



HAZARDOUS MATERIALS AND WASTES MANAGEMENT GUIDE FOR SMALL AND MEDIUM ENTERPRISES IN JORDAN

Produced by



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THE AUTHORS

Royal Scientific Society

The Royal Scientific Society (RSS) was established in 1970 in Amman / Jordan. RSS is a non-for profit organization dedicated to undertaking scientific and technological research related to the development process in Jordan and to disseminating awareness in scientific and technological fields to the public. RSS comprises six technical centers, one of which is the Environmental Research Center (ERC). ERC undertakes and manages directed applied research and studies in selected environmental areas such as cleaner production, environmental management system, water quality management, air quality management and control, noise pollution assessment and hazardous and solid waste management as well as conducting specialized technical training.

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Sustainable Business Associates (SBA) is an international non-governmental organization (NGO) based in Switzerland. It co-operates with enterprises within the context of sustainable development, to encourage their participation in environmental action, in order to simultaneously improve their economic efficiency and reduce their ecological impacts. SBA activities are information (conferences, seminars, newsletter, and Web site) and training-oriented (courses, training-action, etc.) on eco-management and cleaner production.

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PREFACE

Like in other countries, hazardous materials (HM) and hazardous waste (HW) management in Jordan is a very serious environmental problem, which is getting more and more attention from both government and industry. Jordan has promulgated laws and regulations to implement the safe management and control of hazardous materials. The laws also defined the road map for hazardous waste management. However, guidance for implementing the laws and regulations in Jordan is not yet fully matured.

As a result of the survey conducted by RSS team for the analysis of the industrial context during December 2003 – January 2004, many Small and Medium Enterprises (SMEs) in Jordan use hazardous materials and generate different types of hazardous waste. SMEs may not be in full knowledge of best management practices of such materials. Indeed, some SMEs may not even be fully aware of the quantities and types of hazardous materials / wastes at their facilities. On the other hand, they are required to comply with regulations pertaining to the subject. This is often a difficult task for SMEs as many of them lack the knowledge. Therefore, this guide intends to be a helpful tool for SMEs to be able to identify, quantify and manage hazardous materials and hazardous waste in an environmentally sound manner.

The guide is prepared to help the operator at SMEs in sequential, systematic steps to adequately manage hazardous substances and hazardous waste in their facility utilizing the internal human resources at their own company and / or with external assistance from technical body.

The Guide is the result of a fruitful collaboration and sharing of expertise between stakeholders with different backgrounds, including the Government of Jordan, national and international specialized organizations and consultancy firms, as well as some of small and medium size enterprises in Jordan. The preparation of this guide has been funded under the Strategic Plan of the Basel Convention (2002 - 2010) with additional financial support from the Swiss Agency for Development (SDC). In this regard, the management guide should be considered as an operational tool to assist with the implementation of the various Basel Convention Technical Guidelines for the Sound Environmental Management of Hazardous Waste, which the reader is kindly invited to consult further.

Amman, September 27, 2005

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GLOSSARY

Action Plan	A detailed plan identifying corrective actions, means, responsibilities, resources and time frame for remedial.
Corrosive	Substance or waste that causes destruction of, or damage to materials or living tissues on contact by chemical action.
Cleaner Production	A concept of industrial production which minimizes all environmental impacts through careful management of resources use, of product design and use, systematic waste avoidance and management of residuals, safe working practices and industrial safety
Environment	The physical factors of the surroundings of human beings including the land, water, atmosphere, climate, sound, odors, tastes; the biological factors of animals and plants and the social factor of aesthetics.
Explosive	Solid or liquid substance or waste which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such speed as to cause damage to the surroundings.
Flammable	A non-explosive material that is capable of producing fire as a result of friction, heat retained from production or which, if ignited, produces a serious transportation hazard.
Flammable liquid	Liquids with a flash point below 61°C
Ignitable	A liquid, which has a flash point of less than 60°C. It is capable of causing fire through friction or absorption of moisture, or can undergo spontaneous chemical change, which can result in vigorous and persistent burning under standard temperature and pressure.
Infectious	Bio-hazardous, which have qualities that may cause infection. It contains pathogens, including bacteria, viruses, rickettsiae, parasites, fungi or recombinant micro-organisms that are known, or reasonably expected, to cause infectious disease in humans and animals that are exposed to them.
Irritant	It is a chemical, which may cause reversible inflammation on contact.
Management	Effective control of activities involving waste materials. Cradle-to-grave management involves the supervision of all phases in the life cycle of a waste material.
Material Safety Data Sheet (MSDS)	MSDS is a very widely used abbreviation for Material Safety Data Sheet. It contains details of the hazards associated with a chemical, and gives information on its safe use.
Minimization	Actions to avoid / reduce or in other ways diminish the hazardous waste at their source. Recycling is not a minimization technique but is often included in such programs for practical reasons.
Oxidizer	A material, which is in itself not combustible, may cause or contribute to the combustion of other material generally by yielding oxygen.
Pesticides	Generally addressing plant treatment products used to protect plants against diseases. Includes antibacterial and antifungal products and often herbicides as well. May eventually include non-agricultural uses of antimicrobials.
Pollutant	Any undesirable solid, liquid, or gaseous matter in a gaseous, liquid or solid medium.
Poisonous	A substance that adversely affects one's health by causing injury, illness, or death. These are often marked with skull and crossbones.
Radioactive	Radioactive substance means a radionuclide or mixture of radionuclides, either alone or in chemical combination with other elements.

Reactive	A material that is normally unstable and undergoes violent chemical change without detonating, can react violently with water to form potentially explosive mixtures or can generate dangerous or possibly toxic gases, vapors or fumes in a quantity sufficient to present a danger to public safety, health or welfare or to the environment.
Recycling	The retrieval of materials or products either for re-use in their original form, or for re-processing into products of similar composition.
Segregation	Taking action to prevent the mixing of chemically unrelated or incompatible materials in the same container.
Toxic	Any substance producing a harmful effect on living organisms by physical contact, ingestion or inhalation.
Waste	Any matter prescribed to be waste under national legislation, any material listed as waste in appropriate schedules, and in general, any surplus or reject material that is no longer useful and which is to be disposed of.

ABBREVIATION

HM	Hazardous Materials
HW	Hazardous Wastes
HWM	Hazardous Waste Management
MENA	Middle East and North Africa
MoE	Ministry of Environment
MoPIC	Ministry of Planning and International Cooperation of Jordan
MSDS	Material Safety Data Sheet
PCB	Polychlorinated Biphenyls
PHC	Petroleum Hydrocarbon Compounds
RSS	Royal Scientific Society
SBA	Sustainable Business Associates
SMEs	Small and Medium Enterprises
UNEP	United Nations Environment Programme
UNITAR	United Nations Institute for Training and Research

INTRODUCTION

Hazardous waste management (HWM) is one of the most important environmental issues. The majority of the small and medium enterprises (SMEs) are concerned with this kind of waste. Some SMEs create hazardous wastes as part of their operating procedure and may pose a threat to human health and to the environment. In fact, the authorities and the public demand a closer control and better management of these toxic wastes and the associated residues.

Almost all countries in the Middle East and North Africa (MENA) region lack adequate infrastructure for hazardous waste management and are still at early stages of developing relevant legislative frameworks. Moreover, little relevant and accurate scientific information on national production of hazardous wastes (quantity and quality) as well as on treatment and disposal strategies is available. Few countries have recently completed their national chemicals profile with the assistance of UNITAR (such as Egypt, Jordan and Syria).

This guide aims at providing the small and medium enterprises (SMEs) with useful practices of HWM. Indeed, this guide allows the user to explore his/her company and to identify its weaknesses in order to take adequate corrective measures. Moreover, the guide is adapted to local needs by adopting a systematic methodology designed according to the available local rules and regulations. The steps described in the methodology section can be followed in a systematic way throughout the guide to reach to a full understanding of the hazardous materials (HM) and hazardous waste (HW) status, and to develop and implement an appropriate action plan for managing the hazardous materials and hazardous waste.

What is hazardous material?

The hazardous materials are used or handled by companies in their production process. Most of these materials when processed or disposed of contribute to the release of a pollutant, or contaminant. Such materials can also have a significant threat to the safety of employees. In order to make the users aware of the types of hazardous materials, a variety of different symbols are used. These symbols are internationally known to indicate the hazardous material. Examples of some of these materials and associated symbols are listed below.

Characteristic	Symbols	Examples
Explosives		Trinitrotoluene (TNT), ammunitions, powdered charcoal, ammonium nitrate
Compressed gases and cryogenic liquids	    	Liquefied petroleum gas (LPG), acetylene, carbon dioxide, nitrogen, argon, oxygen
Flammable liquids	 	Methanol, acetone, benzene, fuel oil, diesel fuel, gasoline, jet fuel, kerosene
Flammable solids, spontaneously combustible, and water reactive generating flammable gases	   	Calcium carbide, calcium phosphide, metal powders and organic material powders

Characteristic	Symbols	Examples
Oxidizers		Oxygen, nitrous oxide
Toxic substances	    	Chlorine, ammonia, calcium phosphide, all pesticides, insecticides, chromium, cadmium, selenium, nickel, lead and mercury compounds
Radioactive		Uranium 238, cesium, cobalt
Corrosives		Sulfuric and nitric acids, hydroxides such as sodium hydroxide
Miscellaneous hazardous materials	   	Hot asphalt, liquid surfactants

What is hazardous waste?

Hazardous waste is a discarded substance in the form of solid, liquid or gaseous material that has the potential to harm humans or the environment, and requires special management. Categories of hazardous waste materials include, but are not limited to, explosives, flammables, oxidizers, poisonous, irritants, toxic, ignitable, reactive, infectious and corrosives.

The Ministry of Environment (MoE) issued the "Management and Circulation of the Harmful and Hazardous Materials Regulation, No. 43 for the year 1999". This regulation lists the harmful and hazardous waste to be controlled. This list is the same one defined in Annex I of the Basel Convention, see Annex 1 of this guide.

How to determine if the waste is potentially hazardous?

- Check if one of your wastes is under the categories of the wastes listed in Annex 1.
- Check label and shipping documents of the substances you use in your production processes.
- Look if your waste contains one or more material having any of the characteristics (symbols) listed in the table above.
- Check the material safety data sheets (MSDS) for the chemicals you use that are prepared by the manufacturer or search for them on an internet site, such as <http://www.msdssearch.com/>

In order to help you to identify the nature of your wastes, you can follow this flowchart.

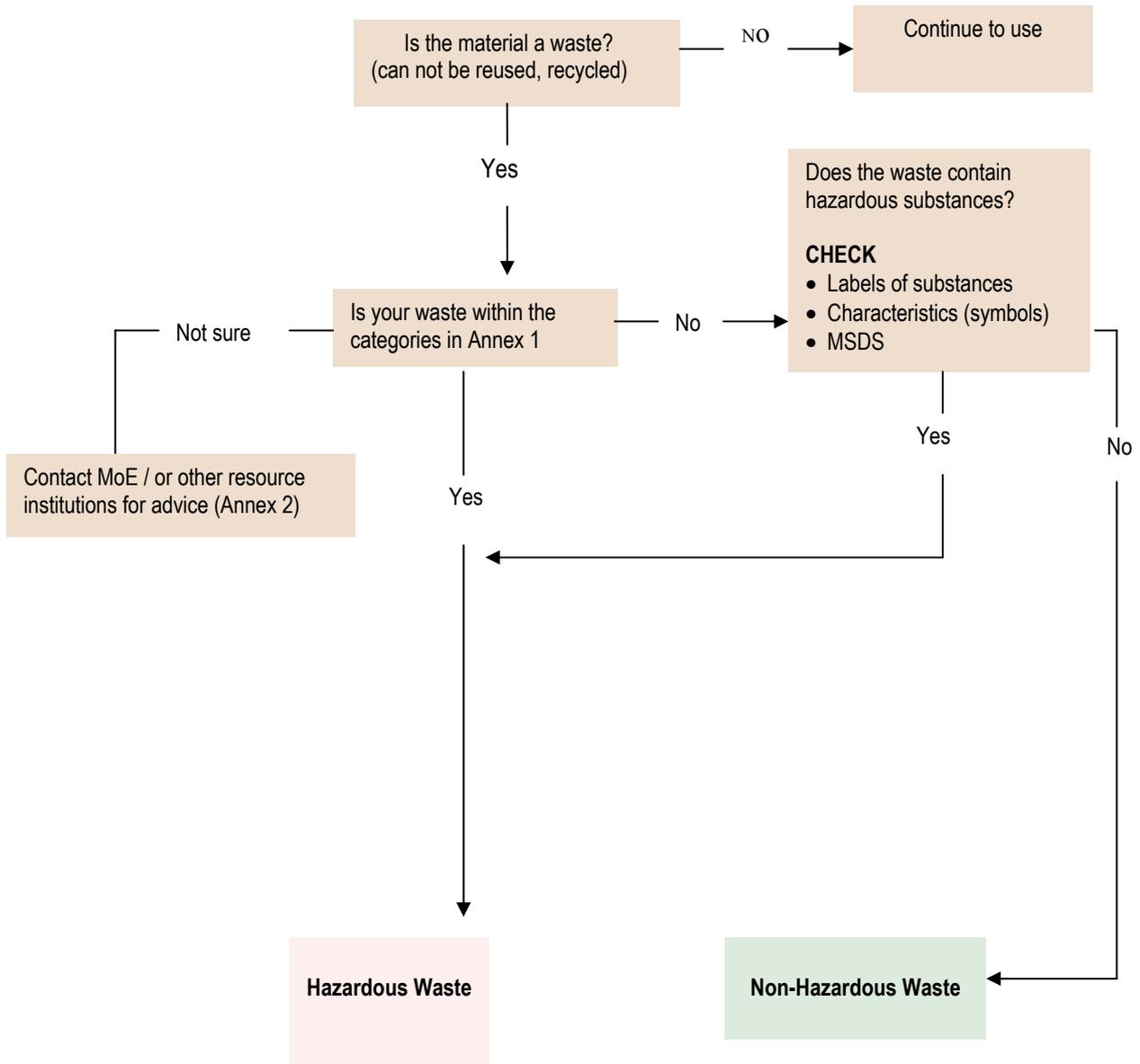


Figure 1: Hazardous Waste Identification Flowchart

Examples of **hazardous waste** include:

- Waste oil from car or machine maintenance
- Waste oil from maintenance
- Spent chemical solutions
- Used solvents
- Halogenated solvents
- Heavy metal waste
- Used batteries
- Expired paints, dyes ink and varnish solvents
- Mercury and mercury compounds
- Chlorinated hydrocarbons
- Spent photographic fixer
- Waste containing PCBs
- Compressed gas cylinders and spray cans
- Infectious hospital waste

Examples of **industry** that most probably generate HW:

- Electroplating industry
- Textile dyeing
- Car maintenance
- Hospitals
- Paint production
- Foundries
- Printing
- Pesticides manufacturing
- Cosmetics industry
- Pulp and paper
- Petroleum refineries
- Rubber and plastic
- Metallic production

Example of **materials** used in production process and can lead to HW:

- Petroleum material
- Dyes, paints, printing inks and whitening / bleaching material
- Pesticides, herbicides, insecticides, etc
- Acid or caustic material for treating metal, wood, paper or clothing
- Solvents (hexane, chloroform, acetone, etc.)
- Metal surface material containing heavy metals (Zn, Cr, Ni, Cu, Cd, Pb, etc.)

METHODOLOGY

This guide is intended to be a tool for SMEs to help them identify, quantify, assess and improve the management of HM and HW at their facilities.

The methodology is therefore an interactive one. It assumes that the enterprise is keen and interested in improving the way of doing things, and thus the enterprise would work in preparing its own procedures and action plan based on this guide.

The work starts by understanding the profile of the enterprise, although this may be clear to the management, however, it may not be so for all staff. This information is also useful for future work (as it provides reference point of current status). It is also useful for external interested parties i.e. the enterprise may wish to show / share its HM and HW management system for example as part of the overall environmental management system.

Then the enterprise shall present an overview of the production process. This shall be supported with a rough material flow diagram including the amounts of inputs, outputs, wastes and emissions. This enables the team from the enterprise to spot and concentrate on a first priority areas of very toxic wastes or high waste generation; HW streams that requires proper management.

Once HM and HW are identified and quantified in the process, it is then necessary to know how the segregation and the storage management are undertaken and to identify possible measures for improvement.

On the other hand, HW streams ought to be followed up completely until safe disposal is secured. For this purpose, the team shall work on specifying current practices for segregation, handling and treating HW on site and how the treated waste is finally disposed. The issue should then be followed to assess adequacy of the practices by comparing it with existing laws and regulations in Jordan or the environmentally sound practices, and thus identify areas for future improvements. **Generating and selecting options to improve the HM and HW management is the key objective of the guide.**

Finally, all areas of improvements shall be prepared in an action plan detailing the measures (actions), responsible persons and time frame. In a first priority the team of the enterprise shall try to fulfill this task alone. However, it is understood that many SMEs may be in need for external resources in this regard. This can be conducted through literature such as Best Available and Economically Attractive Technologies, Material Safety Data Sheet (MSDS), codes for safe storage and handling of HM and HW, and instructions given by local authorities like Ministry of Environment, Civil Defense, or by consulting external specialists.

In executing the above tasks, the design of the guide depends on information to be gathered by the enterprise team. Thus for every task, there is an example together with a form to be completed as per given instructions. To be able to obtain a complete system for managing HM and HW for the enterprise, you will find all the tables displayed in the guide in Annex 3. They are blank so that you can make numerous photocopies and use them as working documents for more convenience.

I. COMPANY PROFILE

1. Basic Information about the Company

The purpose of this section is to present the company and to provide important basic information. A short description of the company is required as shown in Table 1.

Example

Table 1: Company Profile

Name of the company	XYZ Electroplating Company	
Address	Amman, Sahab, Abdullah II Ibn Al-Hussein Industrial Estate	
Telephone number	+962-6-1234567	
Fax number	+962-6-1234567	
E-mail	xyz@xyz.com	
Contact person	Eng. M. XYZ	
Number of employees and working hours scheme	126 employees (1 shift) 8 hours a day, 6 days a week	
Main raw materials	Brass, chemicals (H ₂ SO ₄ , CrO ₃ , NiSO ₄ , etc...) and water	
Main product(s)	Brass fittings for taps and mixers.	
Departments		
Production	Maintenance	Marketing
Finance	Environmental, Occupational Health and Safety	Administration
Available Environmental Features / Facilities		
Industrial wastewater treatment unit		
Other Important Information		
The company was established in 1997. It maintains share in the local and the regional market. It plans to get ISO 9001 certificate.		
Date	20 / 10 / 2004	

2. Hazardous Materials and Hazardous Waste Management Team

Normally, companies dealing with HM and HW should have dedicated persons responsible for the management of such materials. You may identify the persons responsible for handling and managing HM and HW at your facility as shown in Table 2

Example

Table 2: Hazardous Materials and Hazardous Waste Management Team

Name and Position	Responsibility	Qualifications
Name: Eng. M. XYZ Position: Production Manager	1. Leading the employees to run the plant 2. Manage the production activities	M.Sc. Chemical Engineering
Name: Mrs. S. ABC Position: Head of Environment Office	1. Manage the environment issues and supervise the treatment unit	B.Sc. Chemistry
Name: Eng. A. EFG Position: Head of Occupational Health and Safety Office	1. Manage the training regarding safety issues 2. Conducting inspection at the plant	B.Sc. Chemical Engineering

II. PRODUCTION OVERVIEW

To provide a general understanding of the production activities, an overview is useful. This is prepared in brief to inform the HM and HW team and any external concerned party of the general scope of the activities. This brief description is also intended to help identifying issues related to HM and HW management. One page summary can be sufficient.

Then, to be able to identify where HM is used in the production process and in what quantity and also to identify the sources of HW and its quantity, a rough material flow diagram should be prepared by the production staff and the HM and HW team. The flow diagram should include **inputs, process step, and outputs including wastes and emissions.**

An example for a well known / simple process is given below. You can prepare your own description and material flow diagram in the blank form.

Example

Production process of XYZ Electroplating Company

General description of the production process

The company is specialized in electroplating of brass fittings for taps and mixers. Brass electroplating line is used and the process is as follows:

1. Forged brass parts are cleaned by ultrasonic degreasing, followed by electrocleaning (anodic and cathodic baths) and water rinsing. Cleansers and cyanide salts solutions are used in the baths.
2. The parts are then transferred to a nickel plating bath containing nickel sulphate (NiSO_4), nickel chloride (NiCl_2), boric acid (H_3BO_4) solution, and then rinsed consecutively in two baths.
3. The parts are then plated in a chrome bath with a chromic acid (CrO_3) solution, followed by rinsing.
4. Finally, the pieces are transferred to a chromium treatment bath. The bath contains sodium metabisulphite (NaHSO_3) to reduce the dragged – out hexavalent chromium (Cr^{+6}) ions to trivalent chromium (Cr^{+3}). The Cr^{+3} ions are washed off in two consecutive rinse baths.

The rinsing and spent solutions are sent to the wastewater treatment unit, which comprises cyanide (CN) treatment unit and physiochemical treatment for the heavy metals.

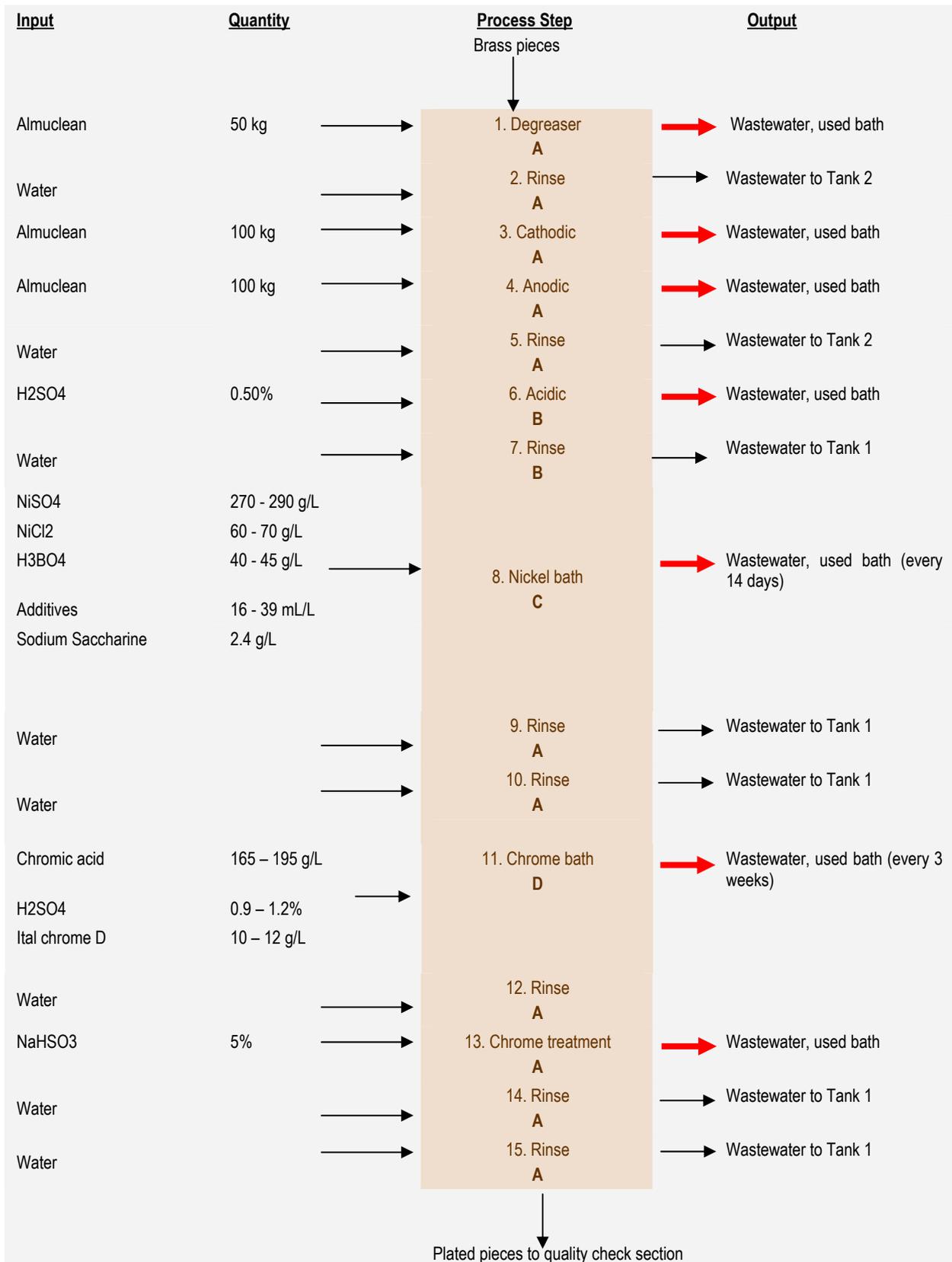


Figure 2: Material Flow Diagram

Legend:

A: 1200 L, B: 1525 L, C: 4000 L, D: 1500 L, Tank 1: Acidic wastewater storage tank, Tank 2: Alkali wastewater storage tank

- **High priority areas** at XYZ Electroplating Company
 - Ni and Cr baths (if to be discharged), since they contain Ni and Cr ions in addition to other pollutants such as Cl and SO₄
 - The wastewater from the rinsing baths together with the treatment system
 - The sludge generated from the treatment system, since it contains high concentrations of Ni and Cr hydroxides that have to be completely stabilized before being disposed in a landfill
 - And chemical spillage on the floor of the electroplating area

III. HAZARDOUS MATERIALS AND HAZARDOUS WASTE SEGREGATION AND STORAGE MANAGEMENT

The segregation and storage of HM and HW is a vital stage in the management process, as many issues may result during storage of HM and HW. For example inappropriate storage conditions, inadequate packaging and stacking, spillage, fire hazards, unlabeled material and mixed storage of material of different properties may have serious effects and could lead to dangerous incidents.

In this section, the company should look at the segregation and storage of HM and HW carefully. The company is required to describe how HM and HW are stored at its facility.

The MoE issued a regulation titled "Hazardous Waste Management and Handling of the year 2002". This regulation covers issues related to the management of HW such as

- Conditions and special requirements for the producers of hazardous wastes
- Storage and collection requirements for hazardous waste
- Emergency plan and procedures
- Records keeping and reporting
- Procedures before transferring HW
- Required measures for packaging HW
- Conditions and special requirements for HW transporters
- Conditions and requirements for managing HW empty containers
- Special conditional requirements for owners and operators of sites dedicated for storage, treatment and disposal of HW

For more information on HW regulations, see <http://www.moenv.gov.jo>

As a generator of HW, the company has to take some actions in order to improve the waste management. As far as segregation is concerned, the company must act with caution to assure that incompatible classes of HW are isolated appropriately in separated areas. The segregation of HW enhances safety and optimizes the disposability.

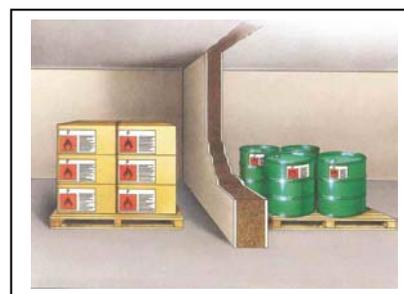
The company should follow the following rules:

- Don't mix HW when you doubt about the result
- Be watchful that resulting mixture could ignite, explode, or produce toxic gases
- Contamination of HW with another may make its treatment more difficult and therefore increase waste management costs

Here you can find a list that intended to indicate the need for special precautions when managing these incompatible HW:

- Oxidizers waste should be kept separate from organics, flammables and combustibles
- Segregate from other materials like cyanides, sulfides, and isocyanates
- Separate halogenated from non-halogenated used solvents and store them in appropriate containers away from heat and ignition sources

- Material exhibiting unstable, highly reactive, explosive or extremely toxic properties should be kept separate from other waste and stored in an isolated area prior to disposal pick up



[Source: carbotech AG, Fredy Dinkel]

The following are examples of incompatible hazardous materials:



Hazardous Material	Symbols or example
Flammables and oxidizers	 
Elemental metals and hydrides	Mercury (Hg) & Sodium Borohydride (NaBH ₄)
Cyanides and acids	Sodium Cyanide (NaCN) & Hydrochloric Acid (HCl)
Sulfides and acids	Sodium Sulfide (Na ₂ S) & Hydrochloric Acid (HCl)
Bases and acids	Sodium Hydroxide (NaOH) & Sulfuric Acid (H ₂ SO ₄)
Flammables and acids	 
Chlorine compounds and acids	Calcium Hypochloride (Ca (OCl) ₂) & Sulfuric Acid (H ₂ SO ₄)
Chlorine compounds and amines	Sodium Hypochloride & Aniline
Air or water reactive and anything	Calcium carbide (CaC ₂) and Water (H ₂ O)
Organic peroxides and anything	 

According to the Jordanian Hazardous Waste Management and Handling Regulation of the year 2002, the HW and HM must be stored in safe conditions. These include:

- Differentiate HW from non HW using Figure 1
- Segregate liquid HW from solid HW
- Store the HW and HM separately in compatible groups to avoid the possibility that their vapors or gas react together (e.g. of incompatible materials: oxidizers and flammables)

- Store all compatible HM in one place to monitor closely their use and limit and control the access to this area (do the same with HW)
- Respect the stocking conditions recommended on MSDS available from suppliers
- Use containers made of, or lined with, material that is compatible with HW to be stored
- Maintain the containers in good condition and change the leaking ones
- Keep the containers closed all the time except when removing wastes
- Never completely fill any container containing liquid hazardous waste, allow at least two inches of air space near the top
- Label correctly the HW containers by using the words “Hazardous Waste” or according to the hazard class in order to prevent mistakes on the part of the employees
- Put in the storage area warning signs describing precautionary and preventive measures
- Storage of HW in fume hoods or under sinks is not recommended
- Provide sufficient ventilation to keep humidity, temperature and concentration of fumes and vapors at a low level



[Source: carbotech AG, Fredy Dinkel]

- Make sure that the floor of the storage area is made of non-permeable material to prevent contamination of soil and groundwater and keep the area clean



[Source: Hazardous Waste Management Training Kit of UNEP, David Wilson, Fritz Balkau, Maggie Thurgood]

- Ensure that storage sections are provided with containment area to contain any spillage. The floor of the containment area shall be lined with a material compatible with the stored material



[Source: carbotech AG, Fredy Dinkel]

- Pay attention that the floor of the storage area is flat to allow easy handling of HM or HW containers to prevent spills
- Equip the storage area with portable fire extinguishers and alarm system
- Leave enough space between containers to facilitate the inspection and the handling
- Make sure that the storage area there has at least 2 clearly marked exits (e.g. doors, windows) that are always accessible (not blocked by materials or locked)
- Containers must be inspected weekly for signs of leaks, corrosion, or deterioration
- Inspect regularly (at least weekly) the storage areas of HW and HM
- Mark the containers with the starting date when the HW were generated
- Ensure that flammable substances are not exposed to direct sunlight in order to avoid self-inflammation
- Do not place ignitable or reactive waste in tanks unless certain precautions are taken
- Carry out regular checks and keep written records

An appropriate storage requires a labeling system. The Hazardous Waste labeling must clearly identify the following information:

- The content of the container
- The hazard symbol of the contents
- The degree of the hazard of the contents
- Initial date of the collection and the closure date
- Initial date of the collection and the closure date
- The name and the address of the waste generator
- In addition, the label must contain the following statement

“ Hazardous Waste, shall be disposed off in an authorized manner only, if found in unauthorized area call the Police (191), Civil Defense (199), or the Ministry of Environment immediately ”



[Source: Hazardous Waste Management Training Kit of UNEP, David Wilson, Fritz Balkau, Maggie Thurgood]

The following flowchart gives some guidelines for labeling:

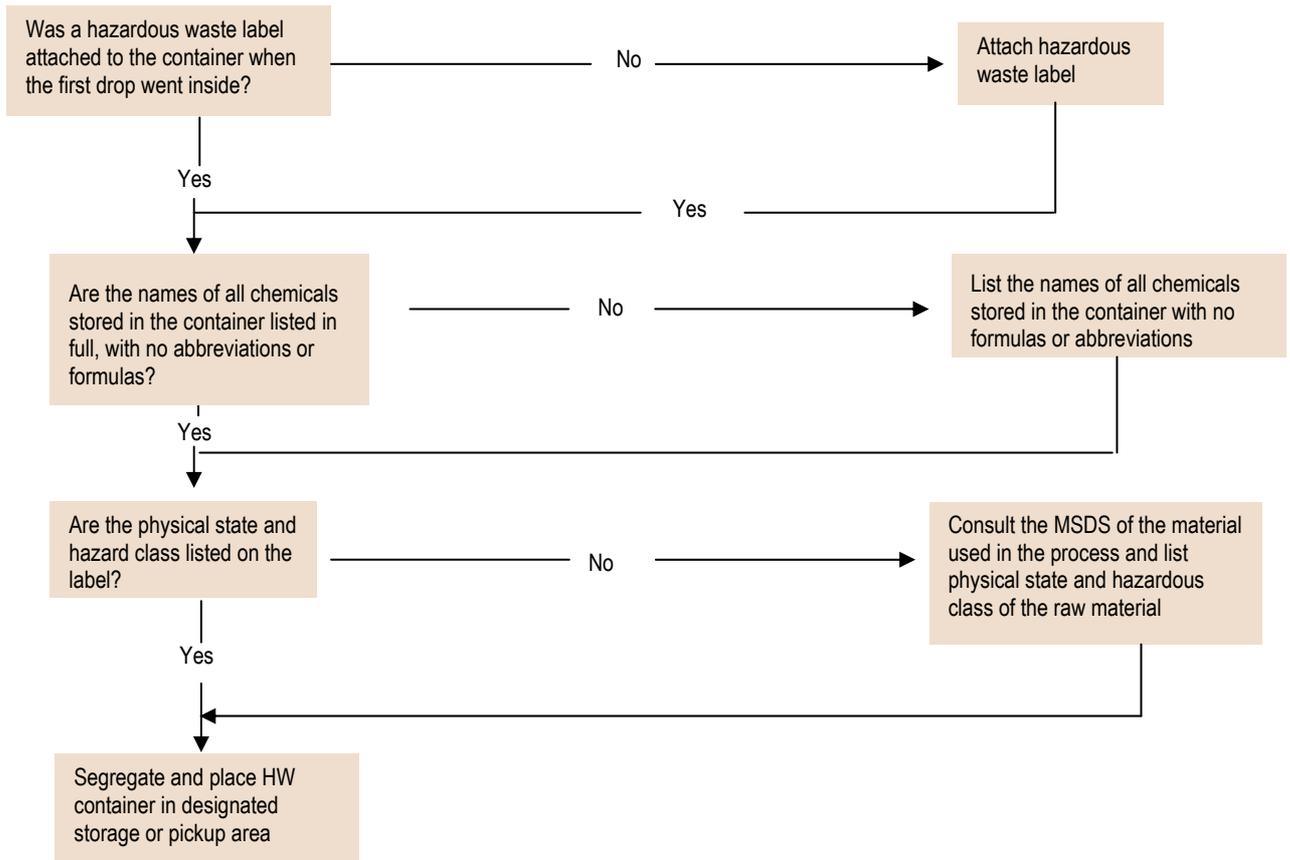


Figure 3: Flowchart Illustrates the Labeling Process [Adapted from California Institute of Technology]

To label your HW containers you have to use the following label that could only be used for non-mixed chemicals:

Hazardous Waste	
Contents:	
1. _____	-%
2. _____	-%
3. _____	-%
4. _____	-%
5. _____	-%
6. _____	-%
Hazard(s): <input type="checkbox"/> Ignitable <input type="checkbox"/> Reactive <input type="checkbox"/> Corrosive <input type="checkbox"/> Toxic	
Date of Accumulation: _____/_____/_____	Generator name, address and tel. No.
<ul style="list-style-type: none"> This container shall be disposed off in an authorized manner only If found in unauthorized area, call (199 or 191) or call MOE (06 5350149) 	

Figure 4: Example of Labeling of Hazardous Waste

In the table below, the quantities available at the store(s) during a period of time (monthly, quarterly) may be well estimated based on quantities coming in and going out of the store(s). The types and conditions of storage shall be mentioned to enable assessing the soundness and adequacy of the storage process. The logbook has to be prepared for the storage of **raw hazardous materials and hazardous wastes**. The example below is for storage of raw materials. It is up to the company adapt the table below to include the applicable information that concerns and fits the company's activities. This table can also serve as inventory of inputs and outputs for the company.

Example

Table 3: Example of Storage of Raw Hazardous Materials for the Period: **Jan 1 – April 1, 2004**

Store Area No.	Material Name and Concentration	Physical State ¹	Input Quantity ²	Output Quantity	Material on Hand	Wastes during Storage	Storage Structure ³ and Area	Storage Environmental Controls ⁴	Container Size and Type ⁵	Storage Environment ⁶	Storage Safety and Emergency Response Features
1.	Hydrochloric Acid (HCl) (95 %)	Liquid	10,000 l	6,000 l	3,997 l	3 l	Room/ 6X10X6 m	Mechanical Ventilation/ No Other Controls	12, 000 l / Acid Resistant Stainless Steel Tank	Indoor	First Aid Kit Portable Fire Extinguishers, Shower, Eyewash, spillage collection containment tools
2.	Sodium Hydroxide (NaOH) (98 %)	Solid	24,000 kg	10,000 kg	13,960 kg	40 kg	Room / 12X20X6 m	None	Polypropylene drums (200 l)	Indoor	First Aid Kit Portable Fire Extinguishers, Shower, Eyewash, spillage collection tools

Legend:

1. Physical State: Solid, liquid, gas, sludge
2. Quantity: kg, ton, l
3. Storage Structure: Warehouse, room, shipping container, metal cabinets.
4. Storage Environmental Controls: ventilated, temperature.
5. Container Type: Metal or plastic.
6. Storage Environment: Indoor or Outdoor

IV. POTENTIAL IN HOUSE HAZARDOUS WASTE TREATMENT ACTIVITIES

Waste prevention is the best way to protect the environment. However, even after an industrial facility has established an effective waste minimization, segregation, and management program, hazardous wastes may still be generated that require on-site or off-site treatment or final disposal.

Some enterprises may have on-site small treatment facilities for hazardous waste. In this section, the company would describe the available treatment facilities including treatment technology, waste treated, capacity of the treatment system, output, and final disposal practices.

Some of on-site treatment technologies are intended to allow recovery and recycling of HW such as distillation and reuse of organic solvents. Other types provide treatment to allow safer final disposal of the waste such as the treatment of wastewater containing heavy metals by neutralization and precipitation.

Table 4 provides an overview and a simple description of common treatment technologies that can be used for specific wastes. More detailed information about the treatment technologies is available in many technical guidelines that illustrate specialized treatment technologies for HW such as Basel Convention Technical Guidelines on Hazardous Waste Physico-Chemical Treatment / Biological Treatment, see <http://www.basel.int/meetings/sbc/workdoc/techdocs.html>

Table 4: Summary of Common Hazardous Waste Treatment Technologies ⁽¹⁾

Technology	Description	Waste Treated	Relative Cost
Biological Treatment	Uses micro-organisms to break down hazardous organic compounds in a waste stream and make the waste less toxic.	Organics or non-metallic inorganic (e.g., degradable inorganic that contain the elements of phosphorus, nitrogen and sulfur)	Medium to High
Carbon Adsorption	Chemical process that removes hazardous substances from the waste using specially treated carbon. Particularly effective in removing organic compounds from liquid wastes.	Non-metallic inorganic, organo-metallic and/or organic constituents (HW is only adsorbed and must be treated afterwards)	Medium
Incineration in a hazardous waste incinerator or a cement kiln	Destroys waste or makes it less hazardous through mineralization and Reduces the volume. Residues are inorganic materials and Energy of the waste can be reused	Organic constituents	High for a hazardous waste incinerator, low for incineration in a state of the art cement kiln
Deactivation	Removes the hazardous characteristics of a waste due to its ignitability and / or reactivity. Includes controlled reaction with water for highly reactive inorganic / organic chemicals with precautionary controls for protection of workers from potential violent reactions, as well as precautionary controls for potential emissions of toxic/ignitable levels of gases are released during the reaction.	Ignitable and/or reactive wastes	Low

Technology	Description	Waste Treated	Relative Cost
Neutralization	Neutralization with the following reagents (or waste reagents) or combinations of reagents; acids; bases; water (including wastewaters) resulting in a pH greater than 2 but less than 12.5 as measured in the aqueous residuals.	Corrosive wastes	Low
Chemical Oxidation	Chemical or electrolytic oxidation makes a waste less toxic by combining it with oxygen. Utilizes the following oxidation reagents (or waste reagents) or combinations of reagents; hypochlorite (e.g., bleach); chlorine; chlorine dioxide; ozone or ultraviolet light assisted ozone; peroxides; persulfates; perchlorates; or permanganates.	Organic constituents	Low to Medium
Precipitation	Chemical precipitation as insoluble precipitates of oxides, hydroxides, carbonates, sulfides, sulfates, chlorides, fluorides, or phosphates. The following reagents (or waste reagents) are typically used alone or in combination; lime (i.e., containing oxides and/or hydroxides of calcium and/or magnesium; caustic (i.e., sodium and/or potassium hydroxides; soda ash (i.e., sodium carbonate); sodium sulfide; ferric sulfate or ferric chloride; alum; or sodium sulfate.	Metals and other inorganic (leads to up concentration of metals)	Low
Recovery (Metals)	Utilizing one or more of the following direct physical/removal technologies; ion exchange; resin or solid (e.g., zeolites) adsorption; reverse osmosis; chelation/solvent extraction; freeze crystallization; ultrafiltration; and/or simple precipitation (e.g., crystallization).	Metals and other inorganic	Medium
Recovery (Organics)	Utilizes one or more of the following technologies; distillation; thin film evaporation; steam stripping; carbon adsorption; critical fluid extraction; liquid-liquid extraction; precipitation/crystallization (including freeze crystallization); or chemical phase separation techniques (e.g., addition of acids, bases, demulsifiers, or similar chemicals)	Organics	Medium to High
Reduction	Utilizes the following reducing reagents (or waste reagents) or combinations of reagents; sulfur dioxide; sodium, potassium, or alkali salts or sulfites, bisulfites, metabisulfites and polyethylene glycols; sodium hydrosulfide; or ferrous salts.	Commonly used for the reduction of hexavalent chromium to the trivalent state	Low to Medium

Technology	Description	Waste Treated	Relative Cost
Solidification and Stabilization	Removes wastewater from a waste or changes it chemically, making it less likely to be transported by water. May use the following reagents (or waste reagents) or combinations of reagents; Portland cement; or lime (e.g., fly ash and cement kiln dust)—this does not preclude the addition of reagents (e.g., iron salts, silicates and clays) designed to enhance the set/cure time and/or compressive strength, or to overall reduce the leachability of the metal or inorganic.	Metals and other inorganic	Low
Solvent Extraction	Separates hazardous constituents from oily wastes, oils, sludge and sediments to reduce the volume of waste requiring disposal	Oily wastes, oils, sludge, and sediments	Medium to High
Steam Stripping	Utilizes direct application of steam to the wastes, resulting in a condensed extract high in organics that must undergo either incineration, reuse as a fuel, or other recovery/reuse, and an extracted wastewater that must undergo further treatment as appropriate to the type of waste.	Organics from liquid wastes	Medium
Thermal Treatment	Uses elevated temperatures as the primary means of changing the chemical, physical, or biological character of a waste. (Examples include wet air oxidation, molten salt pyrolysis, and calcination).	Specific hazardous organic materials	Medium to High

(1): Adopted from the Manual of Hazardous Waste Management Training Course, Wageningen, Netherlands, 2003.

Utilizing the information given above and the existing conditions in the enterprise, the HM and HW team can describe the existing HW treatment as shown in the following example (Table 5).

Example

Table 5: Available Hazardous Waste Treatment Facilities at XYZ Electroplating Company

Hazardous Waste	Treatment Technology	Capacity	Output	Final Disposal Way
Heavy metals in wastewater	Physical chemical treatment (neutralization + precipitation)	1 m ³ of wastewater per day	Treated wastewater (no metals)	Reuse for irrigation after checking full conformity with standards.
			Sludge containing heavy metals hydroxides	Disposal in coordination with MoE.

V. EMERGENCY REQUIRMENTS AND PROCEDURES

Depending on the type and size of the company, the emergency requirements will vary. The following are the general requirements for emergencies according to the Ministry of Environment Regulation for Hazardous Waste Management and Handling Regulation of the year 2002:

- Emergency response kits should be available on site to deal with HW leakage and spill such as adsorbing material and personal protection devices
- Appointing a qualified emergency officer to be responsible for the following:
 1. Deal with HW emergencies and the emergency procedures related to the work mission during ordinary work conditions or during emergencies conditions
 2. Respond to any emergency case and conduct the following:
 - In the case of fire occurrence, an immediate call to the Civil Defense and then work on putting off the fire
 - In the case of leakage or spill, it should be contained immediately and cleaned up
 - Secure entry to the spill area (NO ENTRY)
 - Use suitable personal protection devices and consult MSDS for dealing with spills
 - Protect the storm and sanitary sewer networks and surface water from the spilled material
 - Deal with the absorbed material or any of the polluted material as HW
- In the case of explosion or other accidents that may threaten the human health or environment outside the company, or in case that spill may reach the surface water, the producer shall immediately do the following:
 1. Call the Civil Defense, MoE and / or any other related authority, see Annex 2
 2. Fill the required applicable report with the following information:
 - Date, time and type of the accident (fire, explosion, spill, etc.)
 - Quantity and type of waste
 - Magnitude of damage (if occurred)
 - The estimated quantities of the recovered material and the disposal method adopted

VI. TRANSPORT OF HAZARDOUS WASTE

Transport of HM and HW in a safe manner is an important aspect to protect human health, environment and real property. Jordan Hazardous Waste Management and Handling Regulation for the year 2002 includes instructions and conditions for hazardous waste transportation. These instructions cover the required procedures before and during HW transportation.

The instructions include the following:

- The producer shall package the waste in a safe manner where the container and packaging material should be in a good condition and compatible with the waste.
- The producer shall fill the manifest completely, see Annex 5
- The producer shall label the waste container according to section III of the guide
- Then to transport the labeled containers, please note that:
 - ➔ The HW shall only be transported using licensed vehicles
 - ➔ Vehicles used for transporting HW shall not pass through residential areas
 - ➔ Drivers of these vehicles shall have special training to deal with emergencies involving HW
 - ➔ The vehicles should have the following properties:
 - It should be in a good working condition and supplied with all required safety equipment
 - The required capacity for the waste being hauled
 - It should have clean marks that indicate the degree of their loads and the best way to do during emergency

The above requirements governs the transportation of HW in Jordan. It is the responsibility of the licensed transporters to comply with these requirements. Therefore, consult the Ministry of Environment for the required permits and proper transportation means.

The international movement of HW is controlled by Basel Convention for Transboundary Movement of HW, which is also applied by the Jordanian authorities. Therefore, contact the Ministry of Environment for cases of this regard.

VII. EVALUATION AND IMPROVEMENT OF HAZARDOUS MATERIALS AND WASTE MANAGEMENT

A good HM and HW management system shall be based on the following priorities: cleaner production, reuse and recycling, environmentally sound treatment and safe final disposal. The company has to consider these actions because they will minimize waste, help anticipate and avoid any problem of disposal and thus save costs. Moreover, other benefits could be attained:

- Increased productivity through more efficient use of raw materials and improved processes
- Reduction of HW disposal costs, due to reduction of quantities and types of HW
- Reduction of scope and cost of activities pertaining to demonstrating compliance with regulations
- Efficient management of HW indoor, thus improved work environment
- Improvement of the workers safety and health and reduction in associated costs by minimizing exposure to HW

In the following sections, priority ways for management of HW are outlined. Further information and case studies are available in references, see Annex 6.

1. Cleaner Production

The way to reduce or to eliminate the HW is to avoid generating them in the first place. There are several terms used to describe the prevention approach, The United Nations are using Cleaner Production, the USA are using the term Pollution Prevention, the Japanese created Green Productivity and the Europeans started with Waste Minimization. However, they all refer to one common idea that minimizing HW can help the company to reduce waste management costs and impact on the environment.

Cleaner production is an environmental management approach that encourages identification and implementation of opportunities to increase efficiency and decrease or eliminate the use of hazardous materials and generation of hazardous wastes. It takes reduction of wastes up the production chain, incorporating source reduction into the design, manufacturing and even packaging of a product, which represents a fundamental change in how industry thinks about and plans for its products and processes. It is certainly something to aim for as your hazardous waste management program develops.

The separation of waste and sorting at source, may be accomplished through different ways such as improvements in housekeeping, substitution of less toxic raw materials, maintenance, inventory control, labeling of stored material, process or procedure modifications, reformulation or redesign of products, equipment or technology modifications, and training. Through cleaner production, industries can reduce discharges of hazardous wastes to the environment and the need for the traditional end-of-pipe treatment.

Reduction of hazardous waste at the source (Cleaner Production) is the most important step, because it emphasizes on avoiding the generation of waste at source.

Applying cleaner production approach will result in:

- Reducing or eliminating generation of hazardous waste
- Preventing spills and accidental releases of hazardous waste
- Reducing worker and public exposure and health impacts
- Enhancing efficiency and prevent product loss

- Reducing the costs associated with procurement of hazardous materials and hazardous waste management and disposal
- Conserving raw materials and energy
- Reducing the quantity and toxicity of all emissions and wastes from production processes
- Reducing environmental impacts throughout the life cycle of a product, from raw material extraction through use to its ultimate disposal; and
- Incorporating environmental concerns into the design and delivery of services

Here are some simple actions to be taken for the cleaner production of HW:

- Inspect containers upon receipt, and reject leaking or damaged ones.
- Avoid losses of HM during storage by ensuring proper storage way and conditions.
- Use HM more efficiently and label them to prevent the generation of unknown wastes.
- Sort the HW at source and avoid mixing HW with the other types of company wastes.
- Separate HW from other waste in order to avoid contamination and unnecessary increase of the toxic waste.
- Provide appropriate containers for the HW collection in sufficient numbers and sizes.
- Avoid keeping unnecessary large quantity of HM stock on hand and adopt a “first-in, first-out” policy.
- Try to regenerate any solvents used in the production process (in a safe manner) in order to recover valuable material.
- Repair machines that leak oil to reduce clean up and disposal of oily waste.
- Select and optimize the processes to prevent scraps or waste products.
- Maintain and repair equipment and materials before replacing them.
- Consider the quantity and type of waste to be generated when selecting new equipment.
- Identify and use less hazardous or non-hazardous materials that are just as effective for your purposes.
- Review the use of highly toxic, reactive, carcinogenic, or mutagenic materials to determine if safer alternatives could be used.
- Substitute biodegradable non-toxic detergents for cleaning solvents.
- Review your procedures at least annually to see if quantities of HM and/or HW could be reduced.
- Inform your employees about the need to prevent spills and losses.
- Check regularly if the separation of wastes is respected and the good housekeeping practices are maintained.
- Control the access to storage areas and make routine containers inspections.
- Be prepared to respond promptly to spills.
- Recycle HW whenever possible.
- Train your employees regarding HM and HW management on regular basis.

2. Reuse and Recycling

Reuse and recycling conducted in an environmentally sound manner, can reduce the need for treatment or disposal, and conserve energy and resources. Industrial hazardous wastes can find beneficial reuse as effective substitutes for raw materials or as a substitute for commercial chemical products. For example, a manufacturer whose operations generate an acid as a by-product of production, can recycle that acid for use

as a raw material in paints and solvents or for use in the scrubber systems of power plants to help reduce emissions of sulfur dioxide. Many companies have installed cost effective distillation stills to recover usable solvent for on-site reuse, others have equipment to capture (recover) the silver from photographic wastes for resale and reuse. However, care should also be taken to ensure that the reuse / recycle is undertaken according to safe environmental practices and that the environmental emissions are not higher when compared with the use of new materials.

A prerequisite for any reuse and recycling is a strict segregation of all wastes produced in the company. Without this measure, hazardous wastes are mixed and cannot be recycled or reused.

Examples of actions to consider for recycling or reusing of HW:

- Identify the possibility for reusing and recycling of HW.
- Regenerate solvents used in the production process in order to recover valuable material.
- Purchase compressed gas cylinders from manufacturers who will accept the return of empty or partially used cylinders.
- Do not contaminate the oil with solvents or heavy metals

3. Environmentally Sound Treatment and Final Disposal

Environmentally sound treatment to reduce the volume or the potentially harmful environmental impacts of hazardous waste comes at the last option of HW management. Wastes that cannot feasibly be reduced at the source or recycled should be treated to reduce the hazard and/or volume of the waste. Treatment should be conducted in accordance with national or international environmental regulations. Treatment precedes disposal, which is the least favored option.

For the environmentally sound treatment and the final disposal of hazardous wastes, the following technical principles should be followed:

- a. Treatment systems should only produce two types of products, material that can be reused or recycled and material which is suitable for final disposal.
- b. Hazardous material should never be diluted, treatment facilities should make sure that hazardous material is up-concentrated.
- c. In principal, liquid and hazardous organic material (carbon content more than 5%) should never be disposed in a landfill. Liquid inorganic hazardous waste must be up-concentrated and dewatered before disposing in a landfill. Such material can be destructed by proper incineration, this method is favored also as it ensures complete final disposal when done in a proper way and provides a source of energy.

A hazardous waste management committee consisting of representatives of relevant ministries and other organizations is established at the Ministry of Environment. The committee manages issues arising from SMEs and other economic sectors in Jordan. Thus, SMEs can consult the Ministry for administrative and technical issues. Additionally other institutions can also be consulted according to the subject of concern, see Annex 2.

Concerning the final treatment and disposal of HW, Jordan is in the process of constructing a centralized treatment and disposal facility for all types of hazardous wastes generated in the country. However, at present, the Ministry under certain conditions of urgency would accept some amounts of HW at the facility for intermediate storage or disposal.

The following flowchart illustrates the procedure to be followed by the hazardous waste generators for treatment and final disposal

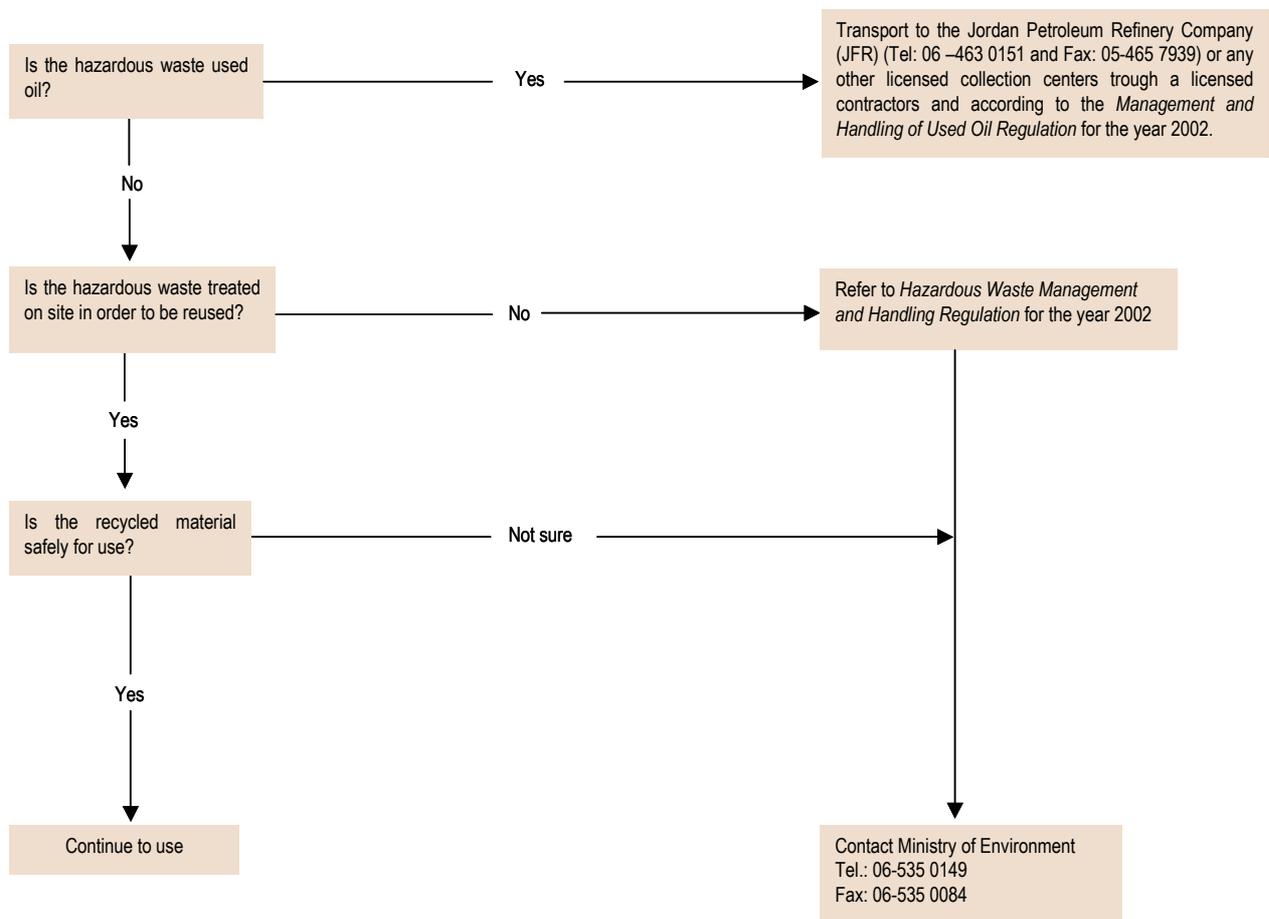


Figure 5: Procedure to be followed for Hazardous Waste Disposal

VIII. ACTION PLAN FOR THE IMPLEMENTATION OF NEW MEASURES

Based on the information established the previous sections, the company should be able to identify major areas of improvement taking the mentioned strategy of cleaner production into account. In that respect, the measures chosen by the company can be written down formally in an action plan. The action plan will help the company in implementing the identified measures and to meet environmental objectives.

Measures can be divided into the following:

- Cleaner production
- Segregation
- Storage
- Reuse and recycling
- Treatment
- Final disposal

The company should develop an action plan to make sure that new options are implemented in a proper manner.

The action plan will contain the following information:

- The measures for improving a situation in the company
- Responsible person(s)
- Time frame
- Investment (capital) and running cost
- Expected environmental benefits

Example

Table 6: Action Plan for the XYZ Electroplating Company

Situation/ Problem	Measure	Responsible Person(s)	Time Frame	Investment and Running Cost	Expected Environmental Benefits
Liquid chemical spillage on floor	<ul style="list-style-type: none"> • Clear instructions to avoid spillage are given and displayed • Containment area for rinsing and electroplating baths 	Eng. M. XYZ (production manager)	1.5 months	300 JD (investment cost only)	<ul style="list-style-type: none"> • Protect health of employees • Protect ground and surface water from pollution • Improve work safety

IX. MAINTAINING SOUND MANAGEMENT OF HAZARDOUS WASTE MEASURES

1. On-going Monitoring

For the decided actions taken by the company, a plan for the follow-up and the monitoring should be made to see the effectiveness of the implemented actions and the status of the HM and HW management system in the company.

The monitoring plan should not be only for decided actions taken by the company, but it should include all other aspects related to HM and HW operations in the company

The only way to continuously improve HM and HW is to monitor the consumption of resources and waste streams, and to present the results to management and employees. The management should approve the plan for on-going monitoring and would accordingly issue instructions for further implementation.

Example

Table 7: Monitoring List of Implemented Actions at XYZ Electroplating Company

Implemented Measures	On- going Monitoring Plan
Containment area for rinsing and electroplating baths	<ul style="list-style-type: none">• Regular inspections for containment area for cracks• Quantities of consumed or used chemicals in the process• Record of spillage / accidents (quantity of chemicals lost)

Example

Table 8: Monitoring List of other HM and HW Aspects at XYZ Electroplating Company

Existed Measures	On- going Monitoring Plan
Treatment unit	<ul style="list-style-type: none">• Analyze the treated wastewater for heavy metals (Ni, Cr, Cu, etc...) to comply with Jordanian Standards for water used in irrigation (JS: 202 / 2004)

2. Follow-up

For continual improvement and to ensure sustainability of the system, the company should always have follow up actions. These may include periodical auditing on the HM and HW, establishing unit dedicated to HM and HW management, training and awareness raising of the staff concerned. In the following form, the company can fill in the envisaged follow up actions noting that these actions shall be revised and updated on a continuous basis and shall be approved by the management.

Example

Table 9: Envisaged Follow up Actions by the Company at XYZ Electroplating Company

Envisaged follow up actions by the company:
<ul style="list-style-type: none">• During year one of the implementation, perform at least 3 audits to check proper adaptation / implementation of the system
<ul style="list-style-type: none">• On a yearly basis, revisit the action plan and add necessary modifications (upgrading)
<ul style="list-style-type: none">• Look always for cleaner production potentials opportunities
<ul style="list-style-type: none">• Keep employees up to date with new information / resources for HM and HW management through access to web sites or related training

If you have still open questions or problems with the management of your hazardous material or waste, please do not hesitate to contact the Ministry of Environment or other organizations as shown in Annex 2.

X. List of Annexes

Annex 1: Harmful and Hazardous Waste Categories that are to be Controlled in Jordan

Annex 2: List of Technical Resource Institutions in Jordan

Annex 3: Blank Tables and Forms to be Used/ Adopted by the Company

- Company Profile
- Hazardous Materials and Hazardous Waste Management Team
- General Description of the Production Process
- Material Flow Diagram
- Storage of Hazardous Raw Materials
- Storage of Hazardous Waste
- Available Hazardous Waste Treatment Facilities
- Action Plan
- On-going Monitoring
- Follow up

Annex 4: Material Safety Data Sheet

Annex 5: Manifest for Transportation and Disposal of Hazardous Waste

Annex 6: Reference for Pollution Prevention and Hazardous Waste Management

Annex 7: Bibliography

Annex 1

Harmful and Hazardous Waste Categories that are to be Controlled in Jordan

Code	Categories of hazardous waste to be controlled
Y1	Clinical wastes from medical care in hospitals, medical centers and clinics
Y2	Wastes from the production and preparation of pharmaceutical products
Y3	Waste pharmaceuticals, drugs and medicines
Y4	Wastes from the production, formulation and use of biocides and phytopharmaceuticals
Y5	Wastes from the manufacture, formulation and use of wood preserving chemicals
Y6	Wastes from the production, formulation and use of organic solvents
Y7	Wastes from heat treatment and tempering operations containing cyanides
Y8	Waste mineral oils unfit for their originally intended use
Y9	Waste oils/water, hydrocarbons/water mixtures, emulsions
Y10	Waste substances and articles containing or contaminated with polychlorinated biphenyls (PCBs) and/or polychlorinated terphenyls (PCTs) and/or polybrominated biphenyls (PBBs)
Y11	Waste tarry residues arising from refining, distillation and any pyrolytic treatment
Y12	Wastes from production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish
Y13	Wastes from production, formulation and use of resins, latex, plasticizers, glues/adhesives
Y14	Waste chemical substances arising from research and development or teaching activities which are not identified and/or are new and whose effects on man and/or the environment are not known
Y15	Wastes of an explosive nature not subject to other legislation
Y16	Wastes from production, formulation and use of photographic chemicals and processing materials
Y17	Wastes resulting from surface treatment of metals and plastics
Y18	Residues arising from industrial waste disposal operations Wastes having as constituents:
Y19	Metal carbonyls
Y20	Beryllium; beryllium compounds
Y21	Hexavalent chromium compounds
Y22	Copper compounds
Y23	Zinc compounds
Y24	Arsenic; arsenic compounds
Y25	Selenium; selenium compounds
Y26	Cadmium; cadmium compounds
Y27	Antimony; antimony compounds
Y28	Tellurium; tellurium compounds
Y29	Mercury; mercury compounds
Y30	Thallium; thallium compounds
Y31	Lead; lead compounds
Y32	Inorganic fluorine compounds excluding calcium fluoride

Code	Categories of hazardous waste to be controlled
Y33	Inorganic cyanides
Y34	Acidic solutions or acids in solid form
Y35	Basic solutions or bases in solid form
Y36	Asbestos (dust and fibers)
Y37	Organic phosphorus compounds
Y38	Organic cyanides
Y39	Phenols; phenol compounds including chlorophenols
Y40	Ethers
Y41	Halogenated organic solvents
Y42	Organic solvents excluding halogenated solvents
Y43	Any congener of polychlorinated dibenzo-furan
Y44	Any congener of polychlorinated dibenzo-P-dioxin
Y45	Organohalogen compounds other than substances referred to in this Annex (e.g. Y39, Y41, Y42, Y43, Y44)

For detailed subcategories, consult Basel Convention classification document.

Annex 2

List of Technical Resource Institutions in Jordan

Name	Telephone	Fax	Web Site
Ministry of Environment	06 5350149	06 5350084	http://www.moenv.gov.jo
Ministry of Health	06 5685397	06 5666147	http://www.moh.gov.jo
Ministry of Agriculture	06 5686151	06 5686310	http://www.moa.gov.jo
Ministry of Water and Irrigation	06 5680100	06 5679143	http://www.mwi.gov.jo
Ministry of Labor	06 5629130	06 5685055	http://www.mol.gov.jo
Civil Defense	199 or 06 5661111	06 5667717	http://www.cdd.gov.jo
Royal Scientific Society / Environmental Research Center	06 5344701	06 5340373	http://www.rss.gov.jo

In addition to a number of Jordanian Universities

Annex 3

Blank Tables and Forms to be Used / Adopted by the Company

Company Profile

Please complete the table to describe your company profile

Name of the company		
Address		
Telephone number		
Fax number		
E-mail		
Contact person		
Number of employees and working hours scheme		
Main raw materials		
Main product(s)		
Departments		
Available Environmental Features / Facilities		
Other Important Information		
Date		

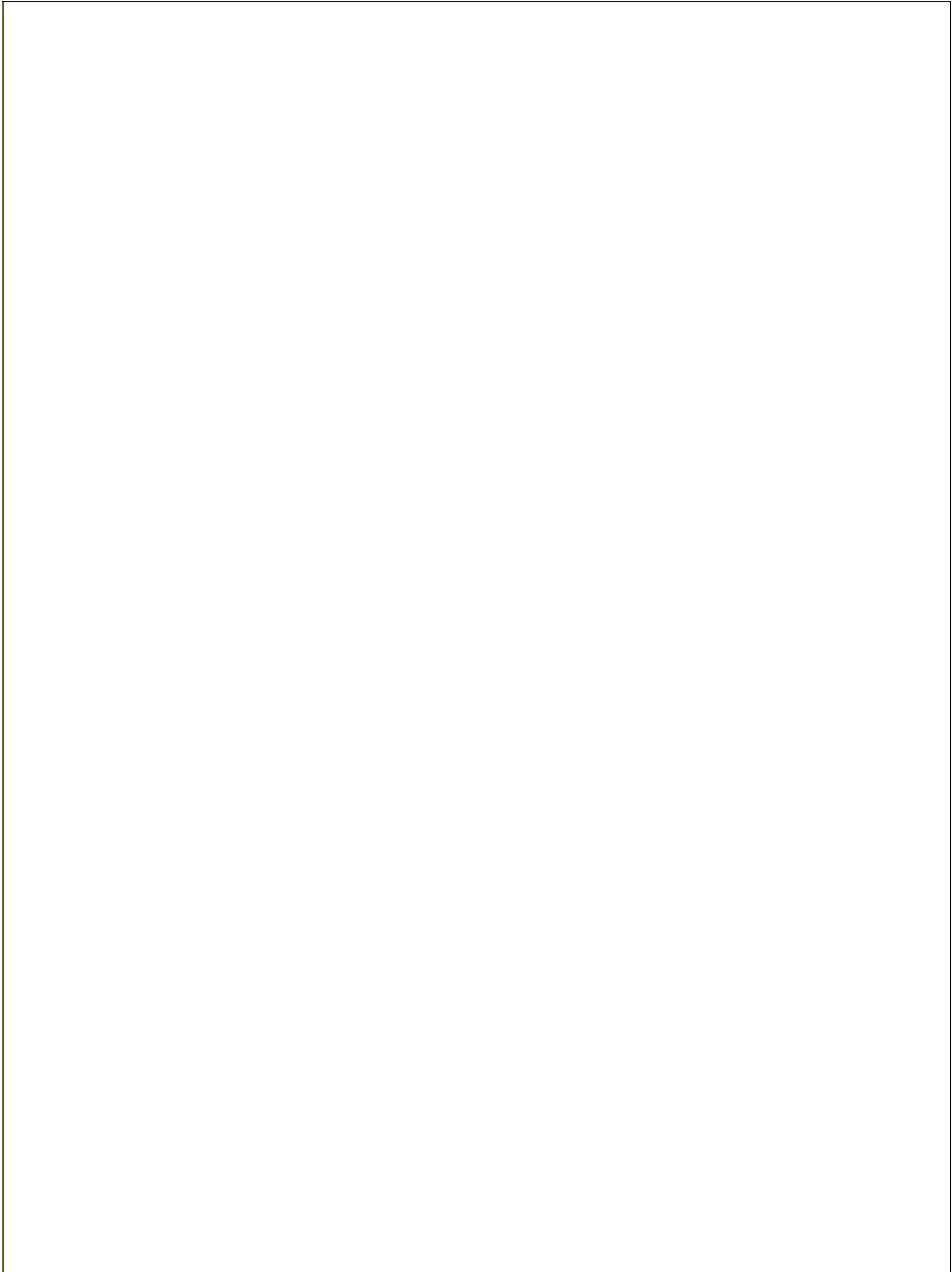
Hazardous Materials and Hazardous Waste Management Team

Please list the persons in charge of handling and managing HM and HW at your company, their positions, responsibilities, and qualifications.

Name and Position	Responsibility	Qualifications
Name: Position:	1. 2. 3.	
Name: Position:	1. 2. 3.	
Name: Position:	1. 2. 3.	

Material Flow Diagram

Please draw a flow diagram for the process you described

A large, empty rectangular box with a thin black border, intended for drawing a material flow diagram. The box is currently blank.

Storage of Hazardous Raw Materials for the Period

Please complete the table for the hazardous raw materials storage. You can use this table as much as you need.

Area Store No.	Material Name / Concentration	Physical State (Liquid, Solid, Gas, Sludge)	Input Quantity	Output Quantity	Material on Hand	Wastes during storage	Storage Structure / Area	Storage Environmental Controls	Container Size / Type	Storage Environment	Storage Safety and Emergency Response Features

Storage of Hazardous Wastes for the Period

*Please complete the for the **hazardous wastes storage**. You can use this table as much as you need.*

Area Store No.	Material Name / Concentration	Physical State (Liquid, Solid, Gas, Sludge)	Input Quantity	Output Quantity	Material on Hand	Wastes during storage	Storage Structure / Area	Storage Environmental Controls	Container Size / Type	Storage Environment	Storage Safety and Emergency Response Features

Available Hazardous Waste Treatment Facilities

Please fill the table regarding all waste streams generated at your company, the applied treatment technology and final disposal for each hazardous waste stream.

Hazardous Waste	Treatment Technology	Capacity	Output	Final Disposal Way

Action Plan

Please fill the table to establish the outline of the HM and HW action plan at your company.

Situation / Problem	Measures	Responsible Person(s)	Time Frame	Investment and Running Cost	Expected Environmental Benefits

On-going Monitoring

Please fill the following table regarding the implemented actions at your company

Implemented Measures	On-going Monitoring Plan

Please fill the following table regarding other HM and HW aspects at your company

Existed Measures	On-going Monitoring Plan

Annex 4

Material Safety Data Sheet

Material Safety Data Sheet (MSDS) is required under the [OSHA Hazard Communication Standard](#). The MSDS is a detailed informational document prepared by the manufacturer or importer of a hazardous chemical. It describes the physical and chemical properties of the product. MSDS contains useful information such as flash point, toxicity, procedures for spills and leaks, and storage guidelines. Information included in a Material Safety Data Sheet aids in the selection of safe products, helps you understand the potential health and physical hazards of a chemical and describes how to respond effectively to exposure situations. Although there is an effort currently underway to standardize MSDS, the quality of individual MSDS varies. A MSDS may be useful but it can not substitute for prudent practices and comprehensive risk management [Source: *Picosearch LLC, USA*].

Annex 5

Manifest for Transportation and Disposal of Hazardous Waste

Manifest for Transportation and Disposal of Hazardous Waste

Copy To	Ministry Of Environment
Copy To	Waste Generator
Copy To	The Treatment, Storage and Disposal Facility
Copy To	Transporter

Ministry Of Environment
Tuba TSDF
Tel.: 5350149
Fax: 5350084
P.O. Box 1408
Zip Code: 11941
Amman – Jordan

1. Generator Information

The Listed Material In Paragraph 2 Has Been Collected From (Generator Facility Name)

.....

And Transported To

Based On The Recommendation Of The Ministry Of Environment.

Generator Name Title Signature

Time (Hrs: Min) Date / /

Address Tel. No. Fax

Carrier Company Name Tel. No.

Address Fax No.

2. Hazardous Waste Description

a- General Waste Description

b- Waste Physical State

Solid Semi Solid Sludge Liquid

Other (Describe)

c- Hazard Class

Toxic Flammable Corrosive Explosive

Other (Describe)

d- Waste Class

Waste Oil Chemical Materials Inorganic

Halogens Solvents Pesticides

e- Waste Information

Waste Weight/ Volume No. Of Transport Vehicles.....

Vehicle Capacity

f- Specify Activities That Generated The Waste

3. Transporter

a- I Certify That I Collected The Wastes Listed In Paragraph 2 Above And The Declared Materials Are Accurate.

b- The Above-Mentioned Wastes Were Transported From

Time (Hrs : Min) Date

Name : Signature: Vehicle License No.

4. Treatment Storage And Disposal Facility (TSDF)

a- The Waste Listed In Paragraph 2 Above Was Treated/ Disposed Of Let Location

b- Method Of Treatment/ Disposal

Landfill

Incineration

Chemical Treatment

Detonation

Other (Specify)

5. Ministry Of Environment

a- The Ministry Of Environment Certifies That The Waste Listed In Paragraph 2 Above Have Been Received / Treated / Disposed Of On Date

The Waste Belongs To: Generator Name

b- Ministry Of Environment Representative

c- Title

d- Signature

Annex 6

References for Pollution Prevention and Hazardous Waste Management

- The World Bank, Pollution Prevention and Abatement Handbook for specific industries, <http://wbln0018.worldbank.org/essd/essd.nsf/Docs/TOC>
- U.S. Agency for International Development (USAID) Environmental Pollution Prevention Project <http://es.epa.gov/ep3/ep3.html>
- USEPA Pollution Prevention site <http://www.epa.gov/opptintr/p2home>
- Pollution Prevention Information Clearinghouse (PPIC), a free service of USEPA dedicated to reducing or eliminating industrial pollutants through technology transfer, education, and public awareness. <http://www.epa.gov/opptintr/library/ppicindex.htm>
- Links to cleaner production resources and case studies: www.cleanerproduction.com
- Links to cleaner production resources: <http://www.cleanerproduction.ch/>
- Additional links addressing particular industry sectors:
www.cleanerproduction.com/industries/industries.htm
- Basel Convention Technical and Scientific Guidelines for Implementation on Hazardous Waste Management:
<http://www.basel.int/meetings/sbc/workdoc/techdocs.html>

Annex 7

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