



REPUBLIC OF LEBANON
MINISTRY OF ENVIRONMENT

LEB/99/005

W3A



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

الجمهورية اللبنانية
مكتب وزير الدولة لشؤون التنمية الإدارية
مركز مشاريع ودراسات القطاع العام

ANALYSIS OF SELECTED TOPICS IN
"LEBANON ASSESSMENT OF THE STATE OF ENVIRONMENT 1995"

TOPICS STUDIED ARE:

AIR QUALITY
ENERGY SECTOR
ECONOMY AND ENVIRONMENT
SOLID WASTE
POPULATION AND HUMAN SETTLEMENT

SARA YEHYA
1999



GLOSSARY

ERM: Environmental Resources Management

CDR: Council for Development and Reconstruction

CO₂: Carbon Dioxide

CO: Carbon Monoxide

METAP: Mediterranean Environmental Technical Assistance Programme

NERP: National Emergency Recovery Plan

NO_x: Nitrogen Oxide

O₃: Ozone

SO₂: Sulfur Dioxide

TPM: Total Particulate Matter

VRO: Vehicle Registration Office

VOCs: Volatile Organic Compounds

WHO: World Health Organization

1 toe: 41.8 Ggajoules

General Definition

Coastal Zone: Defined as the inclusive of the shoreline, the coastal plain (and lower plateau of Akkar till 500m) and the foothills of Mount Lebanon (up to 250m).



AIR QUALITY

There is no available data concerning air quality in Lebanon and so there can be no direct description of the exposure of the population to airborne pollutants. Sufficient is known of the Lebanon's Transport Systems, industry, population density, geography and climate to identify the key issues. The key data available for the quantification of atmospheric emissions can be summarized as follows:

- **Number of vehicles**
- **Vehicle flows on the roads**
- **Fuel type and use**
- **Location and type of major industries**
- **Population statistics**
- **Energy use**

Based on the fuels used in Lebanon, a crude inventory of total emissions has been prepared; the emissions covered are: CO₂, SO₂, NO_x, Total Suspended Particulate (TSP). Total emissions of SO₂ are estimated about 85,000 tons in 1993. The emissions of NO_x contribute an estimated 32,000 tons in 1993/4. The volume of these emissions is expected to increase, so overall air quality is likely to deteriorate.

Environmental Impacts

- Energy /combustion emissions from industry and from power station, airborne pollutants produced by vehicles, including CO, SO₂, NO_x, CO₂ and Volatile Organic Compounds (VOC), lead to high concentrations of these pollutants emissions and pose a localized problem but are outweighed in health terms.
- Use of lead fuel is widespread in Lebanon and so emissions of lead and its compounds may be of concern for public health. The estimates of total lead emissions represent significant quantities of lead and suggest that particularly in the atmosphere could pose health problem.
- Ozone affects different section level of the population from those directly affected by vehicle emissions. There is no direct measurement of Ozone in Lebanon however the vehicle concentrations emissions are elevated around Beirut and along the main coastal road.



Related effects of air pollution are the following:

- Damage to sensitive ecosystems by acidic compounds and excess nitrogen
- Long range transport of pollutants
- Soiling of building by particulate matter and damage to building materials caused by reactive pollutants.

Information to be updated

- Locations of Road-side peak-hour ambient air quality;
- Traffic concentration in urban areas;
- Areas where certain pollutants (such as CO, HC3, Pb, NOx, SO2, O3) may be present in the atmosphere in sufficient concentrations. This might be of main concern for human health and the environment;
- Quantity of Cement and fertilization production by plant (t/year) in Lebanon and associated emissions of dust (t/year);
- Monitoring of lead concentration in the atmosphere: this needs to be undertaken in order to determine the extent of any lead problems in towns and cities and near the major roads;
- Measurement of elevated Ozone concentration in Lebanon around urban zones;
- Concentrations and emissions of SO2 from industry, power stations and vehicles;
- Concentrations and emissions of CO2;
- New data from the VRO about vehicles throughout; and inspection of any new information that could be helpful in this field;
- Detecting any new proposal or new project that could be launched;

Monitoring activities and monitored pollutants should be concentrated on:

1. Emissions from industry particularly cement plants, fertilizer and sugar-beet factories.



2. Emissions from Power Generation, as thermal power plants, private power generation and acid deposition
3. Emissions from refineries.
4. Emissions from vehicles.

Project and studies related to "Air Quality"

1. The Beirut Transportation Study prepared by Team International in 1994 gives a description of traffic flows in the city.
2. EDL has prepared in 1993 a summary of Lebanese Power Station Data
3. ERM: - Estimated inventory of emissions of selected pollutants to air in Lebanon (1993 and 2010)
 - Expected emissions from Electricity Generation (t/year) in 2010
 - Estimated emissions from Electricity Generation and vehicles in 1993/4 (t/year)
 - Estimated emissions from vehicle and health effects (1995)
 - Estimated Maximum Hourly concentrations of the pollutants (1995)
4. WHO and METAP have made research and studies which are interesting in Air Quality field.



REPUBLIC OF LEBANON
MINISTRY OF ENVIRONMENT





ENERGY SECTOR

Data related to the Energy sector can be drawn from 3 major sources:

1. Electricité de France together with Electricité du Liban
2. The Ministry of Industry together with the Ministry of petroleum
3. Some original research concerning the use of internal generated electricity by the Environmental Resources Management Team

It is essential to mention that the petroleum and gas sector is the responsibility of the Ministry of Petroleum. The Ministry of Petroleum and the Ministry of Industry are also responsible for pollution generated from petroleum industry. Electricity is supplied through EDL.

Apart from a modest amount of hydropower, Lebanon is entirely dependent on imports of fuel for energy. Primary energy consumption in Lebanon in 1993/94 was 3.5 M/toe. The balance of primary energy is consumed by the Cement Plants, 0.126 Mtoe, and in the form of petroleum largely used for vehicles.

Plans for the energy sector are majorly concerned with rehabilitating the physical infrastructure and securing the supply supply to industrial and domestic consumers. The immediate effect of rehabilitation of the power supply is the reduction of the use of private generators for domestic electricity supply.

Environmental impacts

The Energy Sector have serious environmental impacts on certain phenomena. Following is a list of these phenomena with their impacts:

- Atmospheric emissions: The thermal power stations, informal generation and refineries give rise to emissions of Sulfur Dioxide (SO₂), Oxides of nitrogen (NO_x) and CO/CO₂... The impact of these emissions on air quality and human health will depend on the capacity of the plant, the fuel burned, and the proximity to human...
- Oil Spills: The movement of oil tankers along the Lebanese coast represent a potential oil spill hazard with potentially serious impacts on marine and coastal ecosystems;
- Disposal of used oils: Waste oil from stations produces localized problems at the outfall of on-site drains, or the waste oil from private generators is more dispersed. The discharge of oil does not pose a major short-term problem,



uncontrolled disposal of oil will cause a long term low level chronic pollution problem;

- Cooling water discharges: Lebanon's major power plants require cooling water from the sea (Zouk, Jieh, Haryche). Discharge of cooling water from coastal power stations can give rise to a number of damaging impacts on the marine environment.

Information to be updated

- The imports of Petroleum products and their main uses;
- Current status and trends of Energy sector: consumption, imports, and energy balance;
- Projected emissions of SO₂ (For the Power Sector in thermal power stations, informal generations and refineries);
- The value of cooling water flows of the power plants (l/s) and the impact assessment of these discharges;
- The generation of waste lubricating oil in the Power sector;
- Updating information about EDL supply;
- Updating the information and following the progress of "Solar Water Heating in the Domestic and Commercial Sectors", a phenomenon that had a considerable potential in Lebanon;
- Docking, storage and spill facilities of oil tankers to prevent any oil spill hazard.



POPULATION AND HUMAN SETTLEMENTS

There has been no census of population since 1932; current estimates of population in Lebanon are largely built on those developed from this census.

Like many other countries there has been a continuing move towards increasing urbanization, and in Lebanon the population has centered on the narrow coastal zone.

The spatial distribution of population has major implications on environmental quality, mainly the demand for land resources and for environmental services: waste, water treatment, water supply and disposal of solid waste. The estimated distribution of population in 1994 shows that population is distributed with about 60% on the coastal zone. These statistics illustrate the immensity of the demand for natural resources in the coastal zone; implying considerable pressure on the coastal ecosystems together with land and water resources. It is important to note that during the war period (1975- 1990), urbanization has extended and produced new urbanized areas such as the Southern Suburbs of Beirut and the extensions of the Northan part. But much of this urbanization is considered as an illegal/ unauthorized development. Some of the aspects reflecting these forms of unauthorized development are:

- Location of industries within residential lands;
- Absence of public open space;
- Low investment in urban infrastructure ranging from sewerage to the maintenance of the urban fabric.

Environmental impacts

Population growth has some potential impacts on the natural resources and the environmental management services. Lebanon birth rate was estimated at 25 to 33 births/1000 persons in 1970. The estimated crude death rates lies between 5 to 8 deaths /1000 populations in 1995. A positive net growth of around 2% can be foreseen for the coming 10 –20 years overall.

On the other hand the process of unplanned and uncontrolled development and the intense pressure on land use and natural resources (particularly the coastal zone) have imposed a huge pressure on natural environment. The environmental impacts are revealed by:

- Threatening the land area and the quality of coastal waters;
- Decaying old city centers bordering the water front (with historical monuments and archeological sites);
- Bad operating conditions of commercial, fishery and tourist ports;



- Encroachment of residential development on the remaining plantations and the forested mountain slopes bounding coastal plains;
- Pollution of remaining public beaches which are littered with garbage;
- Incompatible coastal land use with polluting industrial activities next to residential and touristic developments;
- High levels of air pollution from industry and traffic;
- Use of agrochemicals in the intensively farmed and irrigated plantations along the coastal zone resulting in land and water contamination.

Information to be updated

- Percentage of the urbanization of agricultural land around cities;
- The pressure from the tourism or the % of tourism per year;
- Demonstration of the new state of the coastal zones: What's new about the city center, population density, and commercial business. And what are the effects of the population pressure and the unplanned development;
- What's new about the Principal Contributors to Environmental Stress (specially on the coastal zone) as:
 - Irrigated areas
 - Coastal sand mining
 - Major dump sites
 - Forest fires
 - Industries and refineries
- The population in Beirut is expected to grow during the year of reconstruction (central district), So as we have seen there will be a considerable impact on the environmental management services. **Therefore an accurate updating of the growth rate is needed;**
- Checking and following any new development programme or new strategy for the unplanned urban area especially coastal zones; also checking if these programmes are respecting environmental norms.



REPUBLIC OF LEBANON
MINISTRY OF ENVIRONMENT





Related projects and studies to be checked and followed:

- The Ministry of Planning had presented in 1969/70 the distribution of the population of Lebanon by Administration Division;
- The General Directorate of Urban planning (1973) has devised an approach to separate urban zones with green strips and concentrate urban development;
- The Recovery Programme (Bechtel wp44, 1991) has made a number of proposals for a rural-urban landuse planning strategy;
- Between 1974 and 1992, the Director General of Urbanism (Mohammad Fawaz) has identified many reasons for the “failure urban planning in Lebanon”:
 - Absence of a comprehensive plan on a national level
 - Negative attitude of municipalities towards local Master Plans
 - Weak support by the central government and the public at large for Master Plans and development controls
 - Disregard of building laws
 - The low budget allocated for urban planning research

It is required to manifest and update the aims concerning these projects, and to give a specified study concerning their funds, and point out any achievement took or is taking place.



SOLID WASTE

Different waste types

Domestic wastes: the quantity of domestic wastes is expressed as a "Generation Rate", that is the average weight of solid waste produced by one person in one day.

Industrial wastes: most industrial wastes are reasonably inert, but some are classed as toxic or hazardous and must be handled and disposed of with special care. Much of the industrial waste in Lebanon comes from small industries, many of which are sited residential areas, so that their waste is mixed with domestic waste. Although very little industrial solid waste is tough to be hazardous, wastewater discharges from some industries, notably tanneries and metal treatment, may contain higher quantities of toxic material.

Commercial wastes: it typically consists of food wastes or metal and rubber, or paper. The predictability of wastes from such sources often makes them suitable for some recycling.

Vehicle tires: An estimate of the rate at which vehicle are being discarded was made by Libanconsult in 1994. It was estimated that 400000 people in Beirut discard over 10000 tires each year.

Construction wastes: Lebanon has very large quantities of construction and demolition wastes to be disposed of as a direct result of the war.

Waste oil: waste oil is currently disposed of to sewers, drains wasteland, waterways, municipal dumps and some is burned. ERM's analysis that the Power Sector generated about 300t/year in 1995 and used lubricating oil from vehicles amounting to about 7000t/year.

Hospital wastes: there is very little information on the generation of hospital wastes in Lebanon. The degree of danger from clinical wastes varies by hospital and type of waste management.

Different waste treatments:

Dump sites: (Borj Hammoud- East Beirut, Normandy Bay- Wes Beirut, Tripoli, Saida) Most of the current disposal sites in Lebanon are uncontrolled dumps and the sites of any of these dumps were chosen without taking regard for the environmental impacts of the operation.



Compost plants: A compost plant was built between 1975 and 1978 at Qarantina at Beirut, but it has never operated satisfactorily.

Incinerators: An incinerator was installed by INOR at Ammroussieh near Beirut Airport in the 1980's, but it has not been operating according to the designer's specification. It has been operated by Sukkar Engineering in 1993 under a contract by CDR. Nearby residents have protested about the odors from the incoming waste and from the flue gases. On the basis of experience, incineration has not shown to be a satisfactory option technically or environmentally.

It is important to note that some recovery for recycling in Lebanon took place. Scavengers remove domestic wastes from street containers in Beirut, and recycle aluminum cans, paper and card. The existing recycling activity should be encouraged as an important part of an overall solid waste management and treatment strategy.

Responsible Authorities:

Municipalities: The Ministry of Municipalities is responsible for overseeing the collection of refuse outside Beirut

The Ministry of Environment: The MoE is promoting laws and regulations to control environmental pollution resulting from solid wastes and other sources. The Sector Implementation Unit (SIU) attached to the MoE and contracted to the CDR, is wholly concerned with solid waste management.

Environmental Impacts

- The unknown quantities and locations of toxic wastes including the drums of toxic chemical waste that are known to have been dumped around the country, give risk of contamination of water supplies and soils with dangerous implications for human health.
- The disposal routes of industrial wastes pose serious threats to ground and surface water particularly where the industry is concentrated.
- Unmanaged waste dumps cause forest fires.
- Odor and dust are a further problem from unmanaged dumps.
- Used tires, currently dumped or burned, give rise to a range of environmental problems.



- Most of the hospital waste generated is collected and disposed of by municipal collection systems carrying serious risk of epidemic and infection.

Information to be updated

- What's new about the management of existing dumps and how to clean up remains?
- Inventory of municipalities which are concerned by waste collection, indicating constraints faced by these municipalities; plus mentioning their capital and operating costs of waste collection;
- Municipalities funds provided to solve solid waste problems;
- All information about the most significant shoreline dumps (high- volume truckloads of waste/ day – waste composition) and the plans for their future;
- Estimates of total wastes arising by type (t/year): domestic wastes, industrial wastes, commercial wastes, construction wastes, and hospital wastes;
- Aims and achievements of the Sector Implementation Unit; also the estimation of the required funds
- The existing recycling activity: collection (quantity/day/region), disposal, cost recovery charging;
- Is there new programme to manage wastes problem that could be based on public awareness and participation;
- Detecting any new programme that encourages hospitals to separate their wastes; toxic wastes and untoxic wastes, and creating database that could follow and control managements and collection wastes in hospitals;
- Development of new studies and research to find an approach that will be successful for the treatment of water in Lebanon.

Projects and studies related to Solid Waste field:

- Camp Dresser and Mckee (CDM) in association with Khatib and Alami carried out a major study of the whole waste management sector;
- CREED and Libanconsult produced designs for sanitary landfills in 1994;
- Libanconsult have proposed composting projects outside Beirut and an incinerator project in Beirut;



- Libanconsult carried out in 1994 a survey of industrial waste type, quantities, and disposal routes;
- ERM has performed a very detailed study of generation rates examining small daily samples in order to build up a picture of generation rates throughout the country (in 1995);
- Sukkar Engineering has elaborated a project related to the "Contracting of waste collection";
- The Ministry of environment has prepared Terms of Reference for studies into management of both industrial and clinical waste;
- A full waste management plan was agreed upon in April 1995 with the support of the World Bank, for 24 landfills in each cazas: 12 of the 24 landfills are to be financed through the NERP, and the Balance through a loan from the World bank;
- CDR and SIU were preparing contracts for the collection of industrial and hospital wastes and car wrecks;
- The MoE's Master Plan in 1993 proposed 4 new incinerators in Lebanon each with its capacity to be: Dora (600 t/year), Zouk (200 t/year), Saida (200 t/year), Tripoli (indefinitive);
- In 1995 and according to MoE, there were committed plans for composting plants, with planned capacities of composting at: Ammroussieh (600 t/day), Qarantina (600 t/day), Zahle (200 t/day), Sour (150 t/day), Saida (200 t/day).



Economy and Environment

Before 1975, Lebanon was considered to have a strong and stable economy, where growth was largely led by services, in particular tourism and financial services, with some manufacturing industry. By the end of the war period, Lebanon had lost half its capital stock (source: World Bank, 1995); since then, the economy has struggled to reassert its previous comparative advantages. The Tourism infrastructure had been badly damaged and the coastline spoiled as a result of uncontrolled waste dumps and urban pollution.

In 1989, the government has drawn up a program for rehabilitation and recovery in Lebanon called *Horizon 2000*. The main goals of this program are as follows:

- Re-establish Lebanon as a financial center in the Middle East.
- Repair damaged industries.
- Redevelop the tourism industry in Lebanon.
- Invest in rural areas to redevelop agriculture (repairing damaged irrigation systems).

A public investment program, known as the National Emergency Recovery Program (NERP), was developed between 1993 and 1995. The responsibility of the recovery program is vested in CDR. Its expenditure is broadly broken down by physical infrastructure, and the four largest budgets are planned for transport (US \$ 3.0 billion), electricity (US \$ 1.6 billion), education (US \$ 1.5 billion), and housing and resettlement (US \$ 1.05 billion). This recovery plan aims for real GDP growth of 11% per year, in order to regain the prewar level of output by the end of the millenium.

There are no available statistics/data showing the structure of the economy, also any available employment data, although there is a number of indicators of high-levels economic activities in the private sector such as: total employment of nearly 470,000 of a population of 1.16 million (IAURIF 1994), total manufacturing workforce of 140,000 in the industry survey (MoIP 1994), and agricultural employment and the public reconstruction program (valued at US \$ 1 million in 1994).

Financing of the recovery program is currently problematic due to the following reasons:

- Weak central government taxation
- Serious problems with the local government financing (municipal funds)
- Problems with excise duties and import controls



Recovery Program and The Environment

The development of the economic activity and the policies which poster that development have a profound impact on the environment and the use of environmental resources. For the reasons below, a significant proportion of the expenditure program is planned for the environmental infrastructure: water treatment, solid waste management, and water supply. Investment in the energy sector also has an environmental impact.

Infrastructure Programs:

- *Transport:* Roads sector is the largest sector in the Horizon 2000 program. The net impact on the environment here could be negative if this sector generates increased traffic flows in the absence of offsetting policies to improve the emission levels for vehicles.
- *Water Supply and Wastewater:* This investment is urgently needed since much of the water supply in the country is contaminated, posing health hazard on the population. The waste master infrastructure is also badly damaged, and untreated sewage is directly discharging to the sea, rivers, and wadis. The main elements of the recovery program are the rehabilitation of the water supplies and sewers, and construction of long sea out falls.
- *Solid Waste Management:* The rehabilitation and construction of landfills, compost plants, and incinerators for solid wastes are the essential aims of this program.
- *Power Sector:* The planned investments in the power sector are to reduce the rate of pollutant emissions and to increase the efficiency of production.

→ Taxation and the level of government revenues have a direct impact on the environment in two ways:

1. Taxes may provide incentives for behavior which affect the environment, both positively and negatively.
2. While some environmental management activities may lie within sector, or where there is scope for direct cost recovery, others lie firmly in the public good domain such as nature conservation; the availability of public resources is central to the effective implementation of environmental policies.

Information to be Updated:

- The Recovery Program: Expenditure in different sectors, which are:



- Physical Infrastructure
- Social Infrastructure
- Productive Sectors

- The distribution of employment between major economic activities: Agriculture, Industry, Manufacturing, Electricity, Gas, Water, Construction, Transport, Communications and other services.

- Municipal funds for local government

- The percentage of the population connected to sewers, since the recovery program aimed to connect 50% of the population to sewers by 1997.

- Breakdown of Recovery Expenditure for the Environment including the following major items:
 - Construction and equipment for new building and institutional strengthening.
 - Environmental monitoring units.
 - Equipment for Central Environmental Laboratory.
 - Industrial pollution study and laboratory.
 - Environmental standards study.
 - Campaign for cleaning shoreline.
 - Vehicles and equipment for emergency preparedness.
 - Environmental protection and establishment of nature reserves.
 - Environmental awareness campaign.

(Horizon 2000 and CDR have already done this breakdown in 1992.)

- New governmental plan to provide reconstruction and economic performance.
- Current Lebanese GDP or GDP growth (percent per year).
- The distribution of employment between main economic activities

(The National Employment Office has already shown the distribution of employment in 1992. And the ERM has made an estimated distribution in 1994.)

- Detection of the achievements of the infrastructure programs in the Horizon 2000 program.
- The current budget of the Ministry of Environment regarding the sustainability of the environment investment program.
- Ability of the municipalities to manage the environmental program.