (halogenated filter cakes)	- Filtration process
	- Outdated pesticides and/or ones off- specifications	
	- Sludges from effluent treatment	- Wastewater treatment plant (WWTP)
Dyes and pigment	- Aqueous washing liquids and mother liquors - Waste halogenated organic solvents	- Equipment (tanks, vessels, mixers, mills, and reactors) cleaning and washing
	- Halogenated still bottoms	- Still bottoms residues
	- Sludges contaminated with heavy metals, waste pigment and dyes	- Wastewater treatment (WWTP)

Industrial Activity	Waste Type	Generating Process
Paints, printing inks, alkyd resins, and varnishes	- Waste solvents, containing paints/ inks/ varnishes/ resins	- Equipment (tanks, vessels, mixers, mills, and reactors) cleaning and washing
	- Sludge containing pigments, oils, fatty acids, fillers, and solvents	- Paints, resins, varnishes, and inks filtration process
	- Sludges containing pigments, fillers, and other additives, containing heavy metals (cadmium, chromium, lead, mercury, oils etc..	- Wastewater treatment (WWTP)
	- Spent filter bags, containing pigments and chemicals	- Filtration
Soap, fat, grease detergents, disinfectants and cosmetics	- Sludges from effluent treatment (heavy metals, waste oils/ water, hydrocarbon/ water mixtures and emulsions)	- Wastewater treatment (WWTP)
	- Halogenated filter cakes and spent absorbents (fuller earth)	- Bleaching
Metallurgical industry	- Sludges; tars and other carbon-containing waste from aluminum metallurgy	- From anodic process - From secondary smelting
	- Black drosses containing heavy metal from aluminum industry	- From secondary smelting
	- Slags/ white drosses containing heavy metals)	- From secondary smelting
	- Spent pot lining (cyanide compounds) from aluminum metallurgy	- Maintenance of smelting furnaces
	- Salt slags containing inorganic fluoride compounds from aluminum metallurgy	- From secondary smelting
	- Sludges (heavy metals)	- From off-gases treatment
	- Slag (Calcium arsenate) from lead metallurgy	- From secondary smelting
	- Leaching residues, dust and sludges such as jarosite, hematite, etc from zinc metallurgy	- From secondary smelting

Industrial Activity	Waste Type	Generating Process
Fabricated Metal (Metal treatment , finishing, and coating)	- Cyanidic alkaline waste	- Galvanization process
	- Waste acidic pickling solutions - Spent acids and alkalis solutions	- Pickling process - Etching process
	- Sludge from WWTP, containing heavy metals	- Wastewater treatment (WWTP)
	- Oil , emulsions and grease	- Drilling and cutting machines - Degreasing before painting
	- Waste solvents	- Painting processes
	- Heavy metal solutions	- Metal finishing processes
Electronic industry	- Waste acidic pickling solution	- Pickling process - Etching, processes
	- Sludges or solid waste containing heavy metals	- Wastewater treatment (WWTP)
Petroleum refining	- Crude oil and products storage Tanks bottom sludge	- Storage tanks
	- Sludges from WWTP (API separators, DAF unit, and biological unit)	- Wastewater treatment (WWTP)
	- Spent catalyst	- Catalyst replacement
	- Solid waste, catalyst fines	- Catalyst regeneration
	- Desalter sludge, containing oil, heavy metals	- Crude oil desalting process
Coolants, foam/aerosol propellants	- Spent halogenated solvents and solvent mixes	- Manufacturing (synthesis) processes
	- Sludges and solid waste containing halogenated solvents or other solvents	- Process leaks or spills - Wastewater treatment (WWTP)

Annex IV
Information to be Submitted for Acquiring a Hazardous Waste Permit

Information to be Submitted for Acquiring a Hazardous Waste Permit[20]

(Article 26, 27 - ER of Law 4/1994)

When applying for a hazardous waste handling permit, industrial establishments should provide the following information regarding their intended hazardous waste management practices:

Description	- Provide complete description of the types and composition of the hazardous substances used and the hazardous waste generated.
Quantity	- Determine the annual quantity of the hazardous substances used and the hazardous waste generated
Storage	- Describe the intended mean of HW packaging (barrels-tanks-etc.) - Describe the period and storage methods of hazardous substances and HW. - Be committed to clearly label the containers of hazardous substances and HW indicating the content and the actions taken in the case of emergency.
Transport	- Describe the intended modes of hazardous waste transportation, routing and time schedule
Treatment	- Comprehensive description of the indented hazardous waste treatment and disposal methods.
Emergency plan	- Detailed description of the emergency plan in order to confront unexpected incidents - The plan should be reviewed and approved by the permit granting authority, the Ministry of Industry
Previous experience	- The establishment should provide documents for previous experience in handling of hazardous substances and waste
Commitments	The industrial establishment should provide a written commitment to the following: - Not to mix hazardous substances and waste with other non-hazardous substances and waste. - Take all essential measures for proper packaging storage and transportation of hazardous waste. - Keep comprehensive records for such waste - Keep such documents for 5 years from after the date of establishment.
Declaration	- Provide a declaration of the correctness of the data stated above

[20] Guidelines for permitting are currently under preparations at EEAA.

Permits for handling hazardous substances and waste are valid for a maximum period of five renewable years. The permit can be suspended by the Ministry of Industry by justified decision in the following cases:

1. If the permit has been issued upon the submission of incorrect information.

2. If the party who has been granted the permit has violated its conditions.

3. If an activity results in severe adverse impacts which were not foreseen at the time of permit issuance.

4. If new technologies become available, that may, if implemented with minor modification, result in further improvement in the environmental conditions and human health.

5. If EEAA concludes that it is unsafe to handle the hazardous substances and waste stated in the permit.

Annex V
Waste Compatibility

Examples for Waste Compatibility

No.	Reactivity Group Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	101	102	103	104	105	106	107
1	Acids, Mineral, Non-oxidizing																																									
2	Acids, Mineral, Oxidizing																																									
3	Acids, Organic		G H																																						
4	Alcohols and Glycols	H	H F	H P																																					
5	Aldehydes	H P	H F	H P																																					
6	Amides	H	H GT																																						
7	Amines, Aliphatic and Aromatic	H	H GT	H		H																																		
8	Azo Compounds, Diazo Compounds and Hydrazines	H G	H GT	H G	H G	H																																		
9	Carbamates	H G	H GT						G H																															
10	Caustics	H	H	H		H				H G																														
11	Cyanides	GT GF	GT GF	GT GF					G																															
12	Dithiocarbamates	H,F GF	H,F GF	H,GT GF		GF GT		U	H G																															
13	Esters	H	H F						H G		H																													
14	Ethers	H	H F																																					
15	Fluorides, Inorganic	GT	GT	GT																																				
16	Hydrocarbons, Aromatic		H F																																					
17	Halogenated Organics	H GT	H,F GT					H GT	H G		H GF	H																												
18	Isocyanates	H G	H,F GT	H G	H P			H P	H G		H,P G	H G	U																												
19	Ketones	H	H F						H G		H	H																												
20	Mercaptans and Other Organic Sulfides	GT GF	H,F GT						H G										H	H	H	20																	
21	Metals, Alkali and Alkaline Earth, Elemental	H,F GF	H,F GF	H,F GF	H,F GF	H,F GF	GF H	GF H	GF H	GF H	GF H	GF H	GF,H GT	GF H					H E	GF H	GF H	GF H	21																
22	Metals, Other Elemental & Alloys as Powders, Vapors, or Sponges	H,F GF	H,F GF	G F					H,F GT	U	GF H								H E	GF H		H,F GF		22															
23	Metals, Other Elemental & Alloys as Sheets, Rods, Drops, etc.	H,F GF	H,F GF						H,F G										H F						23													
24	Metals and Metal Compounds, Toxic	S	S	S			S	S			S															24												
25	Nitrides	GF HF	H,F E	H GF	H,E GF	GF H			U	H G	U	GF H	GF H	GF H					GF H	U	GF H	GF H	E				25											
26	Nitriles	H,GT GF	H,F GT	H							U												H P			S	GF H	26									
27	Nitro Compounds, Organic		H,F GT			H					H E												H,E GF				H,E GF		27								
28	Hydrocarbons, Aliphatic, Unsaturated	H	H F			H																		H E					28								
29	Hydrocarbons, Aliphatic, Saturated		H F																											29								
30	Peroxides and Hydroperoxides, Organic	H G	H E		H F	H G		H GT	H,F E	H,F GT		H,E GT	H,F GT						H E	H	E	H,F GT	H E	H G		H G	H,E GF	H,P GT		H P	.	30							
31	Phenols and Cresols	H	H F						H G											H P			GF H				GF H				H	31						
32	Organophosphates, Phosphothioates, Phosphodithioates	H GT	H GT						U		H E												H								U	32						
33	Sulfides, Inorganic	GT GF	HF GF	GT		H			E											H													33					
34	Epoxides	H P	H P	H P	H P	U		H P	H P		H P	H P	U									H P	H P	H P		H P	H P						H P	H P	U	H P	34			
101	Combustible and Flammable Materials, Miscellaneous	H G	H,F GT																				H,F G				H,F GF							H,F GT			101		
102	Explosives	H E	H E	H E					H E		H E			H E									H E	H E	H E	E	E						H E	H E		H E	H E	H E	102		
103	Polymerizable Compounds	P H	P H	P H					P H		P H	P H	U										P H	P H	P H	P H	P H				P H	P H			P H			H E	103		
104	Oxidizing Agents, Strong	H GT		H GT	H F	H F	H,F GT	H,F GT	H E	H,F GT		H,E GT	H,F GT	H F	H F		H F	H GT	H,F GT	H F	H,F GT	H,F E	H,F E	H F		H,F E	H,F GT	H E	H F	H F	H G	H F	H,F GT	H,F GT	H,F G	H,F G	H E	H,F GT	104		
105	Reducing Agents, Strong	H GF	H,F GT	H GF	H,F GF	H,F GF	H GF	H G				H GT	H F				H,F E	H E	H GF	H GF	H GF						H GF	H E				H E	H GF	H,GT GF		H	H GF	H E	H,P GF	H,F E	105		
106	Water and Mixtures Containing Water	H	H						G										H G				H GF	H GF		S	H GF							GT GF						GF GT	106	
107	Water Reactive Substances	<---------EXTREMELY REACTIVE!!!! DO NOT MIX WITH ANY CHEMICAL OR WASTE MATERIAL!!!! EXTREMELY REACTIVE!!!!---------->																																						107

Legend	
Code	Consequences
H	Heat Generation
F	Fire
G	Innocuous and non-flammable gas generation
GT	Toxic Gas formation
GF	Flammable Gas formation
E	Explosion
P	Violent Polymerization
S	Solubilization of toxic substance
U	May be hazardous, but Unknown

Source: EPA's Chemical Compatibility Chart EPA-600/2-80-076 l 1980, US Environmental Protection Agency

Annex VI
Storage Requirements and Hazardous Signs

Hazardous Waste Collection and Storage Requirements And Basic Hazardous Signs

(Article 28.2 ER of Law 4/1994)

Storage Area	
Location	• Waste storage should be away from public places in order to prevent any harm to the public or those persons exposed to the waste.
Size	• The area should be of adequate size for the waste quantities to be stored.
Safety conditions	• These areas should be clearly designated and equipped with the necessary safety and protection equipment such as fire extinguishers, protective clothing, absorbing materials and first aid equipment.
Storage Containers	
Location	• Hazardous waste storage containers should not be placed in public areas.
Specifications	• Hazardous waste storage containers must be of inert materials which do not react with the waste. • Storage containers must be properly sealed to avoid any leakages or spills during storage or movement.
Labeling	• The hazardous waste containers should be labeled with clear signs indicating their content, the handling requirements and the associated hazards if improperly handled.
Washing	• The waste generator is responsible for maintaining the containers, clean and wash them after use.
Waste Collection	
Collection schedule	• A time schedule should be set for collection of waste so that the waste is not kept for long periods in the storage containers.

These requirements are further detailed in the Guidelines for On-site Storage and Handling of Hazardous Waste, available at the General Department of Hazardous Substances and Waste, EEAA.

Hazard Signs

Explosive

Flammable Liquids

Flammable Solids

Spontaneously Combustible

Dangerous when Wet

Oxidizing

Organic Peroxides

Corrosive

Toxic

Infectious

Annex VII
Common Hazardous Waste Treatment Methods

Common Hazardous Waste Treatment Methods

Option	Description	Application
Physical treatment		
Sedimentation	- It is a process relying upon gravity to remove suspended solids from aqueous waste streams. It can be carried out in lined impoundments, conventional settling basins or clarifiers.	- Applied to remove suspended solids heavier than water. - As a pretreatment step for many chemical processes.
Solvent Extraction (liquid-liquid extraction)	- It is the separation of impurities of a liquid by contact with another immiscible liquid for which the impurities have high affinity.	- Recovery of phenol from aqueous wastes. - Recovery of halogenated hydrocarbon solvents from organic solutions containing other water-soluble components.
Ion Exchange	- It is a process in which ions, held by electrostatic forces on the surface of a solid, are exchanged for ions of similar charge in a solution.	- Removal of dissolved heavy metals in wastewater such as chromium, zinc, lead, etc.
Physical Stabilization/ Solidification	- Physical stabilization: involves blending semi-solid waste with a bulking agent to produce a coarse-grained solids that can be transported. - Solidification: is the production of a solid mass with sufficient structural integrity suitable for transport without requiring secondary containers	- To convert hazardous waste streams into inert, physically stable mass with low leachability and sufficient mechanical strength to be suitable for landfilling.
Chemical treatment		
Precipitation/ flocculation	- It is a physicochemical process based on alteration of chemical equilibrium affecting the solubility of inorganic substances.	- Removal of metals (zinc, cadmium, chromium, copper, lead, etc.) from wastewater in form of metal hydroxides or sulfides, usually using lime or sodium sulfides.

	- The dissolved substances are transformed into a solid phase.	

Option	Description	Application
Chemical oxidation	- Oxidation involves electron transfer from the substances being oxidized to the oxidizing agents.	- Facilitates the complete breakdown of hazardous waste into non-hazardous components. - oxidation of cyanide effluents, phenols, etc cyanide solution - the used oxidizing agents include potassium permanganate, ozone, chlorine hydrogen peroxide, UV radiations, etc.
Chemical reduction	- Reduction involves electron transfer from the reducing agent to the substances being reduced	- Reduction of hexavalent chromium to the trivalent chromium before carrying out hydroxide precipitation.
Neutralization	- It is the process of adjusting an acidic or basic waste stream to a pH near neutrality.	- Precipitation of dissolved heavy metals. - Providing neutral pH solution suitable for recycling. - Used in oil emulsion breaking.
Chemical Stabilization/ Solidification	- Chemical stabilization: is the immobilization of hazardous substances by reacting them chemically to form insoluble compounds. - Solidification: is the production of a solid mass with sufficient structural integrity suitable for transport without requiring secondary containers.	- To convert hazardous waste streams into inert, physically stable mass with low leachability and sufficient mechanical strength to be suitable for landfilling.
Biological treatment Sludge Processing	- It is the treatment of sludge resulting from wastewater treatment processes. The process involves sludge conditioning, digestion (aerobic/ anaerobic) and composting.	- Recycling: such that sludge quality is suitable for the reuse system (eg. land application). - Disposal: in order to reduce the volume of sludge prior disposal.
Treatment of Oily	- It is the process of oil	- Separation of oily waste from

waste	removal through skimming, emulsion breaking, flotation, etc.	cleaning operation, machinery maintenance, washing or rinsing of oily parts, spills and leaks, etc.

Option	Description	Application
Thermal Treatment	- It is a high temperature, thermal oxidation process in which hazardous waste is converted, in the presence of oxygen, into gases and/or incombustible solid residues. Incineration is accompanied by significant reduction in the weight and volume of waste. - The product gases can be released to the atmosphere with or without cleaning and the solid residue can be landfilled.	Incineration is chosen for: - Biologically hazardous waste - Non-biodegradable and persistent waste - Volatile dispersible waste - Waste with flash point below 40^0C - For cyanide and sulphide bearing waste

Annex VIII
Requirements For
Hazardous Waste Transport

Requirements for Hazardous Waste Transport

(Article 28.3 ER of Law 4/1994)

Transport permits	• Transportation should only be carried out by establishments licensed for hazardous waste transportation.
Collection schedule	• The rotation schedule for waste collection must be adequate for quantities of the waste to be transported, preventing accumulation of such waste on-site.
Vehicle Capacity	• The capacity of the vehicles must be adequate for the quantities of the waste to be transported.
Signs	• The vehicles must be clearly signed indicating the type of waste transported.
Safety equipment	• The vehicles must be equipped with the necessary safety equipment, such as fire extinguishers, protective clothing and absorbing materials in case of spills, as well as first aid equipment, etc.
Vehicle Washing	• The vehicles should be regularly washed and cleaned after each use according to the instructions set by the Ministry of Health.
Vehicle Routing	• Routing of vehicles should be determined and the civil defense is to be notified. • Hazardous waste transport vehicles should not pass through populated areas through daytime
Garages	• The official competent body should be notified with the address of the garages where these vehicles park as well as the number and date of their permits.
Driver Training	• Drivers of these vehicles must be trained to take the necessary action in case of emergencies and accidents.

These requirements are further detailed in the Hazardous Waste Transportation Guidelines, available at the General Department of Hazardous Substances and Waste, EEAA.

Annex IX
Requirements For Hazardous Waste Disposal Sites

Requirements For Hazardous Waste Disposal Sites

(Article 28.5 ER of Law 4/1994)

Location	• Hazardous Waste disposal sites should be located at a minimum distance of 3 km from populated and residential areas.
Size	• The site must be adequate to accommodate the waste to be disposed of.
Surrounding walls	• The sites must be surrounded with brick walls of minimum height of 2.5 m.
Gates	• The sites should be provided with more than one gate of suitable width to allow the easy entry of waste transport vehicles.
Safety conditions	• The sites must be equipped with all necessary safety and protective equipment described in the labour and vocational health laws.
Storage	• The site should be provided with a specially equipped storage area for storing hazardous waste until treatment and/ or disposal.
Utilities	• The site should be provided with appropriate water sources. • The site should be provided with telephone line.
Other requirements	• The site should be provided with all mechanical equipment and installations for storing and classifying waste. • The site should be provided with incinerators to be used for certain types of waste. • The site should have sanitary landfills of adequate capacity for landfilling incineration ashes.

Annex X
Model for Hazardous Waste Register

Model for Hazardous Waste Register

Instruction for filling in the register

1. This is a register where the generated HW is to be recorded.

2. A designated person should be responsible for filling the register. His name and position are to be stated in points 3 and 4 of section I.

3. The time period covered by the current data (point 5, section I), is that time period for which the hazardous waste data provided in section II and III are valid.

4. The frequency for filling in this register depends on the amounts of hazardous waste generated. As guidance, it is recommended that this register is filled quarterly and kept for a period of 10 years.

I) General Information:

1. Name of the Establishment: ……....

2. Name of Owner of the Establishment*…….

3. Address:…….……..Tel*……

District*:..……Governorate*…….

4. Name of the person responsible for filing the register:

……..……...……..

5. Job title of the person responsible for filing the register:

……..…….

6. The period covered by the current data:
……..……...……..……..

7. Specific conditions issued for the establishment by EEAA: (attach where applicable)
……..……..……

8. Date on which the form is filled: ……...……..

9. Signature of the officer in Charge: ……...……...…..

* These information are not explicitly required by article 33 of ER regarding requirements of the HW register

II) Types and Quantities of Generated Hazardous Waste:

Type of hazardous Waste	Generating Process	Quantity[21]	Waste Composition*	Physical Status*

III) Methods of Hazardous Waste Disposal:

Type of Hazardous Waste	Quantity Disposed of	Disposal Method	Name of waste contractor where applicable

IV) Licensed HW Contractors to Receive Waste:

Name of Contractor	Type of license (off-site treatment/ disposal)	Types of Waste delivered	Quantity delivered

[21] The quantity is given for the time period stated in point 5 section I.

Annex XI
Hazardous Waste Inspection Checklist

Hazardous Waste Inspection Checklist

Items marked with an (*) and shaded are concerned with HW permitting. Currently the permitting system is under adoption and not yet fully operational. In consequence, HW-related permits are not currently available. Their absence would therefore not be considered a violation.

Requirement			Compliance status		Comments
			Yes	No	
1	**Generation of HW**				
1.1	From the gathered background information, is the establishment likely to generate HW?				
Note 1: Before carrying out the inspection visit, it is recommended that the team prepares a brief information summary about the industry, using the collected background information. The summary should include a short description of the process, the likely used hazardous input material, and the expected types of generated HW.					
2	**Document Review**				
2.1	***Licenses***				
2.1.1*	Does the establishment have the necessary HW licenses?				
2.1.2*	Are these valid?				
2.2	***On-site HW treatment***				
2.2.1*	In case of HW treatment on-site, does the establishment have a HW handling license form the Ministry of Industry?				
2.2.2	Does the establishment have an approval from EEAA on the treatment operation(s)?				
2.2.3	Is the treatment approval valid?				
2.3	***HW transport***				
2.3.1	If the establishment is transporting its own HW off-site				
	2.3.1.a*	Does the establishment have a HW transport license? ***(Copy of permit should be available)***			
	2.3.1.b*	Is the license valid?			
	2.3.1.c	Are delivery documents to the receiving facility (recycling/ treatment /disposal) available?			
	2.3.1.d*	Is the receiving facility permitted to receive HW? ? ***(Details of permit should be available)***			
	2.3.1.e	Is routing of the transport vehicles determined?			

2.3.2	If the establishment is not transporting its HW off-site, but delivering to a transporter				
	2.3.2.a	Are agreements/ delivery documents to HW transporters available?			
	2.3.2.b*	Is the transporter permitted to transport HW? ***(Details of license should be available)***			
2.4	***HW Disposal***				
2.4.1*	In case of on-site disposal of HW, does the establishment have a HW disposal license?				
2.4.2*	Is the license valid?				
2.5	***HW Register***				
2.5.1	Is the HW register available?				
2.5.2	Is it consistent with the requirements of article 33 of ER?				
2.5.3	Do the contents of the HW Register describe the situation in the establishment accurately? ***(Answer after field inspection)***				
2.6	***Emergency plan***				
2.6.1	Is the emergency plan for dealing with accidents available?				
2.7	***Training records***				
2.7.1	Are the training records for concerned personnel available?				
Note 2: Regardless of the answers in section 2, if the inspection team suspects that the establishment is generating HW (based on the background information), it should carry out a HW field inspection.					
3	**HW generating Units**				
3.1	Is the generated HW identified and quantified?				
3.2	Are the quantities of generated HW consistent with quantities stated in the HW register?				
3.3	Is HW segregated from one another as well as from other non-HW?				
3.4	Are the HW collection containers of adequate capacity?				
3.5	Does the establishment ensure that **no** HW is accumulated/ stored at the generating units for long periods?				
3.6	Is the generated HW transferred to the main HW storage area?				
3.7	Are the employees aware of proper HW handling and trained to act in emergency cases?				
Note 3: If the inspector identifies possible HW minimization opportunities during the field inspection of HW generating units, he/she should briefly discuss it with the establishment's representatives during the closing meeting.					

4.	**Utilities for HW management**			
4.1	***On-site Treatment of HW***			
4.1.1	Is the treatment process consistent with provisions of EEAA approval?			
4.1.2	If HW is generated from the treatment process, is the waste properly identified and quantified?			
4.1.3	Is the HW from the treatment process separated from one another as well as from other non-HW?			
4.1.4	Are the employees aware of proper HW handling and trained to act in emergency cases?			
4.2	***On-site storage of HW***			
4.2.1	Is there a specifically designated HW storage area?			
4.2.2	Is the storage area meeting the legal requirements?			
4.2.3	Are the storage containers meeting the legal requirements?			
4.2.4	Are there clear labels inscribed with the required information on the containers?			
4.2.5	Is the storage area suitable for the types and quantities of waste stored?			
4.2.6	Are the types and quantities of stored HW consistent with the information in the register?			
4.2.7	Are the employees aware of proper HW handling and trained to act in emergency cases?			
4.3	***On-site disposal of HW*** ***If a specifically designated HW disposal area is available on-site:***			
4.3.1	Is this area meeting the legal requirements?			
4.3.2	Is disposal taking place in accordance to Law 4 and the ER?			
4.3.3	Are the quantities and types of HW disposed of consistent with the information in the register?			
4.4	***HW transport vehicles*** ***If the establishment transports HW:***			
4.4.1	Are the vehicles meeting the legal requirements?			
4.4.2	Are the transport vehicles properly signed indicating the type of waste transported?			
4.4.3	Are the drivers properly trained to act in emergency cases?			