

Developing a Hazardous Waste Transportation System For Egypt

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1. Introduction

Hazardous waste (HW) is waste with physico-chemical and/or biological properties rendering it dangerous, with possible adverse impacts to human health and the environment. In this respect, HW management is addressed by Law 4/1994 for the Environment and its Executive Regulations (ER), which specify the necessary requirements for the safe handling of this type of waste, through the different stages of its management, from points of generation to treatment and final disposal, through segregation, collection, storage, transport, and possible reuse and recycling.

Within this context, hazardous waste transportation, as an essential component of the integrated hazardous waste management system, is addressed by Law 4/1994 for the Environment and its (ER) with the main issues that need to be taken into consideration during the transport operation. In this respect, properly operated HW transport effectively contributes to the success of the overall HW management system. Therefore, detailed description of the different activities of the transport operations is deemed essential for a overall functional system.

This paper presents the process through which HW transportation System was developed for Egypt, as presented by the HW Transportation Guidelines, then summarizes the principle components of this system.

2. Background

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”.

Within the framework of this definition, a National Classification System for HW was developed, and waste identified as hazardous on the basis of four main characteristics: Ignitibility, Corrosiveness, Reactivity and Toxicity.

Furthermore, the six line ministries (Ministry of Industry, Health, Electricity, Interior, Petroleum and Agriculture) concerned with HW management have developed lists including HW generated within their scope of competence with the purpose of assisting the process of HW identification.

Within this context, hazardous waste is generated from a wide range of activities including domestic, agricultural, commercial and industrial activities. However, the industrial sector can be considered one major generator of hazardous waste.

3. Regulatory Framework for HW transportation

Law 4/1994 for the Environment and its ER, stipulate requirements to be implemented by transport operators in order to ensure the safe handling of this type of waste. HW transportation is addressed by point 3 of article 28 of the ER. Table (1) below summarizes these requirements.

Table (1): Legal Requirements for Hazardous Waste Transportation

Legal Requirement	Description
HW Transport Permit (Article 28.3A - ER)	<ul style="list-style-type: none"> - HW is to only be transported by transport operators possessing transport permit - HW is to be only transported in transport means owned by entities/operators possessing transport permit
Specifications of Transport Vehicles (Article 28.3A.1&2- ER)	<ul style="list-style-type: none"> - HW transport vehicles are to be equipped with the necessary safety equipment - The vehicles must be in good working condition and suitable for operation - The vehicles must be of adequate capacity and have rotation frequency suitable for the quantities of HW intended for transport
Drivers of HW Transport Vehicles (Article 28.3A.3 – ER)	<ul style="list-style-type: none"> - Drivers of HW transport vehicles must receive adequate training to be qualified and capable to act in cases of emergency
Labeling of HW Transport Vehicles (Article 28.3A.4 - ER)	<ul style="list-style-type: none"> - Clear and visible labels must be inscribed on HW transport vehicles indicating the type of transported waste and the associated hazard as well as action to be taken in cases of emergency
Routing of HW Transport Vehicles (Article 28.3B&C - ER)	<ul style="list-style-type: none"> - HW transport routes are to be determined - The transporter must notify the Authority for Civil Defense of any changes in the routing plan - HW transport vehicles are not allowed to pass through residential and other populated areas and city centers during daytime - The concerned competent authority should be notified of the garage address in which the vehicles park as well as the number and date of their licenses
Maintenance and Cleaning of HW Transport Vehicles (Article 28.3E – ER)	<ul style="list-style-type: none"> - HW transport vehicles must be continuously washed and cleaned after each use according to the instructions set by the Ministry of Health in coordination with the concerned competent administrative authority

4. Development of a Hazardous Waste Transportation System for Egypt

In developing an integrated hazardous waste management system in Egypt, there was an essential need to identify and provide in details the constituents of each of the different HW management system components, as well as the operation procedures for each component in order to achieve a successful overall HW management system.

In this respect, this section briefly presents the process of developing the national HW transportation system for Egypt. Within this context, HW transportation systems in a number of selected countries, including developed and developing countries have been investigated. These included the EU, the US as examples for the developed countries, Sri Lanka and India as examples of developing countries at a similar stage of development as Egypt. In addition, the Emirate of Dubai, as an examples in the Middle East.

These different systems were investigated with the objective of having an overall perspective of what are the main requirements of an integrated transport system that would be of use and at the same time can be applicable within the Egyptian Context.

• **Methodology**

The investigation methodology of the different transportation systems was primarily carried out on the basis of the requirements of the Egyptian legislations. Within this context, identified key issues included:

- **HW Classification:** this is concerned with categorization of HW into transportation classes. HW classification present the basis for the transport operational procedures, as well as the technical specifications For example, the specifications for storage containers depend on the category of waste to be stored in them; and the specifications for the means of transport of HW primarily depend on the type and class of the transported waste.
- **Permits:** this is concerned with obtaining permits for HW transportation to ensure compliance to the legal requirements.
- **Specifications and Standards:** these include technical specification of the transport means and the labeling and placarding requirements.
- **Manifest system:** this is concerned with tracking the waste, controlling the transportation process and minimizing illegal disposal.
- **Training:** this is concerned with the capability of personnel involved in HW transportation to efficiently carry out the transport operations and act soundly in cases of emergencies.

• **Investigation Results**

Analysis of the collected data and information regarding the implementation of HW transportation systems in different countries showed that transportation operations are regulated by various technical and operational requirements. The extent of such regulations and requirements varies substantially within international efforts in this

regard. Generally, countries with well-established HW management systems regulate HW transport more extensively than others, where systems have come under implementation more recently. However, HW transportation requirements are found to fall within the following general categories: the permitting system, waste tracking systems (Manifest), the specifications of the means of transport (including waste holding compartments and safety specifications), labeling and the competence of drivers, as well as the general issues of waste acceptance and compatibility of transported waste.

Within this context, it was identified that the existing Egyptian regulatory framework addresses the major issues related to HW transportation. However, there are evident needs for implementation procedures and documents, particularly for HW classification and permitting which are essential for developing the transportation system. Regarding vehicle specifications and standards, these have been determined for minimum requirements that would ensure safe HW transport operation. Moreover, for the Egyptian context, three main modes of transportation have been addressed namely, road transport, transport by rail and vessels. Other more complex modes were not investigated, such as transport of HW vehicles by rail.

In addition, other critical issues are found to be of crucial importance for the success of the HW transportation system in Egypt, namely the manifest system and the liability of HW consignments. Although the use of manifest systems is not mentioned as a legal requirement of law 4/1994 and its ER, however, a manifest system was developed with the purpose of achieving maximum control on the waste movement process and hence avoid, to the extent possible, illegal HW disposal. In addition, although the legal liability is transferred with the physical movement of waste, the generator should have the overall liability for his waste. This is reflected in the fact that the generator bears the costs of waste transport, treatment and disposal.

Table (2) below provides a brief summary of the transportation system components in the five countries.

Table (2) Summary of HW transportation System Components in the different Countries

	EU	USA	India	Sri Lanka	Dubai
Transport modes	All modes	All modes	Mode unspecified	Mode unspecified	Only transport by road
Permits	<ul style="list-style-type: none"> - Operator permit - Certificate for specification of transport means 	<ul style="list-style-type: none"> - Operator permit - Certificate for specification of transport means 	<ul style="list-style-type: none"> - Operator permits 	<ul style="list-style-type: none"> - National permit 	<ul style="list-style-type: none"> - General business license
Waste tracking	Manifest system used	Manifest system used	Manifest system used	Manifest system used	No Manifest system, tracking through transport documents
Specifications of the means of transport	<ul style="list-style-type: none"> - Detailed specifications (compartments, electric, mechanical, etc) - Labeling - Cleaning 	<ul style="list-style-type: none"> - Detailed specifications (compartments, electric, mechanical, etc) - Labeling - Cleaning 	<ul style="list-style-type: none"> - Labeling 	<ul style="list-style-type: none"> - Requirements for construction materials - Labeling - Cleaning 	<ul style="list-style-type: none"> - Requirements for compartments, electric, mechanical, etc) - Labeling - Cleaning
Competence of drivers and action in emergencies	<ul style="list-style-type: none"> - Drivers and other personnel trained 	<ul style="list-style-type: none"> - Drivers and other personnel trained 	<ul style="list-style-type: none"> - Drivers and other personnel trained 	<ul style="list-style-type: none"> - Drivers and other personnel trained 	<ul style="list-style-type: none"> - Drivers and other personnel trained
Waste acceptance and compatibility	<ul style="list-style-type: none"> - Goods only accepted if properly identified; for packaged goods, packages must be undamaged and labeled - Incompatible goods are not to be transported together 	<ul style="list-style-type: none"> - Goods only accepted if properly identified; for packaged goods, packages must be undamaged and labeled - Incompatible goods are not to be transported together 	<ul style="list-style-type: none"> - Goods only accepted if properly identified; for packaged goods, packages must be undamaged and labeled - Incompatible goods are not to be transported together 	<ul style="list-style-type: none"> - Goods only accepted if properly identified; for packaged goods, packages must be undamaged and labeled - Incompatible goods are not to be transported together 	<ul style="list-style-type: none"> - Goods only accepted if properly identified; for packaged goods, packages must be undamaged and labeled - Incompatible goods are not to be transported together

5. Classes of Transportable Hazardous Waste

Categorizing hazardous waste based on physical and chemical properties enables the determination of clear requirements and specifications necessary for the different operations of its management cycle. In this context, transportable hazardous waste in Egypt are categorized into 9 main groups, each with specified signs indicating the type of hazards related to it, and specifications for the means used for its transport.

These groups encompass:

- Explosive waste
- Flammable and combustible liquids
- Flammable and combustible solids
- Oxidizing waste
- Toxic waste
- Infectious and other healthcare waste
- Radioactive
- Corrosive waste
- Mixed waste

Table (3) below relates each of these groups with the four basic hazardous characteristics of the National Hazardous Waste Classification System.

Table (3): Hazardous Characteristics and/or Classification System List Corresponding to each of the HW Transportation Classes

HW Transportation Class	Hazardous Characteristic or Classification System List
Explosive waste	Reactivity
Flammable and combustible liquids	Ignitability
Flammable and combustible solids	Ignitability
Oxidizing waste	Reactivity
Toxic waste	Toxicity
Infectious and other healthcare waste	List S (Special waste)
Radioactive waste	List S (Special waste)
Corrosive waste	Corrosiveness
Mixed waste	All characteristics and lists

6. The Liability for Hazardous Waste

The hazardous waste generators have the overall responsibility for generated HW throughout its entire life cycle (from cradle-to-grave). This means that HW generators are to ensure that the waste is properly managed, according to set safety conditions and procedures, throughout the different phases of its management, from the point of generation up to the point of final disposal. This is most clearly manifested by the fact that generators bear the costs of waste handling, from generation up to treatment and disposal. This is in accordance with the “polluter pays principle”.

However, the legal liability for HW during its management cycle is transferred with the physical transfer of the waste from one “handler”/operator to another. For the case of HW transportation, this means that once a transporter receives HW, he is legally liable for the proper handling and movement of this waste, within all legal, technical and safety requirements and taking all necessary measures to avoid potential risks to human health and the environment. This is true till waste delivery to a treatment and/or disposal operator. In this regard, HW transporters in Egypt must

be fully familiar with existing regulations and legal requirements managing HW transportation to continuously ensure compliance to them.

7. Operational Procedures for HW Transportation

7.1 Permitting for Hazardous Waste Transportation

Law 4/1994 and its ER stipulate that handling¹ of hazardous waste requires a license issued from competent administrative authorities. Within this context, HW transportation off-site (i.e waste transport beyond the property line of the facility where it is generated) is identified as an activity requiring licensing. This is mainly due to potential risks associated with the transportation process. In this regard, the permitting requirements for HW transportation entail providing details of the intended transportation process including types of waste to be transported, specifications of the transport means and the transportation routes. However, it should be noted that the national permitting system for all HW handling activities is yet under operationalization, with HW transportation permitting still to be implemented.

7.2 Hazardous Waste Manifest

One of the primary issues contributing to the success of the HW management system is ensuring that hazardous waste is tracked from the point of generation throughout to final disposal. This significantly contributes to the minimization of incidents of illegal disposal of the waste, as well as ensuring proper identification of the waste in cases of accidents.

The key component of this tracking system is the Hazardous Waste Manifest which is a paper document of a single form of multiple copies. This form is divided into three sections to be filled out by the generator, transporter and the receiving storage/treatment/disposal/. It is to include information on the type and quantity of the waste being transported, its hazardous class(es), its packaging details, instructions for handling, and signatures of all parties involved in the transportation process (generators delivering the waste to the transporters, the transport operators, as well as the facility receiving the waste for storage, treatment and/or disposal). In this regard, the Manifest serves as a legal transportation document which must accompany the waste during its movement, and transporting HW off-site of is to be prohibited without a Manifest.

Figure (1) presents a Prototype for a Hazardous Waste Manifest form suggested for use in Egypt.

¹ 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

Figure (1) Prototype for a Hazardous Waste Manifest

																		kg	<input type="checkbox"/>
																		m ³	<input type="checkbox"/>
																		kg	<input type="checkbox"/>
																		m ³	<input type="checkbox"/>
																		kg	<input type="checkbox"/>
																		m ³	<input type="checkbox"/>
14) Additional description and/or handling instructions for waste listed above																			
<i>Declaration: I hereby declare that the information above is accurate and that the described waste has been identified, packed and labeled in accordance with legal provisions set by the national authorities.</i>																			
Name of Generator:					Signature:					Date:									
Transporter s	15) Acknowledgement of receipt of waste																		
	Principal Transporter Name:					Signature:					Date:								
	Other Transporters Names:					Corresponding Signatures:					Dates:								
S - T - D Facility⁴	16) Comments regarding any inconsistency in waste consignment																		
	17) Acknowledgement of receipt of waste by the treatment/disposal facility <u>except</u> discrepancies stated in point 16 above.																		
	Name:					Signature:					Date:								
	18) Acknowledgement of receipt of waste by the treatment/disposal facility <u>including</u> the discrepancies stated in point 16 above																		
Name:					Signature:					Date:									

⁴ Storage – Treatment – Disposal Facility

7.2.1 Using the HW manifest

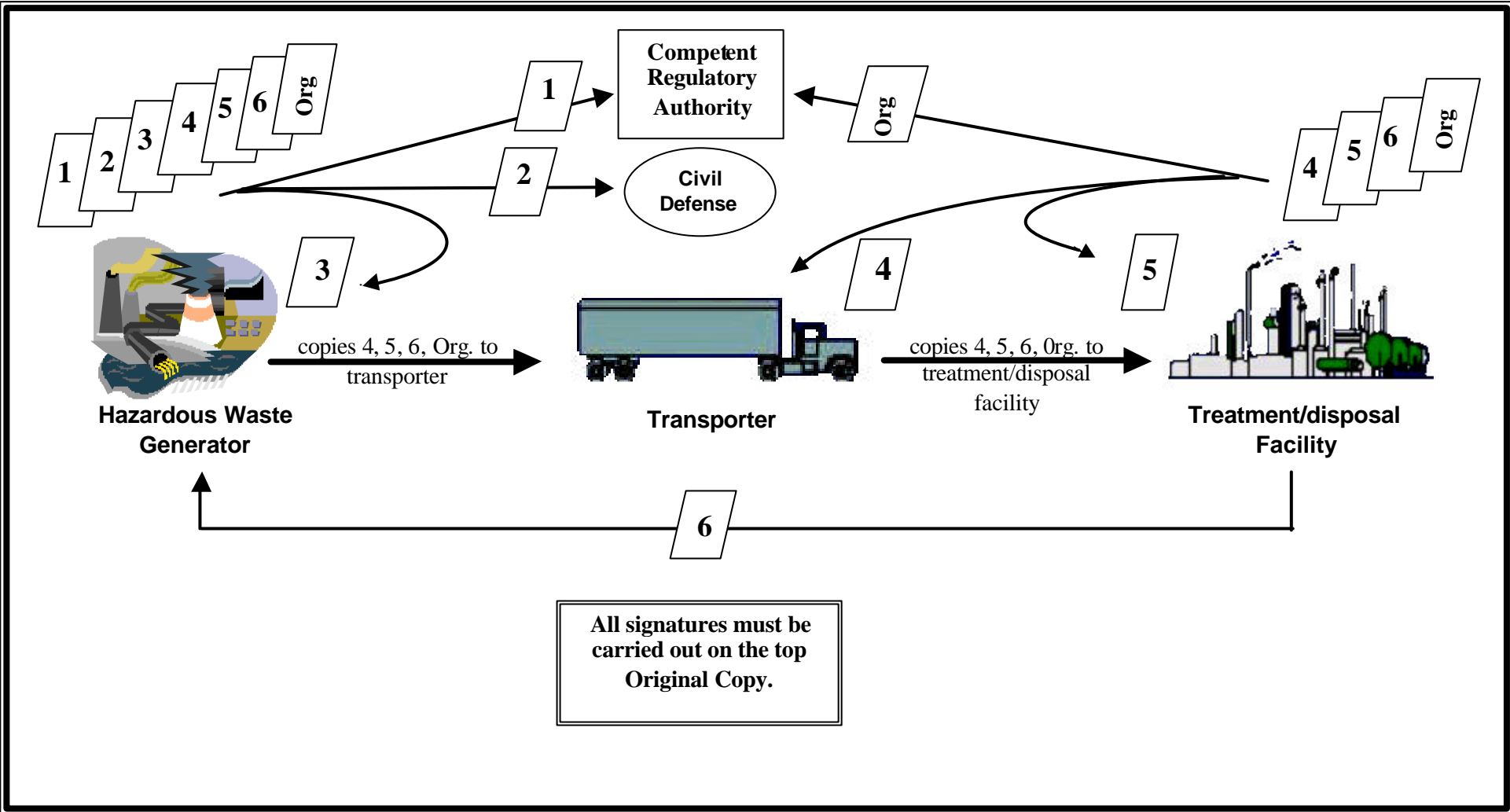
The Manifest is to be composed of seven copies of a single form, a top original and six underlying carbon copies. Each entity that handles the waste must sign the manifest and retain a copy. This would ensure accountability in the transportation and storage/treatment/disposal processes. Once the waste reaches its destination, the receiving facility returns a signed copy of the Manifest to the generator, confirming that the transport operators have delivered the waste to the designated facility. Regulatory authorities receive two copies of the Manifest, one at the beginning of the transport process (from the generator), and one at its termination (from the receiving facility). This would enable these authorities to have a complete record of every HW transport operation. In addition, the generator sends one copy to the Civil Defense Authority, the entity responsible for intervention in cases of accidents or spills.

Whenever waste is delivered from one entity to the other, the entities always sign and date the manifest on the top original copy. The six carbon copies are distributed as follows:

1. **Carbon copy (1)**, the lowest copy, is sent by the generator to the concerned competent authority, once the sections of the generator and transport operator are filled out and signatures and dates inscribed on the top original copy.
2. **Carbon copy (2)**, the next copy up, is sent by the generator to the Civil Defense Authority, the responsible entity for intervention in cases of accidents or spills.
3. **Carbon copy (3)**, the next copy up, is retained by the waste generator as a record for the delivery of the waste. The remaining copies are handed over to the transport operator.
4. **Carbon copy (4)**, the next copy up, is retained by the transport operator after delivering the waste to the storage/treatment/disposal facility and necessary information, signatures and dates, inscribed on the top original copy. This is a record for the transport operator for proper waste delivery. The remaining copies are handed over at the storage/treatment/disposal facility.
5. **Carbon copy (5)**, the next copy up, is retained by the storage/treatment/disposal facility as a record for the waste received.
6. **Carbon copy (6)**, the next copy up, is sent back to the generator by the storage/treatment/disposal facility. It provides a record for the generator that his waste has been properly transported and delivered for storage, treatment, and/or disposal.
7. **The top original copy**, now containing information about all deliveries of waste, the concerned entities, and the original signatures, is sent to the competent regulatory authority by the storage/treatment/disposal facility. This copy, together with carbon copy (1) sent to the regulatory authority at the initiation of the transport process, provide a complete record of the HW transport operation.

Figure (2) schematically presents the HW manifest distribution process.

Figure (2): Hazardous Waste Manifest Distribution



7.3 Labeling

HW means of transport must have “placards” clearly located on the vehicles:

- They should indicate the hazardous characteristics of the transported waste and the type of hazard associated with these characteristics and that special care required in handling of the shipment in cases of emergency.
- For cases of transportation of two or more categories of HW requiring different placards, a “DANGEROUS” placard is used on the means of transport rather than the separate placards for each hazardous category.
- The placards must be placed on the sides, as well as the rear of the vehicle.
- They must also be clearly visible for inspection.

The following figure (3) shows the signs and placards to be used on HW transport means. These signs are based on the hazard identification signs used internationally. The wording on the signs have been produced in an Arabic version by EEAA in order fit into the Egyptian context and for easy understanding and use.

Figure (3) Hazardous Waste Transport Signs



In addition to the placards, the means of HW transportation are to have stickers placed on all sides, indicating that these means are approved and licensed for transporting HW. The stickers would also have inscribed the telephone numbers of the Civil Defense Authority, and the EEAA Contingency Plan Operation Room for rapid contact in case of accidents

7.4 General Operational Provisions

7.4.1 Waste Acceptance

When receiving the waste, the transport operator must check the following:

- The waste documentation
- The waste packaging and labeling, ensuring that they comply to regulations,
- The availability of the Manifest form with all information complete and signed by the generator.

7.4.2 Waste Compatibility

If incompatible wastes are mixed together dangerous and undesirable reaction can take place. In this respect, incompatible wastes cannot be transported in bulk together. Moreover, packaged incompatible wastes must not be transported in the same compartment, and special loading/unloading practices must be followed to avoid accidental mixing. Table (4) below summarizes the chemical reactions resulting from mixing of incompatible HW.

7.4.3 Safety Procedures

Handling HW during transportation operations requires the application of specific safety procedures (waste handling, loading and unloading and stowage plans). In addition adequate safety equipment must be available on board of the transport means. Moreover, the competence of drivers and other personnel involved in these operations is a requirement of the ER of Law 4/1994. In cases of accidents or emergencies the crew members must try to minimize, as much as in their ability, the risks of the transported load to public health and the environment.

In cases of life-threatening situations (fires, risks of explosion, toxic fumes, etc.), the Civil Defense Authority must be contacted immediately.

8. Specifications of HW Transport Vehicles

The HW transport vehicles must have specifications in order to ensure the proper containment of the transported waste, and minimize potential risks associated with the movement of such waste.

The minimum specifications for HW transport vehicles are summarized in table (5).

Table (5): Specifications for HW transport Vehicles

Specifications of Compartments holding the waste	General Specifications	Safety Procedures
<p><u>General:</u></p> <ul style="list-style-type: none"> - Compartments should be designed to hold the load without risk of spillage or damage to the vehicle. - Compartment must be able to contain the load safely in cases of accidents. - No vehicles with open compartments to be used. - Compartments must not be loaded above the top of their walls. - The inside of the compartment must be smooth to allow easy cleaning. Also the compartment holding the waste must be earthed <p><u>Capacity:</u></p> <ul style="list-style-type: none"> - For packaged waste, the compartment tray must contain the volume of the largest package without spillage outside the compartment (for cases of leaks). <p><u>Bulk liquid waste:</u></p>	<p><u>General:</u></p> <ul style="list-style-type: none"> - The vehicle must be in good condition <p><u>Electric system:</u></p> <ul style="list-style-type: none"> - The vehicle must have an electric isolation switch to shut off all electrical systems in cases of emergencies <p><u>Engine location:</u></p> <ul style="list-style-type: none"> - The engine must be situated so as to avoid any danger to the load through heating or ignition <p><u>Exhaust:</u></p> <ul style="list-style-type: none"> - For flammable and combustible waste, the exhaust pipe must discharge horizontally, and parts of the exhaust under the waste compartment must have a minimum clearance of 100mm or be protected with a thermal shield. 	<p><u>Prior to loading</u></p> <ul style="list-style-type: none"> - Ensure that compartments that will hold the waste must be clean from any previous waste residues, to prevent the interaction of previous waste residues with the load resulting in dangerous reactions, as well as from debris that can damage the waste containers. <p><u>Loading</u></p> <ul style="list-style-type: none"> - Loading should be carried out by qualified personnel. - For packaged waste, the loading equipment must not damage the containers in any way. - For packaged waste, containers must be loaded upright, and in such a way so as to secure their stability during movement. If fastening the containers is necessary, this must be carried out. - For bulk waste, loading is

Specifications of Compartments holding the waste	General Specifications	Safety Procedures
<ul style="list-style-type: none"> - For bulk liquid waste, compartments must be supplied with closures (for loading/unloading) that can be hermetically closed. <p><u>Flammable and combustible waste:</u></p> <ul style="list-style-type: none"> - For flammable and combustible waste, only closed vehicles with compartments with metal bodies must be used (no combustible material should be within waste compartment). Also compartments walls must ensure that no overheating occurs. <p><u>Oxidizing waste:</u></p> <ul style="list-style-type: none"> - For oxidizing waste, if covered vehicles are used, the cover must be non-combustible, and impermeable to water. <p><u>Corrosive waste:</u></p> <ul style="list-style-type: none"> - For corrosive waste, the internal surface of the compartment must be in steel resistant to corrosion. <p><u>Explosive</u></p> <ul style="list-style-type: none"> - Transport according to requirements set by the ministry of Interior <p><u>Infectious waste</u></p> <ul style="list-style-type: none"> - No bulk transportation is allowed <p><u>Radioactive waste</u></p> <ul style="list-style-type: none"> - Refer to National Center for Nuclear Safety and Radiation Control, and the corresponding regulations 	<p><u>Fuel tank:</u></p> <ul style="list-style-type: none"> - The fuel tank must be equipped with an automated shutting mechanisms, preventing fuel from reaching the engine in cases of collisions - In cases of fuel leakages, the fuel tank must drain to the ground without coming into contact with hot parts of the vehicle or the load - The fuel tank must be equipped with a closure that would keep the opening properly sealed. 	<p>to be carried out with minimum spillage of waste onto the outside surfaces of the waste compartments. If this occurs, washing must take place before the movement of the means of transport.</p> <p><u>Transport</u></p> <ul style="list-style-type: none"> - For packaged waste, the containers must not overturn, spilling their content inside, or outside the means of transport. - For bulk waste, leakage or spillage outside the compartment holding the waste must be avoided. - The manifest copies should be located somewhere clear and easily reachable in a protective cover. <p><u>Unloading</u></p> <ul style="list-style-type: none"> - Unloading should be carried out by qualified personnel. - For packaged waste, the unloading equipment must not damage the containers in any way. - For bulk waste, unloading should be carried out with minimum spillage of waste onto the outside surfaces of the waste compartments. If this occurs, washing must take place.

9. Training

According to article 28.3 ER personnel involved in HW transportation must be aware of the different types of hazards associated with the transported consignments and must be qualified to act properly in cases of emergency, through adequate training. The HW transport operator is to be responsible for providing the crew of the means of transport with sufficient training.

10. Roles and responsibilities of the different entities involved in the transportation process

In order to achieve an effective HW transportation system, all bodies involved in the transportation process, namely the generators, the transport operators, the treatment/disposal facilities and the competent regulatory authorities, must be aware of their roles and responsibilities and carry them effectively according to the set procedures and requirements. In this regard, the responsibilities of the four main contributors to HW transportation, are presented as follows:

- **The Competent Regulatory Authority**
 - Grant permits
 - Implement permit conditions
 - Revoke permits in case of violation
 - Enforce and monitor the use of manifest
 - Carry out inspection to verify that generator/transporter and the treatment and disposal facility carry out their respective responsibilities
 - Approve training programs

- **Hazardous Waste Generator**
 - Proper waste identification and classification
 - Waste labeling and packaging where applicable
 - Ensure that transporter and the treatment and disposal facility used have the necessary HW licenses
 - Use of Manifest

- **Hazardous Waste Transporter**
 - Obtain necessary permits
 - Use vehicles with proper specifications and placards
 - Implements necessary safety procedures and use safety equipment
 - Follow the agreed-upon routing
 - Carry out vehicle maintenance and cleaning
 - Training of all staff
 - Only accept waste properly identified and where applicable packaged and labeled.
 - Use of manifest

- **Treatment/disposal facility**
 - Only accept waste properly identifies and where applicable packaged and labeled
 - Use the manifest
 - Ensure that transporter has a HW transportation license
 - Carry out vehicle cleaning before it leaves the facility

11. Conclusion

HW transportation is a key component in the integrated HW management system, and is addressed by Law 4/1994 and its ER where the main issues to be considered during carrying out the transport operations are stipulated.

In Egypt, transportable HW is categorized into 9 hazardous classes related to the four main hazardous characteristics. The transport operations should be carried out according to certain operating procedures in order to ensure the efficiency of the transport process and minimizing potential risks associated with the movement of the waste. One of the main tools contributing to effective waste monitoring and tracking is the HW manifest form. This form serves as a legal transportation document which must accompany the waste during its movement, presenting documentation of the chain of custody for this waste.

Proper waste packaging and labeling as well as waste compatibility are also important factors for the effectiveness of the transport process. Transportation by road is the mostly common mode of transportation in Egypt, therefore HW transport vehicle should meet the necessary specification regarding both the compartments holding the waste during transportation, and other specific features of the means of transport (engine, exhaust, electrical system, etc.), in order to safely contain the waste till its delivery to the designated facility. Within this context, each of the bodies involved in the transportation process, the generators, transporter, the waste receiving facility and the competent regulatory authority should meet their obligations in order to achieve an effective transportation process and hence a successful HW management system.

12. References

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