3. INDUSTRY

The industrial sector in Lebanon has experienced a major expansion since the end of the war. However, ill-defined industrial zones, an ailing economy, inadequate reforms and future economic uncertainties have undermined the industrial sector since the mid-1990s. Industries in Lebanon are frequently blamed for many environmental ills. Industries generate industrial effluents, solid waste and potentially toxic air emissions. Currently, most of the liquid, solid and gaseous emissions are discharged into the environment without any form of treatment. Industries tap underground water at liberty and the majority are located outside existing industrial zones. While recognizing the need to support the industry sector, the MoE is working to introduce effective and enforceable pollution control regulations.

3.1 Targeted Description

The Ministry of Industry (MoI) launched in 1994-95 an industrial census with the assistance of the German Technical Cooperation (GTZ). Using surveys, this census was then updated in 1998-99 providing targeted information on industries such as legal status, year of establishment, operating surface area, and value added (MoI, 2000). The industrial establishments are listed according to the International Standard Industrial Classification (ISIC) codes.

In 1995, the industrial sector represented 17.3 percent of the national GDP (about US$2 billion). In 1999, industry contributed only US$1.7 billion to GDP (MoI, 2000).

On a different level, the Central Administration of Statistics conducted between 1996 and 1997 a census of buildings and establishments (see Section 1.2.1). The census provides valuable information on establishments, both industrial and non-industrial. It grouped industrial establishments into eight categories, including the manufacturing of textiles, furniture, metallic products, non-metallic products and printing. The classification of industrial establishments adopted by CAS does not entirely conform to the ISIC.

A review of the data provided by the updated MoI census (Mohafaza level) and the CAS census (Caza level) reveals significant disparities in the number and distribution of industrial establishments. This chapter builds on the updated MoI census, but also highlights relevant disparities with the data provided by the CAS census.

3.1.1 Number of industries and geographic distribution

In 1999, there were 22,026 industrial establishments in Lebanon (MoI, 2000). About half of these establishments are located in Mount Lebanon and 17.5 percent in the North (see Table 3.1). According to CAS, however, there were 29,282 industrial establishments in 1996-1997, almost 33 percent more than the number of industries reported by the MoI. Figure 3.1 further reveals important disparities in the relative geographic distribution of industrial establishments reported by the two censuses.

One possible explanation for this discrepancy is that CAS did a door-to-door field census covering all establishments (irrespective of their legal status), whereas the data provided by the MoI are based on the Mini
presumably based on industrial certificates, rather than licenses, of which an unknown

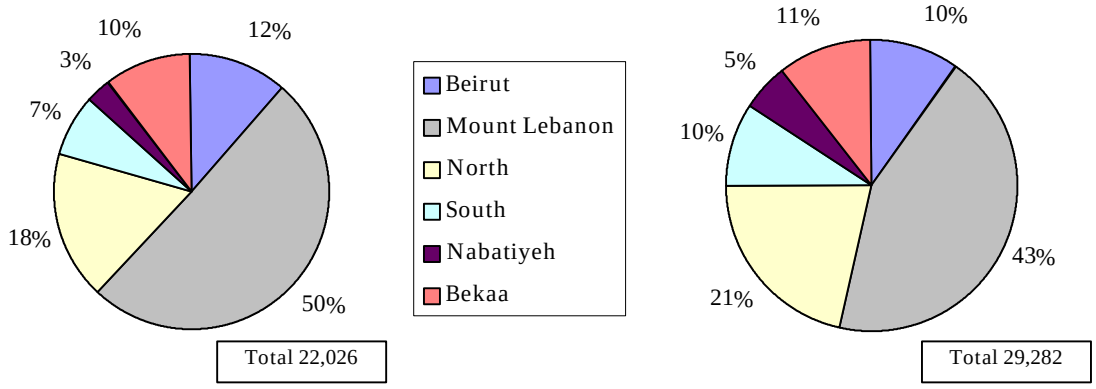
percentage of facilities are actually licensed. *The remainder of this chapter builds on MoI data because they are more explicit and conform to the ISIC code.*

Table 3. 1
Number and Distribution of Industries According to MoI and CAS

Mohafaza	*Number of Industries According to*		Divergence
	MoI (1998-99)	CAS (1996-97)	(Percent)
Beirut	2,547	2,931	+15.1
Mount Lebanon	11,011	12,696	+15.3
North	3,865	6,231	+61.2
South	1,641	2,804	+70.9
Nabatiyeh	712	1,517	+113.1
Bekaa	2,250	3,103	+37.9
Total	**22,026**	**29,282**	**+32.9**

Source: MoI, 2000 (based on data compiled in 1998-99) & CAS Studies, 1996-98

Figure 3. 1
Distribution of Industrial Establishments by Mohafaza



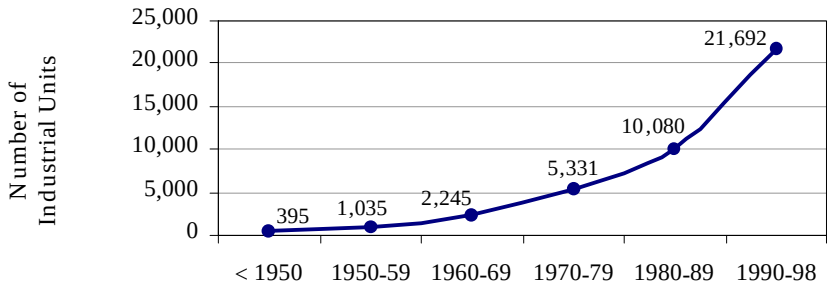
Source: MoI, 2000

Source: CAS Studies, 1996-98

3.1.2 Evolution of industry sector

The MoI statistics for 1998-1999 represent a two percent increase compared to 1994 and more than a 50 percent increase compared to the early 1990s (more than 11,600 new establishments were registered between 1990 and 2000). Figure 3. 2 shows the approximate evolution of the number of industrial units over the course of the last 50 years.

Figure 3. 2
Evolution of Industrial Sector (Between 1950 and 1998) [a/]



[a/] Does not include 333 industrial units for which the date of establishment was not determined
Source: MoI, 2000 & Fawaz, 1990

3.1.3 Size and type of industries

Most industries in Lebanon are light manufacturing plants. More than 90 percent of all industries employ less than 10 people. Only 47 industrial establishments employ more than 100 people and 20 employ more than 250 people.

There are 23 industrial branches in Lebanon (not including water, power and construction activities). Nearly 89 percent of the industries belong to eight branches only: food and beverages (20 percent of total), fabricated metal products (16 percent), non-metallic mineral products (12 percent), furniture (11 percent), clothes and dyeing fur (10 percent), wood products (10 percent), leather products (6 percent), and textiles (4 percent). Table 3.2 presents the geographic distribution of these eight leading industry branches.

Table 3. 2
Distribution of Eight Largest Industrial Branches Across Mohafaza

Industrial Branch	*Beirut*	*Mount Lebanon*	*North*	*South*	*Bekaa*	*Nabatiyeh*	*Total*
Food products and beverages	720	1,615	1,020	385	580	160	4,480
Leather and leather products	143	969	117	15	21	25	1,290
Textiles	76	500	115	38	56	19	804
Clothes & dyeing fur	534	1,302	286	18	95	28	2,263
Wood products	208	1,188	151	309	310	83	2,249
Non-metallic mineral products	20	1,132	551	238	458	131	2,530
Fabricated metal products	286	1,946	477	274	371	199	3,553
Furniture & other manufactured goods	185	1,018	770	236	104	39	2,352

Source: MoI, 2000

The industry sector has a permanent workforce of 114,000 people, 31 percent of whom are also owners, plus about 40,000 seasonal workers. The average number of employees per industrial establishment across all branches was 5.2 employees in 1998-1999, down from 6.4 in 1994.

3.1.4 High-risk facilities

Until May 2000, classified establishments in Lebanon were subdivided into three classes (Decree 4917, 24/4/1994). Classified establishments include both *industrial* and *non-industrial* establishments. This classification system was not explicitly based on the degree of threat to human health and the environment. The decree relied on intangible environmental criteria, such as the size of the establishment, the number of employees, available machinery and horsepower etc. Therefore, the classification of classified establishments under Decree 4917/1994 has little environmental relevance.

Decree 5243 (5/4/2001) amended this classification by introducing five industrial classes (Class I to V, see Section 3.3.3 for information on the environmental implications of industrial classes). This decree targets industrial establishments only and therefore does not replace Decree 4917/1994. This new classification system relied on several environmental criteria (e.g., impact on water, air and soil, environmental risk, odour, and noise) to define the degree of environmental threat. Scoring matrices were developed for each type of industry and the industrial class was defined accordingly. To date, several obstacles prevent the application of Decree 5243/01 (see Box 3.1).

Box 3. 1
Impediments to Implementing Decree 5243/01 Defining Five Classes of Industrial Establishments

Several hurdles currently prevent the implementation of Decree 5243/2001. Council of State Decision 245 (1999) stated
standards, procedures and conditions for permitting of the construction and operation of

not been promulgated yet, but also there is no progress in implementing the law establishing the Ministry of Industry (Law 642/1997), which gave the Ministry overall jurisdiction over the permitting of industrial establishments. Nor is it clear how the five new classes of industrial establishments would be allowed to be located within each of the three existing types of industrial zones. Finally, the exact boundary between the universe of industrial establishments to be covered by Decree 5243/01 and the universe of non-industrial classified establishments covered by Decree 4917/94 has yet to be drawn.

Source: *Pers comm* Hamdan O and Huteit H, MoE/Department of Protection of Urban Environment

Class I industries are considered high-risk facilities. They include tanneries, cement, paper (from pulp), fertilizer, ammunition production plants and gas products. There are about 973 Class I industries employing 4,650 people and generating an estimated US$104 million in added value per year (see Table 3.3). Industries that manufacture cement lime and plaster account for 68 percent of the total added value of Class I industries. There is no information concerning the geographic distribution of Class I industries.

Table 3. 3
Overview of Class I Industries Based on Decree 5243/2001

ISIC Code and Industrial Branch	*Number of Establishments*	*Number of Permanent Employees*	*Value Added*
19 Leather and Leather Products			
- Tanning and dressing of leather	47[a]	339	7,843
21 Pulp, Paper and Paper Products			
- Manufacture of pulp, paper, and paperboard	73	732	7981
24 Chemical Products and Man Made Fibres			
- Production of gas products	10	132	8,528
- Manufacture of fertilizers & Nit. compounds	2	37	2,463
26 Other non-metallic mineral products			
- Manufacture of cement, lime and plaster	812	3,304	71,542
29 Machinery and Equipment			
- Manufacture of weapons and ammunition	29	107	5,462
Total	**973**	**4,651**	**103,819**

Source: ECODIT, based on MoI, 2000 and Decree 5243 (5 / 04 / 2001)

[A/] Based on the records of the syndicate of tanneries, the sector comprises only 26 tanneries (MoE / Envirotech, 1998).

Class II and III industries are considered high to medium-risk facilities and potentially pose significant risks to human health and the environment, because they are numerous (several thousands), scattered, and located often in residential areas. Unlike Class I industries, Class II and III industries generally do not have the awareness and resources required to prevent or control pollution. Therefore, it is essential that government efforts focus on providing technical assistance and financial incentives to such facilities to improve their environmental performance. See Table 3.9 for a crosswalk between the old and new classes.

3.1.5 Industrial zones

As per January 1999, there were 72 industrial zones in Lebanon (see Appendix D). However, not all of them have been decreed, and none are adequately equipped to host industrial establishments (e.g., waste collection and treatment). Moreover, many industrial zones were established *de facto* and are presently being decreed even though they are located close to residential areas or natural sites. The relative distribution of industrial establishments inside and outside industrial zones is examined in Section 3.2.1.

Industrial zones tend to be concentrated in and around Mount Lebanon. Several industrial zones remain relatively empty to this date, in particular due to speculation-driven increases in land prices, which forces industrialists to locate outside such zones. In the late nineties, IDAL proposed a new strategy for industrial zones in Lebanon, which called for a more balanced geographic distribution, specific infrastructure, environmental and urban requirements, and financial incentives to encourage investments (IDAL, 1997). However, implementing this strategy continues to face significant difficulties.

3.2 Pressures on the Environment

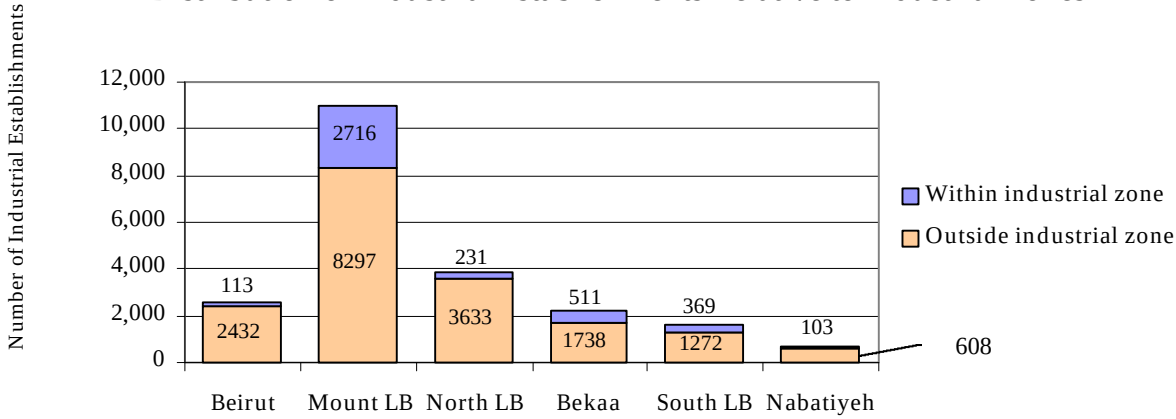
The majority of industries in Lebanon are located outside industrial zones (MoI, 2000). While existing industrial zones are poorly equipped to collect and/or treat industrial waste, such infrastructure is completely lacking outside industrial zones causing severe environmental pressures. Industrial units located within residential areas pose severe risks to public health and safety. Industries generate special wastes that impact water and soil quality and are a major source of air and noise pollution.

3.2.1 Industries outside industrial zones

Almost 82 percent of all industrial establishments in Lebanon are located outside industrial zones (see Figure 3.3). In the absence of specific waste collection services and treatment infrastructure:

- Industrial solid waste usually ends up in curbside waste containers and is dumped with the municipal solid waste stream;
- Industrial wastewater is co-disposed in the domestic wastewater system collection network; and
- Industrial air and noise emissions may affect nearby residential communities.

Figure 3. 3
Distribution of Industrial Establishments Relative to Industrial Zones



Source: MoI, 2000

An analysis of the floor area of industrial establishments shows significant disparities between those located inside and those located outside industrial zones. In particular, industrial establishments located inside industrial zones have more floor area than industries located outside: average floor area of 600 m^2 inside industrial zones, compared to 116 m^2 for industries located outside industrial zones (see Table 3.4). These findings suggest that industrial establishments located outside industrial zones have no potential to expand and consequently few opportunities to benefit from economies of scale. Furthermore, higher floor area inside industrial zones is a compelling incentive for investors and industrialists to establish new industries inside industrial zones.

Table 3. 4
Number of Industrial Units Versus Floor Area Inside and Outside Industrial Zones

Category	*Number of Industrial Establishments*	*Floor Area (square meters)*	*Average Floor Area per Industrial Establishment (m^2)*
Outside Industrial Zones	17,980	2,085,155	116
Within Industrial Zones	4,043	2,424,435	600
Total	**22,023**	**4,509,590**	**205**

Source: MoI, 2000

3.2.2 Light industries within residential areas

Many light industries are currently located in residential areas (e.g., basements, parking lots, warehouses). Examples include car mechanics, fruit fermentation chambers, woodcutting plants, glass craftwork, furniture manufacturing, print shops and olive mills. Residential areas also host many establishments such as water purification and bottling facilities.[1] Information on the type and location of light industries located in residential areas is not available. In theory, however, the CAS census on buildings and establishments could be used to determine the share of industrial establishments that are located in mixed buildings.

3.2.3 Water consumption by industry

Little is known of the quantity of water used by the industrial sector. In addition to receiving water through the public water distribution system, most industries are equipped with private (unmonitored) water wells and tap underground water at liberty (and for free). Anecdotal evidence suggests that deep wells are running dry more frequently than before in certain parts of the country. Taking such data limitations into consideration, the industrial sector was estimated to consume about 130 Mm^3 in 1994 (see Section 8.2.1 for information on sectoral water consumption). Water consumption is expected to reach 240 Mm^3 in 2015. This corresponds to about 9-17 percent of total water consumption in Lebanon, assuming a national consumption of 1,400 Mm^3. Future water consumption trends are a function of water availability and industrial growth rate.

3.2.4 Air emissions by industry

Industries release primary air pollutants (e.g., particulate matter, lead, CO, SOx, NO_x), some of which are greenhouse gases (e.g., CO, SO_x, NO_x), as well as other greenhouse gases (e.g., CO_2, methane). Air pollution loads for different gases vary from one industrial branch to another. No information is available on the contribution of different industry branches to air pollution loads for different gases. In terms of total air emissions, the potentially most polluting sectors are the cement industries (see Section 9.3.3 on attempts to make Portland cement plants compliant with national standards), the fertilizer industry and the asphalt mixing plants (METAP/ERM, 1995).

Chapter 9 (Air) provides the contribution of industry to air pollution relative to other sectors, such as energy and agriculture, for different greenhouse gases. The *First National Communication on Climate Change* estimated greenhouse gases (GHG) emissions

[1] Decree 108/83 organizes water purification and bottling facilities

from all sectors, including the industrial sector, for the year 1994 (MoE-UNDP, 1999a). That year, industries contributed 14 percent of total CO_2 emissions by all sectors, four percent of SO_2, and 76 percent of non-methane volatile organic compounds (NMVOC). About 77 percent of CO_2 emissions from the industrial sector came from the cement industry alone, and 22 percent from the steel and iron industry (see Table 3.5). Carbon emissions from industries result mainly from the combustion of fuel oil in furnaces and boilers. Current efforts to audit industries using a standard and unified audit manual will produce more reliable and significant pollution load estimates. Box 3.2 provides an overview of ozone depleting substances and their phase out in Lebanon.

Table 3. 5
Major Greenhouse Gas Emissions from Industrial Sector for Year 1994 (in KTonnes)

Greenhouse Gas Source	*CO_2*	*NO_x*	*CO*	*NMVOC*	*SO_2*
Energy industries (thermal power plants)	3,615.1	9.5	0.7	0.2	45.0
Manufacturing Industries and construction:	4,698.2	7.7	1.1	274.1	28.0
- Energy combustion	2,774.1	7.7	1.1	0.3	24.7
- Industrial processes	1,924.1	0.01	Negligible	273.9	3.4
Total	**8,313.2**	**17.1**	**1.8**	**274.4**	**73.1**

Source: MoE-UNDP, 1999a

3.2.5 Solid waste generated by industry

It is difficult to produce reliable industrial solid waste estimates because there are no comprehensive waste surveys or industrial production statistics (as opposed to output); nor are there dedicated landfills to dispose those wastes. The most recent effort to develop a management strategy for industrial and hazardous waste has estimated that Lebanon generates about 188,850 tonnes of industrial solid waste annually (see Table 3.6). This estimate includes hazardous waste (e.g., pesticides, heavy metals, waste oil, resins, paints and PCBs), non-hazardous waste, construction and demolition waste, and putrescible waste**.** The estimate was derived based on the literature, company visits, and industrial questionnaires, supplemented by available data on raw materials and output of select industries. To date, Lebanon has no industrial hazardous waste landfill or treatment facility. Section 14.4 provides more information on industrial solid waste management.

In the future, hazardous waste quantities would be expected to increase with industrial growth. Likewise, environmental controls could create new sources of hazardous waste, such as sludge from wastewater treatment plants (see Section 15.3.2) and incineration residues (bottom and fly ash). Conversely, environmental controls would increase waste management costs to industry and encourage it to minimize waste and use cleaner technologies.

Table 3. 6
Generation of Industrial Solid Waste by Source and Category

Category	*Source/type*	*Quantity (ton/year)*	*Remarks*
Hazardous waste	❑ Pesticides manufacturing	326	❑ Mainly packaging waste and sludge contaminated with pesticides
	❑ Industrial waste containing heavy metals	1,166	❑ From waste paper recycling, printing, ceramics industry (pigments), metal galvanizing, non-ferro metal recycling
	❑ Industrial oily waste	1,018	❑ Residues from waste oil recycling, oily sludge, residues from solvents recycling
	❑ Industrial paints, resins, dyes, adhesive residues	538	❑ Mainly from paint, and wooden and metal products manufacturing
	❑ Polychlorinated biphenols (PCBs)	40	
	❑ Tanneries	250	❑ Hazardous due to chromium content
Subtotal		*3,338*	
Non-hazardous waste **or** recyclable waste	❑ Various process waste with heavy metal contents below hazardous waste limits	1,292	❑ Scrap leather, wood and paper waste, waste from textile, printing and ferro-metal industry
	❑ Sludge from asbestos / cement manufacture	2,400	❑ Dumped at private landfills
	❑ Used lubricating oils	10,000	
	❑ End of life vehicles	6,300	❑ Recyclable parts
	❑ End of life vehicles	700	❑ Non-recyclables, this can be hazardous waste, depending on the type of car dismantling
	❑ Industrial mixed waste (non-process related)	20,000	
	❑ Car tires	14,000	
Subtotal		*54,692*	
Construction and demolition waste	❑ Ceramic industry (tiles, flags), cement industry	73,000	❑ Around 71,000 tons / year of this waste is dumped at private landfills (cement industry)
Putrescent waste	❑ Food and beverage manufacturing	17,820	
	❑ Slaughterhouses	40,000	
Total		**188,850**	

A) ,

hence their inclusion in this table.

Source: METAP / Tebodin, 1998

3.2.6 Industrial Wastewaters

In an earlier industrial waste management study, it was estimated that industries generated about 61,000 m^3 of wastewater per day in 1994, or about 12 percent of the total (domestic and industrial) wastewater stream generated in Lebanon (MoE / Dar Al-Handasah, 1996). Table 3.7 shows the regional distribution of wastewater generation. According to this study, Mount Lebanon generates over two-thirds of the national industrial wastewater flow (about 44,000 m^3 per day) and has the highest proportion of industrial wastewaters in its overall wastewater stream (21 percent). These estimates were derived based on industry employment statistics and an approximation of water consumption rates for several key industrial branches.

Table 3. 7
Industrial Wastewater Generation Quantities

Mohafaza	*Industrial Wastewater Generation Estimate for 1994*		*Industrial Wastewater Generation Projection for 2020*	
	Quantity (m^3/d)	*Percent of total wastewater stream*	*Quantity (m^3/d)*	*Percent of total wastewater stream*
Beirut	2,754	3	2,754	1
Bekaa	5,279	10	42,159	23
Mount Lebanon	43,914	21	107,584	17
Nabatiyeh	698	3	1,479	2
North Lebanon	6,084	6	34,378	11
South Lebanon	2,391	6	3,269	3
Total	**61,120**	**12%**	**191,623**	**12%**

Source: MoE / Dar Al-Handasah, 1996

Alternatively, several studies and audits have focused on select industrial branches. For example, it was estimated that tanneries discharge around 40 tonnes of chromium into the Mediterranean Sea each year. A fertilizer company in Selaata / Chekka produces a significant amount of phosphogypsum (about 950 tonnes per day), currently discharged in slurry form into the sea (METAP / Tebodin, 1998b). The plant is also estimated to discharge about 0.7 tonnes of cadmium, 2 tonnes of lead, and 2 tonnes of nickel per year into the sea (MoE / Envirotech, 1999).

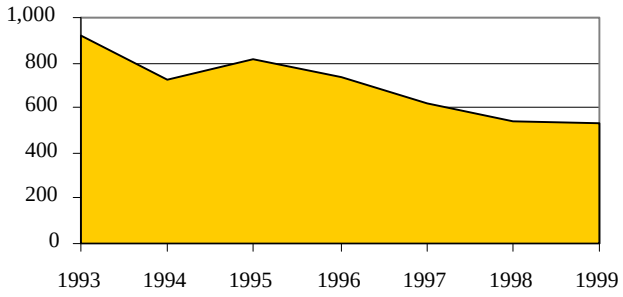
Other regional studies were also conducted recently in support of planned pollution control activities for the coastal zone (CDR / Libanconsult, 2000) and the Litani watershed (MoE-CDR / MVM, 2000)**,** but none of these studies has produced reliable estimates of the quantities of industrial wastewaters generated in the targeted regions or of the associated pollutant loads. Ultimately, most industrial wastewaters are discharged into the environment with little or no prior treatment, either directly into rivers and streams or through sewer networks. Discharge into the sewer network of industrial effluents with a high BOD load or heavy metals contents could affect the operation of planned wastewater treatment plants.

Box 3. 2
Phasing Out Ozone Depleting Substances

Ozone depleting substances (ODS), such as chorofluorocarbons (CFCs) and methyl bromide, deplete the stratospheric ozone layer which protects us from the harmful effects of solar ultraviolet rays. ODS are typically stable molecules which instead of breaking down in the lower atmosphere, migrate into the stratosphere where they are broken down by ultraviolet radiation releasing free chlorine radicals (in the case of CFCs). These chlorine radicals catalyze the break-up of ozone molecules thereby depleting the ozone layer. ODS are commonly found in fire extinguishers, air conditioning, and refrigerators.

In Lebanon, consumption of ODS peaked in 1993 at about 920 tonnes. Since then, consumption has decreased 42 percent to reach 527 tonnes in 1999 (see Figure). Notwithstanding the Montreal Protocol and MLF assistance, consumption of ODS was forecasted to reach 1,000 tonnes in 1995 and 2,080 tonnes in 2010. The main ODS substances used in Lebanon are CFC 11 and 12, which account for 75 and 21 percent of total ODS imports, respectively. The refrigerator sector is by far the largest consumer of ODS (38 percent with 42 manufacturers), followed by the aerosol sector (36 percent and eight manufacturers) and the foam industry (18 percent and nine manufacturers).

Consumption of ODS Between 1993 and 1999 (Tonnes)



All ODS used in Lebanon are imported. Lebanon ratified the Vienna Convention on March 30, 1993 and the Montreal Protocol on March 31, 1993. A National Working Committee on ODS was established in 1994. The committee overviewed the preparation of the Country Program which was ultimately approved by the Ozone secretariat and led to the establishment of the Ozone Office at the MoE, in January 1998. Lebanon has since received US$179,000 from the Multilateral Fund (MLF) to implement institutional strengthening projects and about US$6.2 million for technology transfer and ODS phase out. Phase out implies that local industries dismantle and destroy manufacturing equipment that use ODS and replace them with equipment that does not use ODS. Implementing/supporting agencies include UNIDO, the UNDP, the FFEM and GTZ. While ODS are still imported (and will be until industries phase out ODS completely), halons were banned in July 1994. The GoL expects to phase out ODS completely by 2007.

Source: MoE, Ozone Office, 2001

3.3 Key Policies and Actions

The GoL has invested significant efforts and resources to improve the environmental performance of classified and industrial establishments. This requires command and control mechanisms (i.e., permitting system, standards, monitoring) as well as non-regulatory approaches (i.e., financial incentives, cleaner production). The MoE has initiated several efforts to abate industrial pollution from select industrial branches (e.g., tanneries, paper, olive oil pressing) and is currently setting up a hazardous waste unit to promote sound hazardous waste management practices (see Section 14.4.1 on hazardous waste management).

3.3.1 International Conventions

Lebanon ratified the *Basel Convention* on the control of transboundary movements of hazardous wastes and their disposal in 1994. In fulfilment of its obligations, the MoE has prepared a draft decree for regulating the import and export of industrial waste. Import restrictions have been defined for hundreds of industrial waste products, subdivided into three groups: industrial waste (1) banned from entering Lebanon, or (2) which requires express licensing before arriving to Lebanon, or (3) which requires a permit upon arrival to Lebanon.[2]

Lebanon has signed (1976) and ratified (Decree Law 126, 1977) the *Barcelona Convention* for the Protection of the Mediterranean Sea against Pollution. Lebanon has also signed four of the five protocols of the Barcelona Convention, namely Protocol 1 on pollution from ships and aircraft or incineration at sea (ratified by Decree Law 126), Protocol 2 on combating pollution from oil and other harmful substances (ratified by Decree Law 126), Protocol 3 on land-based sources of contamination (accession in 1994), and Protocol 4 on specially-protected areas and biological diversity (accession in 1994).

In May 2001, the GoL also signed the *Stockholm Convention* on persistent organic pollutants (POPs). The MoE has prepared a set of environmental guidelines for handling POPs. Already in 1998, the MoA banned 110 pesticides (Decision 94 / 1, 20 / 5 / 98) of which many contain persistent organic pollutants. The GoL recently secured GEF funding to develop a national implementation plan that will put environmental guidelines into practice. Concurrently, the MoE has prepared a *Chemical Safety National Plan*. This plan will also include environmental guidelines on how to import, transport, store, and dispose chemical residues and compounds.

3.3.2 Improving Fuel Quality

In the absence of strict quality control, imported fuel oil is presumed to contain at least 2-2.5 percent sulphur (S). This is considered high by international standards, especially considering the proximity of several large-scale industries and thermal power plants to residential areas.[3] If thermal power plants and industries converted to lower sulphur content fuel, say 1 percent sulphur content, total emissions of SO_2 would markedly decrease. However, one percent sulphur content fuel requires costly treatment operations (i.e., desulphurisation) and is therefore significantly more expensive. Pursuant

[2] *Pers comm* Kodeih N, MoE / Department for the Prevention of Impacts from Technology and Natural Hazards
[3] 2-2.5 percent Sulphur content is considered Grade 5 or Grade 6 on a scale of 1 (0.1 percent S) to 6 (2.8 percent S)

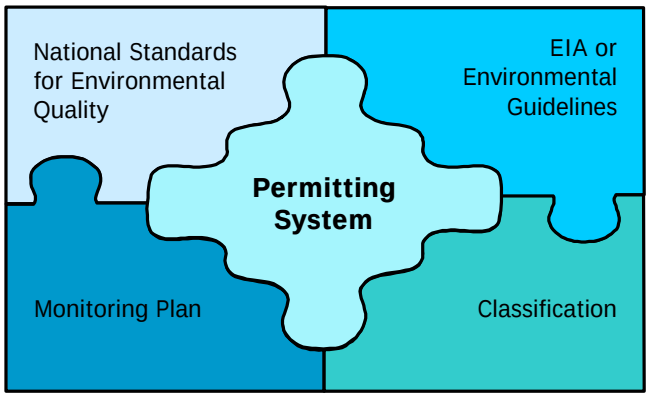
to Law 341 / 2001 on reducing air pollution from the transport sector, the MoE has drafted a decree that will define minimum quality standards for all major types of fuels, not only unleaded gasoline (e.g., maximum allowable lead content), but also fuel oil (e.g., maximum allowable sulphur content), diesel for transport vehicles, and diesel oil for industries (see Section 5.4.2 on implementing Law 341 / 2001).

3.3.3 Permitting System

With grant funding from the EU Life program and under UNDP management, the MoE is developing a workable strategy to reshape the permitting and auditing system of industries (i.e., SPASI project).[4] In view of several constraints (e.g., limited human resources, ill-defined industrial zones, and no control and monitoring mechanisms), the MoE opted for limiting its scope during the first years of the program. In particular, SPASI was perceived as a management tool to contain the problem while also provide environmental guidance to new facilities and improve MoE monitoring capabilities. The MoE strategy to improve the environmental performance of classified establishments includes a *Permitting System* for new facilities (described below) and a *Compliance Action Plan* for existing facilities (see Section 3.3.4).

the preparation of environmental impact assessment studies, environmental guidelines for several classified establishments, implementation of the new classification system for industrial establishments, a revision of national standards for environmental quality and a monitoring plan.

Figure 3. 4
Permitting System for New Facilities



Source: SPASI project, MoE

Environmental guidelines for new facilities

The MoE has designed and initiated an EIA process and project cycle. Section 12.1.3 describes the EIA draft decree, current achievements and constraints. It also developed general environmental guidelines for select types of establishments, including gas stations, farms, tanneries, and slaughterhouses (see Table 3.8 for an updated list). As of December 2001, the MoE had promulgated environmental guidelines for nine different

[4]

classified establishments and expects to release two other sets of guidelines in 2002. The guidelines provide both generic and detailed environmental specifications and should be followed in the design phase for new classified establishments.

Table 3. 8
Environmental Guidelines for 12 Classified Establishments

Type of Establishment	*Ministerial Decision (MoE)*	*Date published in Official Gazette*
Gas Stations	5/1	25/1/2001
Farms	16/1	5/4/2001
Rubber	Pending	-
Tanneries	75/1	21/9/2000
Slaughterhouses	4/1	25/1/2001
Rendering plants	3/1	25/1/2001
Dairy Production	29/1	31/5/2001
Fruit & Vegetable Processing	5/1	4/1/2001
Glass Manufacturing	Pending	-
Stone cutting	60/1	20/9/2001
Plastics	61/1	20/9/2001

Source: MoE, SPASI, 2001

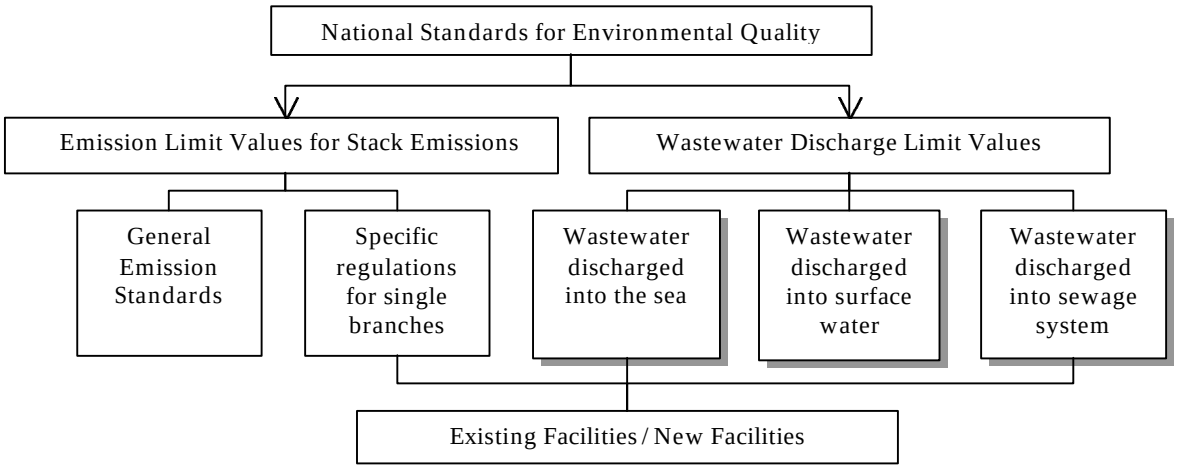
National Standards for Environmental Quality

The MoE/SPASI developed national standards for environmental quality (NSEQ). Promulgated by Ministerial Decision 8/1 (1/3/2001), these standards are in the form of upper limit concentration values (e.g., ppm, mg/m^3), as opposed to pollutant load values (e.g., kg/day), for stack emissions and wastewater discharges from both existing and new facilities (see Figure 3.5). The NSEQ cover all sectors and replace corresponding standards under Decision 52/1 (1996). Section 9.2.2 describes air emission standards for classified establishments. The NSEQ were developed based on a concerted effort by various stakeholders:

> values are the result of profound research work and an in-depth overview, revision and analysis of similar legislation in neighbouring countries, the Arab League regulations and the international agreements and obligations to which Lebanon is committed. The decision on the exact value of the thresholds was based on the level and the characteristics of the respective pollutant, the available emission combating technology, the local ecological, geographical and physical characteristics as well as the economic capacity of the Lebanese industry. These standards were scrutinized through an exhaustive evaluation process with all concerned stakeholders and were agreed upon on a consensus basis, allowing them to be *nationally owned* [5]

[5] Excerpt from MoE/SPASI, 2001a

Figure 3. 5
Structure of National Standards for Environmental Quality (Decision 8/1)



Source: MoE / SPASI, 2001a

New classification system

As explained in Section 3.1.4, a five-class system (referred to as Class I to V in this report) has amended (but not replaced) the old classification of industries into three classes (1, 2, and 3). In theory, industries belonging to the old Class 1 and Class 3 were divided into two classes each. The new classification is based on a study commissioned by IDAL (IDAL / Fugro, 1996), which also recommended setback distances from populated areas for each new class of industries based on odour emissions (see Table 3.9). However, the new decree (Decree 5243 / 2001) did not specify any setback distances. This is one of the major limitations of Decree 5243 / 2001 (see Box 3.1 for other key impediments to implementing Decree 5243).

Table 3. 9
Industrial Classification Based on Environmental Threat

Decree 4917 (1994)	*Decree 5243 (2001)*	*Degree of threat to the environment and health*	*Minimum distance to dwelling units based on odour (*
Class 1	Class I	Serious	500
	Class II	Significant	250
Class 2	Class III	Limited	100
Class 3	Class IV	Insignificant	20
	Class V	No threat	10

Source: IDAL / Fugro, 1996

Furthermore, the decr
recommendations to classify industrial zones into three area classes (A, B, and C), depending on location and environmental considerations, that can host only certain classes of industries. Instead, the GoL issued a string of legislation surrounding the siting

of industries, which has created significant confusion and legal inconsistencies, particularly on Class 2 industries. For example:

- industries to be located inside industrial zones; and
- industries from the previous obligation to be located inside an industrial zone.

Monitoring Plan

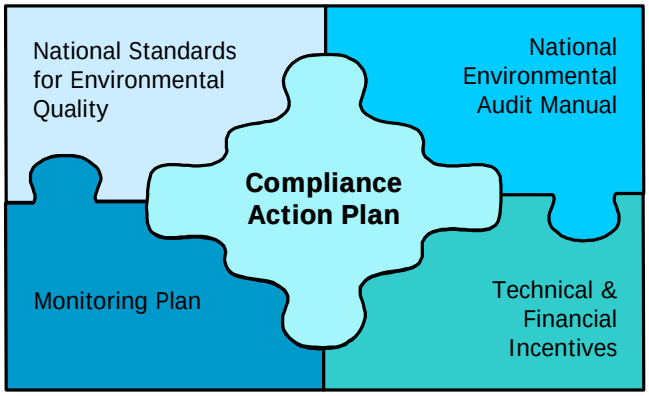
MoE/SPASI developed a monitoring strategy for classified establishments to ensure their compliance with the new emissions standards. As part of this strategy, MoE will require classified establishments to submit regular status reports to MoE for review and approval. MoE has developed a tailored software program to help it monitor and keep track of reporting by classified establishments. The software provides an automated reporting system (thus reducing human interference), and GIS compatibility (e.g., mapping of compliant vs. non-compliant facilities). Operating the software will require

to be visited to verify compliance. The Ministry plans to install the software in 2002 and will thereafter gradually build a user-friendly GIS database of industries.

3.3.4 Compliance Action Plan

The CAP also requires an auditing system and the provision of technical and financial incentives to support compliance initiatives among existing facilities (see Figure 3.6). Section 3.3.3 provided a discussion of the NSEQ (which also include standards for existing facilities, different from new facilities) and the MoE industry monitoring software.

Figure 3. 6
Compliance Action Plan for Existing Facilities



Source: SPASI project, MoE

National Environmental Audit Manual

To assess compliance with the National Standards for Environmental Quality, existing and new facilities will need to be audited. The MoE and SPASI developed a National Environmental Audit Manual (NEAM) to unify the auditing procedures. The

Manual provides in-depth guidelines and procedures for conducting audits, including checklists for environmental management, production process, water supply, wastewater management, air emissions, solid waste management, noise pollution, energy consumption, and occupational health and safety. The manual also presents checklists for primary pollutants that would need to be measured as part of an environmental audit. Through proper dissemination of this manual, the MoE aims to develop sector-specific action plans to optimize resource management and improve process performance. Industrialists can use the audit manual directly to conduct a quick in-house audit.

3.3.5 Technical and financial incentives

compliance with the new standards.

Financial incentives

Financial incentives include soft loans (e.g., *Kafalat Incorporation*) and opportunities for co-financing. Also, with grant support from EU, the MoI will implement the Industrial Modernization Program. MoE plans to prepare all the legal documents for putting in place a selection of financial incentives during 2002.

Technical incentives

Meanwhile, a number of technical incentives are being studied. For example, MoE

format options for green certification and the legal mechanisms for issuing certification in Lebanon. MoE plans also to develop a green directory of compliant industries. This directory will be available on the homepage of the ministry. MoE also will encourage industries to invest in cleaner technologies and pollution prevention techniques as a way to comply with the new standards. However, retrofitting existing facilities to use cleaner production technologies would be expensive (see Box 3.2 for the case of phasing out ODS using the Multilateral Fund under the Montreal Protocol). The MoE has started some actions to promote cleaner production:

- Following a preliminary screening of industrial and hazardous waste in Lebanon (METAP/Tebodin, 1998), the MoE identified the tanning sector as one of several priority branches. An ensuing detailed audit of the tanning sector came up with several recommendations for cleaner production, including relocating the sector to an industrial zone (MoE/Envirotech, 1998). A detailed pre-feasibility study on the relocation of the tanning sector generated seven scenarios that were all financially feasible and two candidate sites have since been identified (Choueifat and Naameh). The MoE and concerned stakeholders are currently exploring available options for financing the relocation.
- With the help of ALIND and DELTA, the MoE was also active in disseminating the *Good Housekeeping Guide*, an environmental management tool for small- and medium-sized enterprises (SMEs) developed by the German Agency for Technical Cooperation (GTZ) and Sustainable Business Associates (SBA).

Notwithstanding a number of MoE actions, select industries have concurrently taken some initiatives to improve quality and environmental performance. Currently, four industries in Lebanon have acquired ISO 14000 certification and another 77 have acquired ISO 9000 (see Table 3.10). Although not mandatory and unrelated to existing national standards, ISO 14000 certification does set certain waste reduction and energy efficiency targets.

Table 3. 10
Number of ISO-Certified Establishments

Year	*ISO 9000*	*ISO 14000*	*Total*
1994	12	0	12
1995	0	0	0
1996	4	1	5
1997	10	0	10
1998	8	0	8
1999	43	3	46
Total	**77**	**4**	**81**

Source: MoI, Annual Bulletin

3.4 Outlook

Lebanon has signed many bilateral trade liberalization agreements, namely with Syria, Egypt and Kuwait, as well as multilateral agreements such as the Arab Free Trade Agreement of January 1998. The GoL is also concluding negotiations with the European Union (EU) that will lead to the ratification of the Euro-Med Association Agreement. On the international scene, Lebanon is negotiating the terms for its accession to the World Trade Organisation (WTO). These agreements bind Lebanon to improving product quality and environmental performance (MoE / NEAM, 2001).

With the assistance of the SPASI project, the MoE has developed a strategy for improving the environmental performance of industries. It has issued national standards for environmental quality as well as environmental guidelines for new facilities, produced audit manuals, and developed a monitoring software tool. Introducing non-regulatory approaches to achieving compliance, such as economic and fiscal incentives, is equally necessary. Promoting cleaner technologies and cleaner production will help industries reduce waste and pollution at the source and thus comply with the new standards. In this context, the MoE has secured a grant from the EU 3rd Countries Life Programme to establish the Lebanon Cleaner Production Centre (LCPC). Expected to be launched in 2002, the LCPC will provide a platform for demonstrating cleaner production methods and providing technical assistance to facilitate the adoption of cleaner technologies and pollution prevention techniques.