

## 1.0 Introduction

This paper aims to provide a broad overview of the industrialization process in the Ramallah and al-Bireh District. It forms part of a bigger and more comprehensive investigation covering a variety of environmental issues relevant to industries in Ramallah. The information contained in this paper is of importance for the following reasons:

- It is the first time such data has been gathered and summarized in this region and field.
- Despite the broad nature of the information contained in this paper, it does allow officials to utilize it for decision making purposes regarding the future industrial development in the region while taking into consideration environmental health.
- It provides the template around which further investigations on the particular topic will be made.

### Urbanization and Industrialization

Urbanization and industrialization are parallel phenomena being witnessed throughout the world. Industrialization serves as the magnet to draw rural dwellers to urban settlements, in turn shifting from rural agricultural employment to employment in the industrial sector.<sup>1</sup> Urbanization and industrialization are further linked through increasing demand for man-made consumer goods which arises when people settle in urban areas. As the demand for the factory-made products grows, so too will the supply, thereby increasing the incentive to establish new factories.<sup>2</sup> Urbanization also introduces diversity of choice and taste: not only is there an increase in the

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<sup>1</sup> World Resources Institute (WRI). "Chapter One," *Cities and the Environment: The Urban Environment--A guide to the global environment, 1996-1997*. New York and Oxford: Oxford University Press, 1997.

<sup>2</sup> Ghatak, S. and Katzen, L. "Population, poverty and income distribution, employment and migration," *Introduction to Development Economics*. London: Routledge, 1995. p. 231.

number of factories within one industrial sector, but new industries arise during this simultaneous urbanization-industrialization process.

When examining health issues in urbanizing areas, we are concerned with how urbanization and industrialization work together to negatively influence the community's health. It is when urbanized industrial growth is rapid, unorganized and goes unchecked that negative impacts on health increase.<sup>3</sup> Building factories in primarily residential areas where zoning laws do not exist, or if they do exist but are not enforced, jeopardizes the health of locals through the factories' noise, air, wastewater and solid waste emissions. If industries are collected into an 'industrial area' and no regulations are made by a local authority regarding emissions, the high concentration of emissions saturate the air, land and water, jeopardizing the health of even those who do not neighbor the area.<sup>4</sup> A combined problem of zoning laws and emissions standards is accentuated when residential units are allowed to be built within or next to an industrial area. Emissions standards are set with the idea that residential units will be a specified distance from the industrial area, allowing for a dissipation of emissions before they reach residential areas. If emissions regulations are met but housing is built within the industrial area, the high concentrations of emissions will negatively impact the health of the residents.

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<sup>3</sup> Organization for Economic Co-Operations and Development (OECD). "Policies and Strategies to Promote Cleaner Production," *Promoting Cleaner Production in Developing Countries: The role of Development Co-operation*. Paris: OECD, 1995.

<sup>4</sup> Cooper-Weil, D.E. et al. *The Impact of development policies on health: A review in the literature*. Geneva: WHO, 1990. Cited in *Our Planet, Our Health: Report of the WHO Commission on Health and Environment*. Geneva: WHO, 1992.

### **Industrialization, Urbanization and Sustainable Development**

Industrial development of a nation relies on having a healthy population to sustain its growth.<sup>5</sup> However, as noted above, when development goes unchecked, the environment and health of a nation's people is compromised. Some critics of development believe the solution to protecting the environment and people's health is to halt the process of development and revert back to the way society lived before the shift to an industrialized lifestyle. It seems unrealistic, however, to stop the worldwide push towards development a more realistic solution is necessary. The best solution yet for such problems was conceptualized in the term "sustainable development."<sup>6</sup>

In 1987 the Brundtland Report, a result of the World Commission on Environment and Development, incorporated the seemingly competing ideas of development and environmental protection. The international coalition drafting the Report addressed the constraints faced by nations which are increasing development activities and at the same time are compromising the quality of the environment. The solution in the Brundtland Report: no development without sustainability; no sustainability without development.<sup>7</sup> This points to continuing development but in such a way as to take into consideration the nation's future, not only its present state.<sup>8</sup> This idea behind sustainable development encourages people to think more about their environment and the new technologies being introduced at a rapid pace. It pushes those involved in the development process to find optimal balance between production, overall economics and the environment. Yet, it is not easy to achieve the balance between sustainability and development, and in some cases it may be impossible. However, nations can strive to achieve this balance and if they do not succeed, at least they can minimize the negative impact of

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<sup>5</sup> WHO. *Environmental Health in Urban Development: Report of a WHO Expert Committee*. Geneva: WHO, 1991.

<sup>6</sup> World Commission on Environment and Development. *Our Common Future*. Oxford, UK: Oxford University Press, 1987. p.1. Cited in W. Sachs, ed. *The Development Dictionary: A Guide to Knowledge and Power*. London: Zed Books, 1992.

<sup>7</sup> Ibid.

<sup>8</sup> Poreteous, A. *Dictionary of Environmental Science and Technology*. West Sussex, UK: Chichester, John Wiley & Sons, 1997. pp. 524-527

development on the environment, and in turn on the health of its citizens.

### **Industrialization, Urbanization and Palestine**

With sustainable development in mind, it is time to think about applying this development philosophy to our own context. Here in Palestine, as cities undergo the urbanization process, a host of environmental problems are arising. These problems are intensified by the increasing number of factories being built with little foresight given to sustainable development. In light of the current situation, this paper focuses on the industries in the Ramallah and al-Bireh District, with specific detail given to zoning and wastewater.

#### *Industrialization and zoning in the Ramallah and al-Bireh District*

Ideally, land within a municipality is portioned into zones according to the needs and purposes of the community, be it residential, commercial industrial, agricultural, or a combination of the above. Palestinian National Authority (PNA) Guideline number 30, Article number 21 designated the following zones in the areas under its control: residential, rural residential, agricultural residential, commercial, industrial, office, public building, and tourist.<sup>9</sup> All lands not mentioned in the above structural plan are commonly recognized for agricultural use. This paper is concerned with only four categories of zones: industrial, commercial, agricultural and residential.

During periods of construction, zoning provides guidelines where homes, workshops and industries, can and cannot be built. For example, workshops and industries cannot be built in residential, rural residential or agricultural zones when zoning is properly enforced. Commercial zones are to be used for buildings with commercial purposes and public services, as well as residencies. Office zones are used for offices, public services, residencies, or any other type of building or structure that is declared in the structural plan. Industrial zones are to be used for industries and workshops, but it is possible for

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<sup>9</sup> Palestinian High Council on Organization. *Guideline number 30, 24/August/ 1996. Guidelines for Planning and Building.* Articles number 27-34.

residencies, commercial businesses and public services to be built in industrial zones if mentioned in the structural plan.<sup>10</sup>

*Industrial wastewater status in the Ramallah and al-Bireh District*

Industrial wastewater is one of the main effluents produced by industrial sites, and if not properly treated or handled, may adversely affect the environment, and in turn, people's health. For example, there are currently no regulations prohibiting the irrigation of agriculture with wastewater. By implementing sustainable development principles and practices we can control the effluents in wastewater and ensure it is treated, reaching a safe destination. In 1995, the Applied Research Institute of Jerusalem (ARIJ) surveyed approximately 70% of the industrial facilities in the Ramallah and al-Bireh District, and found these sites generated 206,000m<sup>3</sup> of wastewater annually. These 206,000m<sup>3</sup> of wastewater were disposed of through a number of means: cess pits, septic tanks, reused, sent directly into the municipal sewage system or disposed of in open areas near the facility.<sup>11</sup> None of these methods of disposal are desirable for contaminated water. As the Peace Agreement progresses, extensive industrial development is expected to continue, heightening concerns about industries producing harmful sewage from both a large number and a wide variety of industries. Not only must developers and environmentalists be concerned with properly treating wastewater from one type of industry, but with also ensuring the wastewater from the variety of industries is homogeneous.

There are a growing number of small- and medium-sized industrial plants discharging wastewater into the municipal sewers of Ramallah. Almost all factories in the city's industrial area are connected to the wastewater treatment plant, except those located in the northern part of the industrial area not served by the municipal sewer network. Only a few factories have some form of simple pretreatment or wastewater recycling on-site; the remaining factories and workshops

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<sup>10</sup> Palestinian High Council on Organization. *Guideline number 30, 24/August/1996. Guidelines for Planning and Building.* Articles number 27-34.

<sup>11</sup> Applied Research Institute of Jerusalem (ARIJ). *Environmental Profile for the West Bank: The Ramallah District.* Bethlehem: ARIJ, 1996. p.80.

discharge effluents in to the municipal sewer system untreated.<sup>12</sup> In the al-Bireh industrial area, a municipal sewer network exists. Some of the factories and workshops are connected to the municipal collection system. Industries in al-Bireh, however, are not required to connect to the sewer system, and for those that do connect, all factories are not required to pre-treat wastewater before depositing their effluents.<sup>13</sup>

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<sup>12</sup> Project in Development and the Environment (PRIDE). *Environmental Assessment for American Near East Refugee Aid (ANERA) Project on Ramallah's Wastewater Treatment Plant Complex*. Washington, DC: PRIDE, 1994.

<sup>13</sup> Telephone interview by author with official representative from al-Bireh Municipality, June 1998.

## 2.0 Methodology

From the end of 1994 to the beginning of 1995, the Department of Environmental Health within the Ministry of Health (MOH) took the initiative to survey 111 factories operating at that time in the Ramallah and al-Bireh District. The exact number of factories and workshops in operation during this period is unknown. However, Ministry officials believe these factories represented the majority of factories operating in the area at that time. The data was collected utilizing a questionnaire designed by the MOH. Factories were chosen for the study by the MOH based upon the following definition of an industrial site: any building in which there are workers and where a process occurs of changing the form of a raw material to another “product”.<sup>14</sup> Two MOH employees administered the questionnaire on-site, completing it with a knowledgeable employee of the factory or workshop.

In this survey, information related to water consumption was reported from monthly water bills. Thus the data pertains to the monthly rather than daily or annual consumption. Wastewater generation, however, is not recorded on an industrial site’s monthly water bill; it is estimated by subtracting the estimated amount of water lost in production from the monthly water consumed.

The data was coded and entered into the computer, cleaned and analyzed by the staff of the Institute of Community and Public Health, Birzeit University. Although some of the data contained inconsistencies, important and generally reliable information was obtained from the questionnaires, whereby a general presentation of the findings became possible. Although the questionnaire covered a wide array of information on each facility, only information on the location of the industrial site, licensing of the factory, dangerous

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<sup>14</sup> Interview by author with Mr. R. Titi, Director of the Department of Environmental Health, Ministry of Health.

materials used in the factory, water use, wastewater generation and treatment were analyzed for the purposes of this paper.

The Ramallah and al-Bireh District includes two major urban areas of Ramallah and al-Bireh, as well as 99 villages and towns. Ninety-three villages are classified as rural due to the existence of a village council or local committee. The remaining six towns are urbanizing or semi-urban communities, defined by the presence of a local municipal council, as well as other social, commercial and industrial activities. Examples of these urbanizing communities are Beitounia, Birzeit, and al-Ram.

It is important to reiterate the definition of a zone: it is a portion of land assigned one of the titles previously mentioned in the municipal structural plan and can be used for purposes stated in PNA guidelines. Zones with different specified purposes may neighbor one another or overlap, which clouds the boundary of the zone as well as what type of structures may be built upon it.

### **3.0 Findings**

One hundred and eleven factories and workshops are included in the findings, believed to represent a majority of industries operating in 1994, at the time when the MOH conducted the survey . These 111 factories and workshops were distributed throughout the District of Ramallah and al-Bireh.

#### **3.1 Industry profile**

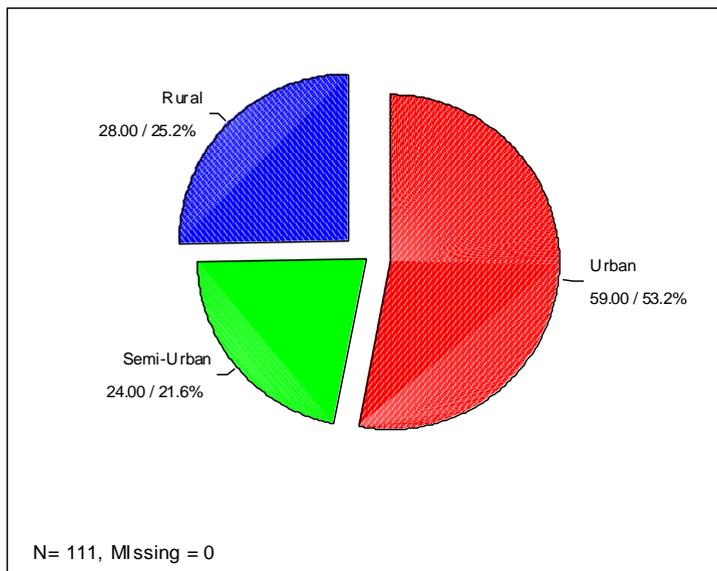
##### **a) Urban, semi-urban, and rural distribution**

The distribution of factories by locale, urban, semi-urban and rural, is important to establish before assessing the environmental impact of the factories. Not only must it be understood that the three demographic areas are affected differently by industries, but also that there is an interdependent relationship between the location and type of industry. This reinforces the necessity to disaggregate industries based upon their demographic location, in the search to assess the environmental impact industries make upon each area, as well as to find solutions appropriate for the demographic area. Finally, by classifying industries by location, it may also provide more information as to how the urbanization process affects industrialization.

The results in Chart 1 show 59 (53%) factories are located in the two urban areas of the District of Ramallah and al-Bireh, with the remaining 52 (47%) factories located in semi-urban and rural communities. In the semi-urban areas, there are 24 factories (22%) distributed throughout the six communities in the District; the remaining 28 factories (25%) are scattered throughout the 93 rural communities.

Chart 1

### Distribution of industrial sites by locale, 1995



#### b) Zone distribution

The concept of planning and zoning is done in part to ease efforts of regulation by the municipalities as well as to protect the population. With concern to industrialization, merely ensuring industries are located in the same area is only half of the job that needs to be done. High concentrations of industries without a good system of monitoring and regulation defeats the purpose of zoning.<sup>15,16</sup>

Residential, industrial, commercial and agricultural zones all appear in urban areas and in some circumstances, in semi-urban areas, while only residential and agricultural zones are in rural areas. Of the one hundred and two factories responding to this question on the survey, 54 (53%) are located in industrial areas, 13 (13%) in commercial

<sup>15</sup> WHO. "Industry," *Our Planet, Our Health: Report of the WHO Commission on Health and Environment*. Geneva: WHO, 1992.

<sup>16</sup> Cooper-Weil, D.E. et al. *The Impact of development policies on health: A review in the literature*. Geneva: WHO, 1990. Cited in *Our Planet, Our Health: Report of the WHO Commission on Health and Environment*. Geneva: WHO, 1992.

## Industrialization, Urbanization and Environmental Health

areas, 25 (25%) in residential areas, and 9 (9%) are located in agricultural areas. One factory (1%) was defined as being located in both a residential and commercial zone according to the owner (Chart 2).

Chart 2  
Distribution of factories by zone, 1995



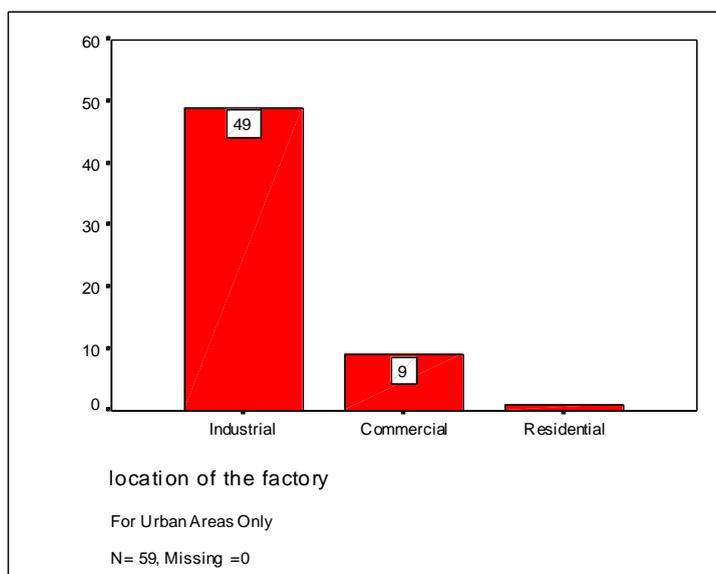
- A factory in an agricultural zone by definition is only in the semi-urban and rural areas, not in an urban area. Of the nine factories located in agricultural zones, two are in semi-urban areas.
- In the Ramallah and al-Bireh District there are three industrial zones; two are in the urban areas and one in Beitounia, classified as a semi-urban area. It is worth noting that of the 54 factories that are located in industrial zones in the District, 90% are in an urban area. The remaining five factories are divided between semi-urban and rural areas. Two factories are in a rural area, Anata, which does not have an industrial zone but the factories' owners declared themselves in such zones on the

questionnaire. The remaining three factories are in Beitounia's industrial zone.

- Three-quarters of the factories located in residential zones are in rural areas. Twenty percent, or five factories, are in semi-urban communities, with a negligible percent in urban areas.
- Finally within the commercial zones, nine factories are in urban areas, and four in semi-urban areas.

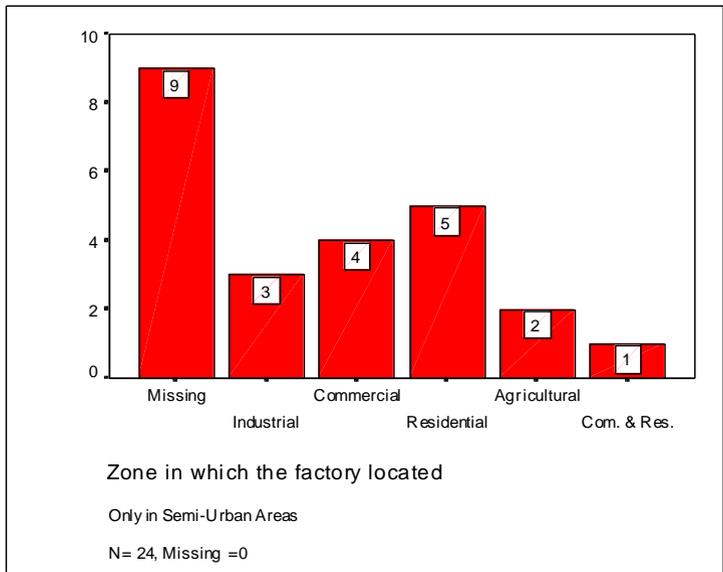
The results presented above may be explained by the urbanization process currently underway in Palestine:

Chart 3  
Distribution of factories in urban areas by zone, 1995



- The large number of factories in industrial zones are found in urban areas, consistent with what we would expect to see in any urbanized area. Here, zoning is generally in place and the building and registration of factories or workshops occurs if they are built in the industrial or commercial zones (Chart 3).

Chart 4  
Distribution of factories in semi-urban areas by zone, 1995



- In semi-urban areas it appears zoning does not work as effectively as in urban areas, or is not enforced, as there is an almost equal distribution of factories in industrial, commercial and residential zones (Chart 4). Of these three zones, “factory in residential zones” is reported most frequently.
- In rural areas the concept of zoning does not apply as it does in urban areas. Of the 28 factories located in rural areas, 19 are on residential lands and seven on agricultural lands. In rural areas it is not uncommon for people to build workshops or factories close to their homes; hence we see the large number of factories in residential areas. A growing trend is for privately owned agricultural land to be used for industrial purposes despite the fact the lands surrounding it are still used for agricultural purposes.

These differences can be explained by the way decisions are made, and who they are made by, in each of the different locales. Rural areas

with their local village councils often make decisions based upon social and cultural needs and concerns, rather than with local infrastructure in mind. No foresight is given concerning the planning in relation to zoning of the village, partially explaining why we see factories in rural areas being built on residential or agricultural lands.

In contrast, urban areas have municipalities concerned with the provision of services to its residents; they are responsible for zoning, planning, and providing services. In short, they are accountable for the future of the city. This in turn partially explains the concentration of factories and workshops in the industrial and commercial zones, and not in the residential zones in urban areas.

Semi-urban areas fall somewhere in the middle of the continuum of rural and urban areas in terms of their zoning and provision of services. However, not all semi-urban areas are in the same stage of transition, some are further along than others. This is why we see in semi-urban areas, when taken as a group, an almost equal distribution of factories in industrial, commercial and residential zones.

### **c) Location of factories in relation to residences**

No laws exist taking into consideration a need for minimum distance between factories and residences. While authorities try to prevent factories and workshops from being built in the residential area, they are unable to prevent residences from being built in the industrial areas, often under the guise of commercial sites.<sup>17</sup>

Another problem lies in the zoning and demarcation of areas. In practice, there is not always a clear boundary between an industrial zone and its neighboring zones, allowing for overlap. When industrialized zones were first created in the Ramallah and al-Bireh District they were not located next to residential or commercial zones, but on the outskirts of the city. Now with the rapid expansion of the

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<sup>17</sup> Palestinian High Council on Organization. *Guideline number 30, 24/August/ 1996. Guidelines for Planning and Building*. Article number 31.

cities, the residential areas are encroaching on the industrialized areas so they now border one another.

Not only is the distance between residences and industries important to keep in mind, but also the level of toxicity of the emissions from the industry or workshop as well. There is no standardized procedure to weigh the toxicity of a factory's emissions; it is based upon the knowledge of the municipality employee evaluating the application, allowing for random and dangerous approvals to occur. It is for these reasons that the population we are most concerned with here are those living closest to the factories; the ones receiving the largest doses of noise, air, solid waste and wastewater pollution.

Chart 5  
Distribution of factories by distance to closest residence, 1995

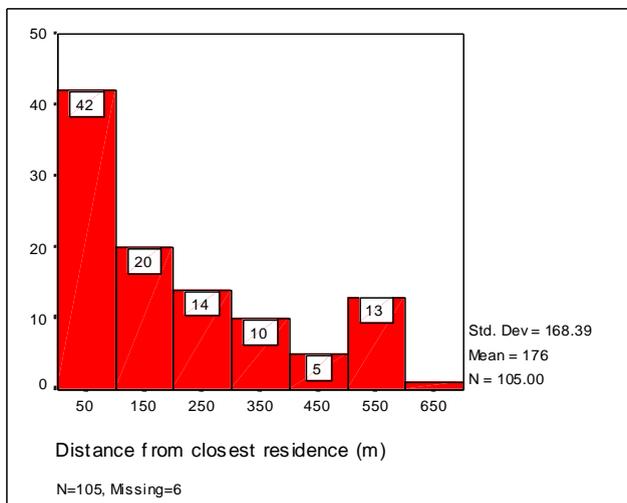


Chart 5 shows 42 factories are within less than 100 meters from the closest residence. Thirty-four factories are between 100-299 meters from the nearest residences, 15 factories are within 300-499 meters, and 14 factories are within 500-699 meters. The six factories or

workshops not included in Chart 5 are those situated 1000 meters or more from the closest residence.

#### **d) Licensing of factories**

As of Fall 1998, the standards for licensing factories in Palestine were still undecided. It must be brought to the reader's attention that Palestinians are restricted by the Peace Agreement, unable to create enforceable laws in PNA territory. What normally would be a "law" is instead a "guideline" or "recommendation" under these political circumstances. Palestinian ministries do have the capability to use pre-existing regulations from Jordan and the Israeli occupation, despite their outdated requirements. This is currently being done with the food stuffs industry with regard to health conditions. Therefore, an individual wanting to establish a food production plant must meet the requirements before production begins.

Creating enforceable licensing laws is only half the job; they must be also be implemented. The complex economic and political situation here in Palestine adds an extra burden to the implementation of licensing laws. While economic barriers to implementation are worldwide, the PNA's relationship with the Israelis complicates issues further.<sup>18</sup> Finally, the monitoring of industries requires human and technical resources which the Palestinian government does not have at this time. Tests for air pollution, for example, are nearly impossible due to the lack of staff, training and equipment.

In Palestine there are three forms of licenses required to be a legally registered factory: a license from the Ministry of Industry (MOI), a Municipal Building license, and a license from the MOH.

- License from the MOI:

The MOI plays the role of coordinating licensing; it does not have any special conditions that the industrial site must fulfill in order to

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<sup>18</sup> Michaels, D. et al. "Economic development and occupational health in Latin America: New direction for public health in less developed countries." *American Journal of Public Health*, 75(5): 1985. pp. 536-542.

obtain the license. The MOI gives licenses based upon the industrial site having the approval of:

- the municipality,
- the MOH, Department of Environmental Health,
- other ministries directly affected by, or involved with, this type of industry, and
- the government's Archeology Department.<sup>19</sup>

Sixty-four (58%) factories and workshops have an industrial license to run as a factory, while 34% do not; nine factories did not respond to this question. Of the 38 factories that do not have a license from the MOI, six are located in urban areas, 14 in semi-urban areas, and 18 in rural areas.

- Licenses from the municipalities for the building itself:  
Seventy-five percent of the factories have a building license. This is not the license to legally run a factory, but is simply for the creation or use of the building. There are 15 factories that do not have a municipal building license and are distributed as follows: 12 in rural areas, one in a semi-urban area, and two in urban areas (Table 1).

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<sup>19</sup> Information was obtained from Director of Department of Licensing, Ministry of Industry.

Table 1  
Distribution of factories by possession of licenses, 1995

Type of License	No. of factories	% of factories
Do not have any license	15	13.5
Have Municipal Building License	83	74.8
Have license from the Ministry of Health (MOH)	49	44.1
Have license from the Ministry of Industry (MOI)	64	57.6
Have at least one license	28	25.2
Have at least two licenses	36	32.4
Have all three licenses	32	28.8
Have licenses from both MOI and MOH	40	36.0
Have neither the MOH nor MOI license	38	34.2

n=111

If no municipality exists in an area where a building permit is being sought, for example in a village, the Central Committee for Buildings and Planning for the District will decide on the issuance of a building permit. This committee is a higher authority than the municipality, but is not invoked in urban areas where the municipality's services apply. When large factories or industrial facilities seek a building permit and the municipality or Central Committee believes the structure will have a significant impact on the area, the application is referred to the Higher Council on Planning.<sup>20</sup> This national level office then takes the responsibility of issuing the building permit.

The building license is granted with the knowledge that the building may be used for another purpose in the future other than the current one specified. Due to a building's tenants and its purposes changing, it has led to the creation of residences in

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<sup>20</sup> Palestinian High Council on Organization. Guideline number 30, 24/August/ 1996. Guidelines for Planning and Building.

industrial zones, and workshops and factories in residential zones. It has, in fact, defeated the purpose of zoning.<sup>21</sup>

- License from the MOH, Department of Environmental Health:  
This license is crucial as it allows inspectors from this department to check the factory for hazardous emissions, enforce environmental health conditions to the highest degree possible, and give permission as the individual inspector sees fit. Inspections can also take place whether or not the factory or workshop has a license from the MOH.  
The factories sampled in this survey are divided nearly evenly in their possession of an environmental license. Almost half of the factories have an environmental license at 44%, while 47% do not; 9% of factories did not respond to this question.

In exploring the relationship between the ownership of the environmental and industrial licenses, 36% of factories possess both licenses. Of the factories which do not have industrial licenses, 87% also do not have the environmental license. Of those factories which do have an industrial license, 73% possess an environmental license; falling short 27% of ideal licensing requirements. These examples, along with the one-third of factories surveyed without the environmental and industrial licenses highlight the gaps between ministries when implementing licensing procedures. Without the environmental and industrial licenses, we believe these factories have never met environmental health conditions, and are unsure if they are monitored for further health risks during its on-going operation.

#### e) Rented versus owned buildings

It is important for future policy recommendations to recognize how different regulations apply to factories operating in rented buildings as opposed to buildings owned by the factory itself. Factories located in rented buildings cannot make changes within or to the building without the approval of the owner. A positive aspect of this is

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<sup>21</sup> Palestinian High Council on Organization. *Guideline number 30, 24/August/ 1996. Guidelines for Planning and Building.*

factories operating in rented space have the ability to move to a new location or zone if policy dictates, whereas factories located in a space owned by the factory do not have as much flexibility in terms of moving to a new location. These latter factories can, however, be asked and expected to make changes to their place of operation.

Fifty-seven percent of the buildings in which the factories are located are also owned by the factory. The remaining 43% of factories are in buildings which they rent.

#### **f) Distribution of factories by type of industry**

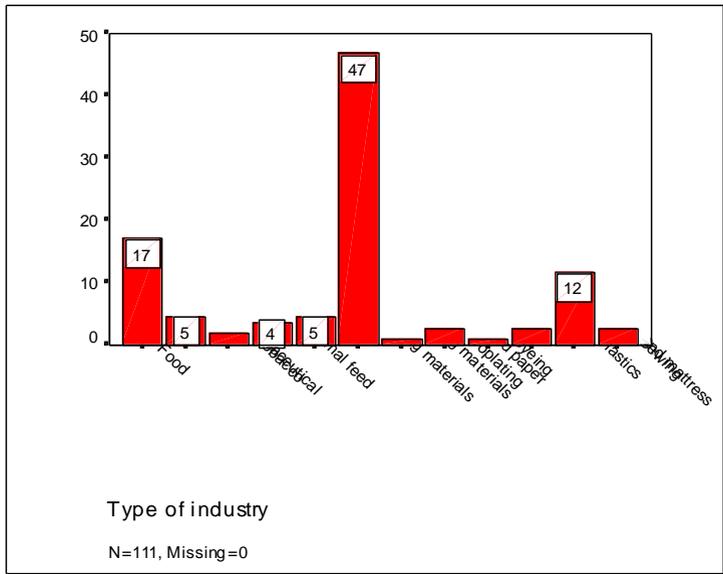
It is important to bring to attention the different types of industries for environmental control and evaluation purposes as their by-products vary by type and intensity; until this study, this has never been done. The Central Bureau of Statistics groups factories according to what goods are produced on-site. Electroplating factories and workshops are categorized with the metals industry, for example. With environmental concerns in mind, it is more suitable to categorize electroplating manufacturers with other factories emitting hazardous effluents.

Chart 6 depicts the 12 major types of industries in the Ramallah and al-Bireh District. Forty-seven percent of the factories produce building materials, such as block manufacturing and stone cutting. The second major industry in the Ramallah District is the food stuffs, followed by the plastics industry.

For a number of reasons, the category “building material” comprises the largest percentage of industries in the Ramallah and al-Bireh District. First, the raw materials necessary for these factories are locally available. Secondly, industries such as stone cutting are traditional in this area and have a long history here. Finally, the increase in the building movement has created a huge demand for the basic supplies necessary to meet the need.

Chart 6

Distribution of the factories by type of industry, 1995



- In urban areas there are 59 factories producing a variety of goods. Twenty-nine percent (17) of these 59 factories in urban areas are categorized as being involved in the food industry, 19% (11) in the plastics industry, and 10% (6) in building materials. Although the building material industry accounts for the largest percentage of total industries, it is not the most common industry in the urban area. This is due to the amount of land and the size of the factory required to house those seeking this large-scale industry. A small-scale factory involved in the building industry can be housed in the urban area, but has little opportunity to grow due to spatial constraints.
- Over three-quarters of the factories in the semi-urban areas are involved in the building materials industry, with only two in the plastics industry.
- All the factories (28) in rural areas are involved with building materials except for one dealing with dairy production.

### 3.2 Consumption of water by District factories

The consumption of water by factories is vital information for policy makers determining the industrial composition of the District, particularly in an area short on water supplies. This information gives an overall picture of fresh water consumption by the industries in the District, as well as highlights individual industries and factories consuming large amounts of water.

Data about water consumption was collected for 99 factories, or 89% of the factories participating in the study. Of the factories responding, the industries in the Ramallah and al-Bireh District consume about 18,443m<sup>3</sup> of water per month or 221,316m<sup>3</sup> per year (Table 2). The median monthly water consumption is 50 m<sup>3</sup> and the mean is 186m<sup>3</sup>. Overall, industries are moderate consumers of water but a few factories consume large amounts of water, skewing the mean amount of water consumed and making for the large difference between the median and mean.

Table 2  
Monthly consumption of water in m<sup>3</sup>, 1995

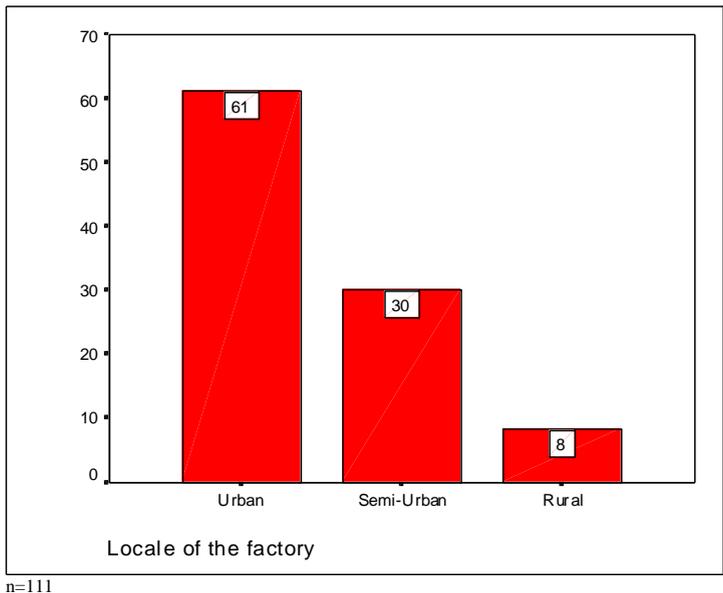
<b>Number of factories</b>	99	<b>Maximum</b>	6000
<b>Missing</b>	12	<b>Sum</b>	18443
<b>Mean</b>	186.29	<b>percentiles (25)</b>	24.00
<b>Median</b>	50.00	<b>percentiles (50)</b>	50.00
<b>Minimum</b>	1	<b>percentiles (75)</b>	150.00

The largest amount of water consumed on a per factory basis is worth noting in two cases. The first one is involved in food stuffs located in the city of Ramallah, consuming 6000m<sup>3</sup> of water per month. The second major consumer of water is a pharmaceutical factory located in Beitounia; its water consumption is 2500m<sup>3</sup> per month.

Note in Chart 7 of the total consumption of water, industries in urban areas consume more water per month than the rural and semi-urban industries combined. With 53% of all industries in the District, industries in the urban area consume 61% of the water, or about 11,171m<sup>3</sup> per month. Industries in semi-urban areas consume about 5578m<sup>3</sup>, or 31% of the total consumption of water by industries,

although 22% of all factories are located in these areas. Finally, industries in rural areas consume the most disproportionate amount of water at 8%, or the equivalent of 1559m<sup>3</sup>, despite the fact 25% of all participating factories are in these rural communities (Chart 7).

Chart 7  
Percentage distribution of water consumption in m<sup>3</sup> by locale, 1995



**a) Consumption of water by type of industry**

The major consumers of water in this study are factories involved in food stuffs and the creation of building materials. It is interesting to note that the dyeing industries did not respond to the questions pertaining to water consumption, although we know the dyeing industry as a whole consumes more water than any other industry.

Of water used for industrial purposes in the Ramallah and al-Bireh District, the food stuffs industry is the largest consumer at 8245m<sup>3</sup> or 44%. (Chart 8) The second largest consumer is the building material industry which uses 5652m<sup>3</sup> of water per month, or 31% of total water used for industrial purposes. The pharmaceutical industry consumes

the third largest amount of water at 2633m<sup>3</sup>, or 14%. The last group of industries worth noting are the five factories in the cleaning materials industry which consume 680m<sup>3</sup> of water, or 4% of all water used for industrial purposes.

Chart 8  
Percentage of water consumed by type of industry, 1995

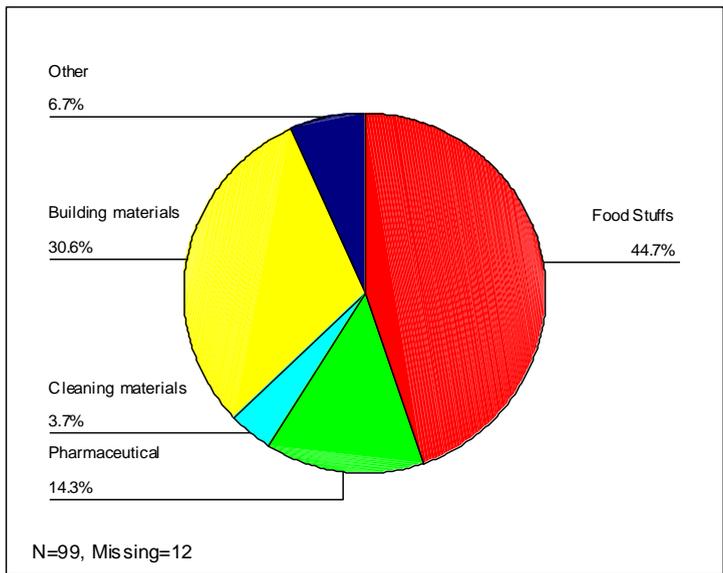
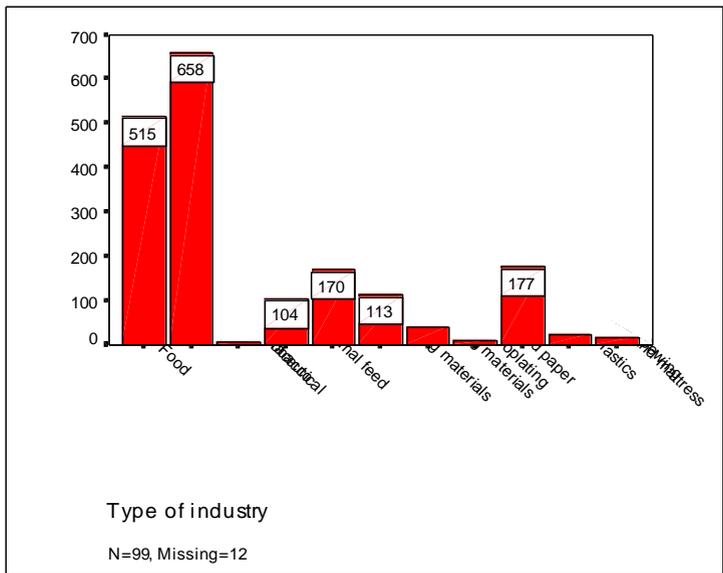


Chart 9 displays the mean consumption of water by each type of industry. This information is valuable for planning purposes as it helps predict the impact of a new factory on water resources available in Palestine. This information, used in combination, can help determine the industrial make up of the District while keeping in mind limited natural resources. For example, although all pharmaceutical companies only consume 14% of all industrial water on a monthly basis, these few factories consume on average 658m<sup>3</sup> of water each.

Chart 9  
Mean monthly consumption of water in m<sup>3</sup>  
by type of industry, 1995



### 3.3 Utilization and disposal of dangerous materials used for production

All industrial processes generate waste; no production system can transform all resource inputs into useful output products.<sup>22</sup> Typical wastes, if disposed of properly, are not a problem. But when wastes are not handled properly and are allowed to be deposited with industrial wastewater into the environment they can be dangerous for the community's health. This is the issue at hand.

Certain industrial wastes are categorized as hazardous or toxic because of the special care needed for their storage and disposal. This is to ensure they are isolated from human contact and stored in ways that prevent them from contaminating the environment. Other wastes can be classified as hazardous because so little is known about them. The lack of information on how to handle certain wastes may make for a lethal situation, so they are classified as hazardous as a precautionary measure. Danger also runs high when dealing with more than one

<sup>22</sup> Conway, R. *Handbook of Industrial Waste Disposal*. New York: Van Nostrand Reinhold Company, 1980.

material at a time. While a substance may not be toxic on its own, when mixed, it can be deadly.

It is not enough to simply say a waste is hazardous, but to define why it is hazardous. Three questions should be answered when dealing with hazardous wastes: to whom is this material hazardous (people, plants, environment), why is it hazardous (the nature of hazardous material toxicant, flammable reactive), and when is this material hazardous (in the factory, in the environment, or only under certain conditions).<sup>23</sup>

The existence of dangerous materials in factories affects the quality of wastewater, in turn damaging sewerage pipes, treatment plants, soil, vegetation, and ground water. Therefore, for a number of reasons, interest lies in detecting the prevalence of dangerous materials in the Ramallah and al-Bireh District's factories. A number of questions were included in the questionnaire regarding different dangerous materials in terms of their availability and type, be they poison, fuel, caustic or oxidant materials, or others. In 12%, or 12 of the factories, dangerous materials exist, such as poison, toxicants, oxidants, caustic materials, and other toxic chemicals, found in the form of raw materials, additives or by-products.

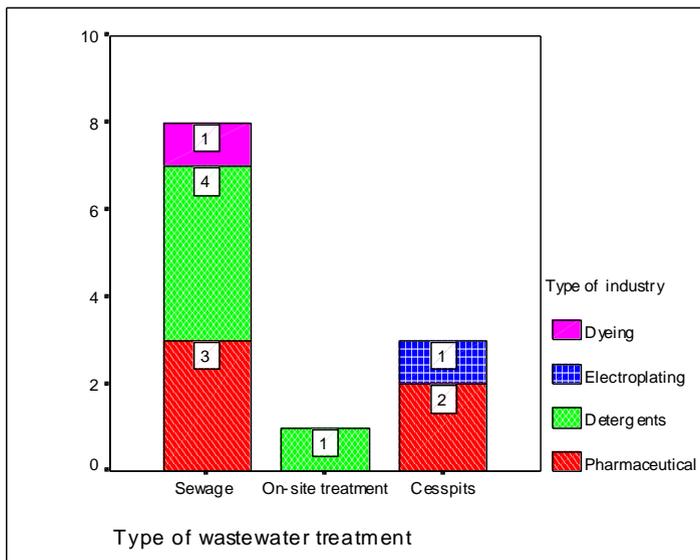
Microorganisms are also another form of hazardous materials. Four factories in the study use microorganisms in production. In general, the low quantities of adequate disposal of microorganisms, including a lack of appropriate treatment, is an issue needing to be urgently addressed. This is especially true in the pharmaceutical industries. The current study found that of the five pharmaceutical factories, two have cess pits to store wastewater; the other three are directly connected to the sewage system. The use of cess pits is not a form of treatment, but rather a form of storage until the waste is disposed of by trucks.

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<sup>23</sup> Conway, R. *Handbook of Industrial Waste Disposal*. New York: Van Nostrand Reinhold Company, 1980.

Chart 10 shows the distribution of the 12 industries with hazardous wastes in their effluents by their type of wastewater disposal. We can see that eight factories are connected to the sewage system without any on-site treatment. Three of the factories use cess pits, and one has unspecified on-site treatment. The lack of information in the survey regarding the nature of the hazardous material (to whom, when and why it is hazardous) prevents the issue being addressed any further in the study. Yet it alerts us to the degree hazardous materials are being introduced into the open environment.

Chart 10  
 Distribution of industries with hazardous wastes in their effluents by type of wastewater disposal, 1995



n=12

### 3.4 Generation of industrial wastewater

Knowing the quantities of wastewater generated by industries is necessary to evaluate the danger threatening public health. Equally important is the knowledge of what contaminants are in the water. Industrial wastewater is often considered to be more dangerous than domestic wastewater as it is often contaminated with chemicals

dangerous to human health. Not only is it dangerous for consumption, but the very high or low pH levels in the contaminated water also negatively affects the soil and aquifers.

Chart 11  
 Distribution of factories by estimated monthly generation of wastewater in m<sup>3</sup>, 1995

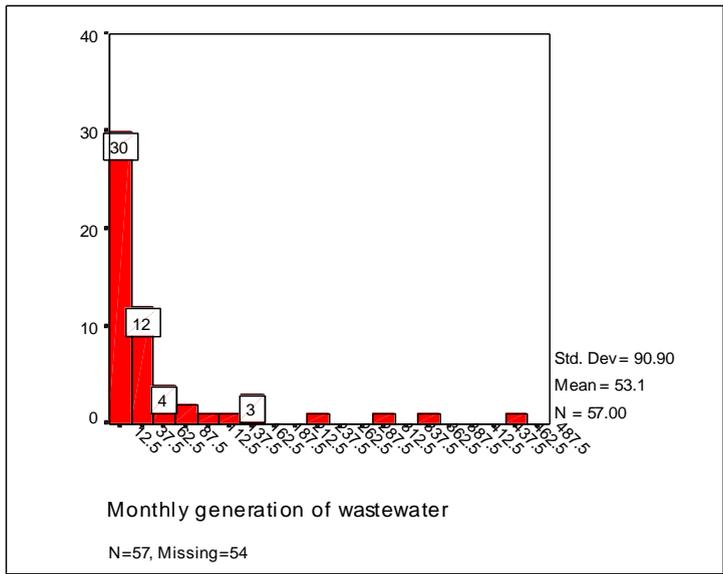
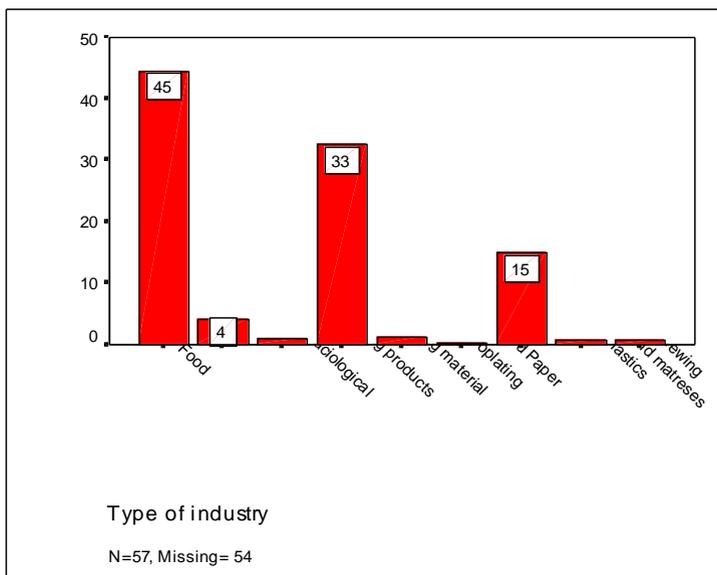


Chart 11 shows the estimated generation of wastewater in the Ramallah and al-Bireh District. It must be noted that only 57 factories responded to this question, or 51% of all the factories sampled. The total quantity of wastewater generated from the 57 factories is 3025m<sup>3</sup>; the mean generation is 53m<sup>3</sup>. Thirty of the fifty-seven responding factories generate less than 25m<sup>3</sup> of wastewater per month, with 16 factories producing between 25-75m<sup>3</sup> monthly. It must be noted that the 3025m<sup>3</sup> of total wastewater output is believed to be less than the actual amount due to biased estimation, both accidental and purposeful.

**a) Distribution of wastewater generation by type of industry**

The food industry, consisting of 14 factories in this study, is the major producer of wastewater at 45% of the total wastewater generation. This is the equivalent to 1347 m<sup>3</sup> per month. The 27 factories in the building materials industry generate the second largest amount of wastewater at 33% (985m<sup>3</sup> per month). The one sponge and mattress production factory generates 15% of the industrial wastewater (450m<sup>3</sup> per month), while the four factories in the pharmaceutical industry generate 4 % of industrial wastewater (125m<sup>3</sup> per month) (Chart 12). It is worth mentioning that the dyeing industry is believed to be the major generator of wastewater but these industries did not report their amounts of wastewater generated.

Chart 12  
Percentage distribution of wastewater generation by type of industry, 1995



### 3.5 Sewage treatment

One way to minimize wastewater pollution is by on-site treatment, reducing contaminants before wastewater is deposited into the environment.

The effort needed to treat the production effluent depends on whether it contains hazardous substances. We are aware that not all the industrial wastewater must be treated before entering the sewage system. Water used for cooling during production and not contaminated with chemicals or hazardous materials does not need to be pre-treated. Domestic wastewater from industrial sites, if separated from industrial wastewater, is not going to harm the sewage system either. It is both a legal requirement and a question of operational common sense to treat effluents from different sources in different ways.

Fifty-eight percent of the 108 factories surveyed “treat” wastewater on-site without connecting to the municipal sewer system. Forty-two percent of the factories are connected to the municipal sewage system directly, a potentially serious problem. Three factories, or 3% of the factories surveyed, treat sewage on-site before connecting to the municipal sewage system.

Fifty-one of the 63 factories treating wastewater on-site use cess pits. This water sits in the cess pits until they reach maximum storage capacity, at which time the water is transported by truck to an undisclosed dumping site. Not only does the wastewater in the cess pits pollute the area where it is stored, but also the area where the wastewater is dumped. Ten of the 63 factories use sedimentation pools as a form of on-site treatment, as does one of the three factories which is connected to the municipal sewer system. Sedimentation pools are slightly better than cess pits because they are sealed from the bottom and sides, preventing seepage into the ground. However as with cess pits, the sewage is dumped at a secondary site or siphoned into the municipal sewer system, never having been properly treated. Sedimentation pools allow the factory or workshop to reuse the water in the pool once particles have settled, but water which is unsuitable for reuse and sediment must be deposited. The ten factories using sedimentation did not provide information as to where the treated water and sludge is then disposed.

## Industrialization, Urbanization and Environmental Health

## 4.0 Summary of Findings

In 1995, The Environmental Health Department of the MOH boldly took the initiative to survey a majority of the factories operating in the Ramallah and al-Bireh District. With this information, the Institute of Community and Public Health at Birzeit University aimed to give an overview of the industrial status in the District. [This study provides a historical look at the status of industries in the Ramallah and al-Bireh District, and contributes to the base of knowledge in this field in which so little has been done.](#) The study findings include:

- There are no standards for the categorization of factories by type of industry, leading to difficulties in control and monitoring. This study succeeded in categorizing the factories in the study by the industries' effluents and can now be used for environmental health purposes.
- The urbanization process has encouraged the use of zoning in determining a factory's location. Most of the factories included in this study were located in urban areas' industrial zones. In semi-urban areas we noticed an almost equal distribution of factories located in the four zones, only some factories were in the industrial zones. In rural areas all the factories were on either agricultural or residential lands. It should be noted that in rural areas land is not zoned and it appears the concept of zoning is not yet well established in these communities.
- No regulations exist regarding the minimum distance between different zones. This may counter the purpose of zoning when industrial and residential zones border one another.
- No regulations exist recognizing the need for a minimum distance between residences and factories.
- Loopholes in PNA regulations allow the building of residences in industrial zones, exposing people living in these residential units to high environmental risks.

- Although guidelines exist for licensing factories, they are not enforced due to a lack of coordination between ministries, as of the time the questionnaire.
- No regulations exist to control industries' consumption of water. The use of fresh water is a key issue in determining the policy of this country with its limited access to sources of fresh water.
- The wastewater disposal system of factories and workshops included in this study are severely under-developed and pose a hazard to health and the environment.
- No system of handling and management of hazardous materials exists.

## 5.0 Conclusion and Recommendations

It is crucial to develop industries as a component of Palestinian economic development as a way to bring about related improvements in the quality of life. At the same time, this development must be accomplished while realizing the potential for environmental degradation and deterioration of human health. The challenge facing Palestinians is to build a system to control industries through a combination of policy, legislation, setting guidelines and standards, monitoring and auditing. At this stage it is clear through intersectional collaboration between different ministries, the governate, municipalities, NGOs, research institutions and community centers, improvements can be made.

On a local level:

- The control of industries must include stricter zoning regulations by municipalities and their enforcement in semi-urban and rural areas. This will allow for better management of industries as a whole, and provide better protection of the environment and human health.
- Municipalities need to evaluate construction requests more carefully before their issuance.
- In villages where there are no zoning procedures, thought needs to be given to the creations of industrial areas, or a way of collecting industries. Land control is under great fluctuation in this politically unstable time, complicating issues of who will finally control the land. Yet Palestinians cannot be passive waiting for final determination of land status. People in rural areas can take action and group industries together on their own.
- More foresight must be given to where industries will be built in the near future as urban industrial areas fill. Residential areas need to be directed away from, not towards, industrial areas.

- Allow for buffers between residential and industrial areas so the two zones do not directly neighbor one another.

At the national level:

- A system for industrial wastewater disposal is needed. There must be a national policy to deal with these potential hazards, and more education and awareness for those who deal with these wastes.
- More education and support for on-site treatment of industrial wastewater is needed, as well as making pretreatment mandatory. There is a need to help factories and workshops to choose forms of treatment which are appropriate and helpful, rather than harmful, to the environment.
- Gaps must be filled in current regulations. The need exists to outlaw residences in industrial zones given that industries can be outlawed in residential areas; extreme health hazards exist in both situations.
- Environmental auditing is needed to help factories find solutions to their problems of polluting the environment.
- Work with factories to reduce wasteful water consumption is essential. For those not willing to comply, there is a need to establish tariffs for excess water use.
- One of the best ways to manage pollution is to make those responsible for the generation also responsible for adequately managing and disposing of their contaminating effluents. If unable to meet the requirements for adequate disposal, the polluter must pay for their contaminating effluents.

This paper examined selected issues brought to light by the MOH's study. There is much left to learn in this area as well as related topics. More policy-oriented research is needed particularly in the following areas:

- Test wastewater to learn exactly what types and levels of contamination are present. This will assist in finding appropriate solutions for treatment.

- Group factories and workshops by sector before examining the situation. This will allow for an in-depth look within one type of industry, for very specific data collection to occur and appropriate recommendations to be made.
- Research on other forms of pollution by factories and workshops in the District, such as noise, air, and solid waste emissions.