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Environmental Assessment of Hazardous Waste Management at Selected Sites in the Gaza Strip

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Thesis Title

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يقول الله تعالى في كتابه الكريم :

﴿ظهر الفساد في البر و البحر بما كسبت أيدي الناس ليذيقهم بعض الذي عملوا لعلهم يرجعون﴾

صدق الله العظيم

سورة الروم – الآية 41

Dedication

I would like to dedicate this work to my family, the Mayor of Gaza City and my colleagues in Gaza Municipality for their ever-constant endless generous support.

Abdel Rahem Abul Kumboz

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I would like to express my deep thanks to all people who were involved in helping me in my study, without whose cooperation, this study would not have been possible.

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Abstract

There are several environmental problems in the Gaza Strip such as air pollution, water and wastewater problems, marine pollution and solid waste either domestic or hazardous waste.

Globally, evaluation of hazardous waste management continues to be a very essential issue. Subsequently, the study aims to evaluate current mechanisms, standards and practices relevant to this issue.

Five hundred and thirty questionnaires were distributed among workers from the medical fields for instant, (workers in El Shifa hospital-El Sheikh Radwan and El Sorany clinics) as well as the industrial field such as ten factories witch produce Hazardous Waste.

The results of the study reveal that knowledge deficit of the various kinds of industrial and medical hazardous waste and inadequacy of managerial related issues such as planning, presence of legislation, coordination and so on. The study indicates that management is the most single factor that could affect hazardous solid waste management. The study illustrates the importance of awareness programs and the provision of structures that are conducive to quality hazardous waste management, such as legislation and the provision of tools and equipment.

Furthermore, the study provided several tentative recommendations, such as developing legislations, coordinating among the various concerned bodies, organizing awareness campaigns and providing training for workers from the different categories. The study contributes towards establishing a baseline for hazardous wastes management and reflects the need for further research.

ملخص

التقييم البيئي لإدارة النفايات الخطرة بمواقع مختارة في قطاع غزة

موضوع الدراسة تم اختياره لما تشكله النفايات الخطرة من مخاطر على صحة الإنسان والبيئة، وقد سُلط الضوء على قطاعي الصحة والصناعة حيث أن النفايات الخطرة المنتجة منهما تشكل ما يزيد عن 70% من مجموع النفايات الخطرة المنتجة يومياً.

هدف الدراسة:

- تحديد الأنواع المختلفة من النفايات الخطرة والتي تنتج من مواقع الدراسة وكذلك لتقييم وضع النفايات الخطرة بقطاع غزة.
- تقييم استراتيجيات إدارة النفايات الخطرة الجاري تطبيقها في المؤسسات التي تم اختيارها.
- تقييم مدى المعرفة لدى العاملين وتوجهاتهم وممارساتهم في مجال إدارة النفايات الخطرة.
- تحديد مواقع القوة والضعف بإدارة النفايات الخطرة.
- تزويد متخذي القرارات بالوزارات والمؤسسات المعنية باقتراحات وتوصيات من خلال نتائج بحث إدارة النفايات الخطرة.

الفئة المستهدفة:

كل المتعاملين مع النفايات الخطرة في كل من المجال الصحي مثل الأطباء والممرضين والصيادلة والعمال والمجال الصناعي مثل المهندسين والعمال الفنيين والعاديين.

جمع البيانات:

تم جمع البيانات من خلال استبيان يتضمن أسئلة تتعلق بالمعرفة والتوجه والممارسة بإدارة النفايات الخطرة ، وقد تم توزيع 530 استبيان حيث كانت نسبة الاستجابة 84.9%.

تحليل البيانات:

تم استخدام برنامج SPSS في التحليل و قد اختبرت النتائج باستخدام اختبار " chi-square, ANOVA and t-test " وقُبلت النتائج عندما كانت الفروقات الإحصائية بنسبة أقل من 5%.

نتائج البحث:

- ❖ دلت النتائج على نقص وجود قوانين وتشريعات تنظم إدارة النفايات الخطرة.
- ❖ التنسيق فيما بين المؤسسات ذات العلاقة بالموضوع بشكل متدني لا يحكمه أي نظام.
- ❖ فصل النفايات من المصدر شبه معدوم إلا في بعض المؤسسات الصحية وبمبادرات بسيطة لفصل بعض أنواع النفايات الطبية كالإبر والمشارط وما شابه مع العلم بأنه لا يتم الفصل في المجال الصناعي
- ❖ بالنسبة لجمع النفايات حيث أن الفصل من المصدر لا يتم بطريقة منظمة وُجد أنه يتم جمع ما يتم فصله في بعض المؤسسات ، إلا أن الجمع لا تتبعه العمليات الإدارية السليمة من نقل ومعالجة وتخلص بل يتم التخلص في حاويات البلدية خلافاً للتعليمات.
- ❖ معرفة العاملين بأنواع النفايات متفاوتة حيث أظهرت النتائج معرفة مرتفعة بين العاملين في المجال الصحي للنفايات الحادة مثل الإبر والمشارط أما الأنواع الأخرى مثل النفايات المشعة والعلب المضغوطة وخلافه فكانت المعرفة بها دون المتوسط.

- ❖ توجهات العاملين في المجال الصحي والصناعي مرتفعة من حيث طلبهم للتدريب واستعدادهم للتعاون بين المؤسسات المختلفة وطلبهم لوجود لوائح تنظم العمل.
- ❖ ممارسات العاملين بمجال النفايات الخطرة كالفصل والترحيل والمعالجة محدودة جداً وذلك بسبب قلة الوعي والنقص الشديد في الإمكانيات سواء التشريعات أو الأدوات وحتى التنسيق بين المؤسسات لاستكمال السلسلة ذات الحلقات المنبثقة من مؤسسات مختلفة كوزارة البيئة والصحة والصناعة والبلديات.

أهم التوصيات:

- ○ ضرورة وجود قانون ينظم إدارة النفايات الخطرة مع عمل لوائح مكملة للقوانين في المؤسسات ذات العلاقة.
- ○ إنشاء لجنة عليا من المؤسسات ذات العلاقة لتنسيق إدارة النفايات الخطرة.
- ○ عمل نظام للمعلومات بكل مؤسسة لتسجيل الحالات المرضية والإصابات الناتجة عن النفايات الخطرة.
- ○ برامج تدريب لجميع الفئات التي تتعامل مع النفايات في المؤسسات ذات العلاقة.
- ○ الكشف الطبي الدوري للعاملين وذلك للكشف المبكر عن الإصابات.
- ○ فصل وجمع النفايات الخطرة من المصدر لتوفير الجهد والمال.
- ○ برامج توعية وإرشاد للعاملين في مجال النفايات الخطرة.

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List of Acronyms

AIDS	Acquired Immune Deficiency Syndrome
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
GCSWDP	Gaza City Solid Waste Disposal Project
GDP	Gross Domestic Product
HCW	Health Care Waste
HMW	Hazardous Medical Waste
HW	Hazardous Wastes
HWS	Hazardous Waste Section
IHE	International Institute for Infrastructure, Hydraulic and Environment.
MEnA	Ministry of Environmental Affaires
MOPIC	Ministry of Planning and International Co-operation
MOG	Municipality of Gaza
MOH	Ministry of Health
OECD	Organization for Economic Co-operation and Development
PCBS	Palestinian Central Bureau of Statistic
PEPA	Palestinian Environmental Protection Authority
PHC	Primary Health Care
RCRA	Resource Conservation and Recovery Act
SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
UNEP	United Nations Environmental Program
UNRWA	United Nations Relief and Works Agency
USEPA	United States Environmental Protection Agency

Operational Definition

Al-Mazraa: Municipality of Gaza Landfill which all solid waste are disposed of.

Landfill: Large pits where waste is dumped and buried, the bottom is lined with clay and/or heavy plastic to reduce the chance of contaminated groundwater.

Leachate: Liquid that has percolated through solid waste and has extracted, dissolved or suspended materials in it, this liquid may contaminate ground or surface water.

Medical Waste: Is generated by medical establishments as hospital, clinics, pharmacies, blood banks and so on.

Industrial Hazardous Waste: A chemical that has the potential of being toxic, ignitable, corrosive and reactive if improperly stored, used, or disposed

Domestic Waste: Waste generated by household, commercial activities, street sweeping and collected by municipalities

Agricultural Waste: Which generated by agricultural activities such as empty pesticide containers, excess product, rinse waste from containers, material from clean up of spills and contaminated greenhouse plastics.

Incineration: process of burning waste at very high temperature to produce gases and residues ashes.

Mutagen: A chemical, which causes changes in genetic material (DNA)

Pesticide: An agent that kills pests (insects, fungi, rodents, etc.)

Treatment: Any method, technique or process for altering the biological, chemical, or physical characteristics of waste to reduce the hazards it presents and facilitate, or reduce the costs of disposal.

Managerial Issues: the questionnaire included six questions related to the management of HW, the answers of these questions were re-coded to numbers in order to facilitate the analyses by using either t-test or ANOVA test.

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Chapter (1)

Introduction

This chapter includes Historical, Geographical and Demographical data about Palestine due to the importance of these information for recognizing the area with most of its details, furthermore it contains definitions, objectives of the study, research questions and the study fields which are industrial and medical organizations.

Contextual Background "History and Demography"

Palestine is a historical region on the east coast of the Mediterranean, also known as the Holy Land. The borders of Palestine have fluctuated throughout history but have generally included the territory lying between the south eastern Mediterranean coast on the west, the Jordan/Dead Sea Valley on the east, the Negev Desert on the south and the Litany River on the north with an area that is about 280 km long and 128 km wide. This land has been coveted throughout history because, by local standards, it is relatively well watered and strategically located on major land routes linking western Asia and northern Africa (Robert and Calvin, 1996).

The Gaza Strip is a narrow band of desert like land along the western Mediterranean coast (Annex 1), it lies along Egypt south and Mediterranean Sea West. It is about 45 km long and 6.5 to 12 km wide (MOH, 2001). From 1917 to 1948 the Gaza Strip was part of the British Mandate of Palestine. Egypt took control of the Gaza Strip after the Arab-Israeli War of 1948 and controlled it (except for a brief period of Israeli occupation in 1956-57) until the Six-Day War of 1967, when Israel occupied it again (Benvensti and Khayat, 1990).

The economy of the Gaza Strip centers on agriculture, livestock raising, fishing, and small industry (PCBS, 1997). Poverty and unemployment are widespread (Robert and Calvin, 1996). The Gaza Strip population according the Palestinian Central Bureau of

Statistics (1997) was 1,039,000 inhabitants live in an area no more 365 square kilometers. This means that the Gaza Strip is a very densely populated area and Gaza City is by far the biggest city in the Strip and is one of the oldest cities in the Mediterranean region (Annex 2), it's population of about 354,052 inhabitants (PCBS, 1997) and few hundreds of settlers who live in settlements that currently cover 35% of the Strip; they have the most fertile land and use more than 30% of water resources (Gaza Environmental Profile, 1994).

The Gaza Strip is located in a transitional zone between the arid desert climate of Sinai and the semi-humid Mediterranean climate along the cost. The average daily mean temperature ranges from 25^0C in summer to 13^0C in winter. The above-mentioned temperatures are observations made at the meteorological station at Gaza City situated at a short distance from the Mediterranean coast. Inland temperatures rapidly increase, although the longest distance from the sea to the eastern border is not more than 12.5 km. Daily relative humidity fluctuates between 65% in the daytime and 85% at night in the summer and between 60% and 80% respectively in winter (Gaza Environmental Profile, 1994).

Environmental Background

There are several environmental problems in the Gaza Strip. The abnormal situation resulting from the 27 years of Israeli occupation have led to significant degradation of the natural and human environment. Overpopulation has created adverse living conditions, influencing directly or indirectly the quality of health and social well being of the population. In some situations, human and animal life is directly threatened and requires an immediate response (MOH, 2001). In others, adverse developments such as the unsustainable use of scarce resources like land and water may inhibit economic and social development of the area in the medium term. High economic cost may result if

no immediate action is taken to control a further degradation of the environment and reverse negative developments. Due to over pumping, the water table is continuously declining for several meters per year. The water quality is poor and does not meet the WHO standards for chloride and nitrate (Buiteman, 1996). Over-exploitation of groundwater leads to depletion of the aquifer. Consequently, the quality of groundwater is decreasing dramatically because of salinization and insufficient recharge of the aquifer (Gaza Environmental Profile, 1994). The network is a branched one, many dead pipe ends are present and from a point of view of quality control, this situation is not preferable. It is obvious that the network should be renovated soon, also because of the large number of leaking pipe joints and valves, which could lead easily together with low water pressures to contamination of water in the supply system (MOPIC, 1996).

An uncontrolled use of pesticides and fumigants (such as methyl bromide) in horticulture threatens the quality of groundwater, which is the only source for drinking water and agriculture (Safi, 1995). Additionally, uncontrolled wastewater disposal into the sea contributes to further degradation of the last remaining natural assets and pollutes beaches and groundwater (MOH, 2001). Salinization of agricultural soils has caused decreased crop yields (Gaza Environmental Profile, 1994). If this issue is not addressed soon, valuable land will be taken out of production. Deforestation and unlimited quarrying of coastal dunes has led to increase wind erosion and sand dunes invading urban and agricultural lands (Gaza Environmental Profile, 1994). Moreover, trapping and poisoning of small birds and mammals reduces even further the already suppressed and minimal wildlife of the Gaza Strip (Gaza Environmental Profile, 1994).Although the population is aware of environmental and public health issues, relatively little is done to translate awareness into action and improvement (WRAP,

1995). In this respect, environmental awareness and education is in its infancy. For instance, in primary and secondary schools little attention is paid to the subject.

In the Gaza Strip there are a large number of transportation vehicles estimated at 30,000 to 35,000 motor vehicles, that constitutes the major source of air pollution. What adds to the problem that most cars available in the Gaza Strip are very old (> 15 years) and outdated. Car exhausts release to the ambient air large quantities of carbon monoxide, nitrogen oxide, and lead that are considered very poisonous and some may be carcinogenic and may affect the respiratory and nervous system.(Safi, 1998). Poor solid waste and hazardous waste collection, transport and disposal systems form a public health hazard and an environmental threat. There are many open dumpsites in Palestine, most of them are used in the West Bank while many small uncontrolled dumping sites have been closed in the Gaza Strip (MOH, 2001). Currently, there are two controlled and sanitary landfills in Gaza City and Deir El-Balah (MOH,2001). The inadequate handling of solid waste is a main cause of deterioration of water quality, land degradation, air pollution and consequently public health diseases and problems (MOH, 2001). Absence of adequate legal and administrative framework for planning, control and enforcement of land use leads to serious losses in agricultural land through wild urbanization and industrialization (Isaac, and Shuval, 1994).

Hazardous waste (HW), which is produced from medical and industrial resources, is considered an important subject due to its serious risks affecting both humankind and the environment as well. Therefore this study has been chosen due to its importance especially in the Palestinian context. The literature indicates different conceptual definitions for HW. HW could be defined as toxic, inflammatory, reactive, or infectious and include such wastes as heavy metals in batteries, electroplating sludge, paint

solvents, pesticides and infectious wastes (Cointreau, 2000). However, depending on the country, other definitions of HW are provided in Chapter 2.

It is worth mentioning that in 1994, the Palestinian Environmental Protection Authority (PEPA), has identified problems of hazardous waste as crucial issues and also has defined elements of hazardous waste strategies (Gaza Environmental Profile, 1995). However, this strategy has never been implemented; subsequently, the inappropriate management of hazardous wastes would result in serious future environmental hazards as detailed in Chapter 2.

The limited environmental resources and the huge number of people living in the Gaza Strip pose a high-pressure on the environment and subsequently a high risk of resource depletion. For instance, scarce groundwater resources, which form the main sources for drinking water, are threatened. Limited agricultural production areas can be polluted irreversibly, bringing hazardous substances in the food chain, and direct exposure to hazardous waste brings about high risks for human health, flora, and fauna (Gaza Environmental Profile, 1994). Thus it is assumed that many valuable issues could be revealed by this study as explicitly detailed in the coming paragraphs.

Value and Significance of the Study

The Gaza City Solid Waste Disposal Project (GCSWDP), Funded by the European Commission, has started in 1993 with assessment needs and a project formulation. The subsequent following years, a waste collection scheme, an environmental health education programme and a controlled landfill and landfill operations were realised. At Al-Mazraa controlled landfill, an isolated hazardous waste section (HWS) was completed in 1998 (Municipality of Gaza, 1998). In 2001, this section was hardly in operation. HW was still disposed of at the municipal landfill together with and as a component of municipal

wastes. The main reason for this being that a hazardous waste management system had not yet been developed.

In July 1999, the Palestinian Environmental Law was enacted. This law states that producers of HW must comply with orders and directives of the Ministry of Environmental Affairs and the competent agency, which in this case is the Health and Environment Department (HED) of the Municipality of Gaza (MOG). In April 2001 these orders and directives were not yet elaborated. The law furthermore states that the Ministry of Environment will define a list of hazardous wastes, which are to be considered under the law. In 2001, the Ministry of Environment was still elaborating the definition of normal wastes and had not yet worked on the definitions of HW. Hence in 2001 the environmental law of Palestine was not yet operative where HW is concerned (Ministry of Environmental Affairs, 1999).

In April 2000 the Palestinian Environmental Assessment Policy was established. This Policy states amongst others that the construction of HW disposal sites requires an Environmental Impact Assessment (EIA). The Policy furthermore gives the procedure for such an assessment. An EIA however should have been made before construction of the HWS, but at that time, the Palestinian Environmental Law and the Palestinian Environmental Assessment Policy were not yet established (Ministry of Environmental Affairs, 2000).

An Environmental Impact Studies (EIS) focussing on alternatives for the HWS location and the groundwater situation was finished in 1995 before commencement of construction of the HWS in 1998. As a result of these developments the Municipality has the availability of an up to standard HWS, but has not taken this facility in operation. The reasons for this are twofold: firstly, an EIA such as described in the Oslo-II agreement was not available and secondly, a hazardous waste management system that feeds the

HWS had not yet been developed. It was decided that an EIA for the HWS was superfluous for reasons mentioned earlier. For this reason the Municipality of Gaza decided to make an environmental assessment of the future Gaza hazardous waste management system (HWMS) which will make use of the already assessed and constructed HW disposal facility.

In spite of the importance of HWM and its risks for public health and the environment if it mismanaged, there were lack of previous research studies to deal with this concern in the Gaza Strip. The researcher's profession as a Director of Health and Environment Department in the Municipality of Gaza, gives the study a significant point related to the practical application of the findings, as he is a crucial decision-maker in this issue. The timing of the study was also significant, as it has been carried out during such a transitional period characterized by setting rules and regulations; therefore, findings could help decision makers to recognize areas that need special focus. The study hopes to increase the understanding of managers about HWM. The more HWs are understood the more the chance of effectively managing them.

Overall Aim of the Study

The overall aim of this study is to evaluate hazardous solid waste management at selected sites in the Gaza Strip. The study aims to evaluate current mechanisms, standards and practices for hazardous solid waste management for the purpose of developing more effective polices and regulations in this vital issue. Subsequently, the study will contribute in providing a scientific base for HWM in a way that decreases human and environmental hazards associated with mismanagement of HW.

Specific Objectives

1. To recognise the different kinds of hazardous wastes generated at the studied places and to assess hazardous wastes status in the Gaza Strip.

2. To appraise the strategies currently utilised regarding the management of hazardous waste material in the concerned organisations.
3. To assess the range of knowledge, attitude and practices of the concerned people with hazardous waste management.
4. To identify areas of strengths and areas of weaknesses in hazardous waste management.
5. To provide suggestions and recommendations for decision makers, politicians and concerned people in this regard.

Research Questions

- How is the status of Hazardous wastes in term of production, concern about and management?
- What is the level of knowledge of those people, who deal with HW?
- Do people's practices reflect a sound knowledge and desirable attitudes about HW?
- Is there any investigation to identify the kinds and amount of HW in the concerned organizations (industrial or medical)?
- What are the areas of strengths and weaknesses in HWM in the Gaza Strip?
- Do people who work in the industrial and medical fields need training in HW aspects?
- Is there coordination or cooperation between organizations that deal with HW in the Gaza Strip?
- Are there clear strategies and plans for HWM in the concerned organizations?
- What is the attitude of the decision makers towards HWM?
- What are the conclusions and recommendations drawn from the study that could positively influence HWM?

Industrial Wastes in the Gaza Strip

In this study some factories that produced and generated hazardous wastes have been selected in order to represent the industrial field. Most of HWs from these factories were usually disposed with the normal wastes in the landfills. To ensure representativeness, different factories were included such as companies and factories that are concerned with cosmetics and pharmaceutical products. Moreover, factories that produce different kinds of drugs such as tablets, capsules, ointments, creams and liquids were included. Additionally, chemical, plastic, heavy metals and painting factories were included in the study. In addition, factories that produce detergents, chlorine, printing, fiberglass, polystyrene, plastic and leather were also included. For more details about the included industries, see chapter 2 and the attached (Annex 3).

Medical Wastes in the Gaza Strip

Ministry of Health (MOH) is the main health provider in Palestine besides, UNRWA, NGOs and private health sector. MOH is responsible of supervision, regulation and control for whole health services. There are 65 hospitals in Palestine under the responsibility of MOH, Military services, NGOs, Palestinian Red Crescent Society, private sector and UNRWA. Of them 17 are in the Gaza Strip, with ratio 66,949 persons per hospital and 48 are in the West Bank, with ratio 41,915 persons per hospital. The bed/population ratio is 1.4 beds per 1000 inhabitants. In addition, MOH provides 80% of beds in the Gaza Strips and it operates five hospitals. There are more than forty primary health care clinics under responsibility of MOH and UNRWA, the second major health provider in the Gaza Strip (MOH, 2001). MOH has 8 hospitals in the Gaza Strip and Shifa Hospital is the largest one (Massrouje, 2000). Shifa Hospital is located in Gaza City (Annex 2) and it has 562 beds and includes different specialty, such as Oncology Department, Operation Department, Cardiac Department, Dialysis,

X–ray Department (radiology), Blood Bank, Dentistry, Laboratory and Intensive care. Additionally, it includes Maternity Department, Gynecology Department, Pharmacy, Pathology and Plastic Surgery and Burns. Moreover, more than 1000 employees are working in this hospital from the different disciplines. For being the major hospital in Palestine, this site was selected as a representative of hospitals and also some clinics were selected from both UNRWA and MOH to be included in the study.

Medical waste in Palestine is not given the proper concern. MOH is responsible for monitoring of medical waste in Primary Health Care (PHC) and hospitals. In addition, it is responsible of monitoring the landfills and treatment and the problems that arising from solid waste in cooperation with MEnA and municipalities. The amount of medical waste, which generated in health care organizations, is about 8 tons/day and about 2.67kg/patient/day in Shifa Hospital (MOH, 2001).There is no segregation of the medical waste except sharps, which are collected in special boxes, donated by WHO. There are no storage rooms for medical waste. In addition, there is no system of color-coding bags. In PHC clinics, medical waste is disposed with domestic waste without separation or any treatment processes. However, in El-Shifa Hospital there is an incinerator for burning the waste but unfortunately it is not sufficient. There is no control on incinerator emissions and no measurement of pollutants production. Inadequate practices are due to lack of coordination between ministries and lack of knowledge between people who work in health field.

Chapter (2)

Literature Review

In this chapter definitions are presented, classifications and generation sources of HW both internationally and locally. Then the risks and dangers associated with the mis-management of HW which affects the public health are discussed, the people's health and the environment as well. Moreover, HWM both internationally and locally are illustrated exploring all the steps composing this process starting with the productive stage, collecting stage, transporting stage and lasting with disposal in the landfill sites. Beside that, the legislations, which regulate these efforts are explored,. In addition, several literature related to this concern are exhibited throughout this chapter.

Conceptual Definition of HW

Each country defines hazardous waste according to its own law. Internationally, there are several organizations that have drawn up lists of wastes that are to be considered as hazardous waste.

In the following paragraphs, some useful definitions of HW are provided.

Hazardous wastes are all wastes other than radioactive wastes, which by reason of their chemical reactivity, or toxic, explosive, corrosive or other characteristics causing danger, or likely to cause danger to health or to the environment, whether alone, or when coming into contact with other wastes, are legally defined as hazardous in the state in which they are generated, or in which they are disposed of, or through which they are transported (Batstone et al, 1989).

Hazardous Waste are generated by the various activities and operation or the ash thereof, which preserve the characteristics of hazardous substance which have no usage such as atomic waste, medical waste, or reuse emanating from manufacturing of

pharmaceutical products, medicine, organic solvents, dues, painting, pesticides or any other similar substance (Ministry of Environmental Affairs, 1999).

Medical hazardous wastes are generated by medical institutions, which are: hospitals, clinics, health centers, blood centers, hygienic service laboratories, facilities for aged people's health, midwifery stations, medical examination for animals, and institutions for medical examination and research (WHO, 1999). There are also other wordings in use for medical waste. Health care waste is an overall term used in different publications. Medical waste is the overall wording used in the USA. Clinical waste is the wording used by the Basel Convention on hazardous wastes (Coat, 1994).

However, communal waste includes all solid waste which are not including infectious, chemical, or radioactive waste (Sauer et al, 2001). This waste stream can include items such as packaging materials and office supplies. This stream can be disposed of in communal landfill or other arrangement. Segregation of materials, which can be reused or recycled, will greatly reduce the impact burden of this waste stream (USEPA, 1990). In contrast to that, hazardous material that may cause or significantly contribute to serious illness or death, or that poses a substantial threat to human health or the environment when improperly managed. The term "solid" includes waste, which can be the consistency of honey (Resource Conservation and Recovery Act "RCRA" 1976).

However, in the Palestinian context, the Palestinian Environmental Law (July 1999) actually is a framework for more detailed legislation. The law states that the Ministry of Environmental Affairs will elaborate a list of definitions of hazardous wastes. The Ministry currently works on a list of descriptions of general solid wastes and a list with definitions of hazardous wastes will follow (Ministry of Environmental Affairs, 2000). Therefore, in the current situation there is no legal designation for hazardous wastes in Gaza and a lot of work needs to be done in this regard.

Characteristics of Hazardous Materials

To determine whether a waste is hazardous, it is important to know which substances are present in the waste. Subsequently, several countries have been drafted lists of dangerous substances, which require priority consideration (Tanaka, 2000). The availability of these lists facilitates the defining of hazardous wastes. Also the concentration of priority substances in the waste is important. This concentration should be compared with threshold levels. Analytical methods for determining the character and concentration of dangerous substances have to be defined by law. Therefore, proper enforcement of the regulations begins with obtaining samples, which are representative for the waste (Gregory, 1996).

Hazardous wastes present risks, which can cause incidents such as intoxication, fires and explosions (Kanitz et al, 1995). By identifying these risks and preparing for the incidents that could happen, many incidents can be prevented from occurring and the effects of these incidents can be minimized. A chemical has the potential of being toxic, ignitable, corrosive and reactive if improperly stored, used, or disposed (USEPA, 1990). Many characteristics are considered wastes such as ignitable wastes, which may ignite in the presence of a spark, friction or water. Toxic waste is a category of hazardous waste that can produce acute or chronic health damage. They can be organic, inorganic, or synthetic organic chemicals. However, reactive wastes are chemically unstable, which can explode or release highly toxic gases when exposed to heat, water, pressure or other wastes. On the other hand, corrosive wastes are chemicals, which cause a reversible inflammatory effect on living tissue like a skin wash (USEPA, 1990).

It is worth remembering that healthcare waste includes all the waste generated by health care establishments such as hospitals, primary healthcare and private sectors. These include non-risk healthcare waste that represents 75 – 90% of the total waste (WHO

1999) and that comes from the administrative offices, healthcare kitchens, maintenance departments and waste generated from house keeping functions. Contrary to that, hazardous healthcare waste represents 10 – 20% of the total waste (WHO 1999) and that category should be dealt with special procedure.

Classification of Hazardous Health Care Waste

Several classification systems are used for the characterization of the different components of health care waste.

WHO Classification (Pruss et al, 1999)

Infectious waste: Which contain pathogens, so that they pose a serious threat, such as cultures from laboratories, waste from surgery and autopsies on patients with infectious disease, waste contacted infected patients and any other instruments or materials that have been in contact with infected persons or animals.

Pathological waste: Which includes human tissues or fluids e.g. body parts, blood and other body fluids and fetuses.

Sharps: Any item that could cause acute or puncture, especially needles, infusion sets, scalpels, knives, blades and broken glass.

Pharmaceutical waste: Consisting of /or containing pharmaceuticals, including: expired, no longer needed, containers, packaging, items contaminated by or containing pharmaceutical bottles, boxes and drug vials.

Genotoxic waste: Consisting of, or containing substances with genotoxic properties" mutagenic, teratogenic and carcinogenic" and including cytotoxic, antineoplastic drugs and genotoxic chemicals. Genotoxic wastes are generated from several sources and can include the following:

- Contaminated materials from drugs preparation such as: syringes, needles and vial packaging.

- Expired drugs and drugs returned from the wards.
- Urine, faeces and vomit from patients.

Chemical waste: Consisting of, or containing chemical substances, including: Laboratory chemicals, film developer, disinfectants expired or no longer needed solvents, cleaning agents and others.

Heavy metals: Consisting of materials and equipment with heavy metals and derivatives including batteries, thermometers, and manometers.

Pressurized containers: Consisting of full or empty containers with pressurized liquids, gas, or powdered materials, including gas containers and aerosol cans.

Radioactive waste: Includes unused liquids from radiotherapy or laboratory research, contaminated glassware, packages or absorbent paper, urine and excreta from patients treated or tested with unsealed radio nuclides.

However, other classifications were provided by other organizations as clear from the following paragraphs. For practical purposes, more simplified classifications were used in developing countries which were found helpful in the research design. Particularly, Coat's (1994) classification of HW was adopted. These classification systems have five categories instead of nine and that is recommended to limit the number; this practice may pose no problems with separations, collection, transfer, and final disposal. These five categories are:

- General waste, or Non-hazardous waste.
- Sharps.
- Infectious waste.
- Chemical and pharmaceutical wastes.
- Other hazardous medical wastes.

Categories of HW

The amount of waste generated by the inhabitants, institutes and companies in Gaza Strip is growing and within this waste the relative amount of hazardous waste increases. The four main sources of hazardous waste are: (Suaer et al, 2001)

1- Households (domestic hazardous waste).

2- Industry and small companies (industrial hazardous waste).

3- Hospitals, clinics and laboratories (medical hazardous waste).

4- Horticulture and greenhouses (agricultural hazardous waste)

Domestic Hazardous Waste

A part from the amounts of hazardous waste it is important to gain insight in the character of this category of waste. In the United States, the following materials form the major part of domestic hazardous waste (Ohio State University, 1990): Antifreeze, car batteries, car wax, car polish, degreasers, engine and radiator flush, cleaner, motor oil, gasoline, rust preventers, removers, Pesticides as herbicides, insecticide, and rodenticides, asphalt and roofing tar. Additionally, this list includes paints, paint thinner, water proofers, wood preservatives, wood putty, wood stains, varnish, wood strippers, bleach, disinfectants, drain cleaner, floor cleaner, furniture wax, furniture polish and metal polish. In addition, oven cleaner, septic tank cleaners, silver cleaner and polish, spot removers, toilet bowl cleaner, window cleaners, nail polish, flea powder, batteries, inks and mothballs were included.

In the European Union the following hazardous components are common within domestic hazardous waste (Suaer et al, 2001): Car batteries, acetone, batteries, car petrol, domestic pesticides and insecticides, type correction fluids, etching fluids, photo fixative, photo developing liquids, wood preservatives, hypodermic needles, inks, paint brush softeners, paint brush cleaners, mercury switches, mercury thermometers, lamp

oil, glues and sealants, alkalides, lead wine seals, medicines, furniture polish and oil, motor oil, nail polish, nail polish remover, oil filters, degreasers, petroleum, filler, break oil, greases, Tube lights and energy saving lamps, paints, paint strippers, paint thinners, spot removers, flea collars and hydrochloric acid.

The lists of the United States and the European Union show many similarities. It also shows that definition of hazardous waste can be done by application of the product. This makes it easier for people (the waste generators) and also for waste laborers to identify a product as a potentially hazardous waste. This may also facilitate future awareness campaigns (USEPA, 1990).

Industrial Hazardous Waste

In 1994, the amount of industrial hazardous waste and agricultural hazardous waste together was estimated at 750 m3 per year (Sauer et al, 2001). This estimation was still very indicative and more detailed figures about the different fractions were still lacking. Also for this type of hazardous waste gradually more information became available on industrial hazardous waste during the Gaza City Solid Waste Disposal Project. However, the Ministry of Planning and International Co-operation reviewed the numbers and different categories of industries in the Gaza Strip in 1996 (MOPIC, 1996). This gave a far better insight in the potential producers of hazardous waste.

In April 2001, the Ministry of Industry made estimations about the hazardous waste arising from industry in the Gaza Strip (Wadi and Nashwan, 2001). This has been achieved by multiplying the production capacity and/or the number of employees with standard load factors for hazardous waste output. This approach has led to figures on important hazardous waste streams.

Additionally, on the basis of improved data on waste generation from the Health and Environment Department, the total amount of industrial waste was calculated at 68

Metric Tone MT a day (Disselkoen, 1997). The availability and quality of data improved, but there still was no accurate figure for the amount of industrial hazardous waste at that time.

All activities in industrial solid waste management involve risk, either to the worker directly involved, or to the nearby resident. Risks could occur at every step in the process, from the point where residents source segregate wastes in to different components for collection and recycling, to the point of ultimate disposal (EEAA, 2000). Hazardous wastes in the Gaza Strip cause severe environmental problems and pose serious health risks. It is worth remembering that most industrial waste is toxic, persistent, and tends to accumulate in the environment. Uncontrolled discharge of hazardous contaminants results in severe degradation of air quality, water resources, and serious health problem (Nicholas, 1995).

The estimated amounts of hazardous waste generated annually from the industrial in the Gaza Strip 803 tonnes (Sauer et al, 2001). About hundred eighty nine small industrial establishments contribute appreciable portion of the hazardous waste arising, which comprises the major part of the manufacturing industry in the Gaza Strip are generate hazardous waste (Sauer et al, 2001). At present, management of hazardous waste is impeded due to absence of Palestinian legislation, lack of centralised facilities for recovery and treatment of wastes, scarcity of information on sources of hazardous waste and lack of experiences lead to the wide spread practices of illegal dumping with municipal wastes.

Industrial wastes are produced from factories and workshops in industrial areas. There are several industrial areas in the Gaza Strip, such as Beit Hanoon Industrial Area, which located in the north of Gaza Strip and includes different kinds of trades and industries, such as medical, cosmetic, plastic barrels factories, printing houses, textile

dyeing factories, batteries factories and so on. The wastes of these factories are usually placed in the municipality's containers and then the municipality transfers them to the landfill (Sauer et al, 2001). Gaza Industrial Area (Al-Montar) falls under the responsibility of Industrial Estate Foundation management. It is organized geographically in a way that facilitates management of solid wastes, which are produced from this area. The municipality is responsible for transporting the waste's containers by its trucks to the sanitary landfill three times a week. The Industrial Area in Deir El Balah and the South of Gaza is located in Deir El Balah area and includes different kinds of trades and industries.

What make things worse, the presence of semi-industrial areas that are distributed among residential areas because of the absence of industrial areas during the occupation period and due to the lack of resources. Meaning that, the lack of governmental land for this purpose, the absence of environmental legislation and enforcement of the law, industries and trades have expanded among residential areas (Wadi and Nashwan, 2001). This situation has complicated hazardous solid waste management.

Medical Hazardous Waste

The medical institutions as aforementioned before generate medical wastes. However, hospitals are among the largest generators of solid waste on a per capita basis (MOH, 2001). Much of the waste from hospitals comes from the trash basket at the patient's bed and includes paper and other domestic items, but also broken syringes, discarded splints, masks, rubber gloves and broken ampoules amongst others, as a result of the daily routine activities around the patient's bed. From the surgical rooms, isolation wards and special medical procedure room's infectious waste is generated, while medical laboratories produce infectious and chemical hazardous waste. X-ray activities cause radioactive waste. For the last twenty years, the use of disposable products and

single use items has increased dramatically, consequently increasing the amount of waste to be disposed of (Pollock, 1978).Wastes coming from hospitals are for around 80% non-hazardous, around 10% are infectious hazardous waste and 5% is other hazardous waste (WHO, 1992). This means that under normal conditions around 15% of the hospital waste will be hazardous. Due to poor separation of waste in developing countries however, the amount of the hazardous component may be 10% to 40% in these countries. Segregation of hospital waste is therefore of great importance. From studies on clinical waste generation in the US and Canada it was concluded that the amount varies between 1.5 and 7.5 kg per bed per day. The actual amount is depending upon the institution's practice of throwaway materials. Investigations revealed that the amount of hospital waste (including the non-hazardous fraction) in developing countries in South America quoted 1.2 to 6.0 kg per bed per day (WHO, 1992). Around 10 to 40% of this wastes are thought to be hazardous. For a calculation example the average of 25% will be taken. With this percentage the amounts of hazardous waste from hospitals in developing countries in South America arrives at 0.3 to 1.5 kg per bed / day. Calculation with the number of beds in the 5 hospitals of Gaza (692 beds at the time of study) and using the average of the above figures for developing countries (0.9 kg per bed per day), the amount of clinical waste could be calculated at 623 kg a day (Batstone et al, 1989). However this first estimation is very indicative. Congruently, in March 1997 a survey was carried out in Al Shifa Hospital on the generation and the amounts and types of hazardous wastes in the Al Shifa Hospital (Zaorob, 1997). It was concluded that 35% of the total amount of the waste generation of this hospital was hazardous waste. This indicates poor segregation practices according to international standards (WHO 1992).

In 1996 the Spanish Government donated three medical waste incinerators. These were installed in Shifa Hospital and in Naser Hospital, both located in Gaza City, and in Khan Younis Hospital. After a first period of starting problems and inadequate performance the incinerators were taken in daily operation. The incinerator of Shifa handles 500 kg of waste a day according to the operator. No monitoring is performed at the incinerator so this figure is indicative. Separation is hardly practiced in the hospital. There are guidelines but the responsible personnel do not apply them (Massrouj, 2000). This leads to the situation that much of the waste that ought to be incinerated ends up in the municipal container, while other categories, amongst others normal waste, is being incinerated. In the field of medical hazardous waste a number of initiatives has been developed to structure the waste management within the hospitals. This was done mainly for health safety reasons but has also positive results for the future hazardous waste management system. Therefore these initiatives have been described in the following paragraphs.

Under World Bank funding the Ministry of Health conducts the Quality Improvement Project. Amongst others, this project addresses medical waste management within the hospitals and clinics in Palestine. The project develops guidelines for the separation, handling and treatment of medical waste (MOH, 1999). In May 2001, the drafts of these guidelines were ready. They will have to be approved within the Ministry of Health and subsequently they will be discussed with the Ministry of Environmental Affairs and the different Municipalities in the Gaza Strip and the West Bank who are responsible for waste collection. Once approved, these guidelines need to be used for all the hospitals, clinics and medical laboratories in the Palestine.

In line with the WHO, seven categories of clinical waste have been distinguished: pathological waste, infectious waste, sharps, pharmaceutical aste, hemical aste, pressurized containers and radioactive waste (Jonkhans, 1998).

The Ministry of Health has developed tools for implementation according to the principles of ISO 14 000. In 1998, preliminary training on clinical waste management was conducted for 25 doctors, nurses and for 35 cleaners from the hospitals of Gaza. The training aimed at segregation, waste handling and safety. During implementation of the guidelines an additional training program is envisaged making use of the experiences of the preliminary training. The Quality Improvement Project provides budget for human resources, but not for collection and segregation equipment. This will have to be paid for by the hospitals and clinics themselves, which will almost certainly become a problem in the implementation phase.

Agricultural Hazardous Waste

The intensive agriculture relies heavily on the use of fertilizers and pesticides. Severe misuse and uncontrolled use of pesticides and fertilizers is reported in the Gaza Strip (Safi, 2001). It thus constitutes a potential threat to the local population, to consumers of the agricultural produce originating from the area, and to the environment (Safi, 2001).

These data are the result of questionnaires that were distributed from 1995 to 1999 among farmers and from data of the Ministry of Agriculture about pesticide use. The lower quantity of pesticides for 2000 is due to the closure of the Gaza Strip since September 2000. According to Safi (2001) Hazardous waste generated by agriculture consists of:

1. Empty pesticide containers.
2. Excess product and excess mixture
3. Rinse waste from containers and application equipment

4. Material generated from clean up of spills and leaks
5. Contaminated greenhouse plastics

However, from all the above-mentioned sources, the generation of hazardous waste increases in the Gaza Strip. Without proper management of the hazardous waste streams, this growth will result in risks of increasing magnitude (Tesink, 1994).

Hazardous Waste Generation

To install a hazardous waste management system it is required that information is available about quantities and character of the hazardous waste, which is generated. Obtaining reliable information about these issues however proves to be very difficult. In many situations, only rough estimations of the generated hazardous waste can be made. A first indication about national annual production of hazardous wastes can be calculated using the relation with the gross domestic product (GDP) in US$ (Batstone et al, 1989):

- **High developed countries: 10,000 tonnes per billion GDP**
- **Countries with mature industry: 5,000 tonnes per billion GDP**
- **Newly industrialized countries: 2,000 tonnes per billion GDP**
- **Developing countries: 1,000 tonnes per billion GDP**

In Europe, in 1998, industrial waste generation ranged from 0.3 to 1.0 tones/person /year, with the highest levels in high income industrialized countries like Germany and lower levels in poor countries like Portugal. From 1%to 3% of industrial wastes produced were considered hazardous (Whiting and Schwage, 1998)

The average of solid waste, which is generated from super specialty hospital, is about 360kg per day. This gives about 1 – 1.4 kg per bed in 300 bed capacity hospital. Out of this waste, around 15.42 percent are infectious and the remaining is not infectious. The combined waste consists of 91.67 % flammable and the rest is not flammable matter.

The waste on an average contains about 37.6 percent moisture with a density of 627.5kg per cubic meter (Manohar and Kotaiah, 1997).

In many desk studies the amounts of hazardous waste are estimated by multiplying the number of employees in a particular industrial sector or institute or inhabitants when it concerns domestic hazardous waste by a standard load factor. Experience with detailed waste surveys however has shown wide variations in waste per employee figures, even within narrowly defined sectors (Batstone et al, 1989). Therefore these types of studies only give a global idea about the generation of hazardous waste. If more reliable figures are necessary for instance to install a hazardous waste management system, or to draw up national regulations, more detailed and comprehensive surveys are required. For the Gaza Strip, which may fit in the category of developing countries, this would imply a yearly production of hazardous waste of about 2000 tones. According to Ministry of Health the GDP of the Gaza Strip was 1484 US$ in 2000 (MOH, 2001) .

A research study was done in 1994 on the composition of the municipal waste from Gaza (Disselkoen, 1994). A total of 60 randomly collected samples were separated and the different fractions were weighed. The percentage of domestic hazardous waste within total waste was calculated at 0.3% by weight. An amount of 360 MT hazardous waste per year from households was the consequent estimation in 1994. This amount was assumed to be equivalent with a volume of approximately 480 m3/y in compacted condition. The Health and Environment Department of the Municipality of Gaza estimated the amount of medical waste in 1994 at 750 m3/y. For industrial and agricultural hazardous waste together the estimation of 1994 was also 750 m3/y. So the estimation for the total production in 1994 was approximately 2 000 m3/y. Because the relation between weight and volume of the waste in Gaza was still unclear, there was no reliable estimation of the weight of the hazardous waste at that time. The figures of

1994 were used for the design of the disposal facility at the landfill (Tesink, 1994). For this purpose, the volume of the waste (after compaction) is important. The above figures for the volume refer to the compacted situation. When a complete hazardous waste system is developed however, information about volume and weight are both required for the design of the collection and transport system. Therefore it is important to collect also information about the mass weight in uncompacted condition, which represents the hazardous waste at the stage of collection (El-Fadel et al, 1997).

In 1994 data on hazardous waste generation were still mainly based on above type of estimations. Because of lack of information, there was no real alternative. From 1993 onward, it became clear from observations that the amounts of hazardous waste from hospitals and industry were increasing gradually. For this reason there was a growing concern about hazardous waste within the Health and Environment Department and during the years between 1993 and 1998 several attempts were undertaken to get a better knowledge about hazardous waste production. The improving insight in the hazardous waste generation is reflected in the following.

From the improved figures of 1998 an update can be made for 2001. Between 1987 and 1996 the average growth of the population of Gaza City was 5.2 % (Disselkoen, 1997). When this average growth is assumed to be valid also for the period from 1998 till 2001 the number of inhabitants within the service area in 2001 can be estimated at 395 800.

From the statistics, which were set up by the Health and Environment Department of Gaza City, the amount of collected waste can be monitored on a monthly basis. The statistics are based on the weighing of all waste trucks that arrive at the landfill before and after disposal of their collected waste. On the basis of the figures from October 1999 till March 2001 it can be calculated that the average daily collected amount of waste is 389 MT (Health and Environment Dept., 2001).

Environmental Health Risks

People living and working in the vicinity of hazardous waste processing and disposal facilities also are exposed to environmental health and accident risks. These risks relate to the emissions from the hazardous solid waste, the pollution control measures used to manage these emissions; these emissions are still largely unmanaged in most developing countries. Pollution control costs money to safe design standards requires commitments to construction and operation supervision.

According to aquifer contamination by leachate of hazardous waste. Groundwater samples collected from hazardous waste sites throughout the USA showed that 50% were contaminated with high levels of trichlorethylene, with average concentrations of about 2000 μg/l compared to a drinking water standard of 5μg/l (Lee and Jones, 1994).

A study in the USA (1990) examined mutagencity for a solid waste incinerator and two medical waste incinerators. The results for the solid waste incinerator closely matched the Japanese results for solid waste incinerators. The results indicate that the completeness of combustion and the effectiveness of pollution control equipment more significantly affect mutagenic potency, than by the nature of the material being burned. The mutagenicity data from solid waste incinerators and medical waste incinerators were comparable to industrial and utility boilers burning coal, wood and oil (Watts and Lemieux 1992). Down gradient users of leachate contaminated groundwater's can potentially be exposed to significant dissolved contaminant levels, but seldom do disease microorganisms migrate far in most soils except sand due to ion exchange and adsorption attenuation mechanisms. (Ware, 1980)

It is known from previous research studies that during the expansion of the landfill, the design of individual cells evolved to the existing design, which comprises a double liner system with a compound secondary liner (Eith et al, 1997). Collection of leachate and

leak detection flows is found as the foundations for comparison of the overall performance of the different cell designs (Giardino et al, 1997). Hazardous chemicals are increasingly being used and released. This happens in agriculture (pesticides), in industry (heavy metals and toxic compounds) in commerce and by households. In 1995 and 1996 the Environmental Planning Directorate of the Ministry of Planning and International Co-operation carried out a pilot study to assess the impact of the increasing use and disposal of hazardous substances in Gaza on ground water quality. Samples were taken from wells, which were expected to be polluted. Analyses showed though minor traces of organic contamination and heavy metals (MOPIC, 1996).

Health and Injuries: Occupational Health Risks

Throughout the world, workers, waste pickers and the target who deal with hazardous waste are exposed to occupational health and accident risks related to the content of the materials are handling, emissions from those materials, and the equipment being used. In high-income countries, these risks are being managed to minimise the incidence of disease and injury. Because of the inadequate understanding of the magnitude of the problem and poor financial resources, the risks are still largely unmanaged in most developing countries (Coat, 1994). To protect the workers and waste pickers, that costs money, in poor countries like Palestine characterised by inadequate waste collection, disposal that is still by open dumping, workers without health benefits or job security, so such costs still need external assistance either financial or experiences (Sauer et al, 2001). Uncontrolled hazardous waste sites are very dangerous for public health as well as the environment everywhere. The high percentage of sites with completed exposure pathways and the toxicity potential of substances in these pathways indicate that uncontrolled hazardous waste sites are a major environment threat to human health (Johnson and Derossa 1997). Solid waste disposal sites in developing countries

typically receive both general municipal waste and hazardous medical and industrial wastes. No data could be found on whether there is any increased cancer incidence associated with these sites. Data from hazardous waste sites in the USA indicates that there were at least 30 priority pollutants that were present at a significant number of hazardous waste sites and that had completed exposure pathways from the source of contamination to the receptor population (Johnson and Derossa, 1997).

To complicate the exposure risk to workers and waste pickers, their personal hygiene is often inadequate. Washing facilities are not typically provided for these people to use at the work place, inadequate education on hygiene and health practices. A Study by USA Agency for International Development indicates that cost-effective investment in sanitation requires hygiene promotion and education to achieve successful mortality and morbidity reductions (Varley and Bendahmane, 1997).

Effects of solid waste handling is that the dirty nature of the work de-motivates people about their hygiene (Cointreau, 2000). Dumpsite waste pickers in Nepal, revealed that 73% did not use soup to wash their hands, 88% didn't use soup to wash their feet, and more than 65% didn't change their clothes daily, about 18% regularly waited more than a week between bathes and changing clothes (*GTZ*, 1996). In wash picking families in India, women reported preparing meals immediately after returning home from waste picking, without bath. Most women pickers bathed only once a week. Since these women know they will become as dirty during the next day of work, they say they are not motivated to clean at the end of each day (Huisman, 1994).

At the Bombay, India open dumpsites, 95 solid waste workers were surveyed and examined. Of all landfill workers surveyed, 80% had eye problems, 73% had respiratory ailments, 51% had gastrointestinal problems, 40% had skin infections and 22% had orthopedic problems (Konnoth, 1994). Based on clinical examination, 90% had

decreased visual acuity and most workers complained of eye burning, redness and watering (Konnoth, 1994). At Metro Manila's main open dump, in 1981, 750 waste pickers studied revealed 40% had shin diseases and 70% had upper respiratory diseases (Adan et al, 1982).

A comparative study of waste pickers working at calcutta's dump in the 1980's and nearby farmers who use organic solid waste as fertilizer, showed that picker's reported higher prevalence of respiratory diseases (pickers 71% vs. farmers 34%), diarrhea (pickers 55% vs. farmers 28%) and protozoa, helminthic infestation (32% vs. 12%) (Nath, 1995).

Moreover, the review of literature in 1998 of various studies in the USA indicated that women living near municipal waste disposal sites showed increased risk of infants with birth defects such eye/ear anomalies, chromosome anomalies, heart problem, neural tube defects. Thus, these sites may have received hazardous waste mixed with the non-hazardous wastes (Croen, 1998). Additionally, significantly elevated level of cadmium in blood was found in paper sorters and hazardous solid waste handlers (Poulsen and Midtgard 1996). Mercury was elevated in blood only among paper sorters (Poulsen and Brum 1995). High blood lead levels (mean of 28 µg/dl) are reported for child waste pickers in Metro Manila (Torres et al, 1991). More than 70% of children working at Metro Manila's largest dumpsite had blood lead levels exceeding WHO's guideline of 20 µg/dl , also the average blood lead levels of children in a Metro Manila slum removed from the zone of influence of the dumpsite were significantly lower, at 11 µg/dl (Torres et al, 1991). Thus for blood lead to be at the reported levels, air contamination is the most probable explanation. This is likely due to open burning of solid wastes that typically contain lead in batteries, paints, soldered cans, ceramics, glass, and electronics (Reinhart, 1993). For comparative purposes, it is worthwhile to

note that blood lead levels were examined in 104 urban children in Mexico city between 1987 and 1993 and that the overall geometric mean blood lead level was 9.6, despite the city's well known urban air pollution problem (Rothenberg et al, 1998).

Incinerators discharge heavy metals (Mercury, Lead, Cadmium, and Arsenic) in various forms (Coat, 1994). Incinerator workers are required to clean particulate monthly from the electrostatic precipitator system for control of stack emissions (WHO, 1999). Significantly lower blood lead levels were found in workers reporting that they consistently wore respiratory protection during cleaning of the precipitators (Malkin and Brandt 1992). Chlorinated and brominated dioxins and furans are considered among the most hazardous substances created during incineration (Reimann, 1992).

A national commission in Germany from 1985-90 measured dioxin and furan concentrations under various operating conditions in 15 incineration units, with the findings that these emissions could be limited by continuously controlling and operating conditions, but still always require flue gas pollution control to reach acceptable emission standards (Johnke and Stelzner, 1992).

In high-income countries, the high concern of infectious medical waste is the transmission of HIV, which cause AIDS, or hepatitis viruses, through injuries caused by syringe needles with contaminated blood, those most at risk are health care workers. The USA reported 31 health care workers who were infected with HIV by contaminated puncture wounds, but none in housekeeping workers. The risk of HIV infection after puncture has been estimated to be about 0.3% (WHO, 1995). The risk of hepatitis B virus infection from a comparable injury was estimated to be at least 10 times higher (WHO, 1995).

In most developing countries, infectious wastes are still mixed with general solid waste for collection. Waste pickers, many of whom are children, at the dumpsites commonly

segregate and recycle the disposable syringes and cotton bandages, despite the obvious contamination from the blood and other human fluids visible on these wastes. When queried, they are commonly unaware of the health risks associated with these materials (Coggon et al, 1993).

Waste collection injuries, considered one among important issues as demonstrated in 1995, the relative risk for an occupational accident among Denmark's waste collectors was about 5.6, compared to total work force. From 1989 to 1992, the number of occupational accidents in the Danish waste collection activity was 95 per 1,000 workers per year, compared to only 17 per 1,000 nationally for all workers (Poulsen and Brum 1995). A Brazilian study found that the legs were the most injured part of the body during waste collection, followed by the arms (Poulsen and Midtgard 1996).

Consideration of background exposures in the management of HW recommends a new approach to risk assessment and risk management related to toxic waste sites. Under this new approach, which called public health risk assessment, chemical substances would be classified into a level of concern based on the potential health risks associated with typical national and regional background exposures. Problems can be foreseen with this approach; the key advantage is that resources would be allocated to reduce the most important sources of human exposure (Smith et al, 1996).

The Cairo waste picking community had an infant mortality rate of about 240 deaths per 1000 live births compared to only 98 per 1000 nationally (Zabbaleen Environmental and Development Program, 1996). The major causes of infant death were neo-natal tetanus, diarrhea, respiratory infection and measles, with tetanus causing roughly 50% of neonatal deaths, and after improving the working conditions, basic sanitation, education, and birthing assistance, the infant mortality reduced to 117 per 1000 live births (Zabbaleen Environmental and Development Program, 1996).

A Study conducted in Nuseirat Municipality and local community committees to initiating educational health activities that would raise the awareness about the environmental health issues. The prevalence of parasites among study population was (29.8%) and diarrhea was (13.7%) while skin diseases was (16%). The prevalence of previous disease which was more found in ages up to 4 years reflects the hygienic and environmental issues. (Abu Mourad, 2001)

Hazardous waste management

To cope with the risk of hazardous wastes, a control system is imperative. Such a system should have five vital components (Batstone et al, 1989):

1- Legislation and regulations

2- Implementation and enforcement procedures

3- Facilities for hazardous waste treatment and disposal

4- Training schemes for enforcement officers and plant operators

5- Public awareness and educational programs

In Gaza, no one of these five components is completely applied. Environmentally secure disposal facilities have been realized by the Municipality of Gaza at the municipal landfill in the form of a fully isolated hazardous waste section (Disselkoen, 1998).

Legislative aspects

The Organization for Economic Co-operation and Development (OECD) decided in 1994 that the exports of hazardous wastes from OECD to non-OECD states for final disposal would be prohibited immediately. All trans-boundary movements had to be phased out by the end of 1997 (Conference of Paris, 1994). Earlier than the OECD, in 1989, the Basel Convention was signed. The Convention was also designed to control the export of hazardous wastes. The Convention lists the hazardous wastes, which have

to be controlled (Environmental Law Institute, 1996). The listings of Basel would be a solid basis for the future definitions that have to be elaborated in the Palestinian Environmental Law. The Basel Convention places an obligation on the parties to manage the allowed transboundary movements of waste in an environmentally sound manner. The Convention also requires from parties to take appropriate national measures towards minimization, pollution prevention and environmentally sound management of hazardous wastes. Further parties must provide adequate disposal facilities (Convention of Basel, 1989).

Seen this international attention for hazardous waste, it would be desirable for the sustainable development of Palestine, if future legislation and hazardous waste management would be such that Palestine could also be amongst the countries that apply above international agreements (Environmental Resources Management, 1999). The Palestinian National Authority has established a framework for legislation on hazardous waste, but, as pointed out above, detailed legislation on hazardous waste, which would enable policy enforcement, is still lacking (Ministry of Environmental affairs, 1999).

In July 1999 the Palestinian Environmental Law was enacted (Ministry of Environmental Affairs,1999). This law states that producers of hazardous waste must comply with orders and directives of the Ministry of Environmental Affairs and the competent agency, which in this case is the Health and Environment Department of the Municipality of Gaza. In May 2001, during the drafting of this review, these orders and directives were not yet elaborated.

The law furthermore states that the Ministry of Environmental Affairs will define a list of hazardous wastes, which are to be considered under the law. As described above, these definitions of hazardous waste are not available yet. Hence in May 2001 the

environmental law of Palestine was not yet operative where hazardous waste is concerned. That means that policy enforcement is not an applicable instrument yet. It is seen as the highest priority that legislation on hazardous waste becomes operational, because it is evident that without proper legislation and enforcement, there will be no adequate hazardous waste management in Gaza except few initiatives in some organizations (Sauer et al, 2001).

In April 2000 the Palestinian Environmental Assessment Policy was established. This Policy states amongst others that the construction of hazardous waste disposal sites requires an Environmental Impact Assessment (Ministry of Environmental Affairs, 2000). The Policy furthermore gives the procedure for such an assessment. This means that actually an environmental impact assessment would have been required for the hazardous waste section, which was constructed at the landfill site of Gaza City. Such an assessment however should have been made before construction of the hazardous waste section, but at that time the Palestinian Environmental Assessment Policy was not yet established. An Environmental Impact Study focusing on alternatives for the location of the hazardous waste section and groundwater quality was made in 1994 before commencement of construction of the hazardous waste section in 1998 (IHE, 1994). An additional round of surveys was done, regarded the basis for the development of the hazardous waste disposal facility, although up to present legal standards, such a study would be insufficient. Reason for this being the fact that development of the hazardous waste section began before legislation was available. For future main developments however and Environmental Impact Assessment will be imperative. This might be the case when for instance a central incineration unit would be implemented in the hazardous waste management system (Vrins, 1995).

Implementation Aspects

Environmental policy and the reduction of HW started in 1976 by Environmental Protection Agency (EPA). In 1984 it was encompassed in Hazardous and Solid Waste Amendments (HSWA) by the congress. The foundation of HSWA was Land Disposal Restriction (LDRs). The approach forbids the land disposal of untreated HW. Both of the attitudes of LDRs and waste management prices have significant negative effects on generation level. At the individual generator level, the results of the analysis, exhibits the presence of large industry and rigid effects, announcing that the reply to public may show significant difference (Peretz et al, 1997)

More attention was thought to be necessary for the reduction of the disposal of hazardous wastes into the environment. As a result the first ideas about a hazardous waste management system were born. It was also recommended that a priority list of hazardous chemicals would be elaborated. To implement hazardous waste management, separation of the hazardous fractions from the rest of the waste is imperative (Tesink, 1996). Chemical inventory control program for mixed and hazardous waste facilities at Savannah River Site controlling chemicals in stored normal or hazardous waste. A specific threshold ratio can be determined and the chemicals above this threshold ratio are included in the program. The others, which are below this level, will be dealing with according to the low of the State. The facilities will be managed according to the process safety management principles (Ades,m and Vinceet,A 1997).

Chemical fixation increases options for hazardous waste treatment. The disposal of hazardous waste on or in the land is not acceptable so far. This land disposal limitation demands that all specifications of the listed HW have to be treated before disposing according to specific standards, which define technologies and concentration limits. Without these standard limits it is forbidden to dispose HW in or on the land

(Indelicato, G. and Tipton, G. 1996). In 1993, industrial and medical waste surveys conducted in 21 countries of Latin America showed more than 30% of the industrial wastes were inappropriately discharged to open dumps and controlled landfills. Hazardous medical waste was being co-disposed with general municipal solid waste in open dumps, seldom in sanitary landfills (Konnoth, 1994). The possibility to separately collect hazardous wastes differs and is dependent upon the source. The separation of industrial, medical and agricultural waste for instance is relative simple, but the separation of domestic hazardous wastes usually takes much more effort and requires a high level of environmental awareness. Once separated, hazardous waste should be collected transported, processed and disposed of using specially designed hazardous waste equipment and facilities (Vrins, 1998). Waste disposal systems, in high income countries, essentially all collected wastes go to safe sanitary landfill, composting, material recovery and incineration facilities that are designed and operated to meet environmental protection standards. In these countries, hazardous wastes are handled separately from municipal solid waste. In 1998, landfilling in the USA accounted for 55.4% of the nation's municipal solid waste disposal, incineration and materials recovery, and composting shared the remaining 44.6% (USEPA, 1998). These systems minimize environmental and health risks associated with hazardous waste.

A strategy for reducing the risks of hazardous medical wastes should focus on recognizing the risks as spread of particular diseases, developing a comprehensive plan to involve all related manpower who deal with medical wastes and training courses to all population who deal with hazardous wastes. The focus also should consider planning for equipment and tools related to hazardous medical waste, co-coordinating with other organizations in term of second collection, transfer, treatment and final disposal (El khodary, 1997). To minimize the risk of waste management and disposal

practices, and to create a financial incentive to reduce the generation of hazardous waste requiring management, EPA disseminated "command and control" regulation for defining, tracking, storing, transporting, treating, recycling and disposing of hazardous waste (Greenblot, 1996).

Chapter (3)

Methodology

This chapter explores the methodology utilized in this research. The chapter provides information about the research design, target population, sample and sampling, instrumentation and the process of data collection. Issues of scientific rigor such as validity were explicitly demonstrated. The chapter also addresses issues of ethical concerns, eligibility criteria and piloting process. Clarification was provided regarding data analysis and procedure followed to achieve that.

Study Design

Based on epidemiological perspectives, the type of this study is a quantitative cross-sectional study. This design was selected because of its advantages such as, it is economical in saving time and money and it is used for evaluative studies, this was emphasized in the following literature. It has been selected because it is useful for descriptive, correctional, interpretative and evaluative purposes (Burns and Grove, 1997). Cross-sectional studies are generally carried out in a population at a point of time or over a short period. Cross-sectional studies usually are quick (snap-shot) and economical (Polit and Hungler, 1999). Cause and effect are being examined at the same point of time. It may give some insight and understanding of the association between the cause and the effect (Coggon et al, 1993).

Method of Study

A self-administered questionnaire was elected for its advantages, such as wide coverage (Bell, 1993), generalisability, saving time (Holloway and Wheeler, 1996), enhancing confidentiality, supporting internal and external validity, facilitating analysis, saving resources and limiting researcher's effect on the study (Polit and Hungler, 1999).

In other words, a self-administrated questionnaires were used for its various advantages. This was significant as according to the researcher's background of being the Director of Health and Environment Department in Gaza Municipality, he has a direct contact with most industries and subjects in the study.

Period of Study

The study started on the first of February 2001, when the researcher started by seeking ethical approval and setting up the administrative procedures and so on. Data collection started soon after the ethical approval was obtained. Questionnaire forms were made available and data collection continued until the mid of June 2001, then continued by data analyses and writing results and discussion followed by conclusion and recommendations. The study was ready in the middle of November 2001

Study Location

The study was carried out in certain selected health centers (El-Shifa Hospital, 4 Governmental and UNRWA Clinics) (Annex 2) and 10 different industrial factories in the Gaza Strip (Annex 3) which were dealing with the industrial hazardous wastes at the time of study.

Study Population

The study population consists of subjects who had contact with medical wastes and or were dealing with the hazardous industrial wastes at the time of the study.

Inclusion Criteria

The subjects who were eligible in this study all employees who were working in the selected study sites and have certain contact with hazardous wastes.

Exclusion Criteria

All employees who have no contact or any deal with hazardous wastes as secretaries, personnel in rehabilitation centers and school of nursing. Illiterate subjects were

excluded from the study and other literate ones substituted them. The substitution was done by random choosing of the next subjects.

Sample Size

All employees who were dealing with the industrial wastes were included. It is worth mentioning that the industries in the Gaza Strip are considered a small-scale industry with around twenty employees in each factory therefore all of them were included in this study. In contrast, at El-Shifa Hospital, the largest health institution in the Gaza Strip with more than 1000 employees, 200 subjects were randomly selected (20% of the total employees). However, from the four clinics, 120 subjects were randomly selected (50% of the total employees).

Sample Method

The study population was selected through a systematic random sample to ensure a representative sample of all employees who were dealing with hazardous wastes. A list of employees' names for each institution was prepared and then a sample was chosen. In other words, 200 questionnaires were distributed in El-Shifa Hospital, 120 distributed in clinics and 210 questionnaire forms were distributed in factories.

Questionnaire Design

According to the review of literature related to the concern issue, after asking HW experts who deal with the subject and different levels of employees who have contact with HW, a self-administrated, self-designed questionnaire was developed with closed and open-ended questions (Annex 4). The questionnaire was designed in the Arabic Language, as most the target population were unfamiliar with the English Language. Unnecessary personal data, leading, complex and duplicated questions were avoided. In each questionnaire, an explanatory letter was attached to cover some ethical considerations and to facilitate questionnaire filling (Annex 5).

The questionnaire included several areas of questions such as demographic data (category of the organization, age, gender, marital status, education levels, occupations and so on) and managerial issues such as the existence of HW management, management plan, presence of special team for HW, legislations and co-ordination with others in relation to the concerned issue. Additionally, it included questions related to knowledge about the HW, types, separations, collections, risks and so on.

Questions were arranged in a logical sequence to facilitate filling the questionnaire (Bell, 1997). Variables such as age, year of experience, collection/transfer per day and so on were left open in order to be categorized later on in the analysis. In other words, they were categorized according to the findings.

A draft questionnaire was designed with the help of supervisor and advisor. This draft was discussed with a group of environmental specialists. They induced some changes. Some changes were also made after the pilot study to clarify confusion and ambiguity reported by the pilot study subjects.

Ethical Matter

A formal approval to conduct the study in governmental hospital and primary health care clinics were taken from the director general of the Ministry of Health, Director of Health at the UNRWA and the owners of the concerned factories to conduct the study. The following ethical consideration were dealt with:

- Every subject was given an explanatory form about the study. This form included: The purpose of the research, funding, confidentiality of information, and findings and so on.
- Guarantees of anonymity and confidentiality were given and maintained.

- An official letter of request was sent to each institution either health or industries in the Gaza Strip to obtain approval for subjects participation in the study.

Instrument Validity

The validity of an instrument is a determination of the extent to which the instrument reflects the abstract construct being examined. Messick (1989), defined the validity of an instrument as: "*An integrated evaluative judgement of the degree to which empirical evidence and theoretical rational support the adequacy and appropriateness of inferences and actions based on test scores or other models of measurement*" (Messick, 1989, p. 143). To accumulate evidence of validity, two types of validity were utilized in this study; face validity and Content Related Validity as presented in the coming paragraphs:

Face validity relates to the suitability, layout, appearance and arrangement of the questionnaire and assessed by independent evaluators who suggested useful remarks. By the end, the questionnaire was produced by a professional attractive manner.

Content related validity examines the extent to which the method of measurement includes all the major elements relevant to the construct being measured (Messick, 1989; Burns and Grove, 1997). This evidence is usually obtained from three sources: the literature, representatives of the relevant populations and content experts. The domain of this study was determined and developed through a concept analysis and an extensive review of the literature.

Six experienced researchers were chosen to evaluate the initial research instrument. Specific instructions were given to them, such as conceptual definitions, operational definitions, numerical scales and so on. The CVI developed by Waltz and Bausell (1981) was adopted as an instrument that determines the validity of the items provided

in the questionnaire. Using this instrument, experts rated the content relevance of each item using a 4-point rating scale. The following scale has been adopted: 1=not relevant item and should be omitted; 2=not relevant unless major change are introduced; 3= relevant but needs minor modifications; 4=very relevant and succinct (Waltz and Bausell, 1981; Burns and Grove, 1997).

Six experts rated the content relevance of each item. Experts' panel discussion took place and at least four out of six (experts) had to agreed on each item. Many items were added, modified or deleted. The experts' panel discussion took about 2 hours.

Pilot Study

A pilot study was conducted before the start of data collection, to test recruitment response rate, size of effect, validity and suitability of questionnaire as well as areas of ambiguity before the long expensive study started so that remodeling and reforming could tack place (Burns and Grove, 1997). Twenty forms were distributed in the different study fields, (health and industry). The chosen employees were invited to participate in the piloting process so they received an explanation about study and had been asked to complete the questionnaires. Some of them asked question about the explanation of certain terms. By the end, discussion with study sample about the meaning of question took place to ensure the validity and reliability of the questionnaire. By the end of the pilot study, some changes were introduced, some were cancelled and the final form of the questionnaire was produced.

Data Collection

Data was collected quantitatively. Collection of data from the study population in the field took about two months. Arrangements started by conducting the ethical matters and the administrative arrangement with the institutions. Meetings were arranged between the researcher and the head of sections and departments at the concerned

organizations to explain the purpose, importance and procedure of the study and so on. It has been started with the industrial field by firstly visiting all the selected factories in the Gaza Strip. The questionnaire has been explained to the owners or managers of the different factories and they were provided with the ethical form and the questionnaire. In the second visit, the forms were distributed to the target population according to a pre-determined plan. After a couple of days, the filled questionnaires were collected. That means each factory was visited at least three times. However, the average time for filling a questionnaire was about 15 minutes. The process of data collection from the industrial areas took around 40 days. At El-Shifa Hospital, the questionnaires were distributed to the different wards, and the process of data collection was achieved within two weeks. Regarding health clinics, the needed data were collected within 3 weeks.

Response Rate

The response rate for all the study population was 84.9%. The hospital response rate was 80%, the clinics were 88.3% and the industrial field response was 87.6%.

Limitations of the Study

The researcher's background enabled him to have the least possible obstacles in this study. Organizations offered help including supportive services and access to the study population. This might aid in explaining the high response rate, 84.9%, in this study. However, the following constraints have been reported:

The bad general situation resulted from the political and economic problems especially at the time of distributing the questionnaire, made some obstacles in collecting the needed data.

The incompetence of the health information system at some levels in the Ministry of Health and Ministry of Industry in the Gaza Strip contributed to complicating the work.

There were differences between registries and actual findings relating the place of work and job title.

Weak reporting in most organizations which were dealing with hazardous waste.

The limitations of this study are those common in cross-sectional surveys. Cross-sectional studies (snap-shot) evaluate the situation at a particular time, while this issue could be influenced by time and circumstances. Using research designs with longitudinal methods of data collection might also elicit more accurate information.

The data collected, especially quantitative data, was solely reliant on self-report instruments. Self-report surveys may be inaccurate because participants are sometimes unwilling to describe accurately their experiences, attitudes or feelings (Burns and Grove, 1997).

The questionnaire's questions are more vulnerable to changes in wording, emphasis and sequence than are questions about facts.

Other difficulties arise associated with field studies, including problems of ambiguity and bias. Relative to experimental and quasi-experimental research, such studies reduce the ability to determine causal relationships (Polit and Hungler, 1999).

The study considered certain localities therefore generalisability is therefore reduced. Thus, to extend the generalisability of this study, future comparative research could perhaps focus on samples from other places in Palestine.

The surveyed questionnaires also inherit another limitation related to the fact that it forces the participant to give opinions in regard to certain given statements. There could be other factors that affect the studied issue but not mentioned in the questionnaire.

An unanswered question remains as to the status of the sample population is non-respondents. It is possible that non-respondents are extremely critical in this respect.

Other limitations included limited time available, limited resources, such as educational materials, journals and books and lack of logistic facilities.

Data Coding and Data Entry

Questionnaires were numerically coded to enter the data systematically and efficiently. Data was entered using SPSS "Statistical Package for Social Sciences" My advisors were consulted for guidance. Filled questionnaires have been entered after over viewing them and excluding the incomplete and inaccurately filled ones. Data cleaning was carried out through double check both manually and through using the computer.

Statistical Analysis

Quantitative statistical analysis for questionnaires were done using SPSS as follows:

- Defining and coding of variables.
- Entering data to an entry model
- Cleaning data
- Frequency tables for all study variables
- Re-coding of data
- Computing variables, which could reflect a construct such as the concept of knowledge about HW and management of HW.
- Cross tabulation of results.
- The statistical tests of significance were variant and various tests were used depending on the nature of data such as Chi square, ANOVA and t-test. The results were accepted as statistically significant when the P value was less than 5% ($P < 0.05$).

Chapter (4)

Results

The sources of results were the self-administrated questionnaires distributed to the total study populations. Four hundred fifty usable questionnaires were analyzed and provided the findings presented in this chapter. However, it was started by presenting some information about the characteristics of the study population, description of HWM and knowledge level among participants in this regard. Later on, the findings of statistical procedures that clarify the nature of the relationships between HW and other variables were presented.

Knowledge, Attitude and Practices of Study Population towards HWM.
Characteristics of the Study Population
Table (1) Summary of the main characteristics of the study population

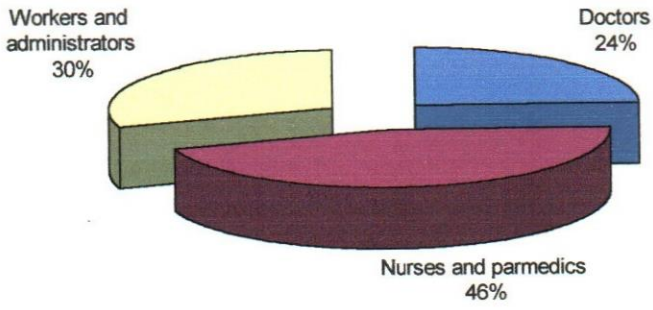
Variable		No.	Percent	Total
Category of the organization	Hospital	160	35.6	450
	Clinic	106	23.6	
	Factory	184	40.8	
Gender (total population)	Male	359	79.8	450
	Female	91	20.2	
Gender (health)	Male	182	68.4	266
	Female	84	31.6	
Gender (industry)	Male	177	96.2	184
	Female	7	3.8	
Age	<35 years	258	60.3	428
	36-44 years	103	24.1	
	>45 years	67	15.6	
Education level (health)	Primary	2	.8	266
	Preparatory	11	4.1	
	Secondary	41	15.4	
	Academic	184	69.2	
	Others	28	10.5	
Education level (industry)	Primary	21	11.4	184
	Preparatory	47	25.5	
	Secondary	68	37	
	Academic	44	23.9	
	Others	4	22	
Longevity of service	<5	225	51.3	439
	6-10	98	22.3	
	>11	116	26.4	

As shown in table 1, most of study populations (79.8%) were male and the lowest percentage were female workers especially in the industrial field (3.8%). However, females in health organizations represented 31.6%. The highest age group of the study population was less than 35 years old (60.3%) and the mean age of study populations was 34.8 years (SD 9.5).

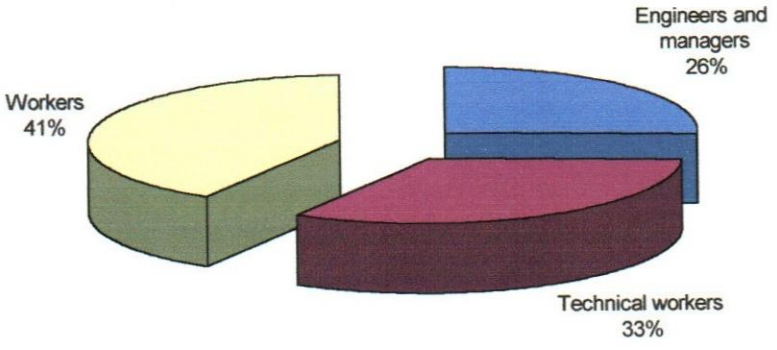
Regarding the educational level, there were obvious variations among the study participants. As shown in table (1), in health organizations, the academic education represented 69.2% while in industry, it represented 23.9%. Contrary to that, the primary level in health organizations represented 8% while in industry it represented 11.4%. The workers with secondary level education represented 37% in industry while they represented 15.4% in health organizations.

It seems that most participants had short period of experience. The employees who worked less than five years in the same place were represented the majority (51.3%). In contrast, employees who worked more than eleven years represented 26.4%. Whilst, the average years of work in health organizations was 8.83 (SD 6.9), the mean for industrial workers was 5.4 years with (SD 5.9).

(Graph 1a): Distriburion ofRespondent Health Occupation



(Graph 1b): Distribution of Respondent Industrial Occupation



As shown in (Graph 1a), the nursing occupation represented the highest percentage among health personnel (46%), while doctors represent the lowest percentage (24%). In comparison, the highest category in industry was workers and technical workers, which represented 41% and 33% respectively (Graph 1b).

Distribution of the Study Population by their Awareness and Relation to HWM

Table 2: Distribution of the study population by their awareness about HWM

Variable		No.	%	Total
Presence of HWM	Yes	249	55.5	449
	No	163	36.3	
	Lack of knowledge	37	8.2	
Presence of legislation	Yes	186	41.4	449
	No	164	36.5	
	Lack of knowledge	99	22.0	
Coordination with others	Yes	247	55.1	448
	No	76	17.0	
	Lack of knowledge	125	27.9	
Knowledge about HW	Yes	346	76.9	450
	No	104	23.1	
Evaluation of HWM	Excellent	34	7.6	449
	Very good	86	19.2	
	Good	151	33.6	
	Acceptable	141	31.4	
	Unacceptable	37	8.2	

Total respondent (450), Missing numbers was referring to people who didn't answer the questionnaire.

Whilst about half of the subjects reported the presence of HWM in their organizations, nearly one third (36.3%) reported the lack of HWM. However the rest said that they don't know anything about this subject. This result reflects the weakness of the managerial issues related to HW. Similarly, legislation, which is considered as a cornerstone of HWM because its absence leads to mismanagement of HW and that, will increase the risks to public health as well as to the environment. Congruently, as shown in table 2, about 41.4% of the study population knew that there were legislations in their organizations. In contrast, 36.5% of them reported the absence of legislations while 22% mentioned that they don't know about the presence of legislations in their organizations. Regarding the coordination with other organizations, almost more than

half of the study population perceived their organizations as being coordinating with others in this field. Around 27%, had no idea about that and the rest reported the lack of coordination in this regard (17%). However, such result reveals the weakness of the coordination between organizations in this regard. The majority of the study population (76.9%) reported their awareness and familiarities of HWM. A considerable number of participants (23.1%) reported their lack of knowledge in this regard. In response to the evaluated question, the majority of respondents indicated that HWM is good (33.6%) and acceptable (31.4%) in their organizations. Nevertheless, few respondents perceived HWM as exceptionally good (7.6%) or unacceptable (8.2%).

Table (3): Distribution of the Study Population in relation to HWM and improvements

Variable		No.	%	Total
Separation of HW	Continuously	173	46.3	374
	Sometimes	107	28.6	
	Not absolutely	51	13.6	
	Lack of knowledge	43	11.5	
Collection of HW	Yes	352	78.2	450
	No	49	10.9	
	Lack of knowledge	49	10.9	
Improvement of HW services	Yes	266	59.2	449
	No	70	15.6	
	Lack of knowledge	113	25.2	
Positive environmental impacts	Yes	322	71.6	450
	No	53	11.8	
	Lack of knowledge	75	16.7	
Presence of tools for HWM	Yes	399	89.9	444
	No	27	6.1	
	Lack of knowledge	18	4.1	
Regular medical follow up	Regularly	65	14.5	448
	Some times	133	29.7	
	Not Absolutely	250	55.8	
Availability of preventive tools	Regularly	184	41.1	448
	Sometimes	181	40.4	
	Not Absolutely	67	15.0	
	Lack of knowledge	16	3.6	
Causes of absence of HW tools	Lack of funds	108	31.9	339
	Lack of workers awareness	96	28.3	
	Lack of policies	124	36.6	
	Others	11	3.2	

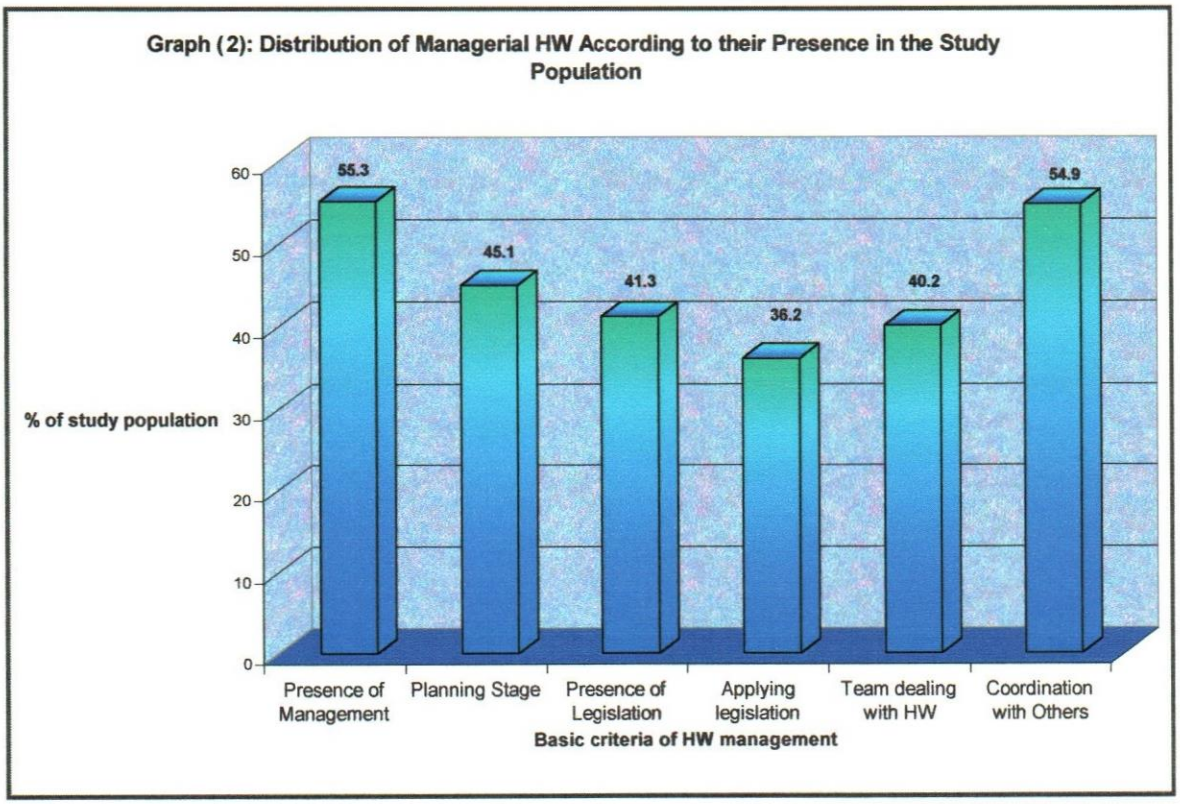
As shown in table 3, it has been started by the issue of separation of the HW, the most important item in HWM. It is worth remembering that handling and disposal are entirely depending on this issue. However, around half of the study population stated that there was continuous separation of HW in their organizations while the rest provided different answers. Participants who reported occasional separation represented 28.6%. The remaining population reported the absence of separation (13.6%) or their lack of knowledge about this issue (11.5%). This result could be explained by the presence of sharps and needles, which are usually seriously considered and carefully handled within the health organizations.

Congruent with that, was the process of collection of HW. The majority of participants (78.2%) confirmed the presence of regular collection services in their organizations. Nevertheless, the remaining responses were variant. Around 10% reported that there was no collecting system in their organizations and the rest reported that they don't have information about this issue (10.9%). It is worthy noting that, after the departure of the Israeli occupation, the PNA has given health and environment high priorities. Meaning that, both donors and the Palestinian government have invested a lot of resources in this field. Subsequently, the outcome of this study declared that 59.2% of the study population pointed that they have noticed improvements in HW services. This has been reflected on the high percentage (71.6%) of participants who perceived the high levels of environmental benefits in their organizations. Inconsistently, 15.6% reported that there was no improvement in the services and the rest (25.2%) don't know if there were improvements or not.

Regarding the presence of special tool items most of the study population (89.9%) stated that there were special tools for dealing with HW in their organizations. In contrast, few percent of people (6.1%) said that they did not have such tools and (4.1%)

of subjects don't have information about the issue. Moreover, the majority of participants reported the availability of preventive tools (regularly and occasionally) in their organizations (81.5%). The rest reported either the absence of such tools or their lack of knowledge of this issue. Interestingly, the lack of availability of such tools has been referred by participants to the lack of obligations, funds and/or lack of workers' awareness. What makes things worse, is the lack of regular medical assessment, as most of the study population said that there was no regular medical examination in their organizations.

Practice of Managerial Issues Related to HWM



(Graph2) shows that around half of the study population said that there was HWM in their organizations while the rest confirmed that there was no management. 45.1% mentioned that there were some planning to manage this issue moreover around 40% mentioned that there was legislation to control the HWM but about 64% stated that their organizations didn't apply it. Almost about 40% of the study population said that there was teamwork that deal with the HWM. Regarding coordination with other organizations that deal with the same issue, 45.1% confirmed that there was no coordination in their organizations with the others.

Distribution of the Study Population by their Perception of Risks, Training and Attitudes towards HW

Table (4): Distribution of subjects by their perception of risks linked to HW

Variable		No.	%	Total
Risk-links of HW	Children playing	310	69.4	447
	Presence of sharps	106	23.7	
	Presence of animals	13	2.9	
	Others	18	4	
Health problems due to dealing with HW	Yes	226	50.3	449
	No	176	39.2	
	Lack of knowledge	74	10.5	
Self-harm from HW	Yes	44	9.8	450
	No	402	89.3	
	Lack of knowledge	4	.9	
Disease-linked with dealing with HW	Skin diseases	104	43.9	234
	Respiratory diseases	62	26.2	
	Intestine diseases	67	28.3	
	Eyes diseases	4	1.7	

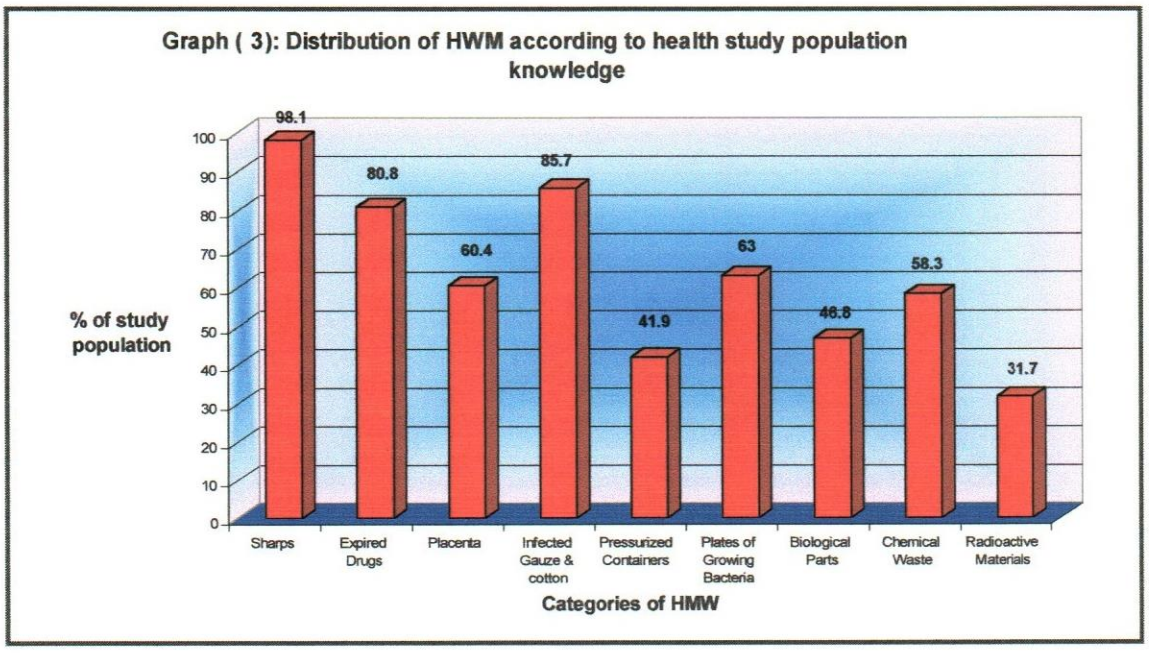
As shown in table 4, the majority of study population (69.4%) said that children's playing with H.W causes the main source of harm. However, the second important reported factor was the presence of sharps and needles (23.7%). The other perceived harms were the presence of animals like street's dogs, cats and rodents. In relation to the effect of HW on health, around half of the study population said that they noticed health problems due to dealing with hazardous wastes through different diseases especially skin diseases (43.9%), intestine diseases (28.3%), respiratory diseases (26.2%) and eye diseases (1.7%). However, when participants were asked about experiencing self-harms from dealing with hazardous waste, most study population mentioned that they didn't experienced any harms.

Table (5): Distribution of participants by their training and attitudes towards HW

Variable		No.	%	Total
Attending previous training	Yes	79	17.6	450
	No	371	82.4	
Needs for training	Yes	344	76.4	450
	No	106	23.6	
Presence of mass media	Yes	115	25.6	449
	No	292	65.0	
	Lack of knowledge	42	9.4	
Health educators' visits	Yes	117	26.1	449
	No	259	57.5	
	Lack of knowledge	73	16.3	
Willingness to cooperate on training	Yes	390	86.7	450
	No	60	13.3	

As shown in table 5, the majority of participants didn't have any previous training (82.4%), on HW. Only 17.6% said that they have had previous training in this field. Moreover, 76.4% of participants stated that they need training courses in how to deal with hazardous waste. Similarly, almost about quarter of the study population stated that there was mass media specially posters and leaflets but however, most of them (65%) said that there was no mass media in their organizations. Moreover, more than half of the study population in both fields, health and industries, said that there were no health education visits. Interestingly, most of the study population showed their willingness to cooperate with others in HW (86.7%).

Categories of Hazardous Medical Waste



From the above graph we notice that most of health study population (98.1%) recognize needles and sharps as HW and (85.7%) of them consider infected gauze and cotton as HW while the lowest percentage of health study population know that pressurized containers and radioactive materials as HW.

Furthermore (80.8%) of health study population stated that they know expired drugs, (60.4%) mentioned placenta as HW. In addition the percentage of employees who know plates of growing bacteria, chemical waste, biological parts and radioactive material as HW are (63%), (58.5%) and (46.8%) and (31.7%) respectively.

Distribution of the Study Population by Category of the Organization and the Presence of HW Tools, Regular Medical Examination, Separation and Collection of HW and Development of Service

Table (6): Distribution of the study population by category of the organization and the presence of HW tools

Presence of HW tools	Category of the organization								
	Hospital		Clinic		Factory		Total		P Value
	No	%	No	%	No	%	No	%	
Yes	138	86.3	94	90.4	167	92.8	399	89.9	0.135
No	22	13.8	10	9.6	13	7.2	45	10.1	
Total	160	100	104	100	180	100	444	100	

X^2=4.003, DF=2, CI=95%

The vast majority of the study population (89.9%) confirmed that there were HW tools in their organizations whereas (10.1%) of them said that there were no HW tools such as plastic bags, special boxes and eye glasses. In addition, 92.8% of factories participants said that there were HW tools in their factories. Among hospital participants, 86.3% have confirmed the presence of HW tools in their organizations. The same was true about 90.4% of clinic participants. The statistical analysis shows no significant differences among the various organizations in this regard (P value=0.135). Similarly, as shown in table 7, the majority of the hospital and factories' participants said that the preventive equipment were available while the rest (18.5%) said that the preventive equipment were not available. Concerning clinics' participants, 71.7% reported the availability of preventive equipment in their organizations. However, the study shows that there is a strong statistical significance differences in this regard (P value = 0.001)

Table (7): Distribution of study population by category of the organization and availability of preventive equipment

Availability of preventive equipment's	Category of the organization								
	Hospital		Clinic		Factory		Total		P Value
	No	%	No	%	No	%	No	%	
Regularly	54	33.8	36	34	94	51.6	184	41.1	0.001
Some times	77	48.1	40	37.7	64	35.2	181	40.4	
Not absolutely	29	18.1	30	28.3	24	13.2	83	18.5	
Total	160	100	106	100	182	100	448	100	

X^2 =20.416, DF=4, CI=95%

Table (8): Distribution of the study population by category of the organization and their evaluation of dealing with HW

Evaluation of dealing with HW	Category of the organization								
	Hospital		Clinic		Factory		Total		P value
	No	%	No	%	No	%	No	%	
Excellent	5	3.1	13	12.3	16	8.7	34	6.7	0.001
Very good	21	13.2	15	14.2	50	27.2	86	19.2	
Good	60	37.7	23	21.7	68	37	151	33.6	
Acceptable	49	30.8	46	43.4	46	25	141	31.4	
Unacceptable	24	15.1	9	8.5	4	2.2	24	15.1	
Total	159	100	106	100	184	100	449	100	

X^2 =48.46, DF= 8, CI=95%

Table (8) shows that 25.9% of total study population evaluated dealing with HW as being excellent and very good. The majority of study participants (65%) perceived dealing with HW as being good and acceptable. The rest negatively perceived dealing with HW as they perceived it as being unacceptable. From those, about 16.3% of hospital participants evaluated the situation of HW as being excellent and very good. In contrast, most of them (68.5%) evaluated the situation as being good and acceptable. The rest (15.1%) recognized the situation as being unacceptable. Concerning the other categories, there were similar differences as it is clear from the table. However, generally, factories elicited the most positive evaluation, followed by clinics and hospital consequently. Moreover, the variations among the different organizations were statistically significant (P value = 0.001).

Table (9): Distribution of participants by regular medical examination

Regular medical exam	Category of the organization								
	Hospital		Clinic		Factory		Total		P value
	No	%	No	%	No	%	No	%	
Regularly	14	8.8	36	34.0	15	8.2	65	14.5	0.001
Some times	55	34.6	24	22.6	54	29.5	133	19.7	
Absolutely no	90	56.6	46	43.4	114	62.3	250	55.8	
Total	159	100	106	100	183	100	448	100	

X^2 =43.62, DF=4 , CI=95%

Whilst, the study revealed that more than half of the study population (Table9) said that there were no regular medical exams in their organizations, 14.5% confirmed that there

were regular medical exams. The rest (19.7%) said that medical examination is conducted occasionally. The highest percentage of medical examination was carried out in clinics (56.6%) followed by hospital (43.4%). Industrial field shows the lowest level in this regard (37.7%). More importantly, the above table clarifies statistical significant differences between the category of the organization and the provision of medical exams for the study population (P value =0.001).

Table (10): Distribution of the study population by category of the organization and separation of HW

Separation of HW	Category of the organization								
	Hospital		Clinic		Factory		Total		P Value
	No	%	No	%	No	%	No	%	
Continuously	57	38	59	61.5	57	44.5	173	46.3	0.001
Sometimes	52	34.7	14	14.6	41	32	107	28.6	
Not Absolutely	16	10.7	12	12.5	23	18	51	13.6	
Lack of Knowledge	25	16.7	25	16.7	25	16.7	43	11.5	
Total	150	100	96	100	150	100	374	100	

X^2 =26.49, DF= 6, CI=95%

The majority of study population reported that there was separation of HW (Table 10)in their organization (74.9%). The rest (24.9%) mentioned that there was no separation. The results revealed that 61.5% of the clinics participants said that there was continuous separation of HW. Among the hospital participants 38% said that separation has been carried out some times. Concerning factories participants, 44.5% of the study population said that there was continuous separation of HW. The differences among the study participants were statistically significant (P value = 0.001)

Table (11): Distribution of the study population by category of the organization and collection of HW

Collection of HW	Category of the organization								
	Hospital		Clinic		Factory		Total		P Value
	No	%	No	%	No	%	No	%	
Yes	122	76.3	79	82.9	151	82.1	352	78.2	0.341
No	16	10	14	13.2	19	10.3	49	10.9	
Don't know	22	13.8	13	12.3	14	7.6	49	10.9	
Total	160	100	106	100	184	100	450	100	

X^2 =4.51, DF=4 , CI=95%

According to the above table (11), 78.2% of the study population reported that there was collection of HW in their organizations. The results also showed that 82.9% among clinic participants confirmed the presence of collection, 82.1% among industrial participants and 76.3% among hospital participants. In contrary, the rest reported that either the lack of collection or their lack of knowledge in this regard. However, there were no statistical significant differences between the study respondents regarding collection of HW (P value = 0.341).

Table (12): Distribution of the study population by category of the organization and their perception of HW improvements since the presence of PNA

Development of services since PNA	Category of the organization								P Value
	Hospital		Clinic		Factory		Total		
	No	%	No	%	No	%	No	%	
Yes	76	47.5	55	52.4	135	73.4	266	59	0.001
No	31	19.4	21	20	18	9.8	70	15.6	
Don't know	53	33.1	19	27.6	31	16.8	113	25.2	
Total	160	100	105	100	184	100	449	100	

X^2 =26.85, DF= 4, CI=95%

Fifty nine percent of study population reported that there were development of HW services since PNA had taken over the responsibilities meanwhile, the rest were either unaware or perceived no improvement in this regard (Table 12). However, the comparison between the different categories regarding their perception of HW improvement showed that the highest percent of those who perceived positive improvement were among industrial participants (73.4%) followed by clinic participants (52.4%) and hospital participants (47.5%). The table also indicates statistically significant differences between participants of the different categories of the organizations (P value = 0.001).

Knowledge of the study population of HW

Table (13): Distribution of the study population by their knowledge of HW

Knowledge of HW	Category of the organization								
	Hospital		Clinic		Factory		Total		P Value
	No	%	No	%	No	%	No	%	
Yes	127	79.4	93	87.7	126	68.5	346	76.9	0.001
No	33	20.6	13	12.3	58	31.5	104	23.1	
Total	160	100	106	100	184	100	450	100	

X^2 =14.9, DF=2, CI=95%

Most of study population (76.9%) confirmed that they knew about HW, but the rest said that they did not know any idea about the subject. Regarding the relationships between participants from the different categories to this issue, table 13 shows that the majority of clinic participants (87.7%) said that they have good knowledge about HW compared to 68.5% of industry participants and 79.4% of hospital participants. In other words, highest percentage among categories regarding their knowledge of HW was among clinics participants. It is worth noting that there were statistically significant differences between participants of the different organizations and their knowledge of HW (P value = 0.001)

Table (14): Distribution of participants of the different organizations by their knowledge of HW

Knowledge of HW	Name of the organization								
	Gov-hosp.		Gov-clinic		UN-clinic		Total		P Value
	No	%	No	%	No	%	No	%	
Yes	127	79.4	51	86.4	42	89.4	220	82.7	0.195
No	33	20.6	8	13.6	5	10.6	46	17.3	
Total	160	100	59	100	47	100	266	100	

X^2 =3.27, DF= 2, CI=95%

As shown in table 14, 82.7% from health sector participants said that they had good knowledge of HW; meanwhile, 17.3 % of them said that they didn't have any idea about the issue. It is worth noting that, the highest percentage of knowledge about HW (89.4%) was among UNRWA health employees and the lowest were hospital employees (79.4%). However, governmental clinics employees were less

knowledgeable about this issue than UNRWA clinics employees but more than hospital employees. However, it is clear that there were no statistical significant differences between organizations regarding their employees' level of knowledge about HW (P value = 0.195)

Table (15): Distribution of the study population of the different organization by conducting regular medical exam

Regular medical exam.	Name of the organization								
	Gov-hosp.		Gov-clinic		UN-clinic		Total		P Value
	No	%	No	%	No	%	No	%	
Regularly	14	8.8	4	6.8	32	68.1	50	18.9	0.001
Some times	55	34.6	12	20.3	12	25.5	79	29.8	
Absolutely no	90	56.6	43	72.9	3	6.4	136	51.3	
Total	159	100	59	100	47	100	265	100	

X^2 =101.43, DF= 4, CI=95%

Whilst more than half of the health sector participants have confirmed that there were no regular medical examinations in their organizations, 29.8% of them said that it had happened occasionally. The rest said that there were regular medical exams. UNRWA clinics elicited the highest percentage (68.1%) meanwhile the lowest percentage (6.8%) was among governmental clinics participants. The statistical analysis demonstrates that there are highly statistical significant differences between the different organizations regarding conducting medical exam (P value = 0.001)

Table (16): Distribution of participants by their educational level and knowledge about HW

Educational level	Knowledge of HW						P Value
	Yes	%	No	%	Total	%	
Primary	10	43.5	13	56.5	23	5.1	0.001
Preparatory	35	60.3	23	39.7	58	12.5	
Secondary	80	73.4	29	26.6	109	24.2	
Academic	200	87.7	28	12.3	228	50.7	
Others	21	65.6	11	34.4	32	7.1	
Total	346	76.9	104	23.1	450	100	

X^2 =41.47, DF= 4, CI=95%

As shown in the above table (16), 5.1% of the study participants were prepared at the primary level. From them, 43.5% knew about HW and the rest (56.5%) did not know

about this subject. This category was the lowest in terms of knowledge among the different categories. Participants who prepared at secondary level represented 24.2% of the total population and 73.4% of them said that they knew HW, while 26.6% said that they did not know it. However, the highest percentage among the study population was academics who represented 50.7% of the study. Out of them, 87.7% of them said that they knew about HW, while 12.3% of them stated that they did not know about it. In general, 76.9% of the study population said that they knew HW, while the rest (23.1%) said that they did not know about it. The differences in subjects' knowledge about HW in reference to the educational level showed statistically significance differences (P value = 0.001).

Table (17): Distribution of health sector subjects by knowledge of HW

Occupation	Knowledge of HW						
	Yes		No		Total		P Value
	No	%	No	%	No	%	
Doctors	54	83.1	11	16.9	65	24.4	0.069
Nurses and paramedics	106	87.6	15	12.4	121	45.5	
Workers and Administrators	60	75.0	20	25.0	80	30.1	
Total	220	82.7	46	17.3	266	100	

X^2 =5.357, DF= 2, CI=95%

Table (17) shows that nurses and paramedics were not only the largest group of health subjects (45.5%), but also the most knowledgeable (87.6%) ones about HW. Only 12.4% of them didn't have any idea about the issue. The study indicated that 24.4% of health sector subjects were doctors and out of them, 83.1% were having knowledge about HW. The rest of health sector respondents (30.1%) were workers and administrators and 75% of them were having knowledge about HW.

In general, 82.7% of health study population were having information about HW, while the rest of them (17.3%) didn't have any information about the subject. However, the differences among participants in level of knowledge about HW were about to reach statistical significance (P value = 0.069).

Table (18): Distribution of industry sector participants by their knowledge about HW

Occupation of industrial organization	Knowledge of HW						
	Yes		No		Total		P value
	No	%	No	%	No	%	
Engineers and managers	42	89.4	5	10.6	47	25.7	0.001
Technical workers	41	67.2	20	32.8	61	33.3	
Workers	42	56.0	33	44.0	75	41.0	
Total	125	68.3	58	31.7	183	100	

$X^2 = 14.905$, $DF = 2$, $CI = 95\%$

Technical workers and workers represented the highest category in the industrial sector (Table18) as they represented (74.3%). Of the technical workers, 67.2% were having information about HW. Among workers, 56% were having information about the issue. Concerning engineers, managers and supporting staff they represented 25.7% of the industrial sector participants and 89.4% of them were having good knowledge about HW. In general, (68.3%) among industrial study population were having knowledge about HW and the rest were having no information about this issue. It is cleared from the statistical analysis that there are strongly statistical significant differences among the various categories of participants in relation to their knowledge about HW (P value = 0.01).

Relationship between participant's knowledge about HW and presence of special tools and health education visits

Table (19): Relationships between participants' knowledge about HW and the presence of special tools for HW

Presence of special tools for HW	Knowledge of HW						
	yes		No		Total		P value
	No	%	No	%	No	%	
Yes	310	90.4	89	88.1	399	89.9	0.795
No	20	5.8	7.0	6.9	27	6.1	
Don't know	13	3.8	5.0	5.0	18	4.1	
Total	343	100	101	100	444	100	

$X^2 = .46$, $DF = 2$, $CI = 95\%$

Whilst 90.4% of people who knew about HW said that there were special tools in their organizations, 5.8% said that there were no special tools. The rest did not know if there

were HW tools in their organizations or not. In contrast, 88.1% of the study population who said that they didn't know about HW reported that there were special tools for HW in their organizations. Around 7% of them said that there were no special tools and the rest (5%) didn't know any thing about this subject. However, from the statistical analysis it could concluded that there was no statistical significance difference between knowledge of HW and the presence of special tools (P value = 0.795)

Table (20): Relationship between participants' knowledge about HW and health education visits

Health education visits	Knowledge of HW						
	Yes		No		Total		P value
	No	%	No	%	No	%	
Yes	100	29.0	17	16.3	117	26.1	0.01
No	186	53.9	73	70.2	259	57.7	
Don't know	59	17.1	14	13.5	73	16.3	
Total	345	100	104	100	449	100	

X^2 =9.22, DF= 2, CI=95%

In general, 26.1% of study population said that there were health education visits in their organization. In contrast, the majority of participant who represented 57.7% said that there were no educational visits. The rest reported the lack of knowledge about this subject. In more specific terms, 29% of the study population who said that they knew about HW stated that there were educational visits in their organizations.

In contrast, 53.9% of participants mentioned that there were no educational visits and 17.1% of them didn't know if there were educational visits or not.

The table also shows that 16.3% of the study population, who said that they don't know about HW, mentioned that there were health education visits and the rest (13.5%) didn't know any thing about the issue. The results showed that there were statistically significant differences between the presence of health education visits and the knowledge about HW (P value = 0.01).

Relationship between development of HW services and health education visits and environmental advantages

Table (21): Relationships between development of HW services and health education visits

Health education visits	Development of services since presence of PNA								
	Yes		No		Don't no		Total		P Value
	No	%	No	%	No	%	No	%	
Yes	92	34.6	14	20.0	10	8.9	116	25.9	0.001
No	137	51.5	52	74.3	70	62.5	259	57.8	
Lack of knowledge	37	13.9	4	5.7	32	28.6	73	16.3	
Total	266	100	70	100	122	100	448	100	

$X^2 = 42.79$, $DF = 4$, $CI = 95\%$

As shown in (Table21), 25.9% of the study population confirmed that there were health education visits to their organizations, while the majority 57.8% said that there were no health education visits and the rest who represented 16.3% didn't know about such visits. According to the same table, 34.6% of the study population who said that there is development of services since the presence of PNA mentioned that there are health education visits in their organizations.

However, 51.5% of them said that there were no health education visits.

Congruently, 74.3% of the study population who said that there were no development of HW services declared that there were no health education visits in their organizations, while the rest were varying between yes and didn't know about the issue. Moreover, 62.5% of the study population who stated that they don't know about the development of services mentioned that they don't know about the health education visits. In addition, 57.8% of the study population said that there were development of services and the rest stated varying answers between no and their lack of knowledge about this issue. However, results clarified that there was a strong statistically significant difference between the development of HW and health visits (P value = 0.001).

Table (22): Relationships between development of HW services and environmental advantages

Environmental advantages in HWM	Development of services since presence of PNA								
	Yes		No		Don't no		Total		P value
	No	%	No	%	No	%	No	%	
Yes	234	88.0	37	52.9	50	44.2	321	71.5	0.001
No	14	5.3	24	34.3	15	13.3	53	11.8	
Don't know	18	6.8	9	12.9	48	42.5	75	16.7	
Total	266	100	70	100	113	100	449	100	

X^2=126.34, DF=4 , CI=95%

From the table, whilst the highest percent (71.5%) of the study population stated that there were environmental advantages in HWM, the rest were varying between no and lack of knowledge. It is clear that 88% of the study population who said that there were development of services since the presence of PNA confirmed that there were environmental advantages in HW, while the rest declared different answers varying between no and lack of knowledge. Also, 52.9% of the study population who said that there was no development of services stated that there were environmental advantages in HW. Moreover, 34.3% of them stated that there were no environmental advantages and the rest who represented 12.9% didn't know of the subject. In contrast, 44.2% of the study population who said that they didn't know about the development of services since presence of PNA mentioned that there were environmental advantages in HW. Additionally, 13.3% of them stated that there were no environmental advantages in HW and the rest didn't know if there were environmental advantages or not. The results also indicated that there were statistically significant differences between the two mentioned variables (P value = 0.001).

Comparison between HW managerial related issues for organizational variables, processes variables and HW impact

Table (23): Comparing HW managerial related issues and organizational variables

Independent Variables		Sum of squares	Df	Mean square	F	P value
Category of the organization	Between groups	57.91	2	28.955	6.33	0.002*
	Within groups	2044.555	447	4.574		
	Total	2102.464	449			
Health organization owner	Between groups	154.749	2	77.357	18.42	0.001*
	Within groups	1104.589	263	4.2		
	Total	1259.338	265			
Development of services	Between groups	294.441	2	147.22	36.53	0.001*
	Within groups	1797.314	446	4.03		
	Total	2091.755	448			

** Statistically significant*

Regarding the managerial concern to the hazardous waste (presence of policies, regulations and so on), table 23 shows significant variations among the different organizations dealing with solid waste. Scheffe test results indicated that community health centers showed significantly the highest concern for HWM, while the lowest concern was revealed among hospital. Additionally, factories showed less concern than the community centers and more than hospital.

Such variation were statistically significant as it is clear from the ANOVA table (P value = 0.002).

Also from the table (23) it could be inferred that UNRWA clinics elicited the highest category in presence of HWM and the lowest concern was revealed among governmental clinics (P value 0.001).

In other words, the presence of HW managerial related concern is a statistically, significantly related to organizational ownership with a preference to the UNRWA clinics in this study. Concerning the perception of HW services development, table 23 showed variations among participants in this regard. Scheffe test cleared that the study population who mentioned that there were developments of services in their

organizations since the presence of PNA showed the highest interest about the HW. In contrast, the lowest concern was observed among participants who reported that they did not perceive any development after the end of the occupation and those who were not aware about the issue. Such variations among the different groups were statistically significant (P value = 0.001).

Table (24): Comparison between HW managerial related issues and its processes variables

Independent Var.		**Sum of squares**	**Df**	**Mean square**	**F**	**P value**
Availability of preventive equipment's	Between groups	112.74	3	37.58	8.42	0.001*
	Within groups	1985.65	444	4.46		
	Total	2093.39	447			
Presence of HW tools in the organization	Between groups	80.798	2	40.399	8.944	0.001*
	Within groups	1991.88	441	4.517		
	Total	2072.67	443			
Transfer frequency of HW per day	Between groups	24.358	2	12.179	2.919	0.056*
	Within groups	847.006	203	4.172		
	Total	871.364	205			
Collection of HW	Between groups	192.181	2	96.09	22.49	0.001*
	Within groups	1910.284	447	4.294		
	Total	2102.464	449			
Separation of HW	Between groups	216.115	3	72.038	17.30	0.001*
	Within groups	1540.420	370	4.163		
	Total	1756.535	373			
HW evaluation	Between groups	394.37	4	98.59	25.7	0.001*
	Within groups	1702.94	444	3.84		
	Total	2097.31	448			

** Statistically significant*

Table 24 shows significant variations in the processes of HW by reference to the presence of HW managerial concern. Concerning the availability of preventive equipment, Scheffe test revealed that participants who reported the regular presence of preventive equipment were those from organizations that showed high concern for HW. In contrary, the lowest managerial concern was associated with the absence of preventive equipment. Interestingly, ANOVA test indicated that these differences among the different groups were statistically significant (P value = 0.001).

Congruently, regarding the presence of special tools for HW in the organization, table (24) exhibits that people who said there were special tools for HW in their organizations scored the highest points in HWM in their organizations while the lowest was among people who said there were no special equipment. ANOVA test indicates that the differences among the groups were statistical significant (P value = 0.001).

Regarding the daily transfer frequency of HW, Scheffe test indicated that the highest concern for HWM was among participants, who said that the number of transferring HW in their organizations was from (1.1 - 2.9 times /day), whilst the lowest concern was revealed among participants who said that the number of transfers was more than (3 times/day). Participants who said that the number of transfers were less than one time daily showed concern which was less than who mentioned from (1.1 - 2.9) times and more than who stated (+3) times. ANOVA test showed a nearly statistical significant association between the different groups (P value = 0.056).

Regarding the collection of HW and its relationship to the presence of managerial related concern table 24 shows that the study population who paid more concern to the managerial issues also paid more attention to the collection process and visa versa. ANOVA test showed that there is a statistically significant among differences among the different groups in collecting HW (P value = 0.001). Congruently, the high managerial concern to HW has been reflected in the separation process. In other words, Scheffe test indicated that the presence of separation services was associated with the high concern to HWM. Such differences were found to be statistically significant (P value = 0.001).

Concerning the presence of a managerial concern to HW and its relationships with subjects' evaluation of HW, Scheffe test indicated that participants evaluation were positive with the presence of managerial concern to HW. Similarly, the negative

among participants who perceived no environmental advantages. ANOVA test clarified that there are statistically significant differences between the two variables (P value = 0.001).

Comparison between participants knowledge of HW and selected variables

Table (26): Comparing participants' knowledge of HW and selected variables

Independent Variables		Sum of squares	Df	Mean squares	F	P Value
Years of education	Between groups	86.098	2	43.049	7.506	0.001*
	Within groups	1502.68	262	5.735		
	Total	1588.777	264			
Occupation of health	Between groups	66.580	8	8.322	1.400	0.197
	Within groups	1522.197	256	5.946		
	Total	1588.777	264			
Age group	Between groups	7.876	2	3.938	0.655	0.520
	Within groups	1491.503	248	6.014		
	Total	1499.378	250			
Years of experience	Between groups	11.071	2	5.536	0.910	0.404
	Within groups	1544.796	254	6.082		
	Total	1555.868	256			
Separation of HW	Between groups	30.108	3	10.036	1.723	0.163
	Within groups	1403.892	241	5.825		
	Total	1434.000	244			
Health education visits	Between groups	9.277	2	4.639	0.769	0.464
	Within groups	1579.500	262	6.029		
	Total	1588.777	264			
Willingness to co-operation with other organizations	Between groups	74.341	2	37.171	6.431	0.002*
	Within groups	1514.436	262	5.780		
	Total	1588.777	264			
Regular medical exam	Between groups	.116	2	5.806	0.010	0.991
	Within roups	1588.213	261	6.085		
	Total	1588.330	263			

* *Statistically significant*

Table 26 shows the relationship between years of education and the knowledge about HW. The results exhibit a highly statistical significant differences among the different groups in this regard (P value = 0.001). Whilst, Scheffe test demonstrated that the highest level of knowledge was among people with more than 17 years of education, the lowest level was among participants who were under 12 years of education.

Concerning the relationship between knowledge level and professional status, table 26 shows the variations among health professionals and workers regarding their knowledge of HMW. Doctors scored the highest points in their knowledge about HMW, the lowest level of knowledge was found among workers and administrators. It is worth mentioning that ANOVA test showed that these variables among the different groups were statistically significant (P value = 0.020).

Concerning age and its relationship to knowledge level about HW, table 26 shows the association between age and knowledge about HW. ANOVA test showed that there were some differences among the different groups in this regard. Sheffee test results indicated that the study population who were between 36 – 44 years elicited the highest scores in their knowledge while the people beneath 35 years were elicited lower scores. The level of knowledge was found to be the lowest among people who were more than 45 years old. The differences between the different groups were statistically not significant (P value = 0.520).

In regard to years of experience and its relation with the knowledge of HW, it is revealed that there were some variations among the different groups. The highest level of knowledge was found among people who had 6-10 years of experience and followed by the study population who had more than 11 years. The lowest level was found among people under 5 years of experience. The ANOVA test indicated that these variations among the groups were not statistically significant (P value = 0.404).

Concerning separation of HW and its association with knowledge about HMW, Scheffe test results revealed that the level of knowledge were significantly higher among participants who mentioned that there were no separation in their organizations. The separation has been carried out sometimes in organizations characterized by participants with low level of knowledge about HMW. ANOVA test showed that there were no

statistical significant differences among the different groups in this regard (P value = 0.163).

As shown in table 26, the relationships between participant's knowledge and health education visits showed some differences. Scheffe test results indicated that the study population who mentioned that there were health education's visits in their organizations showed the highest level of knowledge about HSW. The lowest level of knowledge was found among participants who said that there were no health education visits. ANOVA test showed that there was no statistical significant associations between these health education visits and knowledge about HW (P value = 0.464).

Regarding the relationships between knowledge about hazardous medical wastes and willingness to cooperate with other organizations, it is clear from the table (26) that the level of knowledge was the highest among people who said that they were willing to cooperate with HW specialized committees. In contrary, the lowest level of knowledge was among people who said that they were not willing to cooperate. It is worth noting that such a relationship between knowledge about HW and the willingness to cooperate with the specialized committees showed is a statistically significant association between the two variables (P value = 0.002).

Moreover, the table also shows the relationship between knowledge about HMW and the execution of regular medical examination. Scheffe test demonstrated that the level of knowledge was the highest between study population who said that there were regular medical exam, while the lowest was among people who stated that it happened some times. However, ANOVA test showed no statistical significant association between knowledge of HW and execution of medical examination (P value = 0.991).

Independent t-test comparing managerial concern and knowledge about HW and selected variables

Table (27): Independent t-test comparing managerial concern about HW and selected variables

Dependent Var.	Independent Var.		No	Mean	S.D.	T	P value
Managerial concern	Ownership	Gov-clinic	59	2.2373	2.0872	-4.857	0.648
		UN-clinic	47	4.2553	2.1716		
	HW-Knowledge.	Yes	346	2.9017	2.1992	3.080	0.002*
		No	104	2.1635	1.9464		

* *Statistically significant*

As shown in table 27, t-test comparing the managerial concern about HW showed differences among governmental clinics and UNRWA clinics. UNRWA clinics showed more concern to the management of HW than governmental clinics. However, as clear from the table, t – test results revealed no statistical differences between the two categories (P value = 0.648).

By comparing the managerial concern about HW and having knowledge about this issue, there were differences among people who had information about HW and people who didn't have. Participants who said that they knew about HW exhibited more concern to the issue than the others. From the table it is clear that t-test revealed statistically significant differences between the two variables (P value = 0.002).

Table (28): Independent t-test comparing knowledge about HW and selected variables

Dependent Var.	Independent Var.		No	Mean	S.D.	t	P value
Knowledge of medical waste	Hospital		160	5.7375	2.3962	0.569	0.570
	Clinic		105	5.5619	2.5454		
	Previous exp.	Yes	89	6.0787	2.3800	1.965	0.050*
		No	173	5.4509	2.4835		
	Previous training	Yes	63	5.1746	2.5498	-1.836	0.067
		No	202	5.8218	2.4081		
	Training needs	Yes	195	5.8154	2.4255	1.638	0.102
		No	70	5.2571	2.5004		

* *Statistically significant*

As shown in table 28, t-test results showed there were variations in knowledge about HMW among health organizations. The hospital scored the highest points in the level of knowledge whereas clinics scored the lowest points. However, t-test demonstrated that there were no statistical significant differences among these variables (P value = 0.570). Concerning years of experience and its relationship to knowledge level as it is clear from table (26) there were more knowledge about HW among experienced participants. Meaning that, study population who had previous experience showed more understanding about medical waste than people who had no previous experience. As clear from table (28) t-test revealed statistical significant differences among experienced and non-experienced participants (P value = 0.05).

Similarly, regarding the previous training, statistical analysis revealed differences among study population who had previous training and the others who had not. The highest level of knowledge was among participants who had no training while the lowest was among participants who had pervious training. t-test results showed no statistically significant differences between the two categories in this regard (P value = 0.67).

Finally, concerning training needs, t-test showed variations in knowledge level between participants who reported their desire and need for training and people who did not. The study population who requested more training scored higher in their knowledge about HW more than others. The table also shows that t-test revealed no statistical significant differences between the two categories in this regard (P value =0.102).

Chapter (5)

Discussion

This research is considered a substantial issue whereas hazardous or medical waste affects directly public health as well as the environment. This is particularly important in the Palestinian context, because until this moment, HWM didn't rely on scientific concepts. Furthermore, HWM didn't depend on formal legislation, but there are individual enterprises from some organizations, the coming paragraphs demonstrate and illustrate the main research findings.

HWM in Different Localities

Through comparing between the different places it was concluded that dealing with HW in community clinics is better than it in the hospital and industrial areas. Subsequently, regular medical exams were implemented in clinics more than hospitals and industrial organizations. This finding is supported by the literature, which indicates similar findings (Massrouje, 2000). Similarly, regarding HW managerial processes, such as knowledge, separation and collecting there were significant higher level of concern in clinics more than hospitals and industrial organization in this respect. In addition, it was noticed that the concern and awareness at UNRWA clinics was higher than governmental clinics.

The investigator claims that this concern about HW is more prominent among clinic participants than hospital and industrial field subjects and is related to their health background. The primary care orientation of clinics and its focus on environment as an important factor affecting health has affected the concern to this issue. The investigator also assumes that the concern with HW is low and requires more serious interventions. This assumption is supported by the literature, which indicates that the present situation in the Palestinian organizations is due to primary, sporadic initiatives (Sauer et al,

2001). Therefore, the study clearly indicated the need for awareness programs for all categories of people who are dealing with HW such as doctors, nurses and workers.

The Study Population's Characteristics and HW

The results showed that both men and women are dealing with HW. Whilst, the percentage of men who were working in the medical field was higher than their women counterparts, the ratio gap was severely sharp in the industrial field, which exhibited that the percentage of men was 96.2%. Given that, the nature of woman's work in industries is culturally underpinned, most females were working as secretaries comparing with those, who worked in medical field. This finding is supported by the PCBS reports about the Palestinian women's work and assumes that programs of HW need to target all the concerned population.

Contrary to the industrial field, the results of the study revealed that the academically trained group among health field represented the majority of this category of participants (70%). This is due to the presence of academically prepared health personnel such as doctors; nurses and administrators in health organizations, while the majority of subjects in factories were workers. More importantly, the study indicated a link between the level of knowledge about HW and the educational level. The academically trained category has the highest level of knowledge, while the workers have the lowest level in this regard. It is well known that workers are dealing directly with HW; therefore, it is essential to target this group and conduct awareness programs for them (Coat, 1994). The study reveals that knowledge about HW is significantly related to occupation for instant nurses, paramedical, and engineers elicited the highest scores in terms of knowledge followed by doctors and workers how elicited the lowest scores. This implies that more attention should be directed to workers the most vulnerable group for injuries and risks of HW.

Regarding years of experience, the majority of subjects have reasonable years of experience (50% less than 5 years and the rest more than 5 years). This affected their level of knowledge and understanding about their organization issue including HW. Meaning that, years of experience are connected with knowledge and awareness about waste management. Whenever the years of experience are increasing consequently the level of performance in this regard is increasing and this phenomenon was assured in other studies (Coat, 1994; Cointreau, 2000). The fact that the turnover rate in the Palestinian organizations is low (Hamad, 2001), is a positive sign for organizations to set long term plans and to develop their employees regarding HW.

Presence of HWM

The study revealed that there were some concern for HWM in some organization and the lack of it in others. The review of literature confirms that the HWM in the Gaza Strip relied on individual initiatives and still need central decision from PNA to organize it (Sauer et al, 2001). Meaning that, management of HW, either medical or industrial requires diligence and care from a chain of people, starting with the nurses, doctors or engineers who use the equipment and material that become wastes. The process continues through the laborers, who provide clean sacks or containers and carry away the waste on the mechanics and technicians who keep the vehicles and containers in good conditions and finishing with the persons responsible for ensuring that residues are disposed of in the correct way (Coat, 1994). If any of these chains was badly managed or dealt with, the chain would have been broken and respectively the risks would have been happened (EEAA, 2000). Both the industrial and medical hazardous waste management are very substantial for public health and the environment as well. Most of the organizations that deal with this issue operate individually without coordination or cooperation. To have more effective HWM, measures should be taken

to regulate such activities and endorse it within the structures of the concerned organizations. In addition, they work with their own legislation (if any is present) without any references or controlling by PNA. Therefore, it is assumed that the HW needs more concern and attention from the different organizations as well as from policy makers. In order to manage this issue, a special conceptual form (annex 6) that can be applied for HWM in the Palestinian context was presented.

Planning of HW

The scientific plan for HWM considers as a principal procedure for the successful of HW management. It is known from the economical and environmental point of view that the proper planning facilitates the implementation of the operations. That reflects positively on the public health and the environment as well (GCSWDP, 1994).

The developing countries as well as Palestine don't focus or pay attention to organize the operation of segregation, collecting, transferring and the disposal of HW therefore many risks occur (Cointeau, 2000). At the organizational level, the study revealed that 45% of the study population ratified the presence of the planning while the rest confirmed the absence of HWM planning. It is clear that there is no comprehensive planning for HWM in most of the organizations and there are only certain steps such as separation, primary collection but without proper transferring or sanitary disposal. Therefore the circle is broken and consequently the risk is more likely to occur. Therefore, at both the strategic and the organizational levels more efforts need to be focused from the different stakeholders primarily PNA for developing more comprehensive plans and special programs in order to provide the structure and equipment for every stage in the HWM cycle. Measures such as conducting training, the provision of preventive tools and adopting regular and systematic follow up could support this.

Presence of legislation

The study indicated that the issue of HW and its management in the Gaza Strip is new and is not adequately yet conceptualized neither by subjects nor by governing bodies. The above-mentioned results were emphasized also by the literature review (Ministry of Environmental Affair, 2000; Massrouji, 2000; Zaorob, 1997). Therefore the researcher suggests also that the concerned ministries such as MEnA, MOH and Ministry of Industry have to form a special committee consist of legal and technical members in medical and industrial field in order to put instructions for regulating this work. The reason behind that is related to the fact that Environmental Law (1999) stated HW without any explanation.

The study findings support the literature which indicates that due to the potentially dangerous properties of many wastes generated in health care and industrial establishments, it is essential that proper legal controls should be employed. The aim of that is to ensure that all health care and industrial wastes are handled and disposed of by the safe means (Reksnohadhy, 1994). Legislative and administrative guidelines would be appropriate to protect occupational, public health and environmental hazards talking the account of aesthetic aspects (Coat, 1994). Additionally, they are needed to encourage the recovery and recycling of materials and to control health and environmental risks.

Additionally, the literature indicates that the relevant legislation and enforcement agencies vary from country to country. Health and industry establishments should be held legally accountable for their wastes management practices. Relevant legislation concerning environmental pollution and HWM were not recognized yet in Palestine (Palestinian Environmental Affair, 1999). MEnA, as the responsible party, doesn't have the capacity in terms of manpower, funding and supporting laws to enforce the control

system (Sauer et al, 2001). In spite of the fact that the main and basic issue for hazardous waste management is legislation, it was cleared from the study that the majority of subjects (60%) were unfamiliar with legislation and only small portion were committed for applying these legislation.

Team Dealing with HW

The study revealed that the majority of organizations don't have teams for HWM and this is supported by the literature (Sauer et al, 2001) that indicates the lack of HWM teams in the Palestinian situation and confirms the importance of having such teams. Such teams save the time, money and implement the work with the minimal risks. This is only possible if the working groups work together and each one of them knows his duty and position.

It is worth reminding the reader that the aforementioned concept means the presence of special integral team in order to manage this issue. For example, the wastes, either medical or industrial have to be segregated at the sources then the trained workers will collect these wastes and store it in temporary stations. After that the municipality's team will transmit it to the disposal site in order to be treated afterward it will be disposed (WHO, 1995). For ensuring the success, the above-mentioned processes have to be implemented with perfect planning and comprehensive cooperation with the entire persons, who are involved and related to this concern (WHO, 1991).

Coordination with the others

It is worth remembering that many parties are involved in HWM including Ministry of Health, which deals with hazardous medical waste in its organizations such as hospitals, clinics and so on. In addition, UNRWA is responsible for its medical organizations (MOH, 2001). On the other side, the factories are in the same situation were it is relatively left for each to deal with its wastes. All those productive units for HW are

responsible for segregating and collecting HW in special containers till the municipalities take over the roles by transferring the wastes to its stations and then landfill sites in order to be disposed (Sauer et al, 2001). The consequences of such structure is exhibited in this study were 45% of the subjects ratified the absence of any coordination regarding HW. This reflects negatively on the HW managerial processes, therefore, decision-makers have to devote more efforts for supporting this concern. The role of MEnA is very essential in controlling and imposing legislation. To ensure success of this issue there should be previous and plentiful cooperation between the involved parties in this issue and according to scientific plans. From the above-mentioned we notice that there is an obvious deficiency in HWM and this causes this issue to be mismanaged.

The ministries and the municipalities as well have to focus their efforts and to invest more resources in this subject. HWM doesn't depend on one party; every part has its role. For instance, the Ministry of Environmental Affair need to work on legislation, and the MOH is to manage and monitor inside and outside health organizations the health impact of HW. The role of municipalities is to transport and dispose HW in sanitary landfills. It is worth mentioning the assistance roles of others such as police and civil defense. All these parties have to coordinate among themselves toward the successful management of HW.

Knowledge about Medical Hazardous Waste

It is a matter of fact that, the most important issue in MHW is that the workers of the organization can recognize hazardous materials according to their positions and the component of the substances. For example, workers in the medical field have to recognize and know medical substances. Furthermore the others in industrial field have to know the sorts of industrial materials. The results of the study revealed that 75% of

workers in both fields know hazardous materials, which they were handling. This ratio doesn't reflect the recognition of all kinds of hazardous waste but for the type or kinds which workers were dealing with. Although, this level of knowledge is reasonable, efforts are still needed to increase workers awareness and level of knowledge about HW.

The results revealed that there were many significant variables related to the knowledge about HW such as occupation; educational level and environmental awareness visits. Particularly it has been interested to discuss some kinds of HW in relation to knowledge about them as follows;

Sharps: The study revealed that the highest percentage (98%) of the study population knew that sharps are considered as HW. This phenomenon is due to the large wide of personnel use of this item. In addition, many groups such as doctors, nurses and Pharmacists deal always with it. The literature supports this finding (Johnson and Derossa, 1997). The study showed that most of the injuries occurred from this item (Coat, 1994). This means that there was a gap between participants' knowledge and practices in this regard. The literature indicates that sharps should be separated, collected, and placed in suitable sharps' containers (Coat, 1994). When those containers are filled or at maximum interval, which don't exceed than one week, it should be sealed and placed in to clinical waste bag for storage prior to removal and treatment stage by incineration (Pruss et al, 1999).

From his personal experience the investigator noticed that medical wastes, which were produced from the medical organizations, were not segregated.

However, some organizations segregate sharps in special boxes, but unfortunately, they are transferred to the municipal containers and rarely transported to the incinerator that is in El Shifa and El Naser Hospitals. The widespread phenomenon in

the Gaza Strip is throwing medical waste with municipal wastes, which lead to risks and many injuries for scavengers who usually scavenge in the landfill.

This concern is clearly explicit in the literature (Massrouji, 2000; ElKhodary, 1997; WHO, 1999; WHO, 1992; Zaorob, 1997).

Infectious Waste: The study revealed that the infectious waste represents wide items of dangerous waste and 85% of the study populations have good knowledge about the issue. This item need special attention to deal with, so most problems come from the poor management of this kind of waste. Moreover, most WHO publications (WHO 1999, WHO 1995, WHO 1992) confirm that this issue leads to transmitting of some diseases for humans. In addition, the literature shows that there were significant link between this kind of HW and many of the injuries and diseases (El Khodary, 1997; Johnson and Derossa, 1997 ; Poulsen and Midtgard 1996 ; Barbeito and Shapiro 1977). Therefore more focus and attention from the MOH should be directed to this issue.

***Pharmaceutical waste*:** The study cleared up that about 85% of health study population were having knowledge about such kinds of wastes, but the target didn't know about the processing and the final disposal of it. This observable fact matches the developing countries level. Currently, the expired drugs were disposed some times by coordination with MOG in HW sanitary landfill. In addition, the literature indicates that unwanted pharmaceuticals should be returned to the pharmacy that initially provided them (Grau, 1997) and there should be a special department that deals with all kinds of drugs in the private pharmacies, stores of MOH and in the households. A waterproof container, preferably red, should be used for the storage and later on, the special municipal trucks will collect the filled containers to the suitable disposal site (Gray et al, 1999).

Laboratory waste: This kind of waste consists of infected or contaminated laboratory animal carcasses and the media for growing bacteria, which should be incinerated. The

study indicated that only about 60% of the study population knew about this kind of HW. More importantly, the major problem is with the separation and the collection, where this wastes are dumped with normal municipal waste causing several health and occupational risks. Ideally, if an incinerator is not available, small things should be wrapped in an expandable waterproof bag, closed with adhesive plastic tape (WHO 1999), placed in a suitable and leak proof container and taken to a point designated by the disposal authority either governmental or municipalities (Coat, 1994). However, such special treatment of laboratory wastes is lacking in the Palestinian health organization and necessitates urgent intervention.

Biological parts and placentas: The study indicated that 55% of the subjects have knowledge about the placenta but they don't know how to manage this issue. For the above-mentioned reason, MOH has to formulate special and clear instructions that identify the quality of services such as the collecting, transporting and the disposal of this kind of waste. The literature indicates that all human tissues, limbs and placentas should be placed in special waste bag and bin, and appropriately disposed by incineration (Walker, 1991). Currently, at El-Shifa Hospital they still dispose these wastes in municipal containers that causes harm to the waste handlers and to the public as well (Massrouji, 2000). Beside on cultural reason, the researcher claims that the process of management should incorporate collecting placentas and the human parts in special bags and dump it under 0.5 meters layer of normal waste. The study findings that there was statistical significant association between knowledge and medical HWM, calls for setting protocols, standards and legislations in this regard.

Chemical waste: Most of chemicals, which are usually used in healthcare establishments and in industrial fields are considered hazardous and cause toxic, genotoxic, corrosive, flammable, reactive, explosive and shock-sensitive (WHO, 1999).

The chemical substance mostly exist in small quantities in health field and large quantities are normally found in industrial field or when unwanted chemicals or pharmaceuticals are disposed of (Wadi and Nashwan, 2001). Chemical waste consists of discarded solid, liquid and gaseous chemicals, for example, from diagnostic and experimental work, and from cleaning, housekeeping and disinfecting procedures, insecticides and medical preservatives. However, almost half of the study population stated that they knew that chemical waste as hazardous waste but didn't know how to manage it properly. Furthermore, the study revealed that the majority of the industrial study population (70%) mentioned chemical wastes as HW, while 11.5% stated paint waste and 6% mentioned batteries and drugs represented 7.7%.

It is worth mentioning that, in developing countries as Palestine, chemical waste are discharged to the sewer system and that effects negatively the operations of wastewater treatment. This increases the treatment costs and pollutes the environment (Coat, 1994; Smith, 1996). The best solution is to collect the quantities of waste in special containers and to execute the appropriate processing for each such as: neutralization, solidification and then final disposal (Tesink 1994; Ades, 1997).

It is clear from the study that chemical wastes falls within medical and industrial wastes. It is also clear that knowing and recognizing these items affects directly the quality of managing them. Therefore, the researcher perspective in this field is that MOH, Ministry of Industry and Ministry of Work have to take their duties towards stipulating directions and instructions for environmental health awareness and for training as well.

Pressurized containers: Different types of gases are used in healthcare and are often stored in pressurized cylinders, cartridges and pressurized containers such as aerosol cans. About the knowledge of that category, the study revealed that only 40% of the subjects have knowledge about this issue. This kind of wastes must not be placed in

waste disposal bags destined for incineration, but should be stored separately in containers, which are marked with words "don't incinerate", "don't puncture", "keep out of direct sunlight" (WHO, 1999; Coat, 1994). High-pressured containers should be buried or sent back to their manufacturers but never burnt or processed mechanically (Tesink, 1994; USEPA, 1990). It was believed that this issue has special importance due to a lot of injuries and explosions, which may occur, especially at the disposal sites (Croen, 1998). Moreover he confirms the prohibition of disposing this land by burning but it has to be buried under special conditions. Therefore, the various stakeholders must pay attention about this item and must be aware about the risks that associated with.

Radioactive materials: Which include unused liquids from radiotherapy or laboratory research studies, contaminated glassware, packages or absorbent paper, urine and excreta from patients treated or tested with unsealed radio nuclides and sealed sources (WHO, 1999). Radioactive materials may be sent back to the nuclear industry that supplied them. Most radioactive materials from medical establishments have fairy, low level of radioactivity and a short half-life (WHO, 1999). It may be possible to store such wastes under carefully controlled conditions until the level of radioactivity becomes low that it may be treated as other waste (WHO 1999). Special care is needed when old equipment containing radioactive sources is being discarded. In general, radioactive materials in the Gaza Strip are rarely used (MOH, 2001), and the study demonstrated that only about 30% of the study population have knowledge about radioactive materials. It was thought that the majority of the health employees need instructions about the radioactive waste and how to deal with it. The researcher emphasizes the importance of defining the proprieties of radioactive materials besides what are the safety measures and the conditions of dealing with this waste.

Heavy metals: Are consisting of both materials and equipment's with heavy metals and directives including batteries, thermometers and most of industrial wastes that contain heavy metals as chemicals, paints, papers, and plastic industries (Sauer et al, 2001; Coat, 1994). All those kinds must be collected in special containers and must be disposed in special isolated landfills (Tesink, 1996). The majority of heavy metals come from industries and incineration processes (Reimann, 1992; Poulsen and Mitdgard 1996). It has been comprehended that heavy metals, such as cadmium, lead and so on, are produced from industrial, agricultural and medical processes. They directly affect the public health, as the literature indicates and denotes this concern (Reinhart, 1993; Torres et al, 1991; Safi, 1998; Poulsen and Midtgard 1996). However, the results of the study emphasized the statistical significant association between knowledge of this waste and how can it be managed. For the importance of the recognition of HW, we recommend that MOH, MEnA and the related ministries have to work hard collaboratly for managing this field. In addition, more research is needed in this vital issue.

Processes of HWM

Separation of hazardous waste: Segregation of hazardous waste is considered as a corner stone of the HWM because hazardous waste management has a very high risk due to either dealing with it or in term of costing money, which is about twenty times more than normal waste (Sauer et al, 2001). Poor segregation of HW at source in the Gaza Strip due to the low education of personnel in charge will multiply the component of hazardous waste therefore it becomes 40% instead of less than 10% of the total. In addition, the lack of proper storing of needles and sharps demonstrates the numerous injures among waste handlers (Nath, 1995; Elkhodary, 1997)

According to the results of the study, more than 50% of the subjects confirmed that there was no segregation at source. For instance, at El-Shifa Hospital, most of

hazardous wastes were dumped together with municipal garbage in main municipal containers. Hospital incinerator was also used however it seemed to be working in an inappropriate manner. In addition, there were several health problems, which caused direct risks to the personnel and the environment as well (MOH, 2001). On the other hand, the factories haven't separated the HW but they usually dump it directly to municipal containers and that causes harms to solid waste handlers as well as waste pickers (Zoarob, 1997). The results also revealed that there was a statistical significant association between the category and the separation of waste and thus affects HWM. The researcher recommends that all organizations, which deal with HW, have to segregate their wastes at source because this process reduces the risks and also saves the money and efforts as well. The above mentioned subject was emphasized by the literature (Coat, 1994; El Khodary, 1997 ; WHO, 1999)

Collection of HW: The collection of HW is the key to whole management processes; if wastes were segregated properly it would have been easier to deal with and to handle without problems. For example, sharps and needles should be placed in special containers in order to prevent them from puncturing the handlers and subsequently decrease the injuries (Environmental Bureau Sapporo Municipality, 2000). Most of hospital's staff probably know little about what usually happens to the waste when it is taken from the ward and probably rarely think about the hazardous that are posed by materials they discard (Massrouji, 2000). In fact there are two stages of collection (Sauer et al, 2001): Firstly, collection of different kinds of hazardous waste from different sections in both of health and industrial field. Secondly, municipal collection from identified locations to the disposal sites. The results of the study revealed that more than 75% of the subjects said that there were HW collection in their sections and the rest mentioned that they didn't know about the issue.

Furthermore, the literature confirms the mismanagement in this important item (Massrouji, 2000; Health and Environment Department, 2001; Vrins, 1998)

The researcher supposes that MOH has to segregate HW according to a clear plan. Moreover, it has to coordinate and cooperate with the related organizations such as municipalities in order to save the bags and containers. Up to date MOH is not doing this work.

Handling of HW: The study revealed that about 65% of the subjects said that the HW transferred one time or less per day to the waste bags or containers. Ideally, HW should be sealed and carried to a special waste storage room where they will be placed in separate piles according to the colors of the sacks (Mikkel et al, 2000). This storage facility should be secured so that unauthorized people can't gain access to the waste. Additionally, carts and vehicles used to transport the waste should be carefully designed in order to be stable, quite in operation (Vrins, 1995). In addition, all the quantities must be stored in a special room as transfer station (Sauer et al, 2001).

It was emphasized that the results revealed statistical significant relationship between the proper dealing with HW and the presence of HWM. In addition, these results were similar to previous studies, such as Massrouji (2000), but the problem was transmitting these wastes with the domestic wastes to the municipal containers. Therefore, the researcher calls for an urgent need that decision-makers and policy setters are required to concentrate their efforts to follow up and control these processes. Such policies need to be enforced by clear well formulated legislations.

Transport and Disposal of HW: After internal collection and pretreatment, municipal employees, using suitable collection vehicles transport HW. A number of impacts are associated with the use of HW collection vehicles like increase of traffic frequency, smell, dust and so on. Disposal of HW means the placing of wastes in its final place.

HW should never be disposed of with water because of the risks of chemical, microbiological and gross pollution (Adams, et al 1981). Gaza municipality has constructed special isolated section for disposal purpose (Annex 7) taking into account all the international standards (Sauer et al, 2001). Disposal processes in GM-HWS were well designated and all the preventive procedures were taken (Disselkoen, 1998). However, in spite of the importance of the two latter chains in HWM, this issue is beyond the limitation of this study.

Recent Improvements of HWM

Developments and improvements of HWM in the studied places were obvious. In general and by contrasting the situation before and after the presence of PNA, it is cleared that the situation of SW is better after PNA took over the place than it was during the Israelis occupation (MOH, 2001). The literature also supports this finding and indicates that before the PNA, HW services were neglected (GCSWDP, 1994). Although the current change is intelligible and obvious, it is still in primary initiative phase from some organizations. The positive thing is that the PNA continues to pay attention and try to encourage investments in this vital issue. The study demonstrated that 60% of the study population confirmed the improvements in their organizations.

Regarding the availability of special tools related to HW, such as special containers, plastic bags and so on, 40% of the subject confirmed the presence of preventive tools, such as masks, eyeglasses, boots, special uniforms, detective devices to detect gases and so on and that matches the literature (Sauer et al, 2001). The study population confirmed that the reasons for absence of tools were the lack of fund, lack of worker awareness and lack of department obligation. Generally, all the above initiatives reflected benefits either for public human health or the environment and the study revealed that 60% confirmed these benefits.

The special tools for dealing with HW are considered as a substantial issue. Proper management provides tools and equipment related to this concern started with containers, which are appropriate for each kind of waste. This equipment must be easy to deal with. Furthermore, it has special colors and signs in order to facilitate the workers mission in this field. In general, the appropriate management of WH implies that attention should be paid to the other preventive facilities, which include: special uniforms, preventive eyeglasses, special hat, detective devices to detect gases and so on (Sauer et al, 2001). These tools reduce the risks of injuries, which may be caused by dealing with hazardous materials. Furthermore, it will encourage and stimulate the workers to work more effectively (Batstone et al, 1989).

Concerning subjects' evaluation of dealing with HW, the results exhibited that 55% of the subjects ratified their satisfaction about the level of HW introduced services in the hospitals whilst this percentage was 50% in clinics and 72% in industrial field.

As shown before, the percentage was high in the industrial field. This phenomenon could be related to their expectation or related to the threat culture in the private sector. Health sector subjects are governmental employees with secured jobs and may have high expectations congruent with their level of education. To meet subjects' expectations and to solve the above-mentioned problem, it is very imperative that the related ministries such as MOH, MEnA and the municipalities must impose proper and comprehensive strategic policy for the concerned issue.

Dealing with hazardous medical and industrial wastes requires some follow up procedures, such as health regular exam for all the workers in this field. In the Gaza Strip, no studies were executed among people who work in this field. The study outputs indicated that only 15% of the study population mentioned that there were regular medical exams in their health and industrial organizations but the rest confirmed the

absence of any exam. In spite of the whole deliberates and cautious measurements in industrial countries, they examine their workers regularly. In addition, they produce the appropriate preventive remedy for them. In contrast, the situation is different in developing countries whereas there is no sufficient interest in this concern so this leads to increase the number of diseases cases among workers such as lead toxicity (Torres et al, 1991). This requires more interests from the concern ministries to pay attention and to concentrate their efforts towards this aspect in order to identify the risks, which affect the workers and to impose legislation as well as lists to organize this task. Whilst the study indicated that there are positive hints that need to be supported and built on the various organizations towards having a well-established HWM system, the study clearly demonstrates the need for a comprehensive plan for HWM. The governing body must set strategic plan for national level that focuses on several issues related to HWM.

Firstly, every health care or industrial facility should have or develop a waste management plan that includes daily routines for segregation, collection, handling, and packing of all the different waste categories. Secondly, facility managers should ensure that this plan is in place with an adequate budget and personnel in order to be implemented and lastly, implementation of HWM plan routine monitoring should be carried out in parallel with the information and specific training programs.

Hazards of Mismanagement of HW

There are some widespread phenomena in the Gaza Strip related to HW, such as children playing around waste containers. This bad habit is due to lack of awareness about hazards and risks from this issue. HW can transmit several diseases as well as causing hazardous injuries from playing with these hazardous wastes (White et al, 1997; Nath, 1995). The consequences of this study demonstrated that 70% of the study population ratified that children playing with wastes causes health risks to public health.

Furthermore, the study revealed that 30% of the study population confirmed the presence of sharps in wastes, which were the main and direct cause of diseases and injuries. The above finding corroborates with other research findings which reported similar results in The Gaza Strip as well as in developing countries, such as India, Philippine and so on (Mato and Kassenga1997; Kungskullniti and Chumpusakdi 1991; El khodaery, 1997). Problems and diseases, which might be caused from dealing with HW are various and miscellaneous. The literature indicates that wastes cause respiratory diseases, intestinal diseases and skin disease (Konnoth, 1994; Abu Mourad, 2001).

The findings of this study give therefore signals for decision makers in Ministry of Health, Ministry of Environmental Affairs and Health and Environment Department in the Municipalities to concentrate their efforts for promoting environment and health awareness programs. Moreover, taking measures such as providing and supporting preventive requirements for all workers who deal and handle wastes is essential.

Awareness and Training Related to HW

The results of the study revealed that health education significantly affects directly the improvements and development of HWM. Therefore, the researcher emphasizes and recommends that the concerned ministries need to concentrate on comprehensive awareness programs. All health care and industrial staff should be aware of the facility's basic healthcare and industries waste management plan and their role in the plan. This includes management and regulatory staff, medical doctors, nurses and nursing assistants, cleaners, waste handlers and visitors to the facility, engineers, technical workers and so on. The waste management plan should be presented in simplified method and displayed in a diagram at all points of waste generation. Better health and environmental working conditions for waste handlers should be addressed in planning resources for waste management. This includes but not limited to the use of

protection clothing and specialized equipment to ensure worker safety as well as for the general public (Soliman et al, 1993). Although the study results demonstrated that more than 82% of the subjects didn't attend any kind of HW training courses, the study clarified that 76% of the study population were looking for attending HWM training courses. Also, the results demonstrated that there is statistical significant association between health education and improvement of services for HWM. From the aforementioned the researcher recommends that all the concerned bodies have to give special interest to educational and awareness programs.

Similar results were registered in the Gaza Strip as well as in developing countries (WHO, 1992; Massrouje, 2000). Training and awareness should include basic information about HCW, industrial waste and the risks of bad management of HW (Coat, 1994). Additionally it should provide basic information on the facility's waste management plan (WHO, 1995) and each employee's responsibility and role in HWM. To have effective HWM training program, need assessment should be conducted first then followed by setting priorities that match the available resources. Such need assessment should consider the various stakeholders. It is essential that such a program needs to be approved by all the concerned people to facilitate its implementation and commitment subsequently. The target population should include those people who deal with WH. To support the utilization of such a program recent methods and strategies of training including adult learning principles need to be utilized. Continuous monitoring and evaluation of such a program is essential so that modification could take place. Furthermore, it needs to incorporate technical instruction on application of the practices described in the waste management plan (WHO, 1998).

Additionally HWM training should provide basic information on the facility's waste management plan (WHO, 1995) and each employee's responsibility and role in HWM.

Furthermore, it needs to incorporate technical instruction on application of the practices described in the waste management plan (WHO, 1998). The study revealed that 25% of the study population stated that there was mass media in their organizations. Regarding health educator's visits in both of health and industrial organizations, the consequences of the study confirmed the weakness of this concern whereas 25% of the subjects mentioned that there were health educator visits and 75% ratified the absence of these visits. Mass media by its miscellaneous shapes (posters, leaflets, TV and so on) is considered as a very important issue for increasing health and environmental awareness in HW field (Van Duyl et al, 1997). The above mentioned outputs are supposed to be as a very clear indicator for the decision makers in industrial field as well as health field in order to plan and devise regular programs for health and environmental awareness.

Chapter (6)

Conclusion and Recommendations

Conclusion

The management of hazardous waste in the Gaza Strip requires efforts and care from a chain of people, starting with the nurses, doctors and industrial workers who use the equipment and supplies that become waste, continuing through the laborer who provides clean sacks or containers and carries away the waste, finishing with the person responsible for ensuring that residues are disposed of in the correct way. If any of these are careless in their work, the chain is broken and dangers is follow.

In spite of that HWM is a sequence chain process of work executed by more than individual organization; there is no cooperation between each other. Ministries and organizations related to this issue should cooperate for instance, legislation and sustainability should be supported by MEnA, while MOH and productive organizations should separate and collect the HW within the organization as a previous stage preparing for the role of the municipalities which are responsible for transporting and disposal.

The managerial procedures related to HWM usually urge hazardous medical waste's segregation at source, which should be separated in to five categories, but currently and with the presence of mismanagement in the medical organizations, the HW is collected mixed with domestic wastes and transported to the municipal containers in order to be disposed in the sanitary landfill, this procedure leads to many risks for workers in hospitals as well as in the municipal landfills.

Knowledge of the quantities of the different types of waste is essential if sound management decisions are to be made. The incidents of accidents, injuries and infections should be carefully monitored. All staff, including those in waste disposal,

should have regular medical check-up. Related to that thing, we conclude that HWM in the Gaza Strip in the initial stages and need more attention.

Level of education is very important and it is associated with the development of HWM services, thus it is very essential to take this into the consideration when employing persons who will deal with HW.

The study revealed the absence and lack of legislation and bylaws, which regulate HWM in all the related ministries and organizations.

The main health hazard related to medical waste appears to be the transmission of infectious diseases via sharps and contaminated blood, while the chemical waste was represented the majority of risks among the industrial workers.

Sharps pose the most serious risks to health, they must be stored in puncture-proof containers and disposed of in such away that they are not accessible to children and scavengers. Some medical organizations such as hospitals and clinics separate sharps in special containers and dispose them in the incinerators, which are present in their organizations. Incinerators can be a very effective method of treatment of most hazardous waste in the Gaza Strip, but many don't operate as they should, combustion temperatures are often too low and unstable operator who mainly didn't have any training, so that there are problems and several complains from surroundings of bad odor, smoke, and sharps in the ash may still be hazard.

The study demonstrated lack of interesting within all organizations for regular medical exams, in addition lack of safety tools for persons who deal with HW, therefore this situation reflected negatively the safety of workers.

There is an obvious deficient for training programs in all organizations this lead to an enormous desire from dealers with HW to conduct training programs, these training programs are essential for all levels "administrators, doctors, nurses, engineers and

workers". The training should include the safety handling method with HW, the best methods for using the preventive tools and equipment and so on.

In spite of the importance of regular health education visits with low cost, most of the organizations neglected this essential item, moreover most of the organizations don't have mass media, such as, leaflets, posters and TV spots, due to the lack of knowledge about the importance of this concern.

Careful sorting, handling and storage of wastes inside hospital, clinic and factories are the key to organization hygiene. Normal waste should be kept separate from hazardous wastes. Chemical and pharmaceutical waste collected from hospitals should join industrial waste of similar nature for joint treatment. But the actual situation in the Gaza Strip establishments is unsatisfactory, lack of knowledge among hazardous waste dealers, lack of coordination among different ministries and lack of health education, awareness campaigns and community involvement. The above mentioned are basic needs that should be tackled as soon as possible, and this leads us to suggest the following recommendations

Recommendations

This study and my background as well as my position has led me to the position in which I can make some recommendations which cover personnel and process aspects related to hazardous waste management as follows:

- Relevant national legislation and municipal bylaws must be ready for a full and effective implementation of hazardous waste management and would include waste regulation, regulations on environmental and health impact assessments, environmental emission standards, prevention and control of infectious disease regulations and emergency special procedures.

- It is recommended that other ministries as environment, industry, health and municipalities shall be involved in the elaboration of HW framework, and its implementation in to future legislation and bylaws.
- Special committee has to be formed from the related ministries such as, MEnA, MOH, Ministry of Industry and the Municipalities in order to persist the coordination and imposing legislation and bylaws
- Because of the importance of the education in HWM field, therefore ministries and organizations, which deal with HW have to take into their consideration the employment of educational people.
- Related ministries such as health, industry and municipalities should document all known cases of infections or poisoning through HW, this documents is an initial step toward improving occupational and environmental health.
- Training programs: It is recommended to health and industrial managers in the Gaza Strip, that they train their staff to make them aware of hazards from infected and toxic waste especially from infected sharps.
- Regular medical exams should be carried out for all workers who deal with HW.
- General precaution for HW handlers: The establishments, which deal with hazardous waste, must provide clear plans for all staff at all levels, including operational procedures for safe waste handling, accident response procedures, fire control, gas release response, first aid and emergency evacuation procedures.
- Source segregation procedures: At hospitals, primary health care clinics and industries, the establishments should implement source segregation and separate collection of hazardous waste. Source segregation of recyclable leads to the highest recovery of clean and high-grade recyclable.

- Collection services: this procedure has to be done frequently and on regular basis, in addition safety equipment, which reduce risks and dangers for workers should be provided.
- PNA must support studies that would provide more insight on the magnitude of the health and safety problems in health and industrial establishments in the Gaza Strip and their causes.
- Raising public awareness and supporting health education programs on Hazardous Waste Management is an essential component of the environmental conservation process, so the decision-makers should consider that vital issue and conduct comprehensive programs for all level of personnel.

References

Abu Mourad, T. (2001), *Environmental Health Education/Awareness Program in Nuseirat Refugee Camp,* Palestine Save the Children Foundation, Gaza Strip.

Adams, C., Ford, D. and Eckenfelder, S. (1981), *Development of Design and Operational Criteria for Waste Water Treatment*, Environmental Press, Inc. Nashville, Tennessee, USA.

Adan, B., Cruz, V. and Palabay, M. (1982), *Metro Manila solid waste management study, Scavenging Study: 1-90.* Philippine.

Ades, M. and Vincent, A. (1997), *Chemical Inventory Control Program For Mixed and Hazardous Waste Facilities at Savannah River Site, Govt*-Reports-Announcements and Index Washington, USA.

Barbeito F. and Shapiro, N. (1977), "Microbiological safety evaluation of solid and liquid pathological incinerators", *Journal of Medical Primatology 8,3:44-61.*

Batstone R., Smith J. and Wilson D. (1989), *The Safe Disposal of Hazardous Waste* Vol I, II and III, World Bank in Co-operation with WHO and UNEP, Washington, US.

Bell, J. (1993), *Doing Your Research Project*, Buckingham: Open University Press, UK.

Bell, J. (1997), *Doing Your Research Project*, Buckingham: Open University Press, UK.

Benvensti, M. and Khayat, S. (1990), *The West Bank and Gaza Attlas, Jerusalem.*

Buiteman, J. (1996), *Drinking Water Quality Control In Gaza City,* Training Course, Gaza, International Institute for Infrastructure, Hydraulic and Environmental Engineering, Delft, The Netherlands.

Burns, S.and Grove, K. (1997), *The Practice of Nursing Research.* W.B Saunders, Mosby, USA.

Coat, A. (1994), *Managing Medical Waste in Developing Countries,* WHO, Geneva, Switzerland.

Coggon, D., Rose, G. and Barker, D. (1993), Epidemiology *for the Uninitiated*, London: British Medical Journal Publishing Group. UK.

Cointreau, S. (2000), Occupational and Environmental Health Issues of Solid Waste Management, Special Emphasis on Developing Countries, Roxbury, CT, 06783, USA.

Convention of Basel (1989), *Control of Trans-Boundary Movements of Hazardous Wastes and their Disposal,* Basel, Switzerland.

Croen, L. (1998), *Health Effects from Hazardous Waste Sites: A Critical Review of the Non-European Literature,* California Birth Defects Monitoring Program. USA.

Disselkoen H. (1994), *Gaza City Solid Waste Disposal Project*, First Interim Report, Agrovision, IHE, Infoplan, Holland.

Disselkoen, H. (1997), *Priorities for Improvement of Gaza City Solid Waste Management*, UNCHS/Habitat, Nairobi, Kenya.

Disselkoen, H. (1998), *Gaza City Solid Waste Disposal Project*, Work Plan Final Phase, Agrovision, Holland.

Egyptian Environmental Affairs Agency (2000), *Training Course on Hazardous Waste Management and Implementation of the Basel Convention,* The Regional Center for Training and Technology, Cairo University, Cairo, Egypt.

Eith, A., Koerner, G. and Koerner R. (1997), "Assessment of HDPE geomembrane in a municipal waste landfill double liner system after eight years of service", *Elsevier Applied Science 6,2,* 255-267.

El Khodary, N. (1997), *Minimizing the Risks of Solid Medical Waste* Environmental Planning Directorate, MOPIC, Palestine.

El-Fadel, M., Findikakis, A. and Leckie, J. (1997), "Gas solid waste landfills", *Review Environmental Science Technology 27, 3: 237-283.*

Environmental Law Institute, (1996), *Survey of International Environmental Law Relevant to the Palestinian Authority*, MEnA, PNA

Environmental Resources Management, (1999), *Solid Waste and Environmental Management Project in the West Bank and Gaza Strip*, Solid Waste Management Study Phase 3.World Bank

Environmental Bureau Sapporo Municipality, (2000), *Collection and Disposal of Medical Wastes,* Japan.

Gaza Environmental Profile, (1994), *Inventory of Resources*, Part One, Palestinian Environmental Protection Authority, Euroconsult-Arnhem, The Netherlands, IWACO-Rotterdam, the Netherlands.

Gaza Environmental Profile (1995), *Interactions between Man and Environment-Part two, Towards a Sustainable Use of Resources, Euroconsult-Arnhem,* The Netherlands, IWACO-Rotterdam, the Netherlands, MOPIC-PNA.

GCSWDP, (1994), *Data Collection Program Report, Gaza Strip*, Agro Vision /IHE/ Infoplan / Holland

German Agency for Technical Co-operation (1996), *Scavenger Activities and Health Hazards to Scavengers 1-38, Technical Report,* Manila, Philippine.

Giardino, V., Guglielmetti, J. and Koerner, R. (1997), "Long-term Performance of a Hazardous Waste Landfill Special issue: The 10th Conference Field, Performance of Geotextiles and Geomembrances", *Journal of Waste Management* 15,4-6: 77-89.

Grau, M.(1997), "Deposit-Refund Systems: "A solution to medical waste management", *Journal of Environmental Engineering Science 14,1: 27-32.*

Gray, R.; Hogerzeil, H.; Pruss, A. and Rushbrook, P. (1999), *Guidelines for Safe Disposal of Unwanted Pharmaceuticals in and after Emergencies*, WHO/HTP/EDM/99.2.

Greenblot, J. (1996), *Science and Policy in Hazardous Waste Management* Office of Research and Science Integration, U.S. EPD Office of Research and Development.

Gregory, L. (1996), *Overview of Resource Conservation and Recovery Act (RCRA),* Hazardous Waste Characteristics Team Leader. U.S. EPA Office of Solid Waste.

Hamad, B. (2001), *Determinants of Job Satisfaction and Motivation Among Nurses,* Ph.D. Thesis. Sheffield Hallam University, UK.

Health and Environment Department, Municipality of Gaza, (2001), *Monitoring of Collected Waste from Gaza City.* Abstract from monitoring system for years 1999, 2000 and 2001.Gaza, PNA.

Holloway, I. and Wheeler, S. (1996) *Qualitative Research for nurses.* Oxford: Blackwell Science. UK.

Huisman, M. (1994), *The Position of Waste Pickers in Solid Waste Management.* Solid Waste Management: Modes, assessments, Appraisals and linkages in Bangalore, Manohar, New Delhi. India.

Infrastructure, Hydraulic and Environmental Engineering, (1994), *Environmental Surveys for Gaza City Solid Waste Disposal Project.* Delft, Holland.

Indelicato, G. and Tipton, G. (1996), "Chemical fixation increases options for hazardous waste treatment", *Environ. -Solutions.* 9,5:20-25

Isaac, J. and Shuval, H. (1994), *Water and Peace in the Middle East,* Elsevier science, Amsterdam, Netherlands.

Johnke, B. and Stelzner, E. (1992), "Results of the German Dioxin Measurement Program at MSW Incinerators". *Waste management and Research. Society Journal of International Solid Waste Association 10, 4: 345-55.*

Johnson, B. and Derosa, C. (1997) "The toxicological hazard of super fund hazards waste sites", *Reviews on Environmental Health, 12,4,135-251.*

Jonkhans, H. (1998), *Assistance in landfill management and constructions including hazardous waste for the Gaza City Solid Waste Disposal Project*, Arcadis, Holland.

Kanitz, S., and Poli, A. (1995), *Occupational and Environmental Health Problems At MSW Landfill*: A Case Study. Proceedings of Sardinia, Fifth International Landfill Symposium, Rome, Italy.

Konnoth, N. (1994), *The Forum for Environmental Concern*. Your Clean City at Whose Cost: A Study Working Conditions and Occupation Hazards at The Dumping Sites of Bombay, India.

Kungskullniti, N. and Chompusakdi, P. (1991), "Solid Waste Scavenger Community: An Investigation in Bangkok, Thailand". *Asia-Pacific Journal of Public Health 5,1:54-65.*

Lee, G. and Jones, F. (1994), *Impact of Municipal and Industrial Non-Hazardous waste Landfills on Public Health and Environment:* An Overview. Prepared for California Environmental Protection Agency's Comparative Risk Project.

Malkin, R. and Brandt R. (1992), "Blood lead levels in incinerator workers", *Environmental Research 59: 265-70.*

Manohar, D. and Kotaiah, B. (1997), "Physical and chemical composition of solid waste of a super specialty hospital", *Fresenius Environmental Bull* 6,7-8: 450-455.

Massrouje, H. (2000), *Medical Waste Management Among Health Workers* in Gaza Governorates, *MPH* Thesis, School of Public Health, Al Quds University.

Mato, R. and Kassenga, G. (1997), "A study on problems of management of medical solid wastes in Dar-Esalam and Their Remedial Measures", *Resources Conservation and Recycling 21,1-16: 1997.*

Messick, S. (1989), *Validity* in Linn, R.L.(1989), *Educational Measurement*, New York: Macmillan, USA.

Mikkel, L., Dijkman, M., Bartone, C., Gabriela, M. and Chandra, C. (2000), *HealthCare Waste Management*, Guidance Note, Urban Development Division, Infrastructure Group, Environment Department, World Bank.

Ministry of Environmental Affair, (2000), *Palestinian Environmental Assessment Policy*. PNA.

Ministry of Environmental Affair, (1999), *Palestinian Environmental Law,* PNA.

Ministry of Health, (1999), *Training course of Hazardous Medical Waste,* quality Improvement Center, Gaza Strip.

MOH, (2001), *The Status of Health in Palestine, Palestine 2000,* Annual Report, PNA.

Ministry of Planning and International Co-operation "MOPIC", (1996), *Hazardous Waste Management* in the Gaza Strip, PNA.

Municipality of Gaza (1998), *Specification of Hazardous Waste Section, Gaza City Landfill, Health and Environment Department,* Annual Report, PNA.

Nath, K. (1995), *Socio-Economic and Health Aspects of Recycling of Urban Solid Wastes through Scavenging,* Calcutta. All India institute of Hygiene and public Health. World Health Organization.

Nicholas, P. (1995), *Environmental Health & Safety Management,* A Guide to Compliance, New Jersey, USA.

Ohio State University, (1990), *Household Hazardous Waste*, Solid Waste Authority of Central Ohio, Educational Program, USA.

Palestinian Central Bureau of Statistic "PCBC" (1997), *Population, Housing and Establishment Census-1997, Final Results, Housing Report*, Gaza Strip, PNA.

Peretz, J., Bohm, R. and Jasienczyk, P. (1997), "Environmental Policy and the Reduction of Hazardous Waste", *J-Policy-Anal. - Manage 16,4:556-574.*

Polit, D. and Hungler, B. (1997), *Essentials of Nursing Research: Methods, Appraisal and Utilization,* Lipincott.

Polit, D. and Hungler, B. (1999), *Nursing Research Principles and Methods*, Lippicott, USA.

Pollock J. (1978), "Increase of hospital refuse by use of one-time materials", *Journal of Solid Wastes Management, 11,9:51-67.*

Poulsen, O. and Brum N. (1995), "Collection of Domestic Waste: Review of Occupational Health Problems and their Possible Cause", *The Science of the Total Environment 170, 5:1-19.*

Poulsen, O. and Midtgard, U. (1996), *Proceedings of the International Meetings for Waste Collection and Recycling Bioaerosol Exposure and Health Problem.* Held in Koge, Denmark. Published by the Institute of Agricultural Medicine, Lublin, Poland.

Pruss, A., Giroult, E. and Rushbrook, P. (1999), *Safe Management of Waste from Health-care Activities*, WHO, Geneva, Switzerland.

Reimann, D. (1992), "Dioxin emissions, possible techniques for maintaining the limit of Dioxin: waste management and research", *Society Journal of the International Solid Waste Association 10,1:37-46.*

Reinhart, D. (1993), "A review of recent studies on the sources of hazardous compounds emitted from solid waste landfills", *Society Journal of the International Solid Waste Association 11, 3:257-68.*

Resource Conservation and Recovery Act "RCRA" (1976), *Household Hazardous Waste, USA.*

Reksnohadhy, R. (1994), *Individual Study on Legislation and Practice Concerning the Disposal of Hospital Waste*, IHE, Delftt, The Netherlands.

Robert, G. and Calvin, H. (1996), *Grolier, Multimedia Encyclopedia*, C.D.

Rothenberg, S., Schnaas, L. and Peroni, E. (1998), "Secular trend in blood lead levels in a cohort of Mexico City children", *Archives of Environmental Health 53,3.34-40.*

Safi, J. (1995), "Special problems associated with pesticide use and it is management in the Gaza Strip" *Egyptian Journal of Occupational Medicine 19, 2: 267-276.*

Safi, J. (1998*), "The state of the environment in Gaza Strip", Alexandria Science Exchange 19,1: 137-150.*

Safi, J. (2001), *Types and Amounts of Pesticides and categories of agricultural hazardous waste in the Gaza Strip*, Environmental Protection and Research Institute (EPRI) Report, PNA.

Sauer, W. ;Vrins, W.; Viergever, A.and Safi, J. (2001), *Environmental Assessment of Gaza Hazardous waste Disposal*, Infoplan, Holland.

Smith, A., Sciortino, S., Goeden, H. and Wright, C. (1996), "Consideration of background exposures in the management of HW", *Risk-Analysis* 16,5:619-625.

Soliman, M., Derosa, C., Mielke, H. and Bota, K. (1993), "Hazardous waste, hazardous materials and environmental health inequity", *Toxicology-Ind.-Health.* 9,5: 901-912.

Tanaka, M. (May 2000), *Waste Management and Environmental Impact*, Hazardous Waste, Risk to Health and Measures to be Taken. Okayama University, Japan.

Tesink, J. (1996), *Gaza City Solid Waste Disposal Project,* Mission Report. Infoplan, Holland.

Tesink, J. (1994), *Design of Hazardous Waste Section for Gaza City,* Infoplan, Holland.

Torees, E., Subida, R. and Rabuca, L. (1991) *The Profile of Child Scavengers in Smokey Mountain, Balut, Tondo, Manila.* University of Philippines College of Public Health.

USEPA, (1990), *Medical Waste Management in the United States*, first Interim Report to Congress, Office of Solid Waste, USA.

USEPA (1998*), Characterization of Municipal Solid Waste in the USA*, Report No EPA530-R-98-007, USA.

Van Duyl, B., Zonneveld, E. and Disselkoen, H. (1997), *Mission Report of Training Needs,* Gaza City, IHE, Delft, Agro Vision, Holland.

Varley, R. and Bendahmane, D. (1997), *The Cost Effectiveness Argument.* Newsletter of the USAID Environmental Health Project.

Vrins, W. (1995), *Gaza City Solid Waste Disposal Project*, Third Interim Report. Agrovision, Holland.

Vrins, W. (1998), *Gaza City Solid Waste Disposal Project*, Co-ordination Mission, Agrovision, Holland.

Wadi, M. Nashwan, E. (2001), *Solid and liquid Hazardous Wastes from Industry* (draft overview), Ministry of Industry, Palestine.

Walker, A. (1991), "Waste disposal, fresh look at a rotting problem", *British Medical Journal 303:1391-4.*

Waltz, C. and Bausell, R.B. (1981), *Nursing Research: Design, Statistics and Computer Analysis.* Philadelphia: Davis. USA.

Ware, S. (1980), *A Survey of Pathogen Survival During Municipal Solid Waste and Manure Treatment Processes,* EPA, USA.

Water Resources Action Programme "WRAP", (1995), *Course on Campaigns on Public Awareness and Water Use*, Organized by University of Bradford, European Research and Training Center on Environmental Education. Gaza, PNA.

Watts, R. and Lemieux, P. (1992), "Development of source testing analytical and mutagenicity bioassay producers for evaluation emissions from municipal and hospital waste combustors", *Environmental Health Perspective 98, 1:227-34.*

White, R., Feldman, R., Eviator, L. and Niles, C. (1997), "Hazardous waste and neurobehavioral effects", *Environmental Research*, 73,1-2:113-124.

Whiting, K. and Schwager, F. (1998), *European Trends in the Thermal Treatment of Solid Wastes,* Annual Directory 1997/1998, UK.

WHO, (1991), *Urban Solid Waste Management,* Regional Office for Europe, Copenhagen.

WHO, (1992*), Managing Medical Waste in Developing Countries. Report of A Consultation on Medical Waste Management in Developing Countries,* WHO.

WHO, (1995), *Management of Waste from Hospitals and other Health Care Establishments*, IHE, Delft Library, The Netherlands.

WHO, (1998), *Management of Wastes From Health Care Activities, Teacher Guide*, Geneva, Switzerland.

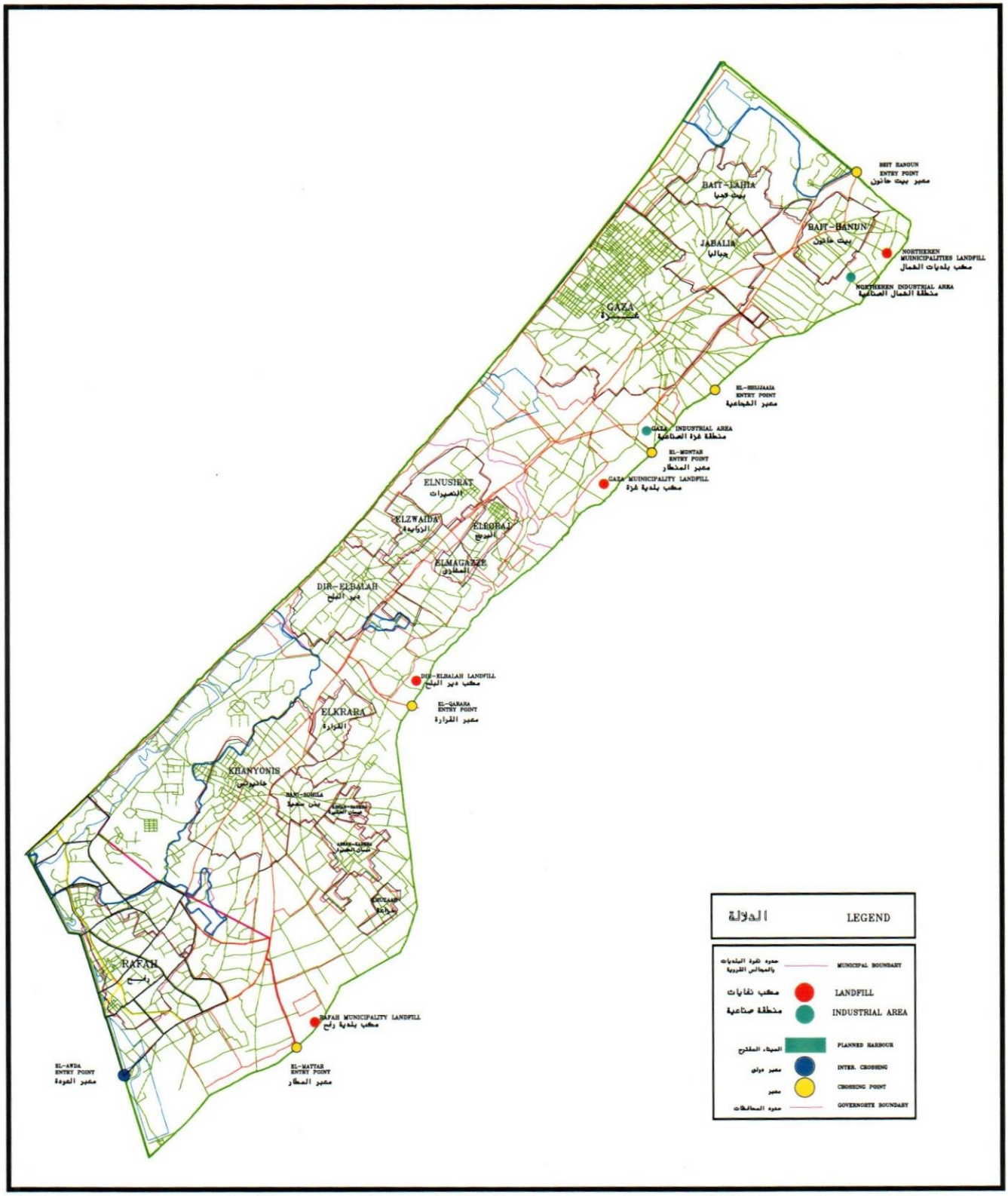
WHO, (1999), Safe *Management of Wastes from Health-Care Activities,* Geneva, Switzerland

Zabbaleen Environmental and Development Program (1996), *A Comprehensive Review and Analysis of Changes in the Moqattam Zabbaleen Settlement* in Cairo, Egypt, from 1981 to 1993.

Zaorob, Z. (1997), *Hazardous Waste Management in the Gaza Strip.* IHE, Delft, Holland.

List of Annexes

ANNEX 1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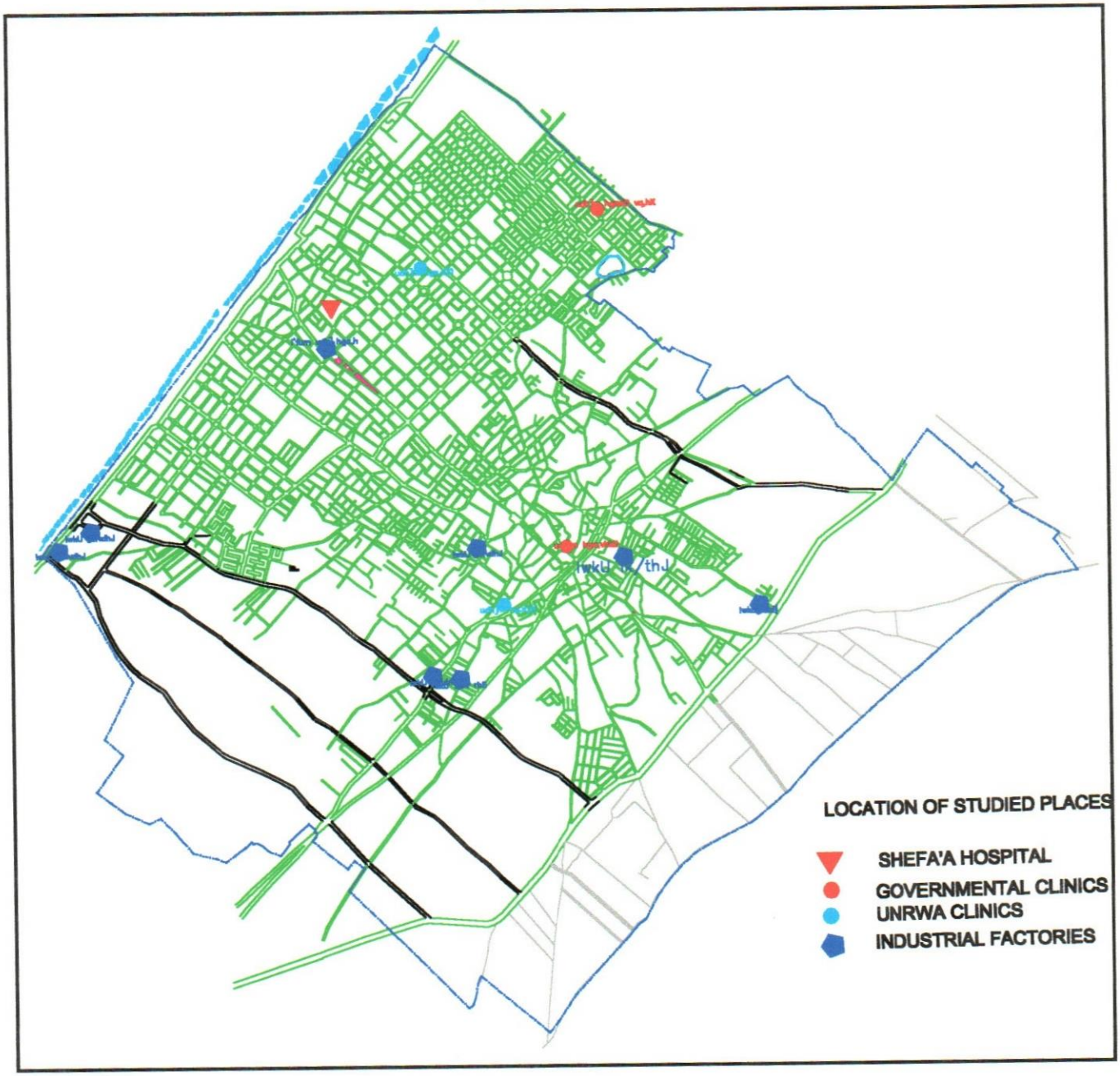
جباليا
NORTHEREN
MUINICIPALITIES LANDFILL
مكب بلديات الشمال
NORTHEREN INDUSTRIAL AREA
منطقة الشمال الصناعية
GAZA
غزة
EL-SHUJAAIA
ENTRY POINT
معبر الشجاعية
GAZA INDUSTRIAL AREA
منطقة غزة الصناعية
EL-MONTAR
ENTRY POINT
معبر المنطار
GAZA MUINICIPALITY LANDFILL
مكب بلدية غزة
ELNUSIRAT
النصيرات
ELZWAIDA
الزوايدة
ELBUREIJ
البريج
ELMAGAZE
المغازي
DIR-ELBALAH
دير البلح
DIR-ELBALAH LANDFILL
مكب دير البلح
EL-QARARA
ENTRY POINT
معبر القرارة
ELKRARA
القرارة
KHANYONIS
خانيونس
BANI-SUHILA
بني سهيلا
RAFAH
رفح
RAFAH MUNICIPALITY LANDFILL
مكب بلدية رفح
EL-AWDA
ENTRY POINT
معبر العودة
EL-MATTAR
ENTRY POINT
معبر المطار
LEGEND
الدلالة
MUNICIPAL BOUNDARY
LANDFILL
INDUSTRIAL AREA
PLANNED HARBOUR
INTER. CROSSING
CROSSING POINT
GOVERNORTE BOUNDARY

ANNEX 2


LOCATION OF STUDIED PLACES
SHEFA'A HOSPITAL
GOVERNMENTAL CLINICS
UNRWA CLINICS
INDUSTRIAL FACTORIES

Annex 3

List of studied HW Factories in the Gaza Strip

Middle East Pharmaceutical and Cosmetics Laboratories Co.Ltd.
It is located in the industrial zone in Beit Hanoon industrial area, this factory is equipped with most modern equipment and the company is a member of the Arab Union for Producers of Drugs and Medical Needs.
This factory produces many kinds of drugs such as tablets, capsules, ointments, creams and liquids.

Chemical substances, which are used in it, are preserved in closed and dark bottles signed with all specifications, precautions and how to deal with this substances. About the disposing of empty bottles or containers they are sent to their original resources in order to reuse or recycle them. The expired materials are replaced by new ones from the original company.
If there are some difficulties in returning the above mentioned substances and waste the company coordinates with the municipality to dispose these wastes by safety methods to the environment and the public health as well.

Al Arabia for Plastic Industrial Co:.

It is located in Beit Hanoon industrial area, this factory produces plastic barrels and consequently it generates many HW substances, which are disposed directly to the containers of the municipality.

El Riashi company for batteries production:

It is located in El-Sheikh Egleen area in El Rimal neighborhood and it deals with lead, which consider as a heavy metal.

Anber's company for electrical painting:
It is located at the northern border of Gaza with Jabalia, it uses several materials through its manufacturing processes such as: sulfuric acid, sodium hydroxide, sodium cyanide nickel and zinc. Most of this factory's wastes are disposed in the normal containers, which are placer by the municipality.

Alewa factory for detergents and chlorine:

It is located in Shigaia area, which is a residential area.
It uses several materials some of them consider hazardous and the others are not hazardous.

El-Redaisi polystyrene and plastic factory:
It is located at Jabalia area and it produces polystyrene and plastic products.

Copra factory:

It is owned by Khader Haboub and located in El-Rimal Area. It produces shoes and it deals with Hazardous materials as well as non-hazardous materials.

Rashad Shawa printing house:

It is located in El-Rimal area and deals with lead so it generates hazardous waste.

Mansour printing house:

It is located in Beit Hanoon industrial area, and it produces HW such as lead.

El-Salam factory:It is located in ElZaiton area and produces fiberglass, which considers as HW material.

Annex 4

استبيان عن وضع خدمات النفايات الخطرة
في قطاع غزة

رقم الاستبيان/ _____

رقم الكود/ _____

1 – تاريخ تعبئة الاستبيان: _____.

2 – نوع المؤسسة : مستشفى ☐ عيادة صحية ☐ مصنع ☐ أخرى ☐

حدد _____ .

-أذكر اسم المؤسسة _____.

3 – المنطقة: الشمال ☐ غزة ☐ الوسطى ☐ خانيونس ☐ رفح ☐

4 – الجنس: ذكر ☐ أنثى ☐ .

5 –العمر إن أمكن: _____.

6 – الحالة الاجتماعية:

متزوج ☐ أعزب ☐ أرمل ☐ مطلق ☐ .

7 – مستوى التعليم:

ابتدائي ☐ إعدادي ☐ ثانوي ☐ جامعي ☐ غير ذلك ☐

8 – عدد سنوات الدراسة الإجمالية : _____.

9 –إذا كنت تعمل في مؤسسة صحية فأجب على السؤال رقم 10 وإذا كنت تعمل بمؤسسة صناعية فأجب على السؤال رقم 11:

10 – المهنة:

- طبيب عام ☐ طبيب أخصائي ☐ طبيب أسنان ☐ صيدلي ☐
ممرض ☐ فني مختبر ☐ فني أشعة ☐ عامل ☐
أخرى ☐ حدد _____ .

11 –المهنة:

مهندس ☐ عامل فني ☐ عامل عادي ☐ أخرى ☐ حدد _____

12 – مدة سنوات العمل في المكان: _____.

13 – هل يوجد إدارة خاصة بالنفايات في مؤسستك؟

نعم ☐ لا ☐ لا أعرف ☐

14 – هل توجد خطة خاصة بإدارة النفايات الصلبة الخطرة في مؤسستك ؟

نعم ☐ لا ☐ لا أعرف ☐

15 – هل يوجد فريق خاص لإدارة النفايات الصلبة الخطرة في مؤسستك ؟

نعم ☐ لا ☐ لا أعرف ☐

16 – هل توجد تشريعات وأنظمة لضبط إدارة النفايات الخطرة بمؤسستك؟

نعم ☐ لا ☐ لا أعرف ☐

17 – إذا كانت الإجابة نعم هل يقوم المسئولون بتطبيق هذه الأنظمة ؟

نعم ☐ لا ☐ لا أعرف ☐

18 – هل إدارة مؤسستك تنسق مع مؤسسات أخرى ذات علاقة بالنفايات؟

نعم ☐ لا ☐ لا أعرف ☐

19 – هل لديك معرفة بالنفايات الخطرة ؟

نعم ☐ لا ☐ .

20 – إذا كانت الإجابة نعم فهل يتم فصل النفايات الخطرة بمركز عملك ؟

دائماً ☐ أحياناً ☐ لا مطلقاً ☐ لا أعرف ☐

21– هل يتم جمع النفايات الخطرة في مؤسستك؟

نعم ☐ لا ☐ لا أعرف ☐ .

22 – إذا كانت الإجابة نعم فهل توجد آلية منتظمة لذلك؟

نعم ☐ لا ☐ لا أعرف ☐ .

23 – إذا كانت الإجابة نعم فكم عدد مرات جمع النفايات الخطرة يومياً بمؤسستك ؟

_____.

24 – هل عملت في مؤسسات أخرى قبل ذلك في نفس المجال ؟

نعم ☐ لا ☐ .

إذا كانت الإجابة نعم أذكر عدد السنوات _____.

25 – هل تعمل المؤسسة على تحسين خدمات جمع النفايات الصلبة الخطرة منذ قدوم السلطة الوطنية الفلسطينية.

نعم ☐ لا ☐ لا أعرف ☐.

26 – هل لاحظت فائدة في مجال إدارة النفايات الخطرة في مؤسستك على المستوى البيئي ؟

نعم ☐ لا ☐ لا أعرف ☐ .

27– إذا كانت الإجابة نعم فما هي الفوائد على المستوى البيئي ؟

نظافة المكان ☐ عدم وجود إصابات عمل ☐ عدم حدوث حرائق ☐

عدم ورود شكاوى مواطنين ☐ أخرى ☐ حدد _____

28 – إذا كانت الإجابة لا ، لماذا حسب اعتقادك ؟

عدم وجود نظام ☐ عدم التزام الموظفين ☐ التكلفة ☐ اخرى ☐

حدد _____.

29 – ما هي الأضرار الناتجة عن إلقاء النفايات الخطرة بالقرب من حاويات النفايات في الشوارع

لعب الأطفال بالنفايات ☐ رؤية أدوات حادة مثل المشارط والإبر ☐

تجمع الحيوانات الضالة ☐ أخرى ☐ حدد _____

30 – هل لاحظت تأثير النفايات الخطرة على صحة الإنسان داخل وفي محيط المؤسسة من خلال وجود مشاكل صحية ؟

نعم ☐ لا ☐ لا أعرف ☐.

31 – إذا كانت الإجابة نعم في السؤال السابق فما هي هذه المشاكل ؟

أمراض جلدية ☐ أمراض تنفسية ☐ أمراض معوية ☐ أمراض العيون ☐

32 – هل تمت زيارتكم من قبل مرشدين و مثقفين صحيين في مجال النفايات الخطرة ؟

نعم ☐ لا ☐ لا أعرف ☐ .

-إذا كانت الإجابة نعم فكم عدد الزيارات في السنة؟ _____

-إذا كانت الإجابة لا فلماذا حسب رأيك؟ _____

33 – إذا كنت تعمل في المجال الصحي فأجب على السؤال رقم 34 وإذا كنت تعمل في المجال الإنتاجي فأجب على السؤال رقم 35:

34 – النفايات الطبية تشمل التالي ، حدد ما تعرفه منها؟

إبر، مشارط ، زجاج مكسور ☐ مخلفات أدوية ☐ الخلاصات ☐

شاش وقطن ☐ علب مضغوطة ☐ أطباق زرع بكتيريا ☐

مواد بيولوجية ☐ مواد كيماوية ☐ مواد مشعة. ☐

أخرى ☐ حدد _____

35 – النفايات الصناعية تشمل التالي اختر ما تعرفه منها :

أدوية ☐ مواد كيماوية ☐ بطاريات ☐ بويات ☐

أخرى ☐ حدد _____

36 – بالنسبة للعمال الذين يقومون بنقل النفايات في مكان عملك:

عمال مدربون على ترحيل النفايات إلى مجمعاتها ☐

عمال عاديون يقومون بهذا العمل ☐

متعهد خاص يقوم بهذا العمل ☐

أخرى ☐ حدد _____ .

– كم عدد مرات نقل النفايات الخطرة من داخل الأقسام في اليوم ؟ _____.

37 – هل عدم معاملة النفايات الخطرة بالطريقة الصحيحة تؤدي لتأثير ضار على البيئة حسب رأيك ؟

نعم ☐ لا ☐ لا أعرف ☐

38 – هل تضررت بإصابات ناتجة عن النفايات الخطرة؟

نعم ☐ لا ☐ لا أعرف ☐

– إذا كانت الإجابة نعم حدد _____

39 – هل لديك علم بتضرر آخرين من النفايات الخطرة؟

نعم ☐ لا ☐ لا أعرف ☐

40 – إذا كانت الإجابة نعم بالسؤال السابق فما هو عدد المتضررين ؟

_____ .

41 – هل بإمكانك تحديد نسبة النفايات الخطرة إلى النفايات العادية ؟

نعم ☐ لا ☐ لا أعرف ☐

إذا كانت نعم فما هي النسبة:_____%.

42 – هل تلقيت تدريب ما عن التعامل مع النفايات الخطرة ؟

نعم ☐ لا ☐

43 – هل أنت بحاجة لتدريب للتعرف على إدارة النفايات الخطرة ؟

نعم ☐ لا ☐

44 – هل يوجد أدوات خاصة بالنفايات الخطرة في مؤسستك ؟

" أكياس خاصة – جرادل – صناديق كرتون ... الخ ".

نعم ☐ لا ☐ لا أعرف ☐

– إذا كانت الإجابة نعم حدد _____

45 –هل تعتقد أن هناك ضرورة لوجود أدوات خاصة للتعامل بالنفايات الخطرة ؟

نعم ☐ لا ☐ لا أعرف ☐

46 – كيف تتم عملية التخلص من النفايات الخطرة بمؤسستك؟

تنقل لحاوية البلدية مباشرة ☐ تنقل لمحرقة آلية مخصصة لهذا الغرض ☐

تحرق في أماكن مفتوحة ☐ تنقل لمكب البلدية بسيارة خاصة ☐

أخرى ☐ حدد _____

47 – هل توجد محارق خاصة للنفايات الخطرة في مؤسستك ؟

نعم ☐ لا ☐ لا أعرف ☐

إذا كانت الإجابة نعم بالسؤال السابق هل أنت راض عن نظام عملها؟

– بدرجة كبيرة ☐ بدرجة متوسطة ☐ بدرجة قليلة ☐ غير راض تماما ☐

– كيف تتم عملية الحرق _____

48 – هل لديك استعداد للتعاون مع اللجان المتخصصة في مجال النفايات الخطرة؟

نعم ☐ لا ☐ لا أعرف ☐

49 – هل يتم إجراء كشف صحي دوري للعاملين بمؤسستك ؟

بانتظام ☐ أحيانا ☐ لا مطلقاً ☐

50 – هل الوسائل الوقائية متوفرة بمركز عملك ؟

" كمامات – كفات – أوفرهول – أحذية – نظارات – أخرى "

دائماً ☐ أحياناً ☐ لا مطلقاً ☐ لا أعرف ☐

51 –إذا كانت تلك الوسائل غير موجودة بالشكل الصحيح فلماذا ؟

قلة الموارد ☐ عدم وجود وعي لدى العاملين ☐

عدم التزام الإدارة بذلك ☐ أخرى ☐ حدد _____

52 – ما هو تقييمك للتعامل مع النفايات الخطرة بمركز عملك ؟

ممتاز ☐ جيد جداً ☐ جيد ☐ مقبول ☐ غير مقبول ☐

53 – هل تستخدم أي من المواد الإعلامية للتوعية من المواد الخطرة بمركز عملك ؟

نعم ☐ لا ☐ لا أعرف ☐

إذا كانت الإجابة نعم فماذا يوجد ؟

تليفزيون ☐ بوستر ☐ نشرة ☐ مسرحية ☐

أشياء أخرى ☐ حدد _____

54 – دون من فضلك أية اقتراحات أخرى تجدها مناسبة لتحسين إدارة النفايات الخطرة في قطاع غزة:

_____

_____

_____

_____.

Annex 4

Environmental Assessment of Hazardous Waste Management at Selected Sites in the Gaza Strip

(Questionnaire)

Serial No.: _____
Code No.: _____

1. Date: _____

2. Type of the organization:
   Hospital ☐ Clinic ☐ Factory ☐
   Others ☐ *(Specify)* _____

   State the name of the organization: _____

3. Area:
   North ☐ Gaza ☐ Middle ☐ Khanyonis ☐ Rafah ☐

4. Gender:
   Male ☐ Female ☐

5. Age, if possible: _____

6. Marital status:
   Married ☐ Single ☐ Widow ☐ Divorced ☐

7. Educational level
   Primary ☐ Preparatory ☐ Secondary ☐
   Academic ☐ Others ☐

8. Educational years: _____

9. If you are working in health organization, please answer Q. 10, and if you are working in industrial organization, please answer Q. 11:

10. Occupation:

General practitioner ☐ Specialized doctor ☐ Dentist ☐

Pharmacist ☐ Nurse ☐ Lab. Technician ☐ Radiologist ☐

Worker ☐ Others ☐ *(Specify)* _____

11. Occupation:

Engineer ☐ Technical worker ☐ Worker ☐

Others ☐ *(Specify)* _____

12. Work duration at the place: _____

13. Is there special waste management in your organization?

Yes ☐ No ☐ Don't know ☐

14. Is there a special plan for HWM in your organization?

Yes ☐ No ☐ Don't know ☐

15. Is there a special team for HWM in your organization?

Yes ☐ No ☐ Don't know ☐

16. Are there legislations and bylaws for controlling HWM in your organization?

Yes ☐ No ☐ Don't know ☐

If the answer is yes in Q 16

17., Are the accountable people applying these regulations and bylaws?

Yes ☐ No ☐ Don't know ☐

18. Does your organization coordinate with other organizations in relation to the waste concern?

Yes ☐ No ☐ Don't know ☐

19. Do you personally know HW?

Yes ☐ No ☐

If the answer is yes in Q 19,

20. Is there any separation for HW within your organization?

Regularly ☐ Sometimes ☐ I don't know ☐ Not absolutely ☐

21. Is there any collection for HW in your organization?

Yes ☐ No ☐ I don't know ☐

If the answer is yes in Q 21,

22. Is there a regular mechanism for this concern?

Yes ☐ No ☐ I don't know ☐

If the answer is yes in Q 22,

23. How many times do they usually collect HW per day?

_____

24. Did you work in other organizations concerned with the same field of your current organization?

Yes ☐ No ☐

If yes, please how many years? _____

25. Have you noticed any improvement in HW services since the presence of PNA?

Yes ☐ No ☐ I don't know ☐

26. Did you notice any environmental progress in HW field in your organization?

Yes ☐ No ☐ I don't know ☐

If the answer is yes in Q 26,

27. What are these improvements?

Cleanliness of the place ☐ Absence of work injures ☐

Absence of fires ☐ Absence of people's complaints ☐

Others ☐ *(Specify)* _____

If the answer is no in Q 26,

28. Why? According to your point of view:

Absence of system and framework ☐ Lack of employees' obligation ☐

Cost ☐ Others ☐ *(Specify)* _____

29. What are the harms, which may be occurred from throwing HW nearby or around the containers in the street?

Children playing with wastes ☐ Visibility of sharps and needles ☐

Presence of astray animals ☐ Others ☐ *(Specify)* _____

30. Did you notice sanitary impacts of HW on the human health within or around your organization?

Yes ☐ No ☐ I don't know ☐

If the answer is yes in Q 30,

31. What are these sanitary problems?

Skin diseases ☐ Respiratory diseases ☐

Intestinal diseases ☐ Ophthalmic diseases ☐

32. Have you been visited by health educators for HW concerns?

Yes ☐ No ☐ I don't know ☐

If yes how many times a year?

_____

If no, why?

_____

33. If you work in health field, please answer question 34, and if you work in industrial field, please answer question 35:

34. Which of the following is considered HW, tick the appropriate?

Needles, sharps, broken glass ☐ Drugs ☐ Placenta ☐

Cotton Compacted cans ☐ Bacterial growing plates ☐

Biological substances ☐ Chemical substances ☐

Radioactive materials ☐ Others ☐ *(Specify)* _____

35. Industrial waste includes the following; choose the items, which you know?

Drugs ☐ Chemical substances ☐ Batteries ☐

Paints ☐ Others ☐ *(Specify)* _____

36. The workers who transport the waste from your work are:

Trained workers ☐ Regular workers ☐ Private sector ☐

Others ☐ *(Specify)* _____

How many times do they usually transport the waste from sections per day? _____

37. According to your point of view, Does the mishandling of HW lead to environmental harms and impacts?

Yes ☐ No ☐ I don't know ☐

38. Have you been injured by HW?

Yes ☐ No ☐ I don't know ☐

If yes, please *(Specify)* _____

39. Have you heard about harms or injures from HW for other people?

Yes ☐ No ☐ I don't know ☐

If the answer is yes in Q 39,

40. How many injured people you know?

_____

41. Can you determine the percentage of HW within the general waste in your organization?

Yes ☐ No ☐ I don't know ☐

If yes, what is the percentage?

_____

42. Have you attended any training course for dealing with HW?

Yes ☐ No ☐

43. Do you need any training for recognizing HWM?

Yes ☐ No ☐

44. Are there special tools for dealing with HW in your organization?

"Special bags – buckets – boxes … etc."

Yes ☐ No ☐ I don't know ☐

If yes, (*Specify the available)* _____

45. Do you think that the presence of special tools is essential for dealing with HW?

Yes ☐ No ☐ I don't know ☐

46. How HW are being disposed in your organization?

Transported directly to the municipal container ☐

Transported to a special incinerator ☐

Burnt in open areas ☐

Transported to the municipal landfill by special vehicle ☐

Others ☐ *(Specify)* _____

47. Are there special incinerators for HW in your organization?

Yes ☐ No ☐ I don't know ☐

If yes, are you satisfied with its system?

Highly satisfied ☐ Satisfied ☐

Dissatisfied ☐ Highly dissatisfied ☐

48. Are you willing to cooperate with HW specialized committees?

Yes ☐ No ☐ I don't know ☐

49. Are there any regular exams for the workers in your organization?

Regularly ☐ Some times ☐ not absolutely ☐

50. Are the preventive equipment available in your organization?

Masks – Gloves – Overalls – Shoes – Eyeglasses -Others

Regularly ☐ Sometimes ☐ not absolutely ☐ I don't know ☐

51. If these equipments are not available in a proper manner, why?

Lack of fund ☐ Lack of workers' awareness ☐ Lack of department's obligation ☐ Others ☐ *(Specify)* _____

52. What's your evaluation about dealing with HW in your organization?

Excellent ☐ Very good ☐ Good ☐

Acceptable ☐ Unacceptable ☐

53. Does your organization use any of mass media for awareness about HW?

Yes ☐ No ☐ I don't know ☐

If yes what is used for this purpose?

TV ☐ Posters ☐ leaflets ☐ Plays ☐

Others ☐ *(Specify)* _____

54. Please note down any proper subjections for improving HWM in the Gaza Strip:

_____

Researcher

Abdel Rahem Abul Kumboz

Annex 5

استبيان حول التقييم البيئي لإدارة النفايات الخطرة في قطاع غزة

المقدم للعاملين والعاملات في حقلي الصحة والصناعات الإنتاجية

قطاع غزة - فلسطين

الرقم المسلسل/ _____

رقم الكود / _____

- يسعدني أن أتقدم لسيادتكم بجزيل الشكر على مشاركتكم الفاعلة في هذه الدراسة والتي هي جزء من رسالة الماجستير في كلية الصحة العامة – جامعة القدس.
- إن هدف الدراسة هو التقييم البيئي لإدارة النفايات الخطرة في مجالي الصحة والصناعات الإنتاجية ومدى المعرفة والتوجهات والخبرة للعاملين في هذا المجال.
- هذا الاستبيان هو فرصة لاطلاعنا على رأيكم والذي يعود بالفائدة على جميع السكان سواء العاملين أو غير العاملين.
- النتائج التي سيتم الحصول عليها ستساعد في تحسين ورفع كفاءة الخدمة المقدمة والتي سيكون لها الأثر الإيجابي على صحة الإنسان وسلامة البيئة.
- إننا نقدر ونثمن وقتكم . . لذا نستأذنكم بتخصيص عشرة دقائق فقط لتعبئة هذا الاستبيان مع العلم بأنه لا حاجة لكتابة الاسم على الاستبيان.
- الرجاء الإجابة على كافة الأسئلة بقدر المستطاع وما أمكن ذلك .
- تعتبر الإجابة على الاستبيان سرية حيث أنها لأغراض البحث العلمي ولن يُشار إلى جهة أو مؤسسة بعينها في النتائج .
- البحث ممول من قبل الباحث فقط ولا توجد جهات ممولة.
- سيتم تزويدكم شخصياً بملخص عن نتائج البحث فور الانتهاء منه.

شاكرين حسن تعاونكم معنا

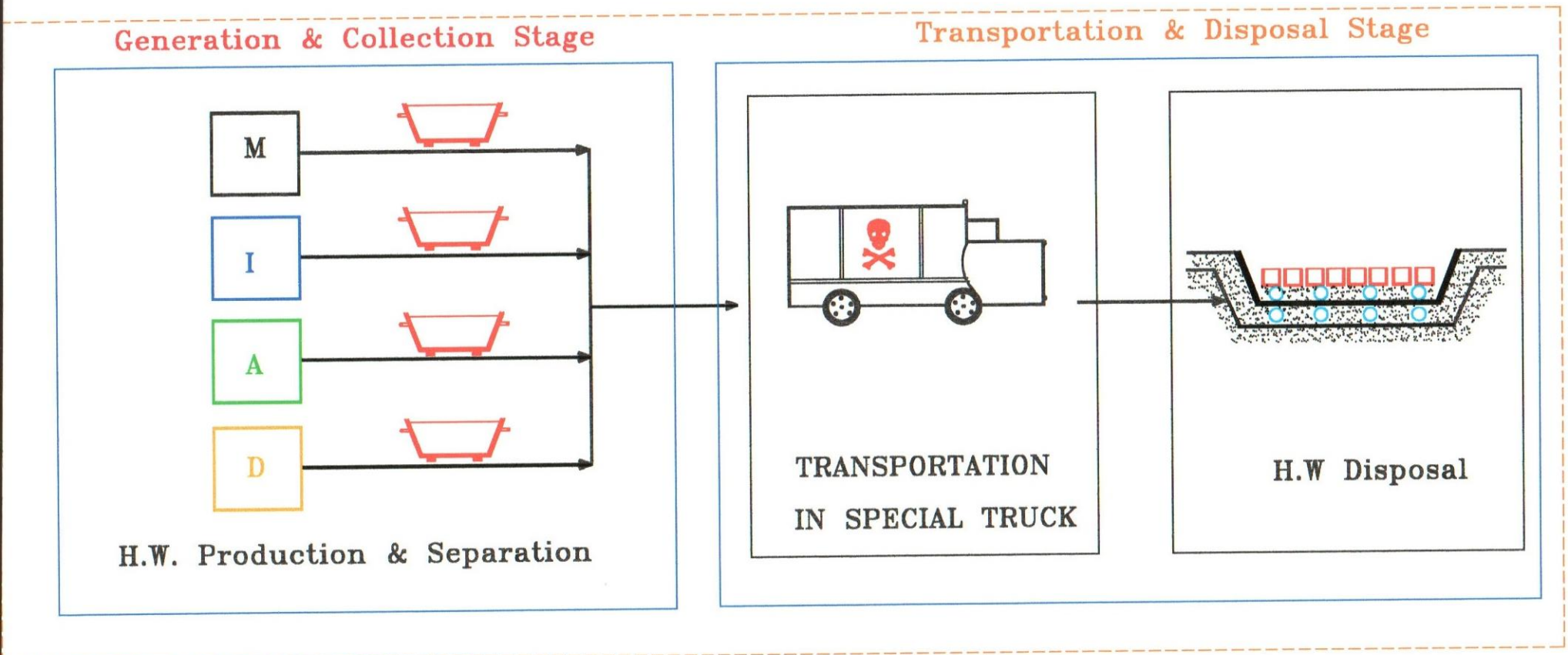
مع فائق الاحترام والتقدير

أخوكم

الطالب / عبد الرحيم أبو القمبز

مدير إدارة الصحة والبيئة ببلدية غزة

Conceptual Frame Work of H.W.M. in the Gaza Strip



Annex 6

M = Medical Hazardous Waste
I = Industrial Hazardous Waste
A = Agricultural Hazardous Waste
D = House hold Hazardous Waste

H.W.M. = Hazardous Waste Managment