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Hazardous waste management and weight-based indicators—The case of Haifa Metropolis

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ABSTRACT

The quantity control of hazardous waste in Israel relies primarily on the Environmental Services Company (ESC) reports. With limited management tools, the Ministry of Environmental Protection (MoEP) has no applicable methodology to confirm or monitor the actual amounts of hazardous waste produced by various industrial sectors. The main goal of this research was to develop a method for estimating the amounts of hazardous waste produced by various sectors. In order to achieve this goal, sector-specific indicators were tested on three hazardous waste producing sectors in the Haifa Metropolis: petroleum refineries, dry cleaners, and public hospitals. The findings reveal poor practice of hazardous waste management in the dry cleaning sector and in the public hospitals sector. Large discrepancies were found in the dry cleaning sector, between the quantities of hazardous waste reported and the corresponding indicator estimates. Furthermore, a lack of documentation on hospitals' pharmaceutical and chemical waste production volume was observed. Only in the case of petroleum refineries, the reported amount was consistent with the estimate.

1. Introduction

Hazardous waste (HW) management is a continuous challenge in Israel. Until the 1990s disposal of HW was conducted voluntarily without any obligatory legislative frame. In 1990 the Business Licensing Regulations [1] were promulgated, determining that any HW producer must remove his waste to the treatment and landfilling site at Ramat Hovav.

Despite legislative changes, four major obstructions hinder the good practice of HW management from being achieved.

The first is the fact that the definition of HW in Israeli legislation is vague and the sole requirement of the law is proper disposal. By law, waste is considered hazardous if it contains hazardous substances that are disposed of from a plant [1] where as in developed counties HW is defined based on material characteristics and properties. For example, in the USA, the Environmental Protection Agency (EPA) defines HW based on physicochemical characteristics, viz. corrosivity, flammability (ignitability), reactivity or toxicity, and a set of lists (F-, K-, P- and U-codes) [2].

The second obstruction concerns the gap between official policy and practiced management. The stated Israeli policy, favors treatment methods, such as source reduction and recovery for energy production, over waste disposal (landfill). However, in practice most produced HW is disposed of according to law.

Another barrier is the fact that there is only one authorized site for disposal of hazardous waste. This site is located at Ramat Hovav, in southern Israel. The site location (300 km from the country's major industrial zones) and gate fee (about €300 per ton of organic HW) make disposal very expensive. The combination of these two factors is more than likely to make other (not necessarily legitimate) options of disposal more appealing.

The last major obstacle of HW management in Israel is a result of the complexity of assessing the extent of the problem. Statistics from the Ministry of Environmental Protection (MoEP) [3] indicate that approximately 330,000 tons of HW were produced in Israel during 2006. However, these figures have not been verified and are based solely on reports by the manufacturers themselves (according to the "hazardous substances permits") and the Environmental Services Company (ESC), which operates the Ramat Hovav site. ESC is a government owned company founded in 1990. One of its main activities is operating a treatment plant for hazardous industrial waste at Ramat Hovav.

Due to legal constraints and limited financial and human resources, the Israeli MoEP has inadequate enforcement abilities and limited management means to confirm this data.

Abbreviations: EIPPCB, European Integrated Pollution Prevention and Control Bureau; EPA, Environmental Protection Agency; ESC, Environmental Services Company; HW, hazardous waste; MoEP, Ministry of Environmental Protection; PERC, perchloroethylene; TRI, Toxics Release Inventory; WHO, World Health Organization.

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The lack of a reliable methodology to assess the amounts and characteristics of HW is a major obstacle in applying best practice of HW management in Israel. Our study suggests establishing the use of practical indicators, which are needed to identify discrepancies between estimated and reported amounts of waste. A performance indicator is a numerical value used to evaluate factors concerning the function of a process or utility. The development of indicators is based on quantitative measurements or statistics of environmental conditions that are tracked over time [4]. Indicators can reflect the current status of environmental management systems and have an important role in assessing system's situation since they can reveal whether the system is functioning well and in compliance with legal regulations. Indicators can be used to quantify HW generation, treatment, minimization, and recycling and also serve in the promotion of awareness and adoption of cleaner production practice [5].

There is lacking evidence in the scientific literature of a comprehensive study on HW indicators based on sector-specific features. Most studies [6–10] have used employment data in order to estimate HW production rates in different industrial sectors.

Earlier studies have tried to formulate indicators for HW estimation in Israel [7–10]. The first study [7] was conducted prior to legislation of the Licensing of Business Regulations (Disposal of Hazardous Substances), 1990, when no law regarding HW disposal or treatment was in force. It estimated that approximately 28,900 tons of HW were produced during 1989. This study was followed by a HW survey, submitted to the ESC, commissioned to create an overall inventory of waste available for treatment. The survey was based on the average waste production rate per industrial employee (assessment according to Danish statistics) [8]. Its findings indicated that approximately 77,000 tons of HW were produced in 1990. Three years later, Goldshmid [9] conducted another survey in order to evaluate the potential for HW combustion in cement kilns of the Nesher Israel Cement Enterprises Ltd. The results indicated that approximately 50,000–60,000 tons of organic HW were produced annually. The last survey, conducted in 2001 [10], was based on employment statistics. According to this survey, the actual annual amounts are 64,000–87,000 tons higher than the amount reported.

These surveys were conducted over a decade ago, and provided a wide range of assessments, casting doubt on their reliability. In order to better predict and control HW production rates, a reliable methodology is needed.

In general, it is common to distinguish between two kinds of waste producers. The first kind, large industries, such as polymers industry, oil refineries etc., are usually located within central industrial zones, adjacent to population centers. In most cases, these industries are operated by public companies that are committed to stakeholders and obligated to present periodical economic reports. These reports also include data on investments related to environmental issues. The MoEP closely monitors these large industries. Therefore, the assumption is that large industries have an incentive to meet environmental standards and legal liability and as a result, implement state-of-the-art technologies, in order to avoid bad publicity and/or heavy fines. The second kind, small industries, e.g. dry cleaners, metal coating facilities, garages etc. usually located within population centers and in most cases are supervised by the local authorities (e.g. municipal environmental departments). Compared with their large counterparts, small industries are subject to less intensive and less strict enforcement, although, in fact, they may present an equal or even greater environmental hazard, in light of their proximity to residential areas.

2. Methodology

The current research uses unique quantitative indicators based on typical production procedures. The methodology was tested on eight industrial sectors in the Haifa Metropolis. Three case studies are discussed in this paper: oil refineries, dry cleaners, and hospitals. The discussed case studies represent two types of sectors. The first kind, large industries, i.e. oil refineries and the second kind, small industries, i.e. dry cleaners.

The research was comprised of two major stages. The first stage was to design a methodology by identifying typical indicators. The second stage was to compare the estimated quantities of HW and those reported by the factories. Data was collected by intensive literature review, questionnaires, interviews and field observations.

The assumption was that discrepancies would be found between the calculated quantities of HW and those reported. However, since the indicator is basically a predictor, a 30% margin of error was considered reasonable.

For each of the industrial sectors, a unique indicator was identified, based on typical production procedures.

3. Theory

3.1. The case of petroleum refineries

3.1.1. General description

Petroleum refining involves a multistage process in which crude oil is fractionated into liquefied petroleum gas, naphtha, kerosene/aviation turbine fuel, diesel oil, and residual fuel oil [11,12]. Oily materials are the primary source of waste for most refineries and are generated when oil coalesces on solids [13]. Oil refinery waste streams normally fall into three categories: (a) sludge—oily sludge, e.g. tank bottoms, desalter sludge, and non-oily sludge (waste water treatment sludge); (b) other refinery waste, e.g. contaminated soil, spent catalyst, oily wastes, spent caustic, spent chemicals, etc., and (c) non-refining wastes, i.e. domestic, demolition, and construction waste [14,15].

Israel has only two petroleum refineries which were recently privatized—Oil Refineries Ltd. within Haifa Metropolis and Paz Ashdod Oil Refinery Ltd. Oil Refineries Ltd. is one of the largest industries in the Haifa Metropolis. Most of the company's products carry a "Green Label" of the Israel Bureau of Standards, which insures compatibility with environmental standards. The environmental management of the Oil Refineries Ltd. complies with ISO 14001 [16].

3.1.2. Relevant indicators

A comprehensive literature review [12,17] revealed that the quantity of HW resulting from oil refining can be estimated according to the amount of crude oil processed.

According to the California EPA [17], the HW generation rate in 1998 was 1.2 kg per ton of crude oil, while in 2002, the waste generation rate was 36% less—0.8 kg per ton of crude oil. The European Integrated Pollution Prevention and Control Bureau (EIPPCB) [12] suggests a different estimation, according to which the solid waste generation rate equals 0.01–2 kg per ton of crude oil, 80% of which may be considered hazardous due to the presence of toxic organics and heavy metals. The EIPPCB estimate is based on the 1995 CONCAWE report [18] on the 1993 European refinery waste position. The former is outdated, and no longer distributed by CONCAWE. Since the EIPPCB document refers to a wide range estimate, it is a problematic reference. Therefore, the California EPA indicator was adopted for the purpose of the present research. However, based on the assumption that the HW management system in California refineries is much more advanced than their counterpart in

Table 1
Estimated hazardous waste generation rate in dry cleaners.

Reference	Indicator	Machine Type	Hazardous waste generation rate (kg/kg)
[20,23,24,25]	Quantity of clothes (by weight)	Dry-to-dry	0.01–0.08
[20]	Quantity of PERC (by weight)	Dry-to-dry	4.2

Israel (where there is no formal obligation to reduce the quantity and/or hazardous characteristics of routinely generated HW), it was decided to refer to the 1998 indicator (1.2 kg per ton of crude oil).

3.2. The case of dry cleaning

3.2.1. General description

The current most used dry-cleaning solvent is perchloroethylene (PERC) [19]. PERC is a volatile, nonflammable, colorless liquid which is toxic, environmentally harmful and a possible human carcinogen [19,20]. Though the use of PERC is being phased out of the dry cleaning process worldwide [21], most Israeli dry cleaners still use it. The dry cleaning process produces bottom residues and cooked powder residues (from powder filtration systems), which are defined as hazardous waste. Bottom residues contain grease, oil, detergent, dyes, sizing, waxes, filter materials, and other non-volatile residues [22].

3.2.2. Relevant indicators

Based on the scientific literature, several typical indicators were identified [20,23–25]. These indicators predict the amount of HW produced according to the weight of clothes dry cleaned and/or the PERC consumed. Table 1 shows the different indicators found in the literature.

3.3. The case of hospitals

3.3.1. General description

Health-care waste includes all the waste generated by health-care establishments, research facilities, and laboratories. In addition, it includes the waste originating from “minor” or “scattered” sources, such as that produced in the course of health care undertaken at homes (dialysis, insulin injections, medication, etc.) [26–28]. According to the World Health Organization (WHO) [27], almost 80% of the total waste generated by health-care activities is comparable to domestic waste. The remaining is considered hazardous materials that may be infectious, toxic, or radioactive. The waste and byproducts cover a diverse range of materials, such as infectious waste, pathological waste, cytotoxic waste, pharmaceutical and chemical waste, and the like.

With regard to health care, the present research was focused on pharmaceutical and chemical waste, which is legislated under the Israeli Licensing of Business Regulations (disposal of hazardous substances), 1990 [1]. According to the WHO, pharmaceutical and chemical waste amounts to about 3% of all waste from health-care activities [27].

In this context, it is essential to mention that though infectious waste presents a major proportion (15%) of health-care waste, it is well regulated under the Public Health Regulations (Waste Treatment in Medical Institutions), 1997, controlled by the Ministry of Health. Under these regulations, infectious waste is treated within the medical institution by sterilization (autoclave treatment). Therefore, it was not accounted within this study.

3.3.2. Relevant indicators

The literature review [28–38] revealed that medical waste management and development of indicators to assess its amount are extensively studied. The most significant factor affecting the generation rates of health-care waste is the occupancy rate (the number of occupied beds) of a hospital. It has been established that the generation rate increases proportionally to the increase in bed occupancy. Bed occupancy varies during the year according to actual figures of hospitalized patients. Therefore, the indicator is based on actual annual bed occupancy.

According to the literature [26], the daily health-care waste production rate in Western Europe is 3–6 kg per bed, per day. Recent research [38] suggests even a smaller range of 2.4–3.2 kg of general medical waste per bed, per day. Pharmaceutical and chemical waste amounts to about 3% of the waste resulting from health-care activities [27]. In other words, the average daily pharmaceutical and chemical waste generation rate is 0.09–0.18 kg per bed.

4. Results and discussion

4.1. The case of petroleum refineries

A comparison between the indicator based estimate, and the reported quantity was conducted. According to the Annual Report of the Haifa District Municipal Association for the Environment [39], 7,540,316 tons of crude oil were processed by Haifa Oil Refineries Ltd. during 2006. Table 2 shows the estimated and reported amounts of HW in Oil Refineries Ltd.

The findings reveal a negligible discrepancy between the estimated and the reported amounts, suggesting that Oil Refineries practice good HW management. Further support for this conclusion is the factory’s reduction of waste disposal by nearly 50% over the last years, through voluntary implementation of land farming for sludge treatment [40]. However, the absence of a comprehensive national plan for HW source reduction negatively affects the incentive of the industry to implement best practice. For this reason alone, the Israeli oil refinery industry cannot be compared with refineries abroad. The difference, as discussed earlier, is reflected in the HW generation rate. While 1.2 kg waste per ton crude oil is the applicable indicator in the Haifa Metropolis, the California oil refineries managed to reduce this rate by nearly 40% (i.e., 0.8 kg per ton)—an objective that should be adopted in Israel as well.

4.2. The case of dry cleaning

In order to characterize the Haifa Metropolis dry cleaning sector, a questionnaire was distributed among six active on-site dry cleaners (see annex 1). The questionnaire (partly based on Ref. [20]) was designed to elicit the following issues: (a) business information (license number, hazardous substances permit, contact details); (b) process information (solvent type used); (c) equipment information (machine type); (d) extent of activity (quantity of clothes dry cleaned, quantity of solvent consumed); (e) waste information (amount, disposal destination). Table 3 summarizes the characteristics of the dry cleaners in the Haifa Metropolis (Due to commercial constrains the actual names are not specified in this paper).

Table 2
Estimated and reported amounts of hazardous waste of Oil Refineries Ltd. [17].

Estimated hazardous waste (ton/year)	Reported hazardous waste (tons/year)	Discrepancy (%)
9048	8759	(−)3%

Table 3
Main findings on dry cleaners in Haifa Metropolis[a].

	Dry cleaner					
	A	B	C	D	E	F
Quantity of PERC (kg) consumed per year	1,500	1,200	100	130	261	163
Quantity of clothes (kg) dry cleaned per year	25,000	15,000	NA[b]	NA	NA	850
Amount of hazardous waste (kg) reported per year	1,000	45	20	120	240	90

[a] All dry cleaners operate dry-to-dry machines using PERC.
[b] NA—not available.

Table 4
Estimated and reported amounts of hazardous waste of dry cleaners in Haifa Metropolis, based on the "PERC indicator" [20].

Dry cleaner	Estimated hazardous waste (kg/year)	Reported hazardous waste (kg/year)	Discrepancy (%)
A	6150	960	(−)84%
B	4920	45	(−)99%
C	410	20	(−)95%
D	535	120	(−)78%
E	1069	240	(−)78%
F	668	90	(−)87%

Table 5
Estimated and reported amounts of hazardous waste of the dry cleaners in Haifa Metropolis, based on the "clothes indicator" [25].

Dry cleaner	Estimated hazardous waste (kg/year)	Reported hazardous waste (kg/year)	Discrepancy (%)
A	769	960	25%
B	481	45	(−)91%
F	27	90	233%

After analyzing the data gathered from the questionnaire, a comparison between estimated and actual amounts of wastes was conducted and the data was further verified by interviews and field observations.

In light of the wide variance among the different indicators (see Table 1), it was essential to isolate the applicable indicator for dry cleaners. In the first stage, a basic calculation was conducted according to the "PERC indicator," as summarized in Table 4.

Table 4 reveals large discrepancies for all dry cleaners between the estimated and the reported quantities. In contrast, the estimate based on the "clothes indicator" (see Table 5) shows that the amount of HW produced by Dry Cleaner A was in accordance with the University of Tennessee indicator [25]. This indicator was the basis for the calculation in Table 5 (only Dry Cleaners A, B, and F reported the amount of clothes dry cleaned).

As Table 5 reveals, only the quantity of HW produced by Dry Cleaner A was within the accepted margin of error. In the other two cases, large discrepancies were identified. In the case of Dry Cleaner F, two possible explanations can be provided: (a) this dry cleaner accumulated waste, though regulations prohibit this practice; (b) this dry cleaner may have reported inaccurate data; it either treated a larger quantity of clothes or produced a larger quantity of waste than was reported.

Further inquiry was required in order to verify the questionnaire data and determine the most reliable indicator. Interviews and field observations were conducted at the two largest dry cleaners in the Haifa Metropolis (Dry Cleaners A and B, which together account for a 40% market share).

According to the interview with the manager of Dry Cleaner A, the facility removes about 960 kg of HW per year. The manager of this facility estimated that, on average, 0.04 kg of HW is produced per 1 kg of clothes dry cleaned [41]. An interview and a field observation were also conducted concerning Dry Cleaner B [42], but the answers revealed a substantial lack of understanding of the issue. Table 6 summarizes the results of the field observation.

The difference between the HW management systems in Dry Cleaners A and B can clearly be seen in Table 6. While Dry Cleaner A produces HW comparable with the literature specifications, Dry Cleaner B, according to its report [42], disposes only lint.

To conclude, the analysis revealed large discrepancies (78–99%) between the amounts of HW reported and the estimates based on the "PERC indicator". In comparison, a high correlation (only 25% gap) was found between the amounts of HW reported by Dry Cleaner A, and the "clothes indicator" [25] (0.03 kg HW per kg clothes).

Interviews and field observations revealed a considerable difference between the HW management system of the two largest dry cleaners in the Haifa Metropolis—A and B. Three findings led to the conclusion that Dry Cleaner B practices poor HW management: (a) the type of HW in the bottom distiller container; (b) the difference between the types of waste in the bottom distiller container and the storage container, respectively; and (c) low amounts of waste compared with the reported scope of the activity. These findings lead to the conclusion that the "clothes indicator" is reliable in predicting the amount of HW resulting from dry cleaning activity. Our results indicate that a dry cleaner operating a dry-to-dry machine will produce approximately 0.03 kg of HW per 1 kg of

Table 6
Field observation results in Dry Cleaners A and B in Haifa Metropolis.

Findings	Dry Cleaner A	Dry Cleaner B
Type of waste—bottom distiller container	Oily sludge	Lint
Type of waste—storage container	Oily sludge	Oily sludge
Storage container volume	3 barrels of 200 l	1 container of 50 l
Storage container location	Fenced, locked, signboard	Open area with no signboard

Table 7
Estimated and reported amounts of hazardous waste produced by public hospitals in Haifa Metropolis.

Hospital	Bed occupancy[a]	Estimated hazardous waste (ton/year)	Reported hazardous waste (ton/year)	Discrepancy (%)
Hospital A	795	26	NA[b]	–
Hospital B	447	15	12.54	(−)15%
Hospital C	349	11	NA	
Hospital D	41	1	NA	–

[a] Source: The Ministry of Health, Information Department [43].
[b] NA—not available.

clothes. Dry Cleaners A and B, which represent a 40% market share, treat 40 tons of clothes annually; therefore it is estimated that the total dry cleaning market in the Haifa Metropolis processes about 100 tons of clothes, which equals to 3.2 tons of HW. According to the data gathered from the questionnaires, dry cleaners in the Haifa Metropolis produced only 1.5 tons of HW during 2006. Thus, more than half of the HW, being produced from dry cleaning activity, was not properly disposed of at the national site for HW at Ramat Hovav. Considering that there are hundreds of dry cleaners in Israel, these findings are troubling, indicating dozens of tons of PERC waste that evaporates and not treated properly.

4.3. The case of hospitals

In order to examine the indicator reliability, the amount of HW that was reported [39] was compared with the amount estimated by the indicator. A cautious estimation was calculated on the basis of a daily generation rate of 0.09 kg per bed. Four public hospitals were sampled: A–D (the actual names are not specified in this paper). Table 7 describes the results of our analysis.

As shown in Table 7, it was estimated that 54 tons of pharmaceutical and chemical waste should have been produced by the 4 public hospitals in Haifa during 2006. A high correlation (only 15% gap) was found between the reported and estimated amount of waste of Hospital B, but there was no available documentation on pharmaceutical and chemical waste disposed of by Hospitals A, C, and D.

In order to complete the missing data, a formal request for information was directed to the MoEP [44,45]. According to the response, Hospitals A, C, and D removed health-care waste via transfer stations.

Transfer stations are intermediate facilities at which HW is transferred from collection vehicles and then temporarily stored or merged before being transported to the HW disposal site at Ramat Hovav. Transfer stations are authorized to merge similar waste streams from different small-quantity generators. A small-quantity generator is defined as one that generates less than 5 tons of HW annually. The mixing process is subjected to a compatibility test according to the EPA chemical reactivity worksheet [46]. Once approved, the transfer station is authorized to merge waste streams only within the same waste types, such as organic acids (except for sulphides and chromium), inorganic acids, organic bases, inorganic bases, solvents, resins, etc. The merged waste stream is considered as HW, attributed to the transfer station and not the original waste producers. It is clear that by omitting the full waste record, the producer liability is undermined, which indirectly affects the producer responsibility principle. According to Table 7, both Hospitals A and C cannot be regarded as "small-quantity generators", since it is estimated that they produce 26 and 11 tons per year, respectively, but, in the records their waste was merged and attributed to the transfer station.

The Information and Operation Center of the MoEP had no documentation on pharmaceutical and chemical waste being disposed of by these hospitals. In fact, according to the data provided, all three hospitals (A, C and D) removed only cytotoxic waste and used gas containers.

Due to lack of documentation of merged waste streams, it is not possible to determine the exact amount of pharmaceutical and chemical waste that was (or was not) disposed of according to regulations. The assumption is that roughly 42 tons of pharmaceutical and chemical waste were credited to the transfer stations, instead of to Hospitals A, C and D (Table 7).

5. Conclusion

HW is produced by different industrial sectors, each characterized by typical waste streams. In the current study, a method was developed to assess the amount of HW produced by different sectors. Former studies in Israel have been based primarily on employment statistics for the estimation of HW generation rates [7–10]. The current research is based on sector-specific indicators, according to specific industries. The estimation method for each sector was determined according to its typical processes.

The research findings indicate several weak points in Israel's HW management system: (a) waste generators do not always keep track of production amounts; (b) transfer stations merge waste streams, precluding identification and control of specific generators; and (c) the MoEP neither controls nor verifies the quantities and the disposal destinations of HW from small and medium-sized enterprises.

In Israel, the control of the quantities of HW disposed is based mainly on the annual reports of ESC, which documents any waste streams received at the Ramat Hovav site and reports this data to the MoEP. However, the wastes delivered to transfer stations are not fully documented.

The Israeli HW management system is utterly different from that of other developed countries. In the USA, for example, the waste generator must disclose its releases of chemicals to air, water, and land, as well as the quantities of chemicals recycled, treated, or otherwise disposed of on-site and off-site. The Toxics Release Inventory (TRI), publicly available database, contains information on toxic chemical releases and waste management activities reported annually by certain industries, as well as USA federal facilities [47]. Other differences are that HW in Israel is (a) legislated under general licensing regulations, whereas in other countries it is subject to specific legislation; (b) managed by The Hazardous Substances Department of the MoEP, whereas in most developed countries it is managed by specialized waste departments; and (c) defined according to the method of treatment, rather than by its characteristics.

To conclude, the research findings demonstrate the need for developing performance indicators in order to control the amount of HW being produced by different industrial sectors. Indicators are important tools that assist decision makers in formulating and implementing policies for management at local and national levels. The main conclusion is that the HW management system in Israel should be significantly improved. It is recommended to mandate toxic release inventories from both HW generators and treatment facilities, to improve control of transfer station activity, and to legislate source reduction and the best available technology.

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Annex 1.

Dry Cleaners' Questionnaire

איגוד ערים אזור חיפה - איכות הסביבה
Haifa District Association of Municipalities for the Environment

חיפה, קרית אתא, קרית ביאליק, קרית ים, נשר, קרית מוצקין, קרית טבעון, זבולון, רכסים

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www.envihaifa.org.il mail@envihaifa.org.il e- mail:

1. **Business Information**
   - **A.** Company name:
   - **B.** Local authority license number:
   - **C.** Hazardous substances permit number:
   - **D.** Address:
   - **E.** Phone number:
   - **F.** Fax number:
   - **G.** E-mail address:
   - **H.** Contact person:

2. **General Information**

   Does the facility have a dry cleaning machine on-site? YES □ NO □.

   If you are only a drop-off shop, please indicate the contact details of the dry cleaning facility:
   - **A.** Company name:
   - **B.** Local authority license number:
   - **C.** Hazardous substances permit number:
   - **D.** Address:
   - **E.** Phone number:
   - **F.** Fax number:
   - **G.** E-mail address:

H. Contact person:

Only on-site dry cleaners should answer the following questions:

3. **Operational Information - Solvents**

A. What types of solvent(s) are used in the machine(s)? **Please mark the right box:**

- ❑ Perc
- ❑ Other- please indicate commercial name: ___________________________

(If you mark X in the above box please answer the following question and then skip to section 5)

B. Please indicate the total amount of solvent purchased in 2006 (Kg): ___________

4. **Operational Information – Machines**

A. Number of dry cleaning machines in the facility: ____________________

B. Please indicate machines capacity (Kg): __________________________

If you own more than one machine please use the following table:

Machine No.	1	2	3	4
Capacity (Kg)				

C. Machine Type: Please mark X in the correct box (If you own more than one machine please indicate next to the relevant box the number of machines from the same type)

- ❑ Transfer - an "open" machine with no final drying stage
- ❑ Dry-to-dry - a "closed" machine

D. Please indicate what kind of devices do the drying machine has:

- ❑ A water cooled condenser
- ❑ An air cool condenser (a refrigerated condenser)
- ❑ An active carbon absorber for the PERC
- ❑ Regeneration of the active carbon
- ❑ Door locks
- ❑ Inductive door fan
- ❑ Other (specify): ____________________

5. **Operational Information – Clothes**

A. Please indicate the total amount of clothes dry cleaned during 2006 (Kg): ______

6. **Waste Information**

A. Please indicate the total amount (Kg) of hazardous waste produced in 2006: __________

B. Please indicate the disposal destination: ___________________________

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