REPUBLIC OF LEBANON
MINISTRY OF ENVIRONMENT
UNEP-MAP

NATIONAL ACTION PLAN FOR THE REDUCTION OF POLLUTION INTO THE MEDITERRANEAN SEA FROM LAND BASED SOURCES

Prepared by

ECODIT

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GEF

MINISTRY OF ENVIRONMENT

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List of Acronyms and Abbreviations

ALIND	Association of Lebanese Industrialists
AUB	American University of Beirut
BB	Baseline Budget
BOD	Biological Oxygen Demand
CDR	Council for Development and Reconstruction
CNRS	National Council for Scientific research
DGUP	Director General of Urban Planning
EIB	European Investment Bank
IRI	Industrial Research Institute
JBIC	Japanese Bank for International Cooperation
KFW	German Reconstruction Fund
LBS	Land Based Sources
LCC	Lebanon Chemical Company
LCPC	Lebanese Cleaner Production Center
MoA	Ministry of Agriculture
MoE	Ministry of Environment
MoEW	Ministry of Energy and Water
MoI	Ministry of Industry
MoPWT	Ministry of Public Works and Transport
NAP	National Action Plan
NCNS	National Center for Marine Sciences
NDA	National Diagnostic Analysis
ODP	Ozone Depleting Potential
ODS	Ozone Depleting Substances
POPs	Persistent Organic Pollutants
SP	Sectoral Plan
USJ	University of Saint Joseph

1. BACKGROUND AND SCOPE

1.1. Background

UNEP contracted ECODIT Liban the preparation of the National Action Plan (NAP) for the reduction of pollution of the Mediterranean Sea from land based sources. This activity comes after the UNEP evaluation committee reviewed an earlier version of the NAP (prepared by another Consultant) and found the report substandard as it did not conform with UNEP guidelines. ECODIT prepared this NAP by relying extensively on the SPs prepared by Envirotech and received significant support from the MEDPOL Focal Point at the Ministry of Environment during the presentation of issues and the identification of priority actions.

1.2. Geography and administrative regions

Lebanon, a small country (10,400 km^2) on the eastern shores of the Mediterranean, measures on average 45 km in width (from East to West) and 225 km in length (from North to South). It is located between N latitude 34° 42' and 33° 3' and East longitudes 35° 6' and 36° 37'. The country is bordered by the Syrian Arab Republic to the north and east and Israel to the South. Lebanon's physiography is unique, dominated by two mountain ranges which run parallel to the sea (NNE-SSW) and are separated by the Bekaa valley. Combined, these mountain ranges cover three-quarters of the country's surface area and harbor a wealth of cultural and natural attractions.

Lebanon is divided into six Governorates (called Mohafazas) and 25 districts (called Cazas). Four of these Governorates are directly connected to the Mediterranean Sea and therefore constitute the Administrative Regions related to this National Action Plan: North (denoted A), Mount Lebanon (B), Beirut (C) and South (D). Figure 1 presents a map of Lebanon and the administrative regions.

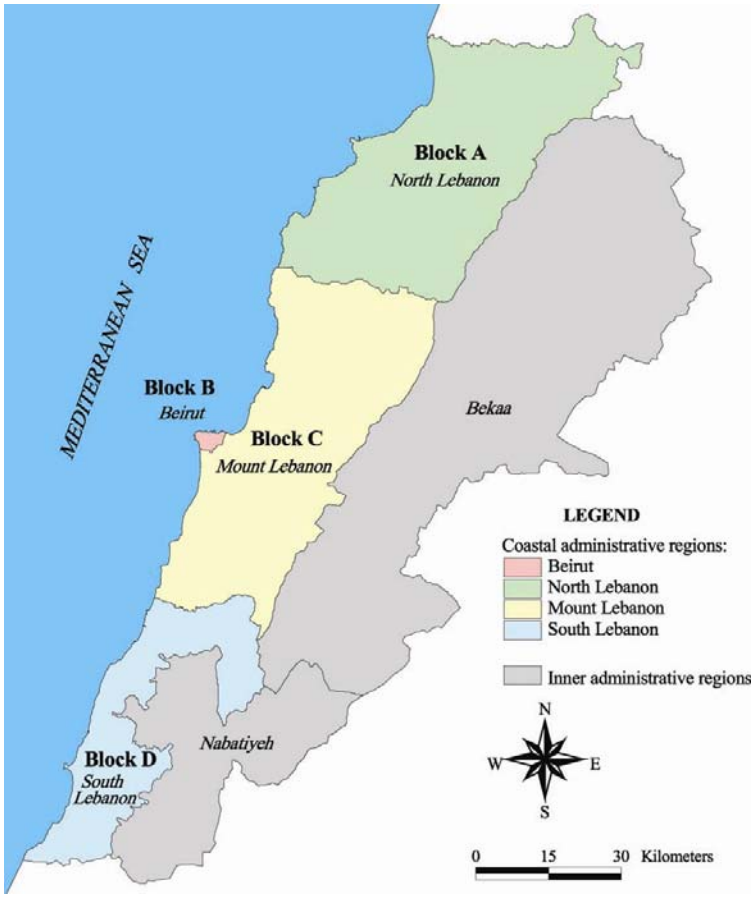

Figure 1: Lebanese Coastal Administrative Regions

* Source: SP, 2005

It is important to note that the administrative region do not cover the entire surface area of the Governorate because significant portions of these Governorates do not impact the Mediterranean Sea whether directly or indirectly. For purposes of both the Sectoral Plan and National Action Plan, we have generally considered each administrative region to represent the coastal strip from the shore up to an altitude of 800 meters a.s.l. or 10 -15 km inland, whichever comes first.

Figure 2: Administrative Regions in Coastal Zone

* Source: SP, 2005

1.3. Overview of the national issues related to LBS Protocol and SAP

Land based sources of pollution in Lebanon, like in most countries of the Mediterranean, include domestic sewage, urban solid waste, industrial effluent, industrial waste (hazardous effluent and solid waste), air pollution, organohalogens and persistent organic pollutants (POPs). These issues impact the Mediterranean Sea in different ways and to different extents. They are a problem in all administrative regions but may not necessarily warrant a priority response in the short-term, i.e., by 2010.

1.4. Developing NAP - strategy and approach

Sectoral Plans

This NAP was prepared based on the Sectoral Plans, the National Diagnostic Analysis (NDA) and the Baseline Budget (BB). The sectoral plans provided detailed information in relation to: sewage, solid waste, heavy metals, industrial hazardous waste, air pollution, POPs and organohalogens. The plans contain information on previous, on-going, as well as pipeline projects and programs in relation to each sector. For each sector, the plans also identify key stakeholders, current status of treatment and disposal, and hotpots.[1]

It is important to recognize the contribution of the National Environmental Action Plan (NEAP) to the preparation of the Sectoral Plans and, by extension, the National Action Plan. However, the NEAP is still being drafted at MOE and will not be finalized before the end of 2005. Therefore, only a draft version of the NEAP could be consulted to support the formulation of this NAP.

Scoring Matrices

Building on the SPs, the NAP summarizes sector-specific issues in each of the four coastal administrative regions. For each administrative region, the NAP then formulates priority actions based on the analysis of issues and impacts in the form of a matrix. Each priority action is then described in terms of target sites (where available), pollutant, expected reduction, stakeholder responsible and time framework for implementation of the proposed action. Naturally, there were many priority issues and actions common to several administrative regions. Issues and actions specific to each administrative region are presented in Chapters 2 through 5 – *Assessment of Issues in Administrative Region A, B, C and D,* respectively. Other issues and actions that are common to several sectors or administrative regions, including policy planning and regulatory interventions, are presented in Chapter 6 – *National Issues.*

In identifying the priority issues, the authors of this report and the MedPol focal point at MOE agreed to limit the number of priority issues in each administrative region to three, for which actions are realistically feasible by 2010, rather than enumerate a long list of important issues and associated actions that cannot be implemented in the foreseeable future.

National Stakeholder Meeting

The Ministry of Environment and ECODIT organized a National Stakeholder Consultation meeting on September 19, 2005 at the Social and Economic Council in Beirut (see program in Appendix A). Thirty three participants attended the workshop (not including workshop organizers) including government staff, municipalities, the private sector and a selection of NGOs. Mr. Michael Angelidis (MEDPOL) attended the meeting as well. The workshop organizers distributed copies of the draft investment portfolios to familiarize the participants with the proposed actions. Finally ECODIT wrote a full stakeholder meeting report to document key findings and recommendations.

Other Consultations

In light of the very limited resources allocated for NAP preparation, ECODIT consulted a selection of individuals in different agencies to validate and fine tune the draft investment portfolios (see list of consultations in Appendix B). Key consultations were conducted with MOE, the Council for Development and Reconstruction, the National Center for Marine Sciences and the Lebanon Chemical

[1] The Sectoral Plans were prepared by Envirotech Ltd (2005).

Company. ECODIT also participated at the "Mediterranean Multi-Stakeholder Forum on the Protection of the Mediterranean Sea from Land-Based Pollution: Prospects and Partnerships" in Athens, October 10-11, to discuss priority issues and proposed actions with neighboring countries. On October 25, the ECODIT team also met with the Director General at the Ministry of Environment, Dr. Berj Hatjian, to validate the priority actions and gauge the ministry's interest and commitment to continue the SAP process and take part in the planning and design of the PDF-C project document that will be prepared by the MEDPOL Secretariat (see MOE letter to the Secretariat in Appendix C).

1.5. Limitations of this report

This report is the first National Action Plan that Lebanon produces in response to the Barcelona Protocol for the protection of the Mediterranean Sea from land-based pollution. Although it contains thoughtful analysis and prioritizes issues in the Lebanese coastal zone, several limitations are noteworthy:

1. **Faulty public and stakeholder participation process:** Implementation of the SAP process in Lebanon did not fully exploit the benefits and opportunities offered through public participation. In particular, the National Diagnostic Analysis and the Baseline Budget were conducted without consulting the public or in-depth assessment of pollution loads; the findings therefore did not enjoy the desired level of ownership necessary to facilitate priority setting.
2. **National Action Plan started late:** UNEP/MEDPOL contracted ECODIT in May 2005 to prepare the National Action Plan. At that time, the Sectoral Plans were not produced yet and therefore NAP preparation did not effectively start till July 2005.
3. **Government programs change:** There is little coordination between line ministries in Lebanon. Consequently, government programs are often modified to accommodate new priorities; for example, investment programs in the solid waste and transport sectors have changed course more than once in recent years in response to political (and social) pressures. This makes the formulation of NAP priority actions that are in line with government programs all the more difficult.
4. **Data on air and water quality poor:** While Lebanon's capabilities in water and air quality monitoring are improving, continuous data are rare or hard to get. It was consequently difficult to apply the UNEP guidelines for scoring environmental issues objectively.
5. **Pollution from the Litani River watershed was not assessed:** Coastal waters in Lebanon are impacted by 16 rivers that discharge into the Mediterranean Sea including the Litani River. The Litani River, the largest river system in Lebanon, receives significant effluent from both domestic and industrial sources. Priority issues in the Litani River watershed were not assessed and therefore no actions have been proposed. However, the Litani River is receiving significant international attention and would need to be included in a future version of the National Action Plan for Lebanon.
6. **Pollutant reduction percentage lack objective and scientific validation:** Principally due to the lack of effective and transparent public consultations during the early phases of the SAP process, percent reduction values presented in the report do not carry sufficient political and social clout. They would need to be discussed more thoroughly with concerned stakeholders to meet the 2010 horizon and any future time horizon.
7. **Cost of priority actions are approximate:** Priority actions costs are based on published figures. The cost of building and operating wastewater treatment plants are based on the official bulletin published by the Council for Development and Reconstruction (which are in turn based on actual tenders). ECODIT did not directly evaluate the costs of the proposed actions under this NAP.

Nevertheless, the NAP provides a solid platform for organizing actions over the coming years to reduce pollution of the Mediterranean Sea from land based sources.

1.6. Report organization

This report is organized into 10 chapters:

1. Background and scope
2. Issues in Administrative Region A (North)
3. Issues in Administrative Region B (Mount Lebanon)
4. Issues in Administrative Region C (Beirut)
5. Issues in Administrative Region D (South)
6. National Issues & Actions
7. National Framework for NAP Implementation
8. Investment Portfolios for NAP Implementation
9. Monitoring and Reporting System
10. Conclusions

2. ISSUES IN ADMINISTRATIVE REGION (A): NORTH

This chapter assesses issues and priority actions in Administration Region A (North). It also presents goals and management objectives to implement the priority actions.

2.1. Introduction

The North Governorate is composed of four cazas (Akkar, Koura, Zgharta and Tripoli) which collectively represent about 620,000 people. This region houses several large scale industrial complexes including three of the country's cement factories and a large chemical fertilizer plant. The capital of the North is Tripoli (population of about 250,000) which is equipped with the country's second largest commercial port. There is one thermal power plant in the North - Deir Ammar; it was completely refurbished in the mid 1990s. The plant has been designed to run on biogas but continues to use diesel until gas conduits from Syria (and/or Egypt) are completed.

2.2. Identification and assessment of priority issues

This section summarizes sector-specific issues in Administrative Region A (North) to come up with priority issues for 2010. The issues are presented by sector based on the findings of the Sectoral Plans.

2.2.1. Sewage management

Sewage management in the North is almost inexistent. The bulk of sewage generated from residential (and industrial) areas is discharged in streams or directly into the sea via 15 short sea outfalls without prior treatment. Hotspot areas include (from North to South) Al Abdeh, Tripoli, Enfeh, Chekka and Selaata. Collectively, these areas receive an estimated 74,300 m^3/day equivalent to a BOD charge of 10,850 tonnes per year[2]. Industries release an additional estimated 6,000 m^3/day (1994 figure) via 13 identified short sea industrial outfalls and the Tripoli dumpsite releases an estimated 24,000 MT of leachate per year. Clearly, sewage poses a significant threat to public health and the marine environment.

2.2.2. Urban solid waste

Although municipal solid waste services have improved significantly in Tripoli and other coastal cities in the North, solid waste continues to be dumped in uncontrolled seafront landfills (Tripoli), on beaches (Akkar coastal plain) or inland. The Tripoli site is by far the largest seafront dumpsite receiving municipal solid waste from an estimated 400,000 people. The dumpsite has in recent years been upgraded and partially rehabilitated (a seawall was erected to contain the site) but continues to be a source of pollution in the form of leachate (see Section 2.2.1) and benthic litter. The site is currently operated and managed by a private contractor at $1.2 million per year – this includes day-to-day operations (routing incoming trucks, compaction, daily cover) and maintenance (gas vents). There are no other significant point sources of pollution from urban solid waste in the North.

2.2.3. Air pollution

Air pollution in the North is potentially severe in specific locations. Sources of air pollution include the transport sector (such as road congestions in Tripoli) and the industrial complex in Chekka (which hosts three of the country's four cement factories). Tripoli and Chekka therefore constitute potentially significant hotpots in Administrative Region A. Air quality monitoring capabilities have improved (e.g., the Federation of Municipalities of Al Fayhaa runs a functional air quality lab and cement factories have installed equipment to monitor stack emissions in coordination with MOE) but need significant additional resources to conduct continuous monitoring across a wider geographic region.

[2] NDA, 2003

2.2.4. Heavy metals

Several activities in the North release potentially significant concentrations of heavy metals in the Mediterranean Sea. These include the Tripoli dumpsite, the port of Tripoli, the industrial complex in Chekka (mainly Cimenterie Nationale) and the chemical fertilizer plant in Selaata (Lebanon Chemical Company). Although it is safe to assume that some degree of bioaccumulation of heavy metals in marine organisms is occurring, there is little tangible data to support such claims. Lebanon's capability in monitoring marine organisms (stocks and tissue quality) is extremely limited.

2.2.5. Organohalogens and POPs

It is difficult to assess organohalogens and POPs in Lebanon at the level of administrative regions. Data on organohalogens and POPs are poor and usually aggregated. A preliminary national inventory of dioxins indicated that the greatest single source of dioxin release in the country is from uncontrolled combustion processes. A similar inventory of PCBs revealed that the electricity sector is the largest repository of PCBs in the country. And a third inventory determined that pesticides (namely those listed under the Stockholm Convention) are generally found in insignificant quantities. The inventories did not identify specific stockpiles or hotpots in relation to dioxins and pesticides though pesticides are expected to have accumulated in some agricultural soils. This assessment however is national in scope and cannot be assumed to affect the coastal zone or the Mediterranean Sea without conducting targeted sampling. The inventory did consider one potential PCB hotspot in the North – the Deir Ammar power plant which is located by the seafront. According to Lebanon's most recent Country Profile for Ozone Depleting Substances (a group of organohalogens), the North consumed about 17 tonnes of ODS / ODP in 2003, most of which by the refrigerator sector.

2.2.6. Industrial waste

Industries in the coastal zone impact the Mediterranean Sea in several ways including direct discharge of industrial effluent, open dumping of solid waste and the settlement of air pollutants in the sea. Industries in the North released in 1994 an estimated 6000 m^3/d – it is reasonable to assume that most of this effluent ends up in the sea. Little data on industrial waste generation in the North proper are available. The single most significant source of industrial waste in North Lebanon originates from the *Lebanon Chemical Company*; a fertilizer plant releasing an estimated 300,000 of gypsum into the sea in the form of a slurry paste. Industrial waste management is lacking in most sectors and it exacerbated by the lack of effective auditing procedures, compliance monitoring and enforcement, as well as skills and know-how in cleaner production.

2.2.7. Summary of priority issues in Administrative Region A

Table 1 presents the issues listed in Section 2.2.1 through 2.2.6 and their impacts on health, the marine environment, the socio-economic environment and the regional and global environment. The scores were assigned based on the UNEP guidelines for scoring issues. Pursuant to these guidelines also, impacts to health received a weight of 4 points; the marine environment, 3 points; socio-economic loss, 2 points; and regional and global environment, 1 point.

Based on the Issues & Impacts matrix for Administrative Region A (North), sewage is the highest priority among all the issues listed (score of 25 points), followed closely by industrial & hazardous waste (23 points) and solid waste (20 points). Sewage ranked highest because it is causing significant BOD release into the Mediterranean Sea (most sewers are not equipped with outfalls and therefore discharge directly in shallow/coastal waters). Such BOD loads affect bathing water quality and may also impact marine ecosystems and fish stocks. Municipal sewage may also contain industrial effluents from light industries in residential areas. While these scores are only indicative, they provide a solid platform for defining priority actions.

The priority actions for Administrative Region A for 2010 have to address sewage as well as other point sources of pollution along the coastline. These other sources cannot be ignored and should be controlled in the near term. They include:

- **Seafront landfill in Tripoli** - Although the site has been contained with a physical barrier to prevent drift waste, the incidence of litter on beaches north of the dumpsite and as far as the Palm Islands (a national reserve and an Important Bird Area) continue to deter the public from recreational activities, and benthic litter is widely reported to cause the suffocation of some aquatic species. The landfill also releases considerable leakage.
- **Lebanon Chemical Plant (Selaata)** - The plant discharges an estimated 300,000 tonnes of gypsum slurry per year directly into the sea (equivalent to 850 tonnes per day) which has altered the sea bed in and around the discharge point. The plant operates 24 hours a day, 365 days a year. The slurry may contain trace metals including Cadmium.

Table 1
Issues and Impacts in Administrative Region (A) – North Lebanon

Issues	***Indicator of Magnitude***	***Impacts***				***Root Causes***	***Score***
		Human Health	*Marine environment*	*Socio-Economic Loss*	*Global Environment*		
Sewage	1. Domestic wastewater discharged to the sea is 74,300 m^3/year with a BOD load of 10,849 tons/year	3	2	3	1	• 15 domestic sewer outfalls and 3 river mouths (El Abdeh and Tripoli coastal Area)	25
Industrial and Hazardous waste	• Industrial wastewater discharged into the sea in: (1994) = 2,220,660 m^3/year and in (2020) =12,547,970 m^3/year • Quantities of hazardous waste generated • 29% spent oil discharged into the sewer system or rivers	3	2	2	1	• 13 industrial short sea outfalls • 3,865 industries located in North Lebanon in 1998 • Slaughter/medical/household solid waste • Heavy discharge load from industrial outfalls (Enfeh coastal area) • Discharge of chemical pollutants from cement and fertilizer industries (Chekka and Selaata coastal areas)	23
Solid Waste	2. Leachate flow from Tripoli dumpsite: 24,000 Mton/year and a BOD load of 7.2 Mton/year	2	2	2	2	• Tripoli dumpsite protruding into the sea (volume not available)	20
Air Pollution	• CO and TSP from the transport sector • NO_x and SO_x	3	1	1	2	• Traffic jams and congested roads i/a Tripoli • Stack emissions from Chekka industrial zone and Deir Ammar power plant	19
Heavy Metals	• Levels of Zinc, Copper, Lead, Mercury, Chromium and Arsenic • Heavy metals (leachate from Tripoli dumpsite): 72 Mton/year	1	3	1	1	• Tripoli dumpsite and harbor • Discharges of heavy metals from industries manufacturing cement and asbestos pipes (Chekka) and chemical fertilizers (Selaata)	16
POPs and organohalogens	• Quantity (tonnes) and concentration (ppm) of PCB oil found • 17 tonnes of ODS/ODP emitted in 2003	2	1	1	2	• Power sector: transformers in power plants and substations may contain PCB oil. Several plants were hit by Israeli air raids resulting in severe oil spills. • ODS/ODP from uncontrolled combustion	15

2.3. Identification of priority actions for each sector

The priority actions for Administrative Region A include:

1. Closure of up to 15 domestic sewer outfalls (or the construction of adequate sea outfalls to provide some dilution effect of BOD loads)
2. On-site storage and treatment of raw effluent from Chemical Fertilizer Plant and/or the introduction of cleaner production including waste exchange
3. Closure or complete containment of coastal dumpsite in Tripoli

Table 2
Priority List of Actions for North Lebanon for 2010

Action	*Site*	*Pollutant*	*Expected Reduction*	*Stakeholders*	*Time Framework*	*Tracking Method*
Closure of sea outfalls (at least half of the 15 short outfalls)	15 sites	BOD and some heavy metals from Municipal wastewater	50%	CDR, MoEW, Federation of Municipalities	By 2010	Visual inspection; construction and operation of associated WWTPs
Treatment of industrial effluent / or introduction of cleaner production	Selaata, Chemical Fertilizer Plant	Gypsum slurry, including trace Cadmium	TBD	Lebanon Chemical Company, MOE, MOI	By 2010	Gradual phase out of polluting technology; reduction in volume of slurry production
Closure or complete containment of seafront dumpsite	Tripoli dumpsite	BOD and heavy metals from leachate, benthic litter	50%	CDR, Federation of Municipalities, MOE, MOTPW	By 2010	Tendering for construction of new sanitary landfill or rehabilitation of existing landfill

3. ISSUES IN ADMINISTRATIVE REGION (B): BEIRUT

This chapter assesses issues and priority actions in Administration Region B (Beirut). It also presents goals and management objectives to implement the priority actions.

3.1. Introduction

Beirut is the capital of Lebanon. It is located in the center of the country's largest agglomeration – the Greater Beirut Area with an estimated population of about 1.4 million people. The population in Beirut proper is about 0.5 million.

3.2. Identification and assessment of issues:

This section summarizes sectoral issues in Administrative Region B (Beirut) to come up with priority issues for 2010. The issues are presented by sector based on the findings of the Sectoral Plans.

3.2.1. Sewage management

Since 1992, sewage management has improved considerably in Beirut after the initiation of the National Emergency Rehabilitation Program (NERP). Currently, Beirut proper does not have a sewer problem per se; sewage networks cover most parts of the city and converge along three principal collectors. Two coastal collectors drain the largest portion of the network and extend to one existing WWTP south of Beirut (Ghadir) and one planned WWTP north of Beirut (Dora), both situated in the Mount Lebanon Administrative Region. The Ghadir WWTP south of Beirut is operational but provides only preliminary treatment. The Dora WWTP north of Beirut has not been built yet and therefore the collectors remain idle.

There are at least four identifiable sea outfalls along Beirut's coastline: Ramlet el Baida, Carlton Hotel, Ras Beirut and Ain Mreiseh areas. These outfalls are situated near popular leisure and tourist attractions including the most highly frequented public beach (Ramlet el Baida) and beachfront boulevard (Raouche) in Beirut. The southern section of the Beirut collector, still under construction, will measure 9 kilometers long and include two pumping stations. It will serve an estimated 784,000 people.

3.2.2. Urban solid waste

Solid Waste Management in Beirut is the most organized system in the country so far (though not sustainable). The system was implemented pursuant to CDR's Emergency Plan for SWM in the GBA (dated January 1997) and based on Decision No. 58, dated 2/01/1997. The plan was executed by Sukkar Engineering Group (Sukomi and Sukleen subsidiaries), a Lebanese waste management contractor, and called for refurbishing the Quarantina composting site and closing the Borj Hammoud dumpsite. The contracts with the Sukkar group of companies included waste collection, treatment, landfilling and street sweeping. Unfortunately, eight years into their contract, waste recovery remains well below targets. For example, according to a regional project under the MedPolicies Initiative of the Mediterranean Environmental Technical Assistance Program METAP III, Beirut generates 12 percent of the total MSW stream in Lebanon, of which only 5 percent are recycled, 15 percent are composted and the remaining 80 percent are landfilled in Nahmeh, about 20 km south of Beirut, in Mount Lebanon (Administrative Region C). The Normandy seafront dumpsite, the only waste disposal site in Beirut during the war and the largest dumpsite in Lebanon, was permanently closed in 1995; an on-going $50 million rehabilitation project is decontaminating and stabilizing the site, and will result in more than 100 hectares of reclaimed lands earmarked for public use and real estate (see Photo 1).

Photo 1
Rehabilitation Works at the Normandy Dumpsite in Beirut


3.2.3. Air pollution

Air pollution in Beirut is potentially severe. The city frequently experiences air pollution spikes mainly from the transport sector. With the completion of several ring roads and penetrator roads, the levels of pollution from traffic congestion have reportedly dropped. The Beirut International Airport, the American University of Beirut (Faculty of Engineering and Architecture's mobile air quality lab) and Saint Joseph University (USJ) have in recent years acquired basic air quality monitoring capabilities and have started to produce structured air quality data for Beirut City. Unfortunately, there is little coordination among them, if any. Meanwhile, the Council for Development and Reconstruction (CDR) recently signed a contract (June, 2005) with Telvent, the Global RealTime IT Company, to modernize and develop traffic management infrastructure and systems in Beirut. This may provide further improvement to air quality.

The second most important source of air pollution in Beirut derives from private diesel generators. Local residents continue to rely on diesel generators because blackouts are frequent, especially in summer when power consumption (mainly for cooling) goes up. A 1997 door-to-door survey conducted by the Central Administration for Statistics showed that 14 percent of all buildings in Beirut were equipped with private generators (at least 6 percent higher than the national average). Unless the city resolves its energy crisis, the number of private and curb-side generators (for multiple users) will continue to increase in the coming years.

3.2.4. Heavy metals

Other than the Normandy dumpsite (currently undergoing rehabilitation), there is little verifiable evidence of other sources of heavy metal contamination in Beirut. A 1997 field study by Greenpeace indicated high levels of heavy metals in the marine sediments as well as in the water and sewage near the Normandy dumpsite. There are hundreds of very small industries interspersed in residential areas. Because they release their effluent in the domestic sewage network, it is impossible to estimate quantities from this sector.

3.2.5. Organohalogens and POPs

According to Volume I of the Country Programme (CP) prepared for the Environmental Control of Ozone Depleting Substances (ODS) and their Alternatives at MOE, Lebanon emitted in 2003 an estimated 114 tonnes of ODS, of which 37 percent in Beirut proper. Seventy six percent of those emissions came from the refrigeration sector. With regards to POPs, three inventories indicate the presence of a potential Dioxin and Furan hotpot near the Normandy dumpsite, presumably the results of leachate. The inventory found no significant PCB release in Beirut.

3.2.6. Industrial Waste

Industrial waste in Beirut is insignificant in comparison with industrial activities in other parts of the country (Beirut hosts only 10-12 percent of industrial establishments in Lebanon). The largest industrial branch in Beirut is food and beverages with a total of 720 establishments. None of these establishments have in-house wastewater treatment or pre-treatment capabilities. Wastewater is discharged in the domestic sewer systems, eventually flowing to the sea – an estimated 2,754 m^3/d. Beirut also generates significant waste oil from vehicles, 38 percent of which are discharged in the domestic sewer system.

3.2.7. Summary of priority issues in Administrative Region B

Table 3 presents the issues listed in Section 3.2.1 through 3.2.6 and their impacts on public health, the marine and socio-economic environments as well as the regional and global environment. The scores were assigned based on UNEP guidelines.

Based on the Issues & Impacts matrix for Administrative Region B (Beirut), sewage is the highest priority issue among all the issues listed (score of 23 points), followed closely by Air Pollution (21 points) and Industrial and Hazardous waste (14 points). Sewage ranked highest because it is causing significant BOD release into the Mediterranean Sea (most sewers discharge directly into the sea without long outfalls causing severe deterioration of water quality near beaches and recreational fishing grounds). Municipal sewage may also contain industrial effluents from light industries in residential areas. While these scores are only indicative, they provide a solid platform for defining priority actions.

Priority actions in Administrative Region B include:

- **At least four sea outfalls:** the four sea outfalls should be completely closed and sewage rerouted to either the northern or southern coastal sewer networks of Beirut, which is closest.
- **Air pollution from vehicles and power generators:** Traffic management within Beirut city need to be upgraded and private generators should be regulated and re-organized. Even though, air pollution from these sectors does not directly contribute to the Mediterranean Sea pollution, air pollutants generated (mostly PM and heavy metals) eventually settle down on the ground were it is washed down into the sea (due to Beirut's natural water drainage system near coastal zone).
- **Solid waste littering along entire Corniche area/public beaches:** Extensive littering is causing serious accretion of solid waste on the sea floor. The municipality of Beirut should support widespread public education programs and increase the number of litter bins along the seafront boulevards.

Table 3
Assessment of Issues and Impacts in Administrative Region B – Beirut

Issues	***Indicator of Magnitude***	***Impacts***				***Root Causes***	***Score***
		Human Health	*Marine environment*	*Socio-Economic Loss*	*Global Environment*		
Sewage	• Domestic wastewater discharged to the sea is 68,800 m^3/year with a BOD load of 10,040 tons/year • Location of short sea outfalls close to frequently visited bathing areas	3	2	2	1	• 4 short sewer outfalls • Industrial waste mixed with domestic wastewater in sewer systems	23
Air pollution	• CO and TSP from the transport sector • NO_x, SO_x and PM from Private generators	3	1	2	2	• Highest traffic density/congestion in Lebanon • Under developed traffic infrastructure and public transport sector • 14% of buildings in Beirut equipped with private generators (1997 figures)-expected to have increased tremendously since	21
Industrial waste	• Industrial wastewater discharged into the sea in: (1994) = 2,754 m^3/year and in (2020) =2,754 m^3/year • 38% spent oil discharged in sewer system	2	1	1	1	• Poorly designed and waste management in Beirut Slaughterhouse (largest in Lebanon since 1975)-evidence of offensive odour generated 100 meters far • 720 food and beverage establishments discharging in sewer system contributing to higher BOD loads in domestic wastewater • Week oil recycling facilities and low demand on used oil market	14

Issues	***Indicator of Magnitude***	***Impacts***				***Root Causes***	***Score***
		Human Health	*Marine environment*	*Socio-Economic Loss*	*Global Environment*		
Urban solid waste	• Contributing to the amount of solid waste dumped in Naemeh Landfill were its leachate is discharged without treatment in to the sea via Ghadir long sea outfall • Large quantities of littered solid waste removed from the sea bed during the annual Blue cleaning campaign	1	2	1	1	• Littering activity along the Roucheh-Ain Mreiseh Corniche by pedestrians and swimmers	13
Heavy metals	• Alarming levels of air born heavy metals in Beirut	2	1	1	1	• Transport and private generator sector	13
Organohalogens and POPs	• 37% of ODS emitted in Beirut (2003) • Quantity (tonnes) and concentration (ppm) of Dioxins and Furans found	1	1	1	1	• 76% of ODS emissions from refrigerator sector • Dioxin and Furan contamination due to the release of leachate from the coastal Normandy dumpsite (expected to be decreased after rehabilitation)	10

3.3. Identification of priority actions for each sector

The priority actions for Administrative Region B include:

1- Closure of 4 domestic short sea outfalls (reconnect to southern or northern section of coastal collectors)
2- Organize the private generator sector
3- Reduce waste littering along beaches and seafront walkways

Table 4
Priority List of Actions for Beirut for 2010

Priority Action	*Site*	*Pollutant*	*Expected Reduction*	*Stakeholders*	*Time Framework*	*Tracking Method*
Closure of all sewer outfalls	Coral, Ain merieseh, Ras Beirut, and Ramleh el Baydah areas	BOD	50-70%	CDR, MoTPW, MoE, Municipality of Beirut	By 2007	Visual inspection, closure and rerouting of sewage to southern/ northern collectors
Upgrade traffic system and regulate the use of private generators	Beirut	PM, NO_x, SO_x	10-20%	CDR, MoTPW, MoE, Municipalities	By 2008	Reduction in traffic congestions and ambient air monitoring
Reduce waste littering along the seafront	Ramlet el Baida through Ain Mreiseh Corniche and public beaches	solid waste including plastics, cans and glass	50-70%	Municipality, private waste contractor	By 2007	Visual inspection, comparative waste quantities removed during annual coastal cleaning campaigns

4. ISSUES IN ADMINISTRATIVE REGION (C): MOUNT LEBANON

This chapter assesses issues and priority actions in Administration Region C (Mount Lebanon). It also presents goals and management objectives to implement the priority actions.

4.1. Introduction

Mount Lebanon is made up of six Cazas (from north to South): Jbail, Keserwan, Metn, Baabda, Aley and Chouf. It is considered the most industrialized Governorate in Lebanon, which gives reason for environmental health concerns the result of industrial pollution along its shoreline and in the sea. The area also hosts two out of Lebanon's three landfills (Naameh, Bsalim, Zahle) as well as the Borj Hammoud dumpsite which was closed in 2000.

4.2. Identification and assessment of issues

4.2.1. Sewage management

Mount Lebanon discharges 257,000 m³/day of domestic wastewater, 48% of which is discharged to the sea without any form of pre-treatment. The area harbors several sea outfalls including domestic (5), industrial (15) and river mouths (3). All the outfalls release raw sewage straight into the Mediterranean. Sewage is usually also disposed off in streams and rivers across the Governorate. Hotspots include the Valley of Nahr Ibrahim, the Zouk and Dora industrial areas. Clearly, sewage poses a significant threat to public health and the marine environment in the Mount Lebanon Governorate and administrate region.

4.2.2. Urban solid waste

Waste disposal at the Naameh landfill began in October 1997. The site, located 3-4 km inland, has been receiving about 1,800 tonnes of MSW per day, well over its original design capacity – more than 4.5 million m3 so far. It generates about 250 tonnes of leachate per day (about 90,000 tonnes per year) that are pre-treated on site (liming and agitation) and then trucked to the Ghadir WWTP (preliminary treatment only). The leachate is mixed with raw sewage and then discharged into the sea via a submersible sea outfall. Such quantities represent at last 40 percent of the leachate produced by Lebanon's landfills and dumpsites. The Bourj Hammoud dumpsite (closed since July 1997) releases an estimated 120,000 tonnes of leachate per year corresponding to more than half the leachate produced by three major coastal dumpsites in Lebanon (Tripoli, Borj Hammoud and Normandy). The Borj Hammoud dumpsite has been capped with top soil to prevent drift waste.

Photo 2
Borj Hammoud Coastal Dumpsite (looking west)

4.2.3. Air pollution

Air pollution from stack emissions is potentially severe near/around urban agglomerations (Jounieh, Anterlias) and industrial areas (Dora and Zouk) in Mount Lebanon. This region also hosts two of the country's largest thermal power plants (Zouk and Jiyeh) that spew SOx and NOx unabated. As a result areas surrounding the plants experience high concentrations of sulfur and particulate matter in the air. The inauguration of the new expressways north and south of Beirut have improved traffic and alleviated congestion (especially for commuters driving in and out of Beirut's southern entrance). The impact of improved traffic on air pollution is uncertain.

4.2.4. Heavy metals

Several activities in Mount Lebanon release potentially significant concentrations of heavy metals in the Mediterranean Sea. The Borj Hammoud dumpsite located on the border between Mount Lebanon and Beirut releases an estimated 360 MT/year of heavy metals contributing more than half of the countries heavy metals discharge. The industrial complexes in Zouk Mosbeh and Dora also release significant amounts of heavy metals from tanneries as well as detergent, paint and petrochemical industries. The tourist region of Jbeil and Halat also receive effluents from paper mills, pesticides and plastics manufacturers. The Zouk and Jiyeh power plants also produce some heavy metals. Mount Lebanon is considered the highest producer of heavy metals that are discharged into the Mediterranean Sea.

4.2.5. Organohalogens and POPs

Data on organohalogens and POPs are poor and scattered. The national PCB inventory indicated the presence of potential PCB hotspots including the Bsalim and Jamhour substations which were shelled by the Israeli Air Force resulting in major oil spillage. Additionally, the Bauchrieh repair shop, a repository of old and broken transformers, including PCB transformers, constitutes a severe environmental problem; however it cannot be claimed that PCB releases from the workshop actually reach the sea. Potential hotspots for dioxins and furans are the Bourj Hammoud coastal dumpsite and the power stations of Jamhour and Bsalim. The refrigeration sector in Mount Lebanon is contributing to total ODS emissions.

4.2.6. Industrial Waste

Industrial effluents from power plants, tanneries, pesticides, plastics and chemical industries reach the sea either directly or via the municipal sewer system. Mount Lebanon contributes approximately 70 percent of the total amount of industrial wastewater generated nationwide. Additionally, special waste including waste from medical facilities and slaughterhouses are usually disposed off without pre-treatment.

Photo 3
Industries located on the coast

4.2.7. Summary of priority issues in administrative region C: Mount Lebanon

Table 5 presents the issues listed in Section 4.2.1 through 4.2.6 and their impacts on public health, the marine and socio-economic environments as well as the regional and global environment. Based on the Issues & Impacts matrix for Administrative Region C (Mount Lebanon), sewage and industrial waste rank highest among all the issues (30 points each), followed by heavy metals (26 points) and solid waste (24 points). Industrial waste is also a significant problem due to poorly equipped industrial areas.

The priority actions for Administrative Region C for 2010 must address sewage, industrial waste and heavy metals as well as other point sources of pollution along the coastline. These other sources cannot be ignored and should be controlled in the near term. They include:

- **Solid waste generation:** The Naameh landfill located 20 km of Beirut and serving an estimated 2 million people will reach full capacity in 2006. With no comprehensive SWM plan in place, Mount Lebanon (and Beirut) will face a very serious SWM crisis.
- **Bourj Hamoud dumpsite:** The dumpsite releases leachate and heavy metals directly into the sea. It must be contained to prevent further releases and reduce nuisance to nearby residents and obstruction of local economic activities including fishing.
- **Uncontrolled stack emission:** Air pollution from uncontrolled stack emissions from the Zouk and Jieh power plants, as well as the express ways leading to the north.

Table 5
Assessment of Issues and Impacts in Administrative Region C – Mount Lebanon

Issues	***Indicator of Magnitude***	***Impacts***				***Root Causes***	***Score***
		Human Health	*Marine environment*	*Socio-Economic Loss*	*Global Environment*		
Sewage	• Domestic wastewater discharged into the sea is 93,805,000 m3/year with a BOD load of 18,012 tons/year	3	3	3	3	• 25 domestic sewer outfalls	30
Solid Waste	• Leachate flow from Burj Hammoud Dumpsite = 120,000 Mton/year • BOD =36 Mton/year	2	3	2	3	• Bourj Hammoud coastal dumpsite • Naameh landfill	24
Heavy Metals	• Levels of Zinc, Copper, Lead, Mercury, chromium, Nickel, Cadmium, Magnesium, aluminium and barium • Heavy Metals (leachate from Bourj Hammoud dumpsite) 360 Mton/year	2	3	3	3	• Elevated levels of heavy metals from paper mill, pesticides and plastics industries (Jbeil and halat). Discharges in Antelias and Zouk Mosbeh areas from tanneries, detergent, paint and petrochemical industries. Also, emissions from the Zouk and Jiyeh power plants. • Bourj Hammoud dumpsite	26
Air Pollution	• Levels of Sulfur, organic compounds, carbon monoxide, carbon dioxide nitrogen oxides and particulate matters	3	1	3	2	• Zouk thermal power plant • Coastal express-highways (Dora-Antelias highway) • Industrial complexes in Dora and Zouk-Mosbeh	23

Issues	Indicator of Magnitude	Impacts				Root Causes	Score
		Human Health	*Marine environment*	*Socio-Economic Loss*	*Global Environment*		
POP's and organohalogens	• Quantity of oil present and, • Spillage due to the shelling of Israeli forces	3	1	1	3	• Zouk thermal power plant contains 4.74 tonnes of PCB oil. • Three hotspots, Bsalim (160 tonnes of oil spilled) and Jamhour (180 tonnes of oil spilled) substations shelled by Israeli forces as well as Bauchrieh repair shop	20
Industrial and Hazardous waste	• Industrial wastewater discharged into the sea in: (1994) =16,028,610 m3/year • (2020) =39,268,160 m3/year	3	3	3	3	• 11,011 industries located in Mount Lebanon • Slaughterhouse, hospital and household waste • Paper mills, pesticide and plastic factories located along the river bank discharging untreated wastewater (Ibrahim river- Jbeil) • All the industrial discharges form tanneries, textile and chemical industries are reaching the sea either directly or via the municipal sewer system. (Zouk and Dora industrial area) • Effluents discharged by the main power plants in the country (Zouk and Jieyeh power plants)	30

4.3. Identification of priority actions for each sector

The priority actions for Mount Lebanon (Administrative Region C) are:

1. The closure of a portion of the 25 domestic sewer outfalls and the construction of wastewater treatment plants (coastal and inland) along the Mount Lebanon coastal strip will reduce BOD loads into the Mediterranean. Government official responsible achieving BOD reduction include: CDR, Ministries of Energy & Water, Environment as well as the relevant Federation of Municipalities along the coastal.
2. Upgrade at least one industrial zone in Mount Lebanon to serve as pilot. Industries within this zone should be provided with basic services including sewage network and solid waste collection. These industries should also gradually phase out dirty production in favor of cleaner production technologies. Good housekeeping practices should also be promoted.
3. Rehabilitation of Borj Hammoud seafront dumpsite. Rehabilitation standards need not be as stringent as the Normandy cleanup operations, but should consider the end use of the site.

Table 6
Priority List of Actions for Mount Lebanon for 2010

Priority Action	*Site*	*Pollutant*	*Expected Reduction*	*Stakeholders*	*Time Framework*	*Tracking Method*
Closure of the 25 domestic sewer outfalls and construction of wastewater treatment plants	25 sites coastal and inland	BOD from municipal wastewater	50 %	CDR, MoEW, Federation of Municipalities, MoE	By 2010	Visual inspection; construction and operation of associated WWTPs
Upgrade at least one industrial zone to serve as pilot. Upgrade works should include WW and SW collection and (pre) treatment	Zouk Mosbeh, Dora, Jbeil and/or Halat	BOD, heavy metals, hazardous waste	50 %	MOE, MOI, MOTPW, Federation of Municipalities	By 2010	Pilot industrial zone selected; SW and WW infrastructure in place; gradual phase-out of dirty processes
Rehabilitation of Borj Hammoud seafront dumpsite	Bourj Hammoud dumpsite	BOD level and heavy metals	50 %	CDR, MOE, MOTPW	By 2010	No leachate detected

5. ISSUES IN ADMINISTRATIVE REGION (D): SOUTH

This section presents current issues in the South which comprise portions of two Casas: Saida and Sour. It also presents goals and management objectives to implement the priority actions.

5.1. Introduction

About 12 percent of the population in Lebanon live the South. Several environmental hotpots came in the spotlight after the liberation of South Lebanon from Israeli occupation in May 2000. For a start, Saida and Sour continue to practice uncontrolled dumping in the sea (Saida) or by the sea (Sour). The Saida dumpsite is impacting all the beaches north and south of it, as large chunks of waste routinely breakaway from the main dumpsite and wash ashore. The Sour dumpsite, located about 0.5 km inland, serves 16 municipalities which represent 65 percent of all the waste generated in the Caza. Like the rest of Lebanon, (short) sea outfalls discharge raw sewage directly in the sea.

5.2. Identification and assessment of issues:

This section summarizes key issues in Administrative Region D (South) to come up with priority issues for 2010. The issues are presented by sector based on the findings of the Sectoral Plans.

5.2.1. Sewage management

According to the NDA, the south generates 11.8 percent of the total amount of domestic wastewater in Lebanon, equivalent to a BOD load of 5,052 tonnes per year. Early this year a preliminary wastewater treatment plant was built in Saida to serve the greater Saida area; the treatment plant is equipped with a 2.6 km submersed sea outfalls that provides for more effective dilution of sewage. Saida is bordered by the Ghazieh industrial area where several tanneries, chemical industries and slaughter houses discharge their effluents directly to the sea.

Similarly, Sour hosts the Bourj el Chemalli industrial area in addition to many sewage outlets. In the Abbasiyeh area in Sour's southern suburbs, a new WWTP (secondary treatment level) is being planned to serve the Sour catchments area. Sour also has five sea outlets the sea. The Zahrani power plant also releases spill water from its desalination units.

5.2.2. Urban solid waste

According to the NDA, the South generates 12.1 percent of the national waste stream. The municipality of Saida has awarded a local waste contractor (NTCC) the collection of domestic solid waste and their disposal at the dumpsite. Although still operational, there are serious calls to close the dumpsite. It is unclear whether any future closure plan can also relocate the dump to another site, as demanded by local authorities and residents. In Sour, a municipal compost/recycling facility is currently under construction; it will service all the communities who currently use the dumpsite which is expected to close in 2006-7.

5.2.3. Air pollution

Urban air pollution from mobile sources, congestion and private power generators is moderate. There is limited air quality data to assess actual pollution levels. An estimated 8 percent of buildings in the south were in 1997 equipped with private generators. This number may have risen even further since.

Photo 4
Leachate discharged to the Mediterranean Sea from the Saida coastal dumpsite

5.2.4. Heavy metals

According to the Greenpeace study of 2001, above-standard levels of heavy metals were detected at the industrial outfalls as well as the harbor of Saida and along the vicinities of the coastal dumpsite. Currently, there is no data concerning the levels of heavy metal contamination in Sour.

5.2.5. Organohalogens and POPs

The latest findings from the national inventories do not show any significant contamination in the South. It is suspected that there is a potential contamination of dioxins, furans and pesticides in agricultural areas. Dioxins and Furans are usually expected to be released from the coastal dumpsite but there is no data to prove that it exists. As for organohalogen emissions, the results of the country program revealed that the South generated 55 tonnes during 2003 (the values includes foams, aerosols and the refrigeration sector.

5.2.6. Industrial Waste

Till today there is an absence of a management strategy for industrial waste in the south. According to projected quantities of industrial wastewater, the South accounts for 2% of the total industrial wastewater generated in Lebanon. South Lebanon is ranked the highest region for discharging spent oil [3]. Collection and reuse of waste oils is as low as 34% the remaining (66%) are disposed in nearby steams, sewer system or inland. Unfortunately there is no data regarding the fraction of waste that is disposed of in streams and sewer systems.

5.2.7. Summary of priority issues in Administrative Region D

Based on the Issues & Impacts matrix for Administrative Region D (South), sewage is the highest priority issue among all the issues listed (score of 30 points), followed closely by solid waste (28 points) and both heavy metals and industrial hazardous waste. Sewage ranked highest because it is causing significant BOD release into the Mediterranean Sea (most sewers are not equipped with outfalls and therefore discharge directly in shallow/coastal waters). Such BOD loads affect bathing water quality and may also impact marine ecosystems and fish stocks. Municipal sewage may also contain industrial effluents from light industries in residential areas. The priority actions for Administrative Region D for 2010 have to address sewage and solid waste as well as other point sources of pollution along the coastline.

[3] *Etec study conducted in 1998*-NEAP, Waste Oil section

Table 7: Assessment of Issues and Impacts in Administrative Region D - South

Issues	***Indicator of Magnitude***	***Impacts***				***Root Causes***	***Score***
		Human Health	*Marine environment*	*Socio-Economic Loss*	*Global Environment*		
Sewage	• Domestic wastewater discharged to the sea is 29,382,500 m^3/year • With a BOD load of 5,052 tons/year	3	3	3	3	• Numerous domestic sea outfalls	30
Solid Waste	• Leachate from Saida and Tyre dumpsites	3	3	2	3	• Saida and Tyre coastal dumpsites	28
Air Pollution	• Levels of Sulfur, organic compounds, carbon monoxide, carbon dioxide nitrogen oxides and particulate matters	1	1	1	2	• Saida and Sour coastal cities • Coastal highways • Zahrani power plant and Jieh power plant • Ghazieh and Burj el Chemalli industrial areas	11
Heavy Metals	• Levels of Zinc, Copper, Lead, Mercury, Chromium, Aluminium, Barium and Nickel	2	3	2	2	• Saida industrial zone, harbor and coastal waste dump • Al Ghazieh industrial zone • Zahrani power plant	23
POP's and organohalogens	• Quantity of PCB oil present (tonnes) • Amount of ODS/ODP emissions released	2	2	0	1	• 37 tonnes of PCB oil present at the Jieh power plant • 55 tonnes of ODS/ODP emissions released mostly from foam sector	13
Industrial and Hazardous waste	• Industrial wastewater discharged into the sea in: • (1994) = 872,715 m^3/year • (2020) = 1,193,185m^3/year	2	3	2	2	• 1,641 industries located in South Lebanon • Ghazieh industrial area hosts several tanneries, chemical industries and a slaughterhouse that directly discharges into the sea • Tyre-Burj el chemali industrial area • Oil waste from harbors	23

5.3. Identification of priority actions for each sector

The priority actions for administrative region D include:

- **Initiating the works on the proposed Secondary WWTP in Sour:** This entails the construction and operation of the secondary treatment plant in Sour. The funding was secured and tendering of the treatment plant has already been initiated by CDR. Completion of the project will be followed by the closure of unnecessary sewage outfalls.
- **Upgrading the primary treatment plant in Saida**: This action includes the introduction of advanced secondary treatment technology required to reduce the BOD load and the heavy metals level.
- **Funding Sour coastal dumpsite rehabilitation**: Implementing the solid waste management plan prepared by Envirotech in 2005 for the Federation of municipalities of Sour Caza. The construction and operation of the proposed 150 tons/day solid waste treatment facility is ongoing and will lead to the closure of the existing coastal dumpsite by 2006. However, no funding was secured for the rehabilitation of the dumpsite.
- **Constructing a new landfill for Saida Caza**: A five million dollar fund has been secured for the rehabilitation of the existing Saida coastal dumpsite. Works are expected to start early 2006. Therefore an alternative waste disposal site should be decided on before the rehabilitation process begins. However, no alternative landfill site for waste disposal has been allocated yet nor the fund required for landfill construction.
- **Promotion of cleaner production for Tannery industry:** Ghazieh industrial area hosts several tanneries (including the largest tannery in Lebanon- Spanish-Lebanese Tannery). The tanneries currently discharge their wastewater and solid waste directly into the sea without any treatment due to the absence of proper industrial wastewater system in the Ghazieh Zone. The wastewater contains significant amount of heavy metals, mostly chromium, a known carcinogen. The ministry of Environment in coordination with the Ministry of Industry and relevant authorities should assist tannery owners in Ghazieh in introducing cleaner production and exercising onsite pre-treatment; incentives for relocating tanneries should be explored further.

Table 8
Priority List of Actions for South Lebanon for 2010

Action	*Site*	*Pollutant*	*Expected Reduction*	*Stakeholders*	*Time Framework*	*Tracking Method*
Closure of sea outfalls and construction of secondary treatment plant in Sour	26 sites	BOD	90%	CDR, MoEW, MoE, Federation of Municipalities	By 2010	Visual inspection; BOD testing
Upgrading the primary treatment plant in Saida	Saida WWTP	BOD	90 %	CDR, MoEW, MoE, Federation of Municipalities	By 2010	BOD testing
Securing the fund for the rehabilitation of Sour coastal dumpsite	Sour coastal dumpsite	Leachate	50 %	Federation of Sour municipalities, MoE, CDR	By 2009	Monitoring the level of heavy metal and leachate discharged

Rehabilitation of Saida coastal dumpsite and securing location and funds for the construction of a new landfill in Saida Caza	Saida dumpsite	Leachate	90%	Federation of municipalities, MoE, CDR	By 2010	Monitoring rehabilitation activities
Promotion of cleaner production for Tannery Industry in Ghazieh Zone	Ghazieh Industrial Zone	Heavy Metals	30-50%	Municipalities, MoTPW, MoE, UNIDO, UNEP	By 2010	Monitoring heavy metal concentrations discharged

6. NATIONAL ISSUES

This chapter presents a summary of the priority issues and actions derived in chapters 2 through chapter 5. A summary of issues and actions specific to the four administrative regions is presented in Section 6.7. These actions as well as other actions that are national in coverage are presented and discussed in Sections 6.1 through 6.6.

6.1. National Wastewater Management Plan

Raw sewage outfalls were considered priority actions in each of the four administrative regions in the Lebanese coastal zone. Treating raw sewage before it is discharged to the sea will require the construction of more than a dozen wastewater treatment plants in the coastal zone. As part of the country's national wastewater management plan, the Government of Lebanon has approved the construction of at least 13 treatment plants stretched from North to South; the Council for Development and Reconstruction is the lead agency charged with the planning and construction of these plants. As summarized in Table 9 two (preliminary treatment) plants have already been completed (Ghadir and Saida) and five (secondary treatment) plants are currently under construction and will become operational in 2006-07 (Tripoli, Chekka, Batroun, Jbail and Chouf). These treatment plants are being designed for the 2030 horizon and will be able to handle up to 6.2 million people-equivalents[4] (secondary treatment for 4.4 million people-equivalents and preliminary treatment for 1.8 million).

WWTP operation will initially be the responsibility of the contractors who build the treatment plants. In particular, CDR has requested contractors to operate the plants for a period of three to five years after which the GOL envisions to transfer plant operation to the relevant water establishments pursuant to Law 241 dated 29/5/2000. The annual cost of operating the plants has been estimated at roughly five percent of construction costs.[5]

6.2. National Plan for Municipal Solid Waste Management in Coastal Areas

Solid waste management in Lebanon is inadequate. Large-scale SWM schemes are in place in Tripoli and the Greater Beirut Area but serious questions are being raised regarding their sustainability. Landfills are running out of space and unless alternative SWM systems are quickly put in place, the GBA (about 2 million people) will face a serious SWM crisis in 2006 when the current sanitary landfill in Naameh will reach full capacity. So far, Lebanon has not formulated serious policies to encourage waste minimization or recycling. The recycling industry complain about an unreliable supply chain of raw materials, high production costs (mainly energy costs), and competition from abroad (recycling industries in neighboring Syria, Jordan and Egypt are much larger). In light of the stalemate characterizing the SWM sector in Lebanon, the Ministry of Environment is currently preparing a draft framework law for SWM. The law defines treatment technologies, delineates responsibility, advocates sources separation and sorting of commingled MSW in centralized plants as a priority to achieve waste minimization and bans the disposal of hazardous waste with the non-hazardous municipal solid waste stream. Until this draft SWM law is reviewed and passed (this will take at least 1 or 2 years), this National Action Plan cannot present any intervention related to solid waste management in general. It does however underline the need to fast-track the closure and rehabilitation of coastal dumpsites.

[4] BOD-equivalent: 6.2 million people-equivalent × 60 mg per day = 372,000,000 mg BOD/day = 372 MT BOD/day

[5] *Pers comm.*, Ismail Makki, Agriculture and Environment Department Manager at CDR. October 2005.

Table 9
Summary of Wastewater Treatment Plants in the Coastal Zone

Location	*People-Equiv.**	*Funding Secured*	*Source*	*Status*	*Treatment*	*Exp Year of Operation*
El Aabdeh	80,000	No	NA	Site identified but not yet expropriated	Secondary	NA
Tripoli	1,200,000	Yes	EIB	Under construction	Secondary	2007
Chekka	80,000	Yes	French Protocol / AFD	Under construction	Secondary	2006
Batroun	80,000	Yes	French Protocol / AFD	Under construction	Secondary	2006
Jbail	80,000	Yes	French Protocol	Under construction	Secondary	2006
Kesrouan - Adma/Dafneh	600,000	No	NA	Site identified but no funding	Secondary	NA
Dora	1,800,000	No	BDO	Site identified and expropriated	Secondary	NA
Ghadir	1,500,000	Partially	KFW	Operational, expansion on hold	Preliminary	NA (expansion)
Jieh - Ras Abi Younes	200,000	Yes	French Protocol	Under construction	Secondary	2006
Saida	300,000	Yes	JBIC	Operational but no power supply	Preliminary	2005
Sarafand	NA	No	NA	Planning stage	Secondary	NA
Tyre - El Abbasieh	200,000	Yes	EIB	Tendering stage	Secondary	NA
Naqoura	100,000	No	NA	Planning stage	Secondary	NA

* People-equivalent is 60 mg BOD per day.

Abbreviations: NA (Not Available); EIB (European Investment Bank); BDO (Build-Design-Operate); KFW (German Reconstruction Fund); AFD (Agence Française pour le Development); JBIC (Japanese Bank for International Cooperation)

6.3. National Plan to Control Air Pollution from Mobile Sources

Building on the Sectoral Plan, air pollution from mobile sources is a serious problem in large agglomerations namely Beirut and Tripoli. Although the transport sector has experienced some improvements in recent years (e.g., introduction of unleaded fuel, partial ban on diesel, completion of major road construction projects), the continued reliance on private vehicles for daily commuting needs, the emission of heavily charged fumes from dilapidated vehicles and trucks, and the proliferation of minivans and buses contribute significantly to air quality deterioration. In light of this current situation, the Ministry of Public Works and the Ministry of Energy and Water are drafting an amendment to Law 341 (dated 06/08/2001) on the reduction of air pollution from mobile sources. The amendment seeks to reorganize the diesel sector and modernize the public transport fleet by providing tax exemptions for imported vehicles. This National Action Plan did not propose new measures to reduce air pollution from the transport sector, pending the promulgation of the project law that will amend Law 341.

6.4. National Plan for the Management of Heavy Metals

There is no national plan to date to control pollution by heavy metals. The upcoming National Environmental Action Plan is expected to provide some orientation on how to control pollution from specific sectors known to release heavy metals. The Lebanon Cleaner Production Center is also examining opportunities for cleaner production and waste minimization but has limited resources to exercise its mandate.

6.5. National Plan for the Control of Organohalogens and POPs

With grant funding from UNEP/GEF, Lebanon is preparing a National Implementation Plan for the Management of Persistent Organic Pollutants (this activity is part of a regional project targeting X other countries). The overall objective of the project is to strengthen national capacity to manage persistent organic pollutants (POPs) and to assist the government of Lebanon in meeting its obligations under the Stockholm Convention.

Developing the NIP passes through five phases (UNEP Guidance Documents):

1. Phase 1: Establishment of Coordinating Mechanism and Process Organization;
2. Phase 2: Establishment of POPs Inventories & Assessment of National Infrastructure & Capacity;
3. Phase 3: Priority Assessment and Objective Setting;
4. Phase 4: Formulation and National Implementation Plan; and
5. Phase 5: Endorsement and Submission of NIP.

As of 01/11/05, Lebanon has completed the first three phases and will submit the NIP (Phase 4) before the end of the present year. In particular, Lebanon has prepared POPs inventories (Dioxins & Furans, PCBs, and Pesticides) and assessed priority issues related to POPs management. The National Implementation Plan will present specific activities (including strategies and action plans) for POPs management with substantive input from relevant stakeholders.

6.6. National Plan for the Collection & Treatment of Waste Oil

Lebanon is generating almost 10,000 tonnes of waste oil every year. The waste oil is a threat to drinking water supplies in the country as they might contaminate 10 million liters of fresh water per year. According to a strategy plan prepared for MSC-IPP in 2003, the country's cement industries can play a key role in the efficient collection and treatment of waste oil. With the cooperation of garages, the cement industries could spearhead a national collection system for waste oil. The strategy note estimated the annual value of the waste oil in Lebanon at $500,000 ($50/tonne). The waste oil collection system would cost about $240,000 ($24/tonne) and create 100 new jobs. To become regulated, MoE must issue a waste oil decree to oblige vehicle owners to change their oil at designated locations and garages and to discourage the reuse of waste oil in engines.

6.7. Summary of Proposed Actions in all the Administrative Regions

Administrative Region A (North)	
ACTION #1	Closure of Domestic Raw Sewage Sea Outfalls
ACTION #2:	Reduce Effluent Concentrations & Quantities from Fertilizer Company
ACTION #3:	Complete containment of Tripoli seafront dumpsite
Administrative Region B (Beirut)	
ACTION #4	Closure of Domestic Raw Sewage Sea Outfalls
ACTION #5	Treatment of Beirut Slaughterhouse Waste (Karantina)
Administrative Region C (Mount Lebanon)	
ACTION #6:	Closure of Domestic Raw Sewage Sea Outfalls
ACTION #7:	Upgrade Select Industrial Zones in Mount Lebanon
ACTION #8:	Reduce Leachate from Borj Hammoud Dumpsite
Administrative Region D (South)	
ACTION #9	Construct Secondary Wastewater Treatment Plants in Sour & Saida
ACTION #10	Rehabilitation of Sour Coastal Dumpsite
ACTION #11	Rehabilitate Saida Seafront Dumpsite
ACTION #12	Promote Cleaner Production & Chromium Recycling in Ghazieh Tanneries
National Actions (A, B, C and D)	
ACTION #13	Implement a National System for the Collection and Treatment of Waste Oil
ACTION #14	Reduce Air Pollution from Mobile Sources in Major Coastal Cities
ACTION #15	Control Littering from Seafront Walkways

7. NATIONAL FRAMEWORK

Implementing the proposed priority actions listed in Chapter 5 (Investment Portfolios) will require the concerted participation of a number of stakeholders and institutions including government bodies (e.g., Governorates, ministries), municipalities, research institutions, industrial associations and syndicates, as summarized in Section 7.1 below. This chapter also assesses existing capacities and resources as well as capacity building needs.

7.1. Assessment of existing institutions, agencies and associations for NAP implementation

Table 10 presents lead agencies and other agencies responsible for the implementation of priority actions. Select agencies are described in more details on the following pages.

Table 10
Selected Lead Agencies for the Implementation of the NAP Actions

Actions	*Lead Agencies*	*Other Agencies*
1. Closure of Domestic Sea Outfalls in the North	CDR	MoE; CNRS; Municipalities of Al Fayhaa; MoEW
2. Identify and Pilot Alternative Uses of Gypsum from Lebanon Chemical Company	MoE; MoF, LCC	ALIND, MoI
3. Complete containment of Tripoli seafront dumpsite	CDR	Federation of Al Fayhaa
4. Closure of Domestic Sewer Outfalls in Beirut	CDR	MoE; CNRS
5. Treatment of Beirut Slaughter House Waste	Municipality of Beirut/ Governor	MoE
6. Closure of Domestic Raw Sewage Sea Outfalls	CDR	MoE
7. Upgrade Select Industrial Zones in Mt. Lebanon	MoE; MoI; ALIND	CDR; MoI; DGUP
8. Reduce Leachate from Borj Hammoud Dumpsite	TBD	MoE
9. Construct Secondary WWTP in Sour and Saida	CDR	MoE; Municipalities
10. Rehabilitation of Sour Coastal Dumpsite	CDR; Council of Ministers	Tyre Municipality; MoE
11. Rehabilitate Saida Seafront Dumpsite	CDR; Council of Ministers	Saida Municipality; MoE
12. Promote Cleaner Production and Chromium Recycling in Ghazieh Tanneries	Syndicate of Tanneries; ALIND	LCPC; MoE; MoI
13. Enforce a Total Ban on the Disposal of Waste Oil into the Sewer System	Council of Ministers; MoE	Importers of Motor oils
14. Reduce Air Pollution From Mobile Sources in Major Coastal Cities	Council of Ministers	MoPWT; MOEW; MoE
15. Control Littering from Seafront Walkways	MoE	TV stations; NGOs

Government agencies

The Council of Ministers holds executive authority and can endorse new decrees (as well as projects/programs). It has a pivotal role in the planning and/or facilitation of several NAP actions including the action to enforce a total ban on the disposal of waste oil into the sewer system and the action to reduce air pollution from mobile sources.

The Ministry of Environment is restructuring. The Lebanese Parliament recently approved Law 690/2005 which redefines the MOE mandate and functions. The law will restructure the ministry into seven departments plus the Directorate General. Several priority actions require direct MoE involvement to ensure timely implementation and consensus building with other line ministries.

Two other government agencies are called to play important roles in sector-specific interventions: the Council for Development and Reconstruction and the Directorate General for Urban Planning.

The Council for Development and Reconstruction (CDR) is a public institution established in 1977. It reports directly to the Council of Ministers and is the lead agency in charge of national planning and infrastructure project design and implementation in all sectors. Almost 85% of foreign funds earmarked for reconstruction transit through CDR. The council can bypass ministries to fast-track projects as necessary. It therefore has tremendous influence in NAP related actions, notably in the solid waste and wastewater sectors.

The General Directorate of Urban Planning (DGUP) falls under the Ministry of Public Works and Transport (MoPWT). Its mandate (Decree 10490) is to develop regulations and organize urban development. It defines urban master plans and issues building permits for municipalities that do not have a municipal council or an engineering department (this includes most of the municipalities in Lebanon except Beirut, Tripoli, Federation of Municipalities of Jbail, Kesrouan and Metn). In recent years, DGUP has been working more closely with MoE to direct urban planning towards a more holistic, integrated approach reconciling the imperatives of economic/social development and the urgency of protecting the environment and sustaining natural resources. In relation to NAP, the DGUP has the authority to redesign industrial zones and the power to issue stringent zoning and building regulations for unplanned areas.

The Governorate is a key administrative body that has the authority to approve and facilitate (or not approve and halt) waste management activities within its jurisdiction. In total, four Governorates (out of the country's seven) can influence activities and project implementation in the Lebanese coastal zone. Municipalities located inside the Governorate report to the Governorate on all municipal works and acquisitions. The Governorate therefore is *the* stakeholder at the level of the Administrative Region.

Municipalities and municipal federations have many responsibilities within their jurisdiction. By law they are responsible for building and maintaining certain infrastructure and providing basic services. They can provide sanitation services, maintain water works, streamline public transport and collect taxes. Municipalities are also responsible for controlling the occurrence of violations due to improper waste disposal. As a result several municipalities were chosen either for the implementation and follow-up of actions such as refurbishing the Beirut slaughter house or monitoring actions implemented by CDR such as the construction of wastewater treatment plants.

Non-governmental Agencies

The National Council for Scientific Research (NCSR) is the umbrella agency for national research in Lebanon. It has three subsidiaries: National Centre for Remote Sensing, National Centre for Atomic Energy, and National Centre for Marine Sciences. Its annual budget is about $4 million allocated to research and for running the subsidiary centers. The Council supports projects in the general field of the environment which are executed either by the Lebanese University or its subsidiary centers. CNRS can play a key role in monitoring environmental receptors (water, air) through sampling and analysis.

Founded in 1943, the Association of Lebanese Industrialists (ALIND) is a Lebanese umbrella organization that groups about 600 industries in Lebanon. ALIND advocates a policy of balanced industrial development for all Lebanese regions. The Association seeks to create and maintain an environment which is favorable to industrial investment, growth and development. It is important to note that all industries in Lebanon are privately owned (except those subsidized like cigarette manufacturing) and that the Association therefore has tremendous influence in the industry sector. In relation to NAP, ALIND can play a key role in mainstreaming cleaner production.

MoE has secured a grant from the EU 3rd Countries Life Programme to establish the Lebanon Cleaner Production Centre (LCPC). The LCPC will promote cleaner technologies to gradually achieve cleaner production and compliance with the national standards for environmental quality (NSEQ) pursuant to MoE decision 8/1 dated 01/03/2001. Launched in 2002, the LCPC provides a platform for demonstrating cleaner production methods and providing technical assistance to facilitate the adoption of cleaner technologies and pollution prevention techniques. As part of the NAP, LCPC will contribute by disseminating good housekeeping practices for the tannery industries to reduce BOD loads before they are discharged into the sewer system and to reduce the amount of waste generated.

Table 11
NAP Related Agencies Organized by Sector

Wastewater CDR; CNRS; MoE MoEW; Municipalities	Air Pollution MoE; MoEW; MoPWT
Solid Waste CDR; MoE; Municipalities	Industrial waste ALIND; CDR; DGUP; LCPC; MoE; MoF; MoI; Municipalities; Syndicate of Tanneries

7.2. Evaluation of existing capacities and human, financial and technical resources

There are significant human and financial resources in Lebanon. Unfortunately, poor resource allocation and/or investment in-productive environmental sectors are limiting Project performance and overall impact.

Financial resources in the country

Starting in the mid 1990s, international donor agencies have played a key role in financing environmental project activities in Lebanon. These projects cover a wide range of issues and areas of intervention, including institutional strengthening, resource management and conservation, biodiversity and energy. Between 1995 and 2000, there has been an increase in the number of grant funds for infrastructure-type works including wastewater treatment. During this period, more than 18 international funding organizations sponsored GoL projects worth well over $50 million (not including NGO grants which typically bypass the GoL). Although grants to NGOs are not well documented, total annual commitment could run in tens of $ millions, as several environmental NGOs have sizeable annual budgets, most of which from international organizations (Oxfam, IDRC, USAID, Novib etc,).

Technical monitoring capabilities

See Section 9.1.

Human resources in the private sector

The Ministry of Environment is actively seeking the participation and collaboration of Consulting firms and analytic laboratories to tackle environmental issues and contribute to improved environmental management. Most consulting firms are small in size and have not been able to grow due to the very small size of the environmental consulting market in the country. Several firms have built a niche in specific environmental sectors, such as solid waste and water/wastewater, while others have wider qualifications and interests that cut across environmental areas and skills. Almost all the local firms have some sort of affiliation, joint venture, and strategic partnership, project-by-project association with a European or American counterpart. To grow and prosper, Lebanese environmental consulting firms have started to market their services regionally including Syria, Jordan, Egypt, etc.

7.3. Identification of capacity building requirements

Cleaner production: For the industries that emit wastewater high in BOD and heavy metal concentrations, it is recommended to further enhance the skills and capabilities of the workers and employees to use cleaner production techniques and technologies. Although the LCPC has completed training a selection of industries from the dairy products and canned food sectors, the country will need to apply such practices on a national scale to ensure the improvement and environmental performance of industries.

Auditing & self-monitoring: With grant funding from EC Life Third Countries, MoE developed a National Environmental Auditing Manual (NEAM) to unify the auditing procedures. Unfortunately proper dissemination of the manual has not been achieved and MoE needs to develop sector-specific action plans to improve process performance. MoE has insufficient resources to audit all major industries and therefore must encourage and seek commitment from industries to conduct rapid in-house audits.

Data management: The absence of proper data management currently plagues Lebanon's public and private establishments. To this date, MoE archiving and document management has not been archived. The ministry has however developed 22 operational manuals to streamline internal procedures (purchasing, archiving, etc.) and is in the process of setting up a Quality Management System (QMS). The ministry has expressed interest in acquiring ISO9001:2000 certification within a year.

8. INVESTMENT PORTFOLIO (IP)

Consistent with the National Diagnostic Analysis, the Baseline Budget and the Sectoral Plan prepared during 2004 and 2005, this National Action Plan has grouped priority issues into 15 actions as follows:

Administrative Region A (North)

1. Closure of Domestic Raw Sewage Sea Outfalls
2. Reduce Effluent Concentrations & Quantities from Fertilizer Company
3. Complete containment of Tripoli seafront dumpsite

Administrative Region B (Beirut)

4. Closure of Domestic Raw Sewage Sea Outfalls
5. Treatment of Beirut Slaughterhouse Waste (Karantina)

Administrative Region C (Mount Lebanon)

6. Closure of Domestic Raw Sewage Sea Outfalls
7. Upgrade Select Industrial Zones in Mount Lebanon
8. Reduce Leachate from Borj Hammoud Dumpsite

Administrative Region D (South)

9. Construct Secondary Wastewater Treatment Plants in Sour & Saida
10. Rehabilitation of Sour Coastal Dumpsite
11. Rehabilitate Saida Seafront Dumpsite
12. Promote Cleaner Production & Chromium Recycling in Ghazieh Tanneries

National Actions (A, B, C and D)

13. Implement a National System for the Collection and Treatment of Waste Oil
14. Reduce Air Pollution from Mobile Sources in Major Coastal Cities
15. Control Littering from Seafront Walkways

These 15 actions are presented next in the form of investment portfolios.

8.1. Administrative Region A (North)

ACTION #1: Closure of Domestic Raw Sewage Sea Outfalls		
MEDPOL Sector	Sewage	
Number of sites	15 domestic short sewer outfalls	
Pollutant	BOD and heavy metals in municipal wastewater that may also contain some industrial effluents	
Expected Reduction	50% by 2010	
Description of the action		
This action aims to close at least half the number of domestic outfalls (15 in total) in the North by 2010. To do that, the Government of Lebanon must first complete the construction of priority sewage networks (upstream) and direct those networks to one of four proposed wastewater treatment plants (WWTP) in North Lebanon: El Abde, Tripoli, Chekka and Batroun. Construction of stormwater-sewage networks in the city of Tripoli (the largest agglomeration in the North) is well underway and construction of the associated WWTP has also begun; CDR has tendered the design and construction of the Tripoli WWTP using a loan by the European Investment Bank (EIB). The Chekka and Batroun WWTPs are under construction and will be operational in 2006. The GOL has identified a potential site in Al Abde to build a WWTP but hasn't secured any source of funding yet to expropriate the site and build the plant.		
Other requirements to implement the proposed action		
Legal & Institutional	➢ Ensure plant operation by the Contractor for at least 3-5 years ➢ Ensure the sustainability of the WWTPs	
Technical	➢ Extend power grid to supply future WWTPs ➢ Consider low-tech / low energy requiring technologies	
Capacity Building	➢ Train select staff from the Water Establishment in the north on the operation and maintenance of WWTPs	
Other	➢ Avoid building the TP on reclaimed land in the sea	
Budget		**Sources of Funding**
El Abde WWTP, Sewage networks	No funding to date $25 million	NA
Tripoli WWTP	$76 million	EIB
Chekka WWTP Sewage networks	€10.1 million $2.9 million	French Protocol AFD
Batroun WWTP Sewage networks	€7.6 million $4.4 million	French Protocol AFD
Timeframe		
El Abde WWTP	Secure funding in 2006; expropriate the designated land area by 2007	
Tripoli WWTP	Under construction; reach operational status by 2007	
Chekka & Batroun WWTPs	Under construction; reach operational status in 2006	
Agency responsible for follow-up		
Lead Agency	CDR (WWTP construction)	
Other Agencies	MOE (discharge standards, evaluation); Federation of Municipalities of Al Fayhaa (El Abde and Tripoli); CNRS (effluent testing); Water Establishment (WWTP operation & maintenance)	

ACTION #2: Identify and Pilot Alternative Uses of Gypsum from Fertilizer Company	
MEDPOL Sector	Industrial Waste
Number of sites	Lebanon Chemical Company (LCC), Selaata
Pollutant	Phosphogypsum slurry (with trace Cadmium)
Expected Reduction	To be determined in consultation with LCC (and based on feasibility study findings regarding alternative uses of gypsum slurry)
Description of the action	
The Lebanon Chemical Company in Selaata produced 175,000 tonnes of (processed) phosphoric acid and 85,000 tonnes of triple super phosphate (TSP) in 2004 – phosphoric acid production in Israel, Tunisia and Morocco is 3, 9 and 18 times higher, respectively. The production of phosphoric acid at LCC generates an estimated **300,000 tonnes** of gypsum slurry per year, of which **40,000 tonnes** are sold to cement factories (Cimenterie National and Holcim) and **260,000 tonnes** are discharged to the sea. The plant operates round-the-clock and year-round. The direct impact of the gypsum slurry on the sea floor is reportedly limited to a 100-meter radius from the discharge point. The raw material (phosphate) is imported from Syria and reportedly very low in Cadmium. Stocking the gypsum slurry on land is not an option given the location of the plant and its proximity to residential areas. This action seeks to explore potential economic uses of the gypsum. Whether the gypsum can be used as an inert material in quarry rehabilitation and/or dumpsite capping, or refined to be used in the manufacturing of gypsum boards, transportation costs are prohibitively high. With grant funding from the EC Life Third Countries program (EU), the MOE is currently implementing a quarry rehabilitation program that could in the future pilot quarry rehab using gypsum. The plant is one of the largest industrial establishments in the country (it represents 7-8 percent of the total value of Lebanon's industrial production) and has been frequently the target of very aggressive anti-pollution campaigns. Reducing total discharges into the sea hinges on the ability to identify and pilot cost-effective uses of the gypsum.	
Other requirements to implement the proposed action	
Legal & Institutional	➢ Develop MOU between relevant parties to work together to identify alternative uses (LCC, MoE, LCPC, IRI, universities, etc.)
Technical	➢ Explore the possibility of using gypsum to rehabilitate quarries ➢ Explore the feasibility of using the gypsum to produce gypsum boards ➢ Assess total quantities of gypsum that cement factories could consume ➢ Identify other uses and determine transportation costs
Capacity Building	➢ To be determined
Budget	**Sources of Funding**
Feasibility Study of using gypsum	$100,000 Lebanon Chemical Company
Pilot demonstration	To be determined based on feasibility study
Timeframe	
Develop MOU	In 2006
Conduct feasibility study	By 2007
Implement FS recommendations	By 2010
Follow-Up	
Lead Agency	MoE (monitoring) and MoI (cleaner production), LCC
Other Agencies	ALIND, Lebanon Cleaner Production Center

ACTION #3: Complete containment of Tripoli seafront dumpsite		
Sector	Solid Waste Management	
Number of sites	One; Tripoli dumpsite	
Pollutant	BOD and heavy metals from leachate	
Expected Reduction	>50%	
Description of the action		
The Tripoli dumpsite serves the greater Tripoli area. It receives about X tonnes of municipal solid waste per day. To contain the site and prevent drift waste, CDR tendered in 19YY the construction of a seawall around the perimeter of the dump. Since 2001, the site is being operated by a private contractor (BATCO). It has been retrofitted with gas wells to reduce gas build-up and associated hazards. CDR commissioned Dar Al Handasah (Nazih Taleb) a detailed study to expand the dumpsite to serve an additional five years. The study calls for the construction of a second gabion reinforced seawall, 9-10 meters high, as well the construction of a sorting and composting facilities on an adjacent land area for a total cost of $12 million (including expansion works and operation over five years). The Council of Ministers reportedly approved the plan earlier this year. Works will begin if/when the budget is explicitly allocated in the budget law for 2006.		
Other requirements to implement the proposed action		
Legal & Institutional	➢ Include dump expansion & extension in 2006 budget law	
Technical	➢ Review seawall specifications to also contain leachate ➢ Ensure extension works also include a leachate treatment plant	
Capacity Building		
Budget		**Sources of Funding**
Design Study	$0.9 million (completed)	GOL
Expansion, O&M	$12 million (pending)	GOL
Timeframe		
Expansion	NA	
Operation	Through 2010-11	
Follow-Up		
Lead Agency	CDR (tendering)	
Other Agencies	Federation of Al Fayhaa (monitoring)	

8.2. Administrative Region B: Beirut

ACTION #4: Closure of Domestic Sewer Outfalls in Beirut	
MEDPOL Sector	Sewage
Number of sites	At least 5 short sewer outfalls
Pollutant	BOD load from domestic (and industrial) wastewater
Expected Reduction	> 50%
Description of the action	
As part of the wastewater management scheme for the Greater Beirut Area, wastewater generated in Beirut will be directed through large coastal collectors to two treatment plants located north and south of Beirut, in Mount Lebanon. In essence therefore, wastewater from Beirut (Administrative Region B) will be treated in Mount Lebanon (Administrative Region C). The construction of the Ghadir wastewater pre-treatment plant for the southern suburbs of Greater Beirut is complete. Under the Beirut coastline wastewater collector project, CDR tendered the construction of wastewater collectors for the northern and southern areas of Beirut: the northern section comprises two large collectors converging in Dora (completed) and the southern section comprises two collectors that converge in Ghadir (under construction). The northern collectors have been idle since 2002 pending the construction of the Dora WWTP. After completing the feasibility study for the expansion and upgrade of the Ghadir wastewater pre-treatment plant, CDR secured $15 million from the German Reconstruction Fund (KFW) to cover part of the costs and is negotiating with several other donor agencies (e.g., IDB, EIB and OPEC) to secure an additional $35 million to complete upgrade and expansion works. *See Action #6 for more information on Ghadir and Dora WWTPs.*	
Other requirements to implement the proposed action	
Legal & Institutional	➢ Expropriate lands for Dora WWTP (incl. sea reclamation?) ➢ CDR and MOEW to award contracts for the operation of the Dora and Ghadir WWTPs
Technical	➢ Complete the construction of the southern collectors ➢ Select proven technology and appropriate site (Dora)
Capacity Building	➢ Provide training to water agencies on how to operate a WWTP
Budget	**Potential Sources of Funding**
Dora WWTP Construction	NA
Ghadir WWTP Extension	$50 million — KFW ($15 million confirmed), IDB, EIB, OPEC
Timeframe	
Ghadir WWTP extension	Secure additional funds by 20YY *(consult CDR)* Begin construction by 20YY Complete construction by 20YY
Dora WWTP construction	Expropriate selected site Decide on finance mechanism and secure funding
Follow-Up	
Lead Agency	CDR (WWTPs)
Other Agencies	MOE (discharge standards, evaluation), CNRS (testing) and MoEW (operation & maintenance of WWTPs)

ACTION #5: Treatment of Beirut Slaughterhouse Waste (Karantina)		
MEDPOL Sector	Industrial Waste	
Number of sites	Beirut slaughterhouse	
Pollutant	BOD from solid waste	
Expected Reduction	50% (only solid waste)	
Description of the action		
The Beirut slaughterhouse, the largest in Lebanon, was built in 1975. Located in Karantina, the slaughterhouse is rudimentary, poorly designed and unsanitary. Bones are stockpiled for weeks on end and then burnt to reduce volume emitting foul odors that affect residences in a wide radius around the site. Other wastes are either shredded (digestive tract) and discharged to the sea or simply discharged to the sea directly (blood, wash water). The Governor of Beirut awarded the construction of a rendering plant/compost facility to a local waste management contractor (Cedar Environmental). The plant is currently under construction. It is located inside the perimeter of the existing slaughterhouse and the resulting compost will reportedly be fit for agricultural use (yet to be demonstrated). The plant will handle up to three tonnes of solid waste per day (bones, digestive system, etc.); liquid waste (urine, blood and wash water) will continue to be discharged to the sea. The plant is expected to operate normally before the end of the year (2005). Cedar Environmental has a four-year contract with the municipality to operate the system.		
Other requirements to implement the proposed action		
Legal & Institutional	➢ Consider the need for exclusivity to justify the capital and operational costs of rendering plants ➢ Encourage waste exchange programs (i.e., using skins in the tanning sectors)	
Technical	➢ Review the proposed composting technology to make sure it can handle slaughter waste and produce a safe byproduct	
Capacity Building	➢ Ban all dumping of slaughter waste in nearby Beirut River	
Budget		**Source of Funding**
Construction	NA	Cedar Environmental
Operation & Maintenance	NA	Municipality of Beirut
Timeframe		
Construction	Construction and testing to be completed by the end of 2005 Propose potential solutions for liquid slaughterhouse waste	
Operation & Maintenance	Full system operation to begin in 2006 Implement the preferred solution for liquid slaughterhouse wastes	
Follow-Up		
Lead Agency	Municipality of Beirut / Beirut Governor	
Other Agencies	Ministry of Environment (performance monitoring)	

8.3. Administrative Region C: Mount Lebanon

ACTION #6: Closure of Domestic Raw Sewage Sea Outfalls - Construction of four WWTPs and Expansion of one existing WWTP		
MEDPOL Sector	Sewage	
Number of sites	25 domestic raw sewage outfalls	
Pollutant	BOD and heavy metals in municipal wastewater that may also contain some industrial effluents	
Expected Reduction	>50%	
Description of the action		
This action seeks to close the majority of short sewer outfalls in Mount Lebanon (about 25) by building four new WWTP's planned along the coastal zone (Jbail, Kesrouan, Dora and Coastal Chouf) and expanding one existing plant (Ghadir). CDR has already awarded contracts for the construction of WWTP's in Jbeil (€9.4 million) and Chouf coastal area (€14.4 million). Funding for the Dora WWTP is still pending; the Government of Lebanon intends to build the Dora plant under a BOT arrangement (an Environmental Impact Assessment was conducted in 2004). A feasibility study of the extension of the Ghadir pre-treatment plant and the construction of a parallel secondary treatment plant has been conducted but current funding ($15 million) does not cover total project costs ($50 million).		
Other requirements to implement the proposed action		
Legal & Institutional	➢ Review financing schemes and secure additional funds to complete planned wastewater projects (specific to hotspots)	
Technical	➢ Control industrial waste discharge into the sewer system (e.g., cleaner production)	
Capacity Building	➢ Train employees and technicians on how to operate and troubleshoot future WWTP	
Budget Summary		**Potential Sources of Funding**
Jbeil WWTP	€9.5 million	French Protocol
Kesrouan WWTP	NA	
Dora WWTP	NA	Design-Build-Operate
Ghadir WWTP	$50 million	$15 M from KFW (confirmed) IDB, EIB, OPEC Fund (prospective)
Chouf (Nabi Younis) WWTP	€14.4 million	French Protocol
Timeframe		
Jbeil WWTP	Construction contract awarded in 2004	
Kesrouan WWTP	*No solid timetable in sight*	
Dora WWTP	Tendering expected in 2006	
Ghadir WWTP	Design phase is completed but is not considered a priority	
Chouf (Nabi Younis) WWTP	Under construction, will reach operational status in 2006	
Follow-Up		
Lead Agency	CDR (WWTPs)	
Other Agencies	MOE (discharge standards, system evaluation), CNRS (testing) and MoEW (manage contracts for operation & maintenance)	

ACTION #7: Upgrade Select Industrial Zones in Mount Lebanon	
MEDPOL Sector	Industrial and Hazardous Waste
Number of sites	A dozen priority industrial zones in Mount Lebanon
Pollutant	BOD, heavy metals and other hazardous wastes
Expected Reduction	50%
Description of the action	
Mount Lebanon hosts the largest number of industrial zones in Lebanon, some of which have been decreed (about 12 zones), others have been approved by the Council of Ministers (about 2) or approved by the Directorate General for Urban Planning (about 8). Other industrial zones exist *de facto* (have no legal status). None of the industrial zones are equipped with environmentally-sound waste management schemes. To reduce the discharge and disposal of industrial and hazardous waste in Mt. Lebanon, the Action seeks to equip a selection of industrial zones with sound waste management facilities. This may require the construction of a dedicated sewer network for industrial waste, solid waste labeling and separation, and the provision of a WWTP for industrial waste. Funding will need to be secured from multiple private and public sources. Meanwhile, the Government should encourage cleaner production to reduce industrial loads and gradually achieve compliance with the national discharge standards (MOE Decision 8/1).	
Other requirements to support the proposed action	
Legal & Institutional	➢ Tax reductions to promote cleaner production ➢ Incentives to encourage the voluntary relocation of some industries
Technical	➢ Introduce pre-treatment methods & practices inside industries ➢ Select appropriate & proven technology for the treatment of industrial and hazardous waste ➢ Expand one WWTP in ML to handle industrial wastewater?
Capacity Building	➢ ALIND to lobby for the provision of *real* industrial zones ➢ Intensify seminars and on-the-job training on cleaner production
Budget	**Potential Sources of Funding**
Equip a dozen priority industrial zones with SW and WWM facilities	NA — GEF, Private Sector
Introduce cleaner production	NA — ALIND, Lebanese Center for Cleaner Production
Timeframe	
Short-term	Select 1 or 2 target industrial zones in Mt. Lebanon Determine waste management needs and requirements Mobilize funding to install waste management infrastructure & services
Long-term	Install waste management infrastructure
Follow-up	
Lead Agency	MOE, MoI, ALIND
Other Agencies	CDR, MOI, DGUP

ACTION #8: Reduce Leachate from Borj Hammoud Dumpsite	
MEDPOL Sector	Solid waste
Number of sites	1 dumpsite (located in Bourj Hammoud, north of Beirut)
Pollutant	Leachate
Expected Reduction	>50%
Description of the action	
The Borj Hammoud dumpsite is located on the seafront immediately north of Beirut. It was the only solid waste disposal site during the 1980s for a sizeable population residing in the Greater Beirut Area. The site was permanently closed in July 1997 and has been inactive since. The dumpsite is about 700 meters long (seashore) and 60 meters high. It contains an estimated 4 million m3 of solid waste (3.7 million m3 above sea level). A feasibility study of gas extraction conducted in 2000 determined that the site could generate an estimated 850 GWh and recover 1.6 million ton-equivalent of CO_2; the waste-to-energy forecast was later contested by several waste management specialists who argued that the dumpsite contained by and large putrescible waste that would have biodegraded in the first years after closure. Reducing leachate into the sea will require drilling soil borings and ground-water monitoring wells to identify the extent and concentration of the leachate produced by the dumpsite. Horizontal and vertical dimensions of soil and groundwater contamination should be defined. Immediate remediation measures should be taken to stop the daily flow of leachate to the sea. Lebanon already has experience in the remediation of large-scale dumpsites (e.g., Normandy) and could transfer that experience to Borj Hammoud, subject to fund availability and the envisioned end-use of the land area.	
Other requirements to implement the proposed action	
Legal & Institutional	NA
Technical	➢ Assess leachate generation and flows into the sea ➢ Select adequate containment measures ➢ Implement environmentally-sound remediation and clean-up measures
Other	NA
Budget	
Sampling and analysis	$50,000
Containment measures	NA
Remediation measures	$8-12/m3 (based on cost figures from Normandy rehabilitation project)
Potential sources of funding	
Sampling and Analysis	NA
Containment	NA
Remediation measures	Carbon Trade Fund? BOT?
Timeframe	
Sampling and Analysis	*No timeframe yet*
Containment	*No timeframe yet*
Remediation measures	*No timeframe yet*
Follow-Up	
Lead Agency	*To Be Determined*
Other Agencies	MOE (sampling and analysis)

8.4. Administrative Region D: South

ACTION #9: Construct Secondary WWTP in Sour & Saida	
MEDPOL Sector	Sewage
Number of sites	2 (Saida and Sour)
Pollutant	BOD and some heavy metals
Expected Reduction	> 50%
Description of the action	
According to CDR, wastewater management works in the South are hampered by a lack of funds. There are about 17 domestic short sewer outfalls in the region, of which fourteen are located in/near Saida and three in Sour. There is no information on the state of these outfalls (length, dimension and loading volume). The Japanese Bank for International Cooperation (JBIC) financed the construction of a (preliminary) treatment plant and associated collectors in Saida at $9.5 million (52% complete) as well as a sea outfall at $9.5 million (20% complete). No funds have yet been secured for the construction of a WWTP in Abbasiyeh to serve Sour. The Saida WWTP provides preliminary treatment – this does not reduce BOD sufficiently to achieve compliance with the LBS protocol. This proposed action involves (1) upgrading the treatment process at the Saida WWTP to provide secondary treatment and (2) building a secondary treatment plant in Abbasiyeh to serve the Sour agglomeration.	
Other requirements to support the proposed action	
Legal & Institutional	➢ Expropriate land for the construction of the Sour WWTP (by decree) ➢ Secure funds for the extension of Saida WWTP ➢ Secure funds to build the Sour WWTP
Technical	➢ Ensure the selection of appropriate & proven treatment technology ➢ Consider low-tech / low energy requiring technologies ➢ Avoid building the TP on reclaimed land in the sea
Capacity Building	➢ Train the future staff of the proposed WWTPs on O&M procedures
Budget Summary	**Sources of Funding**
Sour WWTP design Construction	$1.2 million — EIB? $45 million — EIB?
Saida WWTP design Construction	$4.4 million — JBIC $20 million (constructed) — JBIC
Timeframe	
Sour WWTP	Indicative start date is January 2006, pending availability of funds
Saida WWTP	Preliminary Treatment Plant is reportedly operational Sea outfall constructed
Follow-Up	
Lead Agency	Council for Development and Reconstruction (tendering WWTP construction)
Other Agencies	MOE (discharge standards, system evaluation), CNRS (testing), MoEW (manage contracts for operation & maintenance), municipalities of Saida and Sour (collection of wastewater fees)

ACTION #10: Rehabilitation of Sour Coastal Dumpsite	
MEDPOL Sector	Solid waste
Number of sites	1 (Sour)
Pollutant	Leachate
Expected Reduction	>50%
Description of the action	
The coastal dumpsite in Sour is located about 200 meters from the sea shore. Leachate from the dumpsite reaches the sea via a small channel. Although the dumpsite is still active, CDR and the local municipality are aiming to close it in 2006. As part of its rehabilitation, some of the waste may be transported to a nearby compost facility currently under construction. Dumpsite remediation will require an environmental impact assessment (EIA). The assessment should investigate leachate generation and strength to determine the most suitable rehabilitation method. CDR and the local municipalities need to decide the extent of rehabilitation based on the desired end-use of the site and the availability of funds. Dumpsite closure will require an effective alternative SWM plan for the Sour agglomerate with due consideration to source separation.	
Other requirements to implement the proposed action	
Legal & Institutional	➢ Develop a SWM strategy for Sour ➢ Consider the pros & cons of private vs. municipal SWM service providers
Technical	➢ Ensure the sound operation of the composting facility and adequate compost quality – find suitable end users of municipal compost
Capacity Building	➢ Encourage source separation
Budget Summary	**Potential Source of Funding**
EIA for dump rehab	$75,000 (including testing)
Remediation works	$8-12/m3 (based on rehab costs in Normandy)
Timeframe	
New SWM scheme in place	By 2006
Dump closure	During 2006 (but not before new SWM scheme is in place)
Dump rehabilitation	By 2008
Follow-up	
Lead Agency	CDR (tendering dump rehabilitation works)
Other Agencies	Municipality of Sour (follow-up), MOE (EIA review)

ACTION #11: Rehabilitation of Saida Seafront Dumpsite	
MedPol Sector	Solid waste
Number of sites	1 (Saida)
Pollutant	Leachate seeping into the sea and solid waste falling into the sea
Expected Reduction	90%
Description of the action	
Municipal waste from the Saida district (Caza) are collected and disposed off in a shorefront dumpsite located immediately south of the city. The seafront side of the dumpsite collapsed several times in recent years (the last such event occurred in August 2005). The municipality of Saida has been calling for its complete closure but has so far been unable to find a viable alternative. Recently the municipality received a $5 million pledge by the Walid Bin Talal Foundation to rehabilitate the dumpsite on condition that it closes the site and provides an alternative site for the disposal of inert, unsalvageable and unrecyclable waste. Under contract with the Municipality of Saida, a local waste management contractor (IBC) started construction of a solid waste treatment facility (inc. sorting and composting plants) near the current dumpsite. It is unclear when this facility will be completed and operational. The proposed action has two components: 1) *Emergency Plan:* The dumpsite should be contained to prevent future collapses. The municipality should develop an emergency response plan in case of future collapses and mobilize resources to collect drift waste. The emergency plan should also include actions to prevent leachate seepage into the sea. The level of rehabilitation must be decided in light of environmental requirements and fund availability. 2) *SWM system:* CDR and the Municipality of Saida should conduct a feasibility study of SWM in the Caza of Saida. The feasibility should explore alternative solid waste management methods and sites. It should also assess capital, operation and maintenance costs of the proposed SWM system. The GOL must secure funds for dump rehabilitation and the implementation of an integrated SWM in Saida.	
Other requirements to implement the proposed action	
Legal & Institutional	➢ Consider the pros and cons of private versus public/municipal SWM service providers (including collection and operation of SWM facilities) ➢ Secure more funds for the rehabilitation of the dumpsite
Technical	➢ Salvage the $5 million donation (from Walid Bin Talal Foundation) to rehabilitate the dumpsite (works implemented by South for Construction) ➢ Prepare and implement long-term source separation program
Capacity Building	➢ Implement long-term public awareness campaign on SWM
Budget Summary	**Sources of Funding**
Emergency containment plan	NA
Feasibility study for rehab	Part of $5 million grant from Walid Bin Talal Foundation
Rehabilitation	Part of $5 million grant from Walid Bin Talal Foundation
Timeframe	
Containment	Immediate (2005)
Closure	In 2006
Rehabilitation	By 2010
Follow-Up	
Lead Agency	Council of Ministers, CDR, MoEW
Other Agencies	Municipality of Saida (follow-up and resource mobilization), MOE

ACTION #12: Promote Cleaner Production & Chromium Recycling in Ghazieh & Dora Tanneries		
MedPol Sector	Industrial Waste	
Number of sites	1 (Ghazieh, South Lebanon)	
Pollutant	Heavy metals (Chromium^{+6}) and high BOD concentrations	
Expected Reduction	30- 50 %	
Description of the action		
There are currently 3 tanneries in Ghazieh (Saida's industrial suburb), one of which is reportedly the largest in Lebanon. They generate large quantities of heavily charged wastewater (BOD and Cr^{+6}) that is currently discharged into open sewers that ultimately reach the sea. Several feasibility studies in recent years have found that the relocation of tanneries (including the ones in Ghazieh and Dora) is not possible. There are many recommendations to reduce the environmental load of tanneries: reducing water consumption, recovering and recycling chromium (as chrome hydroxide) and increasing the efficiency of utilized chemicals. Tanneries must receive technical and financial support to introduce pre-treatment of tannery effluent. The discharge of untreated tannery effluent into the public sewer system must stop. The need for a centralized chromium recovery facility for all tanneries in Lebanon should be assessed.		
Other requirements to implement the proposed action		
Legal & Institutional	➢ MoE to set/review existing discharge limits for tanneries ➢ Provide incentives to help tanneries pre-treat their effluent	
Technical	➢ Build slaughterhouses near tanneries to facilitate waste-exchange programs (using skins from slaughterhouses as hides in tanneries) ➢ Encourage the use of Chromium substitutes (e.g., Titanium) ➢ Recycling lime/sulphide liquor	
Capacity Building	➢ Demonstrate cleaner production to tannery staff ➢ Promote good housekeeping practices (e.g., water conservation, checking for leakages, repair and maintenance)	
Budget		**Sources of Funding**
Pre-Treatment on site	NA	?
Cleaner Production Training	NA	?
Chromium Recovery Facility	NA	?
Timeframe		
Pre-Treatment on site	By 2008?	
Cleaner Production Training	2006-07 (including tanneries in Ghazieh and Dora)	
Chromium Recovery Facility	By 2010?	
Follow-Up		
Lead Agency	ALIND, Syndicate of Tanneries	
Other Agencies	Lebanon Cleaner Production Center, MOE, MOI	

8.5. National Actions (Administrative Regions A, B, C and D)

ACTION #13: Implement a National System for the Collection and Treatment of Waste Oil		
MEDPOL Sector	Industrial Waste	
Number of sites	Numerous (River Outfalls, Industrial Outfalls)	
Pollutant	Waste oil	
Expected Reduction	>50%	
Description of the action		
The vehicle fleet in Lebanon consumes an estimated 28,000 tonnes of imported motor lubricating oil and generates about 21,000 tonnes of used oil per year. Nationwide, nearly 58 percent of waste oils are collected and reused as energy supplements; thirteen percent are disposed in water bodies either directly (streams, rivers) or indirectly (sewers) and the remaining 29 percent are disposed on land. It is safe to conclude that a significant quantity of waste oil ultimately reaches the sea. Many vehicles reportedly use filtered waste oil. This practice is counter-productive on two counts: it damages vehicle engine and reduces the viability of national system for waste oil collection and treatment. This action seeks to set in place a national system for the storage, collection and treatment of used oil in the country. Previous attempts by the private sector to build a waste oil treatment facility failed when the government refused to provide exclusivity. In light of the relatively small quantities of waste oil in Lebanon, any future treatment facility may necessitate some form of exclusivity. The components of this action include: (i) Waste oil decree, (ii), Nomination of cement factory for operation of collection systems, (iii) Identification of partial funding for start up costs, (iv) Media campaign to warn against reusing waste oils in engines (or as energy supplement).		
Other requirements to implement the proposed action		
Legal & Institutional	➢ Develop and enforce a waste oil decree on the collection, storage, and treatment of waste oil ➢ Develop some sort of a MOU between MoE, garages and cement industries to formalize the proposed collection system	
Technical	➢ Inspect waste oil storage facilities in gas stations and car mechanics ➢ Test waste oil before incineration in cement factors to make sure it does not contain polychlorinated compounds	
Capacity Building	➢ Educate the public on the deleterious effects of waste oil dumping on the environment and public health as well as the risks of reusing waste oil in car engines.	
Budget		**Sources of Funding**
Waste oil decree	$20,000	MoE (MSC-IPP)
Waste oil collection system	$690,000 (start-up costs); $172,000/year (operational costs)	
Waste oil analysis	$35,000 (start-up costs); $65,000/year (operational costs)	
Waste oil incineration	Recovered by cement factories through the value of waste oil collected	
Timeframe		
Develop waste oil decree	By 2007	
National collection system in place	By 2010	
Follow-Up		
Lead Agency	MOE, Cement Industries	
Other Agencies	Importers of motor oils, garages, technical labs	

ACTION #14: Reduce Air Pollution From Mobile Source in Major Coastal Cities	
MEDPOL Sector	Air
Number of sites	Beirut
Pollutants	PM, NO_x and SO_x
Expected Reduction	>20%
Description of the action	
Despite significant improvements in the transportation sector and major spending on roads and highways, congestion remains a severe problem in big cities like Tripoli, Byblos, Jounieh, Beirut and Saida and in particular along penetrator roads. For example, Beirut's three penetrator roads (north, east and south) are severely congested during peak hours. Air pollution from mobile sources is considered a potentially significant source of pollution from land-based sources into the Mediterranean Sea (e.g., particular matter dropdown, dust and lead in stormwater). Measures to reduce air pollution from mobile sources are very diverse. Lebanon should consider several low-cost interventions including a better enforcement of the road-worthiness tests (mécanique), the removal from circulation of rundown vehicles, and the inspection of fuel quality. A complete overhaul of the public transport system could also achieve significant reductions in air pollution through cleaner fuel and higher occupancy rates. This however would require significant investments.	
Other requirements to implement the proposed action	
Legal & Institutional	➢ Review Law 341 on reducing pollution from mobile sources ➢ Review mandate and status of the Transport Regulatory Unit ➢ Identify new options to upgrade the public transport system
Technical	➢ Rigorously enforce mandatory road-worthiness tests ➢
Capacity Building	➢ Implement a campaign for improved driving (e.g., car pooling)
Budget	**Sources of Funding**
Enforce strict road-worthiness tests (mécanique)	$0 — vehicle owners
Remove old/rundown vehicle from circulation	$0 — GOL / MOTPW
Inspect fuel quality	NA — GOL / MOEW
Timeframe	
Enforce strict road-worthiness tests (mécanique)	Immediate
Remove old/rundown vehicles from circulation	By 2010
Inspect fuel quality (at the pump)	Immediate
Follow-Up	
Lead Agency	Council of Ministers
Other Agencies	MOPWT (mécanique), MOEW (fuel quality), MOE (monitoring)

ACTION #15: Control Littering from Seafront Walkways		
MEDPOL Sector	Solid waste	
Number of sites	Beirut (Raouche), Tripoli (El Mina), etc.	
Pollutant	Solid waste (litter including plastics and glass)	
Expected Reduction	80%	
Description of the action		
Public littering continues to be a very significant problem along seafront walkways in all cities in Lebanon including Halba, Tripoli, Jounieh, Beirut, Saida and Sour. Divers and fishermen routinely complain about the severe build-up of solid waste (mostly plastics and glass) on the sea floor. While some of this waste may have drifted from open dumpsites, a sizeable portion comes from public littering. Local NGOs organize annual cleanup campaigns (with divers) to remove solid waste from the seafloor but the long-term impact of such campaigns is questionable. This action seeks to provide more bins along all seafront walkways. Local municipalities should recruit people to patrol the walkways and inform pedestrians not to litter. The municipality should also consider measures to control the proliferation of kiosks along those walkways (e.g., mandatory registration of kiosk owner, biodegradable packaging materials, and returnable bottles). TV stations should participate in this campaign through TV spots.		
Other requirements to implement the proposed action		
Legal & Institutional	➢ Review and publicize existing legislation on litter offenses ➢ Enforce fines for littering	
Technical	➢ Install bins along all seafront walkways ➢ Recruit municipal patrol teams	
Capacity Building	➢ National TV awareness campaign	
Budget Summary		Sources of Funding
Install bins	$50,000	Local municipality
Municipal patrol teams	NA	Local municipality
TV spot	NA	Private (local TV stations)
Timeframe		
Install bins	2006	
Municipal patrol teams	Starting in 2006	
TV spot	Starting in 2006	
Follow-Up		
Lead Agency	MOE (Department of Environmental Guidance)	
Other Agencies	Local municipalities, TV stations, NGOs	

9. MONITORING AND REPORTING SYSTEM

This chapter reviews Lebanon's monitoring capabilities and presents tentative criteria for evaluating the effectiveness of goal achievement.

9.1. Monitoring capabilities in Lebanon

Lebanon's monitoring capabilities have improved in recent years. Several universities and research institutions now have in-house monitoring capabilities and therefore should be involved in the monitoring of several environmental receptors including seawater, air and phytoplankton. For example:

- National Center for Marine Sciences (NCMS): The center has been monitoring sea water quality since 1999 at 22 fixed locations along the coastline including public beaches, river and sewage outfalls (see full list in Appendix D). The northernmost point is Las Salinas (a popular sea resort in North Lebanon) and the southernmost point is Naqoura near the border zone. Routine test parameters include total coliform, fecal coliform, nitrates, nitrites, electrical conductivity, pH and dissolved oxygen. The NCMS should assume lead responsibility for monitoring sea water quality and effectiveness of goal achievement. The Center needs additional human and financial resources to expand and intensify its monitoring program as well as disseminate their findings.
- University of Saint-Joseph (USF): Working with the Municipality of Beirut, the geography department has been implementing an extensive and continuous air quality monitoring program in the Beirut area. The University should assume lead responsibility for monitoring air quality (improvement) in the GBA.
- Federation of Municipalities of Al Fayhaa: This Federation groups three municipalities in North Lebanon including the municipality of Tripoli which is the second largest in the country. The Federation hosts the Tripoli Environment & Development Observatory which owns and operates mobile air quality measurement units. The Observatory should assume lead responsibility for monitoring air quality in the Tripoli area as well as progress on other NAP fronts including wastewater and solid waste.

9.2. Reporting system

The Ministry of Environment will review progress in relation to the proposed actions on a biannual basis. The MedPol Focal Point will document progress as part of an annual report, to be submitted to the MedPol Secretariat. The annual reports should incorporate the findings of the different agencies that are participating in the monitoring program (NCMS, USF, Observatory, etc.).

10. CONCLUSIONS & NEXT STEPS

The National Action Plan presents 15 priority actions to reduce pollution into the Mediterranean Sea from land-based sources. Some of the actions are already underway and will be completed in 2006-07. This includes four wastewater treatment plants as well as the rehabilitation of the Normandy dumpsite in Beirut. Other actions are still at the planning phase (e.g., wastewater treatment plants in Tyre, Sarafand and Naqoura) while others yet are being proposed for the first time (e.g., litter management program, reutilization of gypsum slurry, collection and treatment of waste oil). Implementation of all 15 priority actions may not be feasible by 2010 but significant progress should have been accomplished by 2010. NAP implementation remains a shared responsibility among several government, private sector and civil society stakeholders.

The National Action Plan is not simply another "report." It is a working document which needs to be disseminated, refined and endorsed by policy makers and the civil society. The next steps in the NAP process are summarized next:

1. Posting of NAP on the MoE website: MoE volunteered to post the draft final NAP report on its website (www.moe.gov.lb) for public dissemination and review. The ministry looks forward to receiving comments from the public at large and incorporating those comments into the NAP as necessary.
2. Participation at the MEDPOL meeting in Portoroz, Slovenia: MoE intends to participate at the high-level meeting of the Contracting Parties to the Barcelona Convention at the Nov X-Y meeting in Slovenia. The ministry has expressed strong interest and commitment to take part in the planning and design of the PDF-C project document that will assist Mediterranean countries implement select actions and project interventions.
3. Continuation of the dialogue: The MEDPOL Focal Point at MoE will take necessary steps to disseminate the NAP as part of a continuous dialogue with civil society, industrialists, key municipalities and government agencies to ensure follow-up and phased implementation of the proposed actions. In fact, the Ministry recognizes the role of civil society in lobbying for NAP implementation and welcomes their structured and results-orientation participation.
4. NAP dissemination leaflet: MoE will produce a NAP informational leaflet that will summarize key findings including the proposed actions. This leaflet will provide cursory information regarding the NAP and, it is hoped, plant the seed for increased interest and commitment from all parties to partake in its implementation.

Appendix A
National Stakeholder Consultation Meeting Program
September 19, 2005
Social and Economic Council

Time	Activity	Presented by
Session 1: **Opening Session**		
08.30 – 09.00	Registration	
09.00 – 09.15	Welcome Note	*Berj Hatjian - MoE*
09.15 – 09.30	Meeting Program and Objectives	*Karim El Jisr - ECODIT*
09.30 – 09.45	Overview of the LBS protocol (Barcelona Convention)	*Olfat Hamdan - MoE*
9.45 – 10.00	***Coffee Break 1***	
Session 2: **Sectoral Plans (SPs)**		
10.00 – 10.15	Methodology & Structure	*Rabih Fayad - Envirotech*
10.15 - 10.30	Priority actions per Sector	
10.30 – 10.45	Q&A regarding Sectoral Plan	
10.45 - 11.00	***Coffee Break 2***	
Session 3: **National Action Plan (NAP)**		
11.00 – 11.15	Lessons Learned from other countries	*Michael Angelidis - MEDPOL*
11.15 - 11.30	Methodology & Structure	*Karim El Jisr - ECODIT*
11.30 – 11.45	Summary of Proposed Priority Actions	
Session 4: **Working Groups**		
11.45 - 13.30	Working Groups • *Group 1: Waste water* • *Group 2: Solid waste* • *Group 3: Air pollution from mobile sources* • *Group 4: POPs, heavy metals and industrial waste*	*Resource Group:* *Olfat Hamdan, Rabih Fayad, Karim El Jisr, Haya El Assi*
13.30 – 14.00	Open Discussion	
Session 5: **Closing Session**		
14.00 – 14.30	Wrap-Up & next steps	*Karim El Jisr - ECODIT*
14.30	***Lunch***	

Appendix B
People Consulted during NAP Preparation

Dr. Berj Hatjian
Director General
Ministry of Environment
Beirut, Lebanon

Mr. Ismail Makki
Agriculture and Environment Department Manager
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Dr. Gaby Khalaf
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Antoine Doumit
Manager
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Mr. Hicham Abu Jawdeh
Secretary of Environment Committee
Association of Lebanese Industrialists
Beirut, Lebanon

Mr. Abdallah Abdel Wahab
Head of Engineering Section
Federation of Municipalities of Al Fayhaa
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Mr. Ziad Abi Chaker
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Cedar Environmental (Waste Management Contractor)
Beirut, Lebanon

Appendix C
Official Letter from the Lebanese Ministry of Environment to the MEDPOL Secretariat

To Be Inserted Later

Appendix D
National Center for Marine Sciences Fixed Monitoring Points along the Lebanese Coastline

To Be Inserted Later.

Appendix E
List of Cited & Consulted References

1. *Working Strategy: Waste Oil Treatment in Lebanon*. Prepared by Dirk Legatis for the Ministry of Environment / MSC-IPP. 2003.
2. *Lebanon 2001State of the Environment Report*. Prepared by ECODIT Liban for the Ministry of Environment, 2002.
3. *National Action Plan to Reduce Pollution into the Mediterranean Sea from Land Based Pollution: Sectoral Plans*. Prepared by Envirotech ltd. for the Ministry of Environment / UNEP, 2005.