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SUPPORT TO POLICY FORMULATION FOR SUSTAINABLE INDUSTRIAL DEVELOPMENT IN LEBANON

Final Report

Republic of Lebanon
Office of the Minister of State for Administrative Reform
Center for Public Sector Projects and Studies
(C.P.S.P.S.)

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EXECUTIVE SUMMARY

This report, based on a two-weeks field mission to Lebanon, provides an assessment of industry-related environmental issues in Lebanon, focusing on the dual role of the Government and the private sector. It concludes with a set of recommendations aiming to assist the Government in the strengthening of environmental policies for sustainable industrial development in Lebanon.

The industrial sector is a major source of water pollution and solid waste. Air pollution from industry is less critical, but do represent a significant local problem in certain industrial areas. Environmental problems are threatening the sustainability of major economic sectors (in particular future tourism development) and have in some areas significant impacts on the quality of human life. Close to 90% of industrial establishments have less than 10 employees and are typically located in, or close to, residential areas. There are plans to relocate industries to dedicated industrial zones, but so far no real incentives exist for the smaller companies. The majority of companies need to improve their environmental performance in order to comply with stricter national standards and to meet emerging demands from international markets. However, they do generally lack both knowledge and financial resources to take appropriate measures. In addition, occupational health and safety issues for workers in small-scale industries are far from adequately addressed, and may represent a substantial social problem.

Environmental pollution standards has recently been introduced by the Ministry of Environment (MoE) based on standards applicable in developed countries. This has been done without consulting relevant stakeholders, including other ministries, and without devising an appropriate mechanism for implementation and enforcement. Industry and industrial associations are in general not aware of these regulations. Presently, there is no efficient system for issuing permits for industrial operations or to control industry compliance with environmental requirements. The Investment Development Authority of Lebanon (IDAL) has recently taken an initiative to develop a permit and inspection system for industrial zones, but it is not clear how this will be implemented.

In order to strengthen environmental monitoring in Lebanon, there is a need for better coordination of existing activities as well as establishing national plans for investment in equipment and training programmes. In terms of plant-level monitoring of industrial emissions and wastes, there is an overall lack of expertise and institutional capacity.

In moving towards sustainable development in Lebanon, the Government is constrained by the overall shortage in financial resources and available expertise, a situation common to most developing countries. However, as this report has indicated, improvement environmental management is also impeded by the lack of coordination and collaboration at political and institutional levels, where conflicting objectives and overlapping responsibilities tend to reduce the overall decision-making power of the Government in dealing with environmental issues.

The government is offering incentives to promote investments in the industrial sector (new industrial areas, streamlined permitting procedures, etc.), but procedures and guidelines need to be put in place to ensure future investments will be environmentally sound. Achieving measurable results is important to overcome public cynicism over some previous technical assistance projects that have not produced the expected results. Hence, the recommendations and proposed follow-up activities in this report are intended to provide tangible results while at the same time support long-term policy formulation and capacity building for sustainable industrial development. Some of the major recommendations and proposals for follow-up activities are summarized below.

It is recommended that the MoE, supported by the Prime Minister, should spearhead an effort to establish an National Environmental Council with the mandate to coordinate and advice on cross-sectoral environmental issues, particularly in relation to policies and implementation mechanisms for environmental management and sustainable development. In addition to representatives from the various ministries, the Council should have access to an independent scientific advisory group. Important government agencies such as CDR and IDAL, as well as sectoral organizations such as ALIND, should participate as observers on a permanent or *ad-hoc* basis, and provide advice as required.

While mainly universities have the basic capacity to carry out ambient monitoring, and indeed are doing so on a limited scale in connection with research activities, environmental monitoring are not coordinated or undertaken on a regular basis. To avoid overlapping and to ensure that resources are used in the most cost-effective way, the MoE should establish a coordination group for monitoring of ambient pollution levels in water, land and air. The group should be chaired by the MoE and should include universities, laboratories and other major stakeholders. An initial task would be the development of a strategy for a national environmental monitoring programme, where the overall needs, priorities and investment requirements are identified both in terms of monitoring activities and capacity building.

Law 216 provides for an Intervention Department (*Moukafaht*) within the MoE to "ensure that all conditions imposed on factories, plants, industrial estates, poultry farms, animal farms, quarries, crushers, asphalt factories and cement plants, are applied in coordination with concerned administrations". The MoE should seek political agreement on its role in monitoring and enforcement of environmental laws and regulations, and should formulate a strategy for short and long term implementation of its function as set out in Law 216. This should include a costed action plan for capacity building in the MoE as well as in collaborating institutions.

In the immediate future, Lebanon do not have the resources to create a new environmental agency, being part of the MoE or not. The MoE is therefore recommended to cooperate with other ministries as well as the industry to strengthen the capacity of a suitable existing institution to provide plant-level monitoring services both to the private sector and the authorities. This is considered the least costly strategy for building up a national core expertise on process monitoring, and will provide the basis for a possible establishment of a governmental agency at a later stage.

Demonstration project for selected areas or industrial zones should be initiated to assess the effects of introducing stricter environmental regulations/standards in combination with appropriate incentives and support mechanisms. This will provide a rational basis for designing and implementing environmental requirements and incentives on a wider national scale. In carrying out this activity, the MoE is recommended to cooperate with IDAL within the framework of the proposed new permit system for industrial zones.

While there is a significant potential for cleaner production in Lebanese industry, the capacities to identify and implement such solutions are generally lacking. High priority should be given to the establishment of a long-term national capacity-building programme on cleaner production, in close cooperation with industry, industrial association and supporting institutes and technical universities. Initial focus should be given to awareness building and the identification of existing capabilities and needs in industry and institutions. Lessons learned from other countries show that industrial experience ("success stories") is the most powerful force for convincing companies, industrial organizations, governmental organizations and other stakeholders of the opportunities and benefits of waste minimization. Demonstration projects and dissemination of information on industrial experience with cleaner production should therefore be at the core of the awareness-building and promotional activities [25]. MoE and MoIP are recommended to jointly

initiate and support this activity, starting with identifying stakeholders and establish a consolidated programme strategy. Activities in the short to medium term would include cooperation with industry and industrial associations to identify and implement plant-level demonstration projects and to organize awareness building workshops at sub-sectoral level. In addition, these workshops could address international environmental standards for products and corporate management systems, covering topics such as EMAS and ISO 14000. While the MoE could take the initial responsibility for developing and running a cleaner production programme, it is recommended that this task is gradually transferred to a independent institutional mechanism. The MoE should work towards establishing a national cleaner production centre within a cooperating network of companies, industrial associations, consultants, technical institutes, universities and government bodies. This could be based on the same framework as utilized in UNEP/UNIDO's National Cleaner Production Centres (NCPC) Programme.

It is of critical importance that information on pollution prevention and control, including environmental regulations and standards, is made available to industry. Special focus should be given to the needs of micro and small-scale enterprises, which comprise most of the industrial sector in Lebanon. In addition to the awareness building workshops mentioned above, the MoE is recommended to investigate the possibility of establishing a more permanent mechanism for dissemination of environmental information. At a later stage, this function may be supported by a possible NCPC. Special consideration should be given to the possibility of using the same institutional network to provide a wide range of services to industrial companies. In addition to environmental information, this may include general information related to market, technology and business development. This opens up for cost-sharing arrangements and better utilization of invested resources.

The report outlines proposals for concrete activities where UNIDO, subject to the availability of funds, may provide technical assistance to the Government. This include the following areas:

- Development of Sustainable Industrial Development (SIS) strategies for specific areas.
- Cleaner production demonstrations.
- Establishment a spatial database on industrial pollution sources and discharges.
- Feasibility study on the relocation of leather tanneries.
- National programme for monitoring of ambient pollution concentrations.
- Strengthen the capacity of the Industry Institute to provide plant-level monitoring services.
- Establishment of a National Cleaner Production Centre.
- Improving occupational health and safety in small industries.

1. INTRODUCTION

The main aim of this project was to carry out an assessment of industry-related environmental issues in Lebanon, focusing on the dual role of the Government and the private sector. The following areas were addressed:

- Policy and regulatory framework, economic incentives and compliance control.
- Environmental and plant-level monitoring.
- Cleaner production (waste reduction) and environmental management systems at enterprise level.
- Awareness and access to information.
- Institutional and technical capacities.

The terms of reference for the project called for a team of UNIDO experts, including an industrial pollution specialist, an environmental monitoring expert and the UNIDO project manager to visit Lebanon for two weeks. The mission took place between 8 and 22 December 1996.

This report is the final report of the project and contains an analysis of the status on environmental management in Lebanon with focus on the industrial sector, and includes an assessment of the present environmental policy, industrial environmental protection and environmental issues to be considered when formulating short and long term policies for sustainable industrial development. The report concludes with a set of recommendations and proposals for follow-up activities, indicating in which areas UNIDO may assist the Government in improving the overall environmental performance of the industrial sector in Lebanon.

2. ACTIVITIES AND METHODOLOGY

Prior to the mission of the international team of experts, background studies on selected topics were prepared by national consultants for review by the international experts. The areas covered included energy management, air pollution, industrial pollution and integrated waste management. During the mission to Lebanon in the period from 8 to 22 December 1996, reports of major studies in the field of environment and industry prepared by UNDP, the World Bank and other international and national agencies were obtained and reviewed by the project team.

Extensive consultations were held with a number of ministries, government agencies and institutions, including the Ministry of Environment (MoE), the Ministry of Industry and Petroleum (MoIP), the Council for Development and Reconstruction (CDR), the Investment Development Authority of Lebanon (IDAL), the Chamber of Commerce and Industry, the Association of Lebanese Industrialists, the Industry Institute and LIBNOR. As well, the Team visited laboratories at the major universities dealing with monitoring of industrial pollution, and meetings were held with selected consulting firms active in the field of industry and environment, including Arthur D. Little, Dar Al-Handasah, Dames and More and Grontmij-MEEA.

The project team was invited to participate as observers at a meeting between the MoE and representatives of municipalities, NGOs and industry in the Chekka area in the north of Lebanon. This area has been facing severe environmental problems due to present and past industrial activities.

Site-visits were made to selected factories, including a large-scale cement plant, several small and medium-size tanneries, a small-scale paint manufacturer and a paper recycling plant. In addition, a visit

was made to Baouchrieh industrial zone, near Beirut, where several small-scale companies were inspected, including a printing shop, foundries, plastics recycling plants and metal workshops. Due to the present focus on the environmental problems in the Chekka area, the visit at the cement factory (*Cimenterie Nationale S.A.L.*) was more comprehensive than for the other plants visited.

As part of the project, UNIDO also sponsored a high-level seminar on Sustainable Industrial Development in cooperation with UNDP and the Ministry of Environment, with particular focus on cleaner production, aiming at rising the national awareness and initiate follow-up activities in this field. The Seminar was organized and conducted by the Team in cooperation with the UNIDO Country Director, and was attended by a representatives from the Government, industry, public and private institutions and NGOs.

Schedule of activities, listing name and address of contact persons as well as brief notes from meetings, is attached as Annex A.

A list of publications and journals distributed during the mission is attached as Annex B.

3. SEMINAR ON SUSTAINABLE INDUSTRIAL DEVELOPMENT

In cooperation with UNDP and UNIDO Lebanon, the UNIDO team organized a half-day seminar on Sustainable Industrial Development and Cleaner Production (see Exhibit 3.1 for the seminar program).

EXHIBIT 3.1
Seminar on Sustainable Industrial Development - Programme
(Beirut, 18 December 1996)

I. Opening Addresses
Mr. Akram Chehayeb (Minister of Environment, The Republic of Lebanon)
Mr. R.S. Mountain (UNDP Resident Representative, Lebanon)
Mr. Al-Hafedh (UNIDO Country Director, Lebanon)
Ms. K. Liebl (Arab Bureau, UNIDO H.Q.)

II. An Introduction to Sustainable Industrial Development (SID)
Mr. L. K. Braute (Industrial Sectors and Environment Division, UNIDO H.Q.)

III. Discussion on SID and critical issues for Lebanon

IV. Sustainable Industrial Development - what the industry can do
Mr. J. Karam (UNIDO Consultant)
- Cleaner Production and Pollution Prevention
- Environmental Management Systems

Mr. S.C. Wallin (UNIDO Consultant)
- Monitoring of Industrial Processes

VI. Sustainable Industrial Development - what the governments can do
Mr. S.C. Wallin (UNIDO Consultant)

VII. Discussion and Summing-up

About 50 participants from the public and private sectors attended the seminar (a list of participants is attached as Annex C). The seminar started with official speeches and presentations, which were followed by short presentations by the UNIDO team members and lively exchanges of ideas with and among the participants, as described next.

3.1 Seminar Opening

Mr. Al-Hafedh, UNIDO Country Director, welcomed the participants, presented a brief overview of the concept of Environmentally Sustainable Industrial Development as formulated in Copenhagen (1993), and introduced the keynote speaker, H.E. Akram Chehayeb, Minister of Environment. Mr. Chehayeb reiterated MOE's commitments to international agreements such as the Rio summit' Agenda 21, the Montreal protocol, and the Basel convention. He also stressed on the need for coordination between the Ministry and industry. Mr. Ross Mountain, UNDP Resident Representative, then reviewed UNDP's environmental activities in Lebanon and called for continuing coordination between UNDP and other UN agencies such as UNIDO and ESCWA. Finally, Ms. Karen Liebl, from the UNIDO Arab Bureau in Vienna, presented an overview of UNIDO's past experience (textile, Industry Institute) and on-going or planned activities (reactivate/rehabilitate the Industry Institute and LIBNOR, Montreal protocol projects, Investment Promotion Forum) in Lebanon.

3.2 Seminar Presentations

Mr. Leif Braute, UNIDO team leader, gave a short introduction to SID and showed a 15-minute videotape on UNIDO cleaner industrial production projects worldwide ("A Better World with Cleaner Production", UNIDO 1996). Mr. Joseph Karam, UNIDO consultant, presented Cleaner Production and Environmental Management Systems, including the upcoming ISO 14000, and facilitated an exchange of ideas, proposals, and experiences among participants. Another 15-minute videotape on pollution prevention ("Pollution Prevention: Can We Afford to Wait?", USAID 1996) was presented. Finally, Mr. Stan Wallin, UNIDO consultant, gave a short presentation and answered questions on the role of national and local governments in promoting SID and monitoring environmental pollution levels. Copies of transparencies used in for presentations are attached as Annex D.

Participants emphasized the importance of self-regulation and the need to motivate people by providing economic incentives and rewards. Industry participants stressed the need for norms so that industries can plan and invest accordingly. They pointed to the government (power plants, etc.) and transportation (cars) as major polluters.

3.3 Seminar Recommendations

At the conclusion of the seminar, Mr. Al-Hafedh summarized the participants' recommendations expressed in earlier sessions and invited more ideas and suggestions. This final exchange produced a solid list of recommendations (see Exhibit 3.2), which should provide a basis for future action by UNIDO and other agencies in promoting sustainable industrial development in Lebanon.

EXHIBIT 3.2
UNIDO Seminar on Sustainable Industrial Development - Recommendations (Beirut, 18 December 1996)

- Examine the need for an Environmental Protection Agency or a National Environmental Council (UNIDO is ready to do study).
- Conduct workshop on ISO 14000 and Environmental Management Systems.
- Conduct awareness campaigns.
- UNIDO to provide support to the cement industry.
- Do area-wide case study (with interim standards).
- Establish information clearinghouse (perhaps at MoE).
- Establish national program for capacity-building in cleaner production for select industrial sectors.
- Emphasize IDAL's role in promoting cleaner production in industrial areas.
- Speed up rehabilitation and strengthening of LIBNOR (OECF loan).
- Investigate the role of the Industry Institute in enhancing cleaner production capacities in industrial sub-sectors.
- Target small to medium-sized industries.
- Follow-up on previous UN recommendations (Sustainable Development Network, International Trade Centre, etc.).
- Build on existing or planned programs such as MOE's Project Preparation Unit and METAP III Public Private Partnership program.

In addition, UNDP offered to join hands with UNIDO. Also, the Association of Lebanese Industrialists (ALIND) declared its readiness to cooperate through its environmental division.

4. REVIEW OF WRITTEN SOURCES OF INFORMATION

4.1. Background Papers Prepared by National Experts

As part of the project, background papers were prepared by selected national experts, covering issues related to air pollution, energy management, industrial pollution and integrated waste management. These reports are submitted separately, and are briefly commented on below:

- *Report on Air Pollution* [1]
  Good coverage of pollution associated with industrial sources and transportation, but there is a paucity of reliable data on the characterisation and quantity of emissions, also ambient air concentrations. For reference, EC/WHO air quality standards are attached in Annex E. A good description of the general meteorological conditions is given. We would suggest that further data are required, if not available at present, on the structure of the atmosphere to facilitate reliable environmental impact assessments (EPA's). An expert group is: the Meteorological Office, Centre de Recherche, Geophysics BP 165432, Beirut.

- *Report on Energy Management [2]*
  There is some confusion between "emission limits" and "air quality standards" and under 2.5 these are NOT European Standards for power plants. For control of NO_x emissions these use combustion systems to minimise the formation of thermal NO_x. The emission estimates appear to be correct for sulphur dioxide but for carbon dioxide, NO_x and TSP these are doubtful.

- *Report on Industrial Pollution* [3]
  This is a comprehensive review of industrial generated pollution. Presumably there will need to be a further re-think on licensing for Classes 1 and 2 Industries once the procedures for EIAs are promulgated. Clearly the industrial re-organisation committee will need to take account of some industries being undesirable neighbours for other although not being highly polluting. For monitoring (2.6) the views expressed are very valid and need to be addressed in the short-term if there is to be effective environmental protection in the Lebanon. The proposed management schemes are sensible and reference to ISO 14001, 14010 and 14012 now published will be helpful. For control purposes regard should be given to legislation already in place for the United States and the European Union. At this stage it is not possible to look critically at Chapters 5 and 6, but surprising to see in Table 6.1.2 no reference to heavy metals such as lead, cadmium and mercury.

- *Report on Integrated Waste Management* [4]
  The term "integrated waste management" in the United States and Europe can sometimes refer to an integrated centre dealing with the treatment and incineration of industrial waste and sewage arising from a number of processes (See Study UNEP/UNIDO, Technical Report No. 27). The composition and characteristics of solid waste indicates a high percentage of putrescible material and therefore with a properly prepared and operated landfill site the production of and utilisation of gas is feasible. Exhibits 1 and 2: it is not surprising that the percentage of paper and cardboard has reduced to half in the past 13 years. Regarding proposals for composting plants: the operation of composting plant is unpleasant and difficult and is most likely to cause environmental and hygiene problems. Incinerators: Although the Von Roll is one of the best designs of mass solid waste (MSW) incinerators there are potential problems of high molecular weight (dioxins) pollutant emissions unless properly operated. Waste-water and sewage arisings for different parts of Lebanon are given and the overall position is unsatisfactory. The monitoring and control proposed is well covered and similar to those in operation in Europe and the United States.

4.2 Other Written Sources

During the mission, the UNIDO Team reviewed reports from previous studies related to environmental management and industrial pollution as well as background information on particular institutions. These are commented on below. Complete references are given in section 9.

- *Energie et Environnement, Elements D'Analyse (ALME)* [5]
  There are several useful tables (1994) that can be used as an input for the most cost effective ways of reducing emissions and pollution levels (such as sulphur dioxide, lead and hydrocarbons) in cities.

- *Les Bilans Energetiques au Liban en 1995 (ALME)* [6]
  The tables on price comparisons need further information particularly for gasoline e.g. the percentage of unleaded to leaded. Also for gas oil there are sulphur limits for the EU and overall sulphur dioxide emission targets for all EU countries,

- *L 'annuaire de l 'Universite St. Joseph* [7]
  There does not appear to be a degree course in Chemical Engineering which could provide a basis for environmental expertise applied to industry.

- *Classification of Industries and Industrial Areas - Final Report (IDAL)* [8]
  Classification of Industries and Industrial Areas, Final Report 1996. A good analysis of the strengths and weaknesses of the European classification system is made, and elements from the Dutch and English systems used to develop the system for Lebanon. In view of this it would be logical to use European pollution control legislation with suitable lead times such as the proposed 4 year periods for conformity in the Lebanon. There is a useful classification of industry with reference to a range of environmental aspects which will provide a good methodology when making EIAs. Land use planning in all countries is a difficult topic and many of the problems have been high-lighted. Section 5.3 provides more details on the proposed classification system.

- *Lebanon Environmental Strategy Framework Paper (World Bank)* [9]
  This is an excellent paper and sets out policy options and recommendations for future targeted investment in the short, medium and long term. Provides requirements and financial estimates for institutional and capacity building that is highly relevant to the present UNIDO mission.

- *METAP - Policy Options for the Ministry of the Environment (World Bank)* [10]
  The weak resources of the Ministries is identified and re-focusing of the M of E and considering the formation of a separate and independent Agency is one option. The monitoring and measurement of environmental quality is targeted to public health. A further important aspect given is the dissemination of information to the general public and via technological transfer and training for specific activities when there are environmental and health consequences.

- *Industrial Census, December 1995 (MoIP)* [11]
  This report is useful in giving the distribution of industrial processes and the employees working in each sector, according to ISIC (rev. 3) classification. It should be useful in aiding the completion of pathways (pollution and waste) into the environment and identifying processes where occupational work is hazardous to health. In view of the large number of motor vehicles it is not clear if transport repair work is classified as a service industry; if not where is this activity included? Section 6.1 provides an analysis of the industrial structure in Lebanon based on data from the Industrial Census report.

- *Occupational Health in Lebanon (AUB)* [12]
  A very good overview of the urgent need to address occupational health and associated environmental problems. Modest long-term objectives are presented and the way to achieve these through a national occupational health policy, primary health care and a participatory approach by industrialists and managers.

- *National Industrial Waste Management Plan - Phase I report (MoE)* [13]
  The legal framework and institutional structure is under review. Solid and aqueous waste disposal current practices need to come under control and liquid waste results indicate some disconcerting

features e.g. phenol compounds, heavy metals and mercury. See section 5.5 for a more detailed assessment of this activity.

- *Conseil du Developpement et de la Reconstruction, Rapport d'Activite (CDR)* [14]
  The financial strategy is to take advantage of the maximum donor support in renewing the country infrastructure. Each of five sectors is made up of a series of projects and these can involve conception and study, construction, supervision and equipment. From January 1992 to September 1996 the estimated cost of the contracts was $1985 millions.

- *Intervention of the Private Sector in the Environment Agenda (UNDP)* [15]
  Areas to initiate private sector interventions have been identified. Private/Public Partnerships aim is to promote genuine partnerships between the private and public investors that promote economically and environmentally sustainable projects.

- *METAP III (1996 - 2000) Regional Initiative - Public Private Partnerships (UNDP)* [16]
  Structures and examples are given for UNDP and sustainable project management (SPM) for a number of projects in Europe and Africa.

- *Auditing, Inspection and Reporting as Instruments for Environmental Management in Lebanon (ESCWA)* [17]
  Guidelines for environmental auditing and inspection of industries by the Ministry of Environment (MoE). Proposal for the establishment of an Inspectorate at the MoE, and outline of institutional structure and implementation strategy. Detailed description of guidelines and good assessment of constraints faced by MoE.

4.3 Concluding Remarks

It became obvious from the published sources of information that there is an urgent need for environment control in practically all aspects of industrial and public services, transport, sewage and solid and aqueous wastes. There exists recommendations in a large number of reports which have been briefly reviewed. Unfortunately, although providing useful information, these reports did not present data on the quantity and characteristics of pollutant loading from point and non-point sources. As well, there is lack of data on ambient pollution concentrations for air, water and land.

5. ASSESSMENT OF ENVIRONMENTAL POLICY

Lebanon already has a large body of sector-specific environmental laws and regulations, some dating back to the 1930's. Generally speaking, these laws and regulations require updating and integration within a well-articulated environmental policy framework. However, efforts at promulgating an environmental protection law or an environmental impact assessment (EIA) law or decree have not been successful so far. Moreover, although the Ministry of Environment (MOE) recently issued environmental pollution standards by decision of the minister, it failed to identify the regulated community and to communicate these standards to it; it also did not put in places the necessary procedures for compliance monitoring and enforcement.

5.1 Draft EIA Requirements and Procedures

With technical and financial support from UNDP's Capacity 21, the MoE has developed draft EIA decree and procedures. However, the draft decree and procedures were not approved by the Council of Ministers. In the absence of national EIA requirements, only projects financed by major international donor agencies (e.g., World Bank, European Investment Bank) appear to be subject to an EIA, such as wastewater and drainage projects in Tripoli, Kesrouan, Saida and Sour, electricity generation (two new power plants in Beddawi and Zahrani) and distribution projects (nationwide), and solid waste management plants (composting and incineration in Beirut, landfill disposal in Saida and Zahle).

The extent to which EIA recommendations are followed through, however, is not well known. Staff of the Council for Development and Reconstruction (CDR), MoE and the line ministries are not familiar with EIA procedures and do not have sufficient capacity to monitor implementation of mitigation measures.

No EIA is performed for projects financed directly by the Lebanese government or for private projects (including industrial projects). Nevertheless, despite the absence of national EIA requirements, the Investment Development Authority of Lebanon (IDAL) is requiring prospective BOT (Build-Operate-Transfer) contractors to submit EIA reports for free trade zones and industrial areas. EIAs have to be in accordance with the World Bank Operational Directive 4.01. However, IDAL has not conducted an environmental assessment of its ambitious industrial restructuring program.

5.2 Environmental Pollution Standards

More than two years ago, the Minister of Environment issued a decision (Decision 20/B, November 2, 1994) promulgating standards for water, air and soil pollution. These standards were drafted quickly (using standards applicable in industrialized countries) and without consulting other concerned parties (such as Ministry of Industry and Petroleum); moreover, they do not provide clear implementation mechanisms (e.g., permitting, monitoring, enforcement).

Recently, the then-outgoing Minister of Environment issued Decision 52/1 (July 29, 1996), which nullified Decision 20/B and established revised and additional standards for water, air and soil pollution. No rationale was provided for this revision. Decision 52/1 provides pollution standards for 14 environmental media and parameters (see Exhibit 5.1). Like the old decision, the new one failed to explain the rationale for these pollution standards or to provide guidance on how the MoE intends to implement and enforce them. Nor was there any attempt to assess the costs and benefits of these pollution standards. For example, the Director General of ACE, at a workshop to discuss the draft Regional Environmental Assessment report on the coastal zone of Lebanon [18], indicated that meeting the wastewater discharge standards would increase the cost of the Dora wastewater treatment plant (under study) by several tens of millions of dollars.

Actually, cost-benefit analysis does not appear to be used in environmental policy-making. For example, the government plans to install wet scrubbers to reduce SO_2 emission levels at the three existing fuel-fired power plants (Zouk, Jiyyeh, and Hreicheh), at a total estimated cost of US$110 million. This cost does not include the costs of gypsum disposal (about 300,000 tonnes per year of gypsum, which is a by-product of wet scrubbing) and of possible efficiency reductions in electricity production (due to retrofitting of the existing power plants with scrubbers). It is not clear to what extent other, less capital-intensive options have been examined, such as judicious use of lower-sulfur fuel.

EXHIBIT 5.1
Environmental media covered by standards
(Minister of Environment's Decision 52/1, July 29, 1996)

MoE Decision 52/1 provides pollution standards for the following environmental media or parameters:

- Drinking water
- Surface water sources of drinking water
- Surface water quality to sustain aquatic life
- Bathing waters: pools, rivers, lakes and sea
- Domestic wastewater
- Treated domestic wastewater
- Waste disposal that could potentially affect the quality of surface or ground water and seawater (non-dangerous waste)
- Liquid waste disposal at sea beyond 500m from the coast
- Ambient air quality in the workplace
- Noise
- Air emissions from burning used oil
- Air emissions from municipal solid waste incineration
- Air emissions from cement plants
- Ambient air quality

5.3 Classification of Industries and Industrial Areas

Decree 4917 (1994) recognizes 209 categories of industries in Lebanon (e.g., cement manufacturing, leather tanning, etc.) and assigns each category to one or more of the following three industrial classes: noxious, annoying, and dangerous *(insalubres, incommodes, ou dangereux)*. These three industry classes were first established by Decree-law 21/L in 1932, based on the French classification system.

During the war, some industries were established without any permit; others obtained permits (in general at the *Mohafaza* level) to locate in non-industrial areas. In order to resolve the legal status of many industries and encourage industrial development in Lebanon, IDAL has developed plans for a new classification system for industries and industrial areas [8]. Based on the ISIC industrial classification system, a combined environmental/health index has been developed for each sector by adding the score of separate indexes for (i) environmental impacts; (ii) noise; and (iii) odour, external danger and dusts. Under the new classification system, Lebanon's current three industry classes would be replaced by a five-class system, according to the total value of the combined index. Class 1 industries pose the highest impact on human health and the environment while Class 5 industries pose no threat to health or the environment. The overall approach seems to be valid, although it is unclear on which basis the index is are calculated for the various sectors.

IDAL is revising the status and extent of existing industrial areas and proposing new ones [20]. Industrial areas have been or will be reclassified based on a number of environmental criteria, including proximity to populated areas, the shorefront, a forested area, agricultural land; steep mountain slopes; and/or a river or natural water course. Industrial areas would be classified into three classes (A, B, and C), and can accept only certain classes of industries. For example, industrial areas A can accept only industries that pose no or insignificant threat to health and the environment (i.e., Class 4 and 5 industries).

Using the new system, all 41 official industrial areas in Lebanon have been classified. There are only two proposed Class C industrial zones, both located on the coast: Tripoli/Beddawi (old IPC refinery, future power plant) and Selaata (chemical industries, fertilizers).

5.4 Enforcement of Environmental Regulations

Poor enforcement is a major weakness of the environmental control system. Two factors contribute to poor enforcement: (i) lack of clarity and internal inconsistencies in legal and regulatory texts; and (ii) institutional weaknesses, including the fact that most if not all enforcement powers lie with the Ministry of Interior. As a result, line ministries lack the means to enforce the legal requirements falling under their jurisdiction and have to rely on the Ministry of Interior's ability and willingness to enforce such requirements.

Law 216, which created the Ministry of Environment, recognizes the need to strengthen enforcement capabilities. It provides for an Intervention Department (*Moukafahat*) within the MoE to "ensure that all conditions imposed on factories, plants, industrial estates, poultry farms, animal farms, quarries, crushers, asphalt factories and cement plants, are applied in coordination with concerned administrations." However, MoE has not yet put in place such a department. A recent study [17] by ESCWA identified a serious lack of capacity at the MoE in terms of technical expertise and financial resources to carry out environmental audits and inspections, and did also point to an overlap with other ministries in terms of environmental responsibilities.

In terms of environmental laboratory capacity, the UNIDO team believe existing laboratories to a large extent would be able to support the technical analysis required within a inspection and monitoring programme. However, the capacity is spread between several institutions and departments, of which some are in competing positions, and would need to be coordinated. In this respect there would be a need for an adequate accreditation system for collaborating laboratories and institutes.

With respect to monitoring programmes carried out by the Ministry of Health, it was indicated a substantial shortage of qualified public health inspectors for inspections of work conditions in factories.

In terms of the institutional framework for industrial permitting, changes are underway. A draft decree would establish an inter-ministerial committee responsible for issuing and extending industrial permits according to the new classification system. Intended to streamline administrative procedures, the committee would be chaired by IDAL and be comprised of representatives from the Ministries of Environment, Health, Industry and Petroleum, and the General Directorate of Urban Planning [8]. Meanwhile, since early 1996, officials at the *mohafaza* level have been instructed to stop issuing industrial permits.

5.5 National Industrial Waste Management Plan

In mid-1996, the MoE launched a national two-phase study of industrial pollution, aimed at developing a national industrial waste management plan. Phase I calls for characterizing and classifying industrial generators and wastes throughout Lebanon. The Phase I final draft report was submitted to MOE last August. In Phase II, the Consultant (Dar Al-Handasah) will prepare a general framework and action plan for industrial waste management, including the need for and location of centralized waste management facilities plus institutional and regulatory measures necessary to implement the plan.

In Phase I, the Consultant surveyed 932 industrial establishments (out of the 22,000 plus operational industrial units nationwide) and sampled and analysed liquid waste, solid waste, and air emissions at 96 establishments. The Consultant also analysed water samples from 25 river points. The Phase I report identifies the types of raw materials used and wastes generated by different industry sectors. It also provides results of the sampling and analysis campaign at the 96 industrial units and the 25 rivers. The report does not indicate the number of samples analysed for each plant or river (only one sample or more?) and how the samples were taken and analysed (which laboratory, sampling and analysis protocols, etc.). Also, the Phase I report does not compare measured concentration levels to existing national or international standards, nor does it estimate the quantities of waste generated by different industry sectors (e.g., using industry-specific default values[1]) or identify priority industries or wastes based on waste quantities and risks to human health and the environment. It is not known whether the Phase II report will address these issues.

5.6 Capacity 21 Project in Lebanon

A two-year Capacity 21 project was initiated in Lebanon in November 1994 to "establish an enabling environment for integrating the principles of sustainable development in Lebanon." Funded by a $550,000 grant from UNDP and a $60,000 grant from UNEP, the project's components included the following:

- Establish a national environmental code and sectoral laws and regulations.
- Train 75 decision makers in environmental impact assessment and draft guidelines, procedures, and technical manuals for EIA
- Develop a program for an efficient operational environmental information management system
- Prepare an equipment acquisition and training plan and supply priority equipment for environmental monitoring
- Formulate a communications program on the concept of sustainable development.

The Capacity 21 project has been extended beyond the initial end date of September 1996.

Evaluation of the Capacity 21 project is beyond the scope of this report. However, based on conversations with different parties from both the public and private sectors, it appears that the project is struggling to achieve its objectives. For example, to the extent MOE staff have not been closely involved with the various project activities, capacity building within MoE remains an elusive goal. This may have resulted from a lack of clear emphasis in the project design on MoE staff participation. For example, the Capacity 21 project called for training 75 decision makers in EIA and drafting EIA guidelines and procedures. However,

[1] See for example the techniques for rapid assessment of sources of air, water and land pollution as recommended by WHO [19] and applied in a number of studies. The same approach is used in a model developed by the World Bank.

experience elsewhere (Syria, Morocco, etc.) suggests that EIA procedures are best developed by a core team of MoE staff, who receive special training in EIA and, with technical assistance from specialized experts, work with other ministries to develop national EIA procedures.

5.7 Government Incentives for Industry and Environment

The 1995 METAP report [10] prepared for the Ministry of Environment, recommended the use of economic incentives in the form of:

- Adequate pricing of natural resources, in particular water and energy
- Cost recovery for environmental services (solid, industrial, hazardous and hospital waste, wastewater)
- Pollution charges, either penalties and fines for non-compliance or permit fees and charges proportional to pollution levels.

Although public water supply prices have gone up in recent years, most industries (using private wells) are probably not paying an adequate price (if any) for water. Sharp increases in electricity prices have also been implemented by Electricité du Liban, but full cost recovery has not been attained yet. Establishing service charges for solid waste and wastewater services remains very controversial politically; meanwhile, solid waste collection and disposal services are either paid for directly from municipal budgets or funded directly by the Council for Development and Reconstruction, as in the case of Greater Beirut. There are no government attempts to levy pollution charges of any kind. As well, there are no tax exempts, soft loan arrangements or other incentives aiming at stimulating the introducing cleaner production technologies in the industry.

As mentioned in section 5.3, IDAL is siting new industrial areas and simplifying the industrial permitting process. However, there are no incentives for use of cleaner technologies and for pollution control, no disincentives against pollution (e.g., penalties and fines for failing to meet pollution standards, pollution charges), and no cost recovery mechanisms for environmental management services (solid waste, wastewater). Although industrial areas and free trade areas are being established or expanded, the government is not committed to investing in the infrastructure which may be required. Nevertheless, IDAL envisions infrastructure restructuring as part of its development plan. This includes the development of primary road networks, sanitation systems, internal building rules specific to each industrial area, as well as coordinated landscaping initiatives.

6. ASSESSMENT OF INDUSTRIAL ENVIRONMENTAL PROTECTION

As distinct from a developing country Lebanon has a contrast between an advanced country and one that because of a long war is underdeveloped in a number of key areas creating large environmental problems. In addition there is a legacy from the war of enormous quantities of domestic and industrial waste dumped in an uncontrolled way; also the water table and rivers in some districts are polluted.

To obtain hands-on data on the status of environmental protection in the Lebanese industry, the team visited a number of companies in various sectors, mainly in the Greater Beirut area. The limited time

available did not allow for a representative coverage of the selected sectors. Hence, the collected data should be considered as "snap-shots" of environmental problems faced by the Lebanese industry, rather than an comprehensive assessment. However, based on consultation with researcher working in the field of occupational health [12], and a general review of data from the industrial sector [11, 13], the team felt that the observed environmental problems might be typical for the sectors visited. On an overall level, it is obvious that the lack of environmental expertise and financial resources, in particular related to waste minimisation and treatment in the industry, has contributed substantially to the general deterioration of the environment.

It was also apparent that in Beirut the large amount of building activity has substantially increased the dustiness of the atmosphere. The dust pollution caused by building operations is difficult to control and in any case will diminish as the reconstruction work is completed. Furthermore, visual observations in Beirut indicated low level inversions, particularly early morning on sunny days. Photochemical smog caused by the reaction of nitrogen oxides, hydrocarbons emitted from vehicles and U.V. was evident. It was not possible to assess the incidence of "acid rain", but on occasions the meteorological conditions are likely to produce this phenomenon particularly on the mountain slopes.

Exhibit 6.1 shows the classification of industrial sectors in Lebanon[2] and sectors were the UNIDO Team visited one or more companies.

EXHIBIT 6.1
Classification (ISIC, ver.3) of industrial sectors [11] and sectors visited by the UNIDO Team (■)

Major sectors in Lebanon

- ☐ 15 - Food products and beverages
- ☐ 18 - Wearing apparels, fur
- ■ 20 - Wood and wood products
- ■ 28 - Fabricated metal products
- ■ 36 - Furniture and other goods

Other sectors

- ☐ 14 - Mining and quarrying
- ☐ 16 - Tobacco products
- ☐ 17 - Textiles
- ■ 19 - Leather and leather products
- ■ 21 - Pulp and paper products
- ■ 22 - Printed matter and recorded media
- ☐ 23 - Coke and refined petroleum products
- ■ 24 - Chemical products and man-made fibers
- ■ 25 - Rubber and plastic products
- ■ 26 - Non-metallic mineral products
- ■ 27 - Basic metals
- ☐ 29 - Machinery and equipment
- ☐ 31 - Electric machinery and products
- ☐ 32 - Radio and communication equipment
- ☐ 33 - Medical, optical, watches and clocks
- ■ 34 - Motor vehicles and trailer
- ☐ 35 - Other transport vehicles
- ☐ 45 - Construction work

[2] The industrial classification systems used in the Industrial Census for Lebanon is Revision 3 (1990) of the International Standard Industrial Classification (ISIC) system. The different codes used in ISIC Ver. 3 and ISIC Ver. 2. may lead to confusion. For example, while "Manufacture of food products and beverages" is classified as ISIC 15 in version 3, this sector is covered under ISIC 31 in Version 2 (with some differences at sub-levels).

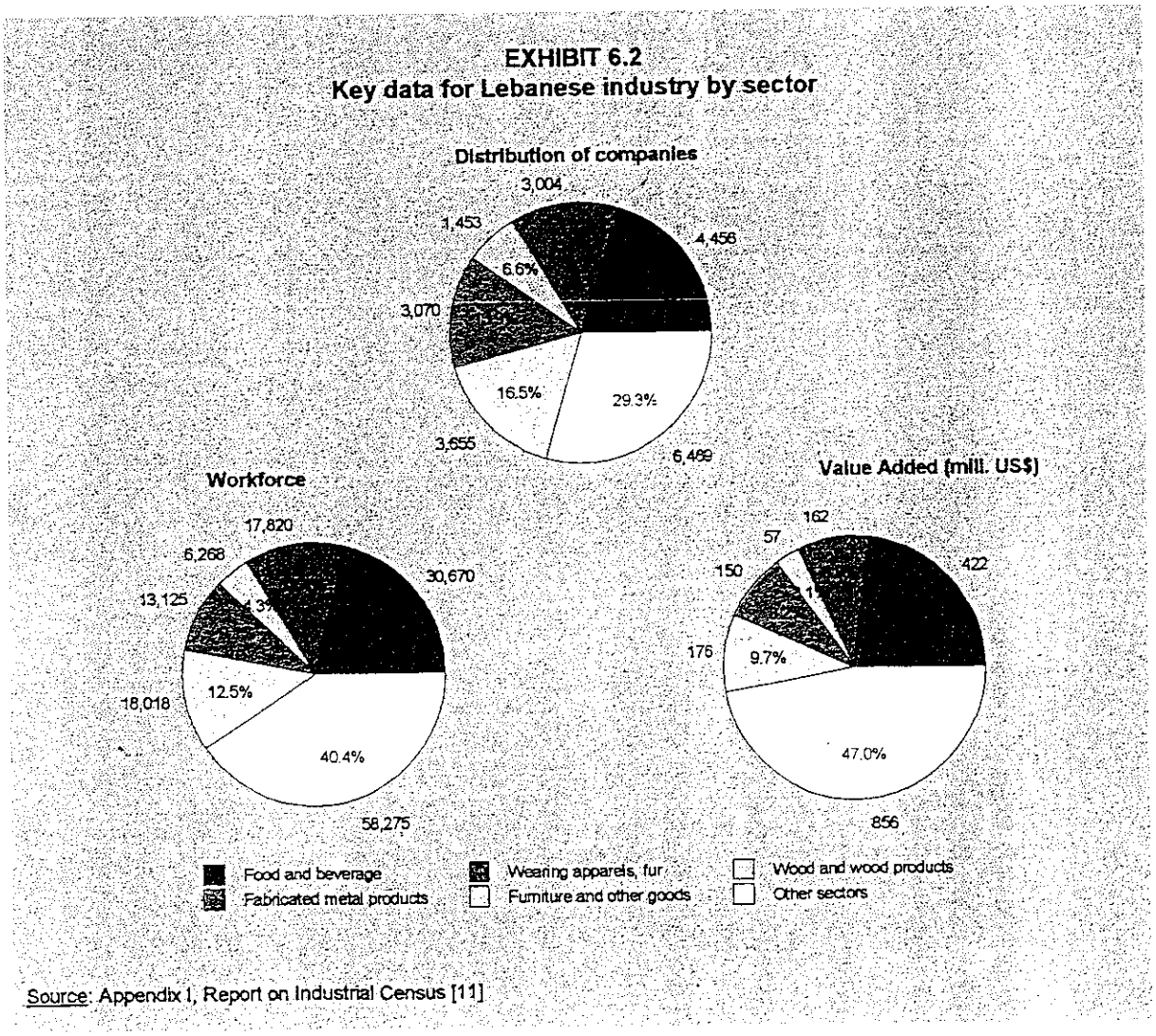
Excluding the "Food Products and Beverage" sector from the total, the industrial sectors represented by the companies visited account for 64% of the total workforce, 69% of the total number of companies and 62% of the total value added. Section 6.2 provides summary reviews of the industries

6.1 Industrial structure

The most important source of up-to-date information on Lebanon's industrial sector is the 1994 Census of Industrial Enterprises, undertaken by the Ministry of Industry and Petroleum with funding support from GTZ (the German international development agency) [11]. It provides comprehensive data on the industrial sector in Lebanon. Although environmental issues were not addressed, it indicates important structural constraints which have to be addressed carefully in a strategy for pollution reduction and improved environmental management in the industrial sector. These are mainly related to the size and the geographical and sectoral distribution of the companies.

Exhibit 6.2 shows the concentration of activities according to major industrial sub-sectors. More than 70% of the companies are working in five sectors: food and beverage; manufacturing of furniture; clothing; metal products; and wood products, and employ about 60% of the workforce.

EXHIBIT 6.2
Key data for Lebanese industry by sector



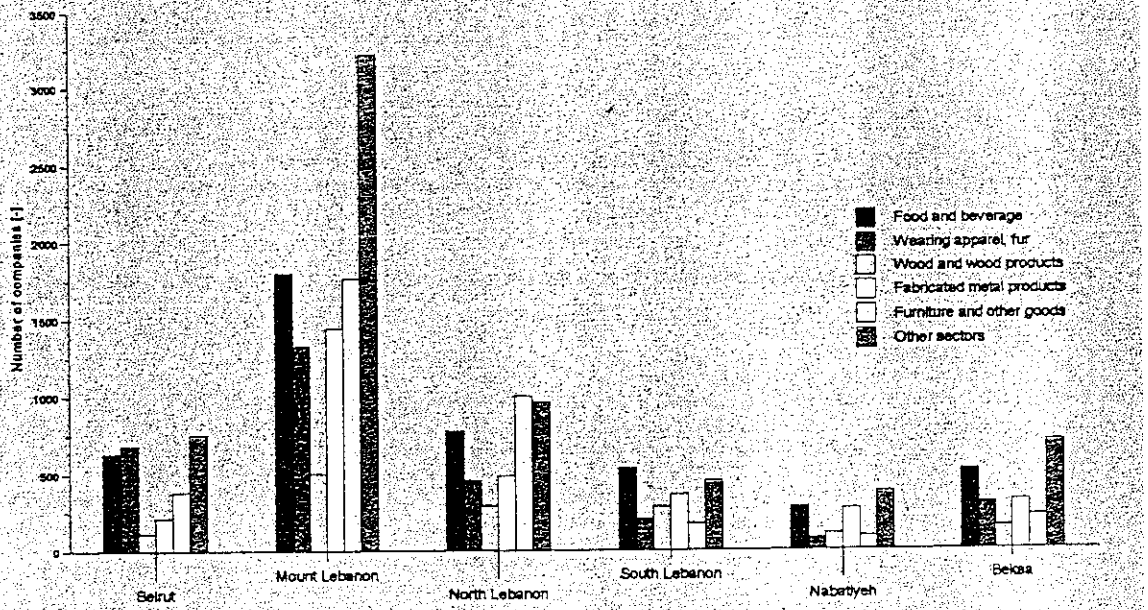
Source: Appendix I, Report on Industrial Census [11]

Total industrial output in 1994 was estimated at $3.72 billion, with an added value of $1.83 billion or about 20 percent of the 1994 GNP. Detailed figures for all industrial sub-sectors are given in Annex F.

As mentioned in section 5.3, IDAL has developed a new classification system for industries and industrial areas [8], where an environmental/health index is developed for each industrial sectors according to the ISIC system. Also in connection with the National Industrial Waste Management Plan, data management systems has been developed [13]. By combining this with the MoIP's database from the Industrial Census, environmental aspects can be incorporated in the spatial and economic analysis of the Lebanese industry. This will provide a powerful decision support tool for establishing more integrated industrial development plans, in particular if utilizing Geographical Information System (GIS) technology [3].

Exhibit 6.3 shows the distribution of industrial units by type of industry and region (*Mohafaza)*, based on the 1994 census. Of the 22,107 operating industrial units nationwide, about 20,000 units are located in the coastal zone (or 85 percent) and employ about 125,000 persons (or 89 percent of the total industrial workforce of about 140,000 persons). Industries are concentrated in Central Lebanon (Greater Beirut Area and Mount Lebanon), which comprises 57 percent of industrial units and 70 percent of the industrial workforce.

EXHIBIT 6.3
Distribution of companies by sector and region (*Muhafaza*)



Source: Appendix I, Report on Industrial Census [11]

With the exception of a few larger plants (cement, construction materials, clothing and food processing), the industrial sector is fragmented and made up of small enterprises, many of which are unlicensed (e.g.,

[3] GIS would also provide the appropriate platform for interlinking with planning in other sectors. In this respect, reference is made to the work carried out by FAO under the TSS-1 project "Environmental Information System for Natural Resource Conservation and Use in Lebanon" (1996).

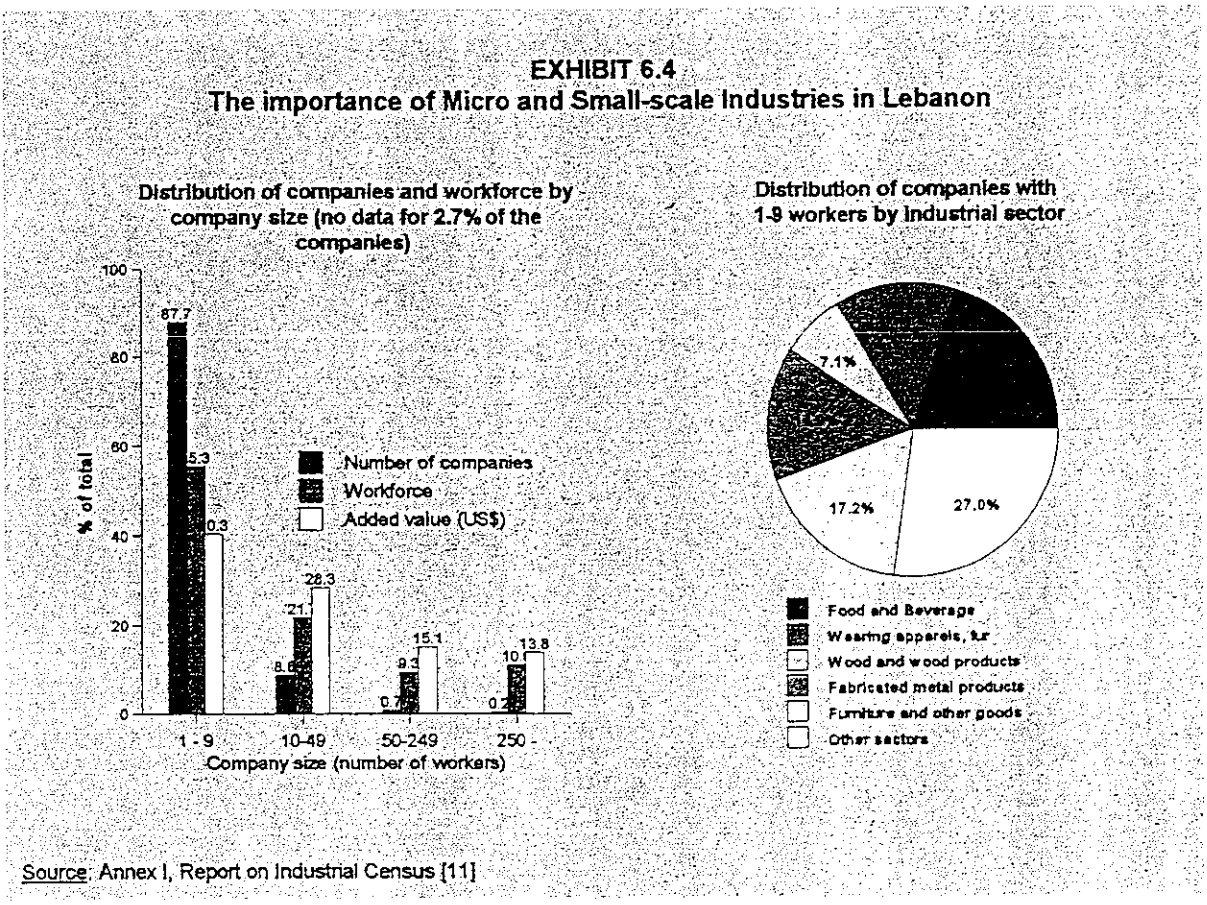
in the southern suburbs of Beirut). Exhibit 6.4 shows the relative importance of micro and small-scale industries in Lebanon.

Close to 90 per cent of Lebanese industrial firms have less than 10 employees, only 78 industrial companies employs more than 100 people and only 35 more than 250. Although the smaller companies represent 90% of the whole, they employ only 55% of the total workforce, provide 37% of the salary charges and contribute to less than 35% of the total turnover.

The distribution of companies with less than 10 employees according to industrial sectors, indicates that 73% of the smaller companies are operating in the major sectors: food and beverage (20.3%); furniture and other goods (17.2%); fabricated metal products (14.9%); wearing apparels (13.6%) and wood and wood products (7.1%). As for the other sectors, 7.4% of the companies are operating in the non-metallic mineral products sector. The remaining 20% of the smaller companies are spread over a wide range of sectors.

Due to their large number and their typical concentration in commercial or residential areas, small industrial firms represent a significant environmental problem for Lebanon.

EXHIBIT 6.4
The importance of Micro and Small-scale Industries in Lebanon



Source: Annex I, Report on Industrial Census [11]

The occupational health and safety of workers in the micro and small-scale industries sector is of immediate concern. Previous studies [12], as well as observations by the UNIDO team (see next section), indicates an overall disregard for occupational health hazards in smaller industrial establishments. There is an urgent need to improve the use of personal protection and taking measures to reduce levels of

exposure in working activities. In spite of the enthusiasm and willingness to change among several managers, the economic recession and the lack of regulation and control represents a real obstacle. This is further complicated with the lack of proper infrastructure [12].

6.2 Review of Sectors Visited

The following are summary reviews derived from visits made by the UNIDO Team to a limited sample of industrial companies. The majority of the companies visited were smaller industries located in the Greater Beirut area.

- *Leather and Leather Products*
  Under this classification the various stages in a tannery operation results in aqueous wastes containing sodium hydroxide, sulphuric acid, organic solvents, chromium and suspended solids which are disposed of via open channels to the sea. Over 50% of the total input of hides are thrown away and present an opportunity for bi-products. Support was expressed for a number of the tanneries to be re-located with the possibility of having a shared waste recovery plant.

- *Pulp and Paper Products*
  The industry visited was an example of selected paper re-cycling. The working environment is satisfactory. Areas for improvement are: (i) flocculation and flotation; (ii) steam and energy generation; and (iii) re-cycling of water and minimization of evaporative losses. It was suggested by the operators of the plant that compacted solid waste could be disposed of in a nearby quarry. Providing the landfill is operated properly this appears to be satisfactory.

- *Chemical Products and Man-made Fibers*
  The manufacture of paint was well controlled with good analytical techniques. Prepared raw materials were mainly used and a bench-type system for solvent recovery has been developed.

- *Wood and Products of Wood*
  Working environment poor and worker protection for operatives hazardous to health not used. High efficiency spraying equipment would reduce waste and improve the environment. Extraction and collection of sander dust is recommended.

- *Basic Metals*
  Simple iron cold-blast cupolas are used with no abatement systems. Their operation produce large amounts of fume and this will pollute the area.. For the production of aluminum and bronze castings small melting pots are used. For future development of these activities it is recommended to use electric induction furnaces, thus producing virtually no fume. To make this an financially feasible option, it is suggested that the furnaces could be installed and shared on a joint venture basis by operators of cold-blast cupolas. Furthermore, the disposal of waste slag can contain toxic chemicals and care should be taken in its disposal.

- *Rubber and Plastic Products*
  The production of pipes and fittings with recycled PVC did not appear to present any environmental problem as any scrap was returned to the factory producing the PVC pellets. The internal working environment was satisfactory using an extraction system to the outside atmosphere. External pollution is minimal. A factory producing polypropylene bowls and general plastic items (30

tonnes/month) was well operated and the working environment was good. The amount of waste products was low.

- *Printed Matter and Recorded Media*
  Offset litho is used for printing a range of black and white and colour on paper or card. The composition of the printing inks was not given, but presumably they are solvent based. Surprisingly the machines are cleaned with petrol and together with sweepings of off cuts are incinerated. A contract is arranged for re-cycling the paper and card. A problem is the need to operate its own diesel electric generators for about 12 hours in every 24 hours which produces noise and air pollution.

- *Motor Vehicles and Trailers*
  Car maintenance throughout Lebanon is a large business and covers:- paint spraying, welding, engine, radiator and tyre repairs. Although collection systems are available in some areas, with recovery of up to 90% of the sump oil, it is more common to discharged the oil directly into the sewer system [12]. There does not appear to be an oil treatment/re-cycling scheme - presumably the oil is blended and burned in combustion systems. The occupational activity presented most problems in paint spraying and welding.

- *Fabricated Metal Goods*
  The construction of kitchen equipment and other stainless steel products were produced using argon arc welding. The welding procedures were not observed, but extraction of the fume containing nickel and chromium is most important to avoid worker exposure to it.

- *Non-metallic Mineral Products*
  A visit was made to a cement works in the Chekka area. Extensive discussions were held with plant management and technical personnel. A separate report from this visit is attached as Annex G, and was submitted to UNDP, MoE and the company during the mission.

6.3 Awareness of Environmental Legislation

As discussed in Section 5.2, pollution standards for water, air and soil were recently promulgated by a decision of the Minister of Environment (Decision 52/1, July 29, 1996). However, the decision did not explain the rationale for these pollution standards; also, MoE failed to communicate these standards to the regulated community or to put in places the necessary procedures for compliance monitoring and enforcement. It is not surprising, therefore, that most industries remain unaware of these standards, as evidenced by a quick survey conducted during the seminar and at the various meetings with industry representatives. For example, the Chamber of Commerce and Industry was not aware of the existence of these standards; at their request, we were happy to provide them with a copy of Decision 52/1. Also, the Association of Lebanese Industrialist (ALIND) was quite puzzled to learn that MOE's draft EIA decree would require all industrial units to submit an EIA, regardless of size and industry type.

Clearly, any environmental decree promulgated without the participation, in one form or another, of the regulated community would not be likely to be implemented. Negotiated agreements have produced successful results in the past, such as in the case of *SIDEM*, an aluminum plant that reached a negotiated agreement with MoE (under H.E. Minister Samir Mokbel) to gradually phase out environmentally-unsound waste disposal practices (chromates, sulfates, and cyanides).

It is hoped that industrial environmental awareness will increase in the trails of increased public environmental awareness. In the past few years, the environmental "movement" has gained significant momentum in Lebanon; various NGOs have been very active at the national and grass-root levels in promoting environmental concerns. One recent example is the public outcry over "deteriorated health conditions in Chekka" following the death of three people in a very short period of time. Local populations and NGOs accuse local industries (cement and cement-asbestos plants) of releasing dangerous pollutants into the air above acceptable levels. The Ministry of Environment has set up a committee of local NGOs and population representatives, local industries, and academia to study this problem and find acceptable solutions.

7. ENVIRONMENTAL CONCERNS AND POLICY RECOMMENDATIONS

Based on an analysis of existing environmental policies and industrial activities in Lebanon, priority areas and recommendations for strategic objectives and immediate actions have been identified. Considering the aim of the project in terms of providing inputs to policy formulations, the primary focus has been given to identifying areas where the MoE, in cooperation with other ministries, institutions and the private sector, may play a significant role in steering the country towards sustainable industrial development.

7.1 Critical Environmental Issues for Industry

Lebanon is facing severe environmental problems. The industrial sector is a major source of water pollution and solid waste. Air pollution from industry is less critical, but does represent a significant local problem in certain industrial areas. Environmental problems are threatening the sustainability of major economic sectors (in particular future tourism development) and have in some areas significant impacts on the quality of human life. The following summarizes critical issues and environmental problem areas in the industrial sector where assistance from the government may be required:

- Close to 90% of the industrial establishments are companies with less than 10 workers, and with activities concentrated in a few major sectors (see Exhibit 6.4). Small-scale industries are typically located in, or close to, residential areas. To improve the long-term environmental performance of the industrial sector, the following issues will therefore have to be addressed by the government: (i) the need to relocate industrial activities from residential areas to dedicated industrial zones; (ii) the complexity in controlling and enforcing environmental compliance for large number of small-scale industries; and (iii) the lack of sufficient financial resources and environmental knowledge and expertise in small companies to meet environmental requirements.

- Occupational health and safety issues for workers in small-scale industries are far from adequately addressed, and may represent a substantial social problem. Due to lack of information, even simple measures to reduce work hazards are generally not applied. Hazardous substances appear not to be properly labelled. It is not clear if a mandatory labelling system exists.

- Some geographical areas (e.g. *Chekka*) and industrial sectors (e.g. cement, tanneries) are facing particular environmental problems which call for a more integrated approach to environmental

management and industrial development planning, involving all stakeholders in the private and public sectors.

- Due to lack of capacity in power stations and the electricity grid, only parts of the electrical energy requirements for Lebanon can be generated by central power plants. The use of small emergency type diesel/electric generators are common in the small-scale industries sector, and is a substantial source of local air pollution and noise. In addition, the fuel efficiently is low.

- The Lebanese industry, in particular smaller companies, are generally not familiar with the concept and benefits of cleaner industrial production. Cleaner production seeks to reduce the generation of waste in the production process and makes it possible to save material, water and energy and thereby increase the process efficiency. Investments in cleaner production have often short payback periods and may improve competitiveness and profitability of the company. Introduction of cleaner production, ranging from simple house-keeping measures to substantial process modifications, represents a significant potential for improving environmental performance of many companies. However, identification and implementation of cleaner production options require specific expertise and investment capital, which are generally not available for the majority of small-scale industries. Moreover, there is no technical support, information or incentives available from the Government, industrial associations or research institutes. On the positive side, some cleaner production expertise exists in environmental consulting firms and within a few industrial companies, and there seems to be a lot of enthusiasm for cleaner production both in the Association of Lebanese Industries (ALIND), the MoE and industry-related support institutions, such as the Industry Institute.

- Environmental Management Systems (EMS), and related standards and recommendations outlined in the ISO 14000 series, provide an enterprise-level framework for addressing the overall environmental performance of a company, including its organization, processes and products. Certification of a company according to ISO 14001 and similar standards is becoming a competitive advantage, if not a requirement, for companies operating in certain sectors in international markets. The concept of EMS implies among others that the company is responsible for monitoring its compliance with environmental standards, that an environmental track record is kept, and that any deviations are reported to the authorities. If properly implemented, a self-monitoring scheme will reduce the resources required by the regulatory body to monitor compliance. On the other hand, it is only feasible when there is a clear benefit to the regulated community and when sufficient capacities exist at company level. Identifying and implementing cleaner production solutions would be an integrated activity within the framework of EMS. Although an attractive long-term option for environmental management in Lebanon, it is felt that within the immediate future the majority of the companies do not have the capacity nor the incentives to meet their obligations under a self-monitoring scheme.

7.2 Shortcomings in Environmental Policy and Management

Presently, there is no efficient system for issuing permits for industrial operations or to control industry compliance with environmental requirements. With new industrial environmental laws and regulations in place or under development, it will be of critical importance to establish an efficient environmental compliance control and enforcement mechanisms. This has to be done in close cooperation with all

relevant ministries, and should include a comprehensive dialog with the industry. The following summarizes the status and some critical concerns for environmental policy and management:

- Environmental pollution standards has recently been introduced by the MoE based on standards applicable in developed countries. This has been done withouth consulting relevant stakeholders, including other ministries, and without devising an appropriate mechanism for implementation and enforcement. Industry and industrial associations are in general not aware of these regulations.

- Law 216, which created the MoE, provides for an Intervention Department within the MoE to monitor and enforce industrial compliance with environmental laws and regulations. The MoE has not yet established such a department, and is facing a critical shortage of financial resources and expertise required to carry out such a function. As well, the fact that most of the enforcement power lies with the Ministry of Interior, implies that MoE does not always have the means to enforce legal requirements falling under its jurisdiction.

- The coordination on environmental matters between the MoE and the other ministries is not adequate, leading to conflicting decisions and lack of a consolidated approach and an efficient strategy to solve national environmental problems. For example, while the UNIDO Team was in Lebanon, the Council of Ministers took a decision to close some quarries immediatly. Several days later, the Minister of Interior acknowledged that these quarries were still operating!

- A decree for Environmental Impact Analysis (EIA) of all industrial activities has been drafted by the MoE with technical and financial support from UNDP's Capacity 21. This has not yet been approved by the Council of Ministers. In general, no EIA is carried out for industrial and infrastructure projects financed by the private sector or directly financed by the Lebanese Government. The staff of the MoE, the line ministries and CDR are not familiar with EIA proceedures. Large scale projects supported by international donor agencies appears to be subject to an EIA, but it is not known to which extent the government is following this through. IDAL is requiring EIA to be submitted for BOT projects in free trade zones and industrial areas, but has not conducted an EIA of its comprehensive industrial restructuring programme.

- A draft decree would establish an inter-ministerial committee with responsibility for issuing and extending industrial permits according to the new classification system established by IDAL. However, it is unclear what mechanisms are foreseen for monitoring and enforcing compliance to the conditions of the permits. Although proposed centralized, there is an obvious shortage of technical and financial capacity to undertake these tasks. With planned decentralization of environmental inspections to the *Mohafazat* level after the transition period, the need for a substantial programme on training and investment in equipment will become even more critical. Furthermore, it is not clear if the initiative covers both existing and planned industrial establishments and to what extent it is concerned with areas outside the defined industrial zones.

- There is no active use of economic instruments to reduce environmental problems and promote pollution prevention. Water and electricity are not adequately priced, charges for wastewater treatment and solid waste services are generally not implemented, and there is no government attempt to levy pollution charges of any kind. There are no economic incentives for introducing cleaner production measures in the industry. Although dedicated industrial zones are promoted all over Lebanon, no real incentives exist for small-scale industry to relocate to these areas. It is also not clear if the required infrastructure within the zones will be financed by the Government.

7.3 Status on Monitoring Capacity

Institutional capacity for environment-related monitoring and analysis is of critical importance for environmental management and the implementation of an industrial compliance control programme. Environmental monitoring deals with environmental quality and ecological processes, releases to the environment and ambient concentrations, while plant-level monitoring focuses on the industrial processes themselves, input materials and energy, and residues discharged from the processes. Principal objectives for monitoring of industrial emmisions and wastes includes [23]: (i) process optimization; (ii) auditing; (iii) compliance with emmisions standards and consents; (iv) quality control; (v) occupational health and safety; (vi) environmental reporting. The following summarizes the status on monitoring capabilities in Lebanon:

- Basic capacity for environmental monitoring and analysis, including monitoring of ambient pollution concentrations in water, air and on land, exists at the universities. The Interfaculty Group for Environmental Research at the American University of Beirut (AUB) is a good focal point. The required expertise is available and upgrading of laboratory equipment is in process. However, there is no integrated national environmental monitoring programme, and little cooperation exists between the different universities. Also, the focus at university-level is by nature more on environmental reasearch than monitoring *per* se.

- The Faculty of Health at AUB is doing research in the field of occupational health and safety, but has limited monitoring capacity. The Ministry of Health is responsible for inspecting working conditions in industrial establishments, but has a lack of health inspectors and laboratory capacity. Support to an expanded training programme and related activities has been promised by international donor agencies.

- There is a lack of capacity to undertake plant-level monitoring to support activities such as waste audits, process improvements, environmental reporting, compliance inspections and certification. With sufficient investment in equipment and expertise, existing institutions will be capable of carrying out these activities in a joint cooperation with the MoE and industrial associations. Some industry-affiliated laboratories have expertise in basic process optimization and waste reduction for specific activities, including paint manufacturing and paper recycling.

- Several initiatives are underway to strengthen the capacity of existing institutions to provide laboratory and monitoring services to industry and authorities. This is also the case for related services such as standardization, information networking and industrial R&D. However, efforts are generally not coordinated and are causing unnecessary competition and conflicts between the various institutions as well as their promoters. This lack of collaboration and the fact that there is no consolidated governmental strategy on "what shall be monitored and by whom", may lead to an inefficient use of the limited funds available.

7.4 Towards a Strategy for Sustainable Industrial Development

In establishing a strategy for sustainable industrial development in Lebanon, all critical issues, of which some are pointed out in this report, need to be analysed with the aim of setting realistic short- and long-term goals and priorities. Which problems can be solved in the near future with existing or additional resources? How can additional resources be made available? How should the various activities be

prioritized? Which problems can only be solved through long-term changes in policies, attitudes and capabilities? What actions can be taken today towards reaching long-term goals? How do we involve all relevant stakeholders and decision-makers? And finally, how do we integrate and prioritize industrial development within an overall strategy for environmental protection and sustainable development across all socio-economic sectors?

Although industry and environment is the main focus of this report, we would like to emphasize that the assessment of environmental concerns and needs should be made based on the overall situation in the country, and with a view to identifying integrated solutions.

The need for similar pollution monitoring services in different sectors is a good example: While atmospheric pollution from industry is not a major concern in Lebanon, emissions from motor vehicle represents an acute air pollution problem, particularly in Beirut. In an overall assessment, air pollution monitoring therefore becomes a high priority issue, due to the need to estimate health impacts and justify appropriate policy measures in the transport sector[4]. The basic requirements for ambient air pollution monitoring can be covered by the application of low-cost equipment and methods similar to what is required for source monitoring of industrial processes. In looking for cost saving solutions, it therefore makes sense if the same institution responsible for industrial monitoring also is responsible for monitoring ambient concentrations from vehicle emissions.

Another example of the need for cross-sectoral planning is the constraints imposed on manufacturing industry by the low capacity in central electric power stations and related infrastructure. A large share of micro and small-scale industries are forced to use small and inefficient diesel/electric generators, which are causing significant local air pollution and noise. The increase in electric energy demand from phasing out the use of local power generation facilities in industry has to be taken into account when planning new investments in the energy sector. An integrated strategy should reflect priorities to reduce noise and pollution in specific geographical areas as well as plans and incentives for relocation of industries.

The overall goal for sustainable industrial development strategies is to integrate and balance over time the objectives of environmental protection and sustainable use of natural resources with those of industrial competitiveness and employment generation. Policies addressing environmental issues in the industrial sector need to take account of this, and should cover in an integrated manner the following areas:

- Environmental laws and regulations, including policy for control and enforcement.
- Institutional structure and capacity to implement a compliance control programme.
- Capacity of industry to respond to environmental requirements.
- Support and incentives mechanisms for industry to improve its environmental performance.

The role of environmental regulations is to modify industry's behaviour in order to reduce the environmental damage associated with industrial production. Environmental standards for industry specify the required pollution control activities or the permitted amount of pollution discharges, and may be defined in three ways[5]:

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[4] An appropriate policy would be to introduce fiscal (tax) measures to increase the use of unleaded fuel. This measure will facilitate the possible use of 3-way catalysts in the longer term. Improvement in the public transportation system and traffic management schemes to improve traffic flow and reduce pollution is also required.

[5] For a more comprehensive coverage of this subject reference is made to UNIDO's Training Course "Ecologically Sustainable Industrial Development - Learning Unit 7: The role of Government in Industrial Environmental Management" (United Nations publication, Sales No. E.94.III.E.2, ISBN 92-1-106291-8)

- Technology-based standards require industry to reduce pollutant discharges based on the expected performance of the available technology, but do not consider the effects on the environment. Government regulators usually prefer technology-based standards because they are easy to administer. Industry usually find them too expensive for the results achieved.

- Ambient-based standards require industry to reduce pollutant discharge to the extent necessary to achieve a defined ambient concentration level or condition; they do not consider costs. Government regulators find the procedures to link industrial pollution discharges to ambient standards and also assigning responsibility for violations to individual sources difficult and costly. Industry likes ambient standards because they direct scarce resources to the more serious problems.

- Between these two extremes are benefit-based standards. These require industry to reduce pollutant discharges only to the extent that there would be a reasonable balance between the benefits and the costs of the measures. Government regulators find it difficult to set benefit-based standards because of the need for extensive data collection and analysis. Industry encourages this type of standard.

While environmental laws and regulations are in place or under development, the other areas have not been adequately addressed by the Government. A key strategic objective for environmental policy in Lebanon would therefore be to establish the required institutional framework and technical capacity to monitor, promote and enforce compliance, while at the same time seeking to establish enabling mechanisms to build the required industrial capacity to comply with regulations. The ultimate goal should be to create an atmosphere in which most of the regulated industry chooses to comply. A compliance control programme normally covers the following functional areas:

- Issuing of permits reflecting the specific location and type of enterprise and the general environment laws and regulations. The permit system should to the extent possible consider pollution discharges to air, land and water in an integrated manner.

- Monitoring of industry compliance to conditions of the permits. This may be done through self-monitoring by the industrial plant, independent inspections, citizen complaints and/or ambient monitoring.

- Implementation of measures to encourage and compel compliance. This include enforcement of permit conditions with informal, administrative, civil and criminal sanctions. Without enforcement, some industrial plants will not comply with the regulations. If this situation becomes too common, there will be general non-compliance, and the regulatory programme will be ineffective.

It general, a politically independent environmental protection agency with a clear mandate, wide political support and technical and operational capacity in the above areas would provide the most optimal mechanisms for implementing a compliance programme. However, in the case of Lebanon, with the limited resources available and with the MoE trying to establish its role in environmental management, it is felt that a more appropriate strategy would be to strengthen the capacity of the MoE to undertake this function. Within such a framework, it is recommended that accredited laboratories and institutes are utilized to provide the required monitoring and analytical services, while the MoE will be responsible for the overall management of permitting, inspections/audits and compliance enforcement. It is critical that the MoE is given the mandate to initiate enforcement actions, and that appropriate enforcement mechanisms are established. In the longer term, the functions undertaken by the MoE might be transferred to an

independent agency, an approach which has been successfully adopted in other countries, for example in the UK. Experience in OECD countries has shown that environmental action requires strong commitment at the highest political level, regardless of the institutional form of environmental management (ministry, agency, part of another ministry). Likewise in Lebanon, neither a MoE nor an independent agency would succeed unless there is a strong and committed political will at the highest level to do something about the environment. Today, the MoE seems to be on the right track and has taken actions which show their willingness to spearhead an effort in the Government to establish a sound environmental policy.

The adopted environmental standards and regulations are very ambitious, and do not necessarily reflect the specific situation in Lebanon. With the present lack of financial resources and environmental expertise in the industry, too strict standards would fail to provide realistic and achievable targets for the majority of the companies. This makes it very difficult, both in terms of political willingness and cooperation with industry, to introduce an effective compliance monitoring and enforcement programme. And without this in place, environmental laws and regulations will have no real impacts.

In moving towards the goal of sound environmental standards and industry compliance, it is recommended that the Government adopts a strategy where environmental requirements gradually are introduced in cooperation with industry and other stakeholders. This may include the establishment of interim environmental standards and the negotiation of compliance schedules (action plans) reflecting the specific characteristics and capacities of the various industrial sectors and company categories (size), as well as environmental concerns and priorities related to specific geographical areas. To facilitate the introduction of stricter standards and possible relocation of industries, it is mandatory that adequate economic incentives/disincentives and support measures are introduced by the Government, and that the industry have access to the information, technical expertise and financial resources required for the identification and implementation of effective pollution prevention and control measures.

Experience from both developed and developing countries has shown that when combined with appropriate policy frameworks, cleaner production represents a cost-effective strategy for reducing the overall pollution load from industry, as well as improving the working environment. Exhibit 7.1 summarizes financial impacts from an UNIDO cleaner production demonstration project for small-scale industry in three industrial sector in India.

EXHIBIT 7.1
Example of financial impacts of implemented cleaner production options

Financial indicator	Pulp and paper industry	Pesticides formulation industry	Textile dyeing and printing industry
Investments	US$ 347, 000	US$ 23,550	US$ 50,650
Net annual savings	US$ 672,000	US$ 20,850	US$ 244,500
Pay back period	6 months	< 14 months	< 3 months

Source: Final report of the project *Demonstration in small Industries for Reducing Waste (DESIRE)*, UNIDO 1995 [25].

While there is a significant potential for cleaner production in Lebanese industry, the capacities to identify and implement such solutions are generally lacking. It should be a long term strategy of the Government to promote and support cleaner production and to develop policies that fosters waste minimization.

It should be recognized that technology-based standards specifying end-of-pipe treatment may actually discourage a cleaner production approach, while regulations that allow industry latitude in choosing least-cost solution are more likely to promote cleaner production.

The use of economic incentives or disincentives may play an important role in achieving voluntarily reductions in pollutant discharges from industry. It may include pollution charges, tradeable permits and subsidies and enforcement incentives (non-compliance fees). Benefits from using economic incentives include:

- Promote least-cost solutions for solving environmental problems.
- Stimulate the development of pollution prevention and control technology and expertise in the private sector.
- Provide the government with a source of revenue to support pollution prevention and control programmes.
- Provide flexibility in the choice of pollution prevention and control technology.
- Reduce the amount of paperwork associated with environmental regulations.

To be effective, environmental policies for the industrial sector need to provide the right mix of regulations, incentives, control mechanisms and capacity building initiatives. While a wide range of environmental policy measures have been successfully applied in a number of countries, care should be taken in simply copying "success prescriptions" from other countries without considering the applicability under Lebanese conditions. A series of questions need to be answered, with the overall goal to find the right balance between regulatory measures (command-control programmes) and market-based mechanisms for pollution prevention. What can be gained through promotion and implementation of cleaner production in industry, and how can resources be mobilized for such activities? Will the industry be interested in - and willing to - make resources available for pollution prevention activities? How can pollution charges, subsidies and other economic incentives be used to promote and encourage this approach? Do the Government have enough resources to embark on a comprehensive compliance control programme? Are there political willingness and resources available to implement the required enforcement mechanisms? What should be the guidelines for the use of selective environmental standards and negotiated compliance schedules? How will the Lebanese industry react on the increasing demand in international markets for eco-labelling of products and certification of companies according environmental standards such as ISO 14001? Is the industry willing to meet requirements under a self-monitoring scheme if sufficient technical resources were available? What is the best strategy for improving the environmental awareness among micro and small-scale industries? And what is the most effective mechanisms for solving critical environmental issues, including relocation and occupational health, for such industries?

In seeking answers to the above questions, as well as others, the Government is recommended to follow a strategy where a series of demonstration projects and pilot studies are carried out, focusing on limited geographical areas or specific sub-sectors or categories of companies. Based on the experience and lessons learned from such activities, cost-effective policies and methodologies can be developed gradually and adopted on a wider national scale. An integrated action plan, where proposals for demonstration projects and pilot studies are identified and prioritized, would also provide a useful tools for the Government when seeking financial support from international donor agencies and development banks.

Section 8 of this report includes a brief description of selected demonstration projects and pilot studies which we recommend should to be given priority within the above framework, and for which UNIDO could provide technical assistance.

7.5 Recommendations for Actions by the MoE

In moving towards sustainable development in Lebanon, the Government is constrained by the overall shortage in financial resources and available expertise, a situation common to most developing countries. However, as this report has indicated, improvement environmental management is also impeded by the lack of coordination and collaboration at political and institutional levels, where conflicting objectives and overlapping responsibilities tend to reduce the overall decision-making power of the Government in dealing with environmental issues. As well, the government has so far failed to involve the regulated community (industry) when developing and introducing environmental standards and procedures. In the further work to develop an effective legal framework and in order to successfully implement a scheme for compliance monitoring and enforcement, it is essential that a dialogue is established with the industry from the very beginning.

To improve transparency, coordination and stakeholder participation in the formulation and implementation environmental policies, the MoE is recommended to take the following actions:

1. The MoE, supported by the Prime Minister, should spearhead an effort to establish an National Environmental Council with the mandate to coordinate and advice on cross-sectoral environmental issues, particularly in relation to policies and implementation mechanisms for environmental management and sustainable development. In addition to representatives from the various ministries, the Council should have access to an independent scientific advisory group. Important government agencies such as CDR and IDAL, as well as sectoral organizations such as ALIND, should participate as observers on a permanent or *ad-hoc* basis, and provide advice as required. The MoE and/or the Prime Minister's office should assume the Secretariat and/or chairmanship of the proposed National Environmental Council.

2. The MoE should carry out an information campaign to increase the awareness of existing and planned environmental laws and regulations among governmental agencies, institutions, industrial associations and the general public. Sector and/or area-specific workshops should be arranged in cooperation with industrial associations, addressing critical environmental issues and aiming at establishing a regular framework to improve the communication between MoE and the industry. Appropriate procedures should be introduced allowing potential stakeholders to comment on draft proposals before being adopted by the Government.

Poor enforcement is a major weakness of the environmental control system in Lebanon. In moving towards the strategic goal of a nation-wide environmental compliance control programme for industry, the MoE is recommended to take the following actions:

3. The MoE should take the initiative, in cooperation with the MoIP, to negotiate political consensus on the establishment and implementation strategy of a national compliance control programme, including systems for permitting, monitoring and enforcement.

4. Law 216 provides for an Intervention Department (*Moukafaht*) within the MoE to "ensure that all conditions imposed on factories, plants, industrial estates, poultry farms, animal farms, quarries, crushers, asphalt factories and cement plants, are applied in coordination with concerned administrations". The MoE should seek political agreement on its role in monitoring and enforcement of environmental laws and regulations, and should formulate a strategy for short and

long term implementation of its function as set out in Law 216. This should include a costed action plan for capacity building in the MoE as well as in collaborating institutions.

5. In connection with the new permit and inspection system which has been proposed by IDAL for industrial zones [8], the MoE should take action to ensure that appropriate environmental standards and procedures are incorporated. In accordance with Law 216, the MoE should be given the overall responsibility for monitoring and enforcement of these. The coordination of environmental activities could still be done through the inter ministerial committee proposed by IDAL. It is recommended that the new permit and compliance control scheme is gradually introduced through demonstration projects in selected industrial zones. This should be coordinated with capacity building in compliance monitoring and enforcement, as indicated in the above paragraph. (See also Recommendation 15).

In order to strengthen environmental monitoring in Lebanon, there is a need for better coordination of existing activities as well as establishing national plans for investment in equipment and training programmes. Aiming at mobilizing existing and new resources required for ambient monitoring both in the short and long term, the MoE is recommended to consider the following:

6. While mainly universities have the basic capacity to carry out ambient monitoring, and indeed are doing so on a limited scale in connection with research activities, environmental monitoring are not coordinated or undertaken on a regular basis. To avoid overlapping and to ensure that resources are used in the most cost-effective way, the MoE should establish a coordination group for monitoring of ambient pollution levels in water, land and air. The group should be chaired by the MoE and should include universities, laboratories and other major stakeholders. An initial task would be the development of a strategy for a national environmental monitoring programme, where the overall needs, priorities and investment requirements are identified both in terms of monitoring activities and capacity building.

7. In a long term strategy to establish an appropriate institutional structure for ambient monitoring, it seems logical to give the responsibility for advanced analysis, training and research to the universities, while routine monitoring is carried out by specialized institutions. However, with the present lack of qualified laboratories and expertise in Lebanon, a more cost-effective solution in the short term might be to build additional capacities within selected universities to enable them to provide monitoring services on a more regular basis. Through this approach, the capacity required for establishing specialized institutions can gradually be built up, while at the same time maximizing the utilization of existing expertise and equipment.

8. In line with the above, the MoE should seek to utilize the available capacity of universities and other institutions to design and implement simple ambient monitoring programmes, starting with small-scale demonstration projects. With limited additional resources, this may significantly support the MoE's policy-making efforts as well as providing a basis for analysing and prioritizing immediate environmental problems. For example, initial assessment of ambient air pollution can be carried out through the application of low-cost methods such as passive samplers in combination with computer simulations based on point source, topographic and atmospheric data. The capacity to carry out such activities exists, and would provide valuable support to the MoE in evaluating the criticality of industrial air pollution in specific areas.

In terms of plant-level monitoring of industrial emissions and wastes, there is an overall lack of expertise and institutional capacity. At the same time there is a growing demand for assessment of environmental performance at plant level both from authorities and industry. In taking initial actions to improve this situation, the following recommendations are made to the MoE:

9. As part of the long term strategy for the establishment of a compliance control programme, the MoE should decide if the technical services required for plant-level monitoring, in the context of compliance control, should be provided by an governmental agency/department or subcontracted to independent institutions. In making this decision, it should be recognized that such monitoring and analysis services may support a wide range of objectives involving different stakeholders. Also, plant-level monitoring requires sector and process-specific knowledge which is most effectively developed in close cooperation with industry.

11. In the immediate future, Lebanon do not have the resources to create a new environmental agency, being part of the MoE or not. The MoE is therefore recommended to cooperate with other ministries as well as the industry to strengthen the capacity of a suitable existing institution to provide plant-level monitoring services both to the private sector and the authorities. This is considered the least costly strategy for building up a national core expertise on process monitoring, and will provide the basis for a possible establishment of a governmental agency at a later stage.

12. Based on an assessment of the capacity and present and past functions of existing institutions, it is recommended that the Industry Institute is selected as the focal point for process monitoring and analyses, possibly in cooperation with universities and specialized laboratories at sub-sector level. With key stakeholders such as MoIP, MoE(?), ALIND, Chamber of Commerce and CDR being members of the board, the Industry Institute is considered the most appropriate institutional set-up for this task. Although basic technical expertise and laboratories exist, substantial investment in equipment and training is required. Its present facilities provide ample space for offices and laboratories. The MoE in cooperation with the other board members is recommended to work with the Industry Institute to develop a comprehensive strategy for upgrading and refocusing of its activities. (See also Recommendation 18).

13. In connection with the planned revitalization of the Lebanese Standards Institution (LIBNOR)[6], it has been proposed that this institution could be given the responsibility and technical capacity for environmental monitoring and inspections. As indicated above, it is felt that this task should be the responsibility of the MoE and, at least in the short to medium term, executed by accredited laboratories with the Industry Institute to be built up as the main focal point and resource centre. It is strongly recommended that LIBNOR should be strengthen to keep its focus on standardization, certification and metrology, which in themselves are comprehensive tasks of critical importance for Lebanon[7]. In the context of environmental compliance monitoring and control, LIBNOR would have the overall responsibility for the accreditation of laboratories and certification of products and company management systems according to international environmental norms and standards, such as EMAS and ISO 14000. In the initial phase, accreditation of laboratories will have to be carried out by internationally recognized certification bodies.

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[6] LIBNOR was established by the Government in 1962 as the sole authority for the "preparation, issuance and amendment of national standards and the mark of conformity of the country", and has been working throughout the years mainly as an administrative agency, with technical services subcontracted to the Industry Institute.

[7] For more detailed recommendations for the role of LIBNOR, see the project proposal "Strengthening of the Lebanese Standards Institutions (LIBNOR)", which was prepared by UNIDO for the MoIP in 1996.

To facilitate the introduction of environmental standards and the possible relocation of industries, it is mandatory that adequate economic incentives and support measures are introduced by the Government, and that the industry has access to the information, technical expertise and financial resources required for the identification and implementation of effective pollution prevention and control measures. This is particular the case for micro and small-scale industry. The MoE has an important role to play in this respect, and is recommended to take the following actions:

14. The MoE should, in cooperation with stakeholders such as ALIND, MoIP and the Ministry of Finance, initiate a study of micro and small-scale industry in Lebanon with the aim to: (i) assess the overall environmental impacts from this sector, and to identify industrial sub-sectors, issues and geographical areas which should be given high priority; (ii) identify major constraints faced by the small companies in improving their environmental performance; (iii) propose cost-effective and feasible economic incentives which could be introduced to encourage improvements; and (iv) propose other measures which may support the required changes. The study should aim at providing guidance for the formulation of policies and action plans at national level. The Industrial Census database [11] is expected to provide a good basis for a rapid assessment of the overall industrial pollution loads according to specific sectors, company-size and areas. Combined with other information such as environmental sensitivity, industrial zoning and relocation policies, population distribution and existing pollution problems, this may support the identification of environmental issues and priorities in the industrial sector. In the preparation of the National Industrial Waste Management Plan [13], some of the tasks foreseen under (i) and (ii) have already been achieved. Activities (ii)-(iv) will require collection and assessment of data from representative companies and industrial areas, and should be carried out in close cooperation with ALIND as well as other sector/area-specific interest organizations. It is important that all relevant ministries and governmental agencies are involved in the development of realistic incentives mechanisms. The MoE is also recommended to evaluate the current pricing of water and electricity, which in most cases do not reflect the actual costs. A too low price will encourage waste and promote environmental pollution.

15. Demonstration project for selected areas or industrial zones should be initiated to assess the effects of introducing stricter environmental regulations/standards in combination with appropriate incentives and support mechanisms. This will provide a rational basis for designing and implementing environmental requirements and incentives on a wider national scale. In carrying out this activity, the MoE is recommended to cooperate with IDAL within the framework of the proposed new permit system for industrial zones. (See also Recommendation 5).

16. While there is a significant potential for cleaner production in Lebanese industry, the capacities to identify and implement such solutions are generally lacking. High priority should be given to the establishment of a long-term national capacity-building programme on cleaner production, in close cooperation with industry, industrial association and supporting institutes and technical universities. Initial focus should be given to awareness building and the identification of existing capabilities and needs in industry and institutions. Lessons learned from other countries show that industrial experience ("success stories") is the most powerful force for convincing companies, industrial organizations, governmental organizations and other stakeholders of the opportunities and benefits of waste minimization. Demonstration projects and dissemination of information on industrial experience with cleaner production should therefore be at the core of the awareness-building and promotional activities [25]. MoE and MoIP are recommended to jointly initiate and support this activity, starting with identifying stakeholders and establish a consolidated programme strategy. Activities in the short to medium term would include cooperation with industry and industrial

associations to identify and implement plant-level demonstration projects and to organize awareness building workshops at sub-sectoral level. In addition, these workshops could address international environmental standards for products and corporate management systems, covering topics such as EMAS and ISO 14000.

17. While the MoE could take the initial responsibility for developing and running a cleaner production programme, it is recommended that this task is gradually transferred to a independent institutional mechanism. The MoE should work towards establishing a national cleaner production centre within a cooperating network of companies, industrial associations, consultants, technical institutes, universities and government bodies. This could be based on the same framework as utilized in UNEP/UNIDO's National Cleaner Production Centres (NCPC) Programme[8]. The ultimate goal of a NCPC is to facilitate an increase in the application of the concept of cleaner production in industry and incorporation of concept in the national environmental policy. Exhibit 7.2 outlines the establishment and operation of a NCPC, as defined in the UNEP/UNIDO Programme. Based on experience, it will take about five years to develop a fully operational NCPC. Required budget is estimated in the range of 0.8 to 1.2 mill.US$.

18. The Industry Institute, in close cooperation with ALIND, MoE and MoIP, is considered a strong candidate for hosting a NCPC. There are several reasons for this choice, the most important being the institute's structure, providing for transparency as well as linkage with industry and authorities, as explained earlier under recommendation 12. Experience shows that to be successful, a NCPC needs to be considered an independant partner by the industry, with no direct government control over its operations. With limited resources available, and considering the inherent linkages between process monitoring and cleaner production, it also makes sense to establish these functions within the same institution.

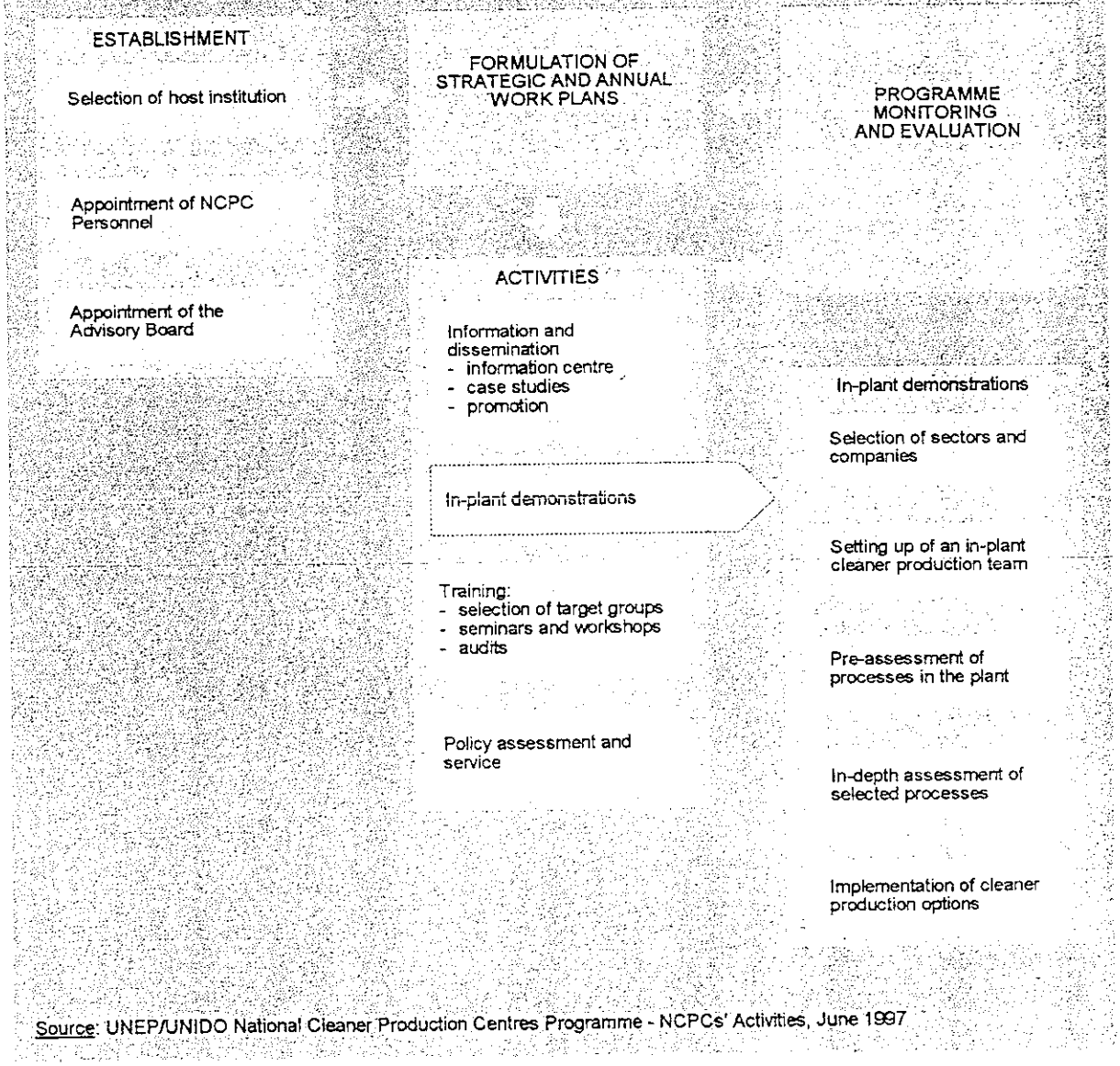
19. The Government should consider to establish a revolving fund administrated by the MoE, or another appropriate body, to finance plant-level cleaner production demonstration projects. Other possible financial incentives include soft loans and tax reductions. To increase the implementation rate of cleaner production measures, the Government could consider in the medium to long term the introduction of obligatory waste audits, possibly as an element of a self-monitoring and reporting scheme.

20. It is of critical importance that information on pollution prevention and control, including environmental regulations and standards, is made available to industry. Special focus should be given to the needs of micro and small-scale enterprises, which comprise most of the industrial sector in Lebanon. In addition to the awareness building workshops mentioned above, the MoE is recommended to investigate the possibility of establishing a more permanent mechanism for dissemination of environmental information (see also Recommendation 2). At a later stage, this function may be supported by a possible NCPC. Special consideration should be given to the possibility of using the same institutional network to provide a wide range of services to the industries sector. In addition to environmental information, this may include general information related to market, technology and business development. This opens up for cost-sharing

[8] The National Cleaner Production Centres Programme is a joint initiative by UNIDO and UNEP Industry and Environment Programme Activity Centre in Paris. UNIDO is the executing agency, with UNEP providing strategic environmental guidance and professional support. In the first phase, eight centres have been established, with an additional 10-12 centres planned for the second phase.

arrangements and better utilization of invested resources. A model approach might be UNIDO's ITMIN (*Industrial Technology and Market Information Network*) concept, which has been sucessfully implemented in several countries. ITMIN is an innovative and flexible framework for providing government agencies and the private sector, in particular small and medium industries, with access to information and services related to technology, market and investment opportunities. It utilizes a global network of commercial and non-commercial sources of information, which are made accessible via an appropriate structure of national and regional focal points. Other features include massive use of the Internet and other networks to promote networking, remove duplication, increase efficiency and effectiveness and reduce communication costs.

EXHIBIT 7.2
Scheme for a National Cleaner Production Centre



Source: UNEP/UNIDO National Cleaner Production Centres Programme - NCPCs' Activities, June 1997

Occupational health and safety is of immediate concern in the majority of small scale industries in Lebanon. There is an urgent need to improve the use of personal protection and taking measures to reduce levels of exposure in working activities. In spite of the enthusiasm and willingness to change among several managers, the economic recession and the lack of regulation and control represents a real obstacle to improvement. In addressing this problem, the MoE is recommended to take the following actions:

21. The MoE in cooperation with the Ministry of Health and AUB should carry out a nation-wide assessment of occupational hazards in micro and small-scale industries. (See also Recommendation 14). The methodology as used in the *Baouchrieh* industrial zone study [12] is recommendd. The will provide a substantial basis for taking action at both policy, institutional and enterprise levels.

22. The MoE is should initiate a demonstration project in a representative industrial zone aiming at finding practical measures to improve the working environment. As recommended in [12], this might include: (i) common health and accident insurance policy; (ii) organizing awareness and training workshops for similar industries; (iii) targeting critical hazards and high-risk occupations; (iv) develop central health and safety clinics and introduce screening programmes.

8. POSSIBLE AREAS FOR COOPERATION WITH UNIDO

The Government has been recommended to initiate demonstration projects and pilot studies aiming at identifying cost-effective strategies and action plans to address environmental problems in the industrial sector. In addition to guide national policy formulations, such activities may provide immediate benefits to project participants as well as local communities.

Subject to the availability of project funds, UNIDO is offering to provide technical assistance to the Government and cooperating agencies in the development and implementation of follow-up activities as recommended in this report. In particular, UNIDO has extensive experience and expertise to provide assistance in the following areas:

- Cleaner production and waste minimization.
- Wastewater and solid waste management. Evaluation of existing plans.
- Plant-level monitoring and waste audits.
- Ambient environmental monitoring and modelling of industrial pollution.
- Pollutant release inventories for selected subsectors or industries.
- Feasibility studies for relocation of industries and establishment of industrial clusters with common environmental facilities.
- Industrial information systems (cleaner technology, general environmental information)
- Area-wide Sustainable Industrial Development (SID) strategies, which provides an integrated framework for industrial planning reflecting the specific environmental and socio-economic needs and opportunities within a geographical area.

Proposals for follow-up activities in some of the above areas are described in more details in the following sections.

8.1 Area-wide Sustainable Industrial Development Strategies

In an area-wide approach[9], the ultimate goal is to identify, decide upon, and implement sustainable industrial development (SID) strategies for a selected region. Development of SID strategies will be coordinated with activities in other sectors through a participatory approach involving industry, municipality, agriculture, tourism and other sectors and stakeholders. SID strategies should reflect environmental quality objectives, interim and long-term environmental standards and regulations, industrial competitiveness and the expected economic and social development scenario for the area. The following tasks would typically be included in an area-wide SID project:

- Assessment (monitoring and modeling) of industrial emissions, their distribution in the ambient environment and their regional impacts (water, air and solids).
- Identify possibilities for waste reduction and treatment (plant-level audits), assessment of their feasibility and development of factory-specific action plans, including financial mechanisms.
- Identify environmental quality targets and developing achievable interim environmental standards.
- Issuing permits and controlling and enforcing their compliance.
- Identify objectives and alternative regional strategies for environmental management or pollution control.
- Integrate information and coordinate planning accross sectors and disciplines. This may include the development and use of Geographical Information Systems (GIS).

Exhibit 8.1 shows an example of a workplan for an area-wide SID project which UNIDO is implementing in the *Viet Tri* region in Viet Nam. This could be used as a model for similar projects in Lebanon.

Based on the experience from similar UNIDO projects, it is estimated that a typical budget requirement would be in the range of 0.8 - 1.1 mill. US$, and with an estimated project duration of 2 years. The development of GIS applications within the project may require additional funding of 0.3-0.5 mill. US$, depending on the availability of data and existing institutional capacity. UNIDO is ready to provide technical assistance in the development and implementation of such projects.

The geographical area to be covered in an area-wide SID project may be selected according to areas of jurisdiction of the regional government or local municipalities, or in order to encompass specific ecosystems or geographical regions (e.g. coastal areas with particular a ecosystems, a river basin, or parts of it. It is important to be aware of cause-effect relationships both within and across the planning area border (e.g. water quality in a river must also satisfy environmental quality objectives downstream of the planning area). Criteria for selection if areas for demonstration projects could include:

- Industrial activities are significant and/or is a long-term development goal.
- Industrial pollution and/or environment issues need urgently to be addressed (high priority areas).
- Lessons learned may be replicable on a nation-wide scale.
- The level of interest and commitment from industry and local authorities.

SID projects are typically initiated for industrial "hot spots" with high national priority. A few examples of potential areas for SID projects in Lebanon are given in Exhibit 8.2.

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[9] This refers to the principles of "Area-wide Environmental Quality Management" (AEQM), which has been applied successfully by UNIDO in several SID projects.

EXHIBIT 8.x
Examples of components and activities in a area-wide SID project

Component	Activities
Capacity building and assessment of emisions (water, gas, solid), their distribution and impacts.	• Field sampling of water quality. • Establish a water quality laboratory and analyse water samples. • Establish a database on hydraulic and water quality parameters. • Develop water quality model, specify additional modelling requirements. • Acquire air quality monitoring equipment. • Training on monitoring of air pollution. • Define monitoring ambient air pollution programme • Estimate existing water pollution. • Estimate existing air pollution. • Define solid waste disposals and assess their impacts. • Assess existing ground water situation and problems. • Assess municipal wastes generated. • Make an overall environmental quality assessment (all selected contaminants in water, air and soil, and inclusing industrial and municipal sources of pollution)
Capacity building and demonstration project on waste reduction auditing	• Establish auditing teams for selected waste reduction demonstration plants. • Training in the principles and execution of waste reduction audits. • Draft a waste auditing manual • Preassessment of waste minimization options in demonstration plants. • Establish material and energy balances in order to identify waste reduction options. • Formulate waste reduction action plans for demonstration plants.
Capacity building and demonstrations projects related to permitting, control and enforcement	• Collect information on selected compliance control demonstration plants. • Develop a permit structure for the plants. • Formulate and agree on compliance schedules. • Review existing land use planning procedures, including industrial siting. • Review of existing permits. • Analysis of institutional and legal arrangements. • Draft procedures for permit system in the project area/region. • Collect information on existing enforcement practices. • Draft guidelines for enforcement, including compliance monitoring.
Formulate and analyse regional strategies for environmental protection	• Collect information on oerall and sectoral development plans. • Establish industrial development scenarios. • Asses emission loads into the environment. • Estimate impact of emission loads on ambient environmental quality. • Assess damages. • Identify and analyse problem areas. • Define objectives and define scope of planning. • Identify promising measures and strategies. • Evaluation of alternative strategies and sollutions. • Develop guidelines for planning and analysis.

Source: Revised Project Document for the project *Industrial Pollution Reductio nin Viet Tri (Viet Nam)*,UNIDO 1996.

EXHIBIT 8.2
Proposed areas for development of
Area-wide Sustainable Industrial Development (SID) demonstration projects

- **Chekka-Selaata**
  Urgent environmental and health problems related to industrial pollutant discharges to air, water and land. Industrial activities includes several cement, lime and gypsum factories, asbestos-cement products, chemical fertilizers and sulfuric/phosphoric acid, sugar refinery and a power plant (the Kadisha power plant is located north of the Chekka area but is important for the region). In addition, there are many smaller plants including fish processing, soap, wood, recycling of lubrication oil, etc. Air pollution problems are causing particular attention from the public and environmental NGOs. Cases of severe health damage and death have been reported, and is claimed to be caused by industrial discharges. The area includes Ras Ech Chaquaa promontory with ecological and landscape values of national importance.

- **Zouk Mosbeh-Zouk Mkayel**
  Various industrial discharges to streams and sea (bleaches, dyes, etc.). Also high air pollution levels due to the Zouk power plant and concentrated/congested traffic flow.

- **Shoueifate, Ain Anoub and Bchamoun industrial areas**
  Wastewater discharges to the sea via the Ghadir stream.

- **Ghazieh coast**
  Various industrial wastewater discharges from tanneries, soap factories, etc. into Nahr Saitaniq and the sea.

8.2 Cleaner Production Demonstrations

Subject to the availability of project funds, UNIDO is proposing to assist the MoE in establishing the first phase of a cleaner production demonstration and awareness-building programme. It is suggested to follow an approach similar to the one adopted in the *DESIRE* project [25], which was designed to create successful examples of the application of the waste minimization approach in small-scale industries in India and to create the necessary starting conditions for dissemination and continuation of waste minimization activities upon completion of the project. However, care should be taken in adjusting the concept to Lebanes conditions. In particular, the following should be considered:

- Although the *DESIRE* project focused on small-scale industries, the average size of the target companies were considerably larger than typical for Lebanon, where close to 90% of the industrial establishments have less than 10 employees. Based on an assessment of the criticality of pollutant discharges and expected benefits from cleaner production, one should in the design phase of the project decide target groups (company size and sectors). It is obviously a much more complex task to promote the concept of cleaner production to a large number of micro-scale industries than to a limited number of medium and large scale enterprises.

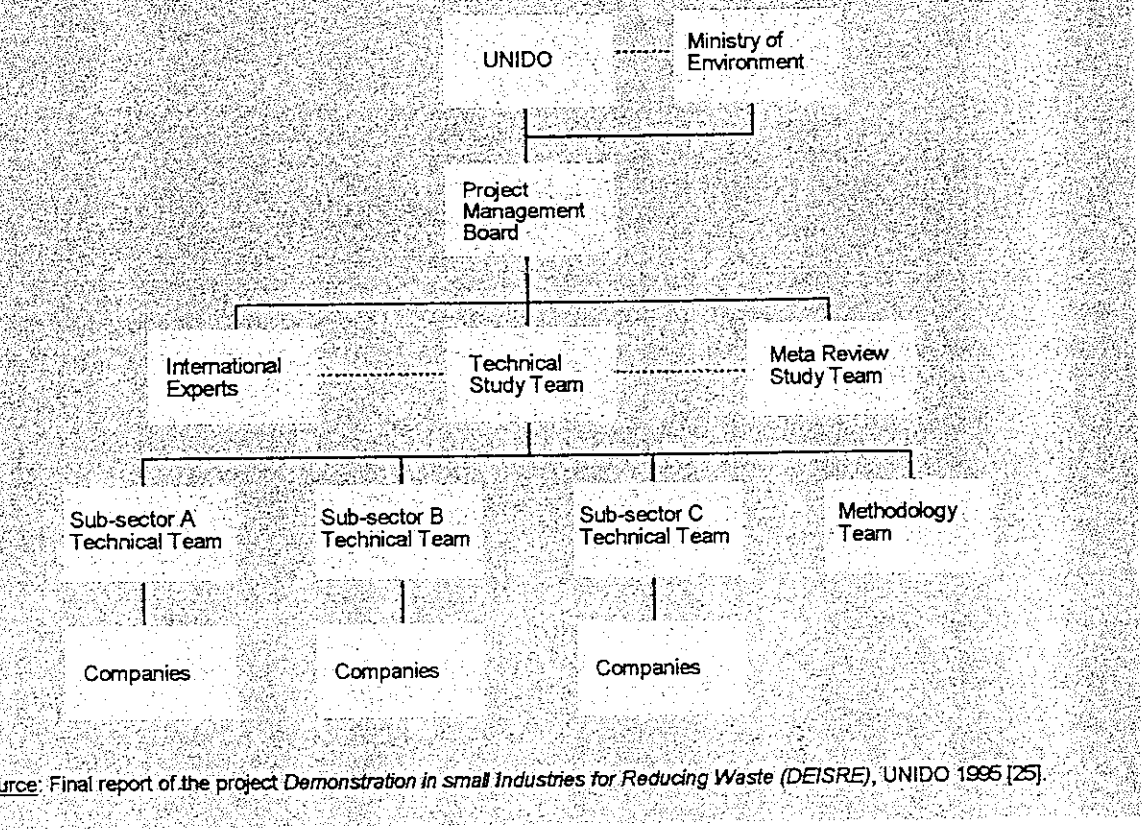
- The *DESIRE* project involved governmental organizations, technical and professional institutes, and industrial associations and companies, and could draw upon basic national expertise and institutional support in the field of process control and waste minimization. In the case of Lebanon, the basic institutional support is lacking, although some consultant firm do have the capacity to

provide relevant technical expertise. In order to ensure long term sustainability of a similar programme in Lebanon, an appropriate institutional focal point for cleaner production needs to be established (see Recommendation 17 and 18). The *DESIRE* project included capacity building activities through training of consultants/trainers in waste minimization at subsectoral level. This would be of critical importance for Lebanon, and should if possible be linked to establishment of a institutional focal point.

The target industries/subsectors will be selected in the design phase of the project. Possible candidates include among others: metal finishing, textiles, printing, leather tanning, olive oil extraction, pulp and paper, food processing and cement. While some of the sectors are constituted mainly of smaller companies, others are dominated by larger industries (e.g. cement works). It is essential that the project implementation strategy reflects the different needs and capabilities of small *versus* larger companies.

The organization structure for the *DESIRE* project [25] is shown in Exhibit 8.2, and is recommended as the basis for a similar project in Lebanon.

EXHIBIT 8.2
Example of organization structure for a cleaner production demonstration project in three industrial sub-sectors



Source: Final report of the project *Demonstration in small Industries for Reducing Waste (DEISRE)*, UNIDO 1995 [25].

Using the *DESIRE* project as the model, a possible workplan for a demonstration project on cleaner production in Lebanon is outlined in Exhibit 8.3. It is recommended the project is implemented as part of an area-wide SID project, as described in section 8.1.

EXHIBIT 8.3
Tentative workplan for a cleaner production demonstration project

Component	Activities
Preparation	• Adaption of international manuals to Lebanese industry. • Establish working relations with industry associations and professional institutes. • Preliminary data collection and evaluation at one company per sector. • Obtain interest from companies to participate.
Sectoral introduction workshops	• Introduction to waste minimization concept, working method and obvious options per sector.
Company pre-assessment work	• Company visits by international technical and methodology experts to boost commitment and involvement and to provide initial on-site guidance. • Two or three visits by the Technical Study Team to organize waste minimization teams, to collect baseline data and to generate the first batch of waste minimization options. • Data analysis and evaluations by the Technical Study Team to compile material and energy balances and evaluate feasibility of first batch of options.
Sectoral mid-term review workshops	• Review of preliminary waste minimization experiences by international industry sub-sector and methodology experts. • Expert visits to generate additional waste minimization options and to contribute to option evaluation and implementation. • Preparation of draft generic waste minimization guide.
Company assessment work	• Two to four visits by Technical Study Team to generate and evaluate additional waste minimalization options and to evaluate progress in implementation of these options. • Completion of the generic waste minimization guide. • Completion of the barriers and incentives study.
Implementation period	• Final evaluation of the company achievements by Technical Study Team. • Preparation of draft sectoral technical waste minimization manuals. • Ongoing implementation activities in the companies.
Dissemination workshops	• Sectoral workshops • National seminar. • Preparation of policy recommendations.
Reporting	• Preparation of final report. • Completion of the sectoral technical waste minimization manuals. • Preparation of promotional video.

Source: Final report of the project *Demonstration in small Industries for Reducing Waste (DEISRE)*, UNIDO 1995 [25].

The planning, organization and implementation of the *DESIRE* project were realised in joint consultation between UNIDO and the Indian Ministry of Environment and Forests. UNIDO took care of overall project management and provided either in-house or international experts covering general waste minimization and specific expertise required for the selected industrial sub-sectors.

The technical study team was organized within the the National Productivity Council (NPC), and consisted of the project manager of the technical study team, senior experts in charge of each industry sector and one energy expert. The three industry sector technical teams were in charge of the actual demonstration projects in the companies as well as the preparation of sectoral waste minimization manuals. These teams were headed by a senior expert from NPC and consisted of all involved experts from NPC as well as from the technical institutes and industry associations. The methodology team was in charge of the development of the *DESIRE* working methods; it was headed by the project manager of the technical study team and gathered inputs from all other study teams as well as from technical institutes and industrial associations. The meta review study team was in charge of the review of the company projects in order to identify barriers and enabling measures, and interacted extensively with the technical team of the NPC. The Project Management Board consisted of representative of UNIDO and the Ministry and the managers of the technical study team, the meta review team and the international waste minimization expert. The NPC has later been selected to host the Indian National Cleaner Production Centre, which is playing an important role in following up and expanding the activities initiated by the *DESIRE* project.

In Lebanon, the required technical and institutional capacity is not expected to be available to the extent indicated above. While a technical study team is recommended to be organized within the Industry Institute due to its possible long-term role in promotion of cleaner production, there are hardly any institute or university in Lebanon with expertise on waste minimization. Hence, there is a need for substantial participation of technical and managerial consultants in the teams. It is of critical importance for the project that a training and coaching programme is established for the various project teams, utilizing international experts and, when available, national consultants.

The required budget for the project will depend on the number of subsectors involved. Based on UNIDO's experience with similar projects, it is estimated that US$ 120,000-150,000 will be required per industrial sub-sector. This excludes the investment costs associated with the implementation of recommended cleaner production options in the selected partner companies. Project duration is estimated to between 1 and 2 years.

8.3 Other Recommended Follow-up Activities

This section briefly outlines other concrete proposal for follow-up activities where UNIDO, subject to the availability of funds, may provide technical assistance:

- *Establish a Spatial Database on Industrial Pollution Sources and Discharges*
  A national inventory of industrial pollutant discharges may provide a powerful tool for environmental management and industrial development planning, especially if spatial data on industrial pollutant sources and activities are incorporated in a Geographical Information System (GIS) together with data on environmental characteristics and other socio-economic activities. The Industrial Census database of the MoIP together with data collected during the preparation of the National Industrial Waste Management Plan, will provide a good basis for establishment of such a system. As a first step, it is proposed to assist the MoE in estimating the pollution intensities of various industrial subsectors and processes based on data in the Industrial Census database and utilizing common rapid assessment methodology. This implies that the expected pollutant loads are estimated based on statistical data on pollution intensities for specific industries/processes as a function of total value of outputs, or similar parameters. The pollutant intensities will be derrived from international databases, and may be adjusted to better reflect the actual technology-level and practices in

Lebanese industry through a callibration execise, where the actual pollution intensities are measured for a sample of representative plants in each major industry. Initially, a pilot project is proposed to estimate pollutant intensities and the total pollutant loads to water and air from three selected industrial subsectors. This activity could be implemented as part of an area-wide SID project. It will provide information for setting up monitoring programmes for critical point sources, as well as inputs to critical loading models where the need for ambient envronmental monitoring programmes can be determined. This proposal may be linked to follow-up activities recommended by FAO in TSS-1 project "Environmental Information System for Natural Resource Conservation and Use in Lebanon" (1996).

Expected duration: 5 months
Estimated cost: US$ 400,000 (excluding development of a GIS application)

- *Feasibility Study on the Relocation of Tanneries*
  The leather tanning industry has indicated the need to relocate into cluster(s) in order to tackle environmental problems in a cost-effective way. It is proposed to undertake a techno-economic feasibility study on the relocation of such industries, preferably to a dedicated industrial zone. It includes an environmental impact assessment and identification and evaluation of options for waste reduction, utilization and treatment. In particular, the feasibility of a common wastewater treatment and chromium recovery plant will be evaluated. It may also include the development of appropriate economic incentives. This project could be linked to an area-wide SID project for the selected industrial zone(s) and also to a cleaner production demonstration project for the leather tanning sector. The basic approach and methodologies applied in the project is expected to provide a framework for dealing with similar issues in other industrial subsectors.

  Expected duration: 8 months
  Estimated cost:: US$ 350,000.

- *National Programme on Environmental Pollution Monitoring*
  Establish a national coordination group for monitoring of ambient industrial pollution and develop a strategy for a national pollution monitoring programme. Assessment of the capacities of existing institutions and propose a detailed plan for training and investment in additional equipment. Initiate demonstration project for ambient pollution monitoring of air and water in in high priority areas, building on the existing capacity and guided by appropriate training/coaching activities.

  Expected duration: 1.5 years
  Estimated cost: US$ 250,000

- *Strengthen the Capacity of the Industry Institute to provide Plant-level Monitoring Services*
  Phase I: Assessment of the existing capacity of the Industry Institute to provide plant-level monitoring and analysis services. Evaluate the future demand for such services, both from industry and regulatory authorities. Develop a detailed action plan for capacity-building, including investment in human resource development and equipment. Evaluate the potential for self-financing activities. Decide on further implemenation. Phase II: Purchase and install required laboratory and other equipment; hire new staff as required; implement training activities and plant-level demonstrations projects. Certification of services according to international standards.

  Expected duration: 5 months (phase I, only)
  Estimated cost: US$ 180,000 (phase I, only)

- *Establishment of a National Cleaner Production Centre*
  This may be linked to the cleaner production demonstration project proposed in section 8.2.
  Phase I: Establish a National Cleaner Production Centre hosted by a well established national institution that maintains good cooperation with industry and has an adequate organizatinal structure. As mentioned earlier, it is believed that the Industry Institute is a good candidate for hosting such a centre. Detailed strategy and activities for the establishment and operation of the centre centre is outlined in UNEP/UNIDO's National Cleaner Production Centre Programme.
  Phase II: Evaluate achievements from phase I, adjust the programme and establish a business plan for the next 4-5 years. The aim of the business plan is to assist the centre in becomming self-sustainable and transforming its activities from need oriented to service oriented.

  Expected duration: 5-6 years (1 year for Phase I, 4-5 years Phase II)
  Estimated cost: US$ 900,000 - 1,200,000 (total for Phase I and II)

- *Occupational Health and Safety in Small Industries*
  To implement a demonstration programme for two or three selected industrial zones, aiming at assessing the occupational hazards in micro and small-scale industries and demonstrating possible measures to improve the situation. The assessment will be based on the methodology applied in the *Baouchrieh* industrial zone study [12]. Activities include an information campaign, targeting selected industrial subsectors or industries where the exposure of workers to hazardous substances is expected to cause a significant problem, and plant-level demonstrations of remedial and protective measures. This initiative could be linked with the cleaner production demonstration programme and the development of industrial information systems specifically aimed at micro and small-scale industries.

  Expected duration: 1 year
  Estimated costs: US$ 400,000

UNIDO is ready to assist with the further development of the above proposals if requested by the Government and if the indicated project funds are likely to be available.

9. CONCLUSION

The time is right to assist MoE and its partners (both public and private sector) to develop and implement environmentally-sound and economically feasible industrial pollution prevention and control policies. The government is offering incentives to promote investments in the industrial sector (new industrial areas, streamlined permitting procedures, etc.), but procedures and guidelines need to be put in place to ensure future investments will be environmentally sound. In addition, existing industries and industrial areas need help to improve the environment and the health and safety of workers and populations. In this respect, particular concerns should be given to the constraints faced by micro and small-scale industries (less than 10 employees), which constitute close to 90% of all industrial establishments in Lebanon.

Achieving measurable results is important to overcome public cynicism over some previous technical assistance projects that have not produced the expected results. Hence, our proposed recommendations and follow-up activities are intended to provide tangible results (e.g. reduced pollution load from companies participating in cleaner production demonstration projects) while at the same time developing action plans

and strengthening institutional capabilities to plan and manage industrial activities on an environmentally sustainable basis in the longer term (e.g. area-wide SID project and National Cleaner Production Centre).

10. BIBLIOGRAPHY

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ANNEX A.
Schedule of Meetings for the UNIDO Team of International Experts

Date	Person/Organization	Comments
Monday 09.12.96	Mr. Mehdi Al-Hafedh, UCD Ms. Randa Nemer, UNDP *UNIDO Office, Beirut*	Planning of visits, general exchange of information and proposed seminar for Wednesday 18 December, 1996
	Mr. Bassam El-Frenn Programmes Division *Council for Development and Reconstruction (CDR)* Banking Str., "Société Nouvelle de la Banque de Syrie et du Liban" P.O. Box 116–5351, Beirut Tel: (01) 647934 Fax (01) 864494	Activity: all aspects of project from conception to completion. 95% of finance from abroad.
Tuesday 10.12.96	Mr. Boghos Ghougassian National Coordinator *Grontmij MEEA* Tarazi Building, Labban St. Hamra P.O. Box 113-5474, Beirut Tel: (01) 341323 Fax (01) 346465	UNIDO National Consultant for the project. Associate company in Holland provides technical support where required. Indicated environmental problem activities in the Lebanon. Consultancy covers Environmental impact assessment EIA, solid waste disposal, etc.
	Mr. Jacques R. Chahine Managing Director *Dames and Moore* Habib Bacha el Saad Str. - Lyan Bld. P.O. Box 116-5249, Beirut Tel/Fax (01) 330268 E-mail: brt@dames.com	UNIDO National Consultant for the project. A national environmental plan considered necessary. Referred to problem industrial activities, also possible water pricing.
	Mr. William Saade Consulting Engineer	UNIDO National Consultant for the project. Comprehensive Industrial Pollution paper discussed. Unfortunately in its present form did not facilitate total industrial emission into the environment. Proposed a number of visits.
Wednesday 11.12.96	Mr. Antoine Semaan Secretary General *Lebanese Standards Institution (LIBNOR)* Beirut Tel: 03-321115	Under resourced at the present time. Standards include: Construction, Food, Chemicals, Textile, Leather and Safety. Eight technical standards to be published in 1997. Possible custodian for technical environmental literature as well as standards.
	Mr. Ghassan Tannous Marketing and Information Department *Investment Development Authority of Lebanon (IDAL)* Beirut Tel: (01) 344676	Development of Industrial zones, promotes government projects. Focal point for 'permits'

Date	Person/Organization	Comments
	Dr. Nadin Cortas Associate Dean, R&D *American University Beirut (AUB)* Beirut Tel: (01) 350000 ext. 4911 E-mail: corstasn@aub.edu.lb	Co-ordinator of Interfaculty Group for Environmental Research. Very little analytical instruments, Indirect coupled plasma, mass spectrometer, gas chromatography arriving early 1997. M.Sc. Course planned for environmental science. Workshop envisaged for NGO's, ministries etc.
Thursday 12.12.96	Dr Said Chelab President, *Agence de l'Environnement et de la Maîtrice de l'Energie (ALME)* Beirut Tel: (01) 385043 Fax (01) 383908	Presented reports on energy usage in Lebanon and supporting information. Arrangement to visit Campus USIB (St. Joseph University)
	Mr Fares Ghandour and Mr Bruno Boustani *Arthur D. Little (ADL)* P.O. Box 116-5045, Beirut Tel: (01) 360266 Fax (01) 360267 E-mail: brun0@cyberia.net.lb	Working on new industrial development strategy. Prioritization of subsectors with long-term growth potential. Urbane planners with good appreciation of Health and Safety requirements.
	Dr. May Jurdi Faculty of Health *American University Beirut (AUB)* Beirut Tel: (01) 350000 Ext. 4620	Indicated expensive environmental issues requiring urgent attention. Emphasises the shortage of public health inspectors (300 extra inspectors for 6 districts - 30 students per year). Support from UNICEF, WHO and UNESCO promised.
Friday 13.12.96	Georges N. El-Khoury, Head of Economic Studies and Industrial Development *Ministry of Industry and Petroleum* Rue Sami Solh Beirut Tel: (01) 427119 Fax (01) 427212	Capacity 21 and improvement of Industry. Environmental standards and cleaner productions.
	Mr. Suhail Srour and Dr. Ahmed El-Shafic, Resources and Environment Department *Dar-Al-Handasah - Shair and Partners* Verdun Str. P.O. Box 7159, Beirut Tel: (01) 869416	Resources and Environment Department, Industrial Waste Management Plan, Phase 1 Diagnostic Phase 2.
Saturday 14.12.96	Mr Anwar Berberi Head of Environmental Division *Association of Lebanese Industrialists (ALIND)* Ain Aar P.O. Box 11-1520, Beirut Tel: (01) 350280, (04) 925800 Fax (01) 351167	Industry institution with experts on analysis, waste recovery and recycling, assistance on consultancy

Date	Person/Organization	Comments
Monday 16.12.96	Dr. Fadi A. Geara Director of Civil Engineering Department, and Prof. Wajdi Najem, Vice Dean, Faculty of Engineering Hydrology. *Saint Joseph University* ES 2B Campus Beirut	The two areas of special interest are Energy Production and Water Quality and Supply.
	Mr. Rashid S. Beydoun Vice President *Chamber of Commerce and Industry* Beirut Tel: (01) 864368 Fax (01) 865802	Representative from Governmental organisations and the private sector. Committees are formed on an ad hoc basis to deal with particular issues. A separate chamber of commerce operates in North Lebanon.
Tuesday 17.12.96	Dr. Ghassom Sebiani UN/CDR Co-ordinator *Council for Development and Reconstruction (CDR)* Banking Str., "Société Nouvelle de la Banque de Syrie et du Liban" P.O. Box 116–5351, Beirut Tel: (01) 647934 Fax (01) 864494	At international level - many environmental projects e.g. Cement production, chemical and industrial. Ministry of Environment requires more capacity and expertise.
	Ms Lami Mansour Sustainable Development Advisor and Mr Peter Van Ruyssevelot Programme Officer *UNDP* United Nations House Bir Hassan P.O. Box 11-3216, Beirut Tel: (01) 603463 Fax (01) 603460 E-mail: fo.lbn@undp.org	Framework for Environmental Impact Assessment finalised. Environmental Management is feasible - specific areas of concern - case studies would be helpful.
	Ms. Sana Sira-Wan and Dr. Zahi Abou-Mansour Technical Advisor *Ministry of Environment* P.O. Box 70-1091 - Antelias Beirut Tel: (01) 521030 Fax (01) 521038	Three main activities; Protection of urban environment (industrial), environmental negative effects, and waste quality. Laws passed in 1993 not enforceable
Wednesday 18.12.96	Participants at the UNIDO Seminar on Sustainable Industrial Development , Carlton Hotel, Beirut	Summary of outcome see Section 3 of this report. For list of participants, see Annex C.

Date	Person/Organization	Comments
	Ministry of Environment Beirut Tel: (01) 521030 Fax: (01) 521038	Meeting of the Environmental Committee for the Chekka Area. Observer status for UNIDO representation. Representatives from factory owners and the municipality of Chekka. 12 attendees with focus mainly on cement and asbestos cement manufacture. Visit arranged to a cement works, see Annex G.
Thursday 19.12.96	Mr. Sameer E. Samaha Director General and Ms. Nadia Khoury Chemist *Industry Institute* Avenue de Paris Rue du Pere Lebret P.O. Box 11-2806, Beirut Tel/Fax (01) 348219	Range of Laboratories that require updating (total area 10,000 m^2) to provide good environmental facilities.
	Mr. Lawrence M. Chidiac Chairman and President *Continental Paper Corporation* P.O. Box 443, Jounieh Tel: (09) 444455 Fax: (09) 937776	Paper making recycling plant. Uses selected paper from schools, offices, etc. Solid waste disposed with general garbage. Possible opportunity to improve recovery from liquid waste with updated flotation system and flocculating agent. Disposal of compacted solid waste to near-by stone quarry should be considered.
	Dr. Iman Nuwayhid Department of Environmental Health *American University Beirut* Beirut Tel: (01) 350000	Research on occupational health in Lebanon with particular reference to industrial processes. Agreed to introduce UNIDO experts to some activities in an industrial area.
Friday 20.12.97	*Gervial Aluminium Co.* Jdeidet El-metn	Construction of signs in aluminium (no welding). 12 persons employed on first floor.
	Philip Daher Wood Furniture Jdeidet El-metn	Sander dust and polyurethane in working environment. No protection for workers. Inefficient spraying of furniture. Workers subjected to paint spray - extraction to atmosphere. 10 persons employed on third floor.
	Planeta Printing Press Jdeidet El-metn	Type off-set. Waste paper card recycled $30/tonne. Waste paper $1.1/tonne. Working conditions good. Extraction of air to atmosphere. Noise and air pollution from electricity generation 24 h/day activity. 12 employed. 12 - 16 h/day operation of diesel electric generators. Electricity supply inadequate.
	Mr. Krikor Dichjekenian Director *Kokoplast* Cite Industrielle B.P. 90007, Jdeidet El-metn Tel: (01) 500933 Fax: (01) 497893	Producing plastic pipes and fittings. PVC used is recycled therefore no problem with the vinyl monomer 4 tonnes/day

Date	Person/Organization	Comments
	Jurdi Foundry Jdeidet El-metn	Simple iron cold-blast Cupola with no emission abatement. Also produces aluminium and bronze castings using small melting pots. 4 persons employed. (The foundries, 3-5 employees in each, in the area were said to produce large pollution problems.)
	Various garages in the industrial zone in Jdeidet El-metn	Large number in the industrial area visited. Car maintenance: welding, paint spraying, engine reconditioning. 90% of sump oil collected; 10% down the drain. Generally 2 -3 persons employed.
	Mr. Joseph Saadeh Owner *Steelcraft* Industrial City P.O. Box 90110, Jdeidet El-metn Tel/Fax (01) 497136	Construction of stainless steel. Argon arc welding. Member of Association of Lebanese Industrialists. 30 persons employed.
	Mr. Pierre J. Doumet Chief Executive Officer, and Mr. Boris Raje Chief Operating Officer, and Mr. George Abdallah Instrumentation Manager and Mr. Sayed Horboss Quality Control and Laboratory Manager. *Cimenterie National SAL* P.O. Box 11-5101, Beirut Tel: (01) 429070 Fax (01) 468556	See separate Memorandum of visit to the cement plant in Chekka attached as Annex G.
Saturday 21.12.96	Kamal Siblini Monitoring and Evaluation Officer *Republic of Lebanon Green Plan* Beirut	Land reclamation contracts. 1997 Environmental Group to evaluate rural roads, small irrigation schemes and carry out EIA.
	Georges Darwiche General Manager *Société Technique Pour l'Industries des Peaux* P.O. Box 329 Zouk Mikael Tel: (09) 210771 Fax (09) 210818	General information on: Tanneries, 26 mainly in Zouk Mikael area. Beirut area - slaughter houses - cow skins 20-25,000/month. Sheep-skins 50-60,000/ month. Imported skins very low.

Date	Person/Organization	Comments
	Shahe J. Imasdounian Marketing Manager *Lebanese Tanning Co.* P.O. Box 55300 Beirut Tel/Fax (1) 497720	Strategic plan to deal with liquid waste (recovery). Emissions to air (odour and gases). Solid waste. Examined present process in operation.
	Hagop Shirikian General Manager Jake H. Shinkan Production Manager Shirikian *Tanning Co.* P.O. Box 80197 Bourj Hammoud Tel: (1) 260627 Fax (1) 582105	Good awareness of environmental problems in the sector. Requested being put on the UNIDO Leather Programme mailing list.
Tuesday 07.01.97	Mr. Naser Nasrallah Director General *Litani River Authority* Beirut	The Litani river's average natural flow (4-5 m^3/s) is dwarfed by sewage flow from upstream villages and towns (which are supplied by ground water). Major polluters are domestic sewage, few industrial discharges (e.g., sugar factory, Mimoza plant mill, a tannery), and pesticide runoff. There is no pollution control plan and the Litani River Authority has no authority to control pollution of the Litani river. Pollution has reached alarming levels and could have serious repercussions on the quality of Lebanon's ground water, considering the altitude of the Litani river (900 m). Mr. Nasrallah is working with the Environment Commission of Parliament and the Ministry of Environment; together, they decided to consider the environment in the Bekaa a top national priority. There is a comprehensive survey of pollution sources of the Litani river; Mr. Nasrallah would be happy to share this information with concerned parties upon request. (The meeting wasundertaken by Mr. J. Karam, UNIDO International Consultant, after the formal end of the mission)

ANNEX B.
Publications and Journals Distributed during the Visits.

Title	Given to
Processes Involving Asbestos (including asbestos cement, cement products, fillers, filters floor coverings, insulated board joists, textiles, etc.) Process Guidance Note IPR 3/3. Ministry of Environment, Environmental Protection Act 1990, UK.	UNIDO Office, Beirut.
UNEP/UNIDO Technical Report No. 27 - Monitoring Wastes and Emissions.	UNIDO Office, Beirut; and Mr. Anwar Berberi, ALIND
Guidance Report for Hide and Skin Process, PG6/21 (96), Department of the Environment, September 1996, UK.	Mr. Hagop Shirikan, General Manager, Shirikan Tanning Co., Beirut.
Processes Subject to Integrated Pollution Control - Cement Manufacture, Lime Manufacture and Associated Processes. Environment Agency IPC Guidance Note Series 2 (S2), September 1996, UK.	Cimenterie Nationale S.A.L. (copied)
Guidance Report for "Quarries", Department of the Environment, 1996, UK.	UNIDO Office, Beirut.
Integrated Pollution Control - Manufacture of of Glas Fibres, Mineral Fibres, Glass Frit, Enamel Frit and Associated Processes. Environmental Agency IPC Guidance Note S2 303 Series 2 (S2), September 1996, UK	UNIDO Office, Beirut.
Landfill Design, Construction and Operational Practice, Waste Management Paper 26B, Department of the Environment, 1995, UK.	UNIDO Office, Beirut.
Landfill Completion, Waste Management Paper 26A, 1994, UK.	UNIDO Office, Beirut.
Petroleum Processes On-shore Oil Production. Process Guidance Note IPR 1/16, HMSO, 1992, UK.	UNIDO Office, Beirut.
Guidance for Clinical Waste Incineration Processes under 1 tonne/h. Environmental Protection Act 1990, Part 1 PG5/1 (95), August 1995, UK.	UNIDO Office, Beirut.
Guidance for Furnaces for the Extraction of Non-Ferrous Metal from Scrap, PG2/a (96), March 1996, UK.	UNIDO Office, Beirut.

ANNEX C.
List of Participants at the UNIDO Seminar on Sustainable Industrial Development (Beirut, 18 December 1996)

Name	Organization	Address/Tel
Hashem Al-Hajjar	Al-Liwa' Newspaper	03-788991
Hassan El-Ajam	Al-Nahar	01-340960
Anwar Berberi	ALIND	
Fady Nakad	Associated Consulting Engineers	01-738036
Raja Habre	Association of Lebanese Industrialists (ALIND)	Chamber of Commerce Bldg., Sanayeh, Beirut
Hisham Abou Jaoude	Association of Lebanese Industrialists (ALIND)	Sin-El-Fil 01-886899 01-480516 / 01-483763
Toufic Mezher	AUB	01-354911 ext.3637
Tamara Hrawi (for Dr. Nadim Cortas)	AUB	01-354911 ext. 4911
Amine Moukheiber	Beirut Stock Exchange	01-807552/331
Ghassan Sibiani	CDR	01-647934/5/6
Maha Zeidan	Chamber of Commerce & Industry	01-744160 - 2
Pierre Doumit	Cimenterie Nationale	01-457130
Roger Tabet	Cosmaline	
Nadine Alfa	Daily Star	587272 - 7
Roula Mohsen	Future T.V.	01-861233
Ghassan Tannous	IDAL	01-344676
Amal Risk	Industry Institute	01-366509
Samia Aboul Hosn	Industry Institute	01-365983
Nadia Khoury	Industry Institute	01-365983
Dory Kodayh	Industry Institute	01-365983
Andrea Kahali	Industry Institute	01-365983
Camelia Kanaan	Industry Institute	01-365983
Sameer Samaha	Industry Institute	01-366509 / 03-629129
Faisal Abou Ezzeddine	IUCN - Ministry of Environment	01-521030 - 6
Antoine Semaan	LIBNOR	03-321115

Name	Organization	Address/Tel
Boghos Ghoughassian	MEEA/MECTAT	01-341323
Kamal Siblini	Minisrty of Administrative Reform	01-591371
Nancy Khoury	Ministry of Environment	01-521030 - 6
Rola Naser Eddine	Ministry of Environment	01-521030 - 6
Hassan Hoteit	Ministry of Environment	01-521030 - 6
Nazih Hashem	Ministry of Environment (Journalist)	01-521030 - 6
Rana Riskallah	Ministry of Industry	01-427145
Sami Assi	Ministry of Industry	01-423809
Rabih Saab	Ministry of Industry	01-426607
Mirna Aramouny	National News Agency	
William Saade	OGERO/MPT	348999 - 335126
Norma El-Helou	Radio Liban	01-351905 - 6
Norma Nacouzi	Radio Orient	373001 - 10
Mounzer Bou Aram	Sawt El-Shaab	
Nagi Maalouf	SOLICAR	Wadi Chahrour 01-464538
Mazen Labban	SOLIVER	01-433675/635
Elie Arfan	Spartan	03-389272
Kareem Al-Hassani	Talal Abu-Ghazaleh International	01-353858/9
Badia Baydoun	Tele Liban	
George Akl	UNDP	01-521030

ANNEX D.
Presentation Material Used for the UNIDO Seminar.

An Introduction
Sustainable Industrial Development

By

Leif K. Braute
Chemical Industries Branch
Industrial Sectors and Environment Division

The Need for a New Approach

- The 48 world's poorest countries produce less than one per cent of global industrial output - the figure is lower even than ten years ago
- Lack of trained manpower means developing countries are failing to create new jobs
- Pollution from industry relative to production is falling everywhere except in the developing countries. There it continues to rise.
- To reverse these trends will take the concerted effort of the international community. This process has been initiated by adoption of Agenda 21 at the UN Earth Summit in 1992.

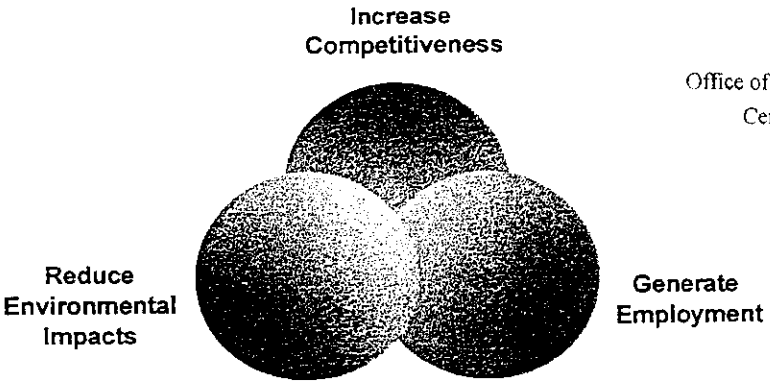
Sustainable Industrial Development

Sustainable Industrial Development (SID) is defined as those patterns of industrialization that enhance economic and social benefits for present and future generations without impairing basic ecological processes

Criteria for SID

- Efficiency, the most efficient conversion of human, material and energy resources into industrial outputs
- Equity, the equitable distribution of the environmental burdens as well as the outputs of industrialization across nations, segments of the society and across generation
- Eco-capacity, the capacity of the ecosystem to continue to function despite pollution and physical alterations.

Integrating and Balancing SID Objectives



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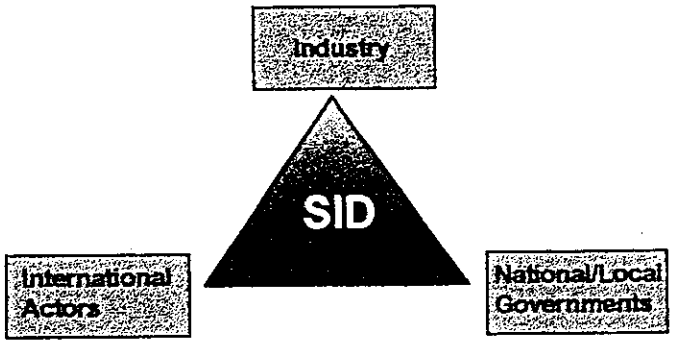
SID Requires Cooperation and Coordinated Actions



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SID Requires Cleaner Production

- Reduction of pollution intensity of industry through Cleaner Production is the only immediate way for industrial development to meet the SID objectives
- Cleaner Production seeks to reduce the generation of waste in the production process and makes it possible to save material, water and energy and thereby increase the process efficiency
- Investments in Cleaner Production have often short payback periods, they improve competitiveness and profitability, and generate environmental benefits
- Promotion of Cleaner Production is a central objective for UNIDO

Tools for Identifying Cleaner Production Options

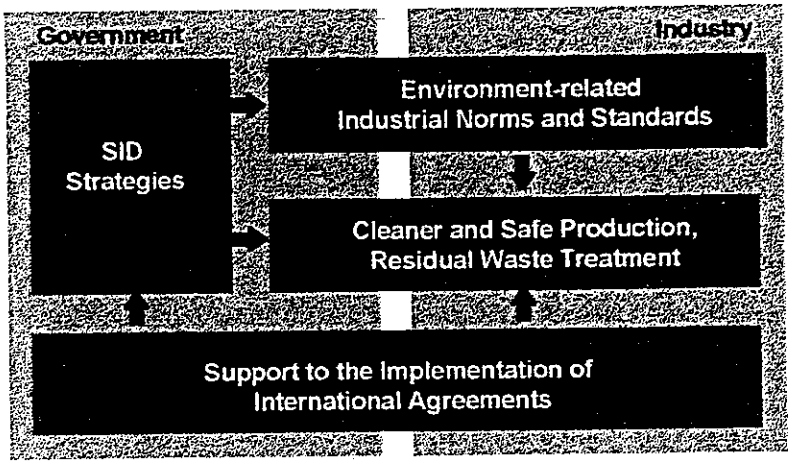
- Waste reduction audit
- Environmental compliance audit
- Product life-cycle analysis
- Environmental impact assessment

Purpose of the Project

- Review existing situation in Lebanon related to industry and environment
- Identification of priority areas and capacity-building needs
- Recommend short and medium-term strategies for priority areas
- Initiate follow-up activities as integrated elements of on-going initiatives

Industrial Sectors and Environment Division L.K. Braute / 9

UNIDO Priorty Programmes



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SID Strategies

- National Sustainable Industrial Development Networks
- Industrial environmental regulatory programmes
- Voluntary initiatives
- Area-wide Environmental Quality Management (AEQM) Planning

Cleaner and Safe Production

- National Cleaner Production Centres
- Mediterranean and Black Sea Cleaner Production Network
- Sub-sectoral support
- Cross-sectoral programmes
  - Industrial Water Use
  - Integrated Waste Management
  - Chemical Safety

International Conventions and Agreements

- The Montreal Protocol
- The Climate Change Convention
- The Basel Convention
- The Global Programme of Action for the Protection of the Marine Environment from Land-based Activities
- Global Action for Sound Management of Toxic Chemicals

Environment-related Industrial Norms and Standards

- Voluntary Guidelines for Pollution Prevention and Abatement for the Private Sector
- Environmental Management Systems (EMS)
- Eco-labelling

Environmental Management Systems and Cleaner Production

By

Joseph Karam
UNIDO Consultant

Cleaner Production and Pollution Prevention - Can we Afford to Wait?

- What is pollution prevention?
- Case studies on pollution prevention
- Benefits of pollution prevention
- Obstacles to pollution prevention
- How can we practice pollution prevention?

Upcomming ISO 14000

- Response to a need expressed at the Rio Conference on Development and Environment (June, 1992)
- Provides methodology to initiate, improve, or sustain environmental management systems (EMS) in the private sector
- Organization evaluation standards: EMS, environmental auditing, environmental site assessment, etc.
- Product evaluation standards: eco-labelling, life-cycle analysis, etc.

Industrial Sectors and Environment Division J. Karam / 3

Proposed ISO 14001

- Environmental policy statement
- Environmental management systems (EMS)
- Auditor (internal and external) to check EMS implementation
- Suppliers and contractors encouraged to establish own ISO 14001
- ISO 14001 certificate

Industrial Sectors and Environment Division J. Karam / 4

Issues for Lebanon

- Link to international trade and WTO
- Industries and trade associations
- Industries and industrial areas
- Role of government (e.g. EIA, pollution standards, monitoring)
- others

Monitoring of Industrial Processes

By

Stan C. Wallin
UNIDO Consultant

Why Monitor? (Objectives)

- Process Optimization
- Auditing of Material Inputs and Outputs
- Compliance with Emission Standards and Consents
- Quality Control
- Occupational Health and Safety
- Environmental Reporting

Stages in a Monitoring Programme

- Initiation of the Programme
- Planning
- Preparation
- Implementation
- Data Analysis and Reporting

Planning

- Specify Objectives
- Familiarization of Process and Plant
- Identify Environmental and Ecological Constraints
- Select Parameters to be Measured
- Define Scope of Programme to Meet Objectives
- Evaluate Technical and Economic Feasibility

The Role of Governments and Municipalities

By

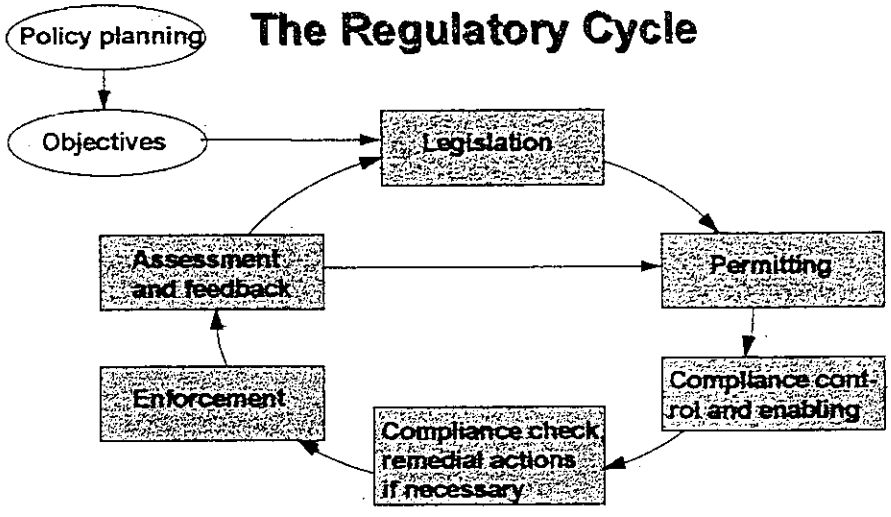
Stan C. Wallin
UNIDO Consultant

Compliance and Enforcement Programme

- Environmental laws and regulations must be in place
- Permitting system
- Verification of compliance (monitoring, inspections of company facilities)
- Encourage or compel compliance
- Regulatory Framework and Compliance Programme must be implemented gradually and provide realistic goals for the industry

Industrial Sectors and Environment Division S. Wallin (2) / 2

The Regulatory Cycle



Industrial Sectors and Environment Division S. Wallin (2) / 1

ANNEX E.
Air Quality Standards and International Agreements

E.1 Air Quality Standards (AQS)

SULPHUR DIOXIDE GUIDELINES			
Guidelines set by	**Description**	**Criteria based on**	**Concentration [µg/m^3]**
European Council	Limit value	98%ile of hourly merans	128
World Health Organization (WHO)	Health guidelines	10 minute mean	500
		1 hour mean	350
		Daily mean	125

NITROGEN DIOXIDE GUIDELINES			
Guidelines set by	**Description**	**Criteria based on**	**Concentration [µg/m^3]**
European Council	Limit value	98%ile of hourly merans	200
World Health Organization (WHO)	Guide value	98%ile of hourly merans	135
		50%ile of hourly means	50
	Health guidelines	1 hour mean	400
		Dayly mean	150

CARBON MONOXIDE GUIDELINES			
Guidelines set by	**Description**	**Criteria based on**	**Concentration [µg/m^3]**
World Health Organization (WHO)	Health guidelines	15 minutes mean	100
		30 minutes mean	60
		1 hour mean	30
		8 hours mean	10

OZONE GUIDELINES			
Guidelines set by	**Description**	**Criteria based on**	**Concentration [µg/m^3]**
European Council	Population information threshold	1 hour mean	180
World Health Organization (WHO)	Population warning threshold	1 hour mean	360
	Health protection threshold	8 hours mean	110
	Health guidelines	1 hour mean	150-200
		8 hours mean	100-120

E.2 International initiatives

UN Conference on Environment and Development (UNCED or the Earth Summit) in 1992 where world leaders endorsed: Framework Convention on the Atmosphere aimed at reducing greenhouse gases to 1990 levels by 2000; Conservation of Biodiversity; Agenda 21 and Commision on Sustainable Development; Agreement on funding with new environmental aid for developing countries.

Montreal Protocol. Revised in 1992 to phase out chlorofluorocarbons, Methyl Bromide, Halons, Carbon Tetrachloride, 1,1,1 - trichloroethane, Hydrobromofluorocarbons,

Sulphur Protocol. Targets for emissions to be reduced. UNECE committee reviewing progress to target emission limits in 1997.

Nitrogen Oxides Protocol. Came into effect in 1991 and emissions to be reduced to take into account critical loads for Europe.

ANNEX F.
Distribution of Companies, Workforce and Value Added for Industrial Sectors in Lebanon

Industrial Sectors	Number of Companies	Workforce		Value Added	
		US$	% of total	US$	% of total
Major Sectors					
Food products and beverages	4,456	30,670	21.3%	422,329,809	23.2%
Wearing apparels, fur	3,004	17,820	12.4%	161,931,479	8.9%
Wood and wood products	1,453	6,268	4.3%	56,551,940	3.1%
Fabricated metal products	3,070	13,125	9.1%	149,914,234	8.2%
Furniture and other goods	3,655	18,018	12.5%	175,916,982	9.7%
Other Sectors					
Mining and quarrying	250	1,905	1.3%	24,515,700	1.3%
Tobacco products	10	2,007	1.4%	31,800,313	1.7%
Textiles	604	4,618	3.2%	55,745,520	3.1%
Leather and leather products	843	6,044	4.2%	50,690,476	2.8%
Pulp and paper products	213	3,841	2.7%	39,598,584	2.2%
Printed matter and recorded media	408	3,931	2.7%	39,489,414	2.2%
Coke and refined petroleum products	20	906	0.6%	26,418,079	1.4%
Chemical products and m.m. fibres	245	2,984	2.1%	40,891,957	2.2%
Rubber and plastic products	399	3,192	2.2%	53,757,311	2.9%
Non-metallic mineral products	1,686	13,767	9.5%	202,087,517	11.1%
Basic metals	253	2,591	1.8%	82,041,314	4.5%
Machinery and equipment	371	3,241	2.2%	36,925,758	2.0%
Electric machinery and products	285	2,369	1.6%	34,287,770	1.9%
Radio and communication equipment	17	92	0.1%	1,299,058	0.1%
Medical, optical, watches and clocks	15	81	0.1%	621,936	0.0%
Motor vehicles and trailer	333	1,477	1.0%	15,973,968	0.9%
Other transport vehicles	19	125	0.1%	717,713	0.0%
Construction work	498	5,104	3.5%	119,374,431	6.6%
Sub Total Other Sectors	6,469	58,275	40.4%	856,236,819	47.0%
Grand Total	22,107	144,176	100.0%	1,822,881,263	100.0%

Source: Appendix I, Report on Industrial Census [11]

ANNEX G.
Visit to Cimenterie Nationale SAL, Chekka Works.

A short visit was made to Cimenterie Nationale SAL Chekka Works on 20 December. Representatives from the Ministry of Environment and American University of Beirut joined the UNIDO team. The cement works has sufficient facilities to carry out self assessment of its plant emissions on the environment. An initial estimate of the relative emissions of the plant indicated that the diesel/electric generators contributed more to ground level concentrations of sulphur dioxide and Nitrogen oxides than the cement making process.

Using meteorological and plant emission data an environmental model has later been developed to predict ground level concentrations of sulphur dioxide and NOx at distances from the source. Verification of these predictions will use simple sampling techniques. The main purpose of the model is to predict where the maximum concentrations of sulphur dioxide and NOx will occur. Careful use of the model is essential to provide the correct emission data under wind speed and direction conditions.

Results of the simulations and recommendations for appropriate sampling equipment, with cost estimates, has been sent to the company.

The detailed report of the visit to Cimenterie Nationale SAL was submitted to MoE, UNDP, UCD and Cimenterie Nationale SAL , and is included in this annex.

United Nations
Industrial Development Organization

L.K. Braute
ISED/CHEM
Beirut, December 21, 1996

MEMO

Notes of a short visit to Cementerie Nationale SAL Chekka works on Friday 20 December 1996

1. The visit was made by UNIDO's international team under the project NC/LEB/94/01D - Support to Policy Formulation for Sustainable Industrial Development and Environmental Protection in Lebanon. In addition, representatives from the Ministry of Environment and the American University of Beirut participated.

2. We were received by Mr. Pierre Doumet (Chief Executive Officer) and his senior staff. Presentations were given on the relevant aspects of the operation and business of the cement company, including:

   - History of company from 1954; introduction of new kiln: in 1957 and 1967, and start of expansion programme in 1993-1994;
   - Physical area, quarries, generating (electrical) capacity, brief factory information;
   - Corporation policy - quality of product, commitment to the enterprise, environmental concerns, also social implications locally;
   - Safety procedures and health requirements for all staff;
   - Medical details: reports of examinations, hospital treatment, blood group (personal) and arrangement for treatment by company nurse;
   - Emergency activities, if necessary;
   - Training seminar for safety, health, etc.

3. Site visits. The visiting representatives were divided into three groups and accompanied by company staff through the works and given information on all activities. Time did not permit visit to the quarry area.

4. Following the factory visit the groups returned to a meeting room for further questions and answer session. In our views the answer were satisfactory and confirmed the company's assertion that they are seriously considering all aspects of environment, health and safety.

5. In view of the diversity in interest and the time constraints this present item five covers only the technical aspects of the plant and the preliminary actions and recommendations proposed by the UNIDO representatives.

5.1 Kiln stack. The gas concentrations to the atmosphere are monitored continuously using an Irwin Sictz transmissometer, the data being recorded (plotted) in chart form. These data combined with gas volume and conditions make it possible to determine the emission rates of SO_2, NO_x and particulates (SPM).

5.2 Other potential release routes to air (A), water (W) and land (L):

- Quarry operation: A, W and L
- Raw material preparation, handling and storage: A, W and L
- Cooler: A
- Cement milling: A
- Product handling, storage and distribution: A

5.3 In plant electric generation. The heavy fuel oil used is said to contain 2.5% S and the emissions of SO_2, NO_x and particulates can be determined for generation up to 10 MW. There will be other emission such as CO, hydrocarbons (aldehydes) and poly-aromatic hydrocarbons (PAHs), but these are relatively small. It should be noted that it is very important tp maintain electricity supply to the plant, also to avoid 'tripping' of the electrostatic precipitators (ESPs) and increasing particulate emissions.

5.4 Technical data on the cement plant. Comprehensive information and flow charts were presented by the company senior staff, and the UNIDO technical expert provided relevant information on cement manufacture and quarries.

5.5 Visual observations. The expansion of the cement plant capacity was observed. Areas for improvement of the existing process discussed during the site visit were observed. It was encouraging to see action of product recovery taking place for reintroduction into process.

5.6 Surrounding area - location of nearest receptor within the vicinity of the works. During the visit we did not establish the location of the nearby property; or the nearby emittors of industrial emissions. From information available and our dispersion model we can identify where to take ambient samples.

6. Conclusions:

- The long kiln precalciner dry process is capable of burning petroleum coke, with the correct operating conditions and meal, in an environmentally acceptable way.
- Replacing the clinker crusher cyclones with ESPs will reduce significantly the emissions from this part of the process.
- It is desirable at this construction stage to increase the height of the new stack by approximately 7 meters. This will reduce the tendency for down drought of the plume thus improving dispersion and reducing maximum ground level concentrations.
- Calculations based on plant operation indicate roughly comparable emissions of SO_2 from cement stacks and the electricity generating facility. In view of the relatively lower discharge height from the diesel generators, these contribute more to ground level concentrations of SO_2 and NO_x.

7. Recommendations:

- The Cementerie Nationale works has sufficient facilities and some training to carry out self assessment of its plant emissions on the ambient atmosphere, water and land. Simple to use field detector kits are available for soil and water at low cost. In view of the request for data in the ambient atmosphere e.g. 'Fenceline' monitoring, low cost kits are available for this function and will provide data on SO_2, NO_x and particulate concentrations. Full details of this equipment and costs will be included UNIDO's final report for the project NC/LEB/94/01D.
- In our view the cement plant does not, on the basis of this visit, create large environmental impacts on the local community, although inevitably there is an amenity effect.

cc: Ministry of Environment
Mr. P. Doumet, Chief Executive Officer, Cementerie Nationale SAL
Mr. R.S. Mountain, Resident Representative, UNDP Lebanon
Mr. Al-Hafedh, UNIDO Country Director, Lebanon