REPUBLIC OF LEBANON
MINISTRY OF ENVIRONMENT

Strengthening the Permitting & Auditing System for Industries SPASI undp

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

Ref: SPASI/Jus./003 MVV

Mr. Yves de San
Resident Representative
United Nations Development Programme (UNDP)
UN House
Beirut

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

Antelias, 9.12.2000

Dear Sir,

Subject: **The 4th Progress Report for Setting the National Standards for Environmental Quality**

Enclosed please find copy of the 4th progress report for the project entitled "*Setting the National Standards for Environmental Quality*" prepared and submitted by MVV InnoTec.

According to the signed contracts, we are requested at this stage to pay 15% of the total cost of the project. In light of that we prepared the necessary request for direct payment.

Appreciating your continuous support, we remain,

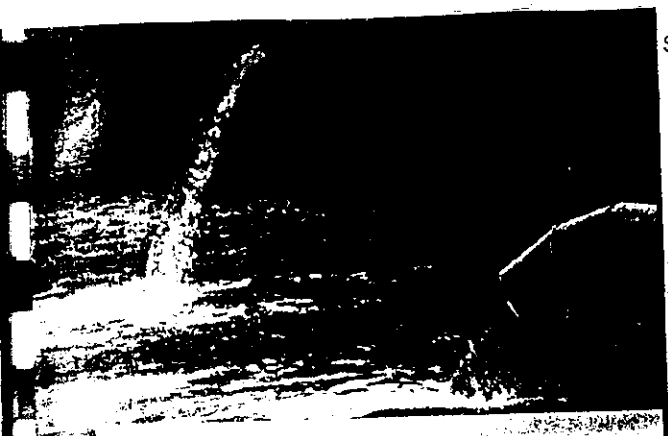
Sincerely yours,

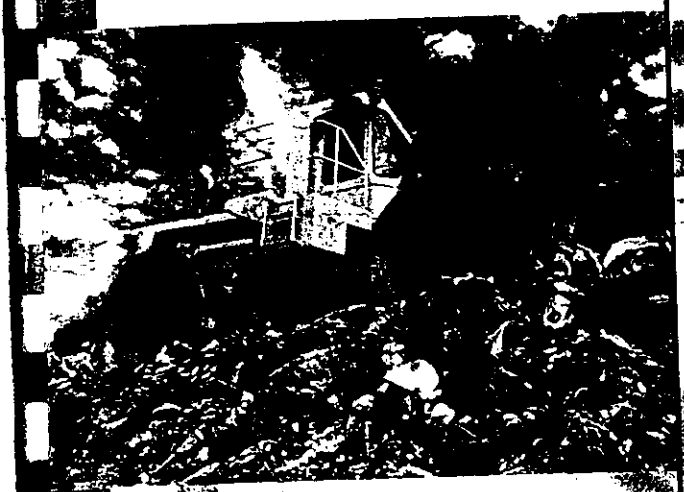
Edgard CHEHAB
Project Manager

Strengthening the Permitting & Auditing System for Industries SPASI

UNDP OFFICE BEIRUT
Ref: Le6/99/004
15 DEC 2000
ACTION | Init. | Date
INFO | RR DRR
ACTION | DR
15 Dec.

Strengthening the Permitting and Auditing System for Industries (SPASI)





Setting the National Standards for Environmental Quality

FOURTH PROGRESS REPORT

Submitted by
MVV InnoTec GmbH, Germany

to the Ministry of Environment of Lebanon

on behalf of the Consortium formed by
MVV InnoTec GmbH, Germany
TÜV Umwelt Berlin-Brandenburg GmbH, Germany

MVV InnoTec

TÜV

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Project Title	:	Setting the National Standards for Environmental Quality – LEB/99/004/02, within the Strengthening the Permitting & Auditing System for Industry Project, Life TCY 98/RL/102 EU, LEB/99/004	
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		Local operator	EC Consultant
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Date of report : 06.12.00
Reporting period : 07.11.00 – 08.12.00
Author of report : Renate Lemke

Section A Project synops is

Project Title	:	Setting the National Standards for Environmental Quality – LEB/99/004/02, within the Strengthening the Permitting & Auditing System for Industry Project, Life TCY 98/RL/102 EU, LEB/99/004
Country	:	Republic of Lebanon

Wider objectives: This project aims to set the national standards for environmental quality for the Republic of Lebanon. These standards will be important tools for the Lebanese Ministry of the Environment for combating common environmental problems, monitoring and enforcement of environmental quality, developing environmental improvement plans leading to sustainable development and fulfilling international duties agreed to in several Conventions.

The overall objective of the project is to reinforce environmental management capacity and to provide tools for the effective protection of environmental resources against pollution from industry. This in turn means developing environmental standards for industry based on realistic assumptions and international obligations which can lead to the practical enforcement of environmental standards and which provide a sound basis for tackling pollution problems and sustainable development.

Specific project objectives The objectives can be summarised as follows:

- Development of a sustainable and commonly accepted system of environmental standards for industry
- Harmonisation of standard system with international duties, including Barcelona, Basle, Montreal, Kyoto and other requirements
- Development of realistic, clearly defined and enforceable standards
- Dissemination of environmental standards and project results.

In order to achieve these objectives the project will ensure:

- Co-operation of national authorities, public sector and industry in the Steering Committee
- Close co-operation with the Association of Lebanese Industrialists
- Conform to international conventions and other agreements.

The objectives of project implementation are to:

- Ensure an appropriate distribution of effort and resources between the parties to facilitate project implementation
- Provide relevant assistance to the environmental management and enforcement bodies
- Support the expert assistance with appropriate information.

Planned outputs : The project output is

- Development of sustainable and accepted environmental standards for waste water discharged directly into sea and surface water, waste water discharged to the sewer system, air emission and a list of hazardous waste

- Harmonisation of a system of standards with international obligations.

Project activities : The activities are

- Close co-operation with the Ministry of the Environment, in particular the SPASI team and industry
- Development of set of environmental standards for industry
- Continuous work with the Steering Committee
- Internet Info-service

Target group[s] : Ministry of the Environment of the Republic of Lebanon, industries

Project start date : 07.08.00

Project duration : 5 months

Section B Analysis and p lanning of the project

B 1 Review of Current Legal Environmental Situation

In close co-operation with the client (SPASI) and the Ministry of Environment (MoE) the current existing legal framework for environmental standards has been reviewed. The term environmental standards is used in the sense parameters, indicators and classification systems which can be used to monitor impacts on the environment, describe environmental quality or determine elements of these.

The priority for the investigation are emissions from industrial facilities into the following media:

- waste water directly discharged into sea, surface water and sewer system (water pollution)
- air pollutants directly discharged into the air
- list of hazardous materials (toxic wastes).

B 1.1 General legislation and Decision 52/1

The constitution is the strongest legislative text in Lebanon. Legislation, in general, must always abide by the spirit and content of the constitution otherwise the constitutional assembly can invalidate them. International treaties ratified by the Government come second place. They should be executed by laws or decrees. However, no legislative text that opposes ratified treaties / agreements should be passed. There are four categories of legislation in Lebanon, as follows:

- **Laws**: they are first proposed by the Council of Ministers or deputies and discussed by the appropriate parliamentary committee prior to final approval by the parliament. The parliamentary committee may include in the case of environmental legislation: the Agriculture/ Tourism/ Environment/ and Municipal & Rural Affairs Committee, the Public Works/ and Transport/ Electric & Hydraulic Resources Committee, and/ or the Planning and Development Committee. Laws become effective as soon as they are published in the Official Newspaper.
- **Decree-laws**: the Council of Ministers has the exceptional power to issue without prior approval or supervision by parliament decree-laws, which have the same legal standing and powers as laws.
- **Decrees**: they are often issued by the Council of Ministers and have the power of the law provided that they do not contravene existing laws. Nevertheless, the State Council must approve first the legal context and format of the decree.
- **Decisions**: they are issued by the relevant minister without prior approval by the Council of Ministers. They have the power of the law provided that they do not contravene any existing law. Nevertheless, the State Council must approve first the legal context and format of the decision. Decision 52/1 is one example.

The investigation of the existing legal framework concerned mainly Decision 52/1 of the Ministry of Environment. This decision is related to the specifications of characteristics and specific levels of air, water and soil pollution, 26.07.1996.

Decision 52/1 sets regulations relative to air, soil and water pollution in fourteen annexes. The marked annexes have been investigated during the project:

- Annex 1: Characteristics related to drinking water

- Annex 2: Water quality requirements for surface water used or destined to be used for the production of water used for human consumption
- **Annex 3: Quality necessary for aquatic water life**
- **Annex 4: Quality requirements for swimming water for rivers, lakes and sea**
- **Annex 5: Characteristics for residual urban water**
- **Annex 6: Minimal quality limit for mainly domestic discharges**
- **Annex 7: Authorisation for the discharges, flows, residuals and other facts that could possibly alter surface and groundwater and sea water within territorial limits (discharges and residues of negligible toxicity)**
- **Annex 8: Characteristics for some aquatic polluting substances discharged into the environment within the 500 metres limit of international waters**
- **Annex 9: Maximum thresholds related to air pollution inside working areas**
- **Annex 10: Permissible thresholds related to sound pollution**
- **Annex 11: Permissible thresholds to be respected during the incineration of used oils**
- **Annex 12: Permissible thresholds to be respected during the incineration of domestic wastes**
- **Annex 13: Permissible thresholds allowable in cement factories**
- Annex 14: Maximum contents for atmospheric pollutants.

Please refer to Annex D 1 for a summary of the relevant parts of decision 52/1. The most relevant sections of Decision 52/1 to industrial pollution are:

- Annex 8: Standards for the disposal of non-domestic effluents in the sea within national waters (Disposal at more than 500m off the coast)
- Annex 9: Maximum allowable standards for occupational air quality
- Annex 10: Standards for allowable noise levels and exposure
- Annex 11: Maximum allowable air emissions from the incineration of used oils and
- Annex 13: Maximum allowable limits for air emissions resulting from cement plants.

B 1.1.1 Wastewater standards

The Annexes 1 – 6 of Decision 52/1 are obviously not relevant for industrial effluents. In particular, as Annex 5 on urban wastewater quality does not specify whether industrial effluents are considered as part of the 'Urban Effluents' or not. Heavy metals for example have not been included among the parameters.

Decision 52/1 does not contain any references to the receiving medium, which could be more important than the type of treatment adopted, or the ultimate use of the water (required quality for effluent to be used in agriculture, for example).

Decision 52/1 implicates the tertiary treatments for Phosphorus and Nitrogen which is expensive. Hence, the need for such treatments must be evaluated (example risk of eutrophication in the receiving medium).

Annex 7 of the Decision 52/1 deals with disposals of negligible toxicity into surface water bodies, groundwater and seawater within the territorial borders. This annex consists of a table reproduced in Fig. B-1.

Conditions	Disposal in rivers	Disposal in water currents, lakes & ponds	Disposal in seawater	Surface spreading	Burried
Maximal pollution flux per real no. of inhabitants/ or equivalents	500	500	500	500	150
Hydrocarbon load (g/ day)	100	10	100	100	30
Cyclic hydroxylated compounds (g/ day)	10	1	10	10	5

Conditions	Disposal in rivers	Disposal in water currents, lakes & ponds	Disposal in seawater	Surface spreading	Burried
Dissolved solids (kg/ day)	300	30	-	300	100
Total nitrogen & phosphorus (g/ day)	-	500	-	-	-
Total nitrogen & phosphorus (kg/ ha/ yr)	-	-	-	300	-
Growth inhibitors	Biologically undetectable	Biologically undetectable	Biologically undetectable	Biologically undetectable	Biologically undetectable

Fig. B-1: Annex 7 of Decision 52/1

The second relevant Annex of Decision 52/1, Annex 8, pertains to disposals into the sea at more than 500m off the coast. Whereas Annex 7 contains only mass flow values and daily quantities allowed to be discharged, Annex 8 expresses concentrations for several substances, substance groups and physical parameters. Please refer to Fig. B-2 for the values. Annex D 1 contains a summary of Decision 52/1.

Parameter	Unit	Max. Value
Temperature	°C	35
pH	pH units	6 - 9
Colour		Absence
BOD_5	mg O_2/ L	60
COD	mg/ L	100
Dissolved material	mg/ L	200
Dry residues at 150°C	mg/ L	1800
Suspended solids	mg/ L	60
Turbidity	NTU	50
Sulphates	mg/ L	1
Oil & grease	mg/ L	15
Petroleum hydrocarbons	mg/ L	0,5
Phosphates (PO_4)	mg/ L	5
Nitrates (NO_3)	mg/ L	40
Phenols	mg/ L	1
Fluorides	mg/ L	1,5
Aluminium	mg/ L	3

Parameter	Unit	Max. Value
Ammonium (NH_4)	mg/ L	3
Mercury	mg/ L	0,005
Lead	mg/ L	0,5
Cadmium	mg/ L	0.05
Arsenic	mg/ L	0,05
Total Chromium	mg/ L	1
Copper	mg/ L	1,5
Nickel	mg/ L	0,1
Iron	mg/ L	1,5
Manganese	mg/ L	1
Zinc	mg/ L	5
Silver	mg/ L	0,1
Barium	mg/ L	2
Cobalt	mg/ L	2
Total pesticides	mg/ L	0,2
Cyanides	mg/ L	0,1
Total coliforms	colony/ 100 ml	5000

Fig. B-2: Annex 8 of Decision 52/1

Special comments to Annex 8 include:

- The petroleum hydrocarbon value is set at 0.5 mg/L (concentration), whereas it has been quoted in Annex 7 as 100g/ day (total load). The relation of these values needs to be clarified.
- The dry residue value at 150°C is much higher than the sum of the total suspended solids and dissolved materials values.

B 1.1.2 Stack emissions

The main approach to the regulation of industrial emissions is explained by the Lebanese Decision 52/1. The background behind the choice of industrial sectors of Decision 52/1 concentrates on the incineration of used oil and the operation of cement plants although other industrial sectors exist in the country. Some of these sectors have, for example, been disregarded or misrepresented. Lebanon's industrial sectors comprise light supply to medium-sized industries mainly concerned with food and beverage processing as well as textiles, wood products and metal works. Whilst the majority are concentrated within the Mount Lebanon region, industries are spread out throughout the country due to current zoning laws being weakly defined and loosely enforced. Larger scale establishments include the cement plants of Chekka and Sibline, the Sidem aluminium casting and fabrication plant, the fertiliser factory in Selaata, and the sugar refinery in the Bekaa valley. The main sectors of Lebanon's industry are listed as follows.

- Food & Beverage
- Metal Products & Equipment
- Furniture & Other Related Goods
- Clothing & Garments

- Non-Metal Products
- Wood Products
- Tanneries
- Paper & Printing

Decision 52/1 contains emission (concentration) figures for only a small part of Lebanon's industry. Special comments on Decision's Annex 13 include regulations on the incineration of used oils and cement plants. The maximum allowable value of SO_2 emissions from kilns (cement industry) is set at 500 mg/m^3. However, this value can go up to an allowable 1,800 mg/m^3 depending on the quality of the raw material (please refer to D 1.15) and the process (please referee to D 1.16). This large range in the EVL is acceptable as part of the SO_2 in the exhaust gas is used in the process to form gypsum.

Returning to the current legal situation it is obvious that there is no regulation on the minimum stack height in relation to the emissions of an industrial plant. In this case a formula based on the output of a combustion engine (generator), for example, would be more applicable than monitoring emissions continuously.

Furthermore, there are no regulations in the event of the construction of a plant in relation to a possible influence on the ambient air situation caused by its emissions. In comparison with European countries no propagation of pollutants are calculated (dispersion of emissions in the atmosphere).

B 1.1.3 Immissions - Pollution of Ambient Air

The content of ambient air pollutants in view of the current legal situation are regulated by Decision 52/1. The specific pollutants are sulphur dioxide, nitrogen dioxide, ozone, carbon monoxide, total suspended solids, suspended black particulates (PM < 10 microns), lead and benzene. Please refer to D 1.17 for the detailed regulations on the ambient air concentrations. These are comparable to regulations found in several European countries.

B 1.1.4 Hazardous waste management

There are no administrative or regulatory frameworks for the control, collection, transport, and disposal of industrial wastes in Lebanon at present as decision 52/1 does not deal with waste. The absence of legislation relating to the management and control of "toxic" and oil wastes, in particular, combined with poor enforcement often result in haphazard disposal. Industries may then pass on their wastes to any party without liability for mis-management. Evidence of uncontrolled tipping, including direct tipping into the sea and watercourses, is commonplace in Lebanon. Industrial managers are often unaware of or unwilling to abide voluntarily to legislation, if existing.

The Republic of Lebanon is a Party to the Basle Convention, but has not fully ratified the Basle Convention as yet. The Lebanese Ministry of the Environment (MoE) has installed a working group on the Basle Convention. The responsible person is Dr Naji Kodeih.

In close co-operation with the MoE and the SPASI team the Consortium has decided to support the MoE in the development of some of the documents necessary to implement the Basle Convention, including drafting:

- National Legislation on the "Management of Hazardous Wastes" and "Control of Transboundary Movements of Hazardous Wastes and their Disposal", please refer to Annex D 15.

The development of the national hazardous waste management will be based on the followin approaches:

- Principle of Prevention: Environmental pollution must be minimised as far as possible That means that transport and disposal of waste has to be consistent with the protection c human health and the environment whatever the place of their disposal and that measure should be taken before damage occurs.
- Polluter Pays Principle: Costs for the environmentally sound transport, storage treatment and disposal of hazardous wastes will have to be borne by the waste generator.
- Principle of Co-operation: Industry and the MoE will have to co-operate in th establishment of a control system according to the guidelines decided at COP4 in Malaysi (so-called "Instruction Manual"). The MoE and industry need to co-operate in th development of a waste management infrastructure, including recycling facilities, landfills etc.
- Generic definition of hazardous waste for all branches of industry according to th guidelines decided at COP4 in Malaysia, please refer to Annex D 15. This definition use waste groups, indication by content as well as restriction or banning of specific substances.
- Implementation of the national legislation on the "Management of Hazardous Wastes" an "Control of Transboundary Movements of Hazardous Wastes and their Disposal" in decree issued by the Council of Ministers, please refer to section B 4.3.

B 1.2 Identification, review and assessment of methodologies used to set existing standards

B 1.2.1 Wastewater standards

Decision 52/1 has been primarily extracted from Egyptian and French law.

B 1.2.2 Stack emissions

Regulations have to ensure that hazardous influence on the environment will be reduced in compliance with the aims of an established environmental law, but they have to be carried out with respect to

- the state-of-the-art
- international technical standards (sampling, analysis, detection devices, personal competence)
- the principle of minimising emissions.

In consideration of the international conventions signed by the Republic of Lebanon, respect and use of the recent technical standards will be part of putting the legal framework into practice (e.g. Barcelona Convention[1], Montreal Protocol[2], not signed yet: Kyoto Protocol[3]).

Regulations for the limitation of stack emissions are proposed to be built up in a system of two groups:

- General regulations
- Individual regulations

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[1] Barcelona Convention - Protocol for the protection of the Mediterranean Sea against pollution from land-based sources

[2] Montreal Protocol on substances that deplete the ozone layer

[3] Kyoto Protocol, United Nations Framework Convention on Climate Change

In the case of missing regulations it will be determined whether other national or international standards can be used.

Dec. 52/1 gives regulations only for part of the industry and no detailed general considerations are mentioned on the stack emissions. Furthermore there is obviously no background for the limits mentioned which are presented by a scientific evaluation or in relation to the state of Lebanese industry.

In deviation from German [WEKA] and European regulations as well as Thai [Royal Government] approaches the proposed system for Lebanon will contain a modification taking into account industrial distribution and emissions in relation to the density of population and the state-of-the-art applied. In order to respect the current state of art, the emission limit values (ELVs) will be established for existing "old" and "new" plants using a margin of tolerance. In order to obtain an approach on the range of this tolerance the difference between German/European and Thai regulations is referred to.

In a first step, the yearly emission mass flow is considered. Fig. B-3 shows a comparison of the emission mass flow of Lebanon and Germany:

	SO_x	NO_x	Number of industrial units
	[kt/a]	[kt/a]	
Berlin (report 1987/88) [Sen Stadt Um][4]	50.6	38.4	790
NRW[5] (report 1996) [LUA NRW]	203	251	83,038
Lebanon 1994[6] [Lebanese Ministry of Environment], [MoIP]	80.2	19.4	23,517

Fig. B-3: Comparison of emission mass flows

Considering the minimum environmental improvement is a question of decreasing the total mass flow, the above mentioned comparison shows that

- specific emissions appear to be lower in Lebanon than in the German areas mentioned
- SO_x emissions are quite high and need to be reduced
- SO_x emissions in Berlin (87/88) show, in comparison to NRW, the development of the emitters (e. g. fuel, combustibles, technology).

The German areas mentioned can be characterised – as in Lebanon - by a high density of population and also partly by high density of industry. Therefore the German approach can be used as a basis and be adapted to specific Lebanese Emissions Limit Values (ELVs). The adaptation process will use a compromise in the way of establishing slightly weaker regulations for "new" or "state of art" plants in comparison to Germany. "Old" plants will be regulated by the state-of-the-art review compared to the 1970-80's. Here the Thai standards are referred to.

General aspects on the Emission Limit Values (ELVs)

The ELVs for stack emissions will be given as concentrations under standard conditions (273 K, 1013 hPa) and related to their individual reference O_2 content correlated to the

[4] The report contains only datas from large scale industry

[5] Federal county of Germany with much industry

[6] Except of Transport, including Energy Industry, Manufactured Industries and Construction, Other Sectors, Industrial Processes [Climate]

conditions of the processes. The German technical directive [WEKA], for example, sets different reference O_2 contents for different processes in the range of 3% for combustion plants (boilers) and 17% for special combustion plants for drying processes. Next to the specific ELVs and the reference O_2 (e.g. boilers, 3%) the state-of-the-art should influence the emissions (e. g. Low NOX Burners). Please refer to Fig. B-4 for a further explanation to the O_2 reference value.

The basic requirements for a technology to be classed as state-of-the-art are:

- it operates generating the minimum amount of emissions technically possible
- it has an optimal prepared process engineering at the respective industry
- it reduces exhaust gas flow to the minimum (O_2 reference value)
- uses material which cause minimum emissions.

How to deal with the reference O_2 value?

The reference O_2 value is a mathematical procedure to standardise the emission concentrations in an exhaust gas, i.e. to create a value which is independent of dilution or the air/fuel ratio.

The standardised emission value E_S is calculated as follows:

$$E_S = \frac{(21 - O_R)}{(21 - O_T)} \cdot E_M$$

21: O_2 concentration of the ambient air
E_S: standardised emission value
E_M: measured emission value
O_R: standardised O_2 value
O_M: measured O_2 value

Example:

The O_2 reference value is 5% (O_R), the measured O_2 value is 9% (O_M). The measured value for the SO_2 concentration is 2,800 mg/m³(E_M).What is the standardised emission value?

$$E_S = \frac{(21 - O_R)}{(21 - O_T)} \cdot E_M = \frac{(21-5)}{(21-9)} \cdot 2{,}800 \text{ mg/m}^3 = 1.33 \cdot 2{,}800 \text{ mg/m}^3 = 3{,}733 \text{ mg/m}^3$$

Fig. B-4: Formula for the O_2 correction of emissions.

For a better evaluation of the ELVs which will be developed in Section B 4 it could be necessary to transfer the concentration values to ppm. The conversion factors are given in Fig. B-5.

Carbon monoxide (CO)	1 ppm	=	1.250 mg/m³
	1 mg/m³	=	0.800 ppm
Carbon dioxide[7] (CO_2)	1 ppm	=	1.964 mg/m³
	1 mg/m³	=	0.509 ppm
Nitrogen monoxide (NO)	1 ppm	=	1.339 mg/m³
	1 mg/m³	=	0.747 ppm

7 The exhaust gas content of CO_2 at a combustion process occurs in a percentage range.

Nitrogen dioxide (NO_2)	1 ppm	=	2.053 mg/m³
	1 mg/m³	=	0.400 ppm
Sulphur dioxide[8] (SO_2)	1 ppm	=	2.926 mg/m³
	1 mg/m³	=	0.341 ppm

Fig. B-5: Conversion factors [9] ppm <–> mg/m³

Fig. B-6 shows Lebanese decision 52/1 in comparison to general German and Thailand regulations. The ELVs are not presented for single compounds. They are classified to groups (group I - III (IV)) depending on their hazardous influence, which has been fixed by scientific investigations. The assignment to the groups is presented in the Annex D 5 and D 6. Concerning individual regulations, please refer to Fig. B-7.

8 Except of SO_2 all compounds are treated as ideal gas [Küster/ Thiel]

9 The data refer to room temperature (0°C/273.15 K) and normal pressure (1.013 bar / 1.013 x 10^5 Pa) and use 22,414 l/mol except for SO_2 (high polarisation)

Parameter	Germany		Remark	Thailand	Lebanon Dec. 52/1
Dust [mg/m³]	50 – 150		-	500 100-300, containing inorganic pollutants	200
Particulate inorganic pollutants [mg/m³]					
	group I group II group III	0.2 1 5	mass flow > 1 g/h mass flow > 5 g/h mass flow > 25 g/h	0.1-1.0 20 (As) 20, 30 (Pb, Cu)	0.2-0.5 (Cd (+ Hg)) 1 (Ni+As) 1.5-5 (Cr+Cu+V, Mn) 5 (Cu)
Gaseous inorganic pollutants [mg/m³]					
	group I group II group III group IV	1 5 30 500	mass flow > 10 g/h mass flow > 50 g/h mass flow > 300 g/h mass flow > 5 kg/h	- 10-100 (combined with dust) - 500 ppm (SO_2), 1000 mg/m^3 (NOx)	- 2-5 (HF) 50 – 250 (HCL) 500 (SO_2) (1,800 individual exception)
Gaseous organic pollutants [mg/m³]					
	group I group II group III	20 100 150	mass flow > 0.1 kg/h mass flow > 2 kg/h mass flow > 3 kg/h	mainly mass flow regulation	-
Cancer causing pollutants [mg/m³]					
	group I group II group III	0.1 1 5	mass flow >0.5 g/h mass flow > 5 g/h mass flow > 25 g/h	27 µg/m^3 (Asbestos), 20 µg/m^3 (Be)	-

Fig. B-6: Lebanese decision 52/1 in comparison to general German and Thai regulations

Individual regulations

Various branches of industry differ in process engineering and actually have different possibilities for emission generation and control. Therefore it will be necessary to have individual regulations for different kinds of industry because different air fuel ratios appear in combustion processes, for example. The following calculation is given as an explanation.

Example: Concerning a reference O_2 content of 5% and a sulphur content in heavy oil of 1-3% there will be an expected SO_2 concentration of about 1,500 – 4,500 mg/Nm³. For a boiler there is an expected SO_2 concentration of about 3,300 mg/m³ (at 3% O_2). A combustion engine - generator - reaches an SO_2 concentration of about 2,900 mg/m³ SO_2 using the same fuel.

Fig. B-7 gives an overview of the current German and Lebanese individual regulations on emissions for:

- Combustion plants
- Generators
- Municipal waste incinerators
- Aluminium manufacturing
- Cement Industry
- Battery manufacturing
- Breweries
- Glass Industry
- Fertiliser Industry
- Electroplating Industry
- Paint Industry
- Plastic Industry

Individual regulations are set for the primary process of a plant. It is in fact possible for more than one process to be carried out at one branch. In this case corresponding regulations have to be used for these processes. In case of pollutants not mentioned in the individual regulations the general regulations apply.

Branch / Industry	Germany[10]	Lebanon Dec. 52/1
Combustion plants fired with oil		
Boiler / steam- energy production < 50 MW thermal capacity		
dust [mg/m³]	80	-
dust [mg/m³] > 5 MW or > 1% sulphur	50	-
dust [RZ] diesel fuel	1 (about < 1 mg/m³)	-
CO [mg/m³]	170	-
NO_x (calculated to NO_2) [mg/m³]		
diesel fuel	250	-
other fuel	450	-
SO_x (calculated to SO_2) [mg/m³]		
diesel fuel (0.2 or 0.05 % Sulphur)	-	-
other	1,700	-

[10] In addition to general standards the following ELV's are applied

Branch / Industry	Germany[10]	Lebanon Dec. 52/1
> 50 MW thermal capacity		
dust [mg/m3]	50	
As+Pb+Cd+Cr+Co+Ni	2	
CO [mg/m³]	175	
NO_x (calculated to NO_2) [mg/m³]	450	
SO_x (calculated to SO_2) [mg/m³]		
> 50 MW < 100 MW	400 (650) (< 15 % rate of sulphur emission)	
	1,700	
>100 MW < 300 MW	1,700 (< 40 % rate of sulphur emission)	
HCL	30	
HF	5	
Different regulations for existing old plants		
NO_x (calculated to NO_2) [mg/m³]	700	
SO_x (calculated to SO_2) [mg/m³]	2,500 (limited operation time)	
Generators operated with oil		
dust [mg/m³]	130	
CO [mg/m³]	650	
NO_x (calculated to NO_2) [mg/m³]		
< 3 MW	4000	
> 3 MW thermal capacity	2000	
SO_x (calculated to SO_2) [mg/m³]	emissions comparable to 0.2 (0.05) sulphur content	
Municipal waste incinerators		
Capacity < 0.75 t/h		
dust [mg/m³]	30	
CO [mg/m³]	100	
Total carbon of organic pollutants [mg/m³]	20	
SO_x (calculated to SO_2) [mg/m³]	100	
HCl [mg/m³]	50	
HF [mg/m³]	2	
Capacity > 0.75 t/h		
dust [mg/m³]	30	
CO [mg/m³]	100	
Total carbon of organic pollutants [mg/m³]	20	
SO_x (calculated to SO2) [mg/m³]	200	
NO_x (calculated to NO2) [mg/m³]	400	
HCl [mg/m³]	60	
HF [mg/m³]	4	
Hg [mg/m³]	0.05	
Cd + Tl [mg/m³]	0.05	0.2 (
Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V+S [mg/m³]	0.5	5 (Pb+Cr
PCDD / PCDF [ng/m³]	0.1	
Aluminium manufacturing		
dust [mg/m³]	20	
Cl_2 [mg/m³]	3	
Total carbon of organic pollutants [mg/m³]	50	
(PCDD / PCDF [ng/m³])	0.1	

Branch / Industry	Germany[10]	Lebanon Dec. 52/1
Cement Industry		
NO_x (calculated to NO_2) [mg/m³]	1,300 – 1,800	
SO_x (calculated to SO_2) [mg/m³]	400	500
Battery manufacturing		
dust [mg/m³]	0.5	-
H_2SO_4 [mg/m³]	1	
Breweries		
identification of odour immissions		-
[%] of hours a year	10 – 15 (calculated immissions)	
Glass Industry		
NO_x (calculated toNO_2) [mg/m³]	1,200 – 3,500	-
SO_x (calculated to SO_2) [mg/m³]	1,100 – 1,800	
Fertiliser Industry		
phosphoric acid plant		
NO_x (calculated to NO_2) [mg/m³]	450	-
emissions have to be colourless		
=> Maximum NO_2 [mg/m³]	=120 / stack mouth diameter [m]	
sulphuric acid plant		
SO_3 [mg/m³]	60-120	
regulations on the process:	recirculation of exhaust gases to process	
	degree of product turnover	
granulating and drying		
dust [mg/m ³]	75	-
Electroplating Industry		
dust [mg/m³]	20	-
Paint Industry		
varnishing / drying		
dust (particulate paint) [mg/m³]	3	
Total carbon of organic pollutants	50	
[mg/m³]		
Plastic Industry		
PVC / Polyacryle		
acryle nitrile [mg/m³]	0.2 – 35	
Others		
single compounds e. g. ethanole [mg/m³]	500	
organic pollutants group I [mg/m³]	40	

B-7: Overview of the current German and Lebanese individual regulations

3 Hazardous waste management

...ions of waste legislation are very complex and must not become a barrier to an ...nt sustainable waste management. Defining a material as waste or secondary raw ...al bears many consequences on what is allowed or not, what administrative procedures ...to its transport, export or processing, and what costs will be incurred. The definition of ...tional Legislation on the "Management of Hazardous Wastes" and on the "Control of ...oundary Movements of Hazardous Wastes and their Disposal" will follow the ...dology of the **"Basle Convention on the Control of Transboundary Movements of ...ous Wastes and their Disposal"** and the decisions for implementation agreed by the

Parties to the Basle Convention during the Conferences of the Parties (please refer to sect B 4.3):

- First Conference of the Parties in Piriapolis, Uruguay on 4 December 1992
- Second Conference of the Parties in Geneva, Switzerland on 25 March 1994
- Third Conference of the Parties in Geneva, Switzerland 18-22 September 1995
- Fourth Conference of the Parties in Kuching, Switzerland 23-27 February 1998
- Fifth Conference of the Parties in Basle, Switzerland 6-10 December 1999.

B 1.3 Identification of gaps in both methodologies and standards

The current legislation is suffering under the following deficiencies:

- **Outdated legislation**: most of the legislation still in force dates back to the twenties.
- **Gap / missing legislation**: there are several important laws awaiting approval parliament or are still under consideration and preparation by the relevant authorities, s as, the Proposed Code of the Environment, the Proposed Environmental Imp Assessment Decree, and the Natural Reserves Law Project.
- **Unenforceable legislation**: the enforcement of the legislation in general is responsibility of the Ministry of Interior. With respect to environmental legislation, Ministry of Environment is supposed to intervene through the Department of Interventi mentioned in Law no. 216 (Establishment of the Ministry of Environment). However, t department has not been established yet. In the past, the enforcement and application some environmental decisions, such as the ban on hunting and the use of harmful produ in fishing have been relegated to the armed forces. Hence, there are no cl implementation or enforcement mechanisms. Penalties and fines are often not proportio to the level of harm done to the environment and society.
- **Overlapping and inconsistent legislation**: a lot of environmental legislation has b passed hastily as a result of social pressure or in response to adverse accidents. Most h been passed without prior consideration of the Basleine conditions or defining relev institutional responsibilities, such as licensing for quarries for example. Most standards reproduced from international standards without any reference to or evaluation of t applicability or relevance to the local political, socio-economic and scientific cont Moreover, the rationale behind the adoption of such standards is often missing.
- **Lack of consultation with concerned parties**: There is a deficiency in disseminat relevant information to the community and concerned parties. Decision 52/1, for exam has been drafted without prior public participation (concerned industries, research cent etc.), as well as consultation and co-ordination with other concerned ministries, such as Ministry of Industry and Petroleum or the Ministry of Electric & Hydraulic Resources.

B 1.3.1 Wastewater standards

Decision 52/1 is mainly based on French and Egyptian environmental law. Only sr adaptations of the laws to Lebanese conditions have been made. As mentioned in sectio 1.1, the most relevant parts for waste water effluents of the Decision are Annexes 7 and 8.

Annex 7 covers only emissions from land based sources. With regard to the annexes of Barcelona Convention, the regulations of suspended solids, hydrocarbons, cy hydroxylated compounds, dissolved salts, total phosphorus and nitrogen and growth inhibi are absolutely insufficient. Decision 52/1 does not take into consideration the request standards of the Barcelona Convention.

On the other hand, Annex 8 regulates non-domestic effluents, e.g. industrial ones, in broader compliance with the requirements of the Barcelona Convention. However, this Annex applies only to disposals at more than 500m off the Lebanese coast. Furthermore, the logical framework of the Annex is not clear: for example, a distinction between Cr(III) and Cr(VI) is absent, the ELV for ammonia is very low in comparison to German regulations (factor 10), other common parameters such as conductivity are missing.

The Consultants estimate that current Lebanese legislation cannot cover the requirements of the international obligations. Thus, the system of water related regulations should be developed far beyond decision 52/1.

B 1.3.2 Stack emissions

By viewing regulations on stack emissions it can be established that ELVs will intend a framework which has to be executed by

- a system of technical standards (sampling, analysis, detection) on surveillance to guarantee the quality of measurements and a comparability of results on the measurements at different companies. The standards have to fix methods and equipment. Please refer to Annex D 11.
- the assessment of emissions in relation to each process to facilitate an interpretation of the results.
- the priority of avoiding hazardous influence in general.
- a hierarchy of measures reducing the concentration of ambient air pollutants.
    1. improvement of technology (e.g. reduce emissions by low-nox burners)
    2. installation of gas cleaning systems (please refer to section 0)
    3. construction of high stacks.

The proposed system will present limitations on emissions through values of concentrations and, in the case of general regulations, a minimum massflow defines the area of applicability for the standards. For companies and industry with emissions below the mentioned minimum massflows (refer to Annex D 5) the regulations are not applied. Administratively these "small scale" polluters have to follow the basic principle of an environmental law (causing no hazardous influence on the neighbourhood) by making sure that the technology used is working correctly.

For setting up environmental standards on emissions it is necessary to take into consideration economic aspects of the existing state of industry. For Lebanon it will be necessary to sort industrial plants into two categories:

- Category A: refers to "new", state-of-the-art plants.
- Category B: refers to "old" or existing plants.

B 1.3.3 Hazardous waste management

In Lebanon no standards on waste management currently exist. The Lebanese MoE as a party to the Basle Convention is closely adhering to the Basle approach, which is following a clear structure and methodology, please refer to section B 2.1.1.

B 2 Development of suitable methodology and consolidation with stakeholders

B 2.1 Proposed Methodology

B 2.1.1 Wastewater standards

Waste water is a multi-substance mixture. Its detailed content can be measured only with a large and unjustifiable effort. Nevertheless, to obtain the best information possible about the pollutant concentration, different group parameters can be introduced. The most important are:

- heavy metals
- toxicity against fish
- AOX: adsorbable organic halogen compounds
- total concentration of organic compounds (to be measured as TOC or CSB)
- total concentration of nutrients (Nitrogen and Phosphor compounds).

Using Emission Limit Values (ELVs) for the group parameters next to limit values for single substances it is possible to cover a wide range of water pollutants.

The National Standards for Environmental Quality developed in the following are generic standards for all branches of industry. The different situations within the industry will be taken into regard later on when setting the deadline for compliance sector by sector. The standards take into account that the new Land Based Sources (LBS) Protocol of the Barcelona Convention has not yet been ratified. Therefore, for existing facilities a weaker preliminary ELV has been proposed in some cases until the LBS Protocol is ratified.

The list of ELVs consists of

- General parameters such as pH, temperature, bio-indicator G_F, suspended soils, microbiological parameters
- Oxygen consumption: BOD_5, COD
- Nutrients: P_{total}, NO_3-N, NH_4-N, N_{total}
- Heavy metals: Ag, Al, As, Ba, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Sb, Sn, Zn
- Inorganic compounds: Cyanides, F^-, active chlorine, SO_4^{2-}
- Organic compounds: AOX, C_xH_y, phenol index, TOC
- Discharge parameters such as minimum flow of the surface water or the outlet design.

The pollution parameters and their ELVs have been chosen on the basis of different aspects:

- ELVs in force in other countries, e.g. EU, Germany, Tunisia, Egypt, Saudi Arabia, Kuwait and the ELVs proposed by the Arab League, please refer to section B 4.1.2 - B 4.1.4.
- Importance of the parameter as an indictor for pollution with industrial waste water
- Level of toxicity of the substances or group parameters, their biological degradability and their impact to the environment
- Quantity of pollution from industry
- Control technology available to control emission
- Economic capacity for implementation of emission control technology.

The proposed set of environmental standards for industry is elaborated in line with the requests of the Barcelona Convention, please refer to section B.2.1.1.1.

The ELVs are set for different receiving water bodies, in particular:

- Industrial waste water directly discharged into the sea

- Industrial waste water directly discharged into the surface water
- Industrial waste water discharged into the sewer.

B.2.1.1.1 Compliance with the Barcelona Convention

The Republic of Lebanon is a Party of several international agreements. With respect to the pollution of waste water the Barcelona Convention is the most important one.

The Barcelona Convention obliges its Contracting Parties to take all appropriate measures to prevent, abate, combat and, to the fullest possible extent, eliminate pollution of the Mediterranean Sea Area and to draw up and implement plans for the reduction and phasing out of substances that are toxic, persistent and liable to bioaccumulate arising from land-based sources.

In a special "Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities"[11] discharges from Land-Based-Sources (LBS) are defined as originating from rivers, coastal establishments or outfalls, or emanating from any other land-based sources and activities within their territories.

Priority has to be given to the phasing out of inputs of substances that are toxic, persistent and liable to bioaccumulate. The Parties shall undertake to eliminate pollution deriving from land-based sources and activities, in particular to phase out inputs of substances that are toxic, persistent and liable to bioaccumulate. These substances are listed in annex I of the LBS Protocol. (Please refer to section B.2.1.1.2 for an extract of the most important articles of the Barcelona Convention and the LBS Protocol).

According to the LBS Protocol, the Parties should take into account, either individually or jointly, the ***best available techniques***[12], when adopting action plans, programmes and measures. As the term "best available techniques" means the latest stage of development (state-of-the-art) of processes, of facilities or of methods of operation which indicate the practical suitability of a particular measure for limiting discharges, emissions and waste, this would mean in consequence that the National Environmental Standards would have to be developed according to technology standards applied in the EU and the US.

However, in addition, the LBS Protocol states that without prejudice to the request of the application of the best available techniques, such common guidelines, standards or criteria shall take into account local ecological, geographical and physical characteristics, as well as ***the economic capacity of the Parties and their need for development,*** the level of existing pollution and the real absorptive capacity of the marine environment.

During the development of the National Environmental Standards particular attention had to be paid to the conflict between the request of the LBS Protocol for the implementation of best available techniques and the economic capacity of the Lebanese industry.

This conflict was resolved in the following way:

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[11] The Protocol on Land-Based Sources (the LBS Protocol) was adopted on 17 May 1980 by the Conference of Plenipotentiaries of the Coastal States of the Mediterranean Region for the Protection of the Mediterranean Sea Against Pollution from Land-based Sources, held in Athens. The Protocol entered into force on 17 June 1983.It was signed by the Republic of Lebanon on 17.5.80 and ratified on 27.12.94.
The original Protocol was modified by amendments adopted on 7 March 1996 by the Conference of Plenipotentiaries on the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources, held in Syracuse on 6 and 7 March 1996 (UNEP(OCA)/MED IG.7/4). The amended Protocol, recorded as "Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities", has not been ratified by the Republic of Lebanon, yet.

[12] Detailed definition is given in section B 4.1.1

- Detailed review of the legislation of EU and Arab countries to derive a list of suitable parameters
- Detailed investigation of the ELVs set in EU, Germany and in the countries of the Arab League. It has been assumed that the German and EU limit values are an indicator for the best available technique. The limit values proposed by the Arabic League have been assumed to present the economic capability of the industry in the region and with this in Lebanon.

As a result the margin for setting the specific limit values for Lebanon could be identified somewhere between the ELVs of the EU/Germany and the Arabic League. The detailed ELV has been set taking into consideration the specific characteristics of the pollutant parameter and the local situation.

B.2.1.1.2 Review of international obligations – Barcelona Convention

Since 1975 the protection of the Mediterranean environment has been the objective of a concerted effort of the countries of this region that brought about the establishment of the Mediterranean Action Plan (MAP). Its legal support, the Barcelona Convention, was adopted the following year, and today, the 20 Mediterranean coastal countries and the EU are Contracting Parties to it, while the UNEP (United Nations Environment Programme) has been designated to carry out the Secretariat functions and to act as co-ordinator of the MAP.

Within this framework, in order to tackle main Mediterranean environmental concerns, priority fields of activities were adopted in 1995, ranging from integrated water management to soil management, fight against erosion and desertification, management of forests and plant cover, management of genetic and marine living resources, and dealing with integrated management of coastal areas, waste management, agriculture, industry and energy, transport, tourism, urban development, as well as with information, assessment, prevention and control of marine pollution and conservation of nature, landscapes and sites.

Furthermore, as a follow-up to Agenda 21 resulting from the Rio Conference, the states bordering the Mediterranean adopted Agenda MED 21 in Tunis (1994), which takes into consideration the specific context of the region and reflects the commitment of the Mediterranean States in pursuing its sustainable development.

The Tunis Conference also adopted a resolution relevant to the creation of the Mediterranean Commission on Sustainable Development, which was established in 1996 within the framework of the Mediterranean Action Plan, as an advisory body to make proposals to the Contracting Parties to the Barcelona Convention for specific actions to be adopted in priority environmental fields.

The Barcelona Convention – Convention for the protection of the Mediterranean Sea against pollution was signed by the Republic of Lebanon on 16.2.1976 and ratified on 8.11.1977.

The protocol for the protection of the Mediterranean Sea against pollution from land-based sources (hereafter the LBS protocol) is the most relevant document within this project.

The LBS Protocol was adopted on 17 May 1980 by the Conference of Plenipotentiaries of the Coastal States of the Mediterranean Region for the Protection of the Mediterranean Sea Against Pollution from Land-based Sources, held in Athens. The Protocol entered into force on 17 June 1983.

The original Protocol was modified by amendments adopted on 7 March 1996 by the Conference of Plenipotentiaries on the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources, held in Syracuse on 6 and 7 March 1996

(UNEP(OCA)/MED IG.7/4). The amended Protocol, recorded as "Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities", has not yet entered into force.

Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean [13]

Article 8 POLLUTION FROM LAND-BASED SOURCES

The Contracting Parties shall *take all appropriate measures to prevent, abate, combat and to the fullest possible extent eliminate pollution of the Mediterranean Sea Area* and to draw up and implement plans for the reduction and phasing out of substances that are toxic, persistent and liable to bioaccumulate arising from land-based sources. These measures shall apply:

(a) to *pollution from land-based sources* originating within the territories of the Parties, and reaching the sea:
- directly from outfalls discharging into the sea or through coastal disposal;
- indirectly through rivers, canals or other watercourses, including underground watercourses, or through run-off;

(b) to pollution from land-based sources transported by the atmosphere.

Barcelona LBS Protocol

Article 1 GENERAL PROVISION

The Contracting Parties to this Protocol (hereinafter referred to as "the Parties") shall take all appropriate measures to *prevent, abate, combat and eliminate to the fullest possible extent pollution of the Mediterranean Sea Area caused by discharges from rivers, coastal establishments or outfalls, or emanating from any other land-based sources and activities within their territories*, giving priority to the phasing out of inputs of substances that are toxic, persistent and liable to bioaccumulate.

Article 5 GENERAL OBLIGATIONS

1. The Parties undertake to *eliminate pollution deriving from land-based sources and activities, in particular to phase out inputs of the substances that are toxic, persistent and liable to bioaccumulate listed in annex I.*

2. To this end, they shall elaborate and implement, individually or jointly, as appropriate, national and regional action plans and programmes, containing measures and timetables for their implementation.

4. When adopting action plans, programmes and measures, the Parties shall take into account, either individually or jointly, the *best available techniques* and the best environmental practice including, where appropriate, clean production technologies, taking into account the criteria set forth in annex IV.

Article 7 COMMON GUIDELINES, STANDARDS AND CRITERIA

1. The Parties shall progressively formulate and adopt, [. . .], *common guidelines and, as appropriate, standards or criteria dealing in particular with*:

(a) The length, depth and position of pipelines for coastal outfalls, taking into account, in particular, the methods used for pretreatment of effluents;
(b) Special requirements for effluents necessitating separate treatment;
(d) The control and progressive replacement of products, installations and industrial and other

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[13] The Convention for the Protection of the Mediterranean Sea Against Pollution (the Barcelona Convention) was adopted on 16 February 1976 by the Conference of Plenipotentiaries of the Coastal States of the Mediterranean Region for the Protection of the Mediterranean Sea, held in Barcelona. The Convention entered into force on 12 February 1978.
The original Convention has been modified by amendments adopted on 10 June 1995 by the Conference of Plenipotentiaries on the Convention for the Protection of the Mediterranean Sea against Pollution and its Protocols, held in Barcelona on 9 and 10 June 1995 (UNEP(OCA)/MED IG.6/7). The ratification of the amended Convention, recorded as "Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean" is under elaboration in the Republic of Lebanon.

processes causing significant pollution of the marine environment;

(e) *Specific requirements concerning the quantities of the substances discharged (listed in annex I), their concentration in effluents and methods of discharging them.*

2. Without prejudice to the provisions of article 5 of this Protocol, such common guidelines, standards or criteria shall take into account local ecological, geographical and physical characteristics, *the economic capacity of the Parties and their need for development, the level of existing pollution and the real absorptive capacity of the marine environment.*

3. The action plans, programmes and measures referred to in articles 5 and 15 of this Protocol shall be adopted by taking into account, for their progressive implementation, the capacity to adapt and reconvert existing installations, the economic capacity of the Parties and their need for development.

Article 15 ADOPTION OF ACTION PLANS, PROGRAMMES AND MEASURES

1. The meeting of the Parties shall adopt, by a two-thirds majority, the short-term and medium-term regional action plans and programmes containing measures and timetables for their implementation provided for in article 5 of this Protocol. [. . .]

3. The measures and timetables adopted in accordance with paragraph 1 of this article shall be notified by the Secretariat to all the Parties. Such measures and timetables become binding on the one hundred and eightieth day following the day of notification for the Parties which have not notified the Secretariat of an objection within one hundred and seventy-nine days from the date of notification.

ANNEX I Elements to be taken into account in the preparation of action plans, programmes and measures for the elimination of pollution from land-based sources and activities

C. Categories of substances

The following categories of substances and sources of pollution will serve as guidance in the preparation of action plans, programmes and measures:

1. Organohalogen compounds and substances which may form such compounds in the marine environment. Priority will be given to Aldrin, Chlordane, DDT, Dieldrin, Dioxins and Furans, Endrin, Heptachlor, Hexachlorobenzene, Mirex, PCBs and Toxaphene;
2. Organophosphorus compounds and substances which may form such compounds in the marine environment;
3. Organotin compounds and substances which may form such compounds in the marine environment;
4. Polycyclic aromatic hydrocarbons;
5. Heavy metals and their compounds;
6. Used lubricating oils;
7. Radioactive substances, including their wastes, when their discharges do not comply with the principles of radiation protection as defined by the competent international organisations, taking into account the protection of the marine environment;
8. Biocides and their derivatives;
9. Pathogenic micro-organisms;
10. Crude oils and hydrocarbons of petroleum origin;
11. Cyanides and fluorides;
12. Non-biodegradable detergents and other non-biodegradable surface-active substances;
13. Compounds of nitrogen and phosphorus and other substances which may cause eutrophication;
14. Litter (any persistent manufactured or processed solid material which is discarded, disposed of, or abandoned in the marine and coastal environment);
15. Thermal discharges;
16. Acid or alkaline compounds which may impair the quality of water;
17. Non-toxic substances that have an adverse effect on the oxygen content of the marine environment;
18. Non-toxic substances that may interfere with any legitimate use of the sea;
19. Non-toxic substances that may have adverse effects on the physical or chemical characteristics of seawater.

Fig. B-8: Main articles of the "Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities"

Within the framework of the Barcelona Convention the technical reports of the MAP are the documents to implement and co-ordinate the Convention. Within MAP Technical Reports Series No. 111[14] for few substances quantitative ELVs and quality standards are expressed.

Year of Adoption	Date of Implementation	Substance	Emission Standard	Water Quality Standard	Water quality Objective
1985	Immediate	Bathing waters	-	100 FC/100ml (50%) 1,000 FC/100ml (90%)	-
1987	Immediate	Mercury	50µg/litre	-	50% above background at 5 km from outfall
1987	Immediate	Shellfish waters	-	300 FC/100 ml flesh of shellfish (75%)	-
1989	01 January 1991	Cadmium	0.2 mg/litre	-	0.5 µg/litre(sw) 50% above background in biota, sediments
1996	01 January 1998	Copper	0.5 mg/litre	-	8 µg/litre (sw)
1996	01 January 1998	Zinc	1.0 mg/litre	-	10µg/litre (sw)

Fig. B-9: Common criteria and standards adopted by the Contracting Parties, 1985 – 1996[15]

Fig. B-9 shows that detailed numerical standards and quality objectives have only so far been adopted at Mediterranean regional level in a small number of cases. In all other cases, national legislation has to be consulted for determining the type and degree of treatment necessary to reduce the pollutant level in an effluent down to the stipulated limit value.

B.2.1.1.3 Review and comparison with international environmental legislation

The Consultants have obtained from the MoE a comparative study of industrial effluent standards in selected countries[16]. The table was completed with

- Annex 8 of the Decision 52/1
- Barcelona Convention (MTS 111)
- ELV of the European Union
- ELV of the German Waste Water Decree

The German Waste Water Decree contains specific regulations for up to fifty different industrial branches. A summary of these values is given in Annex D 2.

The complete table of comparison of international standards is given in Annex D 3. The relevant Directives of the European Union are as follows:

- **Dangerous substances to the aquatic environment, 67/464/EEC** including 7 "daughter"-directives, all amended by 91/692/EEC:
  - Mercury-discharges from chlor-alkali industries, 82/176/EEC
  - Cadmium discharges, 83/513/EEC
  - Other mercury discharges, 84/156/EEC

[14] UNEP/WHO: Guidelines for treatment of effluents prior to discharge into the Mediterranean Sea. MAP Technical Reports Series No. 111 UNEP, Athens, 1996

[15] Guidelines for treatment of effluents prior, to discharge into the Mediterranean Sea (MTS111)

[16] Comparative Analysis of Standards for Selected Countries by: Maha Mehdi – SPASI Team Member, August 2000

- HCH-discharges, 84/491/EEC
- List of substances, 86/280/EEC, amended by 88/347/EEC and 90/415/EEC.

Other water related directives, which do not concern industrial effluents:

- **Bathing water, 76/160/EEC**
- **Drinking water, 80/692/EEC**
- **Surface water for the abstraction of drinking water, 75/440/EEC**
- **Measurement and sampling of drinking water, 79/869/EEC**
- **Fish water, 78/659/EEC**
- **Shellfish water, 79/923/EEC**
- **Urban waste water, 91/271/EEC**
  Related decision 93/481/EEC
- **Nitrates, 91/676/EEC** (only for pollutants from agricultural activities)

Other water related directives, which are out of range of this project

- **Groundwater 80/68/EEC**

For the developing of the National Environmental Standards, the following standards have been taken into consideration:

- Morocco: Strategie pour l'elaboration des valeurs limites de rejets = normes de rejets: Developed by GTZ in 1995. These ELVs take into consideration direct discharging and indirect discharging.
- Tunisia:. Detailed ELVs are given for discharges into the sea, inner surface water and sewer system, 1981.
- Egypt: The ELVs are given for discharging waste water into the sea and into surface water (except of the Nil) and were updated in 1994.
- Saudi Arabia: The ELVs are given for discharging into the sea and into surface water.
- Kuwait and Qatar are providing generic standards for discharging into the sea.
- The "Committee for Combating the Industrial Pollution in the Arab Nations" under the General Director for Economic Issues and the Technical Secretary for the Council of Arab Environmental Ministers have proposed a "Guide Manual on the Permissible Standards for Air Pollutants and Waste Water Effluents in Industrial Facilities of the Arab Countries", 1997.
- EU Council Directive of 21 May 1991 concerning urban waste water treatment (91/271/EEC)
- Germany: Verordnung über Anforderungen an das Einleiten von Abwasser in Gewässer (Abwasserverordnung- AbwV), 1996
- Germany: Gesetz über Abgaben für das Einleiten von Abwasser in Gewässer (Abwasserabgabengesetz – AbwAG), 1994
- Berlin, Germany: Verordnung über die genehmigungspflicht für das Einleiten gefährlicher Stoffe und Stoffgruppen in öffentliche Abwasseranlagen und ihre Überwachung (VGS), 1989
- Verordnung zur Umsetzung der Richtlinie 91/271/EWG des Rates über die Behandlung von kommunalem Abwasser, 1996.

A detailed comparison of the developed limit values with the international standards is given in section B 4.

B.2.1.1.4 Review current Basleine of pollution levels and evaluation of the capacity of the already implemented emission control technology[17]

The results of the investigation of the pollution from 46 case studies have been summarised in Annex D 4.

B 2.1.2 Stack emissions

B.2.1.2.1 Review current Basleine of pollution levels and evaluation of the capacity of the already implemented emission control technology[18]

Plagued by gaps in data, Lebanon lacks the necessary information required for a thorough assessment of air quality. In the absence of strict regulations and much-needed monitoring equipment (the Ministry of Environment has only recently purchased a hand-held air monitoring device designed for the localised testing of emissions), relatively little is known about the quantity and quality of emissions and their dispersion into the atmosphere.

Considering the government's laissez-faire attitude during the war period of 1975-1990 and beyond, it is safe to assume that most industrial emissions are not properly monitored or controlled. The visual evidence from dark smoke and the detection of malodors indicates that communities living near industrial facilities are exposed to unhealthy levels of air pollution. Lebanon's surge in vehicle ownership coupled with the use of high sulphur and lead-containing fuels has created another source of concern.

The prioritisation of air pollutants and subsequently contributing industries and activities is based on their impacts on public health. For this assessment, the WHO threshold limits are applied to judge pollution levels (concentrations) and to identify and set impact and abatement priorities. Pollution concentrations vary in place and time due to meteorological conditions and variations in the level of activities of the contributing sources. Since the main indicators of pollution are the average concentration levels per region, the following classification is used to distinguish between long-term regional problems and localised problems and to determine potential health impacts:

- Concentration > 100% of WHO limit: structural health problems in the total region of concern and possibly outside the region; severe problems in the localised areas.
- Concentration between 10-100% of WHO limit: structural health problems localised in the vicinity of main contributors to the problem; other part of the region may be exposed to concentrations exceeding the limits during unfavourable weather conditions.
- Concentration between 1-10% of WHO limit: structural health problems in the region are unlikely; particularly for low level sources, problems may occur in the direct vicinity of the main sources (within 500-1,000m) during unfavourable weather conditions.
- Concentrations below 1% of WHO limit: health problems are unlikely.

From the available data[19], it can be concluded that there are no activities in Lebanon that cause a pollution level exceeding a 100% WHO limit in the areas studied. However, there are activities that contribute to high levels of priority pollutants, namely NO_x, lead, SO_2 , and particulates with concentrations between 10-100% of the WHO limits. The following lists these primary activities:

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17 National Industrial Waste Management Plan, Dar Al-Handasah, 1998, Industrial Pollution Control Lebanon, Tebodin, 1998.

18 National Industrial Waste Management Plan, Dar Al-Handasah, 1998, Industrial Pollution Control Lebanon, Tebodin, 1998.

19 Tebodin: Industrial and Hazardous Waste Management, on behalf of METAP - The World Bank – MoE, 1998

- *Light & Medium Industries.* Located mostly on the coastal zone, these produce textiles, plastics, foodstuff, detergents, garments, leather and metal goods. Considering the nature of the output products, atmospheric emissions resulting from the operation of the facilities do not pose a serious environmental threat. However, most of these industries generate their own power without the provision of any air pollution control equipment. This combustion process does, in turn, create significant air pollution problems.
- *Heavy Industries.* There are three **cement** plants in Lebanon, two are located in Chekka and specialise in Portland cement production, while the third, located in Sibline, produces white cement. These facilities use coal and fuel oil to run their kilns and, as a result, emit sulphur oxides, nitrogen oxides, carbon oxides, and particulate matter into the atmosphere. Dust emissions are also very high causing a public health threat to local inhabitants. Phosphate-based **fertilisers** are produced at the Selaata factory located in the coastal area of Batroun. Production is based on the chemical reaction between phosphate rock and sulphuric acid. This reaction gives rise to hydrogen fluoride and silicon tetra-fluoride emissions. Dust from the crushing of phosphate rock is another by-product. The **sugar beet** factory in Majdel Anjar is the major industry in the Bekaa region. The plant uses fuel oil to run its machinery. Sulphur oxides, nitrogen oxides, carbon oxides, and particulate matter are released as a result of the combustion process.
- *Power Plants.* The thermal power plants at Zouk, Jieh, and Hrayche operate mainly on fuel oil that contains sulphur compounds. High levels of sulphur dioxide, carbon monoxide, nitrogen oxides, and particulates can be detected near each facility (see Table 28 of 1998 Tebodin Report). Mobile power generators are also used for domestic purposes. The lack of control of these privately owned generators and the combustion gases they emit results in the deterioration of local air quality.
- *Vehicles.* Air pollution caused by vehicles consists of a mixture of carbon monoxide, sulphur dioxide, nitrogen oxides, particulates, lead, and VOC's (volatile organic compounds) (see Table 27 of 1998 Tebodin Report) . Urban areas with heavy traffic flows and a high concentration of tall buildings are at risk of developing 'urban smog' as the natural dispersion of gases is inhibited.
- *Incinerators & Composting Plants.* The largest municipal incinerator is located at Amroussieh in the southern suburbs. Residents often complain about heavy fumes and malodors emanating from the plant. Incinerators are also used to treat solid wastes from hospitals and some industries. The composting plant at Quarantina in Beirut has been plagued by operational problems for many years. Foul odours have significantly reduced air quality in neighbouring areas. Other waste disposal facilities, including the dumpsites of Bourj Hammoud and Normandy, have also contributed to deteriorating air quality levels.
- *Quarries.* These facilities constitute an important economic asset during the reconstruction period Lebanon is experiencing. High levels of airborne particulate matter, however, render this activity as a major contributor to air pollution. Serious localised pollution at the quarry sites and along transport routes are a source of concern.

Further data can be obtained from Annex D 7.

The most important source of information update on industrial activities in Lebanon is the Census for Industrial Enterprises that was undertaken in 1994 under the auspices of the Ministry of Industry and Petroleum [MoIP]. It is worth mentioning that information has been updated since then. A very recent study carried out in association with GTZ has just been completed in this regard. The 1994 census gives a good level of information on the types and

level of industries. However, there is no thorough spatial analysis associated with the geographical distribution of the collected data.

There are very few dedicated industrial cities in Lebanon, and even those are surrounded by heavily populated residential cities. Most of the industries are small-to-medium sized enterprises scattered in the cities. The 1994 census identified 23,517 industrial facilities. There is in general a marked concentration of industries in the Mount Lebanon and Greater Beirut Area, which accommodate around 57 % of the industrial units. The main areas [MoE 1998] of concentration are:

- The industrial city in Dekwaneh (a heavily populated residential area), Zouk, and Bourj Hammoud in Greater Beirut;
- Chekka and Selaata in the north;
- Wadi Chahrour and Chouweifat in Mount Lebanon; and
- Sanniq/ Saida in the South.

Sector	Region					
	Beirut	*Mount Lebanon*	*North*	*Bekaa*	*South*	*Nabatiyeh*
Food processing	655	1,877	929	535	548	294
Textiles, garments	786	1,716	598	428	220	86
Wood products	115	535	332	150	288	106
Paper & printing	189	381	40	23	24	16
Chemicals & plastics	64	463	85	39	21	16
Non-metal minerals	45	686	545	381	181	210
Primary metals	37	156	42	12	13	4
Metal products/ equipment	298	2,047	785	413	475	315
Leather/ leather products	99	613	77	23	32	49
Others (incl. Furniture)	394	1,842	1,124	226	178	87
Construction work and others	167	216	28	30	74	54
TOTAL	**2,849**	**10,532**	**4,585**	**2,260**	**2,054**	**1,237**

Fig. B-10: Distribution of Industry by Type and Region [MoIP]

Regarding air pollution, with the exception of the cement plants, which emit particulate matter and the fertiliser plant (in Selaata), which emits fluorides, emissions from industrial processes, as such are not considered serious (ERM, 1995). However, most industries generate their power partially or totally, and emissions do arise from combustion and power generation processes. There are no thorough assessments of the extent to which environmental controls are in place or planned for industry in Lebanon. However, it is reasonable to assume that there is no effective regulatory regime or controls for air emissions in place.

Overview of the population densities in major Lebanese areas

The population density in Lebanon can reach up to 365 inhabitants per km^2. Moreover, there are sharp variations within the country. For example, the coastal zone accommodates approximately 60% of the population, with a high average population density of about 1,600 inhabitants per km^2. Moreover, there is a marked clustering in urban areas, such as Greater Beirut and Tripoli, Sour (Tyr), Saida and Zahle, in descending order. Fig. B-11 summarises the estimated population distribution (1994 Data).

Area	1994 [20] (000)	% of Total
Greater Beirut Area [21]	*1,165*	*31.3*
Central Beirut	400	10.7
Suburbs	765	20.5
Mount Lebanon (excluding Beirut)	*695*	*18.7*
Jbeil	66	
Kesrouane	156	
Metn	123	
Baabda	25	
Aley	145	
Chouf	180	
Bekka	*460*	*12.4*
Zahle City[22]	80	
Zahle Caza (escluding city)	76	
Hermel	34	
Baalbek	177	
Bekaa Al-Gharbi	63	
Rachaya	30	
North Lebanon	*770*	*20.6*
Tripoli City[23]	300	
Tripoli Caza (excluding city)	53	
Akkar	190	
Zgharta	70	
Koura	84	
Bcharre	22	
Batroun	51	
South Lebanon	*635*	*17.0*
Saida City and suburbs[24]	94	
Saida Caza (excluding city)	110	
Jezzine	25	
Sour	181	
Bint Jbeil	32	
Nabatiyeh	115	

[20] Calculated from spatial distribution in Bechtel WP3 1991, using pro rata distribution of population. Total population increases by about 1 % per annum to give an estimate of the total population of about 3.7 millions (Faour, 1994).

[21] MASS-IAURIF. (1994). Beirut Transportation Study.

[22] The population of Zahle is assumed to have grown by 4% per annum from 1988 to 1995.

[23] The growth of the population of the City of Tripoli is assumed to be 2.5% per annum from 1988 to 1995 (Survey data).

[24] Estimates of the population of the City of Saida and suburbs from a survey in: Jouzy & Partners. Waste & Wastewater Feasibility Studies in Saida Drainage Zone.

Area	1994 [20] (000)	% of Total
Hasbaya	30	
Marjayoun	48	
LEBANON TOTAL (Excluding Palestinians in Camps; Official number ~ 400,000)	**3,725**	**100**

Fig. B-11: Estimated population distribution

Comparison with German situation

In comparison to German Federal County NRW (North Rhine Westphalia) [LUA NRW] a density of 527 inhabitants per km^2 up to a maximum of 1,250 - 2,380 inhabitants per km^2 occurs. NRW includes the densely populated and heavily industrialised "Ruhr" - area which has an industrial tradition built up since the beginning of the 20th century. The ambient air situation was poor up until the 1960's. With the reduction of emissions by improving the state-of-the-art (industry, air cleaning systems, cars, heating) through environmental regulations the air quality improved to a reasonable standard. Viewing the Lebanese situation in relation to "setting up environmental standards" it can be established that there are no reasons for a stricter approach as practised in Germany on the one hand. On the other hand, howerver, German regulations represent air quality and an industrial situation from the beginning of the 1980's. Therefore the proposed limits for Lebanon would not be much weaker than the German standards with a range of tolerance respecting Thai regulations.

B 2.1.3 Hazardous waste management

B.2.1.3.1 Review of international obligations – Basle Convention

The Republic of Lebanon is one of the 135 parties to the Basle Convention. The Basle Convention on the Control of Transboundary movements of Hazardous Wastes and their Disposal was adopted on 22 March 1989 by the 116 States participating in the Conference of Plenipotentiaries on the Global Convention on the Control of Transboundary Movements of Hazardous Wastes, which was convened by the Executive Director of the United Nations Environment Programme (UNEP) and held in Basle at the invitation of the Government of Switzerland. As of April 2000, 135 countries and the European Community are Party to the Basle Convention.

The main objectives of the Convention are:

- to reduce transboundary movements of hazardous wastes and other wastes to a minimum consistent with their environmentally sound management
- to treat and dispose of hazardous wastes and other wastes as close as possible to their source of generation in an environmentally sound manner
- to minimise the generation of hazardous wastes and other wastes (in terms of both quantity and potential hazard).

The Basle Convention represents new norms, rules and procedures in law governing the movements and disposal of hazardous wastes at international as well as national levels. In this context, this instrument represents the intention of the international community to solve this global environmental problem in a collective manner. A regulatory system for the monitoring and control of hazardous wastes has been set up and is displayed in the full text of the Convention. Some of the key elements of the regulatory system of the Basle Convention are the prior informed consent, the prohibition to export to a country which is not a Contracting Party to the Convention, and the legal provisions for duty to re-import and the responsibility of states involved in the transboundary movements.

During its first decade (1989-1999), the Convention was principally devoted to setting up a framework for controlling the "transboundary" movements of hazardous wastes, that is, the movement of hazardous wastes across international frontiers. It also developed the criteria for "environmentally sound management". A Control System, based on prior written notification, was also put into place.

During the next decade (2000-2010), the Convention will build on this framework by emphasising full implementation and enforcement of treaty commitments. The other area of focus will be the minimisation of hazardous waste generation. Recognising that the long-term solution to the stockpiling of hazardous wastes is a reduction in the generation of those wastes - both in terms of quantity and hazardousness - ministers meeting in December of 1999 set out guidelines for the Convention's activities during the next decade, including:

- active promotion and use of cleaner technologies and production methods
- further reduction of the movement of hazardous and other wastes
- the prevention and monitoring of illegal traffic
- improvement of institutional and technical capabilities - through technology when appropriate - especially for developing countries and countries with transitional economies
- further development of regional and sub-regional centres for training and technology transfer.

Main milestones in the Convention's history are:

- **1999 Protocol on Liability and Compensation** - The Protocol on Liability and Compensation, adopted in December 1999, established rules on liability and compensation for damages caused by accidental spills of hazardous waste during export, import or during disposal.
- **1999 Ministerial Declaration** - The Basle Declaration, also adopted at the COP-5 meeting, set out the agenda for the next decade, with special emphasis on minimising hazardous waste.
- **1998 Classification and Characterisations of Wastes** - The Technical Working Group of the Basle Convention agreed on lists of specific wastes characterised as hazardous or non-hazardous. These lists were later adopted by the Parties to the Convention, thereby clarifying the scope of the Convention.
- **1995 Ban Amendment** - The Amendment calls for the prohibition of exports of hazardous wastes (for any purpose) from countries listed in a proposed new annex to the Convention (Annex VIII - Parties that are members of the EU, OECD, Liechtenstein) to all other Parties to the Convention. In order to enter into force, the Ban Amendment has to be ratified by 62 of the Parties present at the time of adoption.
- **1992 Basle Convention enters into force.**
- **1989 Adoption** - After a public outcry against the indiscriminate dumping of hazardous wastes in developing countries by developed-world industries, a diplomatic conference held in Basle, Switzerland, adopted the Convention.

The Basle Convention controls "**Transboundary movement**". That means any movement of hazardous wastes or other wastes from an area under the national jurisdiction of one State to or through an area under the national jurisdiction of another State or to or through an area not under the national jurisdiction of any State, provided at least two States are involved in the movement (Article2, paragraph 3, of the Convention).

The provisions of the Convention shall not affect transboundary movements which take place pursuant to bilateral, multilateral or regional agreements, provided that such agreements are compatible with the environmentally sound management of hazardous wastes and other

wastes as required by this Convention" (Article 11, paragraph 2). Parties shall notify the Secretariat of any such agreement that they enter into regarding transboundary movement of hazardous or other wastes, as well as "those which they have entered into prior to the entry into force of this Convention for them, for the purpose of controlling transboundary movements of hazardous wastes and other wastes which take place entirely among the Parties to such agreements.

In the context of transboundary movements, the Basle Convention **defines wastes** as "substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law" (Article 2, paragraph 1)

Under the Basle Convention the following wastes, subject to a transboundary movement, are defined as hazardous wastes if:

- the wastes belong to any category (Y1-Y45) contained in Annex I of the Convention
- and exhibit one or more of the characteristics (H3-H33) contained in Annex III of the Convention
- wastes that are not covered under Annex I or III but are defined as or are considered to be hazardous wastes by the domestic legislation of the Party of export, import or transit shall be controlled under the terms of the Convention
- Wastes that belong to any of the two categories Y46 and Y47 of Annex II to the Convention, subject to a transboundary movement, are defined as "other wastes" and will be controlled by the Convention
- Wastes which, as a result of being radioactive, are subject to other international control systems (e.g. (IAEA) International Atomic Centre Energy Agency), including international instruments, applying specifically to radioactive materials, and wastes which derive from the normal operations of a ship, the discharge of which is covered by another international instrument, are excluded from control.

B.2.1.3.2 Review current Basleine of pollution levels and evaluation of the capacity of the already implemented emission control technology

In Lebanon, hazardous wastes arise in general from the following sources[25]:

- Pesticides manufacturing, mainly packaging waste and sludge contaminated with pesticides.
- Waste paper recycling, printing, ceramics manufacturing (pigments), metal galvanising, and non-ferrous metal recycling industries, mainly waste containing heavy metals.
- Paint, wood and metal manufactures, mainly industrial paint, resins, dyes, adhesive residues and PCB.
- Waste oil and solvent recycling, mainly oily sludge and oily waste and residues.
- Tanneries, mainly chromium-containing sludge.
- Metal finishing, mainly acid pickling, cyanide wastes, solvent/ pigment sludge.
- Electroplating, mainly, metal and cyanide containing sludge.
- Cement industries, mainly asbestos wastes.

Hazardous waste generation in Lebanon was estimated at approximately 15,000 tons in 1995. This figure is predicted to increase to 22,040 tons in the year 2000 and to 28,100 tons in 2005[26]. The hazardous waste stream includes the following types of hazardous wastes:

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25 Tebodin: Industrial and Hazardous Waste Management, on behalf of METAP - The World Bank – MoE, 1998

- Asbestos
- Acids
- Alkalis
- Organic solvents
- Waste oils
- Tannery solid wastes (including inorganic sulphur compounds).

An estimate of hazardous waste generation based on current industrial activities and employment data is summarised in Fig. B-12. Further information can be obtained from Annex D 8.

Waste Type	Estimated wastes arising (ton per annum)	
	Year 1995	*Year 2020*
Acids	3,450	11,940
Alkalis	5,950	20,600
Plating/ metal treatment waste	920	3,185
Paints/ resins	2,850	9,865
Organic solvents	380	1,315
Waste oils	3,350	11,595
Total	16,900	58,500

Fig. B-12: Estimation of hazardous waste generation in Lebanon[27]

Assessment of existing environmental technologies
Today, the waste management infrastructure is poor.

B.2.1.3.3 Comparison with international environmental standards

Comparing international waste standards is difficult as the notion of waste is relative in two main respects. First, something becomes waste when it loses its primary function for the user. A waste is therefore relative to this primary function. However, and this is the second perspective, what is considered waste with regard to this primary function may be useful for a secondary function as raw material. This relative nature explains why certain wastes keep a significant economic value. The notion of waste is also relative to the technological state-of-the-art and to the location of its generation. One example can be horse manure. In the past it could be considered as a waste in a large city but as a useful fertiliser in rural areas. Today, it has disappeared from towns altogether due to technology change.

Methods of classifying hazardous wastes vary throughout the world. Many countries have their own national or domestic classification schemes and hazard criteria. In the following the classification scheme of the EU, Germany and the Basle Convention are taken into consideration. The Basle Convention in particular is taking into account the different

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26 DAR AL-HANDASAH, IMPERIAL COLLEGE C.E.C.W.M.: National Industrial Waste Management Plan, on behalf of MoE, 1998, including industrial waste water, solid waste, air emission, noise, treatment facilities, legal arrangements and action plan

27 DAR AL-HANDASAH, IMPERIAL COLLEGE C.E.C.W.M.: National Industrial Waste Management Plan, on behalf of MoE, 1998, including industrial waste water, solid waste, air emission, noise, treatment facilities, legal arrangements and action plan

classification systems world-wide because the state-of export and the state of import, as well as the state of transit have to classify the wastes subject to control under the Basle Convention in a unique way.

A) Basle Convention

The wastes subject to control under the Basle Convention are classified into two general categories. Annex I of the Convention provides for a list of 45 categories of wastes which are themselves divided into (please refer to Annex D 7):

- Wastes streams (e.g.: clinical wastes, waste mineral oil, PCBs, etc.)
- Wastes having as constituents certain enumerated substances (e.g.: copper compounds, arsenic, cadmium, lead, organic cyanides, halogenated organic solvent, etc.).

Annex II lists two categories of "other wastes", (please refer to Annex D 7):

- Wastes collected from households (Y46)
- Residues arising from incineration of household wastes (Y47).

The hazard classes of the wastes listed in Annex I to the Basle Convention are contained in Annex III to that Convention, (please refer to Annex D 7). There are 13 classes, with some of them further subdivided into numbered divisions (e.g.: class H4.1, H4.2, H4.3). For example, classification H4.1 means that the waste is in division 1 of class 4 and that the waste exhibits "flammable solids" characteristics.

The hazard classes of the Basle Convention correspond to hazard classification 1 to 9 of the ***United Nations Recommendations on the Transport of Dangerous Goods***. Each hazardous waste will have one of these 9 classes as its primary classification. The primary classification describes the main hazardous property of a hazardous waste.

B) European legislation

The first legal definition of "waste" at European level appeared in the first **Framework Directive on Waste (75/442/EEC)** in 1975. In its Article 1, and *"For the purposes of this Directive"*, it defines waste as *"any substance or object which the holder disposes of or is required to dispose of pursuant to the provisions of national law in force"*. The directive goes on with a list of "wastes" excluded from its scope, and therefore from this definition (e.g. radioactive waste, wastewater etc.). The directive also indirectly defined all recyclable materials as waste insofar as recycling was legally considered as a means of disposal, together with landfilling and incineration.

This situation changed with the revised **Framework Directive on Waste (91/156/EEC)** in 1991. There, the definition of "waste" became *"any substance or object in the categories set out in Annex I which the holder discards or intends or is required to discard."* Annex I contains 16 different categories of waste and is based on OECD Council Decision (88)90. These 16 categories introduce a wider vocabulary than just waste. They talk about residues, products, elements, substances and materials.

In the European Union "hazardous wastes" is covered by directive 91/689/EEC, 1991, which establishes a list of hazardous wastes. Directive 91/689/EEC defines as "hazardous wastes" the *"wastes featuring on a list to be drawn up in accordance with the procedure laid down in Article 18 of Directive 75/442/EEC on the basis of Annexes I and II to this Directive, not later than six months before the date of implementation of this Directive. These wastes must have one or more of the properties listed in Annex III. The list shall take into account the origin and composition of the waste and, where necessary, limit values of concentration."* Please

refer to Annex D 9 for the Annexes I and II of the Council Directive 91/689/EEC of 12 December 1991 on hazardous waste.

The above mentioned list was published in Council Decision 94/904/EEC which establishes a list of hazardous waste pursuant to Article 1 (4) of Council Directive 91/689/EEC on hazardous waste, please refer to Annex D 10. The criterion used to set up this list is essentially to have "*one or more of the properties of Annex III to Directive 91/689/EEC.*" Additionally, this list must be based on Annexes I (*"generic types of hazardous waste"*) and II (*"constituents which render waste hazardous when they have the properties described in Annex III"*) of this same directive. Additionally, *"where necessary limit values of concentration"* will be set.

Apart from the above mentioned definitions, other definitions also exist. These were developed for the sole purpose of their respective directives:

- Titanium Dioxide Waste (78/178/EEC)
- Waste Oils (75/439/EEC)
- PCBs&PCTs (91/86/EEC)
- Batteries (91/86/EEC)
- Sewage Sludge (86/278/EEC).

Assessment of monitoring and enforcement capacity
Will be subject of the next progress report.

B 2.2 Assessment of monitoring and enforcement strategy

The Consortium evaluated the methods for the measurement of the parameters which was set in the standards. Please refer to Annex D 11.

The Consortium evaluated the capacity of the local laboratories which could conduct the field work. This includes:

- technical competence in the use of equipment
- technical equipment (are the instruments suitable to measure the range of the expected contamination level?)
- procedures to analyse the parameters in the necessary levels.

All this information was checked during an on-site assessment performed by the Consortium at the following laboratories:

- American University of Beirut
- Lebanese American University in Byblos
- Public Health Laboratories
- Industrial Research Institute
- ACTS.

Please refer to Annex D 12 for the minutes of the meetings with these institutes. A more detailed analysis of the laboratories and its possible functions within the enforcement strategy in Lebanon will be included in the Final Report.

B 3 Consolidation with Stakeholders

Wide agreement not only on the objectives of the project but also on the methodology for the development of the environmental standards as well as the standards themselves is seen as a

preliminary precondition for the successful implementation of the new system of environmental standards.

The Consortium has created the necessary preconditions for close co-operation between all stakeholders of the project through:

- A methodology with a clear and strict structure and following common agreed objectives.
- Information available at the start of the project which is disseminated to all stakeholders at the earliest possible stage.
- The involvement of stakeholders throughout the process of the project's development.
- A sufficiently large number of stakeholders agreeing on the methodology.
- The methodology considering all relevant points of view as a whole without focusing on individual interests.

The Consortium is co-operating with the Lebanese Association of Industry and the Steering Committee on:

- Objectives for setting Environmental Standards in the short-term
- Long-term environmental quality objectives to be reached by the Environmental Standards
- Determination of a development programme to successively achieve the above mentioned standards, in particular setting of transition deadlines
- Determination of the initial values of the adaptation process
- The Steering Committee will observe conformity with the methodology to guarantee the acceptance of study, examine the results and will be involved before reports are submitted to the client.
- Determination of data.

The Consortium is carrying out the entire project with a high level of co-operation with local stakeholders in order to ensure widespread acceptance by all interest parties:

- The Consortium has put all project ideas and results for discussion on a home page in order to involve a wider public in the results. This page is a sub-page of the existing home page of the SPASI project, please refer to: www.moe.gov.lb/spasimain.htm
- Site visits were carried out at some industrial sectors to obtain an obvious overview of the production and the processes. The following industries were visited:
  - Paint Industry
  - Glass Industry
  - Cement Industry
  - Aluminium Industry

  Annex D 13 contains the protocols of the visits.
- The Consortium sets a number of meetings with the Association of Lebanese Industrialists (ALI) and the Steering Group of the SPASI project.

For this panels, stakeholders, experts and representatives from the client, national authorities such as the MoE, NGOs, governors, cities, important industries and the sub-contractor have been invited in order to guarantee the acceptance of the study. The panel of experts reviewed the methodical correctness and examine the findings. The critical review of the stakeholders had the following targets:

- Identification of problems concerning the implementation of the suggested standards in the Republic of Lebanon
- Evaluation of alternative solutions in order to adjust the draft standards to the specific situation in the target area

- Formulation of alternative settings (ELVs, measurement and monitoring methods) for National Environmental Standards.

Closer co-operation took place with the representative of the Lebanese Association of Industry. Please refer to Fig. B-13 which shows a schedule of envisaged co-ordination meetings.

Date	Target Group	Topic
29.08.00	MoE	• Presentation of the project • Discussion of methodology
12.09.00	ALI	• Discussion of methodology proposed • Discussion of framework of ELVs • Schedule for further meetings
19.09.00	ALI	• Discussion and agreement of adapted methodology proposed • Discussion and agreement of adapted framework of ELVs
20.09.00	Steering Committee	• Presentation of the project • Discussion of methodology
19.10.00	ALI	• Discussion of the proposed draft ELVs
02.12.00	ALI	• Final discussion of proposed ELVs
30.01.00		• Presentation

Fig. B-13: Schedule of co-ordination meetings

In order to consolidate the draft of national standards, a review by ALI and the SC was performed. Meetings took place on 19.10.00 and 02.12.00 for the agreement of the standards with the industrialists. After agreement with the stakeholders the minutes of the meeting on the final agreement with the industrialists will be part of the Final Report.

B 4 Setting the standards for environmental quality

B 4.1 Environmental Limit Values (ELV) for waste water

Please refer to Annex D 14 for some explanations to the waste water parameters mentioned below.

B 4.1.1 Definitions

Best Available Techniques[28]

The term "best available techniques" means the latest stage of development (state-of-the-art) of processes, of facilities or of methods of operation which indicate the practical suitability of a particular measure for limiting discharges, emissions and waste. In determining whether a set of processes, facilities and methods of operation constitute the best available techniques in general or individual cases, special consideration shall be given to:

(a) comparable processes, facilities or methods of operation which have recently been successfully tried out;
(b) technological advances and changes in scientific knowledge and understanding;

[28] (Barcelona. LBS, Annex IV)

(c) the economic feasibility of such techniques;
(d) time limits for installation in both new and existing plants;
(e) the nature and volume of the discharges and emissions concerned.

Discharging
Discharging is the direct conveyance of waste water into a water body, into the sewerage system or into the sea. Conveyance into the subsoil shall be deemed to constitute a discharge into a water, whereby conveyance into the ground within the framework of agricultural soil treatment techniques shall be excluded from this provision.

Waste Water
Waste water is water, the properties of which have been changed by domestic, commercial agricultural or other uses and the water drained together with it during dry weather conditions (polluted water), as well as water running off and collected from built-up or paved or asphalt coated surfaces following precipitation (rain water). Liquids released and collected from facilities designed for the treatment, storage and depositing of waste shall also be deemed to be polluted water.

Waste Water Treatment Plant
A waste water treatment plant is a facility used to reduce or eliminate the noxious content of waste water; facilities serving to prevent the generation of waste water either in full or in part shall also be regarded as waste water treatment plants.

B 4.1.2 Environmental Limit Values (ELV) for waste water discharged into the sea

The first column of the table shows the pollution parameter, the second gives the proposed limit value. The third column contains additional remarks and, in particular, contains exemptions which can be applied to existing facilities. These exceptional regulations will only be valid as long as the Barcelona LBS protocol is not ratified by the Republic of Lebanon.

New facilities will have to deal directly with the ELVs given in the second column.

The outlet of the pipeline for coastal outfalls should have a minimum distance from the coast line and be located in a specific depth[29].

Parameter	ELV for existing facilities[30]	ELV for new facilities	International ELVs
pH	5 – 9	6 – 9	Arab League: 6 – 9 Decision 52/1: 6 – 9 Egypt: 6 – 9 Kuwait: 6.5 – 8.5 Morocco: 6.5 – 8.6 Saudi Arabia: 6 – 9 Tunisia: 6.5 – 8.5 US: 5 – 9

29 Still under discussion

30 These ELVs are valid at least until the final ratification of the new Barcelona LBS protocol has been completed for the Republic of Lebanon

Parameter	ELV for existing facilities[30]	ELV for new facilities	International ELVs
Temperature	35°C	35°C	Arab League: 30°C Decision 52/1: 30°C Egypt: 35°C Morocco: 30°C Tunisia: 35°C
BOD_5 mgO_2/L[31]	100	25	Arab League: 100 Dec 52/1: 60 Egypt: 60 EU[32]: 25 Germany[33]: 20 – 25 Kuwait: 10 Morocco[34]: 100 Qatar: 25 Saudi Arabia: 25 Tunisia: 30
COD mgO_2/L	250	125	Arab League: 100 Dec 52/1: 100 Egypt: 100 EU: 125 Germany[35]: 80 – 250 Morocco[36]: 500 Qatar: 125 Saudi Arabia: 150 Tunisia: 90
Total Phosphorous mgP/L	16	10	Arab League: 16 Germany: 1.5 – 3 Morocco[37]: 10
Total Nitrogen mgN/L[38]	40	30	Arab League: 40 Germany: 18 – 50 Morocco[39]: 30 Tunisia: 30

31 In terms of equality, it needs to be considered that the municipal waste water treatment plants designed according to the state-of-the-art will be able to keep an ELV of 25 mg/L.

32 Municipal waste water after treatment

33 Industrial waste water, different values for different branches of industry

34 This value depends on the receiving water body

35 As a rule 110 mgO_2/L

36 This value depends on the receiving water body

37 This value depends on the receiving water body

38 Sum of Kjeldahl-N (organic N + NH_3), NO_3-N, NO_2-N

39 This value depends on the receiving water body

Parameter	ELV for existing facilities[30]	ELV for new facilities	International ELVs	
Suspended Solids mg/L	200	60	Arab League:	200
			Dec 52/1:	60
			Egypt:	60
			EU:	35
			Kuwait:	25
			Morocco:	50
			Tunisia:	30
			US:	20
AOX	5	5	Arab League:	5
			Germany:	0.1 – 2
			Morocco:	5
Detergents mg/L[40]	3	3	Morocco:	3
Coliform Bacteria 37°C in 100 ml[41]	2,000	2,000	Arab League:	2,000
			Egypt:	5,000
			Saudi Arabia:	1,000
			Tunisia:	2,000
Salmonellae	absence	absence	Arab League:	absence
			Morocco:	absence
Hydrocarbons mg/L	20	20	Arab League:	20
			Kuwait:	25
			Morocco:	10
Phenol index mg/L	0.3	0.3	Germany:	0.15
			Morocco:	0.3
Oil and Grease mg/L	30	30	Arab League:	30
			Morocco:	30
Total Organic Carbon (TOC) mg/L	75	75	Arab League:	75
			Saudi Arabia:	50
Ammonia (NH^{4+}) mg/L	10	10	Arab League:	10
			Dec 52/1:	3
			Egypt:	3
			Germany[42]:	10
			Kuwait:	10
			Saudi Arabia:	1
			Qatar:	2
Silver (Ag) mg/L	0.1	0.1	Arab League:	0.1
			Dec 52/1:	0.1
			Egypt:	0.1
			Germany[43]:	0.1
			Morocco:	0.1
			Tunisia:	0.1

40 Anions, cations and non-ionic

41 For dischargers in close distance to a bathing water a more strict ELV could be necessary.

42 Except metallurgic activities

43 Except of photographic processes (0.7 mg/L)

Parameter	ELV for existing facilities[30]	ELV for new facilities	International ELVs	
Aluminium (Al) mg/L	10	10	Arab League:	10
			Dec 52/1:	3
			Egypt:	3
			Germany:	2 – 3
			Morocco:	10
			Qatar:	20
			Saudi Arabia:	15
			Tunisia:	5
Arsenic (As) mg/L	0.1	0.1	Arab League:	0.1
			Dec 52/1:	0.05
			Egypt:	0.05
			Germany[44]:	0.1
			Morocco:	0.1
			Saudi-Arabia:	0.1
			Tunisia:	0.1
Barium (Ba) mg/L	10	2	Arab League:	10
			Dec 52/1:	2
			Egypt:	2
			EU[45]:	0.1
			EU[46]:	1
			Germany:	2 – 3
			Morocco:	1
			Qatar:	2
			Tunisia:	10
Cadmium (Cd) mg/L	0.2	0.2	Arab League:	0.2
			Dec 52/1:	0.05
			Egypt:	0.05
			Germany:	0.01 – 0.2
			Morocco:	0.2
			Qatar:	0.02
			Saudi Arabia:	0.02
			Tunisia:	0.005
Cobalt (Co) mg/L	0.5	0.5	Arab League:	0.5
			Dec 52/1:	2
			Egypt:	2
			Morocco:	0.5
			Qatar:	0.2
			Tunisia:	0.5

44 Except of manufacturing of glass and mineral fibres (0.3 mg/L)

45 Mandatory value for simple physical treatment and sterilisation

46 Mandatory value for normal physical and chemical treatment and sterilisation, mandatory value for physical and refined chemical treatment, oxidation, adsorption and sterilisation

Parameter	ELV for existing facilities[30]	ELV for new facilities	International ELVs
Chromium total (Cr) mg/L[47]	2	2	Arab League: 2 Dec 52/1: 1 Egypt: 1 Germany: 0.4 – 1 Kuwait: 0.5 Morocco: 2 Qatar: 0.2 Saudi Arabia: 0.1
Hexavalent Chromium (Cr^{VI}) mg/L[48]	0.5	0.2	Arab League: 0.5 Germany: 0.05 – 0.1 Morocco: 0.2 Tunisia: 0.5
Copper total (Cu) mg/L[49]	1.5	1.5	Arab League: 1.5 Dec 52/1: 1.5 Egypt: 1.5 Germany: 0.5 Kuwait: 1.5 Morocco: 0.5 Qatar: 0.4 Saudi Arabia: 0.2 Tunisia: 1.5
Iron total (Fe) mg/L	5	5	Arab League: 5 Dec 52/1: 1.5 Egypt: 1.5 Germany: 0.5 – 3 Kuwait: 0.5 Morocco: 3 Qatar: 8 Tunisia: 1
Mercury total (Hg) mg/L	0.05	0.05	Arab League: 0.05 Dec 52/1: 0.005 Egypt: 0.005 Germany: 0.05 Kuwait: 0.01 Morocco: 0.05 Qatar: 0.002 Saudi Arabia: 0.001 Tunisia: 0.001

47 This weaker ELV is justifiable if ELV for Chromium (VI) is kept

48 Due to toxic potential strict ELV is proposed.

49 Copper is a strong fish poison, but precipitated in salt water.

Parameter	ELV for existing facilities[30]	ELV for new facilities	International ELVs
Manganese (Mn) mg/L	1	1	Arab League: 1 Dec 52/1: 1 Egypt: 1 Morocco: 1 Qatar: 0.4 Tunisia: 1
Nickel total (Ni) mg/L	2	0.5	Arab League: 2 Dec 52/1: 0.1 Egypt: 0.1 Germany[50]: 0.5 Morocco: 0.5 Qatar: 0.4 Saudi Arabia: 0.2 Tunisia: 2
Lead total (Pb) mg/L	0.5	0.5	Arab League: 0.5 Dec 52/1: 0.5 Egypt: 0.5 Germany: 0.5 Kuwait: 0.5 Morocco: 0.5 Qatar: 0.1 Saudi Arabia: 0.1 Tunisia: 0.5
Antimony (Sb) mg/L	0.3	0.3	Arab League: 0.3 Tunisia: 0.1 Morocco: 0.3
Tin total (Sn) mg/L	2	2	Arab League: 2 Germany: 0.5 – 2 Morocco: 2 Tunisia: 2
Zinc total (Zn) mg/L	10	5	Arab League: 10 Dec 52/1: 5 Egypt: 5 Germany: 1 - 2 Morocco: 5 Qatar: 2 Saudi Arabia: 1 Tunisia: 10

50 Except for surface disposal of waste, the ELV is 1 mg/L.

Parameter	ELV for existing facilities[30]	ELV for new facilities	International ELVs	
Active Cl_2 mg/L	1	1	Arab League:	1
			Germany:	0.5
			Egypt:	1
			Kuwait:	0.6
			Morocco:	0.2
			Qatar:	1
			Saudi Arabia:	0.5
			Tunisia:	0.05
Cyanides (CN^-)mg/L	0.1	0.1	Arab League:	0.1
			Dec 52/1:	0.1
			Egypt:	0.1
			Germany[51]:	0.1 – 2
			Morocco:	0.1
			Qatar:	0.1
			Saudi Arabia:	0.05
			Tunisia:	0.05
Fluoride (F^-) mg/L	25	25	Arab League:	15
			Dec 52/1:	1.5
			Egypt:	1
			Germany:	20 –50
			Morocco:	15
			Tunisia:	5
Nitrate (NO_3) mg/L	90	90	Arab League:	90
			Dec 52/1:	40
			Egypt:	40
			Tunisia:	90
Phosphate (PO_4^{3-}) mg/L	5	5	Arab League:	5
			Dec 52/1:	5
			Egypt:	5
			Kuwait:	5
			Qatar:	2
			Saudi Arabia:	1
Sulphate (SO_4^{2-}) mg/L	1,000	1,000	Arab League:	1,000
			Egypt:	1
			Germany:	600 – 3,000
			Tunisia:	1,000
Sulphide (S^{2-})mg/L	5	1	Arab League:	5
			Dec 52/1:	1
			Germany:	0.3 – 1
			Kuwait:	5
			Morocco:	1
			Tunisia:	2

51 In general 0.2, except of photographic processes (2 mg/L) and mineral oil processing (0.1 mg/L)

B 4.1.3 Environmental Limit Values (ELV) for waste water discharged into surface water

Surface water is defined as an inland water and as a running water. A minimum flow of 0.1 m^3/s needs to be guaranteed when discharging.

Parameter	ELV for existing facilities[52]	ELV for new facilities	International ELVs
pH	5 – 9	6 – 9	Arab League: 6 – 9 Egypt: 6 – 9 Morocco: 6.5 – 8.6 Saudi Arabia: 6 – 9 Tunisia: 6.5 – 8.5 US: 5 – 9
Temperature	30°C	30°C	Arab League: 30°C Egypt: 35°C Morocco: 30°C Tunisia: 25°C
BOD_5 mgO_2/L[53]	100	25	Arab League: 100 Egypt: 60 EU[54]: 25 Germany[55]: 20 – 25 Morocco[56]: 100 Saudi Arabia: 25 Tunisia: 30
COD mgO_2/L	250	125	Arab League: 100 Egypt: 100 EU: 125 Germany[57]: 80 – 250 Morocco[58]: 500 Saudi Arabia: 150 Tunisia: 90
Total Phosphorous mgP/L	16	10	Arab League: 16 Germany: 1.5 – 3 Morocco[59]: 10
Total Nitrogen, mgN/L[60]	40	30	Arab League: 40 Germany: 18 – 50 Morocco[61]: 30

52 These ELVs are valid at least until the final ratification of the new Barcelona LBS protocol has been completed for the Republic of Lebanon

53 In terms of equality, it needs to be considered that the municipal waste water treatment plants designed according to the state-of-the-art will be able to keep an ELV of 25 mg/L.

54 Municipal waste water after treatment

55 Industrial waste water, different values for different branches of industry

56 This value depends on the receiving water body

57 As a rule 110 mgO_2/L

58 This value depends on the receiving water body

59 This value depends on the receiving water body

60 Sum of Kjeldahl-N (organic N + NH_3), NO_3-N, NO_2-N

61 This value depends on the receiving water body

Parameter	ELV for existing facilities[52]	ELV for new facilities	International ELVs
Suspended Solids mg/L	200	60	Arab League: 200 Egypt: 60 EU: 35 Morocco: 50 Tunisia: 30 US: 20
AOX	5	5	Arab League: 5 Germany: 0.1 – 2 Morocco: 5
Detergents mg/L[62]	3	3	Morocco: 3
Coliform Bacteria 37°C in 100 ml[63]	2,000	2,000	Arab League: 2,000 Egypt: 5,000 Saudi Arabia: 1,000 Tunisia: 2,000
Salmonellae	absence	absence	Arab League: absence Morocco: absence
Hydrocarbons mg/L	20	20	Arab League: 20 Morocco: 10
Phenol index mg/L	0.3	0.3	Germany: 0.15 Morocco: 0.3
Oil and Grease mg/L	30	30	Arab League: 30 Morocco: 30
Total Organic Carbon (TOC) mg/L	75	75	Arab League: 75 Saudi Arabia: 50
Ammonia (NH^{4+}) mg/L	10	10	Arab League: 10 Germany[64]: 10 Saudi Arabia: 1
Silver (Ag) mg/L	0.1	0.1	Arab League: 0.1 Germany[65]: 0.1 Morocco: 0.1 Tunisia: 0.05
Aluminium (Al) mg/L	10	10	Arab League: 10 Germany: 2 – 3 Morocco: 10 Saudi Arabia: 15 Tunisia: 5
Arsenic (As) mg/L	0.1	0.1	Arab League: 0.1 Germany[66]: 0.1 Morocco: 0.1 Saudi-Arabia: 0.1 Tunisia: 0.05

[62] Anions, cations and non-ionic

[63] For dischargers in close distance to bathing water a more strict ELV could be necessary.

[64] Except metallurgic activities

[65] Except of photographic processes (0.7 mg/L)

[66] Except of manufacturing of glass and mineral fibres (0.3 mg/L)

Parameter	ELV for existing facilities[52]	ELV for new facilities	International ELVs
Barium (Ba) mg/L	2	2	Arab League: 10 EU[67]: 0.1 EU[68]: 1 Germany: 2 – 3 Morocco: 1 Tunisia: 0.5
Cadmium (Cd) mg/L	0.2	0.2	Arab League: 0.2 Germany: 0.01 – 0.2 Morocco: 0.2 Saudi Arabia: 0.02 Tunisia: 0.005
Cobalt (Co) mg/L	0.5	0.5	Arab League: 0.5 Morocco: 0.5 Tunisia: 0.1
Chromium total (Cr) mg/L[69]	2	2	Arab League: 2 Germany: 0.4 – 1 Morocco: 2 Saudi Arabia: 0.1
Hexavalent Chromium (Cr^{VI}) mg/L[70]	0.5	0.2	Arab League: 0.5 Germany: 0.05 – 0.1 Morocco: 0.2 Tunisia: 0.01
Copper total (Cu) mg/L	1.5	0.5	Arab League: 1.5 Germany: 0.5 Morocco: 0.5 Saudi Arabia: 0.2 Tunisia: 0.5
Iron total (Fe) mg/L	5	5	Arab League: 5 Egypt: 1 Germany: 0.5 – 3 Morocco: 3 Tunisia: 1
Mercury total (Hg) mg/L	0.05	0.05	Arab League: 0.05 Germany: 0.05 Morocco: 0.05 Saudi Arabia: 0.001 Tunisia: 0.001
Manganese (Mn) mg/L	1	1	Arab League: 1 Morocco: 1 Tunisia: 0.5

67 Mandatory value for simple physical treatment and sterilisation

68 Mandatory value for normal physical and chemical treatment and sterilisation, mandatory value for physical and refined chemical treatment, oxidation, adsorption and sterilisation

69 This weaker ELV is justifiable if ELV for Chromium (VI) is kept.

70 Due to toxic potential strict ELV is proposed.

Parameter	ELV for existing facilities[52]	ELV for new facilities	International ELVs	
Nickel total (Ni) mg/L	2	0.5	Arab League:	2
			Germany[71]:	0.5
			Morocco:	0.5
			Saudi Arabia:	0.2
			Tunisia:	2
Lead total (Pb) mg/L	0.5	0.5	Arab League:	0.5
			Germany:	0.5
			Morocco:	0.5
			Saudi Arabia:	0.1
			Tunisia:	0.1
Antimony (Sb) mg/L	0.3	0.3	Arab League:	0.3
			Tunisia:	0.1
			Morocco:	0.3
Tin total (Sn) mg/L	2	2	Arab League:	2
			Germany:	0.5 – 2
			Morocco:	2
			Tunisia:	2
Zinc total (Zn) mg/L	5	5	Arab League:	10
			Germany:	1 – 2
			Morocco:	5
			Saudi Arabia:	1
			Tunisia:	5
Active Cl_2 mg/L	1	1	Arab League:	1
			Germany:	0.5
			Morocco:	0.2
			Saudi Arabia:	0.5
			Tunisia:	0.05
Cyanides (CN^-)mg/L	0.1	0.1	Arab League:	0.1
			Egypt:	0.1
			Germany[72]:	0.1 – 2
			Morocco:	0.1
			Saudi Arabia:	0.05
			Tunisia:	0.05
Fluoride (F^-) mg/L	25	25	Arab League:	15
			Egypt:	0.5
			Germany:	20 –50
			Morocco:	15
			Tunisia:	3
Nitrate (NO_3) mg/L	90	90	Arab League:	90
			Egypt:	40
			Tunisia:	50
Phosphate (PO_4^{3-}) mg/L	5	5	Arab League:	5
			Egypt:	10
			Saudi Arabia:	1

[71] Except for surface disposal of waste, the ELV is 1 mg/L.

[72] In general 0.2, except for photographic processes (2 mg/L) and mineral oil processing (0.1 mg/L)

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مؤتمر المشاورات الوطنية لبرنامج لايف

١١-١٢ تشرين الثاني ١٩٩٥، فندق السمرلاند-بيروت

انطلق برنامج لايف اثناء قمة الأرض في ريو دي جانيرو سنة ١٩٩٢. عمل بهذا البرنامج في سبعة بلدان كمرحلة أولية من سنة ١٩٩٣ الى سنة ١٩٩٥. لقد تم تنفيذ ثلاثين مشروعاً في هذه البلدان السبعة وكانت على قدر كبير من النجاح. لقد انضمت خمسة بلدان جديدة الى برنامج لايف، من بينها لبنان، لتبدأ بالمرحلة الثانية من البرنامج.

يعتمد برنامج لايف على الحوار " المحلي – المحلي" لتخطيط وتنفيذ المشاريع البيئية. يتلخص هذا الحوار بالمشاركة الفعلية والتعاون بين مختلف الجهات المحلية و المركزية، العامة والخاصة، الرسمية والأهلية ، بالاضافة الى السكان المحليين لصنع القرار ، التنفيذ، والتقييم للمشاريع المراد تطبيقها في منطقة معينة. ان التعاون بين كل هذه الجهات يزيد من فعالية واستمرارية المشاريع بالاضافة الى كونه محفّزاً للمجتمع المحلي للاهتمام ببيئته.

لدى برنامج لايف خطوط عريضة يعمل على اساسها، منها ان المناطق التي ستستفيد من تقديماته يجب ان تكون مدنية (داخل المدن) وعلى مستوى متدني من الدخل العام. أما المشاكل البيئية التي يعمل عليها البرنامج فهي مختلفة وتتنوع من المياه الى الهواء، الصحة البيئية، التثقيف البيئي وغيرها.

اما هدف المشاورات الوطنية فهو التوصّل الى وضع استراتيجية وطنية للبرنامج في لبنان. تعتمد هذه الستراتيجية على الأولويات البيئية الملحّة في البلد، والمناطق الأكثر حاجة لتقديمات المشروع .

سيتولّى ادارة المشروع في لبنان فريق عمل مؤلف من المنسقة الوطنية لبرنامج لايف تساعدها لجنة اختيار وطنية ستتمثل فيها كافة القطاعات العامة والخاصة والرسمية والأهلية. سيتم انتخاب هذه اللجنة من قبل المشاركين في مؤتمر المشاورات.

موجز عن مرفق المبادرة المحلية للبيئة الحضرية
Local Initiative Facility For Urban Environment
(LIFE)

خلفية:

يعد المعدل السريع والهائل للزحف الحضري بالدول النامية سببا اساسيا في استنفاد الموارد الطبيعية واطلاق نفايات غير معالجة في البيئة مما ينتج عن حدوث مشاكل صحية خطيرة وبخاصة في المناطق الحضرية الفقيرة. ان الحكومات المركزية تفتقر للموارد اللازمة والقدرة على الاستجابة الفعالة لتدهور البيئة الحضرية. وبالتالي فانه من الضروري دعم المبادرات المحلية التي تتقدم بها الحكومات المحلية والمنظمات غير الحكومية وجمعيات خدمة المجتمع (CBO's) . ويوجد اعتراف متنامي بين الحكومات في الدول النامية وهيئات المنح المتعددة الاطراف والثنائية بالدور الحيوي الذي تلعبه الحكومات المحلية والمنظمات غير الحكومية وجمعيات خدمة المجتمع في مجال نشر وتنشيط البيئة والتنمية الحضرية المتواصلة.

ونتيجة للكثير من الانشطة العالمية خلال العام الماضي من بينها برامج تأخي المدن، وكذلك تركيز المنظمات غير الحكومية والمنظمات متعددة الاطراف على دور المدن والمجتمعات في تحسين البيئة الحضرية اعد مؤتمر الامم المتحدة حول البيئة والتنمية (UNCED) "برنامج اعمال ٢١" الذي يتضمن مقاطع حول مبادرات السلطة المحلية والتجمعات السكنية البشرية.

ونتيجة لذلك فكان على برنامج الامم المتحدة للتنمية (UNDP)، بوصفه المنظمة المسؤلة عن عمليات التسويل والتنسيق المركزية لكل انشطة التعاون الفني الخاص بالامم المتحدة ومعترف به من قبل مؤتمر الامم المتحدة حول البيئة والتنمية (UNCED) في هذا السياق ، ان يؤدي دور الوسيط في تعبئة موارد اضافية تدعم عملية التنسيق الاساسية للأنشطة ودعم حوار التنمية بين الحكومات المحلية والمنظمات غير الحكومية وجمعيات المجتمعات والهيئات المانحة الثنائية ومتعددة الاطراف.

<u>وبالتالي فانه تقرر اقامة مرفق المبادرات المحلية للبيئة الحضرية (LIFE) للأسباب التالية:</u>

ان الجمعيات المحلية تفتقر الى سبل الحصول على المعونة الفنية الدولية لتحسين البيئة، لان استراتيجيات التنمية الحضرية لم ترسخ آليات المشاركة. لذلك يجب ان يتحول وينصب الاهتمام على تقوية الحكومات المحلية وتنشيط الحوار المحلي، وهنالك ايضا اجتياح لابداء المرونة عند وضع برامج المعونة الفنية كي ينسنى الاشتراك الفعال من جانب المنظمات غير

الحكومية والمجتمعات في تنفيذ البرنامج ويجب اشتراك الحكومات المحلية لضمان زيادة المبادرات الموجهة للمجتمعات.

وصف البرنامج:

ان الهدف الرئيسي للمرفق هو تنشيط الحوار "المحلي – المحلي" بين المحليات والمنظمات غير الحكومية وجمعيات تنمية المجتمع لتحسين نوعية البيئة الحضرية . اما الاهداف المحددة هي:

١) اختبار وعرض الاستراتيجيات والعمليات والمشاريع ذات النطاق الصغير المبنية على حوار على المستوى المحلي.

التنفيذ:

ان الدول "الرائدة" الـ٢٤ جرى اختيارها وفقا لمعيارين او اكثر من المعايير الآتية:

التوازن الاقليمي بين الدول ، وجود عمليات وممارسات وقوى ديموقراطية للسلطات المحلية، وجود انشطة ناجحة لتحسين البيئة على نطاق متغير وتتوفر لها امكانية التغيير الداخلي والنسخ، ودرجة دعم هذه الانشطة.

في المرحلة الاولى من برنامج مرفق المبادرة المحلية للبيئة الحضرية(LiFE) سيشرع في تنفيذه ٨ دول ، دولتين في كل منطقة جغرافية.

في كل دولة جرى اختيارها ستجري مشاورات بالمشاركة ستضم المنظمات غير الحكومية وجمعيات المجتمع والسلطات المحلية والقطاع الخاص لكي يتسنى وضع اولويات ارشادية عامة لانتقاء المشاريع المحلية والتنفيذ واجراء المشاورات مع المجموعات النسائية والقيادات النسائية وسيجري تشكيل لجنة اختيار من جانب الاطراف المعنية كمتابعة للمشاورات.

وستكون اللجنة من ممثلي المنظمات غير الحكومية وجمعيات المجتمع والقطاع الخاص والسلطات المحلية الحضرية وممثل لبرنامج الامم المتحدة للتنمية(UNDP) وممثلي الجهات المانحة الثنائية التي تقدم اسهامات للمرفق.

وستتلقى اللجنة طلبات التمويل وتقوم بمراجعة واختيار المشاريع المستحقة للمنح. وسيشرف برنامج الامم المتحدة للتنمية على تنفيذ وتقويم المشاريع.

وبعد اختيار المشاريع من جانب اللجنة، سيوقع ممثل برنامج الامم المتحدة للتنمية المقيم على اتفاق مع كل ملتقى للمنحة يوضح ويحدد الانشطة التي سيجري تنفيذها وجدول المدفوعات واجراء المراقبة وتقديم التقارير.

ستكون الادارة المالية النهائية لمرفق المبادرة للبيئة الحضرية هي صندوق الائتمان التابع لمرفق المبادرة المحلية للبيئة الحضرية(LIFE) التي سيقام داخل الادارة المالية في مقر برنامج الامم المتحدة للتنمية. وتشمل مصادر التمويل برنامج الامم المتحدة للتنمية الجهات المانحة الثنائية وشبكات المدن في الدول المتقدمة والمؤسسات الخاصة والشركات والحكومات القومية والهيئات الدولية.

سيبدأ المرفق مرحلة تجريبية مدتها عامان وبعد تقويم آثار واسلوب العمل سيستفيد المرفق من نتائج وتوصيات عمليات التقويم.
وسيتم استنباط وتطوير اساليب المراقبة بالمشاركة والتقويم ويجري استخدامها من جانب المجموعات المحلية وشبكات المدن والمنظمات غير الحكومية.

مدخلات:

ان المدخلات الرئيسية على مستوى الدول ستكون في شكل منح للمجموعات المعنية بخدمة المجتمع والمنظمات غير الحكومية والمحليات، سيتوفر الدعم ايضا لعمليات لجان الاختيار والمنسقين القوميين والتقويم . وفي المقر ستكون المدخلات الرئيسية المنح لأنشطة ما بين الدول، خدمات واسفار هيئة العاملين ايضا من بين المدخلات.
سيدعم المرفق أ) العاملين المكلفين بنشر مبادرات القواعد، ب) عقود مع المؤسسات القومية للتدريب والبحوث والمنظمات غير الحكومية والمدن، ج) التدريب على المستوى المحلي ومستوى المجتمعات، د) التوثيق ونشر الحلول المحلية للمشاكل البيئية الحضرية.

المشاريع الاخرى السابقة او الجارية ذات الصلة:

سيتعاون المرفق مع الآليات والاجراءات والموارد التي جرى اعدادها بالفعل من جانب برنامج الامم المتحدة للتنمية لتنفيذ شبكة افريقيا ٢٠٠٠ ومبادرة آسيا المحيط الهادي ٢٠٠٠ وشبكة التنمية المتواصلة وبرنامج ادارة البيئة الحضرية فى امريكا اللاتينية وشركاء فى برنامج التنمية وبرنامج المرفق العالمي للمنح الصغيرة.
كما سيتعاون المرفق مع ويستفيد من البرامج الحضرية ذات الصلة التي تنفذها هيئات دولية اخرى خاصة برنامج الادارة الحضرية وبرنامج المدن المتواصلة وبرنامج المدن الصحية.

قائمة بالدول الرائدة:

الارجنتين	جاميكا	تايلاند
كوتديفوار	المغرب	تونس
بنجلاديش	موزمبيق	تركيا
البرازيل	نيبال	اوغندا
كولومبيا	نيجيريا	
كوستاريكا	باكستان	
مصر	بيرو	
اثيوبيا	الفلبين	
الهند	السنغال	
لبنان	تنزانيا	

Parameter	ELV for existing facilities[52]	ELV for new facilities	International ELVs
Sulphate (SO_4^{2-}) mg/L	1,000	1,000	Arab League: 1,000 Egypt: 1 Germany: 600 – 3,000 Tunisia: 1,000
Sulphide (S^{2-})mg/L	1	1	Arab League: 5 Germany: 0.3 – 2 Morocco: 1 Tunisia: 0.1

B 4.1.4 Environmental Limit Values (ELV) for waste water discharged into the sewerage system

The following ELVs have the character of guidelines as no as long operation guidelines and statutes exist for the municipal waste treatment plants. After the construction of the municipal waste water treatment plants the industrial facilities need to agree on contracts with the operators. These contracts will determine the detailed characteristics of the waste water which can be discharged based on local conditions and the fees for waste water treatment.

Parameter	ELV for existing facilities[73]	ELV for new facilities	International ELVs
pH	6 – 9	6 – 9	Morocco: 6.5 – 8.6 Saudi Arabia: 5 -10 Tunisia: 6.5 – 9.5
Temperature	35°C	35°C	Morocco: 35°C Tunisia: 35°C
BOD_5 mgO_2/L[74][75][76]	125	125	Morocco: 500 Tunisia: 400
COD mgO_2/L[77][78][79]	500	500	Morocco: 1,000 Tunisia: 1,000
Total Phosphorous mgP/L[80][81]	10	10	Morocco: 10 Germany: 1.5 – 3
Total Nitrogen, TN mg/L[82]	60	60	

73 These ELVs are valid at least until the final ratification of the new Barcelona LBS protocol has been completed for the Republic of Lebanon

74 Performance of waste water treatment plant related to the concentration in the inflow: 70 – 90%, ELV at outlet: 25 mg/L O_2

75 New waste water treatment plants will be state-of-the-art

76 Assuming an outlet concentration of 25 mg/l and a cleaning capacity of 80%

77 Performance of waste water treatment plant related to the concentration in the inflow: 75%, ELV at outlet: 125 mg/L O_2

78 New waste water treatment plants will be state-of-the-art

79 Assuming an outlet concentration of 125 mg/L and a cleaning capacity of 75%

80 Assuming an outlet concentration of 2 mg/l and a cleaning capacity of 80%

81 Performance of waste water treatment plant related to the concentration in the inflow: 80%, ELV at outlet: 2 mgP/L

82 Connected to biological waste water treatment plant. Performance of waste water treatment plant related to the concentration in the inflow: 70 – 80%, ELV at outlet: 15 mg/L N

Parameter	ELV for existing facilities[73]	ELV for new facilities	International ELVs	
Suspended Solids mg/L	600	600	Morocco: Tunisia:	600 400
AOX	5	5	Berlin: Morocco:	0.5 5
Salmonellae	absence	absence	Arab League: Morocco:	absence absence
Hydrocarbons mg/L	20	20	Morocco:	20
Phenol index mg/L	5	5	Morocco:	5
Oil and Grease mg/L	50	50	Morocco:	50
Total Organic Carbon (TOC) mg/L	750	750	Saudi Arabia:	1,000
Ammonia (NH^{4+}) mg/L[83]	-	-		
Silver (Ag) mg/L	0.1	0.1	Berlin[84]: Morocco: Tunisia:	0.2 0.1 0.1
Aluminium (Al) mg/L	10	10	Tunisia:	10
Arsenic (As) mg/L	0.1	0.1	Berlin: Morocco: Saudi-Arabia: Tunisia:	0.05 0.1 1 0.1
Barium (Ba) mg/L	2	2	Morocco: Tunisia:	1 10
Cadmium (Cd) mg/L	0.2	0.2	Berlin: Morocco: Saudi Arabia: Tunisia:	0.02 0.2 0.5 0.1
Cobalt (Co) mg/L[85]	1	1	Morocco: Tunisia:	1 0.5
Chromium total (Cr) mg/L[86]	2	2	Berlin: Morocco: Saudi Arabia:	0.2 2 2
Hexavalent Chromium (Cr^{VI}) mg/L[87]	0.2	0.2	Morocco: Tunisia:	0.2 0.5
Copper total (Cu) mg/L[88]	1	1	Berlin: Morocco: Saudi Arabia: Tunisia:	0.3 1 1 1

[83] Connected to biological waste water treatment plant. Performance of waste water treatment plant related to the concentration in the inflow: 70 – 80%, ELV at outlet: 15 mg/l N

[84] Regulation at Federal level: limit value which requires permission

[85] Hazards emanating from cobalt compounds are slight when compared to other heavy metals, but ELV of 0.5 mg/L must be kept at the outlet of WWTP (on agreement with WWTP operator).

[86] This weaker ELV is justifiable if ELV for Chromium (VI) is kept.

[87] Due to toxic potential strict ELV is proposed.

[88] But ELV of 0.5 mg/L must be kept at the outlet of WWTP (on agreement with WWTP operator).

Parameter	ELV for existing facilities[73]	ELV for new facilities	International ELVs	
Iron total (Fe) mg/L	5	5	Morocco: Tunisia:	3 5
Mercury total (Hg) mg/L	0.05	0.05	Berlin: Morocco: Saudi Arabia: Tunisia:	0.005 0.05 0.01 0.01
Manganese (Mn) mg/L	1	1	Morocco: Tunisia:	1 1
Nickel total (Ni) mg/L[89]	2	2	Berlin: Morocco: Saudi Arabia: Tunisia:	0.2 0.5 2 2
Lead total (Pb) mg/L[90]	1	1	Berlin: Morocco: Saudi Arabia: Tunisia:	0.2 0.5 1 1
Antimony (Sb) mg/L	0.3	0.3	Morocco: Tunisia:	0.3 0.2
Tin total (Sn) mg/L	2	2	Morocco: Tunisia:	2 2
Zinc total (Zn) mg/L[91]	10	10	Berlin: Morocco: Saudi Arabia: Tunisia:	0.5 5 10 5
Cyanides (CN^-)mg/L	1	1	Morocco: Saudi Arabia: Tunisia:	1 1 0.5
Fluoride (F^-) mg/L	15	15	Morocco: Tunisia:	15 3
Nitrate (NO_3) mg/L[92]	-	-	Tunisia:	90
Phosphate (PO_4^{3-}) mg/L[93]	-	-		
Sulphate (SO_4^{2-}) mg/L	1,000	1,000	Morocco: Tunisia:	400 400
Sulphide (S^{2-})mg/L	1	1	Morocco: Tunisia:	1 3

B 4.2 Environmental limit values for stack emission

The evaluation of the current situation is carried out by a comparison of the mentioned general and individual regulations. The results should lead to the proposed limit values.

89 ELV of 0.5 mg/L must be kept at the WWTP outlet (on agreement with WWTP operator).

90 ELV of 0.5 mg/L must be kept at the WWTP outlet (on agreement with WWTP operator).

91 ELV of 5 mg/L must be kept at the WWTP outlet (on agreement with WWTP operator).

92 ELV for total nitrogen has to be kept

93 ELV for total phosphor has to be kept

The following statements give a summary of the main backgrounds characterising the proposed draft of the proposed Lebanese standards.

- Existing Lebanese industrial standards do not differ widely from German or European standards.
- Thai standards should describe the maximum margin of tolerance for existing branches.
- A minimum stack height regulation for generators will be introduced correlated with minimum demands on the emissions.
- Density of population and industry is comparable to selected German industrialised areas.
- Respect to economic situation and the conditions of fuel consumption.
- Fixing a state-of-the-art for new plants.
- Demands on the optimal operation of a process.
- Reduction of exhaust gas flow up to the minimum (O_2 reference value).
- Deployment of material which causes a minimum of emissions or hazardous influence.

General stack ELVs for Lebanon

Fig. B-14 shows the proposed general stack ELVs for Lebanese industrial branches. The values are given in two categories:

- A: for "new" plants
- B: for existing plants

This method is carried out to give a margin of tolerance to protect existing industry on the one hand and to protect or improve the state-of-the-art on the other hand. The assignment of different pollutants to the respective groups is also given in Fig. B-14, the list and classification for gaseous organic compounds is only shown in Annex D 6 due to the large extent of the list.

Parameter	Lebanon		Remark
Dust [mg/m³]	200 (A), 500 (B)		non containing hazardous compounds
Particulate inorganic pollutants [mg/m³]			
	group I	1	mass flow > 5 g/h
	group II	10	mass flow > 25 g/h
	group III	30	mass flow > 50 g/h
Gaseous inorganic pollutants [mg/m³]			
	group I	1	mass flow > 50 g/h
	group II	5	mass flow > 300 g/h
	group III	30	mass flow > 1 kg/h
SO_x, NO_x	group IV	500	mass flow > 10 kg/h
Gaseous organic pollutants [mg/m³]			
	group I	20	mass flow > 500 g/h
	group II	100	mass flow > 4 kg/h
	group III	200	mass flow > 6 kg/h
Cancer causing pollutants [mg/m³]			
	group I	0.2	mass flow > 5 g/h
	group II	2	mass flow > 10 g/h
	group III	10	mass flow > 50 g/h

Particulate inorganic pollutants			
group I	group II	group III	group IV
Cd, Hg, Tl	As, Co, Ni, Se, Te	Sb, Pb, Cr, CN, F, Cu, Mn,	-

		Pt, Pd, Rh, V, Sn	
Gaseous inorganic pollutants			
group I	**group II**	**group III**	**group IV**
H As, Cl CN, Phosgene, H P,	H Br, Cl_2, H CN, H F, H_2S,	HCl not mentioned at group I	SOx, NOx
Cancer causing pollutants			
group I	**group II**	**group III**	**group IV**
Asbestos, Benzo(a)pyren, Beryllium and it's breathable compounds containing Be, Dibenz(a,h)anthracen, 2-Naphthylamin	Arsenic oxides, several Cr (IV) and Cr (III) compounds, Co, Ni and its several breathable compounds in Be, 3,3'-Dichlorbenzidin Dimethylsulphate Ethylenimin	Acrylnitril, Benzene, 1,3-Butadien, 1-Chlor-2,3-Epoxypropan (Epichlorhydrin), 1,2-Dibromethane, 1,2-Epoxypropane, Ethyleneoxide, Hydrazine, Vinylchlorid	-

Fig. B-14: Assignment of pollutants to the groups

Explanations to the proposed ELVs
Dust
The maximum ELV for dust (particulate matters) does not exceed the Thai ELV (500 mg/m³) in case of category B plants. Talking about general regulations a concentration of 200 mg/m³ for category A plants is an acceptable value to regulate several types of industry. A reduction in emission level will be reached by using individual regulations.
Particulate / gaseous inorganic pollutants
The ELVs are adapted from Thai and German standards. A comparison between German and Thai standards with regard to the particulate inorganic pollutant is hardly possible because of the combination of ELVs for some inorganic pollutants with the ELV for dust. Using the "mass flow remark" a definition of the implementation area is built up. That means plants with a lower mass flow are not regulated by this General Regulation. The result of this method may cause the improvement of an industrial process by the operators with the aim being out of regulation which could reduce costs.
Gaseous organic pollutants
The adaptation of the ELV is primarily an estimation considering twice the German limits.
Cancer causing pollutants
In principle, cancer causing substances should be avoided in the operation as much as possible. The estimated relevance of these pollutants is converted to ELVs by using twice the German ELVs whilst increasing the mass flow limit.

Fig. B-15: Comments on the general regulations -G-

Individual regulations for single branches

Different branches of industry can be distinguished through process engineering and have different opportunities concerning their economic capability to reduce emissions. Thus, it is necessary to develop individual regulations for single industries. Individual regulations have been developed for the following industries and processes:

1. Energy sector
   - 1a. Combustion plants fired with oil: boilers, steam-, energy production > 1 MW and < 50 MW thermal capacity

- 1b. Combustion plants fired with oil > 50 MW thermal capacity
- 1c. Additional requirements for plants > 50 MW < 100 MW thermal capacity
- 1d. Additional requirements for plants >100 MW < 300 MW thermal capacity

2. Generators operated with oil > 0,5 MW
3. Cement Industry
4. Glass Industry
5. Battery Manufacturing
6. Electroplating Industry
7. Aluminium Manufacturing
8. Food Industry
9. Municipal Waste Incinerators.

The following tables show the proposed Lebanese specific ELVs for stack emissions. The ELVs are developed for the primary process of a plant. It is actually possible that there more than one process is carried out at one branch. In this case corresponding regulations have to be used for each process. In the case of pollutants emitted which are not mentioned in the individual regulations, the general regulationss have to be followed.

1. Individual regulations for the energy sector

a. Combustion plants fired with oil: boilers, steam-, energy production > 1 MW and < 50 MW thermal capacity

Parameter	Category A	Category B	Remark
O_2 correction	3%	5%	
dust [mg/m³]	150	500	
CO [mg/m³]	250	1,000	
NO_x (calculated as NO_2) [mg/m³]			
diesel fuel (European standard)	300	800	
other fuel	500	1,000	
SO_x (calculated as SO_2) [mg/m³]			
diesel fuel (European standard)	-	-	
other	1,700	3,500	

O_2 correction

With respect to the operation of old boilers, an unstable condition may cause higher O_2 contents in the exhaust gas. In this case the suggested O_2 correction factor for B category plants is 5%.

Dust

For category A plants a stricter regulation in comparison to the general limits is proposed because of a higher relevance of the energy branch. For B category boilers the general category B value should be followed.

CO / NO_x

For category A plants a slightly weaker regulation in comparison German limits is proposed to create a margin of tolerance considering possible variations on the adjustment of burners. Category B boilers should meet the range of Thai standards.

SO_x

Category B: boilers should operate as efficiently as possible

Target: SO_2 reduction should be reached by using a fuel with an S content of a maximum of 2% as a first step. The concentration of 3,500 mg/m³ correlates to this maximum S content.

Fig. B-16: Explanations on the derived ELVs on combustion plants fired with oil > 1 MW and < 50 MW thermal capacity.

1b. Combustion plants fired with oil > 50 MW thermal capacity

Parameter	Category A	Category B	Remark
O_2 correction	3%	5%	
dust [mg/m³]	50	250	
As+Pb+Cd+Cr+Co+Ni	5	15	
CO [mg/m³]	250	1,000	
NO_x (calculated to NO_2) [mg/m³]	500	1,000	
SO_x (calculated to SO_2) [mg/m³] diesel fuel (European Standard) other	 - 2,500	 - 3,5000	

1c. Additional requirements for plants > 50 MW < 100 MW thermal capacity

Parameter	Category A	Category B	Remark
SO_x (calculated as SO_2) [mg/m³] diesel fuel (European Standard) other	 - 2,000	 - 3,5000	

1d. Additional requirements for plants >100 MW < 300 MW thermal capacity

Parameter	Category A	Category B	Remark
SO_x (calculated to SO_2) [mg/m³] diesel fuel (European Standard) other	 - 2,000	 - 3,5000	
HCL	100	200	
HF	10	20	

Additional regulations for inorganic pollutants are proposed because of the greater relevance during increasing plant scales. With respect to the fuel composition (higher sulphur content) the proposed regulations describe weaker regulations than those used in German practice.

Fig. B-17: Explanations on the derived ELVs on combustion plants > 50 MW

2. Generators operated with oil > 0.5 MW

Parameter [94]	Category A	Category B	Remark
O_2 correction	5%	5%	
dust [mg/m³]	20 150 250	20 150 250	using soot filter diesel fuel other fuel
CO [mg/m³]	800	1,500	
NO_x (calculated to NO_2) [mg/m³] < 3 MW / > 3 MW thermal capacity	4,000 / 2,000	6,000	
SO_x (calculated to SO_2) [mg/m³] diesel fuel (European Standard) other	 - 3,000	 - 3,000	

The development of ELVs for category A generators (except of SO_2) is carried out by reviewing current state-of-the-art. Therefore emissions of best available techniques are only 50 % of the above mentioned values for NO_X. Category B values represent the technology

[94] For generators ELVs or minimum stack height approach has to be used.

level of the 1970/80's and can be achieved at the facilities by a correct adjustment of the engines.

Fig. B-18: Explanations on the derived ELVs on generators > 0.5 MW

B.4.2.1.1 Minimum stack height approach for generators

Instead of applying ELVs for generators a minimum stack height is proposed for the release of exhaust gases. This means that an operator of a plant can choose whether he meets the ELVs on the one hand or installs a capacity correlated stack height on the other hand to fulfil the demands on the necessary dilution of the emissions. The proposed formula for the stack height has been developed by the Andhra Pradhesh Pollution Control Board (West India):

$$H = h + 0.2 \cdot \sqrt{kVA}$$

H = Total stack height in metres
h = Height of neighbouring buildings in metres
kVA = Total generator capacity of the set in kVA = kW, i. e. the total capacity which is determined by the maximum fuel (energy) input.

Total generator capacity [kVA = kW]	500	1,000	1,500	2,000	2,500	3,000	3,500	14,000
Building height inside 50 m diameter or average building height in neighbourhood [m]	15	15	15	15	15	15	15	15
Minimum stack height above ground [m]	19	21	23	24	25	26	27	39

Fig. B-19: Examples of the calculated minimum stack heights

The minimum stack height is related to the following conditions:

Area of applicability: > 500 total generator capacity [kVA = kW]
Minimum height: 1 m + height of neighbouring buildings in [m] (inside 50m diameter from the stack or the average building height in the neighbourhood)
Minimum exhaust gas velocity: 15 m/s
More than one generator: total capacity
< 500 total generator capacity [kVA= kW]: 1 m + height of installation hall

3. Cement Industry

Parameter	Category A	Category B	Remark
O_2 correction	-	-	not necessary
NO_x (calculated to NO_2) [mg/m³]		2,500	
	1,500 2,000		grate firing preheater Cyclone preheater
O_x (calculated to SO_2) [mg/m³]	500	850	
In the case of waste incineration	G^{95}	G	

Glass Industry

Parameter	Category A	Category B	Remark
$_2$ correction	13 %	13 %	
$_xO_x$ (calculated to NO_2) [mg/m³]	1,200	4,000	Harbour-Furnaces

Use the general regulations

Parameter	Category A	Category B	Remark
	1,600 2,000 3,500		Tub-Furnaces U-Flame-Tubs Cross-Over-Flame Tubs
SO_x (calculated to SO_2) [mg/m³]	 1,300 2,000	3,500	 Harbour-Furnaces Melting furnaces

5. Battery Manufacturing

Parameter	Category A	Category B	Remark
O_2 correction	-	-	not necessary
dust [mg/m³]	0.5	10	dust contains heavy metals
H_2SO_4 [mg/m³]	1	10	

6. Electroplating Industry

Parameter	Category A	Category B	Remark
O_2 correction	-	-	not necessary
dust [mg/m³]	20	50	dust contains hazardous substances

7. Aluminium Manufacturing

Parameter	Category A	Category B	Remark
O_2 correction	-	-	not necessary
dust [mg/m³]	40	150	
Cl_2 [mg/m³]	5	10	
Total carbon of organic pollutants [mg/m³]	150	150	
(PCDD / PCDF [ng/m³])	1	1	melting processes exhaust gas > 0.5 g/h

8. Food Industry

In the case of the food industry there are a lot of possible variations. In general, they can be classified to groups working on foods, semi-luxury foods, fodder and agricultural products. The most important branches in Lebanon are the dairy industry, flour mills, edible oil and vanaspati production. In general, the food industry produces odour emissions (e.g. farms, drying, smoking) and dust (e.g. sugar, flour mills) from their processes. Emissions of secondary processes are related to the steam and energy production as well as to other thermal processes (e. g. drying processes).

Parameter	Category A	Category B	Remark
O_2 correction	-	-	not necessary
odour emissions [GE/m³]	avoid high odour emissions	avoid high odour emissions	
dust [mg/m³]	100	200	

9. Municipal Waste Incinerators

Parameter	Category A	Category B	Remark

Parameter	Category A	Category B	Remark
O_2 correction	11 %	-	
Capacity < 0.75 t/h			
dust [mg/m³]	30	-	
CO [mg/m³]	100	-	
Total carbon of organic pollutants [mg/m³]	20	-	
SO_x (calculated to SO_2) [mg/m³]	100	-	
H Cl [mg/m³]	50	-	
H F [mg/m³]	2	-	
Capacity > 0.75 t/h			
dust [mg/m³]	30	-	
CO [mg/m³]	100	-	
Total carbon of organic pollutants mg/m³]	20	-	
SO_x (calculated to SO_2) [mg/m³]	200	-	
NO_x (calculated to NO_2) [mg/m³]	400	-	
HCl [mg/m³]	60	-	
HF [mg/m³]	4	-	
Hg [mg/m³]	0.05	-	
Cd + Tl [mg/m³]	0.05	-	
Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V+S mg/m³]	0.5	-	
PCDD / PCDF [ng/m³]	0.1	-	

Currently no waste incinerators are in operation in Lebanon. In the case of the construction of a new plant higher standards should be adopted. The German ELVs mentioned above are roposed for Lebanese regulations. For large scale incinerators more detailed technical egulations are necessary (e.g. EU guideline 89/369/EWG or 89/429/EWG).

Industrial branches regulated by general regulations

he following list contains suggested branches limited by general regulations. These are branches which obviously do not represent relevant emitters in Lebanon:

Breweries
- Pulp and paper
- Rubber

Tanneries
- Textiles
- Chemical (organic)

Integrated iron & steel
- Pesticide industry
- Steel mills.

Existing old branches

In the case of missing individual regulations authorities have to make sure that the operation a plant will not cause hazardous influence on the neighbourhood in compliance with an established environmental law. Measures to reduce emissions have priority against improving the exhaust conditions.

Examples for exhaust gas cleaning systems

Dust removal

Electrostatic precipitator
- Input up to 100-200 gr/m³
- Output < 10 mg
- Combustion gases

Bag filters
- Costly efficient around 100,000 m³/h
- Maximum exhaust gas temperature about 150 °C
- Maximum exhaust gas flow about 50,000 m³/h
- useful in combination with limewash injection

Cyclone / gravity separator
- Big particulates

Soot filter (ceramics)
- Capacity 10.000 m³/h
- Mainly used at generators
- Capable of regeneration
- Allows maximum concentrations of about 50 mg/m³

Nitrogen oxides removal

Ammonia Injection
- Efficiency only for large scale incineration plants

Low-NOx-Burners
- Recirculation
- multi-stage combustion
- DENOX-Steam-Injection (into flame)
- efficient primary measure

Desulphurisation

Wet Scrubber
Limewash Injection (dry
- Adjustable to scale of plant
- Efficient for combustion processes in combination with bag filter.

Removal of gaseous organic pollutants

Thermal Combustion
Regenerative Incineration
- High-range of input concentration possible

Catalytic conversion
- Only for small exhaust gas flows (0.2 m³/h)

Activated-charcoal filter
- Highly Efficient
- Costly in operation
- useful around 100 mg/m³ input concentrations

B 4.3 Hazardous waste management

According to the Basle Convention, to classify waste as hazardous waste, first of all, reference to domestic legislation is required. The national legislation shall specify the criteria and procedure needed to determine the class(es), division(s) and packing group(s) of a specific waste defined as or considered to be hazardous waste by such legislation. This national legislation does not exist in Lebanon. Therefore, the Consultant has decided to develop the National Standards very closely to the recommendations of the Basle Convention. The reasons are as follows:

- The Basle Convention provides a detailed, very well documented approach for the control of transboundary movement of hazardous waste. This approach can be easily adopted to be used for the management of hazardous waste at national level.
- Thus, only one system will be installed for the National Standards as well as compliance with the Basle Convention. This seems to be important because the draw-back for hazardous waste management is seen in the missing infrastructure for enforcement, control, treatment and disposal of hazardous waste in Lebanon. Having only one legal system will help to concentrate on the implementation of standards, not building up two different administrative systems.

For the definition of hazardous waste within the national legislation it is necessary to differentiate between hazardous waste as pure substance, where the composition is known, hazardous waste not fully specified, mixtures containing a specific hazardous waste, or mixtures containing two or more hazardous wastes. According to the recommendations of the Basle Convention, the Consortium intends to refer to and use the criteria for the classification and labelling of dangerous goods in transport contained in the United Nations Recommendations on the Transport of Dangerous Goods. The recommendations are widely used internationally through their adoption by international transportation authorities (air, sea, river, road and rail). These regulations have been considered when developing the definition of hazardous and non-hazardous waste in Annex VIII and Annex IX by the Secretariat of the Basle Convention, please refer to Annex D 16.

The Consultant is aware that these lists are not complete and would need to be extended to the national situation. In a discussion with the MoE, the Consultant will agree on a compromise between having a detailed list on the one hand and / or an easily to administrate system on the other.

According to the recommendations of the Basle Convention the Consultant suggests including the elements and models for "Management of Hazardous Wastes" and "Control of Transboundary Movements of Hazardous Wastes and their Disposal", which have been developed by the Secretariat of the Basle Convention. These elements and models were accepted by the second meeting of the Conference of the Parties to the Basle Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Geneva, 21 to 25 March 1994) by its decision II/5 entitled "Model National Legislation for the Transboundary Movement and Management of Hazardous Waste".

These models have been adopted to the local Lebanese situation. Adoptions have been marked and need to be discussed and agreed with the MoE during this reporting period.

Please refer to Annex D 15 for the draft National Legislation on the "Management of Hazardous Wastes" and "Control of Transboundary Movements of Hazardous Wastes and their Disposal".

With the final report this model legislation will be complemented with a control scheme for import and export of hazardous waste.

B 4.4 Implementation strategy

The implementation strategy will be part of the final report.

B 5 The national dissemination seminar

Subject of a later phase within the project.

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Section D Annexes

D 1 Summary of the relevant parts of decision 52/1

D 1.1 Annex no. 1: Standards for potable water (1)

Parameter	Unit	Guide Level	Max. Admissible Value	Methodology
Total coliforms	number/ 100 ml	0	0	
Faecal streptococcus	number/ 100 ml	0	0	
Faecal coliforms	number/ 100 ml	0	0	
Sulphide-reducing bacteria	number/ 20 ml	-	1	
Thermophilic coliforms	number/ 100 ml	0	0	
Salmonella	number/ 5 L	0	0	
Staphylococcus	number/ 100 ml	0	0	
Faecal bacteriophages	number/ 50 ml	0	0	
Enterovirus	number/ 10 L	0	0	

Fig. D-1: Microbiological parameters

Parameter	Unit	Guide Level	Max. Admissible Value	Methodology
Temperature	°C	12	25	
pH	pH unit	6.5<pH<8.5	9	
Electrical conductivity	mS/ cm at 20°C	400	-	
Chlorides (Cl)	mg/L Cl	25	200	
Sulphates (SO_4)	mg/L SO4	25	250	
Sodium (Na)	mg/L Na	20	150	
Potassium (K)	mg/L K	10	12	
Magnesium (Mg)	mg/L Mg	30	50	
Calcium (Ca)	mg/L Ca	100	-	
Total Aluminum (Al)	mg/L Al	0,05	0,2	
Dry residues	mg/L at 180°C	-	1500	

Fig. D-2: Physio-chemical parameters

Parameter	Unit	Guide Level	Max. Admissible Value	Methodology
Nitrates (NO_3)	mg/L NO_3	25	50	
Nitrites (NO_2)	mg/L NO_2	-	0	
Ammonium (NH_4)	mg/L NH_4	0,05	0,5	
Kjeldahl Nitrogen (N)	mg/L N	-	1	Kjeldahl method
Oxidation Potential	mg/L O_2	2	5	Potassium permanganate in an acid hot medium after 10 min.
Hydrogen Sulphide (H_2S)	mg/L H_2S	-	cannot be determined using organoleptic methods	
Phenols	ug/L phenol index	-	0,5	
Dissolved/ Emulsified Hydrocarbons	ug/L	-	10	Extraction with carbon tetrachloride
Reactive surface reagents	mg/L Lauryl Sulphate	-	0,2	Reaction with methylene blue

Fig. D-3: Undesirable parameters

D 1.2 Annex No. 1: Standards for potable water (2)

Parameter	Unit	Guide Level	Max. Admissible Value	Methodology
Iron (Fe)	µg/L Fe	50	200	
Manganese (Mn)	µg/L Mn	20	50	
Copper (Cu)	mg/L Cu	0,1	1	
Zinc (Zn)	mg/L Zn	0,1	5	
Phosphorus (P)	mg/L P_2O_5	0,4	5	
Silver (Ag)	µg/L Ag	-	10	
Fluor (F)	µg/L F	-	1500 (8°C-15°C) 700 (25°C-30°C)	
Barium (Ba)	µg/L Ba	100	-	
Organo-chloric compounds (other than pesticides)	µg/L	1	-	
Polycyclic aromatic hydrocarbons (PAH) - *Fluoranthene* - *Benzo (3,4) Fluoranthene* - *Benzo (11,12) Fluoranthene* - *Benzo (3,4) Pyrene* - *Benzo (1,12) Perylene* - *Indeno (1,2,3) Pyrene*	µg/L	-	0,2	
- *Benzo (3,4) pyrene*	µg/L	-	0,01	

Fig. D-4: Undesirable parameters (continued)

Parameter	Unit	Guide Level	Max. Admissible Value	Methodology
Chlorinated organic pesticides	µg/L	-	0,1	
Organophosphates	µg/L	-	0,1	
Carbamates	µg/L	-	0,1	
Herbicides	µg/L	-	0,1	
Fungicides	µg/L	-	0,1	
PCB	µg/L	-	0,1	
PCT	µg/L	-	0,1	
Aldrine	µg/L	-	0,03	
Dieldrine	µg/L	-	0,03	
Hexachloro-benzene	µg/L	-	0,01	
Total measured substances	µg/L	-	0,5	

Fig. D-5: Pesticides and similar compounds

Parameter	Unit	Guide Level	Max. Admissible Value	Methodology
Arsenic (As)	µg/L As	-	50	
Cadmium (Cd)	µg/L Cd	-	5	

Fig. D-6: Toxic substances

Parameter	Unit	Guide Level	Max. Admissible Value	Methodology
Cyanide (CN)	µg/L CN	-	50	
Total Chromium (Cr)	µg/L Cr	-	50	
Mercury (Hg)	µg/L Hg	-	1	
Nickel (Ni)	µg/L Ni	-	50	
Lead (Pb)	µg/L Pb	-	50 (in current waters)	
Selenium (Se)	µg/L Se	-	10	
Antimony (Sb)	µg/L Sb	-	10	

Fig. D-7: Toxic substances (continued)

Parameter	Unit	Guide Level	Max. Admissible Value	Methodology
Colour	mg/L Pt/Co	1	15	Platinum (Pt) or Cobalt (Co) Scale
Turbidity	Jackson	0,4	4	
Odor	Dilution rate 2 Dilution rate 3	0 at 12°C 0 at 25°C	2 at 12°C 3 at 25°C	
Taste	Dilution rate 2 Dilution rate 3	0 at 12°C 0 at 25°C	2 at 12°C 3 at 25°C	

Fig. D-8: Organoleptic parameters

D 1.3 Annex No. 2: Standards for raw surface water used for the production of potable water (1)

Parameter	Unit	Guide Level	Max. Admissible Value	Methodology
Colour after simple filtration	mg/L	10	20	Platinum (Pt) Scale
Odor	Dilution Factor at 25°C	3	-	

Fig. D-9: Organoleptic parameters

Parameter	Unit	Guide Level	Max. Admissible Value	Methodology
Temperature	°C	22	25	
pH	pH unit	6.5<pH<8.5	-	
Electrical conductivity	mS/ cm at 20°C	1000	-	
Chlorides (Cl)	mg/L Cl	200	-	
Sulphates (SO_4)	mg/L SO_4	150	250	
Suspended solids	mg/L	25	-	at 20°C without nitrification
BOD_5	mg/L O_2	<3	-	
Dissolved oxygen	$\%O_2$	>70	-	

Fig. D-10: Physio-chemical parameters

Parameter	Unit	Guide Level	Max. Admissible Value	Methodology
Nitrates (NO_3)	mg/L NO_3	25	50	
Ammonium (NH_4)	mg/L NH_4	0,05	-	
Kjeldahl Nitrogen (N) without NO_3	mg/L N	1	-	Kjeldahl method
Dissolved/ Emulsified Hydrocarbons	mg/L	-	0,05	Extraction with petroleum ether
Phenols	mg/L C_6H_5OH	-	0,001	
Reactive surface reagents	mg/L Lauryl Sulphate	0,2	-	Reaction with methylene blue
Extractable substances	mg/L	0,1	-	Extraction with chloroform
Dissolved Iron (Fe)	mg/L Fe	0,1	0,3	
Manganese (Mn)	mg/L Mn	0,05	-	
Copper (Cu)	mg/L Cu	0,02	0,05	
Zinc (Zn)	mg/L Zn	0,5	3	
Phosphorus (P)	mg/L P_2O_5	0,4	-	
Fluor (F)	mg/L F	0.7 - 1	1,5	
Boron	mg/L B	1	-	
Barium (Ba)	mg/L Ba	-	0,1	

Fig. D-11: Undesirable parameters

Parameter	Unit	Guide Level	Max. Admissible Value	Methodology
Arsenic (As)	µg/L As	-	50	
Cadmium (Cd)	µg/L Cd	-	5	
Cyanide (CN)	µg/L CN	-	50	

Fig. D-12: Toxic substances

D 1.4 Annex no. 2: Standards for raw surface water used for the production of potable water (2)

Parameter	Unit	Guide Level	Max. Admissible Value	Methodology
Total Chromium (Cr)	µg/L Cr	-	50	
Lead (Pb)	µg/L Pb	-	50	
Mercury (Hg)	µg/L Hg	-	1	
Selenium (Se)	µg/L Se	-	10	
Polycyclic aromatic hydrocarbons- PAH (total of 6 substances)	µg/L	-	0,2	
Total pesticides: Parathion (HCH) and Dieldrine	µg/L	-	1	

Fig. D-13: Toxic substances (continued)

Parameter	Unit	Guide Level	Max. Admissible Value	Methodology
Total coliforms	Colony/100 ml at 37°C	50	-	
Thermophilic coliforms	Colony/ 100 ml	20	-	
Fecal streptococcus	Colony/ 100 ml	20	-	
Salmonella	Colony/ 5000 ml	Absence	-	

Fig. D-14: Microbiological parameters

D 1.5 Annex no. 3: Standards for water quality suitable for aquatic life

Parameter		Guide Level	Max. Value
Temperature (°C)	(a) measured downstream a thermal effluent disposal point (at the limit of the mixing zone)	-	Natural Temp. + 1.5°C
	(b) The temp. of a thermal effluent downstream its disposal point (at the limit of the mixing zone) should not exceed:	-	21.5 10
Dissolved oxygen	(mg/L O2)	50% > 9	100% > 7
pH	pH unit	-	6 - 9
Suspended solids	mg/L	< 25	-
BOD_5	mg/L O_2	< 3	-
Total Phosphorus	mg/L PO_4	-	0.2 mg/L PO_4
Nitrites	mg/L NO_2	< 0.01	0,01
Phenolic compounds	mg/L C_6H_5OH		Concentrations lower than those causing fish meat tainting
Petroleum hydrocarbons			Must not form a visible film on the surface or sink to the water current or lake bed[96]. Must not cause fish tainting[97] Must not cause injury to fish[98]
Non-ionised ammonia	mg/L NH_3	< 0.005	< 0.025
Total ammonium	mg/L NH_4	< 0.04	< 1
Total residual Chlorine	mg/L HOCl	-	< 0.005
Total zinc	mg/L Zn	-	< 0.3
Soluble Copper	mg/L Cu	-	< 0.04

Fig. D-15: Standards for water quality suitable for aquatic life

96 Water quality suitable for aquatic life

97 Water quality suitable for fish

98 Water quality suitable for Salmons

D 1.6 Annex no. 4: Bathing water quailty standards

Parameters	Unit	Thresh.Level	Max. Adm. Value	Critical Aspects	Methodology
Oxidisable materials	mg/L O_2	-	4		in hot alkaline medium and $KMnO_4$
pH	pH Unit	-	6.9 - 8.2		
Number of aerobic bacteria at 37°C	Colony/ 100ml at 37°C	-	<100		
Total coliforms	Colony/ 100ml	-	<10		
Fecal coliforms	Colony/ 100ml	-	0*	For 90% of tested samples	
Staphylococcus	Colony/ 100ml	-	0*	For 90% of tested samples	
Irritation rate				The water should not irritate the eyes, skin and mucosa	
Transparency				The water is transparent enough to allow seeing clearly a small body of 30 cm side at the deepest end of the pool	

Fig. D-16: Standards for water quality in swimming pools

Parameters	Unit	Threshold Level	Max. Admissible Value	Critical Aspects	Methodology
Total coliforms	Colony/100ml	500	10000		
Thermophilic coliforms	Colony/100ml	100	200		
Fecal streptococcus	Colony/100ml	100	-		
Salmonella	Colony/ L	0	-		
Enterovirus	Colony/ 10L	0	-		

Fig. D-17: Microbiological standards for water quality in rivers, lakes and seawater

Parameters	Unit	Threshold Level	Max. Admissible Value	Critical Aspects	Methodology
pH	pH unit	6 - 9			
Colour		No change			
Mineral oils	mg/L	≤0.3			
Reactive surface reagents	mg/L Lauryl Sulphate	≤ 0.3			Reaction with methylene blue
Dissolved Oxygene	$\%O_2$	80 - 120			Saturation level
Tar and other floating materials		Absence			

Fig. D-18: Physico-chemical standards for water quality in rivers, lakes and seawater

D 1.7 Annex no. 5: Standards for urban wastewater quailty

Parameters	Pollution load
Suspended Solids	90 g
Oxidisable Materials	57 g
Amoniacal & Organic Nitrogen	15 g
Total Phosphorus	4 g

Fig. D-19: Daily pollution per inhabitant

Parameters	Pollution load
COD/ BOD_5	<2.5
COD	< 750 mg/ L
Kjeldahl nitrogen	< 100 mg/ L

Fig. D-20: Standards of wastewater before treatment (average sample over 24 hr, prior decantations for 2 hrs)

Sample	Parameter	General	For Salmonids	For human use/ consumption	Pool water
At the limit of the mixing zone	Max. increase in Temp. (°C)	Compatible with medium	1,5	-	-
	Max. Temp. (°C)	-	21,5	25	-
50m away of outfall	pH	5.9 - 9	6 - 9	6.5 - 8.5	6 - 9

Fig. D-21: Standards of wastewater regardless of the level of treatment

D 1.8 Annex no. 6: Minimal standards for domestic wastewater quality after treatment

Levels	Non-sedimented average sample over 24 hrs				Non-sedimented average sample over 2 hrs		
	Sediment-able materials	Total suspended solids	COD (mg/L)	BOD_5 (mg/L)	Suspended solids (mg/L)	COD (mg/L)	BOD_5 (mg/L)
a - Physical separation by gravity or flotation, and eventual screening	Sepa-ration up to 90%	-	-	-	-	-	-
b – Physico-chemical treatment (floculation /sedimentation)		Separation up to 80%	-	-	-	-	-
c – Same treatment as in (b), re-inforced		Separation up to 90%	-	-	-	-	-
d - Biological processes					120	120	40
e – Biological treatment with sedimentation			90	30	30	120	40
f - Re-inforced treatment (complementary sedimentation & treatment using active carbon)			50	15	20	80	20

Fig. D-22: Minimal quality for wastewater

Parameters	Concentration	Minimal reduction
Total Phosphorus	2 mg/L (equivalent to 10,000 to 100,000 inhabitants)	80%
	1 mg/L (equivalent to more than 100,000 inhabitants)	
Total Nitrogen	15 mg/L (equivalent to 10,000 to 100,000 inhabitants)	70 - 80 %
	10 mg/L (equivalent to more than 100,000 inhabitants)	

Fig. D-23: Quality standards for nitrogenous and phosphoric effluents after treatment

D 1.9 Annex no. 7: Maximum allowable standards for wastewater and solid waste disposal in surface water bodies, groundwater and seawater within the national terrritorial limits (effluents and waste with negligible toxicity)

Conditions	Disposal in rivers	Disposal in water currents, lakes & ponds	Disposal in seawater	Surface spreading	Buried
Maximal pollution flux per real no. of inhabitants/ or equivalents	500	500	500	500	150
Hydrocarbon load (g/ day)	100	10	100	100	30
Cyclic hydroxylated compounds (g/ day)	10	1	10	10	5

Conditions	Disposal in rivers	Disposal in water currents, lakes & ponds	Disposal in seawater	Surface spreading	Burried
Dissolved solids (kg/ day)	300	30	-	300	100
Total nitrogen & phosphorus (g/ day)	-	500	-	-	-
Total nitrogen & phosphorus (kg/ ha/ yr)	-	-	-	300	-
Growth inhibitors	Biologically undetectable	Biologically undetectable	Biologically undetectable	Biologically undetectable	Biologically undetectable

D 1.10 Annex 8: Standards for the Disposal of Non-domestic Effluents in the Sea Within National Waters (Disposal at more than 500m off the coast)

Parameter	Unit	Max. Value
Temperature	°C	35
pH	pH units	6 - 9
Colour		Absence
BOD_5	mg O_2/ L	60
COD	mg/ L	100
Dissolved material	mg/ L	200
Dry residues at 150°C	mg/ L	1800
Suspended solids	mg/ L	60
Turbidity	NTU	50
Sulphates	mg/ L	1
Oil & grease	mg/ L	15
Petroleum hydrocarbons	mg/ L	0,5
Phosphates (PO_4)	mg/ L	5
Nitrates (NO_3)	mg/ L	40
Phenols	mg/ L	1
Fluorides	mg/ L	1,5
Aluminium	mg/ L	3

Parameter	Unit	Max. Value
Ammonium (NH_4)	mg/ L	3
Mercury	mg/ L	0,005
Lead	mg/ L	0,5
Cadmium	mg/ L	0,05
Arsenic	mg/ L	0,05
Total Chromium	mg/ L	1
Copper	mg/ L	1,5
Nickel	mg/ L	0,1
Iron	mg/ L	1,5
Manganese	mg/ L	1
Zinc	mg/ L	5
Silver	mg/ L	0,1
Barium	mg/ L	2
Cobalt	mg/ L	2
Total pesticides	mg/ L	0,2
Cyanides	mg/ L	0,1
Total coliforms	colony/ 100 ml	5000

D 1.11 Annex 9: Maximum allowable standards for occupational air quality

1. Average exposure time: is the average exposure during a working day (8 hours), and to which an employee can be exposed during 5 day-week without physical harm
2. Short-time exposure: is the exposure limits to which an employee is exposed continuously for a period not exceeding 15 min. exposure to these limits should not exceed 4 times a day, and there should be a 60 min interval at least between each subsequent exposure to these limits.
3. Max. allowable limit: is the limit which cannot be exceeded even for a second.

4. When skin absorption is an additional route of exposure, the sign (+ skin) should be indicated next to short-term exposure limits.

Parameter	Average Value		Average Value for short Exposure		Notes
	ppm	mg/ m^3	ppm	mg/ m^3	
Acetylaldehyde	100	180	15	270	
Acetic Acid	10	25	10	37	Ca[99]
Acetone	750	1800	1000	2400	
Acetonitrile	40	70	60	105	
Acetylene tetra-bromide	1	14			Ca, Pc[100]
Acroleine	0,1	0,25	0,3	0,8	Ca, Pc
Acrylamide		0,03			Ca, Pc
Acrylonitrile	2		10		
Aldrine		0,25			Pc
Allylic chlorides	2	5	4	10	
Allyl chlorides	1	3	2	6	
2-amino pyridine	0,5	2			
Ammonia	25	18	35	27	
n-amyl acetate	100	525			
Sec-amyl acetate	125	650			
Anilin & homologues	2	8			Ca, Pc
Antimony & derivatives		0,5			
ANTU (Alphanaphthyl thiourea)		0,3			
Arsenic and soluble derivatives		0,01			Ca
Arsine	0,05	0,2			Ca
Azinphos-methyl		0,2			
Barium and soluble derivatives		0,5			
Benzene (C_6H_6)	1	3,25	5	16,25	Ca
Benzyl chlorides	1		5		
Berylium and derivatives		0,002			Ca
Biphenyl	0,2	1			

Fig. D-24: Maximum allowable standards for occupational air quality

99 Ca: carcinogen

100 Pc: Skin absorption

Parameter	Average Value		Average Value for short Exposure		Notes
	ppm	mg/ m^3	ppm	mg/ m^3	
Pentaborane	0,005	0,01	0,015	0,03	
Boron trifloride	1	3			
Bromium	0,1	0,7	0,3	2	
Bromoform	0,5	5			Pc
1,3 - butadiene	1000	2200			Ca
n-butyl acetate	150	710	200	950	
sec-butyl acetate	200	950	250	1190	
Ter-butyl acetate	200	950	250	1190	
n-butylic alcohol	50	150			Pc
Sec-butylic alcohol	100	305	150	455	
Ter-butylic alcohol	100	300	150	450	
Butyl amine	5	10			Pc
Ter-butyl Chromate (CrO_3)		0,1			Pc, Ca
n-butyl glycidyl ether	0,5	1,5			
Butyl mercaptan	25	135			
Cadmium dust		0,2			Ca
Cadmium smoke		0,1			
Calcium oxide		2			
Carbaryl		5			
Black carbon		3,5			
Carbon dioxide	5000	9000	30000	45000	
Carbon bisulphur (CS_2)	4	12	12	36	Pc
Carbon monoxide	35	40	200	229	
Carbon tetrachloride (CCl_4)			2	12,5	Ca
Chlordane		0,5			Pc, Ca
Chlorocamphene		0,5		1	Pc, Ca
Chlorinated biphenyl oxide		0,5		1	Pc, Ca
Chlore	0,5	1,5	1	3	
Chlore dioxide	0,1	0,3	0,3	0,9	
Chloro acetaldehyde	1 max.	3 max.			
Chlorobenzene	75	350			
Chlorobiphenyl (42% Cl)		1			Pc, Ca
Chloroform	2	9,87			Ca

Fig. D-25: Maximum allowable standards for occupational air quality (continued 2)

Parameter	Average Value		Average Value for short Exposure		Notes
	ppm	mg/ m^3	ppm	mg/ m^3	
Chloro methyl ether	0,001	0,005			Ca
Chloropicrin	0,1	0,7			
Chromium & derivatives		0,5			
Hexavalent chromium		0,001			Ca
Bi- & Trivalent Chromium (II & III)		0,5			
Volatile and soluble tar in benzene		0,2			Ca
Cobalt (dust & smoke)		0,015			
Copper (dust & aerosol)		1			
Copper (smoke)		0,1			
Raw cotton dust		0,2			
Cresols	5	22			Pc
Cumen	50	245			Pc
Cyanide salts		5			
Cyclohexane	300	1050			
Cyclopentadiene	75	200			
Cyclopentaue	600	1720	900	2580	
DDT		1			Ca
Decaborane	0,05	0,3	0,15	0,9	Pc
Diazinone		0,1		0,3	Pc
Dinitromethane	0,2	0,4			
Diborane	0,1	0,1			
Dibutyl phtalate		5			
O-dichlorobenzene	50	300 max.			
P-dichlorobenzene	75	450	110	675	Ca
1.2-dichloroethylene	200	790			
Dichloroethyl ether	5	30	10	60	Pc, Ca
Dichlorvos		1			Pc
Dieldrin		0,25			Pc, Ca
Dimethylaniline	5	25	10	50	Pc
Dinitrobenzene		1			Pc
Dinitro othocresol		0,2			Pc
Dinitrotoluene		1,5			Pc, Ca
Dioxane	25	90			Pc

Fig. D-26: Maximum allowable standards for occupational air quality (continued 3)

Parameter	Average Value		Average Value for short Exposure		Notes
	ppm	mg/ m^3	ppm	mg/ m^3	
Dipropylene glycol	100	600	150	900	Pc
Endrin		0,1			Pc
Epichlorhydrin	2	8			Pc, Ca
2-ethoxyethanol	200	740			Pc
Ethyl acetate	400	1400			
Ethyl acrylate	5	20	25	100	Pc, Ca
Ethyl bromide	200	890	250	1110	
Ethanolamine	3	8	6	15	
Ethyl benzene	100	435	125	545	
Ethyl butyl ketone	50	230			
Ethyl chloride	1000	2600			
Ethyl diamine	10	25			
Ethylene oxide	1	1,83	5	9,15	Ca
1,2-Dichloroethane	1	4	2	8	Ca
Ethylic ether	400	1200	500	1500	
Ethyl mercaptan	0,5	1			
Vanadium Ferric dust		1		3	
Fluorides		2,5			
Fluore	0,1	0,2			
Formaldehyde	1		2		Ca
Formic acid	5	9			
Heptachlore		0,5			Pc, Ca
n-heptane	400	1600	500	2000	
n-hexane	50	180			
2-hexanone	5	20			
Hydrazine	0,1	0,1			Pc, Ca
Hydrogen bromide	3	10			
Hydrogen cyanide			4,7	5	Pc
Hydrochloric acid	5	7			Max. Levels
Hydrofluoric acid	3		6		
Hydrogen peroxide	1	1,4			
Hydrogene selenide	0,05	0,2			
Hydrogen sulphide	10	14	15	21	
Iodine	0,1	1			Max. levels
Iron oxide (smoke)		10			

Fig. D-27: Maximum allowable standards for occupational air quality (continued 4)

Parameter	Average Value		Average Value for short Exposure		Notes
	ppm	mg/ m^3	ppm	mg/ m^3	
Isoamyl acetate	100	525			
Isoamylic alcohol	100	360	125	450	
Isobutyl acetate	150	700			
Isobutyl alcohol	50	150			
Isopropyl acetate	250	950	310	1185	
Isopropylic alcohol	400	980	500	1225	
Mineral lead (dust & smoke)		0,05			
Lindane	1000	1800			Pc
Liquified petroleum gases	1000	1800			
Magnesium oxide (smoke)		10			
Malathion		10			
Manganese dust & derivatives		5			
Mercury (vapour)		0,05			Pc
Organic mercury (alkyls)		0,01		0,03	Pc
Methoxychlore		10			Ca
methyl alcohol	200	260	250	325	Pc
Methyl acrylate	10	35			Pc
Methyl bromide	5	20			Pc, Ca
Methyl chloride	50	105	100	210	Ca
Methyl chloroform	350	1900	450	2450	
Methylene diphenyl isocyanide (MDI)	0,02	0,2			Max. Levels
Methylene chloride	500			1000 Max. level	Ca
Methyl hydrazine	0,2	0.35 Max. level			Pc, Ca
Methyl isocyanate	0,2	0,05			Pc
Methyl mercaptan	0,5	1			
Methyl parathion		0,2		0,6	Pc
Mevinphos, Phosolvin	0,01	0,1	0,03	0,3	Pc
Naphtaline	10	50	15	75	
Nickel carbonyl	0,001	0,007			
Nickel (metal)		1			
Nickel soluble derivatives		0,1		0,3	
Nicotine		0,5			Pc

Fig. D-28: Maximum allowable standards for occupational air Quality (continued 5)

Parameter	Average Value		Average for short Value Exposure		Notes
	ppm	mg/ m^3	ppm	mg/ m^3	
Nitric acid	2	5	4	10	
Nitric oxide	25	30			
P-nitroaniline		3			Pc
Nitrobenzene	1	5			
P-nitrochlorobenzene		1			Pc
Nitrogen dioxide			1	1,8	
Nitrogen trifluoride (NF_3)	10	30			
Nitroglycerine				0,1	Pc
Nitrotoluene	2	11			Pc
Octa chloro naphtalene		0,1		0,3	Pc
Mineral oils aerosols		5		10	
Osmium tetra oxides (OsO_4)	0,002	0,0002	0,006	0,0006	
Oxalic acid		1		2	
Oxygen bifluoride (OF_2)	0,05	0,1			
Ozone	0,1	0,2	0,3	0,6	
Paraquat		0,1			Pc
Parathion		0,1			Pc
Pentachloronaphtalene		0,5			Pc
Pentachlorophenol		0,5			Pc
1,2-dichloroethylene	200	790			
Phenol	5	19	15,6	60	Pc
P-phenylene diamine		0,1			Pc
Phenyl hydrazine	5	20	10	45	Pc, Ca
Phosgene	0,1	0,4	0,2	0,8	
Phosphine	0,3	0,4	1	1	
Phosphoric acid		1		3	
Yellow phosphorus		0,1			
Picric acid		0,1			Pc
Soluble Platinum derivatives		0,002			
Propylic alcohol	200	500	250	625	Pc
Pyrethrin		5			
Pyridin	5	15			
Portland cement		10 total			

Fig. D-29: Maximum allowable standards for occupational air quality (continued 6)

Parameter	Average Value		Average for short Exposure		Notes
	ppm	mg/ m^3	ppm	mg/ m^3	
Rotenone		5			
Selenium salts		0,2			
Selenium hexafluoride	0,05	0,4			
Amorphic silica (SiO_2)		6			
Crystalline silica	Cristobalite Tridymite Quartz Tripoli (?)	0.05	0.1		
Silver (dust & soluble sels)		0,01			
Sodium fluoroacetate		0,05		0,15	Pc
Sodium hydroxyde		0,15			
Stibene ($Sb H_3$)	0,1	0,5			
Strychnin		0,15			
Styrene	50	215	100	425	
Sulphur Dioxide	2	5	5	10	
Sulphuric acid		1			
Sulphur hexafluoride	1000	6000	1250	7500	
Sulphur pentafluoride	0,01	0,1			
Talc (with no asbestos)		2 breathing			
TEPP		0,05			Pc
1.1,2,2-tetra chloroethane	1	7			Pc, Ca
tetraethyl lead	0,075				
Tetryl		1,5			Pc
Thalium soluble salts		0,1			Pc
Thyram		5			
Tin & its inorganic derivatives (except $Sn O_2$)		2			
Organic derivatives of tin		0,1			Pc
Titanium dioxide		10			Ca
Toluene	100	375	150	560	Pc
Toluene di-isocyanate	0,005	0,04	0,02	0,15	Ca
O-toluidine	5	22			Pc, Ca
Tetrachloro ethylene	25	170			Ca
Trichloro ethylene	50	270	200	1080	Ca
Trichloro naphtalene		5			Pc

Fig. D-30: Maximum allowable standards for occupational air quality (continued 7)

Parameter	Average Value		Average Value for short Exposure		Notes
	ppm	mg/ m^3	ppm	mg/ m^3	
2,4,6-trinitrotoluene		0,5			Pc
Tri-orthocresyl phosphate		0,1			Pc
Terpentine	100	260			
Uranium insoluble salts		0,2		0,6	Ca
Uranium soluble salts		0,05			
Vanadium: V_2O_5 smoke & dust	0,05				
Vinyl chloride	1		5 (C-5) Max. limit	A-1	Ca
Warfarin		0,1			
Xylene	100	435	150	600	
Zinc chloride (smoke)		1		2	
Zinc oxide (smoke)		5		10	
Zirconium & derivatives		5		10	

Fig. D-31: Maximum allowable standards for occupational air quality (continued 8)

Type of Fiber[101]	Average Value		Average Value for short Exposure		Notes
	ppm	Fibre/ cm^3	ppm	mg/ m^3	
Amosite			0,5		
Chrysotile			2[102]		
Others			2[7]		

Fig. D-32: Special annex for asbestos

Substances
4-aminobiphenyl
Benzidine
Chloromethyl ether
B-naphtylamine
4-nitrobiphenyl
2-aminofluoride

Fig. D-33: Special annex for carcinogenic substances with no known threshold

101 Fibre definition: the fibre exceeds 5 microns in length, and has a length-to-width ratio of more than 3:1.

102 The average value for short exposure should be lowered to 1 fibre per cm^3 after a year of issuing these standards.

Amithrole
Antimony trioxide production
Arsenic trioxide production
Benzo (a) pyrene
Cadmium oxide production
3,3- Dichlorobenzidin
Dimethyl carbamyle chloride
Dibromoethylene
Hexamethyl Phosphoamide
N--nitroso dimethylamine
N-Phenyl B-Naphtylamine

Fig. D-34: Special annex for suspected carcinogenic substances/ processes

D 1.12 Annex no. 10: Standards for allowable noise levels and exposure (1)

Type of premises & production processes	Maximum Allowable Noise Level in DB (A)
1- In the work place (working hours less than 8 hrs) in order to limit hearing impairment	90
2- Working areas, which require audible signals and clear speech	80
3- Control rooms (follow-up, measurement and operation of machinery)	65
4- Offices (computer/ typing machines, etc.)	70
5- Workplaces where activities require routine mental concentration	60

Fig. D-35: Allowable noise levels in industrial facilities

- Maximum allowable period of exposure to noise in the workplace (industrial plants & sites)
- The assigned values below are based on minimum impairment/ damage to hearing
- Noise must not exceed 90 dB(A) during an 8-hour working day.

In case the noise level exceeds 90 dB(A), the exposure period must be decreased as follows:

Noise Level in dB(a)	Exposure Period (in Hours)
95	4
100	2
105	1
110	1/2
115	1/4

Fig. D-36: Maximum noise level exposure period

The noise level must not exceed 124 dB(A) per second during work.
In case variable noise levels exceed 90 dB(A):
[8] For intermittent periods during the daily work cycle, the resulting figure must not exceed:(1A/ 1B + 2A/ 2B+ ...) the integer 1; where:

A: is the exposure period for a given level of noise (hours)
B: is the allowed exposure period at the same level of noise (hours)

In case of exposure to noise from heavy hammers, exposure level depends on the level of noise (no. of impacts during working hours) as following:

Noise level dB(a)	Allowable no. of impacts during a working day
135	300
130	1000
125	3000
120	10000
115	30000

Fig. D-37: Allowable number of impacts depending on noise level

Noise produced by heavy hammers is considered intermittent if the period between 2 consecutive impacts is 1 sec./ more. However, if this period is shorter than 1 second, the noise is considered continuous, and noise levels are governed by the previous four clauses.

D 1.13 Annex no. 10: Standards for allowable noise levels and exposure (2)

Type of Area	Allowable Noise level in dB (A)	
	During the Day	*In the Evening*
Commercial and administrative areas & city centres	55 - 65	50 - 60
Residential areas including workshops, commercial activities or main road	50 - 60	45 - 55
Residential areas in the city	45 - 55	40 - 50
Residential suburbs (low movement)	40 - 50	35 - 45
Rural residential areas, hospitals and parks	35 - 45	30 - 40
Industrial areas (heavy industries)	60 - 70	55 - 65

Fig. D-38: Allowable noise levels in different areas

D 1.14 Annex 11: Maximum allowable air emissions from the incineration of used oils

Pollutant	Element	Maximum Value (mg/ m^3)
Cadmium	Cd	0,5
Nickel	Ni	
Chromium + Copper + Vanadium	Cr + Cu + V	1,5
Lead	Pb	5
Chlorine in Hydrochloric Acid	Cl in HCl	100
Fluor in Hydrofluoric Acid	F in HF	5
Total suspended solids	dust	-
Sulphur dioxide	SO_2	-

Fig. D-39: Maximum allowable limits for air emissions from oil incineration (thermal capacity >3 MW)

Incinerator capacity	< 1 tons/ hr	1 - 3 tons/ hr	>3 tons/ hr
Pollutant	Max. Value mg/ m^3	Max. Value mg/ m^3	Max. Value mg/ m^3
Total suspended solids	200	100	30
Lead + Cadmium + Copper + Manganese	-	5	5
Nickel + Arsenic + Chromium + Mercury	-	1	1
Cl in HCl	250	0,2	0,2
F in HF	-	100	50
S	-	4	2
CO	-	300	300

Fig. D-40: Maximum allowable limits for air emissions from waste incineration (thermal capacity >3 MW)

D 1.15 Annex 13: Maximum allowable limits for air emissions resulting from cement plants (1)

Maximum allowable value of SO_2 emission from kilns:	500 mg/ m3

Fig. D-41: SO_2 emissions

N.: the limit value may be increased to 1800 mg/ m^3 in the following exceptional cases:
- The raw material used contains a high percentage of SO_2 resulting in high emissions, which cannot be avoided.
- The inefficiency of raw materials to adsorb sulphur derivatives present in the used fuel provided that supporting scientific documentation is submitted by the plant.

	Level mg/ m^3	Max. Limit mg/ Nm^3
Existing kilns [103]	150	150
Kilns under construction	50	50
Clinker cooling [104] (with no gas recycling)	100	100
Grinder (clinker & raw materials) [105]	50	50
Other installations [106]	50	50

Fig. D-42: SO_2 emissions

3 A three-year grace period will be given to existing facilities whose emissions limits exceed 50 mg/ m^3, and 8 years will be given to plants whose emission limits are less than 150 mg/ m^3; this value will be subsequently lowered to 50 mg/m^3.

4 A three-year grace period will be given to existing facilities whose emissions limits exceed 250 mg/ m^3, and 8 years will be given to plants whose emission limits are less than 250 mg/ m^3; this value will be subsequently lowered to 100 mg/m^3.

5 A three-year grace period will be given to existing facilities whose emissions limits exceed 150 mg/ m^3, and 8 years will be given to plants whose emission limits are less than 150 mg/ m^3; this value will be subsequently lowered to 50 mg/m^3.

5 [4] A three-year grace period will be given to existing facilities whose emissions limits exceed 150 mg/ m^3, and 6 years will be given to plants whose emission limits are less than 150 mg/ m^3; this value will be subsequently lowered to 5 mg/m^3.

D 1.16 Annex 13: Maximum allowable limits for air emissions resulting from cement plants (2)

Kilns	Maximum Limits (mg/ Nm^3)
Dry process kilns with heat recuperation	< 1200
Dry/ semi-wet processes kilns with heat recuperation	< 1500
Wet process kilns with no heat recuperation	< 1800

Fig. D-43: Nitrogen oxides (NOx) emissions

Heavy Metals	Maximum Limits (mg/ Nm^3)	
Cd + Ti + Hg	0.2	particles + gases
As + Co + Ni + Se + Te	1	particles
Sb + Cr + Cu + Sn + Mn + Pb + Va + Zn	5	particles

Fig. D-44: Heavy metals

D 1.17 Annex 14: Maximum allowable limits for ambient air pollutants

Pollutant	Maximum Limits ($\mu g/m^3$)	Exposure
Sulphur dioxide (SO_2)	350	1 hr
	120	24 hrs
	80	1 year
Nitrogen dioxide (NO_2)	200	1 hr
	150	24 hrs
	100	1 year
Ozone (O_3)	150	1 hr
	100	8 hrs
Carbon monoxide (CO)	30000	1 hr
	10000	8 hrs
Total suspended solids	120	24 hrs
Suspended black particulates PM < 10 microns	80	24 hrs
Lead (Pb)	1	1 year
Benzene	5 ppb	1 year

Fig. D-45: Maximum allowable limits for ambient air pollutants

D 2 Summary of the German Waste Water Decree

German Waste Water Decree, 09. 02. 1999

Annex	Sector	Comments	COD	BOD5	NH4-N	NO2-N	N total	P total	filterables	Toxicity to fishes	Ag	Al	As	Ba	Pb	Cd	Hg	Cr total	Cr VI
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	G_F	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
1	domestic sewerage		75-150	15-40	10		18	1-2											
2	lignite briquettes		50						50										
5	fruit and vegetable		110	25	10		18	2											
6	soft drinks		110	25				2											
7	fish		110	25	10		25	2											
8	potataoes		150	25	10		18	2											
9	lacuer factory		120	20						2				2	0,5	0,1		0,5	
10	meat		110	25	10		18	2											
11	breweries		110	25	10		18	2											
12	alcoholic drinks		110	25	10		18	2											
13	hard boards		1)*	0,2)*						2									
14	forage drying		110	25				2											
15	organic glue/gelatine		110	25	10		30	2											
16	hard coal								80										
18	sugar		200	25	10		30	2											
20	meat powder		150	25	50														
21	malthouse		110	25															
22	Chemical Ind.		)**				50	2		2									
24	iron foundry		100 g/t							2			0,05 g/t		0,5	0,2	0,05	0,5	0,1
25	leather		250	25	10			2		2					0,25 g/t	0,05 g/t		0,25 g/t	
26	construction materials		150						100									1	0,05
36	Hydrocarbons		120	25			25	1,5										0,4	0,1
37	anorg. Pigments		70-100)***		10					2				2	0,04 kg/t	0,01		0,5	
39	non-ferrous metals	Pb, Cu, Zn	1,5 kg/t							2	0,1		0,1		0,5	0,2	0,05	0,5	0,1
		Al-prod.	0,3 kg/t									0,02 kg/t							
		Al-foundry	0,5 kg/t																

Annex	Sector	Comments	COD	BOD5	NH4-N	NO2-N	N total	P total	filterables	Toxicity to fishes	Ag	Al	As	Ba	Pb	Cd	Hg	Cr total	Cr VI
40	metal processing		100-600)***		20-100)***	5		2		2-6)***	0,1	3	0,1	2	0,5	0,2	0,05	0,5	0,1
41	glass and mineral fibres		130						30				0,3	3	0,5	0,1		0,5	
42	Alkalichloride elektolysis		50-130)***						2	1							0,05		
43	synthetic fibres, viskose		2-50)***	25			10-50)***	2		2									
45	petrol		80	25			40	1,5											
46	coal carbonization		)**	9 g/t			9 g/t	2		2									
48	use of dangerous substances															0,2	0,05		
51	waste disposal about ground		200	20		2	70	3		2			0,1		0,5	0,1	0,05	0,5	0,1
52	dry cleaning																		
53	photpgraphical processes										0,7					0,05	0,05	0,5	0,1
54	semiconductors									2	0,1		0,2		0,5			0,5	0,1
55	laundries		100	25			20	2					0,1		0,5	0,1	0,05	0,5	
57	wool laundries		150	10			30	2		2									

Fig. D-46: Summary of the German Waste Water Decree

Annex	Sector	Comments	Co	Cu	Ni	Zn	Fe	Sn	Se	Hydro-carbons	AOX	Hexachloro-benzol	LHKW	Index of Phenol	Benzen + derivates	PAH	Endosulfan	HCH
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	
1	domestic sewerage																	
2	lignite briquettes																	
5	fruit and vegetable																	
6	soft drinks																	
7	fish																	
8	potataoes																	
9	lacuer factory																	
10	meat		1	0,5	0,5	2		1			1		0,1					
11	breweries																	
12	alcoholic drinks																	
13	hard boards																	
14	forage drying																	
15	organic glue/gelatine													0,0003)*				
16	hard coal																	
18	sugar																	
20	meat powder																	
21	malthouse																	
22	Chemical Ind.																	
24	iron foundry			0,5	0,5	2		2			1-8)***							
25	leather			0,25 g/t	0,25 g/t	1 g/t	5 g/t			5 g/t	0,5 g/t			2,5 g/t				
26	construction materials										0,5		0,1					
36	Hydrocarbons										0,1							
37	anorg. Pigments									2	0,1			0,15	0,05			
39	non-ferrous metals	Pb, Cu, Zn	1	0,5	0,5	1	0,1 kg/t	2			1							
		Al-prod.								0,02 kg/t								
		Al-foundry								0,05 kg/t								

Annex	Sector	Comments	Co	Cu	Ni	Zn	Fe	Sn	Se	Hydro-carbons	AOX	Hexachloro-benzol	LHKW	Index of Phenol	Benzen + derivates	PAH	Endosulfan	HCH
40	metal processing		1	0,5	0,5	2	3	2		10	1		0,1					
41	glass and mineral fibres			0,5	0,5													
42	Alkalichloride elektolysis										3-3,5)***							
43	synthetic fibres, viskose			7 g/t		1					8-40 g/t)***							
45	petrol									2	0,1			0,15				
46	coal carbonization													0,15 g/t	0,03 g/t	0,015 g/t		
48	use of dangerous substances											1,5 - 10 g/t					0,015 - 0,03	2 - 5 g/t
51	waste disposal about ground			0,5	1	2				10	0,5							
52	dry cleaning										0,5							
53	photpgraphical processes							0,5			0,5							
54	semiconductors			0,5	0,5			2	1		0,5		0,1		0,05			
55	laundries			0,5	0,5	2				20	2							
57	wool laundries																	

Fig. D-47: Summary of the German Waste Water Decree

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مركز مشاريع ودراسات القطاع العام

Annex	Sector	Comments	DDT/PCP	Aldrin, Dieldrin, Endrin, Isodrin	CN^-	SO_3^{2-}	SO_4^{2-}	S^{--}	Analine	F^-	free chlorine	Thallium
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
1	domestic sewerage											
2	lignite briquettes											
5	fruit and vegetable											
6	soft drinks											
7	fish											
8	potataoes											
9	lacuer factory											
10	meat											
11	brewerles											
12	alcoholic drinks											
13	hard boards											
14	forage drying											
15	organic glue/gelatine											
16	hard coal											
18	sugar											
20	meat powder											
21	malthouse											
22	Chemical Ind.											
24	Iron foundry				0,5 g/t							
25	leather					2						
26	construction materials											
36	Hydrocarbons					0,6						
37	anorg. Pigments						600-1200)***	20	0,2 kg/t			
39	non-ferrous metals	Pb, Cu, Zn			0,1	1						1
		Al-prod.						0,3 kg/t				
		Al-foundry										

Annex	Sector	Comments	DDT/PCP	Aldrin, Dieldrin, Endrin, Isodrin	CN^-	SO_3^{2-}	SO_4^{2-}	S^-	Analine	F^-	free chlorine	Thallium
40	metal processing				0,2	1				20-50)***	0,5	
41	glass and mineral fibres						3000			30		
42	Alkalichloride elektolysis					1						
43	synthetic fibres, viskose					0,3						
45	petrol				0,1	0,6						
46	coal carbonization				0,03 g/t	0,03 g/t						
48	use of dangerous substances		0	3 g/t								
51	waste disposal about ground				0,2	1						
52	dry cleaning											
53	photpgraphical processes				2							
54	semiconductors				0,2	1					0,5	
55	laundries											
57	wool laundries											

Fig. D-48: Summary of the German Waste Water Decree

D 3 Comparison of international industrial effluent standards

	Items	Units	Tunis	Morocco	Qatar	Kuwait	Algeria	Egypt	Oman	Saudi Arabia	Japan	Lebanon sea	Europe monthly / daily	Source	Germany	Barcelona Convention	U.S
Temperature	°C		35	30	10		30	35				35					
	pH		6.5 - 8.5	6.5 - 8.6		6.5 - 8.5	5.5-8.5	6.0-9.0	6.0-9.0	6.0-9.0	5.8 - 8.5	6 - 9					5.0-9.0
Colour		mg/l	100					N/A				absence					50
Floating Particulates		mg/m2								0							
Precipitated Solids		mg/l	0,3														
Total Suspended Solids	TSS	mg/l							30	15					2 - 100		
Suspended Solids	SS	mg/l	30	50		25	30	30			200	60	a) 35 b) 60)*	91/271/EEC			20
Total Dissolved Solids	TDS	mg/l			1750	1000		1200									
	BOD5	mgO2/l	30	100	25	10	40	30	30	25	160	60	25	91/271/EEC			
	COD	mgO2/l	90	500	125		120	40		150	160	100	125	91/271/EEC			
Dissolved Oxygen	DO	mg/l			2												
	TOC	mg/l			75					50							
Nitrogen	N	mg/l									120						
Nitrite	NO2	mg/l	5												2 - 5		
Nitrate	NO3	mg/l	90									40					
Total nitrogen	TN	mg/l	30						40						18 - 50		
Ammonia	NH4+	mg/l			2	10				1		3			10 - 25		
Phosphor	P	mg/l									16						
Phosphate	PO4---	mg/l			2	5	2	1	0,1			5					
Organic Phosphoric Compounds		mg/l									1						
Total phosphor		mg/l	0,1								1				1,5 - 3		

	Items	Units	Tunis	Morocco	Qatar	Kuwait	Algeria	Egypt	Oman	Saudi Arabia	Japan	Lebanon sea	Europe monthly / daily	Source	Germany	Barcelona Convention	U.S
Potassium	K	mg/l	1000														
Active chlorine	Cl2	mg/l	0,05	0,2	1	0,6	1	1		0,5					0,5		
Chloride	CL-	mg/l	N/A						2,5		1						
Chlorine dioxide	CLO2	mg/l	0,05	0,05													
Sulphide	S--	mg/l	2	1	0,1	5			0,1	0,05		1			0,3 - 2		
Sulphate	SO4--	mg/l	1000					1							600 - 3000		
Sodium	Na	mg/l	N/A														
Sodium absorbent ratio	SAR	mg/l															
Calcium	Ca	mg/l	N/A														
Formaldehyde		mg/l															1
Fluoride	F-	mg/l	5	15				0,5		15		1,5			20 - 50		
Boron	B	mg/l	20														
Magnesium	Mg	mg/l	2000														
Aluminium	Al	mg/l	5	10	20		5			15		3			0,02 g/t 3 mg/l		
Iron	Fe	mg/l	1	3	8	0,5	5	1	2	5		1,5			0,5 - 3		
Dissolved iron		mg/l									10						
Total copper	Cu	mg/l		0,5								1,5			0,5	0,5	
Copper	Cu	mg/l	1,5		0,4	1,5	3	1	0,5	0,2	3	1,5					
Total tin	Sn	mg/l		2											0,5 - 2		
Tin	Sn	mg/l	2														
Manganese	Mn	mg/l	1	1	0,4		1	0,5		0,2		1					max.5.0
Dissolved manganese		mg/l	1						1		10						
Total zinc	Zn	mg/l		5								5				1	max. 5.0
Zinc	Zn	mg/l	10		2		5	1	0,1	1	5	5			1 - 2		
Molybdenum	Mo	mg/l	5														
Cobalt	Co	mg/l	0,5	0,5	0,2							2					
Bromide	Br2	mg/l	0,1														

	Items	Units	Tunis	Morocco	Qatar	Kuwait	Algeria	Egypt	Oman	Saudi Arabia	Japan	Lebanon non	Europe monthly / daily	Genoa	Germany	Barcelona Convention	U.S
Barium	Ba	mg/l	10	1	2					1		2					
Silver	Ag	mg/l	0,1	0,1				0,05	0,0005			0,1			0,1 - 0,7		max. 1.0
Arsenic	As	mg/l	0,1	0,1	0,1			0,05	0,05	0,1		0,05			0,1 - 0,7		
Arsenic compounds		mg/l									0,1						max 0.25
Beryllium	Be	mg/l	0,05														
Cadmium	Cd	mg/l	0,005	0,2	0,02		0,2	0,01	0,05	0,02		0,05	0,2 (monthly)	83/153/EEC	0,01 - 0,2	0,2	max. 0.03
Cadmium compounds		mg/l									0,1		0,2 (monthly)	83/153/EEC			
Cyanide	CN-	mg/l	0,05	0,1	0,1		0,1		0,1	0,05	1	0,1			0,2 - 2		
Chromium	Cr	mg/l		2	0,2	0,5			0,5	0,1		1			0,4 - 1		max. 0.5
Trichrome	Cr III	mg/l	2	0,2			3				2						
Hexochrome	Cr VI	mg/l	0,5	0,2			0,1	0,05			0,5				0,05 - 0,1		
Antimon	Sb	mg/l	0,1	0,3													
Total nickel	Ni	mg/l		0,5								0,1					
Nickel	Ni	mg/l	2		0,4	0,5	5	0,1	0,1	0,2		0,1			0,5 - 1		max. 0.2
Selenium	Se	mg/l	0,5	0,1					0,02								max.0.2
Selenium compounds		mg/l									0,1						
Total mercury		mg/l		0,05							0,005	0,005	0,05 (monthly)	82/176/EEC		0,05	
Mercury	Hg	mg/l	0,001		0,002	0,01	0,01	0,001	0,001	0,001		0,005	0,05 (monthly)	82/176/EEC	0,05		max.0.005
Total lead		mg/l		0,5							0,1	0,5					
Lead	Pb	mg/l	0,5		0,1	0,5	1	0,05	0,1	0,1		0,5			0,5		max. 0.2
Titanium	Ti	mg/l	0,001														
Salfonated grease and oil		mg/l	20								30						
Grease and oil		mg/l		30			20	5	5	8		15					
Grease and oil and mineral asphaltes		mg/l	10		10						5						

	Items	Units	Tunis	Morocco	Qatar	Kuwait	Algeria	Egypt	Oman	Saudi Arabia	Japan	Lebanon sea	Europe monthly / daily	Source	Germany	Barcelona Convention	U.S
Detergent		mg/l		3			2										
Detergent - ABS		mg/l	2					0,05									
Hydrocarbon		mg/l		10		25	20					0,5			2 - 20		
Insecticides		mg/l	0,005									0,2			see DDT / PCP		
AOX		mg/l		5											0,1 - 2		
Phenol		mg/l			0,5	0,05	0,5	0,002	0,1	0,1	5	1					
Phenol Indicator		mg/l		0,3											0,15		
Phenol & phenol's compounds		mg/l	0,05														
Tetrachloroethylene		mg/l									0,1				0,1 as sum		
Trichloroethylene		mg/l									0,3						
1,1,1-Trichloroethane		mg/l															
Dichloromethane		mg/l															
	PCBs	mg/l					0,001				0,003						
Carbontetrachloride	CCl4	mg/l									0,02		1,5 / 3	86/280/EEC	7,5 g/t		
Organic solvents		mg/l					20										
Chlorinated solvents		mg/l	0,05							0,1							
1,2-dichloroethane	EDC	mg/l									0,04		1 / 2	90/415/EEC 0,1 / 0,2 for use for degreasing metals	2,5 - 5 g/t		
Dichloroethylene		mg/l									0,2				defined as "DDT"		
Dichloroethylene	ClCH	mg/l									0,4						
Trichloroethane	ClCH2CH2Cl	mg/l									3						

	Items	Units	Tunis	Morocco	Qatar	Kuwait	Algeria	Egypt	Oman	Saudi Arabia	Japan	Lebanon sea	Europe monthly / daily	Source	Germany	Barcelona Convention	U.S
Trichloroethane		mg/l									0,06						
Dichloropropane		mg/l									0,02						
Thiram		mg/l									0,06						
Simazine		mg/l									0,3						
Thiobencarb		mg/l									0,2						
Benzene		mg/l									0,1						
DDT		mg/l											0,2 / 0,4	86/280/EEC	effluent not allowed from industry		
Pentachlorophenol		mg/l											1 / 2	86/280/EEC			
Aldrin	C12H8C16	mg/l											0,002 / 0,01	88/347/EEC	3 g/t as sum		
Dieldrin	C12H8Cl6O	mg/l											0,002 / 0,01	88/347/EEC			
Endrin	C12H8Cl6O	mg/l											0,002 / 0,01	88/347/EEC			
Isodrin	C12H8Cl6	mg/l											0,002 / 0,01	88/347/EEC			
Hexachlorocyclohexane	HC H	mg/l											2	84/491/EEC	2 - 5 g/t		
Hexachlorobenzene	HCB	mg/l											1 / 2	88/347/EEC	1,5 - 10 g/t		
Chloroform	CHCl3	mg/l											1	88/347/EEC	7,5 g/t		
Trichloroethylene	TRI	mg/l											0,5 / 1	90/415/EEC; 0,1 / 0,2 for use for degreasing metals	2,5 g/t		

	Items	Units	Tunis	Morocco	Qatar	Kuwait	Algeria	Egypt	Oman	Saudi Arabia	Japan	Lebanon sea	Europe monthly / daily	Source	Germany	Barcelona Convention	U.S
Perchloroethylene	PER (Cl2C=CCl2)	mg/l											0,5 / 1	90/415/ EEC; 0,1 / 0,2 for use for degreasing metals	2,5 g/t		
Trichlorobenzene	TBC	mg/l											1 / 2	90/415/EEC	0,5 - 10 g/t		
Fecal coliforms		in 100 ml	2000	n.a				2500		1000	300 000	5000					
Streptococcus fecalis		in 100 ml	1000	n.a													
Salmonella		in 5000 ml	n.a						invisible								
Vibrio cholera		in 5000 ml	n.a														
Egg parasites																	
Worm parasites																	
Tenso-actifs anioniques		mg/l					10										
Permanganate																	
Tar		mg/l															60
Radioactivity		becquerel /l															none
																	none

D 4 Industrial Water Pollution in Lebanon: 46 Case Studies

Classification	Industry	Company Name	Location	Main Production Activities	Plant Description	Main Emissions	Releases to the surface water sewer or soil	Environmental Control Strategies
	Food & Beverage	Conserves Moderne Chtaura s.a.l. (Conserva Chtaura) [2]	Chtaura, Bekaa Next to residential areas	Largest fruit and vegetable conserving company in Lebanon. Activities include: processing, bottling and canning of raw materials, sesame production, and deep freezing of fresh vegetables.	Oldest plant operations are 30-years-old. Yearly upgrading focuses on increasing production capacity. Poor maintenance of non-production equipment.	**Pollutant** BOD SS Oil	**Load (kg/y)** 202,340 65,845 105	Oil produced from electrical generator and boiler is inadequately handled. This contributes to fouling of ground water and surface water. No other environmental control measures are being used. The company is ISO 9001 certified and is interested in ISO 14001.
	Tiles	Uniceramic s.a.l. [2]	Bekaa valley Near the Litani River	Largest producer of wall and floor tiles Raw materials used include clay, sand, and quart.	Technological state is sufficient. There is a relatively high level of maintenance. Future plans for expansion using latest technology that meets EU standards exist.	**Pollutant** SS	**Load (kg/y)** 5,250	Wastewater passes a settlement tank, where heavier materials will settle. Still the wastewater is milky white. Plans exist for future filtration or centrifugation of the wastewater, after which the water will be available for re-use.
	Battery Recycling	OREIBI Company for Trade and Industrial s.a.r.l. [2]	Taanayel, Chtaura Located in an official industrial zone	Extraction of lead from old batteries after sulphuric acid has been removed. Plastic derived from polyethylene cases is shredded and moulded into flowerpots.	The equipment being used is about 10 years old. The bag filter system through which the furnace exhaust gases pass is 4 years old. All machinery is technically in an acceptable state.	**Pollutant** Sulphuric Acid	**Load (kg/y)** NA	Only wash water is used for in the production process and is recycled in a closed loop system for plastic flowerpot production. Sanitary wastewater is collected in a septic tank.
	Paper & Pulp Products	Mimosa Sanitary Paper Co. [2]	Zahle, in the Berdaouni valley 200 m from the Berdaouni River	Products include toilet paper, tissues, cardboard, and other sanitary products.	The equipment of the tissue paper production dates from 1991 and 1994. The equipment for cardboard production is from 1958.	**Pollutant** BOD SS	**Load (kg/y)** 100,000 70,000	Flocculation and aeration processes are used in wastewater treatment. Removal rates are estimated at 35% for BOD and 85% for SS.

Classification	Industry	Company Name	Location	Main Production Activities	Plant Description	Main Emissions	Releases to the surface water sewer or soil	Environmental Control Strategies
	Food & Beverage	Ets. Produits Taanayel [2]	Bekaa 1 km away from residential area 700 m from the Litani River	Production of dairy goods mainly yoghurt, labne and cheese. Process includes pasteurisation of milk, cooling, fermentation, packaging, and distribution	Founded in 1938 and restarted in 1990. Total area = 5000m². Good technical state of the equipment. Plans are in the works for the introduction of a new process.	**Pollutant** NaOH Nitric Acid Detergents	**Load (kg/y)** NA NA NA	There is no specific environmental management system and no future plans for one since production is on a relatively small-scale basis. Cooling water is used for cleaning operation and contains substances like NaOH, detergents and nitric acid. It is directly discharged into the sewer.
	Cement	Ciment Blancs Société Libanaise des Ciments Blancs s.a.l. [2]	Chekka	Production geared towards white cement which is used for white tiles.	The plant was built in 1963 with installation characteristic of a cement factory. Kiln 1 (1963) uses a wet process. Kiln 2 (1975) uses a dry process. Future plans include converting Kiln 1 to a dry process and expanding production.	**Pollutant** SS Oil	**Load (kg/y)** **15,300,000** 3,060,000	Wastewater running from the site is tainted with white cement and a small amount of oil spilled. No measures are taken to reduce these amounts. The plant welcomes environmental management training from the MoE.
	Chemical Products	Lebanon Chemicals Company [2]	Chekka area near city of Selaata 1 km away from a nearby village	Lebanon's only fertiliser plant. Main products are sulphuric acid, phosphoric acid, Triple Super Phosphate (TSP), and Single Super Phosphate (SSP)	The new sulphuric acid plant was built in 1997 according to the latest technology. Plant performance is excellent and efficiency is 99.5-99.7%. The H_2PO_3 plant was built in 1978 and is in moderate condition.	**Pollutant** Sludge	**Load (kg/y)** 346,750,000	The gypsum from the phosphoric acid plant is slurred and discharged to sea. Rainwater from roofs and washing water is sent to the sea. Domestic water is sent to a 3-stage septic tank after which it penetrates into the ground. Wash water for the TSP plant passes through a sedimentation plant after which it is discharged into the sea.

Classification	Industry	Company Name	Location	Main Production Activities	Plant Description	Main Emissions	Releases to the surface water sewer or soil	Environmental Control Strategies
	Metal Products	Eternit S.A. Libanaise [2]	Chekka 500 m from the sea & 1 km away from nearest village	Asbestos cement pipes and sheets, glass reinforced plastic pipes, PVC pipes, polyethylene pipes, concrete pipes. Products are used for water transportation systems.	The plant area covers 200,000m². The asbestos cement plant was built in 1956 while the PVC/HDPE & GRP units were added on later. Basic technology is used and all units are well-maintained.	**Pollutant** Asbestos cement mud water sludge Solid off cuts	**Load (kg/y)** 20,000m3/yr 2,400,000kg/yr 1,500,000kg/yr	Process water rich with $CaCO_3$ and asbestos cement particulates is sent to sedimentation tanks before being discharged to a canal. Domestic water is sent to a septic tank after which it penetrates into the ground.
	Petroleum	Recycling Mineral Oil Co. [2]	Chekka Closest residential area is 500 m & 2500 m from the seashore Non-industrial zone	Only plant of its kind in Lebanon. The plant recycles mineral oil into base oil of a viscosity 20-30w. Most of the oil is used to produce grease. The rest is sold as hydraulic oil or treated to produce lubricant oil (viscosity = 40w).	The plant was founded in 1991. The installation is old and in poor condition. Technology is outdated. Maintenance is low and oil spills are observed throughout the plant.	**Pollutant** Waste Oil & Lube Oil Water + Waste Oil Sludge	**Load (kg/y)** NA 62,400 364,000	Oil spills are observed all over the plant. In the sedimentation operation, water is separated from the waste oil and is disposed off haphazardly. Management is reluctant to invest in environmental control measures or to comply with government mandates.
	Petroleum	Mobil Wardieh Holdings Inc. s.a.l. [2]	Dora Along main road to the port	Handles gasoline in 3 grades (2 leaded, 1 unleaded). Activities include: Unloading of ships, storage in tanks, pumping of gas into tank trucks & production of lubricant oil.	The plant was founded in 1921 and operated until 1976. Operation resumed in 1996. Technical status of the facilities is poor. Installations are old.	**Pollutant** Petroleum products	**Load (kg/y)** NA	Rain water and spills are fed to an oil water separator. It is suspected that gasoline contamination of the soil has taken place. There are no plans for major investments b/c of possible relocation (Linord project).
	Metal	Int'l Metal Company [2]	Located in an industrial zone near the city of Beirut 300 m from a residential area	The company processes old (car) lead batteries. Lead bars are exported to Europe for production of new batteries. By-products (i.e. sulphuric acid, plastics) are sold to factories.	Started in 1993, the plant is currently running at half capacity. The open furnace is out of date and emits burning gases into the work area. Some gases pass through 2 exhaust gas dust filters. Upgrades are needed.	**Pollutant** Acid	**Load (kg/y)** NA	There is no water discharged; the acid/water mixture is sold. The floor in the working room has cracks and thus may leak contaminants to the soil and groundwater.

Classification	Industry	Company Name	Location	Main Production Activities	Plant Description	Main Emissions	Releases to the surface water sewer or soil	Environmental Control Strategies
	Tannery	Arteen Arabian & Sons [2]	Dora In an industrial estate 550 m from the coastal highway	The company is a traditional chromium tannery and processes about 250 tons/year of raw hides (cattle and goat). All steps from raw hide to finished leather are executed.	Most equipment was bought in Europe between 1970 and 1991. All equipment shows a poor level of maintenance and is not up to modern technological standards.	**Pollutant** BOD SS Chromium Fat/grease Sulphide Nitrates/ Ammonia	**Load (kg/y)** 20,000 33,750 1,000 7,500 1,000 3,750	Wastewater is not treated and discharged to an open sewer with its outlet in the Mediterranean Sea. Hair saving and chromium recovery are not applied. Leaking fuel oil is very common. The soil is likely to be contaminated in many places with chromium and oil.
	Tannery	The Lebanese Tannery (Arteen Arabian & Sons) [2]	Dora In an industrial estate 550 m from the coastal highway	The company is a traditional chromium tannery and processes about 800 tons/year of raw hides (cattle and goat). All steps from raw hide to finished leather are executed	The beamhouse (wet process) equipment is 10-30 years old. The finishing equipment is very modern with regular investments made in this area. The plant is very clean and well-maintained.	**Pollutant** BOD SS Chromium Fat/grease Sulphide Nitrates/ Ammonia	**Load (kg/y)** 16,000 27,000 800 6,000 800 3,000	Wastewater is not treated and discharged to an open sewer with its outlet in the Mediterranean Sea. Hair saving and chromium recovery are not applied. The company expects to get the ISO 14001 certificate in the near future. The tidy working environment indicates pro-active management.
	Chemical Products	Oteri [2]	Jal el Dib 40 m away from the seaside	Main products include sulphonic acid and sodium silicate which are sold as raw materials to the local detergent market.	The equipment at the facility is approximately 8-10 years old and in good to moderate condition. There is a maintenance program for all installations.	**Pollutant** Oily wastes	**Load (kg/y)** 600	Process water is sent to the municipal sewer which discharges directly to the sea.
	Cement	Ciment de Sibline s.a.l [2]	Sibline 5 km from the sea and 3 km from the village of 3500	Production consists of two types of cement (types 1 and 2, with type 2 containing ferric oxide)	Line 1: The technology is of reasonable quality, but need of maintenance (leak in kiln). Line 2: state-of-the- art French technology.	**Pollutant** SS Oil	**Load (kg/y)** 2520 504	Waste water treatment system does not handle the suspended solids completely. This will improve with the planned WWTP. Leakage of fuel oil was noticed during the visit.

Class ...ion	...ndus...y	Company Name	Location	Main Production Activities	Plant Description	Main Emissions	Releases to the surface water sewer or soil	Environmental Control Strategies
	Power Generation	EDL Electricité de Liban [2]	2 km north of Jieh Located at the border of the sea	Five power generation lines. 2 Toshiba generators (65 MW), 3 ABB generators (72 MW). All running below capacity.	The plant is of a basic design, not equipped with modern standard equipment such as desulphurisation and deNOx. Maintenance is at a minimum and occurs according to schedule or when problems arise.	**Pollutant** Chemicals Oil Sludge	**Load (kg/y)** NA NA NA	Oil storage facilities are not located on impervious floors thus soil pollution exists. For the sludge on the tank bottom a crude oil decanter is in place, which separates most of the oil from the water. The remaining water is send directly into the sea. Skills in environmental management & performance are generally low.
	Chemical Products	Spartan Chemical Company [2]	Shouiefat Within an industrial area 150 m east of the former highway to Saida	The company produces a number of liquid products for in house and industrial use. Activities include mixing of ingredients, filling, and packaging.	The plant is 20 years old. The apparatus is in reasonably good condition although based on a low level of technology. Production methods and logistics are out-of-date and most of the handling is being done manually.	**Pollutant** BOD Surface active substances	**Load (kg/y)** 2500 1625	There are no environmental controls. The company is considering applying for ISO 9001/2 certification.
	Chemical Products	Procter and Gamble Manufactu-ring Co. of Lebanon s.a.l. [2]	Shoueifat Within an industrial zone Along the main road to Saida	Production and packaging of a multi-purpose powder detergent.	The installation dates from 1962. The technology is not state-of-the-art, but suffices for the single product process. Maintenance is at a reasonable level, but evidence of wear and tear is apparent.	**Pollutant** BOD COD SS Surface active subst Oil	**Load (kg/y)** 0.1 7.1 0.1 1200 1400	P&G does not collect and reuse the wastewater. However; Environmental awareness does exist at the management level. The plant needs to report environmental performance to P&G and is ranked accordingly.
	Food & Beverage	M.O. Gandour and Sons s.a.l. [2]	Near the center of Shoueifat Along the main road betw. Saida and Beirut	The company produces biscuits and chocolate bars from flour, fat, water, and additives. All ingredients are FDA approved.	The operations are being updated. The packaging lines are modernised and automated. The boilers and generators are old and should be checked.	**Pollutant** COD	**Load (kg/y)** NA	No environmental controls exist. Most of the wastewater is cleaning water. There are no data on COD levels.

Classification	Industry	Company Name	Location	Main Production Activities	Plant Description	Main Emissions	Releases to the surface water sewer or soil	Environmental Control, Strategies
	Chemical Products	Chemipaint Universal Paint & Chemical Industries s.a.r.l. (Tinol Int'l) [2]	Shoueifat Within an industrial zone Along main road to Saida	Two main product lines: water and solvent based paints. Process includes wet grinding of the ingredients, homogenisation, and packaging.	The plant started in 1979. The technology is relatively old and does not comply with standard practice.	**Pollutant** No Data	**Load (kg/y)** NA	No monitoring programs exist to measure releases to the environment. There is no specific environmental management system.
	Chemical Products	Seven Plast [2]	Shoueifat Next to Pepsi Cola plant	Seven Plast imports polymers pellets (granulates from various thermo-plastics, i.e. PVC) and mixes them with colorants, softeners, and other additives to produce ready made raw materials for manufacturers of paint products.	The plant uses basic equipment. The process itself does not create relevant emissions to the atmosphere.	**Pollutant** NA	**Load (kg/y)**	Monitoring and control measures need to be implemented. The process uses minor quantities of cooling water with some contamination due to the direct contact with the products. Many fuel oil spills have been seen and parts of the site must be contaminated with oily components.
	Power Generation	Zouk Power Plant [2]	Zouk Michael Located at the border of the sea	The power plant consists of 5 power generation lines with maximum capacity of 631 MW.	The plant is of a basic design, not equipped with modern standard equipment such as desulphurisation and deNOx. Maintenance is at a minimum and occurs according to schedule or when problems arise.	**Pollutant** Chemicals Oil Oily sludge Hydrazine Na_3PO_4	**Load (kg/y)** NA NA NA NA NA	Skills in environmental management & performance are generally low. Oil storage facilities are not located on impervious floors thus soil pollution exists. For the sludge on the tank bottom a crude oil decanter is in place, which separates most of the oil from the water. The remaining water is send directly into the sea.

Classification	Industry	Company Name	Location	Main Production Activities	Plant Description	Main Emissions	Releases to the surface water sewer or soil	Environmental Control Strategies
	Chemical Products	Algorithm s.a.l. [2] & [3]	Located in Zouk Mosbeh Along the highway, near the sea border	The company produces a range of 50 pharmaceutical products. Processes include: mixing of components, forming of tablets, and packaging.	The company is modern. It satisfies high int'l production standards. A laboratory is equipped for raw material and product testing.	**Pollutant** COD	**Load** NA	Good monitoring equipment is available, only not aimed at addressing environmental issues. The wastewater produced was reported to be harmless. Recommended Treatment: diagnosis of the existing pre-treatment unit for eventual improvement.
	Textiles	Colortex Babik Frères [2] & [3]	Zouk Mosbeh Within an industrial zone	Textile importers and exporters. Activities include textile printing (dyeing, printing, and other surface treatments to textiles).	The machinery is old and outdated. The technical state is moderate.	**Pollutant** COD Detergents Colouring agents	**Load** 1-2 g/l NA NA	No monitoring or treatment exists. There is no use of organic solvents in the dyes. Water is used for bleaching washing, untreated fabrics, washing of printing machines and the boiler. Some soil contamination may have occurred from earlier activities that used solvents. Recommended Treatment: Neutralisation.
	Metal Products	Habis [2] & [3]	Adonis Within an industrial zone 500 m from a residential area	The company is a manufacturer of silver plated products destined for internal and external markets.	The company started in 1965 and has its own mould preparations and welding department. The technical state of most equipment is moderate.	**Pollutant** Metals (CN, Cu, Ag, Zn) acids, caustics, and detergents	**Load** NA	No environmental monitoring or wastewater treatment takes place. An environmental management system is neither in place nor planned. Recommended Treatment: Neutralisation; Possibility of pre-treatment for recycling and re-using the water.

Classification	Industry	Company Name	Location	Main Production Activities	Plant Description	Main Emissions	Releases to the surface water sewer or soil	Environmental Control Strategies
	Chemical Products	Adonis Pesticides Sté. Industrielle Adonis s.a.l. [2]	Adonis Near River Ibrahim 100 m from a residential area	The company manufactures insecticides, fungicides, herbicides, fertilisers, and hygiene products.	The technical state of the equipment is moderate to poor. The underground xylene storage tank is 10-years-old. Some of the production units are outdated.	**Pollutant** NA	**Load (kg/y)** NA	No monitoring or wastewater treatment exists. The Management prepares introduction of quality system according to ISO 9001. Some of the equipment after processing highly toxic materials. The cleaning water from this operation is sent to a pit and neutralised with caustic.
	Chemical Products	Pharmaline Cosmaline Industries s.a.l. [2]	Located 200 m from Nahr Ibrahim Nearest residential area is 1 km away	The largest manufacturer of pharmaceuticals and cosmetics in Lebanon. Products include: lotions, creams, gels, liquids, and sprays.	The facility was built in 1989 and upgraded during the years. The technical state of the equipment is high. Production occurs in clean, monitored rooms (humidity, temp., pressure).	**Pollutant** NA	**Load (kg/y)** NA	Environmental management is established. A quality system based on ISO-9001/2 is being implemented. Wastewater is collected and tanked. There is no presence of wastewater treatment plant.
	Metal Products	Chromtek [2]	Located in the industrial zone of Sid El Bouchrieh	The plant is a metal furniture and accessories manufacturer. The plant has internal and external markets.	The installation is fairly new as the plant was rehabilitated in 1990. Housekeeping level is good. Maintenance is carried out periodically.	**Pollutant** NA	**Load (kg/y)** NA	Due to the type of process used and since the degreasing basin is not in use there is no industrial wastewater discharge other than sanitary wastewater.
	Metal Products	Siom Orfevres [2]	Mazraat Yach	The largest electro-plating (silver/nickel) company (60% of internal market). Production consists of silver plated items made out of imported brass sheets. All processes take place on premises.	The company, which started in 1988, has its own mould preparation and welding departments. The technical state of the equipment is modern and in excellent condition. Adheres to international standards.	**Pollutant** Metals salts, acids, caustics, and detergents	**Load (kg/y)** NA	The facilities are ISO 9001 certified. An environmental management system, along with monitoring, is being established. No treatment is applied to wastewater.

		Name	Location	Main Production Activi	Plant Description	Main Emissions	Releases to the surface water sewer or soil	Environmental Control Strategies
	Metal Products	Liban Fonderies [2]	Located in an industrial area in Roumieh Near El Mott River	One of the largest in Lebanon. Activities include: recycling of ferrous scrap metal (iron, stainless steel, etc.) and recycling of non-ferrous scrap metal (aluminium, nickel, zinc, etc.).	The installation is old and in poor condition. The traditional method of metal recycling is used. Housekeeping level is very poor and maintenance is only carried out periodically.	**Pollutant** Gas oil & Lubricants Warm water	**Load (kg/y)** NA 5 m3/day	No monitoring takes place at the plant. No treatment is applied to wastewater. Oil spills to soils and wastewater have been noticed.
	Metal Products	Electro Process [2]	Located in the industrial zone of Sid El Bouchrieh	Main activities are: galvanising and hard chromium plating.	The installation is outdated although the plant was founded in 1992. Traditional methods are used. Housekeeping level is poor and the plant is highly disorganised.	**Pollutant** Oil & Grease	**Load (kg/y)** 24-36	No monitoring is carried out. No treatment is applied to wastewater.
	Chemical Products	Henkel [3]	Zouk Mosbeh	Manufacturing, conditioning and packaging of powder and liquid detergent products		**Pollutant** Detergents COD BOD	**Load** NA 3 to 5 g/l 150-300 kg/d 60-150 kg/d	**No Environmental control or monitoring exists.** Recommended Treatment: Neutralisation with alkaline reagents.
	Tannery	S.T.I.P [3]	Zouk Mosbeh	Main activity consists of tanning hides (cattle) and manufacturing leather products (shoes, bags, etc.).		**Pollutant** Cr COD BOD Grease	**Load** 1-2 g/l > 10 g/l 45 - 75 kg/d 25 - 45 kg/d NA	No Environmental control or monitoring exists. Recommended Treatment: Recycling or treatment of chromated baths; neutralisation; treatment of grease.
	Paper & Pulp Products	NINEX [3]	Zouk Mosbeh	Main activity consists of manufacturing toilet rolls, kitchen paper, etc., from both recycled paper and virgin pulp.		**Pollutant** SS COD BOD	**Load** NA > 5 g/l 360 - 900 kg/d 180 – 270 kg/d	No Environmental control or monitoring exists. Recommended Treatment: Improving the performance of fiber recovery (physico-chemical); grit removal.

Classification	Industry	Company Name	Location	Main Production Activities	Plant Description	Main Emissions	Releases to the surface water sewer or soil	Environmental Control Strategies
	Food & Beverage	Chateau Musar [3]	Ghazir	Manufacturing and bottling wine. The production is about 400,000 to 500,000 bottles per year (about 3,750 hectolitres), using 500 to 700 t of grapes:		**Pollutant** SS COD BOD	**Load** NA > 8 g/l 125 – 250 kg/d 75 – 175 kg/d	No Environmental control or monitoring exists. Recommended Pre-Treatment: physico-chemical; coagulation flocculation and clarification (limited efficiency).
	Chemical Products	Noula [3]	Zouk Mosbeh	Manufacturing, conditioning and packaging of water based and solvent based paints. Production; between 1200 and 1500 tons/year.		**Pollutant** Metals COD BOD Solvent	**Load** NA > 5 g/l 30 - 50 kg/d 10 – 20 kg/d NA	No Environmental control or monitoring exists. Recommended Treatment: physico-chemical; coagulation flocculation and clarification.
	Metal Products	Sidem [3]	Zouk Mosbeh	Manufacturing of aluminium sections from raw aluminium supplied in billet shapes.		**Pollutant** Cr, Al, F Acid, Alkaline	**Load** NA NA	Wastewater treatment exists but partly operated because of sludge disposal problem. Recommended Treatment: physico-chemical; coagulation flocculation and clarification. Removing Cr with bisulphite.
	Food & Beverage	Vegetable Oils Industry [3]	Zouk Mosbeh	Production and refining of vegetable oils from various seeds: sunflower, soja, corn, cotton, etc.		**Pollutant** Grease COD BOD	**Load** NA 20-50 g/l 700 – 1750 kg/d 350 – 700 kg/d	No Environmental control or monitoring exists. Recommended Treatment: physico-chemical; coagulation and flotation.
	Food & Beverage	Hawa Chiken [3]	Safra	Slaughtering, quartering and packaging of poultry		**Pollutant** SS COD BOD Grease	**Load** NA > 5 g/l, 1500 – 3000 kg/d 900 – 2100 kg/d NA	Wastewater treatment plant exists but not sufficient since high loads of BOD, COD & grease pollution are discharged. No environmental control or monitoring exists. Recommended Treatment: physico-chemical; coagulation flocculation and flotation followed by biological treatment.

Classification	Industry	Company Name	Location	Main Production Activities	Plant Description	Main Emissions	Releases to the surface water sewer or soil	Environmental Control Strategies
	Chemical Products	Libano-Italienne de savon et Detergents [3]	Zouk Mosbeh	Manufacturing, conditioning and packaging of detergent products		**Pollutant** Detergents COD	**Load** NA 3-5 g/l	No Environmental control or monitoring exists. Recommended Treatment: Neutralisation
	Food & Beverage	Adams Warner Lambert [3]	Zouk Mikhael	manufacturing and packaging of chewing gum, as pastilles, and candies.		**Pollutant** Sugar COD	**Load** NA 10-20 g/l	No Environmental control or monitoring exists. Recommended Treatment: Neutralisation, hydro-carbon separation
	Paper & Pulp Products	Interpack [3]	Saida	Manufacturing of corrugated paper and cardboard boxes from kraft paper. Some of the cartons are printed on site.		**Pollutant** Glue (starch) COD BOD Colouring agents	**Load** NA 1-2 g/l 60–120 kg/d 20 – 40 kg/d NA	No Environmental control or monitoring exists. Recommended Treatment: Neutralisation, physico-chemical to trap the glue and the colouring agents.
	Tannery	Tannerie Libano-Espagnole [3]	Ghazieh, Saida	Tanning cowhides and sheepskins.		**Pollutant** Cr COD BOD Grease + SS	**Load** 1-2g/l > 20 g/l 195–325 kg/d 65 – 100 kg/d NA	No Environmental control or monitoring exists. Recommended Treatment: Neutralisation, physico-chemical grease removal, treatment of chromated baths.
	Chemical Products	Zahra [3]	Saida	Manufacturing of acetylene from the reaction between calcium carbide and water.		**Pollutant** SS Metals Minerals	**Load** 1-2 g/l SS NA	No Environmental control or monitoring exists. Recommended Treatment: Settling and recycling.
	Textiles	LTI [3]	Saida	Manufacturing of woven curtains (jacquard) from polyester yarn, bleached and dyed on site.		**Pollutant** Detergents COD BOD	**Load** NA 60 – 90 kg/d 20 – 30 kg/d	No Environmental control or monitoring exists. Recommended Treatment: Neutralisation with acid or alkaline reagents.

Classification	Industry	Company Name	Location	Main Production Activities	Plant Description	Main Emissions	Releases to the surface water sewer or soil	Environmental Control Strategies
	Food & Beverage	Saida' Slaughterhouse [3]	Saida	Slaughtering of cattle and sheep.		**Pollutant**	**Load**	No Environmental control or monitoring exists. Recommended Treatment: physico-chemical; coagulation flocculation and flotation.
						SS	NA	
						COD	> 5 g/l 650 – 1300 kg/d	
						BOD	450 – 900 kg/d	
						Grease	NA	

D 5 Explanation of the groups

Particulateinorganic pollutants			
group I	**group II**	**group III**	**group IV**
Cd, Hg, Tl	As, Co, Ni, Se, Te	Sb, Pb, Cr, CN, F, Cu, Mn, Pt, Pd, Rh, V, Sn	-
Gaseous inorganic pollutants			
group I	**group II**	**group III**	**group IV**
AsH_3, ClCN, $COCl_2$, HP,	HBr, Cl_2, HCN, HF, H_2S,	HCl not mentioned at group I	SOx, NOx
Cancer causing pollutants			
group I	**group II**	**group III**	**group IV**
Asbestos, Benzo(a)pyren, Beryllium and its breathable combinations of Be, Dibenz(a,h)anthracen, 2-Naphthylamin	Arsenic oxides, several Chrome (IV) and Chrome (III) combinations, Cobalt, Nickel and its breathable combinations of Be, 3,3'-Dichlorbenzidin Dimethylsulphate Ethylenimin	Acrylnitril, Benzene, 1,3-Butadien, 1-Chlor-2,3-epoxypropan (Epichlorhydrin), 1,2-Dibromethane, 1,2-Epoxypropane, Ethyleneoxide, Hydrazine, Vinylchloride	-

D 6 Gaseous organic pollutants

Gaseous organic pollutants	formular	group
Acetal dehyde	C_2H_4O	I
Acetone	C_3H_6O	III
Acrolein (see 2-Propenal)		
Acryl acid	$C_3H_4O_2$	I
Acrylacidethylester (see Ethylacrylat)		
Acryl acid methylester (see Methylacrylat)		
Alcryl alcohol		III
Alcryl lead compounds		I
Formic acids	CH_2O_2	I
Formic acid methylester (see Methylformiat)		
Aniline	C_6H_7N	I
Benzyl chloride (see α-Chlorine toluene)		
Biphenyl	$C_{12}H_{10}$	I
2-Butanon	C_4H_8O	III
2-Butoxyethanol	$C_6H_{14}O_2$	II
Butyl acetate	$C_6H_{12}O_2$	III
Butyl glycol (see 2-Butoxyethanol)		
Butyral dehyde	C_4H_8O	II
Chlorine acetaldehyde	C_2H_3ClO	I
Chlorine benzene	C_6H_5Cl	II
2-Chlorine-1,3-Butades	C_4H_5Cl	II
Chlorine acetic acid	$C_2H_3ClO_2$	I
Chlorine ethane	C_2H_5Cl	III
Chlorine methane	CH_3Cl	I
Chloroform (see Trichlor methane)		
2-Chloropren (see 2-Chlor-1,3-Butadien)		
2-Chlorine propane	C_3H_7Cl	II
α-Chlorine toluene	C_7H_7Cl	I
Cumo (see Isopropyl benzene)		
Cyclohexanon	$C_6H_{10}O$	II
Diaceton alcohol (see 4-Hydroxy-4methyl-2-pentanon)		
Dibutyl ether	$C_8H_{18}O$	III
1,2-Dichlorobenzene	$C_6H_4Cl_2$	I
1,4-Dichlorobenzene	$C_6H_4Cl_2$	II
Dichlorodifluoride methane	CCl_2F_2	III
1,1-Dichloro ethane	$C_2H_4Cl_2$	II
1,2-Dichloro ethane	$C_2H_4Cl_2$	I
1,1-Dichloroethyl	$C_2H_2Cl_2$	I
1,2-Dichloro ethyl	$C_2H_2Cl_2$	III
Dichloro methane	CH_2Cl_2	III
Dichloro phenol	$C_6H_4Cl_2O$	I
Diethyl anolamin (see 2,2'Iminodiethanol)		
Diethyl amine	$C_4H_{11}N$	I

Gaseous organic pollutants	formular	group
Diethyl ether	$C_4H_{10}O$	III
Di-(2-ethylhexyl)-phthalate	$C_{24}H_{38}O_4$	II
Diiso butylceton (see 2,6-Dimethylheptan-4-on)		
Diiso propylether	$C_6H_{14}O$	III
Dimethyl amin	C_2H_7N	I
Dimethyl ether	C_2H_6O	III
N,N-Dimethyl formamid	C_3H_7NO	II
2,6-Dimethyl heptane-4-on	$C_7H_{14}O$	II
Dioctylphthalat (see Di-(2-ethylhexyl)phthalat)		
1,4-Dioxan	$C_4H_8O_2$	I
Diphenyl (see Biphenyl)		
Ethyl (see Ethyl acetate)		
Acetic acid	$C_2H_4O_2$	II
Acetic acid butyl acetate(see Butyl acetate)		
Acetic acid ethyl acetate (see Ethyl acetate)		
Acetic acid methyl acetate (see Methyl acetate)		
Acetic acid vinyl acetate (see Vinyl acetate)		
Ethanol (see Alcyl alcohol)		
Ether (see Diethyl ether)		
2-Ethoxyethanol	$C_4H_{10}O_2$	II
Ethyl acetate	$C_4H_8O_2$	III
Ethyl acrylate	$C_5H_8O_2$	I
Ethyl amin	C_2H_7N	I
Ethyl benzene	C_8H_{10}	II
Ethyl chloride (see Chlorethan)		
Ethyl englycole	$C_2H_6O_2$	III
Ethyl englycolmonoethylether (see 2-Ethoxyethanol)		
Ethylenglycolmonomethylether (see 2-Methoxyethanol)		
Ethyl glycol (see 2-Ethoxyethanol)		
Ethyl methylceton (see 2-Butanon)		
Formaldehyde	CH_2O	I
2-Furaldehyde	$C_5H_4O_2$	I
Furfural, Furfurol (see 2-Fural dehyde)		
Furfural alcohol	$C_5H_6O_6$	II
Glycol (see Ethylenglycol)		
Sawdust in a breathable form		I
4-Hydroxy-4-methyl-2-pentanon	$C_6H_{12}O_2$	III
2,2'-Iminodiethanol	$C_4H_{11}NO_2$	II
Isobutylmethylcetone (see 4-Methyl-2-pentanon)		
Isopropenyl benzene	C_9H_{10}	II
Isopropyl benzene	C_9H_{12}	II
Carbon disulphide	CS_2	II
Creosols	C_7H_8O	I
Maleic acid anhydride	$C_4H_2O_3$	I
Mercaptanes (see Thioalcohols)		

Gaseous organic pollutants	formular	group
Methacryl acid methylester (see Methylmethacrylat)		
Methanol (see Alkyl alcohol)		
2-Methoxyethanol	$C_3H_8O_2$	II
Methyl acetate	$C_3H_6O_2$	II
Methyl acrylate	$C_4H_6O_2$	I
Methyl amine	CH_5N	I
Methyl benzoate	$C_8H_8O_2$	III
Methyl chloride (see Chlormethan)		
Methyl chloroform (see 1,1,1-Trichlorethan)		
Methyl cyclohexanon	$C_7H_{12}O$	II
Methyl chloride (see Dichlormethane)		
Methylethylceton (see 2-Butanon)		
Methyl formiat	$C_2H_4O_2$	II
Methyl glycol (see 2-Methoxyethanol)		
Methyl isobutylceton(see 4-Methyl-2-pentanon)		
Methyl methycrylat	$C_5H_8O_2$	II
4-Methyl-2-pentanon	$C_6H_{12}O$	III
4-Methylmphenylendiisocyanat	$C_9H_6N_2O_2$	I
N-Methyl pyrrolidon	C_5H_9NO	III
Naphthalene	$C_{10}H_8$	II
Nitro-benzene	$C_6H_5NO_2$	I
Nitro-cresoles	$C_7H_7NO_3$	I
Nitro- phenols	$C_6H_5NO_3$	I
Nitroluoles	$C_7H_7NO_2$	I
Olefin hydro-carbon (with the exception of 1,3-Butadien)		III
Paraffin hydro-carbon (with the exception of Methane)		III
Perchlorine ethylene (see Tetra chlorine-ethylene)		
Phenol	C_6H_6O	I
Pinenes	$C_{10}H_{16}$	III
2-Propenal	C_3H_4O	I
Propional dehyde	C_3H_6O	II
Propion acid	$C_3H_6O_2$	II
Pyridine	C_5H_5N	I
Carbon disulfide (see Carbon disulfide)		
Styrol	C_8H_8	II
1,1,2,2-Tetrachlorethan	$C_2H_2Cl_4$	I
Tetrachlorethylen	C_2Cl_4	II
Tetrachlorcohlenstoff (see Tetrachlormethan)		
Tetrachlorine methane	CCl_4	I
Tetrahydrofuran	C_4H_8O	II
Thio alcohol		I
Thio ether		I
o-Toluidin	C_7H_9N	I
Toluene	C_7H_8	II
Toluylen-2,4-diisocyanat (see 4-		

Gaseous organic pollutants	**formular**	**group**
Methylmphenylendiisocyanat)		
1,1,1-Trichlorethane	$C_2H_3Cl_3$	II
1,1,2-Trichlorethane	$C_2H_3Cl_3$	I
Trichloroethylene	C_2HCl_3	II
Trichloromethane	$CHCl_3$	I
Trichlorophenole	$C_6H_3OCl_3$	I
Triethylamin	$C_6N_{15}N$	I
Trichloroflouride methane	CCl_3F	III
Trimethylbenzenes	C_9H_{12}	II
Vinyl acetate	$C_4H_6O_2$	II
Xylenole (except 2,4-Xylenol)	$C_8H_{10}O$	I
2,4-Xylenol	$C_8H_{10}O$	II
Xylene	C_8H_{10}	II

D 7 Industrial Air Pollution in Lebanon: 31 Case Studies

Classification	Industry	Company Name	Location	Main Production Activities	Plant Description	Main Emissions Releases to the Atmosphere		Environmental Control Strategies
	Food & Beverage	Conserves Moderne Chtaura s.a.l. (Conserva Chtaura)	Chtaura, Bekaa Next to residential areas	Largest fruit and vegetable conserving company in Lebanon. Activities include: processing, bottling and canning of raw materials, sesame production, and deep freezing of fresh vegetables.	Oldest plant operations are 30-years-old. Yearly upgrading focuses on increasing production capacity. Poor maintenance of non-production equipment.	**Pollutant** CO NO_x SO_2 VOC Particulates	**Load (kg/y)** 611 3,414.2 34,000 135.8 718	Emissions are mainly caused by the burning of fuels. Natural ventilation is used to mitigate any malodors. No other environmental control measures are being used. The company is ISO 9001 certified and is interested in ISO 14001.
	Tiles	Uniceramic s.a.l.	Bekaa valley Near the Litani River	Largest producer of wall and floor tiles Raw materials used include clay, sand, and quart.	Technological state is sufficient. There is a relatively high level of maintenance. Future plans for expansion using latest technology that meets EU standards exist.	**Pollutant** CO NO_x SO_2 VOC Particulates	**Load (kg/y)** 4,189 16,966 48,024.5 828 1,960,354	LPG and Mazuth fuel are used. Dust measurements of stacks need to be taken. The spray dryer produces 99% of the particulates (dust) and is equipped with a primary cyclone. A second dryer will be installed with a cyclone/wet scrubber system to reduce particulates emission.
	Battery Recycling	OREIBI Company for Trade and Industrial s.a.r.l.	Taanayel, Chtaura Located in an official industrial zone	Extraction of lead from old batteries after sulphuric acid has been removed. Plastic derived from polyethylene cases is shredded and moulded into flowerpots.	The equipment being used is about 10 years old. The bag filter system through which the furnace exhaust gases pass is 4 years old. All machinery is technically in an acceptable state.	**Pollutant** CO NO_x SO_2 VOC Particulates (40% lead)	**Load (kg/y)** 224 2980 21, 000 44.5 10	Emissions are mainly caused by the burning process. A filter bag system with three filters is used to control emissions. Filters are replaced every 1.5-2 years. The contents of the bag filters contain 40% lead and are put back into the furnace. Filters are checked visually every week. No further monitoring is in place.

Classification	Industry	Company Name	Location	Production Activities	Plant Description	Main Emissions Releases to the Atmosphere		Environmental Control Strategies
						Pollutant	**Load (kg/y)**	
	Paper & Pulp Products	Mimosa Sanitary Paper Co.	Zahle, in the Berdaouni valley 200 m from the Berdaouni River	Products include toilet paper, tissues, cardboard, and other sanitary products.	The equipment of the tissue paper production dates from 1991 and 1994. The equipment for cardboard production is from 1958.	CO NO_x SO_2 VOC Particulates	4,606 14,142 169,000 1,060 3,440	Heavy fuel and diesel are used to run the steam boiler and power generators resulting in excessive sulphur levels. No means for monitoring or emission reduction exists.
	Food & Beverage	Ets. Produits Taanayel	Bekaa 1 km away from residential area 700 m from the Litani River	Production of dairy goods mainly yoghurt, labne and cheese. Process includes pasteurisation of milk, cooling, fermentation, packaging, and distribution	Founded in 1938 and restarted in 1990. Total area = 5000m². Good technical state of the equipment Plans are in the works for the introduction of a new process.	**Pollutant** CO NO_x SO_2 VOC Particulates	**Load (kg/y)** 94 376 2652 4.6 37	No monitoring programs exist to measure releases to the environment. There is no specific environmental management system and no future plans for one since production is on a relatively small-scale basis.
	Cement	Ciment Blancs Sociéte Libanaise des Ciments Blancs s.a.l.	Chekka	Production geared towards white cement which is used for white tiles.	The plant was built in 1963 with installation characteristic of a cement factory. Kiln 1 (1963) uses a wet process. Kiln 2 (1975) uses a dry process. Future plans include converting Kiln 1 to a dry process and expanding production.	**Pollutant** CO NO_x SO_2 VOC Particulates	**Load (kg/y)** NA 182,750 195,500 NA 175,100	Standard emission control measures such as bag filters and ESPs exist, however regular performance checks and measurement data are lacking. Excessive dust emission is due to poor maintenance of facilities. A shift from heavy fuel oil needs to be considered. The plant welcomes environmental management training from the MoE.
	Chemical Products	Lebanon Chemicals Company	Chekka area near city of Selaata 1 km away from a nearby village	Lebanon's only fertiliser plant. Main products are sulphuric acid, phosphoric acid, Triple Super Phosphate (TSP), and Single Super Phosphate (SSP)	The new sulphuric acid plant was built in 1997 according to the latest technology. Plant performance is excellent and efficiency is 99.5-99.7%. The H_2PO_3 plant was built in 1978 and is in moderate condition.	**Pollutant** CO NO_x SO_2 VOC Particulates	**Load (kg/y)** 4,606 14,142 169,000 1,060 3,440	Heavy fuel and diesel are used to run the steam boiler and power generators resulting in excessive sulphur levels. No means for monitoring or emission reduction exists.

Classification	Industry	Company Name	Location	Main Production Activities	Plant Description	Main Emissions Releases to the Atmosphere		Environmental Control Strategies
	Metal Products	Eternit S.A. Libanaise	Chekka 500 m from the sea & 1 km away from nearest village	Asbestos cement pipes and sheets, glass reinforced plastic pipes, PVC pipes, polyethylene pipes, concrete pipes. Products are used for water transportation systems.	The plant area covers 200,000m². The asbestos cement plant was built in 1956 while the PVC/HDPE & GRP units were added on later. Basic technology is used and all units are well-maintained.	**Pollutant** CO NO_x SO_2 VOC Particulates	**Load (kg/y)** NA NA NA NA NA	The plant is equipped with an air treatment system onto which all installations are connected. The air is sent to a cyclone located outside which separates the asbestos cement dust from the air. The dust is collected in bags and sent to a private landfill. All other emissions are released to the atmosphere.
	Petroleum	Recycling Mineral Oil Co.	Chekka Closest residential area is 500 m & 2500 m from the seashore Non-industrial zone	Only plant of its kind in Lebanon. The plant recycles mineral oil into base oil of a viscosity 20-30w. Most of the oil is used to produce grease. The rest is sold as hydraulic oil or treated to produce lubricant oil (viscosity = 40w).	The plant was founded in 1991. The installation is old and in poor condition. Technology is outdated. Maintenance is low and oil spills are observed throughout the plant.	**Pollutant** CO NO_x SO_2 VOC Particulates	**Load (kg/y)** 33.3 442 4212 6.6 89.4	No emission reduction measures are being taken. Exhaust air treatment of boiler and generator stacks is non-existent. Monitoring is not carried out. Management is reluctant to invest in environmental control measures or to comply with government mandates.
	Petroleum	Mobil Wardieh Holdings Inc. s.a.l.	Dora Along main road to the port	Handles gasoline in 3 grades (2 leaded, 1 unleaded). Activities include: Unloading of ships, storage in tanks, pumping of gas into tank trucks & production of lubricant oil.	The plant was founded in 1921 and operated until 1976. Operation resumed in 1996. Technical status of the facilities is poor. Installations are old.	**Pollutant** Alkanes & alkenes Benzene Toluene Xylenes	**Load (kg/y)** 7,883,668 81,262 121,920 40,632	No emission reduction measures are being taken. No data on emission is available. Monitoring is not carried out. The smell of gasoline is prominent and high concentrations may occur under unfavourable weather conditions. There are no plans for major investments b/c of possible relocation (Lenore project).

Classification	Industry	Company Name	Location	Main Production Activities	Plant Description	Main Emissions Releases to the Atmosphere		Environmental Control Strategies
	Metal	Int'l Metal Company	Located in an industrial zone near the city of Beirut 300 m from a residential area	The company processes old (car) lead batteries. Lead bars are exported to Europe for production of new batteries. By-products (i.e. sulphuric acid, plastics) are sold to factories.	Started in 1993, the plant is currently running at half its capacity. The open furnace is out of date and emits burning gases into the work area. Some of the gases pass through 2 exhaust gas dust filters. Upgrades are needed.	**Pollutant** CO NO_x SO_2 VOC Particulates	**Load (kg/y)** 192 2550 18,000 38.1 9 (after filtering)	Emissions to the atmosphere are filtered by a 'jet puff' type filter. It filtrates at a low velocity. Particulates are automatically sent back to the furnace. Exact emissions are not measured and no monitoring system is available. Investment in a closed furnace needs to be considered.
	Tannery	Arteen Arabian & Sons	Dora In an industrial estate 550 m from the coastal highway	The company is a traditional chromium tannery and processes about 250 tons/year of raw hides (cattle and goat). All steps from raw hide to finished leather are executed.	Most equipment was bought in Europe between 1970 and 1991. All equipment shows a poor level of maintenance and is not up to modern technological standards.	**Pollutant** Combustion gases from stack VOC	**Load (kg/y)** minor 280	Monitoring is not performed and environmental issues are dealt with by management on an ad hoc basis. With current market problems, it is unlikely that the level of investment in environmental management will increase. Alliances with other tanneries may be necessary.
	Tannery	The Lebanese Tannery (Arteen Arabian & Sons)	Dora In an industrial estate 550 m from the coastal highway	The company is a traditional chromium tannery and processes about 800 tons/year of raw hides (cattle and goat). All steps from raw hide to finished leather are executed	The beamhouse (wet process) equipment is 10-30 years old. The finishing equipment is very modern with regular investments made in this area. The plant is very clean and well-maintained.	**Pollutant** Combustion gases from stack VOC	**Load (kg/y)** Minor 110	Monitoring is not performed and environmental issues are dealt with by management. The company expects to get the ISO 14001 certificate in the near future. The tidy working environment indicates pro-active management.
	Chemical Products	Oteri	Jal el Dib 40 m away from the seaside	Main products include sulphonic acid and sodium silicate which are sold as raw materials to the local detergent market.	The equipment at the facility is approx. 8-10 years old and in good to moderate condition. There is a maintenance program for all installations.	**Pollutant** CO NO_x SO_3 SO_2 VOC Particulates	**Load (kg/y)** 128 511 50 3,600 6 50	Some of the SO_3 - SO_2 mixture of the sulphur oxidation reactor passes through an electrostatic precipitator. The rest is sent to a scrubber and washed with an alkaline solution. The off gas of the scrubber is discharged into the atmosphere. Sulphur dioxide is monitored.

Classification	Industry	Company Name	Location	Main Production Activities	Plant Description	Main Emissions Releases to the Atmosphere		Environmental Control Strategies
	Cement	Ciment de Sibline s.a.l	Sibline 5 km from the sea and 3 km from the village of 3500	Production consists of two types of cement (types 1 and 2, with type 2 containing ferric oxide)	Line 1: The technology is of reasonable quality, but need of maintenance (leak in kiln). Line 2: state-of-the- art French technology.	**Pollutant** NO_x SO_2 Particulates	**Load (kg/y)** 1,935,000 1,463,000 1,847,375	Apart from the standard emission control measures such as bag filters and ESPs, line 1 is equipped with covered conveyor belts. Line 2 will be equipped with an additional vacuum dust removal system and a low NOx burner. Dust and gas analysers monitor air quality regularly.
	Power Generation	EDL Electricité de Liban	2 km north of Jieh Located at the border of the sea	Five power generation lines. 2 Toshiba generators (65 MW), 3 ABB generators (72 MW). All running below capacity.	The plant is of a basic design, not equipped with modern standard equipment such as desulphurisation and deNOx. Maintenance is at a minimum and occurs according to schedule or when problems arise.	**Pollutant** CO NO_x SO_3 SO_2 VOC Particulates	**Load (kg/y)** 336,000 3,680,000 163,000 13,100.000 85,600 2,100,000	There are no environmental controls except for a visual check via a camera to see if the stacks are emitting visible emissions. Most of the time this happens when the oil has fouled the boiler burners (boilers are fired with heavy fuel oil). Only oxygen levels in the stacks are measured. Skills in environmental management & performance is generally low.
	Chemical Products	Spartan Chemical Company	Shouiefat Within an industrial area 150 m east of the former highway to Saida	The company produces a number of liquid products for in house and industrial use. Activities include mixing of ingredients, filling, and packaging.	The plant is 20 years old. The apparatus is in reasonably good condition although based on a low level of technology. Production methods and logistics are out-of-date and most of the handling is being done manually.	**Pollutant** CO NO_x SO_2 VOC Particulates	**Load (kg/y)** NA NA NA NA NA	The releases are limited to ventilation air during the mixing process. Based on the raw materials used, some ammonia smells may occur. There are no environmental controls. The company is considering applying for ISO 9001/2 certification.

Classification	Industry	Company Name	Location	Main Production Activities	Plant Description	Main Emissions Releases to the Atmosphere		Environmental Control Strategies
	Chemical Products	Procter and Gamble Manufacturing Co. of Lebanon s.a.l.	Shoueifat Within an industrial zone Along the main road to Saida	Production and packaging of a multi-purpose powder detergent.	The installation dates from 1962. The technology is not state-of-the-art, but suffices for the single product process. Maintenance is at a reasonable level, but evidence of wear and tear is apparent.	**Pollutant** CO NO_x SO_3 SO_2 VOC Particulates	**Load (kg/y)** 220.1 880.4 86.8 6,200 11.34 214.72	The main emission point is the stack of the spray dryer. This point is equipped with a cyclone and filter bag. No air quality measurements are being taken. Environmental awareness does exist at the management level. The plant needs to report environmental performance to P&G and is ranked accordingly.
	Food & Beverage	M.O. Gandour and Sons s.a.l.	Near the center of Shoueifat Along the main road between Saida and Beirut	The company produces biscuits and chocolate bars from flour, fat, water, and additives. All ingredients are FDA approved.	The operations are being updated. The packaging lines are modernised and automated. The boilers and generators are old and should be checked.	**Pollutant** CO NO_x SO_3 SO_2 VOC Particulates	**Load (kg/y)** 2,295 16,327 804 36,002.5 256.4 2,589	No environmental controls exist. Environmental impact is low except for the use of heavy fuel oil and mazuth. Changing fuel type and modernising the boiler system need to be considered.
	Chemical Products	Chemipaint Universal Paint & Chemical Industries s.a.r.l. (Tinol Int'l)	Shoueifat Within an industrial zone Along main road to Saida	Two main product lines: water and solvent based paints. Process includes wet grinding of the ingredients, homogenisation, and packaging.	The plant started in 1979. The technology is relatively old and does not comply with standard practice.	**Pollutant** CO NO_x SO_2 VOC Particulates	**Load (kg/y)** NA NA NA 22,500 15,000	No monitoring programs exist to measure releases to the environment. There is no specific environmental management system.
	Chemical Products	Seven Plast	Shoueifat Next to Pepsi Cola plant	Seven Plast imports polymers pellets (granulates from various thermo-plastics, i.e. PVC) and mixes them with colorants, softeners, and other additives to produce ready made raw materials for manufacturers of paint products.	The plant uses basic equipment. The process itself does not create relevant emissions to the atmosphere.	**Pollutant** CO NO_x SO_2 VOC Particulates	**Load (kg/y)** NA NA NA NA NA	Heavy fuel oil is used to run the electrical generator and steam boilers. The most important emissions to the air are the combustion gases from these two sources. A shift to cleaner fuel needs consideration. Monitoring and control measures need to be implemented.

Classification	Industry	Company Name	Location	Main Production Activities	Plant Description	Main Emissions Releases to the Atmosphere		Environmental Control Strategies
	Power Generation	Zouk Power Plant	Zouk Michael Located at the border of the sea	The power plant consists of 5 power generation lines with maximum capacity of 631 MW.	The plant is of a basic design, not equipped with modern standard equipment such as desulphurisation and deNOx. Maintenance is at a minimum and occurs according to schedule or when problems arise.	**Pollutant** CO NO_x SO_3 SO_2 VOC Particulates	**Load (kg/y)** 657,488 7,042,100 247,925 20,042,000 169,947 3, 974,180	There are no environmental controls except for a visual check via a camera to see if the stacks are emitting visible emissions. Most of the time this happens when the oil has fouled the boiler burners (boilers are fired with heavy fuel oil). O_2 and CO_2 levels are measured. Skills in environmental management & performance are generally low.
	Chemical Products	Algorithm s.a.l.	Located in Zouk Mosbeh Along the highway, near the sea border	The company produces a range of 50 pharmaceutical products. Processes include: mixing of components, forming of tablets, and packaging.	The company is modern with good ventilation. It satisfies high int'l production standards. A laboratory is equipped for raw material and product testing.	**Pollutant** CO NO_x SO_2 VOC Particulates	**Load (kg/y)** NA NA NA NA NA	There are dust collection filters on the air exhaust. For VOCs, no emission control measures have been taken. Good monitoring equipment is available, only not aimed at addressing environmental issues.
	Textiles	Colortex Babik Frères	Zouk Mosbeh Within an industrial zone	Textile importers and exporters. Activities include textile printing (dyeing, printing, and other surface treatments to textiles).	The machinery is old and outdated. The technical state is moderate.	**Pollutant** CO NO_x SO_2 VOC Particulates	**Load (kg/y)** NA NA NA NA NA	There is no use of organic solvents in the dyes. The main air emissions are from off gases from the boilers (heavy fuel oil and mazuth are used. No monitoring exists.
	Metal Products	Habis	Adonis Within an industrial zone 500 m from a residential area	The company is a manufacturer of silver plated products destined for internal and external markets.	The company started in 1965 and has its own mould preparations and welding department. The technical state of most equipment is moderate.	**Pollutant** Degreasing with petroleum causes evaporation	**Load (kg/y)** 250 litres per year	The company is equipped with poor ventilation devices. No environmental monitoring takes place. An environmental management system is neither in place nor planned.

Classification	Industry	Company Name	Location	Main Production Activities	Plant Description	Main Emissions Releases to the Atmosphere		Environmental Control Strategies
	Chemical Products	Adonis Pesticides Sté. Industrielle Adonis s.a.l.	Adonis Near River Ibrahim 100 m from a residential area	The company manufactures insecticides, fungicides, herbicides, fertilisers, and hygiene products.	The technical state of the equipment is moderate to poor. The underground xylene storage tank is 10-years-old. Some of the production units are outdated.	**Pollutant** CO NO_x SO_2 VOC Particulates	**Load (kg/y)** NA NA NA NA NA	Releases to the atmosphere are due to dust from the sulphur grinding and the powder section. The efficiency of the dust filters is moderate. Vapours from the liquid pesticide tank are sent to a scrubber and washed with sodium hypochlorite before being released to the atmosphere. The capacity of the scrubber is insufficient causing malodors in the vicinity. No monitoring exists.
	Chemical Products	Pharmaline Cosmaline Industries s.a.l.	Located 200 m from Nahr Ibrahim Nearest residential area is 1 km away	The largest manufacturer of pharmaceuticals and cosmetics in Lebanon. Products include: lotions, creams, gels, liquids, and sprays.	The facility was built in 1989 and upgraded during the years. The technical state of the equipment is high. Production occurs in clean, monitored rooms (humidity, temp., pressure).	**Pollutant** CO NOx SO_2 VOC Particulates	**Load (kg/y)** NA NA NA NA NA	Apart from combustion gases, there are no relevant emissions to the atmosphere. Mazuth is the main source of fuel (120t/y). Environmental management is established. A quality system based on ISO-9001/2 is being implemented.
	Metal Products	Chromtek	Located in the industrial zone of Sid El Bouchrieh	The plant is a metal furniture and accessories manufacturer. The plant has internal and external markets.	The installation is fairly new as the plant was rehabilitated in 1990. Housekeeping level is good. Maintenance is carried out periodically.	**Pollutant** CO NOx SO_2 VOC Particulates	**Load (kg/y)** 53.25 213 7,575 12.75 4.5	No emission reduction measures are being taken. Mazuth is used to run operations. Monitoring is not carried out and no environmental management is being implemented.
	Metal Products	Siom Orfevres	Mazraat Yach	The largest electroplating (silver/nickel) company (60% of internal market). Production consists of silver plated items made out of imported brass sheets. All processes take place on premises.	The company, which started in 1988, has its own mould preparation and welding departments. The technical state of the equipment is modern and in excellent condition. Adheres to international standards.	**Pollutant** CO NOx SO_2 VOC Particulates	**Load (kg/y)** NA NA NA NA NA	The company is equipped with an air ventilation system which complies with US regulations. The air of the polishing unit is sent to a cyclone. Solvents are not used for degreasing purposes. The facilities are ISO 9001 certified. An environmental management system, along with monitoring, is being established.

Classification	Industry	Company Name	Location	Main Production Activities	Plant Description	Main Emissions Releases to the Atmosphere		Environmental Control Strategies
	Metal Products	Liban Fonderies	Located in an industrial area in Roumieh Near El Mott River	One of the largest in Lebanon. Activities include: recycling of ferrous scrap metal (iron, stainless steel, etc.) and recycling of non-ferrous scrap metal (aluminium, nickel, zinc, etc.).	The installation is old and in poor condition. The traditional method of metal recycling is used. Housekeeping level is very poor and maintenance is only carried out periodically.	**Pollutant**	**Load (kg/y)**	The emissions are mainly due to the burning of coke and gas oil in the furnace and the generators. A filter is located on the furnace stack and cleaned monthly. No monitoring takes place at the plant.
						CO	62.48	
						NO_x	249.92	
						SO_2	8,888.8	
						VOC	14.96	
						Particulates	5.28	
	Metal Products	Electro Process	Located in the industrial zone of Sid El Bouchrieh	Main activities are: galvanising and hard chromium plating.	The installation is outdated although the plant was founded in 1992. Traditional methods are used. Housekeeping level is poor and the plant is highly disorganised.	**Pollutant**	**Load (kg/y)**	There are no emissions reduction measures taken and no proper ventilation system in place. No monitoring is carried out.
						CO	42.6	
						NO_x	170.4	
						SO_2	6,060	
						VOC	10.2	
						Particulates	3.6	

D 8 Hazardous waste qualities and quantities

Waste Type	Description	Possible Sources in Lebanon
Waste oils	• Hydraulic oils containing PCBs & PCTs • Hydraulic oils, chlorinated & non-chlorinated • Emulsions, including coolants/ cutting oils Brake fluids • Engine oils, chlorinated and non-chlorinated • Lubricant oils • Insulating and heat transmission oils containing PCBs/ PCTs • Oil/ water separator wastes (solids, sludge, interceptor sludge, emulsions) • Oily filters and filter clays	• Maintenance of any industrial plant & machinery • Vehicle maintenance • Waste from petroleum product storage tank cleaning • Metal working processes involving cutting & turning • Scrap transformers & capacitors • Oil interceptors/ separators • Oil recycling plant
Acids	• Inorganic acids (likely to be mainly sulphuric & hydrochloric acids, with lesser amounts of nitric & phosphoric acids). • Organic acids (likely to be in much lesser amounts and less hazardous; possibly acetic, citric & lactic)	• Metal finishing, including pickling and electroplating, sulphuric acid waste will be generated from the recycling of lead acid batteries. • Organic acids are likely to be used and generated in the food processing industry.
Alkalis	• Predominantly sodium hydroxide and potassium hydroxide	• Degreasing and cleaning of metal surfaces in basic metal & metal fabricating industries. • Cleaning of tanks and vessels, particularly in major food/ beverage processing industries.
Asbestos	• Amosite, chrysotile, and crocidolite (much less harmful when in bonded form)	• Demolition during re-construction works • Waste from the manufacture of bonded asbestos pipes & brake lining.

Waste Type	Description	Possible Sources in Lebanon
Hydrocarbon	• Predominantly aliphatic, alicyclic and aromatics used as fuels, lubricants (see waste oils) and as solvents (paints, thinners, varnishes, lacquers, wood preservatives and cleaning products.	• Manufacture of metal products • Manufacture of wood products and furniture.
Halogenated Hydrocarbon	• The most common are dichloromethane (paint, solvent and stripper), 1,1,1-trichloroethane, trichloroethene (metal degreasants) and tetrachloroethene (dry cleaning)	• Manufacture of metal products and metal finishing • Dry cleaning
Heavy metals	• Plating waste sludge (Cd, Cr, Cu, Ni, Ag, • Sn, Zn salts, and often as Cyanide salts • Cr sludge from tanning • Pb from smelting dross, and batteries • Hg compounds from batteries, fluorescent strip lights and other electrical equipment. • Ag compounds from photographic processing	• Electroplating • Tanneries • Photographic processing • Fluorescent strip lights are used in most industrial & commercial premises
Inorganic Cyanides	• Cyanide salts of heavy metals used in electroplating and from metal tempering waste	• Electroplating • Metal tempering
Inorganic sulphur compounds	• Alkali metal sulphides used in fellmongering	• Leather tanning • fellmongering

Fig. D-49: Potentially hazardous waste streams that are likely to be generated in Lebanon[107]

[107] Source: Ministry of Environment (MOE)

Region	Sector	Type of solid waste (ton/year)			
		Hazardous solid waste	Heavy metals	Putrescent solid waste	Paint and resin waste
Bekaa	Food products and beverages			6,320	
	Pulp and paper products		181		
	Non-metallic mineral products	415			
	Leather industry		136	42	
Chekka & Selaata	Food products and beverages			7,990	
Chouiefat & Kfarchima	Non-metallic mineral products	110			
	Leather industry		34	11	
	Chemical products and man-made fibres				45
Dora & Bourj Hammoud	Leather industry		136	42	
	Textiles				35
	Food products and beverages			260	
	Food products and beverages			2,768	
Zouk Michael & Zouk Mosbeth	Chemical products and man-made fibres				45
	Leather industry		306	95	
Jieh & Sibline/Saida & Ghazieh	Leather industry		204	64	
Lebanon	Basic metals, metal products	25	300		
	Galvanising processes		10		
	Printing activities	120	1		124
	Oil products	150			

Fig. D-50: Solid waste of industrial sources[108]

[108] Tebodin: Industrial and Hazardous Waste Management, on behalf of METAP - The World Bank – MoE, 1998

Code	Description	Typical Waste Generating Processes	Typical specific industrial solid wastes may include the following
13	Agriculture and Hunting	Not generally classified as industrial	Agrochemicals, pesticides, infected animal carcases
14	Mining and Quarrying	Excavation, dressing/cutting, crushing	Stone, powders, dusts
15	Food Products and Beverages	Processing, packaging, transportation	Infected carcases, meats, fats, oils, bones, hooves, feathers, offal, vegetables, fruits, peels, cores, seeds, nuts, shells, cereals, straw, husks, sludges, spent grains, spent hops, yeast, preservatives
16	Tobacco Product!	Processing, packaging, transportation	Waste tobacco, paper
17	Textiles	(Excluding primary manufacturing processes) Cutting, sizing, pressing	Cloth, fibres, metals, plastic, rubber, dyes, pigments, solvents from dressing/finishing
18	Wearing Apparel, Fur	Cutting, sizing, pressing	Cloth, fibres, metals, plastic, rubber, dyes, pigments, solvents from dressing/finishing
19	Leather and Leather Products	Leather tanning and finishing, manufacture of goods, packing	Scrap leather, fibres, liming waste, chromium sludges, dyes, oils, processing and curing compounds
20	Wood and Wood Products	Cutting, preserving	Wood, sawdust, timber preservation chemicals, paints, adhesives
21	Pulp and Paper Products	Paper and card manufacture, carton manufacture	Paper and pulp residues, sludges, treatment chemicals, paper coatings, inks, adhesives
22	Printed Matter and Recorded Media	Printing, lithography, engraving and binding	Paper, cardboard, metals, cloth, inks, solvents, adhesives, spent photographic chemicals
23	Coke and Petroleum Products	Processing, storage and regeneration	Oils, bitumen, tars, sludges
24	Chemical Product* and Man-made Fibre*	Manufacture, formulation, supply and use.	Organic and inorganic chemicals, metals, plastics, rubber, glass, oils. solvents, pigments
25	Rubber and Plastic Product*	Manufacture	Scrap rubber and plastic, curing compounds, pigments, solvents

Code	Description	Typical Waste Generating Processes	Typical specific industrial solid wastes may include the following
26	non-metallic Mineral Products	Manufacture	Glass, cement, clays, ceramics, asbestos, abrasives, pigments
27	Basic Metals	Melting, casting, forging, drawing, rolling, forming, extruding	Scrap metals/dross, slags, spent refactories, sand, cores, bonding agents. dusts/sludges from gas treatment, ash
28	Fabricated Metal Products	Manufacture, surface treatment, surface coating	Metals, ceramics, sand, slag, scale, abrasives, coatings, solvents, lubricants and cutting oils, acid pickling solutions, alkaline degreasing solutions, plating wastes including cyanide containing sludges
29	Machinery and Equipment	Manufacture and repair	Metals, wood, plastics, resins, rubber, cloth, oils, abrasives, paints, solvents, petroleum products
31	Electrical Machinery and Products	Manufacture and repair	Metals, ceramics, rubber, plastics, resins, fibres, cloth, solvents
32	Radio and Communication Equipment	Manufacture and repair	Metals, ceramics, rubber, plastics, resins, fibres, cloth, solvents
33	Medical. Optical. Watches and Clocks	Manufacture and repair	Metals, glass, plastics, resins, leather, oils, adhesives, paints, solvents
34	Motor Vehicles and Trailers	Manufacture and repair	Metals, glass, fibres, plastics, cloth, solvents, paints, oils, hydraulic fluids, spent catalysts, tyres
35	Other Transport Vehicles	Manufacture and repair	Metals, glass, fibres, plastics, cloth, solvents, paints, oils. hydraulic fluids, spent catalysts, tyres
36	Furniture and Other Goods	Manufacture and repair	Wood, sawdust, metals, plastics, resins, glass, adhesives, sealants, paints, solvents, preservation chemicals
45	Construction Work	Materials processing, demolition, construction, refurbishment	Soils, concrete masonry/brickwork/stone, ceramics, metal, wood, glass, plasterboard, bituminous materials, insulation materials including asbestos

Fig. D-51: Sources and types of industrial solid wastes

B. Operations which may Lead to Resources Recovery, Recycling Reclamation, Direct Re-use or Alternative Uses

Section B encompasses all such operations with respect to materials legally defined as or considered to be hazardous waste and which otherwise would have been destined for operations included in Section A.

R1 Use as a fuel (other than in direct incineration) or other means to generate energy
R2 Solvent reclamation/regeneration
R3 Recycling/reclamation of organic substances which are not used as solvents
R4 Recycling/reclamation of metals and metal compounds
R5 Recycling/reclamation of other inorganic materials
R6 Regeneration of acids or bases
R7 Recovery of components used for pollution abatement
R8 Recovery of components from catalysts
R9 Used oil re-refining or other reuses of previously used oil
R10 Land treatment resulting in benefit to agriculture or ecological improvement
R11 Uses of residual materials obtained from any of the operations numbered R1-R10
R12 Exchange of waste for submission to any of the operations numbered R1-R11
R13 Accumulation of material intended for any operation in Section B

32. ion-exchange column residue;
33. sewage sludges, untreated or unsuitable for use in agriculture;
34. residue from cleaning of tanks and/or equipment;
35. contaminated equipment;
36. contaminated containers (e.g. packaging, gas cylinders, etc.) whose contents included one or more of the constituents listed in Annex II;
37. batteries and other electrical cells;
38. vegetable oils;
39. materials resulting from selective waste collections from households and which exhibit any of the characteristics listed in Annex III;
40. any other wastes which contain any of the constituents listed in Annex II and any of the properties listed in Annex III.

(*) Certain duplications of entries found in Annex II are intentional.

ANNEX II

Constituents of the wastes in annex i.b. which render them hazardous when they have the properties described in annex iii (*)

Wastes having as constituents:

C1 beryllium; beryllium compounds;
C2 vanadium compounds;
C3 chromium (VI) compounds;
C4 cobalt compounds;
C5 nickel compounds;
C6 copper compounds;
C7 zinc compounds;
C8 arsenic; arsenic compounds;
C9 selenium; selenium compounds;
C10 silver compounds;
C11 cadmium; cadmium compounds;
C12 tin compounds;
C13 antimony; antimony compounds;
C14 tellurium; tellurium compounds;
C15 barium compounds; excluding barium sulphate;
C16 mercury; mercury compounds;
C17 thallium; thallium compounds;
C18 lead; lead compounds;
C19 inorganic sulphides;
C20 inorganic fluorine compounds, excluding calcium fluoride;
C21 inorganic cyanides;
C22 the following alkaline or alkaline earth metals: lithium, sodium, potassium, calcium, magnesium in uncombined form;
C23 acidic solutions or acids in solid form;
C24 basic solutions or bases in solid form;
C25 asbestos (dust and fibres);
C26 phosphorus: phosphorus compounds, excluding mineral phosphates;
C27 metal carbonyls;
C28 peroxides;
C29 chlorates;
C30 perchlorates;
C31 azides;
C32 PCBs and/or PCTs;
C33 pharmaceutical or veterinary compounds;
C34 biocides and phyto-pharmaceutical substances (e.g. pesticides, etc.);
C35 infectious substances;
C36 creosotes;
C37 isocyanates; thiocyanates;
C38 organic cyanides (e.g. nitriles, etc.);
C39 phenols; phenol compounds;
C40 halogenated solvents;
C41 organic solvents, excluding halogenated solvents;
C42 organohalogen compounds, excluding inert polymerised materials and other substances referred to in this Annex;
C43 aromatic compounds; polycyclic and heterocyclic organic compounds;

C44 aliphatic amines;
C45 aromatic amines C46 ethers;
C47 substances of an explosive character, excluding those listed elsewhere in this Annex;
C48 sulphur organic compounds;
C49 any congener of polychlorinated dibenzo-furan;
C50 any congener of polychlorinated dibenzo-p-dioxin;
C51 hydrocarbons and their oxygen; nitrogen and/or sulphur compounds not otherwise taken into account in this Annex.

(*)Certain duplications of generic types of hazardous wastes listed in Annex I are intentional.

Annex III
PROPERTIES OF WASTES WHICH RENDER THEM HAZARDOUS

H1 'Explosive`: substances and preparations which may explode under the effect of flame or which are more sensitive to shocks or friction than dinitrobenzene.

H2 'Oxidising`: substances and preparations which exhibit highly exothermic reactions when in contact with other substances, particularly flammable substances.

H3-A 'Highly flammable`:

- liquid substances and preparations having a flash point below 21 °C (including extremely flammable liquids), or
- substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without any application of energy, or
- solid substances and preparations which may readily catch fire after brief contact with a source of ignition and which continue to burn or to be consumed after removal of the source of ignition, or
- gaseous substances and preparations which are flammable in air at normal pressure, or
- substances and preparations which, in contact with water or damp air, evolve highly flammable gases in dangerous quantities.

H3-B 'Flammable`: liquid substances and preparations having a flash point equal to or greater than 21 °C and less than or equal to 55 °C.

H4 'Irritant`: non-corrosive substances and preparations which, through immediate, prolonged or repeated contact with the skin or mucous membrane, can cause inflammation.

H5 'harmful`: substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may involve limited health risks.

H6 'Toxic`: substances and preparations (including very toxic substances and preparations) which, if they are inhaled or ingested or if they penetrate the skin, may involve serious, acute or chronic health risks and even death.

H7 'Carcinogenic`: substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce cancer or increase its incidence.

H8 'Corrosive`: substances and preparations which may destroy living tissue on contacts.

H9 'Infectious`: substances containing viable micro-organisms or their toxins which are known or reliably believed to cause disease in man or other living organisms.

H10 'Teratogenic`: substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce non-hereditary congenital malformations or increase their incidence.

H11 'Mutagenic`: substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce hereditary genetic defects or increase their incidence.

H12 Substances and preparations which release toxic or very toxic gases in contact with water, air or an acid.

H13 Substances and preparations capable by any means, after disposal, of yielding another substance, e.g. a leachate, which possesses any of the characteristics listed above.

H14 'Ecotoxic`: substances and preparations which present or may present immediate or delayed risks for one or more sectors of the environment.

Notes

1. Attribution of the hazard properties 'toxic` (and 'very toxic`), 'harmful`, 'corrosive` and 'irritant` is made on the basis of the criteria laid down by Annex VI, part I A and part II B, of Council Directive 67/548/EEC of 27 June 1967 of the approximation of laws, regulations

and administrative provisions relating to the classification, packaging and labelling of dangerous substances (1), in the version as amended by Council Directive 79/831/EEC (2).

2. With regard to attribution of the properties 'carcinogenic`, 'teratogenic` and 'mutagenic`, and reflecting the most recent findings, additional criteria are contained in the Guide to the classification and labelling of dangerous substances and preparations of Annex VI (part II D) to Directive 67/548/EEC in the version as amended by Commission Directive 83/467/EEC (1).

D 1094/904/EC: Council Decision of 22 December 1994 establishing a list of hazardous waste pursuant to Article 1 (4) of Council Directive 91/689/EEC on hazardous waste

ANNEX
HAZARDOUS WASTES ACCORDING TO ARTICLE 1 (4) OF DIRECTIVE 91/689/EEC

Introduction

1. The different types of waste in the list are fully defined by the six-digit code for the waste and the respective two-digit and four-digit chapter headings.

2. Inclusion in the list does not mean that the material or object is a waste in all circumstances. The entry is only relevant when the definition of waste according to Article 1 (a) of Directive 75/442/EEC has been satisfied, unless Article 2 (1) b of the Directive applies.

3. The waste featuring on the list is subject to the provisions of Council Directive 91/689/EEC on hazardous waste, unless Article 1 (5) of the Directive applies.

4. In accordance with Article 1 (4), second indent of Directive 91/689/EEC, any waste other than the ones listed below which is considered by a Member State to display any of the properties listed in Annex III to Council Directive 91/689/EEC on hazardous waste is hazardous. All such cases will be notified to the Commission and will be examined with a view to amending the list in accordance with Article 18 of Directive 75/442/EEC.

Appendix C: Hazardous Waste List (Council Decision 94/904/EEC)

EWC-Code	Description
02	**WASTE FROM AGRICULTURAL, HORTICULTURAL, HUNTING, FISHING AND AQUACULTURE PRIMARY PRODUCTION, FOOD PREPARATION AND PROCESSING**
0201	PRIMARY PRODUCTION WASTE
020105	agrochemical wastes
03	**WASTES FROM WOOD PROCESSING AND THE PRODUCTION OF PAPER, CARDBOARD. PULP. PANELS AND FURNITURE**
0302	WOOD PRESERVATION WASTE
030201	non-halogenated organic wood preservatives
030202	organochlorinated wood preservatives
030203	organometallic wood preservatives
030204	inorganic wood preservatives
04	**WASTES FROM THE LEATHER AND TEXTILE INDUSTRIES**
0401	WASTES FROM THE LEATHER INDUSTRY
040103	degreasing wastes containing solvents without a liquid phase
0402	WASTES FROM TEXTILE INDUSTRY
040211	halogenated wastes from dressing and finishing
05	**WASTES FROM PETROLEUM REFINING, NATURAL GAS PURIFICATION AND PYROLYTIC TREATMENT OF COAL**
0501	OILY SLUDGES AND SOLID WASTES
050103	tank bottom sludges
050104	acid alkyl sludges
050105	oil spills
050107	acid tars
050108	other tars
0504	SPENT FILTER CLAYS
050401	spent filter clays
0506	WASTE FROM THE PYROLYTIC TREATMENT OF COAL
050601	acid tars
050603	other tars
0507	WASTE FROM NATURAL GAS PURIFICATION
050701	sludges containing mercury

0508 WASTES FROM OIL REGENERATION
050801 spent filter clays
050802 acid tars
050803 other tars
050804 aqueous liquid waste from oil regeneration
06 WASTES FROM INORGANIC CHEMICAL PROCESSES
0601 WASTE ACIDIC SOLUTIONS
060101 sulphuric acid and sulphurous acid
060102 hydrochloric acid
060103 hydrofluoric acid
060104 phosphoric and phosphorous acid
060105 nitric acid and nitrous acid
060199 waste not otherwise specified
0602 ALKALINE SOLUTIONS
060201 calcium hydroxide
060202 soda
060203 ammonia
060299 wastes not otherwise specified
0603 WASTE SALTS AND THEIR SOLUTIONS
060311 salts and solutions containing cyanides
0604 METAL-CONTAINING WASTES
060402 metallic salts (except 060300)
060403 wastes containing arsenic
060404 wastes containing mercury
060405 wastes containing heavy metals
0607 WASTES FROM HALOGEN CHEMICAL PROCESSES
060701 wastes containing asbestos from electrolysis
060702 activated carbon from chlorine production
0613 WASTES FROM OTHER INORGANIC CHEMICAL PROCESSES
061301 inorganic pesticides, biocides and wood preserving agents
0613012 spent activated carbon (except 060702)
07 WASTES FROM ORGANIC CHEMICAL PROCESSES
0701 WASTE FROM THE MANUFACTURE, FORMULATION, SUPPLY AND USE (MFSU) OF BASIC ORGANIC CHEMICALS
070101 aqueous washing liquids and mother liquors
070103 organic halogenated solvents, washing liquids and mother liquors
070104 other organic solvents, washing liquids and mother liquors
070107 halogenated still bottoms and reaction residues
070108 other still bottoms and reaction residues
070109 halogenated filter cakes, spent absorbents
070110 other filter cakes, spent absorbents
0702 WASTE FROM THE MFSU OF PLASTICS, SYNTHETIC RUBBER AND MAN-MADE FIBRES
070201 aqueous washing liquids and mother liquors
070203 organic halogenated solvents, washing liquids and mother liquors
070204 other organic solvents, washing liquids and mother liquors
070207 halogenated still bottoms and reaction residues
070208 other still bottoms and reaction residues
070209 halogenated filter cakes, spent absorbents
070210 other filter cakes, spent absorbents
0703 WASTE FROM THE MFSU OF ORGANIC DYES AND PIGMENTS (EXCLUDING 061100)
070301 aqueous washing liquids and mother liquors
070303 organic halogenated solvents, washing liquids and mother liquors 070304 other organic solvents, washing liquids and mother liquors
070307 halogenated still bottoms and reaction residues
070308 other still bottoms and reaction residues
070309 halogenated filter cakes, spent absorbents
070310 other filter cakes, spent absorbents
0704 WASTE FROM THE MFSU OF ORGANIC PESTICIDES (EXCEPT 020105)
070401 aqueous washing liquids and mother liquors
070403 organic halogenated solvents, washing liquids and mother liquors 070404

	other organic solvents, washing liquids and mother liquors
070407	halogenated still bottoms and reaction residues
070408	other still bottoms and reaction residues
070409	halogenated filter cakes, spent absorbents
070410	other filter cakes, spent absorbents
0705	WASTE FROM THE MFSU OF PHARMACEUTICALS
070501	aqueous washing liquids and mother liquors
070503	organic halogenated solvents, washing liquids and mother liquors 070504
	other organic solvents, washing liquids and mother liquors
070507	halogenated still bottoms and reaction residues
070508	other still bottoms and reaction residues
070509	halogenated filter cakes, spent absorbents
070510	other filter cakes, spent absorbents
0706	WASTE FROM THE MFSU OF FATS, GREASE, SOAPS, DETERGENTS, DISINFECTANTS AND COSMETICS
070601	aqueous washing liquids and mother liquors
070603	organic halogenated solvents, washing liquids and mother liquors 070604
	other organic solvents, washing liquids and mother liquors
070607	halogenated still bottoms and reaction residues
070608	other still bottoms and reaction residues
070609	halogenated filter cakes, spent absorbents
070610	other filter cakes, spent absorbents
0707	WASTE FROM THE MFSU OF FINE CHEMICALS AND CHEMICAL PRODUCTS NOT OTHERWISE SPECIFIED
070701	aqueous washing liquids and mother liquors
070703	organic halogenated solvents, washing liquids and mother liquors 070704
	other organic solvents, washing liquids and mother liquors
070707	halogenated still bottoms and reaction residues
070708	other still bottoms and reaction residues
070709	halogenated filter cakes, spent absorbents
070710	other filter cakes, spent absorbents
08	**WASTES FROM THE MANUFACTURE, FORMULATION, SUPPLY AND USE (MFSU) OF COATINGS (PAINTS, VARNISHES AND VITREOUS ENAMELS), ADHESIVE, SEALANTS AND PRINTING INKS**
0801	WASTES FROM MFSU OF PAINT AND VARNISH
080101	waste paints and varnish containing halogenated solvents
080102	waste paints and varnish free of halogenated solvents
080106	sludges from paint or varnish removal containing halogenated solvents
080107	sludges from paint or varnish removal free of halogenated solvents 0803
	WASTES FROM MFSU OF PRINTING INKS
080301	waste ink containing halogenated solvents
080302	waste ink free of halogenated solvents
080305	ink sludges containing halogenated solvents
080306	ink sludges free of halogenated solvents
0804	WASTES FROM MFSU OF ADHESIVE AND SEALANTS (INCLUDING WATERPROOFING PRODUCTS)
080401	waste adhesives and sealants containing halogenated solvents
080402	waste adhesives and sealants free of halogenated solvents
080405	adhesives and sealants sludges containing halogenated solvents 080406
	adhesives and sealants sludges free of halogenated solvents
09	**WASTES FROM THE PHOTOGRAPHIC INDUSTRY**
0901	WASTES FROM PHOTOGRAPHIC INDUSTRY
090101	water based developer and activator solutions
090102	water based offset plate developer solutions
090103	solvent based developer solutions
090104	fixer solutions
090105	bleach solutions and bleach fixer solutions
090106	waste containing silver from on-site treatment of photographic waste
10	**INORGANIC WASTES FROM THERMAL PROCESSES**
1001	WASTES FROM POWER STATION AND OTHER COMBUSTION PLANTS (EXCEPT 190000)
100104	oil fly ash

100109	sulphuric acid
1003	WASTES FROM ALUMINIUM THERMAL METALLURGY
100301	tars and other carbon-containing wastes from anode manufacture skimmings
100304	primary smelting slags/white drosses
100307	spent pot lining
100308	salt slags from secondary smelting
100309	black drosses from secondary smelting
100310	waste from treatment of salt slags and black drosses treatment
1004	WASTES FROM LEAD THERMAL METALLURGY
100401	slags (1st and 2nd smelting)
100402	dross and skimmings (1st and 2nd smelting)
100403	calcium arsenate
100404	flue gas dust
100405	other particulates and dust
100406	solid waste from gas treatment
100407	sludges from gas treatment
1005	WASTES FROM ZINC THERMAL METALLURGY
100501	slags (1st and 2nd smelting)
100502	dross and skimmings (1st and 2nd smelting)
100503	flue gas dust
100505	solid waste from gas treatment
100506	sludges from gas treatment
1006	WASTES FROM COPPER THERMAL METALLURGY
100603	flue gas dust
100605	waste from electrolytic refining
100606	solid waste from gas treatment
100607	sludges from gas treatment
11	**INORGANIC WASTE WITH METALS FROM METAL TREATMENT AND THE COATING OF METALS; NON-FERROUS HYDRO- METALLURGY**
1101	LIQUID WASTES AND SLUDGES FROM METAL TREATMENT AND COATING OF METALS (e.g. GALVANIC PROCESSES, ZINC COATING PROCESSES, PICKLING PROCESSES, ETCHING, PHOSPHATIZING, ALKALINE DECREASING)
110101	cyanidic (alkaline) wastes containing heavy metals other than chromium
110102	cyanidic (alkaline) wastes which do not contain heavy metals
110103	cyanide-free wastes containing chromium
110105	acidic pickling solutions
110106	acids not otherwise specified
110107	alkalis not otherwise specified
110108	phosphatising sludges
1102	WASTES AND SLUDGES FROM NON-FERROUS HYDROMETALLURGICAL PROCESSES
110202	sludges from zinc hydrometallurgy (including jarosite, goethite)
1103	SLUDGES AND SOLIDS FROM TEMPERING PROCESSES
110301	wastes containing cyanide
110302	other wastes
12	**WASTES FROM SHAPING AND SURFACE TREATMENT OF METALS AND PLASTICS**
1201	WASTES FROM SHAPING (INCLUDING FORGING, WELDING, PRESSING, DRAWING, TURNING, CUTTING AND FILING)
120106	waste machining oils containing halogens (not emulsioned)
120107	waste machining oils free of halogens (not emulsioned)
120108	waste machining emulsions containing halogens
120109	waste machining emulsions free of halogens
120110	synthetic machining oils
120111	machining sludges
120112	spent waxes and fats
1203	WASTES FROM WATER AND STEAM DECREASING PROCESSES□(EXCEPT 110000)
120301	aqueous washing liquids
120302	steam degreasing wastes
13	**OIL WASTES (EXCEPT EDIBLE OILS, 050000 AND 120000)**

1301	WASTE HYDRAULIC OILS AND BRAKE FLUIDS
130101	hydraulic oils, containing PCBs or PCTs
130102	other chlorinated hydraulic oils (not emulsions)
130103	non chlorinated hydraulic oils (not emulsions)
130104	chlorinated emulsions
130105	non-chlorinated emulsions
130106	hydraulic oils containing only mineral oil
130107	other hydraulic oils
130108	brake fluids
1302	WASTE ENGINE, GEAR AND LUBRICATING OILS
130201	chlorinated engine, gear and lubricating oils
130202	non-chlorinated engine, gear and lubricating oils
130203	other machine, gear and lubrication oils
1303	WASTE INSULATING AND HEAT TRANSMISSION OILS AND OTHER LIQUIDS
130301	insulating or heat transmission oils and other liquids containing PCBs or PCTs
130302	other chlorinated insulating and heat transmission oils and other liquids
130303	non-chlorinated insulating and heat transmission oils and other liquids
130304	synthetic insulating and heat transmission oils and other liquids
130305	mineral insulating and heat transmission oils
1304	BILGE OILS
130401	bilge oils from inland navigation
130402	bilge oils from jetty sewers
130403	bilge oils from other navigation
1305	OIL/WATER SEPARATOR CONTENTS
130501	oil/water separator solids
130502	oil/water separator sludges
130503	interceptor sludges
130504	desalter sludges or emulsions
130505	other emulsions
1306	OIL WASTE NOT OTHERWISE SPECIFIED
130601	oil waste not otherwise specified
14	**WASTES FROM ORGANIC SUBSTANCES EMPLOYED AS**
1401	SOLVENTS (EXCEPT 070000 AND 080000) WASTES FROM METAL DEGREASING AND MACHINERY MAINTENANCE
140101	chlorofluorocarbons
140102	other halogenated solvents and solvent mixes
140103	other solvents and solvent mixes
140104	aqueous solvent mixes containing halogens
140105	aqueous solvent mixes free of halogens
140106	sludges or solid wastes containing halogenated solvents
140107	sludges or solid wastes free of halogenated solvents
1402	WASTES FROM TEXTILE CLEANING AND DEGREASING OF NATURAL PRODUCTS
140201	halogenated solvents and solvent mixes
140202	solvent mixes or organic liquids free of halogenated solvents
140203	sludges or solid wastes containing halogenated solvents
140204	sludges or solid wastes containing other solvents
1403	WASTES FROM THE ELECTRONIC INDUSTRY
140301	chlorofluorocarbons
140302	other halogenated solvents
140303	solvents and solvent mixes free of halogenated solvents
140304	sludges or solid wastes containing halogenated solvents
140305	sludges or solid wastes containing other solvents
1404	WASTES FROM COOLANTS, FOAM/AEROSOL PROPELLENTS 140401 chlorofluorocarbons
140402	other halogenated solvents and solvent mixes
140403	other solvents and solvent mixes
140404	sludges or solid wastes containing halogenated solvents
140405	sludges or solid wastes containing other solvents
1405	WASTES FROM SOLVENT AND COOLANT RECOVERY (STILL BOTTOMS)
140501	chlorofluorocarbons
140502	halogenated solvents and solvent mixes

140503	other solvents and solvent mixes
140504	sludges containing halogenated solvents
140505	sludges containing other solvents
16	**WASTES NOT OTHERWISE SPECIFIED IN THE CATALOGUE**
1602	DISCARDED EQUIPMENT AND SHREDDER RESIDUES
160201	transformers and capacitors containing PCBs or PCTs
1604	WASTE EXPLOSIVES
160401	waste ammunition
160402	fireworks waste
160403	other waste explosives
1606	BATTERIES AND ACCUMULATORS
160601	lead batteries
160602	Ni-Cd batteries
160603	mercury dry cells
160606	electrolyte from batteries and accumulators
1607	WASTE FROM TRANSPORT AND STORAGE TANK CLEANING□(EXCEPT 050000 AND 120000)
160701	waste from marine transport tank cleaning, containing chemicals
160702	waste from marine transport tank cleaning, containing oil
160703	waste from railway and road transport tank cleaning containing oil
160704	waste from railway and road transport tank cleaning containing chemicals
160705	waste from storage tank cleaning, containing chemicals
160706	waste from storage tank cleaning, containing oil
17	**CONSTRUCTION AND DEMOLITION WASTE (INCLUDING ROAD CONSTRUCTION)**
1706	INSULATION MATERIALS
170601	insulation materials containing asbestos
18	**WASTES FROM HUMAN OR ANIMAL HEALTH CARE AND/OR RELATED RESEARCH (EXCLUDING KITCHEN AND RESTAURANT WASTES WHICH DO NOT ARISE FROM IMMEDIATE HEALTH CARE)**
1801	WASTE FROM NATAL CARE, DIAGNOSIS, TREATMENT OR PREVENTION OF DISEASE IN HUMANS
180103	other wastes whose collection and disposal is subject to special requirements in view of the prevention of infection
1802	WASTE FROM RESEARCH, DIAGNOSIS, TREATMENT OR PREVENTION OF DISEASE INVOLVING ANIMALS
180202	other wastes whose collection and disposal is subject to special requirements in view of the prevention of infection
180204	discarded chemicals
19	**WASTES FROM WASTE TREATMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE WATER INDUSTRY**
1901	WASTES FROM INCINERATION OR PYROLYSIS OF MUNICIPAL AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES
190103	fly ash
190104	boiler dust
190105	filter cake from gas treatment
190106	aqueous liquid waste from gas treatment and other aqueous liquid wastes
190107	solid waste from gas treatment
190110	spent activated carbon from flue gas treatment
1902	WASTES FROM SPECIFIC PHYSICO/CHEMICAL TREATMENTS OF INDUSTRIAL WASTES (e.g. DECHROMATATION, DECYANIDATION, NEUTRALIZATION)
190201	metal hydroxide sludges and other sludges from metal insolubilisation treatment
1904	VITRIFIED WASTES AND WASTES FROM VITRIFICATION
190402	fly ash and other flue gas treatment wastes
190403	non-vitrified solid phase
1908	WASTES FROM WASTE WATER TREATMENT PLANTS NOT OTHERWISE SPECIFIED
190803	grease and oil mixture from oil/waste water separation
190806	saturated or spent ion exchange resins
190807	solutions and sludges from regeneration of ion exchangers
20	**MUNICIPAL WASTES AND SIMILAR COMMERCIAL, INDUSTRIAL AND**

	INSTITUTIONAL WASTES INCLUDING SEPARATELY COLLECTED FRACTIONS
2001	SEPARATELY COLLECTED FRACTIONS
200112	paint, inks, adhesives and resins
200113	solvents
200117	photo chemicals
200119	pesticides
200121	fluorescent tubes and other mercury containing [illegible]

D 11 Measurement methods

D 11.1 Waste water analysis

Parameter	Measurement method	Method available, experience available? other method used, approx. price
pH	Electrometric	
Temperature	Thermometer	
BOD_5 mgO_2/L	*DIN 38409-H51:* BOD within of five days at 20°C, determination of the oxygen concentration through iodometric analysis according to Winkler (DIN 38408-21-1) or through amperometric analysis using an oxygen sonde (DIN 38408-22).	
COD mgO_2/L	*DIN 38409-H41-1, H41-2, H43-1, H43-2, H44-1, H44-2*[109]*:* Oxidation with an excess of potassiumdichromate in an acid environment, the presence of mercury sulphate binds chloride and avoids its oxidation	
Total Phosphorous mgP/L	Photometric analysis as phosphate using the molybdane blue method after opening all phosphor compounds to phosphate.[110]	
Total Nitrogen mgN/L	Total N = Kjedahl-N[111] + NO_2^- + NO_3^-[112]: **Kjedahl-N**: Kjedahl procedure to open nitrogen compounds catalytically to ammonium in sulphuric solution[113]. **Nitrite**: *DIN 38405-D10*: Photometric analysis with sulphanilacid and N-(1-Naphtyle)-ethylendiamine at 540 nm Detection range: 0.01 – 10 mg/L *DIN 38405-D19*: Ionochromatographic analysis	
Suspended Solids mg/L	Gravimetric analysis (filtration through membrane filter of 0.45 µm)	
AOX[114]	*DIN 38409-H14:* Adsorption at activated coal, thermal decomposition and determination of the halogen hydrogen with a micro-coulometer Detection range: 10 – 250 µg/L calculated as Cl	
Detergents mg/L[115]	*DIN 38409-H23-1:*	

[109] According to CSB and chloride concentration, including short-term procedure

[110] Please refer to the measurement of phosphate

[111] Kjeldahl-N (organic N + NH_3)

[112] Please refer to the measurement of nitrate

[113] Please refer to the measurement of ammonium

[114] Adsorbable Organic Halogens

Parameter	Measurement method	Method available, experience available? other method used, approx. price
	Anionic active: Photometric analysis with methylenblue at 650 nm Detection range: 0.2 – 1.5 mg/L (according to TBS) *DIN 38409-H23*: Non-ionic active: Precipitation with Dragendorff reagent	
Coliform Bacteria 37°C in 100 ml	*DIN 38411-K6:* Enrichment in a lactose bouillon: determination of number of Escheria coli and coliforms	
Salmonellae	Concentration through membrane filtration, incubation in a typical environment, identification	
Hydrocarbons mg/L	*DIN 38409-H18*: Infrared spectroscopy analysis: Extraction from solvent with 1,1,2 TCFE, removal of other polar substance using a polar sorbens and measurement of infrared absorption at ν in the range of 3,200 to 2,700 cm^{-1}: CH_3 at λ 3.38 µm (ν = 2,958 cm^{-1}) CH_2 at λ 3.42 µm (ν = 2,924 cm^{-1}) CH at λ 3.30 µm (ν = 3,030 cm^{-1}) Detection range: > 0.1 mg/L	
Phenol index[116] mg/L	*DIN 38409-H16-2*: Photometric analysis (after distillation): phenols and phenol homologues form antipyrine colours in an alkaline solution in the presence of potassium peroxo-disulphate or potassium hexacyanoferrat (III). Shaking the antipyrine colour with chloroform it can be detected quantitively with the photometer at 460 nm. Detection range: 0.02 – 1 mg/L	
Oil and Grease mg/L	Gravimetric analysis after extraction from solvent	
Total Organic Carbon (TOC) mg/L	*DIN 38409-H3-1*: Oxidation of the organic carbon to carbon dioxide. Determination of the carbon dioxide concentration with the infrared spectroscope, coulometry, conductometry or acidimetry or after reduction to methane, determination by using the heat conduction ability or an FID.	
Ammonia (NH^{4+}) mg/L	*DIN 38406-E5-1*: Photometric analysis according to Berthelot (indophenolblue method): Ammonium reacts with chlorine to chlorineamine (pH between 5 and 8). This forms with salicylate ions in the presence of nitroprussid-	

[115] Anion active, cation active and non-ionic active

[116] Includes: Phenol, ortho- and meta bonds of phenols and - depending on the pH - the p-bonds of phenol with carboxyl-, halogen-, methoxy-or sulphonacids

Parameter	Measurement method	Method available, experience available? other method used, approx. price
	Na-ions a blue colour (indophenolblue), to be analysed at 655 nm. Detection range: 0.03 – 1 mg/L *DIN 38406-E5-2*: Acidimetric analysis after distillation in bar acid solution. Detection range: >5 mg/L	
Silver (Ag) mg/L	Atomic Absorption Spectrometer *DIN 38406-E18:* AAS in a graphite tube oven DIN 38406-E21: AAS using the acetylene flame *DIN 38406-E22*: ICP-OES	
Aluminium (Al) mg/L	Atomic Absorption Spectrometer *DIN 38406-E22:* ICP-OES	
Arsenic (As) mg/L	Atomic Absorption Spectrometer *DIN 38405-D18*: Hydride method *DIN 38406-E22:* ICP-OES	
Barium (Ba) mg/L	Atomic Absorption Spectrometer *DIN 51401 –1*	
Cadmium (Cd) mg/L	Atomic Absorption Spectrometer *DIN 38406-E19-1*: using the air-acetylene flame *DIN 38406-E19-2*: forming a chelate with HMDC[117], using the air-acetylene flame *DIN 38406-E19-3*: direct electro-thermal atomisation in the graphite tube cuvette *DIN 38406-E21*: enrichment with HMDC and extraction with diisopropylketon-xylole	
Cobalt (Co) mg/L	Atomic Absorption Spectrometer *DIN 51401 –1*	
Chromium total (Cr) mg/L	Atomic Absorption Spectrometer *DIN 38406-E10-1*: direct atomisation in the flame *DIN 38406-E10-2*: electro-thermal atomisation in the graphite tube cuvette	
Hexavalent Chromium (Cr^{VI}) mg/L	*DIN 38405-D24*: Photometric analysis after reaction with diphenylcarbazide in sulphuric environment at 535 nm	
Copper total (Cu) mg/L	Atomic Absorption Spectrometer *DIN 38406-E21*: enrichment through extraction *DIN 38406-E22*: ICP-OES	
Iron total (Fe) mg/L	*DIN 38406-1*:	

[117] hexamethylammonium-hexamethylene-dithiocarbonat

Parameter	Measurement method	Method available, experience available? other method used, approx. price
	Photometric analysis after forming a complex with 1,10-phenanthroliniumchloride at 492 or 508 nm Detection range: 0.01 – 4 mg/L Atomic Absorption Spectrometer *DIN 51401 –1*	
Mercury total (Hg) mg/L	Atomic Absorption Spectrometer *DIN 38406-E21:* direct detection *DIN 38406-E12-2*: detection after UV opening *DIN 38406-E12-2*: detection after wet chemical opening with potassiumpermanganate and potassiumperoxodi-sulphate	
Manganese (Mn) mg/L	Atomic Absorption Spectrometer *DIN 51401 –1*	
Nickel total (Ni) mg/L	Atomic Absorption Spectrometer *DIN 38406-E22*: ICP-OES	
Lead total (Pb) mg/L	Atomic Absorption Spectrometer *DIN 38406-E6-1*: direct detection after atomisation in the flame (air-acetylene flame) *DIN 38406-E6-2*: enrichment through forming a chelate with HMDC and detection after atomisation in the flame (air-acetylene flame) *DIN 38406-E6-3:* detection after electro-thermal atomisation with AAS in graphite tube oven *DIN 38406-E21:* enrichment through extraction with diisopropylketon-xylole, air-acetylene flame *DIN 38406-E22*: ICP-OES	
Antimony (Sb) mg/L	Atomic Absorption Spectrometer *DIN 51401 –1*	
Tin total (Sn) mg/L	Atomic Absorption Spectrometer *DIN 51401 –1*	
Zinc total (Zn) mg/L	Atomic Absorption Spectrometer *DIN 38406-E8-1*: direct detection after atomisation in the flame *DIN 38406-E8-2*: detection after complexion with HMDC *DIN 38406-E22*: ICP-OES	
Active Cl_2 mg/L	*DIN 38408-G4-1:* Titrimetric analysis: Chlorine forms with N,N-dimethyle-1,4-phenylendiamin (DPD) a red colour which serves as the indicator during titration with iron (II) to colourless	

Parameter	Measurement method	Method available, experience available? other method used, approx. price
	Detection range: 0.1 – 4 mg/L *DIN 38408-G4-2:* Photometric or colourmetric analysis with DPD reagent, evaluation at 510 nm Detection range: 0.03 – 1 mg/L	
Cyanides (CN^-)mg/L	*DIN 38405-D13-1* Photometric: Transformation of cyanide ions with chlorine (chlorine amine T) to chlorinecyan, formation of an aldehyde with pyridine, reaction with barbituracid forming the red-violet polymethinecolour, detection at 578 nm Detection range: 0.02 – 2 mg/L *DIN 38405-D19*: Ionochromatographic analysis	
Fluoride (F^-) mg/L	*DIN 38405-D4-2* Potentiometric: Detection of the total inorganic bounded fluoride after alkaline opening and distillation with an ion sensitive electrode Detection range: 0.02 – 2 mg/L *DIN 38405-D19*: Ionochromatographic analysis	
Nitrate (NO_3) mg/L	*Photometric or titrimetric* after reduction to ammonia and distillation[118] Detection range: photometric analysis > 0.1 mg/L titrimetric analysis > 5 mg/L *DIN 38405-D9-2* Photometric analysis with 2,6 dimethyphenol *DIN 38405-D9-3* Photometric analysis with 4-fluorphenol (in very dirty, coloured and cloudy water with high chloride concentrations Detection range: < 0.2 mg/L *DIN 38405-D19*: Ionochromatographic analysis	
Phosphate (PO_4^{3-}) mg/L	*DIN 38405-D11-1* Photometric analysis: Phosphate ions form in acid solution with vanadate-molybdate-reagent a yellow coloured heteropolyacid, which can be detected at 405 nm Detection range: 0.1 – 12 mg/L	

[118] Please refer to the detection of ammonia

Parameter	Measurement method	Method available, experience available? other method used, approx. price
	DIN 38405-D11-2 Photometric analysis: Phosphate ions form in acid solution with molybdate ions a yellow coloured heteropolyacid, in this environment molybdate is quantitively reduced to molybdane (V) which is known as molybdane blue. Molybdane blue can be photometricly detected at 880 nm Detection range: 0.005 – 0.8 mg/L *DIN 38405-D19*: Ionochromatographic analysis	
Sulphate (SO_4^{2-}) mg/L	*DIN 38405-D5-2* Gravimetric after precipitation as Bariumsulphate Detection range: > 100 mg/L (lower concentration: evaporating of the sample) *DIN 38405-D5-2* Titrimetric with Bariumperchlorate solution and thorine indicator (yellow to red/orange) Detection range: 12 – 1,200 mg/L *DIN 38405-D19*: Ionochromatographic analysis	
Sulphide (S^{2-})mg/L	Titrimetric analysis (iodometric) after precipitation as Cadmiumsulphide (only sulphides which could be disintegrated by HCl are detected) Detection range: >2 mg/L *DIN 38405-D26*: Photometric: sulphide ions form with N,N-Dimethyl-1,4-phenylen-diammoniumdichloride in the presence of iron(III) ions methylene blue, detection at 670 nm Detection range: 0.02 – 20 mg/L	

D 11.2 Stack emission analysis

SOx	
ISO 7934: 1989 (E)	Stationary source emissions Determination of the mass concentration of sulfur dioxide Hydrogen peroxide/barium perchlorate/Thorin method
ISO 7934: 1989/DAM 1	Stationary source emissions Determination of the mass concentration of sulfur dioxide Hydrogen peroxide/barium perchlorate/Thorin method AMENDMENT 1
ISO 7934: 1989/DAM 1	Émissions de sources fixes Détermination de la concentration en masse de dioxyde de soufre Méthode au peroxyde d`hydrogène/perchlorate de baryum/Thorin AMENDMENT 1
ISO 7935: 1992 (E)	Stationary source emissions Determination of the mass concentration of sulfur dioxide Performance characteristics of automated measuring methods
NOx	
ISO 10849: 1996 (E)	Stationary source emissions Determination of the mass concentration of nitrogen oxides Performance characteristics of automated measuring systems
Dust	
ISO 9096: 1992 (E)	Stationary source emissions Determination of concentration and mass flow rate of particulate material in gas-carrying ducts Manual gravimetric method
ISO 10155: 1995 (E)	Stationary source emissions Automated monitoring of mass concentrations of particles Performance characteristics, test methods and specifications
General Aspects	
ISO 10396: 1993 (E) (F)	Stationary source emissions Sampling for the automated determination of gas concentrations Émissions de sources fixes Échantillonnage pour la détermination automatique des concentrations de gaz
Exhaustgas parameter	
ISO 10780: 1994 (E) (F)	Stationary source emissions Measurement of velocity and volume flowrate of gas streams in ducts Émissions de sources fixes Mesurage de la vitesse et du débit-volume des courants gazeux dans des conduites
Other	
ISO 10397: 1993 (E) (F)	Émissions de sources fixes Détermination des émissions par des usines d`amiante Méthode par comptage des fibres
PCDD / PCDF	
EN 1948 (Juni 1996)	Stationary source emissions Determination of the mass concentration of PCDD / PCDF Part 1-3

D 12 Minutes of the meetings at the laboratories

Report:	Visit
Company:	INDUSTRIAL RESEARCH INSTITUTE (IRI) Paris Avenue, Père Lebret Street Ras Beirut (01)364983 (03)623129
Date:	27.11.2000 14:00-16:00
Participants:	Mr. Bassam Frenn (Director General) Mrs. Nadia Khoury (M.SC, IRI, Physical & Chemical Laboratories Division Head) Kaya S. Mohamed Bey (Dipl.-Ing., IRI, Technical Director) Mrs. Renate Lemke (Dipl.-Ing., MVV InnoTec) Mr. A. Foerster (Dipl.-Met., TUBB)
E-mail	Iri@cnrs.edu.lb
Home	Htpp://www.iri.org.lb
Item:	• Interview on the laboratory's capacity • Site visit to the laboratory
Short summary	IRI is working on sampling and analyses in the industrial sector. Its main tasks are water, soil, material, food and air investigations. This includes several methods to determine organic, inorganic pollutants and microbiological parameters. IRI is able to analyse most of the pollutants which are mentioned in the proposed standards on wastewater and stack emissions. For some of the parameters appropriate methods need to be developed. The technical equipment of the IRI also allows sampling of stack emissions (e.g. from burners). IRI has the following available: GC (no high resolution), MS, AAS, HPLC. TOC measurement is not available. Measurement methods for AOX, detergents, hydrocarbons, phenol index, Cr (VI) and the bioassay tests are unknown. NH_4^+, CN^-, F^- could be measured at the electrodes. No ionochromatography exists. The average costs for common analysis is between 3 – 5 cost units (a cost unit is 8,000 LL).
Interests	Accreditation and certification in compliance with German/European or international standards.

Report:	**Visit**
Company:	American University Beirut Core Environmental Laboratory Hamra Beirut Tel: 01/374374
Date:	28.11.2000 10:00-12:00
Participants:	Mrs. Asma Bazzi, Manager assistant at department of pathology laboratory, Medicine and Core Environmental Laboratory, ext.: 5200, aibol@aub.edu.lb Mrs. Maya Masri, Research Assistance at the Core Environmental Laboratory, ext. 4859, 4869 Mrs. Renate Lemke (Dipl.-Ing., MVV InnoTec) Mr. A. Foerster (Dipl.-Met., TUBB)
E-mail	corelabs@aub.edu.lb
Further contact	Dr. Mutasem El Fadel, ext. 3470 Associate Professor civil and environmental engineering mfadel@aub.edu.lb Dr Ghazi Zaatari, ext. 5163 Chairman of the department zaatari@aub.edu.lb
Item:	• Interview on the laboratory's capacity • Site visit to the laboratory
Short summary	The AUB institute is well equipped for working on the analyses of several sample matrix operating methods to determine organic polutants in inorganic pollutants. The institute is able to analyse most of the pollutants which are mentioned in the proposed standards mainly concerning wastewater and stack emissions. For some of the parameters appropriate methods need to be developed. AUB has the following available: GC- MS (high resolution), AAS, NPD, ECD, ICP-MS, HPLC. TOC measurement is not available. Measurement of AOX and bioassay tests are unknown. The measurement of CN^-, F^- and Kjedahl-N is not usual but possible. No ionochromatography exists. Equipment for measurement of VOC is available, also photometer. Microbiological parameters are measured at the near by AUB hospital laboratory. A list of measurement parameters, including prices has been provided. The average cost of each single common parameter is 5 – 8 US$.

Report:	**Visit**
Institute/Company:	Lebanese American University P.O. Box: 36 Byblos / 13-5053 Beirut (09)547254 / 547262
Date:	29.11.2000 14:00-16:00
Participants:	Dr. Gebran N. Karam (Assistant Professor of Civil Engineering) (09)944581 / (01) 867089 Fuad Hashwa (Ph.D.) fhashwa@lau.edu.lb (Microbiological department) Mrs. Renate Lemke (Dipl.-Ing., MVV Innotec) Mr. A. Foerster (Dipl.-Met., TUBB)
Item:	• Interview on the laboratory's capacity • Site visit to the laboratory
Short summary:	LAU is able to carry out sampling of water, sediments and ambient air. LAU is not yet operating in a commercial way. The department for sampling is very well equipped. The environmental laboratory has the capability of analysing COD and BOD. The main compounds can be detected by UV spectrometer and fluorescence meter. The laboratory of the pharmacy faculty is equipped with HPLC and GC Systems (MS, FID, UV, Fluorescence Detection). Furthermore ICP, NMR, LCMS Systems are operated. The investment in an AAS system is planned. Several microbiological parameters in water and food matrices such as salmonella, coliforms and total germ counts could be measured. Concerning the determination of ambient air pollution a mobile measuring system is available. It provides meteorological data such as wind speed and direction, temperature and humidity. Furthermore concentrations of NO_x, SO_x.

Report:	**Visit**
Institute/Company:	Advanced Construction Technology Services (ACTS) P.O. Box: 14-5918 Code: 1105-2080 Beirut Lebanon Tel: (01)737400 Fax: (01)737222
Date:	30.11.2000 10:00-11:00
Participants:	• Mohamad Dokmak (Quality Manager Chief Chemist) mdokmak@acts-int.com • Mrs. Renate Lemke (Dipl.-Ing., MVV InnoTec) • Mr. A. Foerster (Dipl.-Met., TUBB)
Home:	www.acts-int.com
Item:	• Interview on the laboratory's capacity • Site visit to the laboratory
Short summary:	The laboratory visited is mainly working on material testing in the context of construction. Its main field of activities is concrete quality testing and development site investigations such as the stability and load carrying capacity of soils. Several soil, waste and water analyses can be carried out. Metals can be analysed with UV spectrometry. About 30-50 tests on potable water can be carried out such as hardness, aggressivity, pH etc. BOD and COD can be determined by volume-metrically methods. No capabilities concerning the determination of air pollutants are available.

Report:	**Visit**
Institute:	Public Health Laboratory Central Laboratory Nsouli Street P.O. Box: 8508 Beirut Tel.: (01) 810491 Fax: (01) 1810492
Date:	01.12.2000 9:30-10:00
Participants:	Dr. Vanda Barakett, Director Mrs. Renate Lemke (Dipl.-Ing., MVV Innotec) Mr. A. Foerster (Dipl.-Met., TÜV Umwelt Berlin-Brandenburg)
E-mail	
Item:	• Interview on the laboratory's capacity • Site visit to the laboratory
Short summary	The Central Laboratory is well equipped for working on the analyses of sample matrixes of the food and drinking water sector. Related to the tasks of health control they determine a lot of organic, inorganic and microbiological parameters and seem to fulfil most of the environmental parameters. In the case of water the following parameters were named: PH, temperature, conductivity, hardness, heavy metals, COD, BOD, Anions, Cations, Pestizides. The equipment contains, GC with several detection systems, HPLC, ICP and UV Spectrometers. The Public Health Laboratory is especially active – in close co-operation with Libnor – in the development of measurement standards for drinking water and food analysis. The Public Health Laboratory is carrying out it services free of charge, but all orders must be channelled through official channels (e.g. Ministry of the Environment or Health). It could be possible to involve the Public Health Laboratory in the development of standards for waste water measurement in Lebanon.

D 13 Protocols of site visits at industrial plants

Report:	**Visit**
Company:	Etablissement Assaf pour la Peinture Nahr El Mote Vallee Industrielle B.P: 789 Beyrouth (01)897 550
Date:	13.10.2000 10:00-11:00
Participants:	Mr. Samy e. Assaf Mr. Habbid (Envirotec) Mr. A. Foerster (TÜV Umwelt Berlin-Brandenburg)
Item:	• Interview • Viewing of the production
Summary	The company visited is a medium sized paint factory with a capacity of 42 employees at maximum export using a square of 3800 m^2. The production now has decreased to employ only 14 people. In this case a reduction is described from 70 % to 10 % export rate. The process producing the paint is given by grinding and mixing of the inputs. The factory was constructed in 1994 including mainly storage, grinding, stirring and filling areas. The storage of solvents and other inputs is carried out in the natural climate of the basement. No significant smells of solvent could be detected. The grinding works in a closed system but as usual the mixing (stirring) and filling contains process of diffuse and non-continous emissions. The main solvents used in the production are xylole and butyle acetate – no chlorated solvents -. To avoid high indoor concentration a ventilator system is installed to export the emissions to atmosphere. To produce energy a generator is used with a consumption of about 40 l of fuel a day.
Paint Industry	• about 223 factories in Lebanon • production of 34,000 t paint per year
Proposals	• public waste incineration

Report:	**Visit**
Company:	Soliver Glas
Date:	17.10.2000 10:00-12:00
Participants:	Mr. Marwan Oweni (Soliver Glas) Mr. Hisham Abou Jawde (Association of Lebanes Industrialists) Mr. A. Foerster (TÜV Umwelt Berlin-Brandenburg)
Item:	• Interview • Viewing of the production
Summary	The company visited is on the same level as two other factories in Lebanon with a capacity of 135 t/day. The production is divided into the following main parts: • storage of input (used glass and raw material) • melting • forming • preparation and controlling of the products • packing The company was established in 1980 but maintains state-of-the-art at the same level as the other two companies. The melting of glass and raw material is operated by a furnace with direct heating and the injection of secondary air. fuel: fuel oil consumption: 16000 l / day energy: 6 generators (about 1000 kVA each) Remote control by computer systems regulate process, furnace and input composition.

Report:	**Visit**
Company:	Sibline Cement
Date:	17.10.2000 12:00-14:00
Participants:	Mr. Fouad Jaafar (Siblene Cement) Mr. Hisham Abou Jawde (Association of Lebanes Industrialists) Mr. A. Foerster (TÜV Umwelt Berlin-Brandenburg)
Item:	• Interview • Viewing of the production
Summary	The company visited is one of two comparable cement factories in Lebanon. The production is operated in a new line presenting current international state-of-the-art. The second and old line is not in use but can be activated in a time of one or two weeks. The opration is carried out by input, process and emissions monitoring. Following steps describe the process in general: • input (quarrying, crushing, storage) • cement production (kilns) • packing and transport load
Proposals	• waste incineration operated in the cement plant

Report:	**Visit**
Company:	Sidem Aluminium
Date:	18.10.2000 9:00-10:00
Participants:	Mr. Rabih Ph. Khoury (Sidem) Mr. Alexandre Ziade (Sidem) Mr. Hisham Abou Jawde (Association of Lebanes Industrialists) Mr. A. Foerster (TÜV Umwelt Berlin-Brandenburg)
Item:	• Interview • Viewing of the production
Summary	The company visited is the biggest factory in Lebanon producing aluminium parts. The product is a variety of aluminium profiles for the construction e. g. of windows. The production machines are installed about 1980 / 1990 following the state of art. The output is between 60-70 t/day. 460 employees are working for the whole process: • input (recycled, raw aluminium) • melting • forming • surface preparation (powder coating, sealing) There are no stack devices for suction and transport of indoor air. Emissions leave the production area diffuse through the windows or ventilators placed at the side walls of the building. The energy production is carried out by 6 generators with a total of about 12 MW thermal capacity. fuel: fuel oil

D 14 Background information

pH
The pH strongly influences the solubility of several compounds in water, in particular, of heavy metals. In addition, it is important for the balance of substances and its appearance in water, for example NH_4^+ appears at a high pH level as NH_3 which is a strong fish poison.

Temperature
The temperature of a water body is one of the main determinants for the living environment of aquatic species. In addition, the water temperature influences the chemical behaviour of various substances, e.g. solubility and the acid–base–balance (pH!).

BOD_5
The BOD provides the oxygen consumption in mgO_2/L needed for the oxidation of the organic pollutants in a waste water through micro-organism. Normally, the BOD is determined for 5 days at 20°C.

COD
Determination of the oxygen consumption in mgO_2/L for the oxidation of all organic pollutants in the waste water using Kaliumdichromate (K_2CrO_4). The COD gives no information on the natural cleaning capability of a water body. In rivers, the COD is normally several times higher than the BOD (two to five times).

Total Phosphorus
High phosphorous concentrations contribute to the eutrophication of a water body (fertiliser). The total phosphorus concentration is given in mgP/L.

Total Nitrogen
Nitrogen is a classical nutrient and therefore contributes to the eutrophication of a water body. The total nitrogen concentration is determined as the sum of so-called Kjeldahl-N which includes organic N, NH_3, NO_3-N, and NO_2-N. It is given in mgN/L.

Suspended Solids mg/L
This includes all substances which suspended in water.

AOX
AOX is a typical group parameter for waste water. It covers organic bonded halogenated (X means any halogen) compounds which can be adsorbed. If the value is higher than 1 mg/L it is recommended that the type of the AOX be determined in detail to estimate the toxic potential.

Bioassay test
The bioassay test G_f is for investigating the toxicity against fish (G_F). This parameter is used to evaluate the impact of the complex waste water probe to a living organism. The result, e.g. 2, shows the dilution factor for no-effect.

Detergents
Anions, cations and non-ionic.

Coliform Bacteria
The concentration of coliform bacteria is normally determined as the number of species in 100 ml after breeding at 37°C. Coliform bacteria are an indicator for faecal pollution of the waste water (municipal waste water or from livestock breeding) and with this for the possible presence of pathogens.

Salmonellae
No salmonellae should be present in the waste water.

Hydrocarbons
Hydrocarbons are organic compounds consisting exclusively of carbon and hydrogen. Hydrocarbons polluting the water mainly originate from mineral oil and its products. Most of the mineral oil contamination can be recognised by its characteristic smell.

The smell threshold value can be used as a qualitative and semi-quantitative proof. The smell threshold value is defined as the dilution when the smell of the probe is just disappearing. The smell threshold value depends on the kind of pollution, for mineral oil contamination it is approximately 0.1 mg/L (20°C). [Beier]

Phenol index
Phenols are substances containing aromatic six link carbon circle (C_6H_6O). In the phenol group, cresols and the parent compound itself are the most important compounds as well as thymol, naphthols, phenolphthlein, trichlorophenol and pentachlorophenol.

Phenol is heavier than water and sinks to the bottom. It dissolves slowly and continues to form toxic solutions even when diluted. Because of its considerable toxicity in water, phenol is listed in water hazard class 2 in Germany.

The biological degradability of natural phenols is generally very good with the result that there is scarely any accumulation in plants or animals. Aerobic bacterial degradation involves complete breakdown to carbon dioxide.

The biological degradability of synthetic phenols is less pronounced as many phenols are toxic to micro-organisms. Toxicity increases with the number of chlorine or nitrogen atoms in the phenols. "Pentachlorophenol" is thus the most toxic compound of the chlorophenol group and trinitrophenol (picric acid) is the most poisonous within the nitrophenol group. [BMZ, 1995]

There is roughly a 90% degradation in surface water in approx. 7 days (standing water). [Rippen, 1982]

Oil and Grease
The oil and grease concentration is given in mg/L.

Total Organic Carbon (TOC)
The TOC includes all organic bounded carbon, bounded to diluted and suspended substances. In addition, cyanites (CNO^-), thiocynites (CNS^-) and elemental carbon are recorded. In comparison to the COD, which is a parameter for the oxygen demand, the TOC directly gives the mass of the total organic carbon. However, the TOC neglects the level of oxidation of the organic compound [UBA 1999]s

Ammonia (NH^{4+})
Ammonium nitrogen includes NH_3, NH^{4+} and ammonium salts. Nitrogen is a nutrient contributing to eutrophication. NH_3 is a strong fish poison. Ammoniac appears in a balance with ammonium only at high pH levels.

Silver (Ag)
The reference method is Atomic Absorption Spectrometry. [Merck]

Aluminium (Al)
The reference method is Atomic Absorption Spectrometry. [Merck]

Arsenic (As)
In aquatic systems, arsenic mainly exists in the form of arsenides and arsenates. In aquatic phases, arsenic forms insoluble precipitates with a number of compounds (Ca, S, Ba, Al, Fe) resulting in the elimination of arsenic compounds from the water.

The toxicity of arsenic compounds differs significantly. Inorganic compounds are generally more toxic than organic ones. Some arsenic compounds are even carcinogenic. [BMZ, 1995]

The reference method is Atomic Absorption Spectrometry. [Merck]

Barium (Ba)

Barium compounds mostly impact the environment as a result of industrial waste water. Barium compounds are poisonous and highly toxic to aquatic organisms. As little as 0.1 mg/L of barium is sufficient to damage micro-organisms, the self-purification capability of surface and ground water is inhibited from 1 mg/L. [BMZ, 1995]

The reference method is Atomic Absorption Spectrometry. [Merck]

Cadmium (Cd)

Cadmium is regarded as one of the most poisonous metals. Between two-thirds and three-quarters of the cadmium in surface water is adsorbed on suspended matter. It can be mobilised from sediment by complexing agents. Fish toxicity depends, amongst other things, on the calcium content of the water. Generally speaking, a high calcium content of the water reduces the toxic effect of cadmium on fish. The proven accumulation of the element in sediments, the associated possibility of remobilization and the tendency towards bioaccumulation are the major environmental hazards. [BMZ, 1995]

The biological self-purification of surface water is impaired from 0.1 mg/L. [DVGW 1988]

The reference method is Atomic Absorption Spectrometry. [Merck]

Cobalt (Co) mg/L

Cobalt is an important trace element. The hazards emanating from cobalt compounds are slight compared to other heavy metals. From a toxicological point of view it is important to avoid the inhalation of cobalt dusts. [BMZ, 1995]

The reference method is Atomic Absorption Spectrometry. [Merck]

Chromium total (Cr) and Hexavalent Chromium (Cr^{VI})

Various hexavalent chromium compounds represent the major risk especially due to their genetic effects. Chromium (VI) compounds are active in virtually all test systems designed to determine mutagenic action. The carcinogenic effect of chromium (VI) compounds has been substantiated both in animal experiments and by epidemiological studies on groups of population subject of workplace exposure.

In contrast to chromium (VI) compounds there is no clear-cut-evidence of the carcinogenic effect of chromium (III) compounds.

Because of its insolubility, metallic chromium is not toxic in water. The toxicity of soluble chromium compounds in aquatic systems varies depending on the temperature, pH and water hardness as well as on the species of organism. Chromium (VI) compounds are readily soluble in water, but are readily reduced under natural conditions in the presence of organic, oxidisable material to form less water-soluble, stable chromium (III) compounds. [BMZ, 1995]

The reference method for the Chromium total concentration is Atomic Absorption Spectrometry. [Merck]

Copper total (Cu) mg/L

Cu is precipitated in saltwater thus explaining its low content compared to freshwater. [BMZ, 1995] Cu concentrations in the environment are documented as follows:

- Lake Constance (D): 0.75 – 1.1 mg/l [DVGW 1988]
- Rhine (Cologne): 5 – 17 mg/l [DVGW 1988]

- Sea water: 0.0005 – 0.03 mg/l [Hock 1988].

Cu is a powerful fish poison, the active concentration of which depends on the make-up of the water. The toxic effect is enhanced still further by Cd, Zn and Hg:

- Daphnia LD 0.8 mg/l (18 h), Cu sulphate [DVGW 1988]
- Trout LD 0.8 mg/l (2 –3 d), Cu sulphate [DVGW 1988]
- Blue algae 0.03 mg/L Cu_{2+} = damage, Cu sulphate [DVGW 1988]
- Green algae 1.1 mg/L Cu_{2+} = damage, Cu sulphate [DVGW 1988]

The reference method is Atomic Absorption Spectrometry. [Merck]

Iron total (Fe) mg/L
The reference method are Atomic Absorption Spectrometry or photometric with phenanthroliniumchloride. [Merck]

Mercury total (Hg)
Mercury inhibits the metabolic activity of micro-organisms and thus suppresses the self-purification capability of water at concentrations as low as 18µg/L. Mercury is adsorbed on sediment and suspended matter.

Mercury is degraded by micro-organisms (biomethylation) or oxidised to form Hg^{2+}. Methylation produces methyl mercury in a reaction which is promoted by high pH values. Dimethyl mercury, which is only formed chemically (chemical methylation), escapes into the atmosphere and decomposes to form elemental mercury. In addition to methylation, chelate complexes may form from mercury(II) ions. Methyl mercury is a powerful fish poison. The effect of mercury is enhanced by the simultaneous intake of copper, zinc or lead. [BMZ 1995]

The reference method is Atomic Absorption Spectrometry. [Merck]

Lead total (Pb) mg/L
Surface water forms an accumulation sink for organic (e.g. lead tetraethyl and lead tetramethyl) and inorganic lead compounds. Insoluble lead compounds sink and are adsorbed in the sediment or accumulate on suspended matter (in particular the clay fraction). Aquatic plants likewise accumulate inorganic lead. [BMZ, 1995]

The biochemical oxidation of organic substances is inhibited at lead concentrations above 0.1 mg/L; fauna is depleted by concentrations above 0.2 mg/L and 0.3 mg/L is the threshold for fish toxicity (trout and white fish). [DVGW, 1985]

The reference method is Atomic Absorption Spectrometry. [Merck]

Manganese (Mn) mg/L
The reference method is Atomic Absorption Spectrometry. [Merck]

Nickel total (Ni)
Nickel is a trace element. Nickel is usually found in the form of Ni^{2+} in aquatic systems. The form in which it is found in water is dependent amongst other factors on the pH value. Nickel compounds in surface water are generally recorded and listed as "total nickel" despite the fact that the spectrum of the compounds anthropogenically introduced into stretches of water ranges from soluble salts and insoluble oxides to metallic nickel dust.

Naturally-occurring nickel ores are not hazardous. However, the products of synthetic processing are considerably hazardous. [BMZ, 1995]

The reference method is Atomic Absorption Spectrometry. [Merck]

Antimony (Sb) mg/L

Metallic antimony is mainly used in alloys with lead or tin; its compounds have a wide range of industrials uses, e.g. in the manufacture of fireproof fabrics, rubber and synthetics, glass and ceramics, matches, explosives and pyrotechnic materials as well as medicines.

Antimony compounds are poisonous and exhibit a toxicological behaviour similar to that of arsenic. Little is known to date about the environmental risks involved. Water pollution seldom occurs because of the low solubility of most compounds, e.g. SbH_3: 200 ml/L and Sb_2O_3: 0.014 g/l. [BMZ, 1995].

The background impact of antimony is 0.0005 – 1.1 mg/kg in soils and 0.04 – 3µg/l in surface and ground water [Germany, DVGW, 1985].

- LC_{50}: 10 – 100 ppm (96h), antimony compounds [UBA, 1986]
- Conversion factor: 1ppm = 5.19 mg/m³
- Reference method: Atomic Absorption Spectrometry

The reference method is Atomic Absorption Spectrometry. [Merck]

Tin total (Sn) mg/L
The reference method is Atomic Absorption Spectrometry. [Merck]

Zinc total (Zn)
As zinc forms a protective layer, it is stable both in freshwater and seawater. As in the case of all other heavy metals, every effort should be made to stop anthropogenic zinc emissions impacting the environment. The hazard to the environment and the health risks involved with zinc are made abundantly clear by the numerous limit values for water quality. [BMZ, 1995]

The reference method is Atomic Absorption Spectrometry. [Merck]

Active Cl_2
Active chlorine occurs as dissolved elemental chlorine, *unterchlorige* acid or hypochloritions are called active chlorine.

Cyanides (CN^-)
The reference method is photometry after distillation. [Merck]

Fluoride (F^-)
The reference method is photometry. [Merck]

Nitrate Nitrogen
Nitrate is an important fertiliser. The fertiliser effect is also effective in water bodies, prolific growth of water plants contributes the eutrophication of water bodies after plants die.

Phosphate
Phosphate is an important fertiliser. The fertiliser effect is also effective in water bodies, prolific growth of water plants contributes the eutrophication of water bodies after plants die.

Sulphate mg/L
The reference method is gravimetric as barium sulphate . [Merck]

Sulphide mg/L
The reference method is photometry with methyl blue. [Merck]

D 15 National Legislation on the "Management of Hazardous Wastes

D 15.1 Management of hazardous wastes and other wastes

I. *Aim of this law*

The aim of this Law is to minimise the generation of hazardous wastes or other wastes as well as to promote the environmentally sound management of such wastes.

II. *The Authority*

The Ministry of the Environment is the Authority for the purpose of regulating the generation and management of hazardous wastes and other wastes.

III. *Definitions*

1 "Hazardous Wastes" are substances or objects which are disposed of, or are intended to be disposed of, or are required to be disposed of, and which belong to any category contained in Section I of Appendix II to this Law, unless they do not possess any of the characteristics contained in Section II of Appendix II to this law.

2 "Other Wastes" are substances or objects which are disposed of, or are intended to be disposed of, or are required to be disposed of, and which belong to any category contained in Appendix III to this Law.

3. "Management" means the collection, transport and disposal of hazardous wastes and/or other wastes, including after-care of disposal sites.

4. "Collection" means the collection including the environmentally sound mixing, bulking and sorting of wastes and interim storage at an approved site or facility of hazardous wastes and other wastes including those generated in small quantities within the area of the Republic of Lebanon.

5. "Transport" means the movement of hazardous wastes from the place at which they are generated until they arrive for disposal.

6. "Disposal" means any operations specified in Appendix IV to this law.

7. "After-care of disposal site" means the after-care of a site which is still in operation as well as of a site which is no longer in operation.

8. "Approved site or facility" means the site or facility approved for the purpose of disposal by the prior written authorisation of the Authority.

9. "Storage" means to store the wastes for a minimum reasonable period under conditions which will prevent their release to the environment until appropriate recovery, treatment or disposal facilities are provided.

10. "Persons" means any natural or legal person.

IV. *Obligations of the Authority*

(a) The Authority shall ensure the monitoring of the effects on human health and the environment of the management of hazardous wastes or other wastes;

(b) The Authority shall encourage the adoption of new environmentally sound technologies aiming at minimising the generation of hazardous wastes or other wastes;

(c) The Authority shall ensure to the extent possible that adequate recovery[119] and disposal facilities are located as close as possible to the sites of generation of hazardous wastes or other wastes, and, if appropriate, that an integrated network of such facilities is established;

(d) The Authority shall endeavour to establish funding arrangements for assistance in emergency situations at both the national and local levels;

(e) The Authority shall envisage taking, encouraging and facilitating preventive measures.

V. *Control of the management of hazardous wastes and other wastes*

1. All persons involved in the management of hazardous wastes or other wastes within the Republic of Lebanon shall take such steps as are necessary to prevent pollution due to hazardous wastes and other wastes arising from such management and, if such pollution occurs, to minimise the consequences thereof for human health and the environment.

2. A person who wants to collect, transport or dispose of hazardous wastes or other wastes shall apply to the Authority in accordance with the approved form for a general permit to collect, transport or dispose of hazardous wastes or other wastes as the case may be. The permit shall be granted for a maximum period of two years and may be renewed.

3. The Authority shall ensure that hazardous wastes are not mixed with non-hazardous waste unless the generator, collector, storer, transporter or disposer prove that such mixing is more environmentally sound.

4. The Authority may require that further information in addition to that in the approved form be provided in writing in order to deal with the application.

5. The Authority shall grant a permit sought by a person making an application if the application in question is in conformity with the requirements of this law and, in addition, the Authority is satisfied that the management will not pose a risk to human health and the environment.

6. The generator, collector, storer, transporter and disposer shall maintain adequate insurance cover.

7. The Authority shall monitor activities conducted pursuant to any permit granted by it and. if the conditions of the permit have not been met, may amend them as necessary.

8. The Authority will establish waste management plans consistent with this law and the Basle Convention taking into consideration this law and Framework Document on the Preparation of Technical Guidelines for the Environmentally Sound Management of Hazardous Wastes subject to the Basle Convention. This management plan should be periodically reviewed taking into consideration the development of new environmentally sound technologies and management practices.

9. Generators shall develop wastes management plans. These plans may be reviewed by the Authority to make sure that they are consistent with the aim of this law.

10. The Authority shall maintain a record or database on permits granted under this law.

11. Holders of permits shall maintain a register to record the quantity, type, quality and origin of hazardous wastes or other wastes generated, collected, stored, transported, recovered and disposed of by them and provide the Authority every year with such information related to the previous year. Such a register shall be subjected to inspection by the Authority.

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119 Recovery means resource recovery, recycling, reclamation, direct re-use or alternative uses.

12. The generator, collector, storer, transporter and disposer of hazardous wastes or other wastes shall ensure that all his employees are adequately trained in handling hazardous wastes or other wastes and shall report to the Authority on an annual basis the steps taken to ensure that their employees are so trained.

13. The generator, collector, storer, transporter and disposer of hazardous wastes or other wastes is responsible for the health and safety of all his employees.

14. The generator, collector, storer, transporter and disposer of hazardous wastes or other wastes shall have an emergency action plan approved by the Authority. This plan shall be kept up to date and all employees shall have adequate instruction and training to enable them to implement it.

15. Any extension of the activities covered by this law, and outside the scope of an existing permit, by the generator, collector, storer, transporter and disposer of hazardous wastes or other wastes cannot be undertaken without prior authorisation by the Authority.

16. The Authority shall not allow the waste to be transported from the site of generation unless the packaging and containers for their transport are labelled accordingly in a clearly visible form. A movement document shall accompany the transportation.

17. The Authority shall have the power to withdraw any permit for breaches of this law.

VI. *Monitoring of the generation of hazardous wastes and other wastes*

1. The Generator shall inform the Authority every year of the quantity and characteristics of hazardous wastes or other wastes it generated in the previous year.

2. The Generator shall inform the Authority on a yearly basis on measures adopted to implement its waste management plan.

3. The Generator shall provide the Authority with information on accidents which have occurred during or as a result of the generation of hazardous waste or other waste.

VII. *Enforcement*

1. The Authority shall have the power to conduct both regular and random inspections of sites, facilities and cargo.

2. Any person who contravenes any provision of Part V of this law commits a violation and will be subject to appropriate administrative and/or penal sanctions.

D 15.2 National Law on the Control of Transboundary Movements of hazardous Wastes and other Wastes and their Disposal

Part I Aim and Scope

a. The aim of this Law is to control the export, import, transit and disposal of hazardous waste or other waste to ensure that all operations relating to export, import, transit and disposal will be undertaken in an environmentally sound manner.

b. The scope of this Law is confined to hazardous waste or other waste that are subject to the terms of the Basle Convention on the Control of Transboundary Movements of Hazardous Wastes and, their Disposal.

c. Nothing in this legislation shall detract from the obligation to comply with other relevant environmental and health legislation.

d. In case of reasonable doubt about the waste to be defined/covered by this Law, the Authority shall make the distinction

(a) ex officio;
(b) by way of a declaratory decision.

Part II Definitions

1. "Hazardous Wastes" are substances or objects which are disposed of, or are intended to be disposed of, or are required to be disposed of, and which belong to any category contained in Section I of Appendix II to this Law, unless they do not possess any of the characteristics contained in Section II of Appendix II.

2. "Other Wastes" are substances or objects which are disposed of, or are intended to be disposed of, or are required to be disposed of, and which belong to any category contained in Appendix III to this Law.

3. "Management" means the collection, transport and disposal of hazardous wastes and other wastes including after-care of disposal sites.

4. "Transboundary movement" means any movement of hazardous wastes or other wastes from an area under the national jurisdiction of one State to, or through an area under the national jurisdiction of another State, or to or through an area not under the national jurisdiction of any State, provided that at least two States are involved in the movement.

5. "Disposal" means any operations specified in Appendix IV to this law.

6. "Environmentally sound management of hazardous wastes or other wastes" means taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner which will protect human health and the environment against the adverse effects which may result from such wastes.

7. "Environmentally sound manner" means in a manner which will protect human health and the environment against the adverse effects which may result from hazardous wastes and other wastes.

8. "Approved site or facility" means a site or facility for the disposal of hazardous wastes or other wastes which is authorised or permitted to operate for this purpose by the Regulatory Authority.

9. "Regulatory Authority" is the Ministry of the Environment.

10 "Competent Authority" is the authority responsible for receiving the notification of a ra sboundary movement, and any information related to it, and for responding to such a notification as provided in this law. It is responsible for the control of transboundary nc ements of hazardous wastes and other wastes.

1. "The Focal Point" is responsible for receiving and submitting information on hazardous vastes and other wastes.

2 "Area under the national jurisdiction of a State" means any land, marine area or air pace within which this State exercises administrative and regulatory responsibility, in regard) t' protection of human health and/or the environment.

3. "State of export" means the State from which a transboundary movement of hazardous /astes or other wastes is initiated or is planned to be initiated.

4. "State of import" means a State to which a transboundary movement of hazardous /astes or other wastes is planned, or takes place for the purpose of disposal therein, or for the ur se of loading prior to disposal in an area that is not under the national jurisdiction of any ta...

5. "Import" means any entry into the national territory other than entry for transit.

5. "State of transit" means any State, other than the State of export or import, through hich a movement of hazardous wastes or other wastes is planned to take place.

7. "Transit" means the continuous passage from one border to another border through the itional territory without storage, other than temporary storage incidental to transport.

3. "Person" means any natural or legal person.

). "Exporter" means any person under the jurisdiction of the State of export who arranges r l zardous wastes or other wastes to be exported.

). "Importer" means any person under the jurisdiction of the State of import who arranges r hazardous wastes or other wastes to be imported.

. "Carrier" means any person who carries out the transport of hazardous wastes and other istes.

. "Generator" means any person whose activity produces hazardous wastes or other istes or, if that person is not known, the person who is in possession and/or control of those ist...

. "Disposer" means any person to whom hazardous wastes or other wastes are shipped d who carries out the disposal of such wastes.

. "State concerned" means any State of export or import, or transit.

. "Illegal Traffic" means any transboundary movement of hazardous wastes or other st as specified in part VII.

rt VI Regulatory Authority and Implementation of Legislation

The Regulatory Authority is hereby established as the Focal Point and Competent thority of the Republic of Lebanon.

The Regulatory Authority or, according to national circumstances, the relevant national islative-making bodies shall, in consultation with each other and other national authorities, mulate and adopt rules, regulations, schemes and guidelines in order to implement this law.

3. The Regulatory Authority shall maintain a record or database on matters related to this law.

Part IV Exporting Hazardous Wastes and Other Wastes

The export of hazardous wastes and other wastes will only be allowed:

(a) if the Republic of Lebanon does not have the technical capacity and the necessary facilities, capacity or suitable disposal sites in order to dispose of the wastes in question in an environmentally sound and efficient manner; or

(b) if the wastes in question are required as raw material for recycling or recovery industries in the State of import; or

(c) if the export is in accordance with an agreement or arrangement that conforms to the requirements of Article 11 of the Basle Convention.

2. Transboundary movements are prohibited:

(a) To any point south of 60 degrees South latitude;

(b) To any State which has imposed a ban on the import of such wastes and has so notified the Republic of Lebanon or the Secretariat of the Basle Convention;

(c) To any State which cannot provide assurance as to its capacity to dispose of such wastes in an environmentally sound manner;[120]

(d) To any State which is not a Party to the Basle Convention except in the case of a State which is party to any bilateral, multilateral or regional agreement, or arrangement which stipulates provisions not less environmentally sound than those provided by the Basle Convention and to which Republic of Lebanon is also a Party;

3. Where export is allowed under paragraph 1, the Competent Authority may permit the exportation of hazardous wastes and other wastes only after satisfying itself that the following conditions have been fulfilled:

(a) The exporter has formally applied for the transboundary movement of such wastes and has provided the Competent Authority with the information requested in the notification form attached as Appendix V to this law as well as details on labelling in relation to the hazardous wastes and other wastes he intends to export.

(b) An adequate contract exists between the exporter and the disposer specifying environmentally sound management of the waste in question.

(c) Packaging, labelling and transportation are in conformity with the recognised international rules, standards and practices.

(d) The written consent of the competent authorities of the other States concerned have been received by the exporter in accordance with Paragraph 3 of this Part.

(e) In the case of a transit-State which has either no policy of granting written consent in such cases, or has waived the requirement of written consent, "tacit consent" shall be presumed after 60 days of acknowledged receipt (by the transit-State) of the request from the Competent Authority or the Generator (for consent) - so long as no other conditions are imposed or objections raised by the transit-State in question during this sixty-day period.

4. Transboundary movements are subject to the following conditions:

(a) A movement document signed by the person in charge of the transboundary movement shall accompany the hazardous wastes in question. (The movement document is attached as Appendix VI)

120 In accordance with the technical guidelines as adopted by the Parties.

(b) Any transboundary movement of hazardous wastes or other wastes shall be covered by insurance, bond or other guarantee. [121]

5. The Competent Authority shall notify or ask the Exporter to notify, in writing, the competent authorities of the States concerned, in a language acceptable to them, of the proposed transboundary movement. Such notification shall contain detailed information as required by Annex V A of the Basle Convention.

6. If a transboundary movement of hazardous wastes or other wastes, to which consent of the States concerned has been given, subject to the provisions of article ...[122] of this law, cannot be completed in accordance with the terms of the contract, the Competent Authority shall require the exporter to take the wastes back if alternative arrangements cannot be made for their disposal in an environmentally sound manner, within 90 days from the time that the Competent Authority of the State of import informed the Competent Authority of ... or the Generator and the Secretariat of the Basle Convention, or such other period of time as the Parties concerned agree.

7. A permit for the multiple export of hazardous wastes or other wastes can be granted, subject to the written consent of the States concerned, for a maximum period of one year, if:

a) they have the same physical and chemical characteristics, and
b) they are shipped regularly to the same disposer via the same customs office and via the same entry customs office of the importing country, and
c) in the case of transit, via the same customs office of entry and exit of the State or States of transit, and
(d) the countries concerned agree to grant a similar permit.

Part V Importing of Hazardous Wastes or Other Wastes

1. Hazardous wastes or other wastes listed in Decision 71/1[123] may only be imported subject to the written authorisation or permission of the Authority.

2. The Competent Authority may consent in a written form to the import of hazardous wastes and other wastes provided the following conditions are met:

(a) The exporting State is a Party to the Basle Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal or is Party to a bilateral, multilateral or regional agreement or arrangement regarding transboundary movement of hazardous wastes or other wastes in accordance with Article 11 of the Basle Convention.
b) It is not possible to dispose of the wastes within the territory of the exporting State in an environmentally sound and efficient manner or the wastes in question are required as raw material for recycling or recovery industries in the State of import, or the import is in accordance with an agreement or arrangement that conforms with the requirements of Article 11 of the Basle Convention.
c) The request which complies with the requirements of part IV (2) has been received for a transboundary movement containing the information required by Annex V of the Basle Convention and the Competent Authority is satisfied with such information.
d) The labelling, packaging and transportation identified in the notification conforms to the requirements of recognised international rules, standards and practices.

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[121] The persons subject to such provision may include the generator, the exporter, the broker, the importer, the carrier and the disposer.

[122] Will be filled in at the very end.

[123] Decision 71/1 is under review.

(e) The specified approved site or facility is capable of managing and disposing of the waste in an environmentally sound manner.
(f) The disposer guarantees in his contract with the exporter the environmentally sound management of the wastes in question.
(g) The disposer is obliged to inform the exporter, the Competent Authority of the State of export, and the Competent Authority of the Republic of Lebanon of receipt of the hazardous wastes in question and, in due course, the completion of disposal as specified in the notification.
(h) An adequate binding contract exists between the exporter and disposer specifying environmentally sound management of the wastes in question.
(i) The importer and the disposer have a valid license to deal with the categories of hazardous wastes or other wastes proposed for importation.
(j) The generator, exporter, importer, disposer and carrier have appropriate insurance or other adequate financial guarantee.
(k) The importer or any agent acting on his/her behalf are resident in the country of import, or in the case of a corporation, have a place of business in the country of import.

3. A permit for the multiple import of hazardous wastes and other wastes can be granted to the same disposer subject to the written consent of the States concerned, for a maximum period of one year, if:

(a) they have the same physical and chemical characteristics, and
(b) they are shipped regularly via the same customs office and via the same entry customs office of the importing country, and
(c) in the case of transit, via the same customs office of entry and exit of the State or States of transit, and
(d) the countries concerned agree to grant a similar permit.

4. The Competent Authority may, at any time after issuing the written consent to the import of hazardous wastes and other wastes, revoke the permit if it has reason to believe that the wastes will not be managed in an environmentally sound manner. The importer should inform the Competent Authority upon receipt of each shipment of its details as referred to in the notification document.

Part VI Hazardous Wastes or Other Wastes in Transit through the Area under the National Jurisdiction of the Republic of Lebanon

1. The Competent Authority shall be notified of any proposed transboundary movements of hazardous wastes or other wastes through the area under the national jurisdiction of ...

The notification shall include details of:

(a) The final destination of the waste.
(b) A timetable specifying expected dates of transit through the area under the national jurisdiction of the Republic of Lebanon
(c) Proof that the exporter, the carrier, the disposer, and the site or facility for disposal are authorised to carry out the operations in question in relation to the waste.
(d) Information detailing emergency procedures in case of accidents.
(e) Information related to insurance.[124]

124 Information to be provided on the relevant insurance requirements and how they are met by exporter, carrier, and disposer.

2. The language of the notification and the emergency procedure should be accepted as English and Arabic.

3. Labelling and packaging should conform to international standards.

4. The Competent Authority shall seek additional information where necessary.

5. No transit of hazardous wastes and other wastes through the area of jurisdiction of the Republic of Lebanon shall occur without prior written consent of the Competent Authority. The Competent Authority reserves the right to deny any transit of hazardous wastes or other wastes.

6. The Competent Authority shall promptly acknowledge the receipt of any notification under paragraph 1 of this part.

7. The Competent Authority shall make a decision pursuant to paragraph 4 of this part which may include specific conditions relating to the transport of hazardous wastes and other wastes within 60 days of the receipt of notification under paragraph 1 of this part and inform the exporter or the Competent Authority of the State of export as appropriate.

8. In case of a transboundary movement by land through a transit country, the Authority, at the point of entry into its territory, shall ensure that the container is sealed. The Authority should ensure, at the point of exit, that such a seal has not been broken/is still valid.

Part VII Illegal Traffic

1. Any transboundary movement of hazardous wastes or other wastes shall be deemed illegal traffic, if carried out:

(a) Without notification pursuant to Article ... of the provisions of this Law;
(b) Without the consent required under Article ... of this Law;
(c) With consent which has been obtained through falsification, misrepresentation or fraud;
(d) In a manner not in conformity in a material way with the documentation specified under this Law and/or the rules and regulations formulated by the Competent Authority;
(e) In a manner that results in the deliberate disposal (e.g. dumping) of hazardous wastes or other wastes in contravention to the provisions of this Law.

A person commits a crime under this Law if:

(a) He carries out a transboundary movement of hazardous wastes or other wastes in a manner described in paragraph 1;
(b) He aids, abets or conspires with any other person to carry out a transboundary movement of hazardous wastes or other wastes in a manner described in paragraph 1;
(c) He attempts to carry out a transboundary movement of hazardous wastes or other wastes in a manner described in paragraph 1.

3. The relevant authorities shall have the power to conduct both regular and random inspections of sites, facilities and cargo, and to seize the shipments of hazardous wastes or other wastes that are the object of illegal traffic.

The person found guilty of a crime described under paragraph 2 shall be punished by ...

5. In the case of an illegal transboundary movement to another country as a result of conduct on the part of the exporter or generator, he/she shall ensure that the wastes are taken back, or the Regulatory Authority will take them back at the expense of the exporter or generator.

6. In the case of such re-import being impracticable, or in the case of it not being possible to attribute illegal transboundary movement to a particular person, the Regulatory Authority and the Regulatory Authority of the other States concerned shall ensure that the wastes are otherwise disposed of in an environmentally sound manner and in accordance with the provisions of this law.

7. In the case of an illegal transboundary movement to the Republic of Lebanon as a result of conduct on the part of the importer or of the disposer he/she shall, in addition to the penal punishment stipulated in paragraph 3 of part VII of this law, ensure the environmentally sound management of hazardous wastes and/or pay the appropriate sum estimated by the Authority in order to ensure the environmentally sound disposal of the imported hazardous wastes or other wastes.

Appendix I: (General) Application for the Management of Hazardous Wastes and Other Wastes

Form 1

To be filled in by all applicants

1. Name of applicant _____

2. Address _____

_____

_____

Telephone no _____

Telex no _____

Fax no _____

3. Qualification to engage in the activity covered by the permit including insurance cover available

_____

_____

4. Previous violations of this law, if any

_____

_____

5. Types of wastes to be dealt with

_____

_____

6 Arrangements for security and emergency procedures

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

To be filled by Collector only

1. Method of collection _____

2. Details related to storage _____

3. Other relevant information _____

_____

_____

To be filled by Carrier only

1. Mode of transportation to be used _____

_____

2. Range of coverage _____

_____

3. Other relevant information _____

_____

To be filled by Disposer only

1. Description of the site(s) or facility(ies) _____

_____

_____

2. Location of the site(s) or facility(ies) _____

_____

3. Methods for the disposal _____

_____

4. Other relevant information _____

_____

_____

Appendix II

Section I

Categories of Wastes to be Controlled

Waste Streams

Y1 Clinical wastes from medical care in hospitals, medical centres and clinics
Y Wastes from the production and preparation of pharmaceutical products
Y3 Waste pharmaceuticals, drugs and medicines
Y Wastes from the production, formulation and use of biocides and phytopharmaceuticals
Y Wastes from the manufacture, formulation and use of wood preserving chemicals
Y6 Wastes from the production, formulation and use of organic solvents
Y Wastes from heat treatment and tempering operations containing cyanides
Y Waste mineral oils unfit for their originally intended use
Y9 Waste oils/water, hydrocarbons/water mixtures, emulsions
Y 0 Waste substances and articles containing or contaminated with polychlorinated biphenyls (PCBs) and/or polychlorinated terphenyls (PCTs) and/or polybromated biphenyls (PBBs)
Y 1 Waste tarry residues arising from refining, distillation and any pyrolytic treatment
Y12 Wastes from production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish
Y 3 Wastes from production, formulation and use of resins, latex, plasticizers, glues/adhesives
Y 4 Waste chemical substances arising from research and development or teaching activities which are not identified and/or are new and whose effects on man and/or the environment are not known
Y 5 Wastes of an explosive nature not subject to other legislation
Y 6 Wastes from the production, formulation and use of photographic chemicals and processing materials
Y Wastes resulting from the surface treatment of metals and plastics
Y Residues arising from industrial waste disposal operations

Wastes containing:

Y Metal carbonyls
Y20 Beryllium, beryllium compounds
Y Hexavalent chromium compounds
Y22 Copper compounds
Y Zinc compounds
Y Arsenic; arsenic compounds
Y25 Selenium; selenium compounds
Y Cadmium; cadmium compounds
Y Antimony; antimony compounds
Y28 Tellurium; tellurium compounds
Y Mercury; mercury compounds
Y Thallium; thallium compounds
Y31 Lead; lead compounds
Y Inorganic fluorine compounds excluding calcium fluoride
Y Inorganic cyanides Y34 Acidic solutions or acids in solid form
Y Basic solutions or bases in solid form

Y36 Asbestos (dust and fibres)
Y37 Organic phosphorus compounds
Y38 Organic cyanides
Y39 Phenols; phenol compounds including chlorophenols
Y40 Ethers
Y41 Halogenated organic solvents
Y42 Organic solvents excluding halogenated solvents
Y43 Any congenor of polychlorinated dibenzo-furan
Y44 Any congenor of polychlorinated dibenzo-p-dioxin
Y45 Organohalogen compounds other than substances referred to in this Annex (e.g. Y39, Y41, Y42, Y43, Y44)

Section II

List of Hazardous Characteristics

*UN Class******* Code Characteristics*

1	H1	Explosive An explosive substance or waste is a solid or liquid substance or waste (or mixture of substances or wastes) which is in itself capable, through chemical reaction, of producing gas at such a temperature and pressure and at such speed as to cause damage to the surroundings.
3	H3	Flammable liquids The word "flammable" has the same meaning as "inflammable." Flammable liquids are liquids, or mixtures of liquids, or liquids containing solids in solution or suspension (for example, paints, varnishes, lacquers, etc., but not including substances or wastes otherwise classified on account of their dangerous characteristics) which give off a flammable vapour at temperatures of not more than 60.5° C, closed-cup test or not more than 65.6°C, open-cup test. (Since the results of open-cup tests and of closed-cup tests are not strictly comparable and even individual results from the same test are often variable, regulations varying from the above figures to make allowance for such differences would be within the spirit of this definition.)
4.1	H4.1	Flammable solids Solids, or waste solids, other than those classed as explosives, which under conditions encountered in transport are readily combustible, or may cause or contribute to fire through friction.
4.2	H4.2	Substances or wastes liable to spontaneous combustion Substances or wastes which are liable to spontaneous heating under normal conditions encountered in transport, or to heating up on contact with air, and being then liable to catch fire.

******* Corresponds to the hazard classification system included in the United Nations Recommendations on the Transport of Dangerous Goods (ST/SG/AC.10/1 Rev.5, United Nations, New York. 1988)

4.3	H4.3	Substances or wastes which, in contact with water emit flammable gases Substances or wastes which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.
5.1	H5.1	Oxidising Substances or wastes which, while in themselves not necessarily combustible, may, generally by yielding oxygen cause, or contribute to, the combustion of other materials.
.2	H5.2	Organic Peroxides Organic substances or wastes which contain the bivalent-0-0-structure are thermally unstable substances which may undergo exothermic self-accelerating decomposition.
6.1	H6.1	Poisonous (Acute) Substances or wastes liable either to cause death or serious injury or to harm health if swallowed or inhaled or by skin contact.
2	H6.2	Infectious substances Substances or wastes containing viable micro organisms or their toxins which are known or suspected to cause disease in animals and humans.
8	H8	Corrosives Substances or wastes which, by chemical action, will cause severe damage when in contact with living tissue, or, in the case of leakage, will materially damage, or even destroy, other goods or the means of transport; they may also cause other hazards.
9	H10	Liberation of toxic gases in contact with air or water Substances or wastes which, by interaction with air or water, are liable to give off toxic gases in dangerous quantities.
9	H11	Toxic (delayed or chronic) Substances or wastes which, if they are inhaled or ingested or if they penetrate the skin, may involve delayed or chronic effects, including carcinogenicity.
9	H12	Ecotoxic Substances or wastes which if released present or may present immediate or delayed adverse impacts to the environment by means of bioaccumulation and/or toxic effects upon biotic systems.
9	H13	Capable by means, after disposal, of yielding another material, e.g., leachate, which possesses any of the characteristics listed above.

Appendix III

T is provides for two categories of *waste requiring special consideration* under the Convention. They are:

Y46 Waste collected from households

Y47 Residues arising from the incineration of household wastes

Appendix IV
DISPOSAL OPERATIONS

A. Operations which do not lead to the possibility of resource recovery, recycling, reclamation, direct re-use or alternative uses

Section A encompasses all such disposal operations which occur in practice.

D1 Deposit into or onto land, (e.g., landfill, etc.)
D2 Land treatment, (e.g., biodegradation of liquid or sludgy discards in soils, etc.)
D3 Deep injection, (e.g., injection of pumpable discards into wells, salt domes of naturally occurring repositories, etc.)
D4 Surface impoundment, (e.g., placement of liquid or sludge discards into pits, ponds or lagoons, etc.)
D5 Specially engineered landfill, (e.g., placement into lined discrete cells which are capped and isolated from one another and the environment, etc.)
D6 Release into a water body except seas/oceans
D7 Release into seas/oceans including sea-bed insertion
D8 Biological treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations in Section A
D9 Physical-chemical treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations in Section A, (e.g., evaporation, drying, calcination, neutralisation, precipitation, etc.)
D10 Incineration on land
D11 Incineration at sea
D12 Permanent storage (e.g., emplacement of containers in a mine, etc.)
D13 Blending or mixing prior to submission to any of the operations in Section A
D14 Repackaging prior to submission to any of the operations in Section A
D15 Storage pending any of the operations in Section A

Appendix V

TRANSBOUNDARY MOVEMENT OF WASTE - Notification BASLE CONVENTION

1. Exporter (name, address) Contact person: Tel. Fax/Telex: Reason for export:	3. Notification concerning (i) Single movement ☐ (ii) General notification (multiple movement) ☐ Notification Number: (iii) Disposal (no recovery) ☐ (iv) Recovery operation ☐ Pre-authorised facility Yes / No Facility Registration Number (If yes) ☐
2. Importer (name, address) Contact person: Tel. Fax/Telex:	4. Total Intended number of shipments:
	5. Estimated quantity (1) kgs liters
	6. (I) Single shipment: Protected Date: (II) Several shipments Protected Dates or Expected frequency:
7. Intended carries (name, address) Contact person: Tel: Fax/Telex:	8. Disposer (name, address) Contact person: Tel: Fax/Telex:
10. Waste generator (name, address): Contact person: Tel Fax/Telex: Site of generation & process:	9. Method(s) of disposal (%) D code: R code:
	11. Mode(s) of transport (2)
	12 Packaging (2) type: number:
(I) Designation and composition of the waste:	(II) Special handling requirements:
	14. Physical characteristics (2)
15. Waste identification code: in country of export: in country of import: H.S.	MAC: BAC: other
	17. Y number (2)
	18. H number (2)
16. OECD classification (1) amber ☐ and number ☐ other ☐ (attach details)	19. UN identification N°: UN class (2) Shipping name:

20. Concerned countries. Code number of Component authorities, dates of consent and specific points of entry and exit:

Country of export				Country of import
Transit countries				

21. Customs office of entry and/or departure (European Community) Entry Departure:	23. Exporter's declaration: **I certify that the information is completed and correct to my knowledge. I also certify that legally enforceable written contractual obligations have been entered into and that any applicable insurance or other financial guarantees are or shall be in force covering the transboundary movement.** Name: Date: Signature :
22. Number of annexes attached	

FOR USE BY COMPETENT AUTHORITIES

24. To be completed by competent authorities of - import (EEC, OECD) - transit (Basle) Notification received: or Acknowledgement Name of competent authority, stamp and/or signature	25. Consent to the movement provided by competent authority of: Name of competent authority, stamp: and/or signature Consent entries on: Yes Specific conditions No ☐

List of abbreviations used in the notification

Disposal (No Recovery)

Deposit into or onto land (e.g., landfill, etc.)

Land Treatment, (e.g. biodegradation of liquid or sludgy discards in soils, etc...)

Deep Injection, (e.g., injection of pumpable discards into wells, salt domes or naturally occurring repositories, etc.)

Surface impoundment, (e.g., placement of liquid or sludge discards into pits, ponds or lagoons, etc...)

Specially engineered landfill, (e.g., placement into line discrete cells which are capped and isolated from one anther and the environment, etc...)

Release inot a water body except seas/oceans

Release into seas/oceans including sea-bed insertion

Biological treatment not specified elsewhere in this list which results in final compounds or mixtures which are discarded by means of any operations D1 to D12

Physico-chemical treatment not specified elsewhere in this list which results in final compounds or mixtures which are discarded by means of any of the operations D1 to D12 (e.g. evaporation, drying calcination, etc)

Incineration on land

Incineration at sea

Permanent storage, (e.g., emplacement of containers in a mine, etc.)

Blending or mixing prior to submission to any of the operations numbered D1 to D12

Repackaging prior to submission to any of the operations numbered D1 to D12

Storage pending and of the D1 to D12 operations

Recovery Operations

R1 Use as a fuel (other than in direct incineration) or other means to generate energy

R2 Solvent reclamation/regeneration

R3 Recycling/reclamation of organic substances which are not used as solvents

R4 Recycling/reclamation of metal compounds

R5 Recycling/reclamation of other inorganic materials

R6 Regeneration of acids or bases

R7 Recovery of components used for pollution abatement

R8 Recovery of components from catalysts

R9 Used oil re-refining or other reuses of previously used oil

R10 Land treatment resulting in benefit to agriculture or ecological improvement

R11 Uses of residual materials obtained from any of the operations numbered R1 to R10

R12 Exchange of wastes for submission to any of the operations numbered R1 to R11

R13 Accumulation of material intended for any of the operations numbered R1 to R12

Modes of Transport

R	Road
T	Train/Rail
S	Sea
A	Air
W	Inland Waterways

Packaging Types

1	Drum
2	Wooden Barrel
3	Jerry can
4	Box
5	Bag
6	Composite Packaging
7	Pressure receptacle
8	Bulk
9	Other (specify)

Physical Characteristics

1	Powdery/powder	5	Liquid
2	Solid	6	Gaseous
3	Viscous/paste	7	Others (specify)
4	Sludgy		

H Number and UN Class

UN	H Number	Designation
1	H1	Explosive
3	H3	Inflammable Liquids
4.1	H4.1	Inflammable Solids
4.2	H4.2	Substances or wastes liable to spontaneous combustion
4.3	H4.3	Substances or wastes which, in contact with water, emit flammable gases
5.1	H5.1	Oxidising
5.2	H5.2	Organic Peroxides
6.1	H6.1	Poisonous (acute)
6.2	H6.2	Infectious substances
8	H8	Corrosives
9	H10	Liberation of toxic gases in contact with air or water
9	H11	Toxic /delayed or chronic)
9	H12	Eco-toxic
9	H13	Capable, after disposal, of yielding another material, e.g. leachate, which possesses any of the characteristics listed above

Annex 1 to the Basle Convention provides information for the categories of wastes to be controlled by the Convention.

These categories are divided into two groups, namely wastes having as constituents the components listed Y19 to Y45

Please refer to Annex 1 of the Basle Convention for details

Specific Conditions on consenting to the movement

Appendix VI

RANSBOUNOARY MOVEMENT OF WASTE - Movement document — BASLE CONVENTION

i) Exporter (name, address) ontact person: Tel:	3 i) Corresponding to Notification N°	4. Serial number of shipment
	3 ii) Movement subject of (1) single notification / general notification	
1 ii) Waste generator (name, address) ize of generation: Contact person: Tel: Fax/Telex:	8. Disposer (name, address) Contact person: Tel: Fax/Telex:	
Importer (name, address) Contact person: Tel: Fax/Telex:	9. Method of disposal (2): Technology employed: D code: R code:	

1st Carrier (name, address) Registration N°: l: Fax/Telex:	6. 2nd Carrier (3)(name, address) Registration N°: Tel: Fax/Telex:	7. Last Carrier (name, address) Registration N°: Tel: Fax/Telex:
10. Identity of means of transport Date/location of transfer: Signature of Carrier's representative	11. Identity of means of transport Date/location of transfer: Signature of carrier's representative	12. Identity of means of transport Date/location of transfer: Signature of carrier's representative

13. Name and chemical composition of waste		14. Physical characteristics
15. Waste identification code IWIC: other (specify): untry of export: EWC: untry of import: H.S:		17. Actual quantity kgs. / litres 18. Packages (2) Type: Number: 19. UN Classification UN shipping name: UN number: UN class / H number / Y number
OECD classification (1) amber red other and number		
Special Handling requirements (including in case ccidents)	22. Exporter's declaration: I certify that the information in blocks 1 to 9 and 13 to 21 above is complete and correct to the best of my knowledge. I also certify that legally-enforceable written contractual obligations have been entered into, that any applicable insurance or other financial guarantees are in force covering the transboundary movement, and that no objection has been received from the competent authorities of all States concerned which are Parties to the Basle Convention. Date: Signature: Name:	
21. Actual data of shipment		

TO BE COMPLETED BY IMPORTER/DISPOSER

Shipment received by importer on (if not disposer): Quantity received: kg/litres accepted / rejected (*) Date: Name: Signature:	25. I certify that the disposal/recovery of the waste described above has been completed. Date: Name: Signature and stamp:
Shipment received at disposer on: Quantity received: kg/litres accepted / rejected (*) Date: Name: Signature:	
Approximate date of disposal: Method of disposal/recovery:	

(1 Enter X in appropriate boxes: (2) See codes on the reverse: (3) If more than three carriers, attach information as required in blocks 6 and 11
(*)Immediately contact Competent Authorities

List of abbreviations used in the movement document

Disposal (No Recovery)

Deposit into or onto land (e.g., landfill, etc.)

Land Treatment, (e.g. biodegradation of liquid or sludgy discards in soils, etc...)

Deep Injection, (e.g., injection of pumpable discards into wells, salt domes or naturally occurring repositories, etc.)

Surface impoundment, (e.g., placement of liquid or sludge discards into pits, ponds or lagoons, etc...)

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Release inot a water body except seas/oceans

Release into seas/oceans including sea-bed insertion

Biological treatment not specified elsewhere in this list which results in final compounds or mixtures which are discarded by means of any operations D1 to D12

Physico-chemical treatment not specified elsewhere in this list which results in final compounds or mixtures which are discarded by means of any of the operations D1 to D12 (e.g. evaporation, drying calcination, etc)

Incineration on land

Incineration at sea

Permanent storage, (e.g., emplacement of containers in a mine, etc.)

Blending or mixing prior to submission to any of the operations numbered D1 to D12

Repackaging prior to submission to any of the operations numbered D1 to D12

Storage pending and of the D1 to D12 operations

Recovery Operations

R1 Use as a fuel (other than in direct incineration) or other means to generate energy

R2 Solvent reclamation/regeneration

R3 Recycling/reclamation of organic substances which are not used as solvents

R4 Recycling/reclamation of metal compounds

R5 Recycling/reclamation of other inorganic materials

R6 Regeneration of acids or bases

R7 Recovery of components used for pollution abatement

R8 Recovery of components from catalysts

R9 Used oil re-refining or other reuses of previously used oil

R10 Land treatment resulting in benefit to agriculture or ecological improvement

R11 Uses of residual materials obtained from any of the operations numbered R1 to R10

R12 Exchange of wastes for submission to any of the operations numbered R1 to R11

R13 Accumulation of material intended for any of the operations numbered R1 to R12

Physical Characteristics

1	Powdery/powder	5	Liquid
2	Solid	6	Gaseous
3	Viscous/paste	7	Others (specify)
4	Sludgy		

Packaging Types

1	Drum
2	Wooden Barrel
3	Jerrican
4	Box
5	Bag
6	Composite Packaging
7	Pressure receptacle
8	Bulk

Modes of Transport

R	Road
T	Train/Rail
S	Sea
A	Air
W	Inland Waterways

H Number and UN Class

UN	H Number	Designation
1	H1	Explosive
3	H3	Inflammable Liquids
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5.1	H5.1	Oxidising
5.2	H5.2	Organic Peroxides
6.1	H6.1	Poisonous (acute)
6.2	H6.2	Infectious substances
8	H8	Corrosives
9	H10	Liberation of toxic gases in contact with air or water
9	H11	Toxic /delayed or chronic)
9	H12	Eco-toxic
9	H13	Capable, after disposal, of yielding another material, e.g. leachate, which possesses any of the characteristics listed above

FOR USE BY CUSTOMS OFFICES

26. COUNTRY OF EXPORT/DISPATCH OR CUSTOMS OFFICE OF EXIT

The waste described overleaf has left the country on:

Stamp:

28. STAMPS OF CUSTOM OFFICES OF TRANSIT COUNTRIES

Name of country:	Entry	Departure	Name of country:	Entry	Departure

27. COUNTRY OF IMPORT/DESTINATION

The waste described overleaf has left the country on:

Stamp:

Name of country:	Entry	Departure	Name of country:	Entry	Departure

D 16 List of hazardous and non-hazardous waste according to Basle Convention

D 16.1 LIST A

Wastes contained in this Annex are characterised as hazardous and their designation on this Annex does not preclude the use of Annex III to demonstrate that a waste is not hazardous.

A1	Metal and metal-bearing wastes
A1010	Metal wastes and waste consisting of alloys of any of the following: • Antimony • Arsenic • Beryllium • Cadmium • Lead • Mercury • Selenium • Tellurium • Thallium but excluding such wastes specifically listed on list B.
A1020	Waste having as constituents or contaminants, excluding metal waste in massive form, any of the following: • Antimony; antimony compounds • Beryllium; beryllium compounds • Cadmium; cadmium compounds • Lead; lead compounds • Selenium; selenium compounds • Tellurium; tellurium compounds
A1030	Wastes having as constituents or contaminants any of the following: • Arsenic; arsenic compounds • Mercury; mercury compounds. • Thallium; thallium compounds
A1040	Wastes having as constituents any of the following: • Metal carbonyls • Hexavalent chromium compounds
A1050	Galvanic sludges
A1060	Waste liquors from the pickling of metals
A1070	Leaching residues from zinc processing, dust and sludges such as jarosite, hematite, etc.
A1080	Waste zinc residues not included on list B, containing lead and cadmium in concentrations sufficient to exhibit Annex III characteristics
A1090	Ashes from the incineration of insulated copper wire
A1100	Dusts and residues from gas cleaning systems of copper smelters

A1110	Spent electrolytic solutions from copper electrorefining and electrowinning operations
A1120	Waste sludge, excluding anode slimes, from electrolyte purification systems in copper electrorefining and electrowinning operations
A1130	Spent etching solutions containing dissolved copper
A1140	Waste cupric chloride and copper cyanide catalysts
A1150	Precious metal ash from incineration of printed circuit boards not included on list B[125]
A1160	Waste lead-acid batteries, whole or crushed
A1170	Unsorted waste batteries excluding mixtures of only list B batteries. Waste batteries not specified on list B containing Annex I constituents to an extent to render them hazardous.
A1180	Waste electrical and electronic assemblies or scrap[126] containing components such as accumulators and other batteries included on list A, mercury-switches, glass from cathode-ray tubes and other activated glass and PCB-capacitors, or contaminated with Annex I constituents (e.g., cadmium, mercury, lead, polychlorinated biphenyl) to an extent that they possess any of the characteristics contained in Annex III (note the related entry on list B B1110)[127]
A2	**Wastes containing principally inorganic constituents, which may contain metals and organic materials**
A2010	Glass waste from cathode-ray tubes and other activated glasses
A2020	Waste inorganic fluorine compounds in the form of liquids or sludge but excluding such wastes specified on list B
A2030	Waste catalysts but excluding such wastes specified on list B
A2040	Waste gypsum arising from chemical industry processes, when containing Annex I constituents to the extent that it exhibits an Annex III hazardous characteristic (note the related entry on list B B2080)
A2050	Waste asbestos (dusts and fibres)
A2060	Coal-fired power plant fly-ash containing Annex I substances in concentrations sufficient to exhibit Annex III characteristics (note the related entry on list B B2050)
A3	**Wastes containing principally organic constituents, which may contain metals and inorganic materials**
A3010	Waste from the production or processing of petroleum coke and bitumen
A3020	Waste mineral oils unfit for their originally intended use
A3030	Wastes that contain, consist of or are contaminated with leaded anti-knock compound sludge
A3040	Waste thermal (heat transfer) fluids

[125] Note that mirror entry on list B (B1160) does not specify exceptions.

[126] This entry does not include scrap assemblies from electric power generation.

[127] PCBs are at a concentration level of 50 mg/kg or more.

A3050	Wastes from production, formulation and use of resins, latex, plasticizers, glues/adhesives excluding such wastes specified on list B (note the related entry on list B B4020)
A3060	Waste nitrocellulose
A3070	Waste phenols, phenol compounds including chlorophenol in the form of liquids or sludges
A3080	Waste ethers not including those specified on list B
A3090	Waste leather dust, ash, sludge and flours when containing hexavalent chromium compounds or biocides (note the related entry on list B B3100)
A3100	Waste paring and other waste of leather or of composition leather not suitable for the manufacture of leather articles containing hexavalent chromium compounds or biocides (note the related entry on list B B3090)
A3110	Fellmongery wastes containing hexavalent chromium compounds or biocides or infectious substances (note the related entry on list B B3110)
A3120	Fluff - light fraction from shredding
A3130	Waste organic phosphorous compounds
A3140	Waste non-halogenated organic solvents but excluding such wastes specified on list B
A3150	Waste halogenated organic solvents
A3160	Waste halogenated or unhalogenated non-aqueous distillation residues arising from organic solvent recovery operations
A3170	Waste arising from the production of aliphatic halogenated hydrocarbons (such as chloromethane, dichloro-ethane, vinyl chloride, vinylidene chloride, allyl chloride and epichlorhydrin)
A3180	Waste, substances and articles containing, consisting of or contaminated with polychlorinated biphenyl (PCB), polychlorinated terphenyl (PCT), polychlorinated naphthalene (PCN) or polybrominated biphenyl (PBB), or any other polybrominated analogues of these compounds, at a concentration level of 50 mg/kg or more[128]
A3190	Waste tarry residues (excluding asphalt cements) arising from refining, distillation and any pyrolitic treatment of organic materials
A4	**Waste which may contain either inorganic or organic constituents**
A4010	Waste from the production, preparation and use of pharmaceutical products but excluding such wastes as specified on list B
A4020	Clinical and related waste; i.e. waste arising from medical, nursing, dental, veterinary, or similar practices and waste generated in hospitals or other facilities during the investigation or treatment of patients, or research projects
A4030	Waste from the production, formulation and use of biocides and phytopharmaceuticals, including waste pesticides and herbicides which are off-specification, outdated,[129] or unfit for their originally intended use

[128] The 50 mg/kg level is considered to be an internationally practical level for all waste. However, many individual countries have established lower regulatory levels (e.g., 20 mg/kg) for specific waste.

[129] "Outdated" means unused within the period recommended by the manufacturer.

A4040	Wastes from the manufacture, formulation and use of wood-preserving chemicals[130]
A4050	Wastes that contain, consist of or are contaminated with any of the following: • Inorganic cyanides, excepting precious-metal-bearing residues in solid form containing traces of inorganic cyanides • Organic cyanides
A4060	Waste oils/water, hydrocarbons/water mixtures, emulsions
A4070	Wastes from the production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish excluding any such waste specified on list B (note the related entry on list B B4010)
A4080	Wastes of an explosive nature (but excluding such wastes specified on list B)
A4090	Waste acidic or basic solutions, other than those specified in the corresponding entry on list B (note the related entry on list B B2120)
A4100	Wastes from industrial pollution control devices for cleaning of industrial off-gases but excluding such wastes specified on list B
A4110	Wastes that contain, consist of or are contaminated with any of the following: • Any congenor of polychlorinated dibenzo-furan • Any congenor of polychlorinated dibenzo-dioxin
A4120	Wastes that contain, consist of or are contaminated with peroxides
A4130	Waste packages and containers containing Annex I substances in concentrations sufficient to exhibit Annex III hazard characteristics
A4140	Waste consisting of or containing off specification or outdated[131] chemicals corresponding to Annex I categories and exhibiting Annex III hazard characteristics
A4150	Waste chemical substances arising from research and development or teaching activities which are not identified and/or are new and whose effects on human health and/or the environment are not known
A4160	Spent activated carbon not included on list B (note the related entry on list B B2060)

D 16.2 LIST B

Wastes contained in the Annex will not be wastes covered by Article 1, paragraph 1 (a), of this Convention unless they contain Annex I material to an extent causing them to exhibit an Annex III characteristic.

B1	**Metal and metal-bearing wastes**
B1010	Metal and metal-alloy wastes in metallic, non-dispersible form: • Precious metals (gold, silver, the platinum group, but not mercury) • Iron and steel scrap • Copper scrap • Nickel scrap • Aluminium scrap

[130] This entry does not include wood treated with wood preserving chemicals.

[131] "Outdated" means unused within the period recommended by the manufacturer.

	• Zinc scrap • Tin scrap • Tungsten scrap • Molybdenum scrap • Tantalum scrap • Magnesium scrap • Cobalt scrap • Bismuth scrap • Titanium scrap • Zirconium scrap • Manganese scrap • Germanium scrap • Vanadium scrap • Scrap of hafnium, indium, niobium, rhenium and gallium • Thorium scrap • Rare earths scrap
B1020	Clean, uncontaminated metal scrap, including alloys, in bulk finished form (sheet, plate, beams, rods, etc), of: • Antimony scrap • Beryllium scrap • Cadmium scrap • Lead scrap (but excluding lead-acid batteries) • Selenium scrap • Tellurium scrap
B1030	Refractory metals containing residues
B1040	Scrap assemblies from electrical power generation not contaminated with lubricating oil, PCB or PCT to an extent to render them hazardous
B1050	Mixed non-ferrous metal, heavy fraction scrap, not containing Annex I materials in concentrations sufficient to exhibit Annex III characteristics[132]
B1060	Waste selenium and tellurium in metallic elemental form including powder
B1070	Waste of copper and copper alloys in dispersible form, unless they contain Annex I constituents to an extent that they exhibit Annex III characteristics
B1080	Zinc ash and residues including zinc alloys residues in dispersible form unless containing Annex I constituents in concentration such as to exhibit Annex III characteristics or exhibiting hazard characteristic H4.3[133]
B1090	Waste batteries conforming to a specification, excluding those made with lead, cadmium or mercury
B1100	Metal-bearing wastes arising from melting, smelting and refining of metals: • Hard zinc spelter • Zinc-containing drosses:

[132] Note that even where low level contamination with Annex I materials initially exists, subsequent processes, including recycling processes, may result in separated fractions containing significantly enhanced concentrations of those Annex I materials.

[133] The status of zinc ash is currently under review and there is a recommendation with the United Nations Conference on Trade and Development (UNCTAD) that zinc ashes should not be dangerous goods.

	-Galvanising slab zinc top dross (>90% Zn) -Galvanising slab zinc bottom dross (>92% Zn) -Zinc die casting dross (>85% Zn) -Hot dip galvanisers slab zinc dross (batch)(>92% Zn) -Zinc skimmings • Aluminium skimmings (or skims) excluding salt slag • Slag from copper processing for further processing or refining not containing arsenic, lead or cadmium to an extend that they exhibit Annex III hazard characteristics • Wastes of refractory linings, including crucibles, originating from copper smelting • Slag from precious metals processing for further refining • Tantalum-bearing tin slag with less than 0.5% tin
B1110	Electrical and electronic assemblies:
B1120	Spent catalysts excluding liquids used as catalysts, containing: • Electronic assemblies consisting only of metals or alloys • Waste electrical and electronic assemblies or scrap[134] (including printed circuit boards) not containing components such as accumulators and other batteries included on list A, mercury-switches, glass from cathode-ray tubes and other activated glass and PCB-capacitors, or not contaminated with Annex I constituents (e.g., cadmium, mercury, lead, polychlorinated biphenyl) or from which these have been removed, to an extent that they do not possess any of the characteristics contained in Annex III (note the related entry on list A A1180) • Electrical and electronic assemblies (including printed circuit boards, electronic components and wires) destined for direct reuse,[135] and not for recycling or final disposal[136]

Transition metals, excluding waste catalysts (spent catalysts, liquid used catalysts or other catalysts) on list A:	Scandium	Titanium
	Vanadium	Chromium
	Manganese	Iron
	Cobalt	Nickel
	Copper	Zinc
	Yttrium	Zirconium
	Niobium	Molybden
	Hafnium	um
	Tungsten	Tantalum
		Rhenium
Lanthanides (rare earth metals):	Lanthanum	Cerium
	Praseodymium	Neody
	Samarium	Europium
	Gadolinium	Terbium
	Dysprosium	Holmium
	Erbium	Thulium
	Ytterbium	Lutetium

[134] This entry does not include scrap from electrical power generation.

[135] Reuse can include repair, refurbishment or upgrading, but not major re-assembly.

[136] In some countries these materials destined for direct re-use are not considered as waste.

B1130	Cleaned spent precious-metal-bearing catalysts
B1140	Precious-metal-bearing residues in solid form which contain traces of inorganic cyanides
B1150	Precious metals and alloy waste (gold, silver, the platinum group, but not mercury) in a dispersible, non-liquid form with appropriate packaging and labelling
B1160	Precious-metal ash from the incineration of printed circuit boards (note the related entry on list A A1150)
B1170	Precious-metal ash from the incineration of photographic film
B1180	Waste photographic film containing silver halides and metallic silver
B1190	Waste photographic paper containing silver halides and metallic silver
B1200	Granulated slag arising from the manufacture of iron and steel
B1210	Slag arising from the manufacture of iron and steel including slag as a source of TiO2 and vanadium
B1220	Slag from zinc production, chemically stabilised, having a high iron content (above 20%) and processed according to industrial specifications (e.g., DIN 4301) mainly for construction
B1230	Mill scaling arising from the manufacture of iron and steel
B1240	Copper oxide mill-scale
B2	**Waste containing principally inorganic constituents, which may contain metals and organic materials**
B2010	Wastes from mining operations in non-dispersible form: • Natural graphite waste • Slate waste, whether or not roughly trimmed or merely cut, by sawing or otherwise • Mica waste • Leucite, nepheline and nepheline syenite waste • Feldspar waste • Fluorspar waste • Silica waste in solid form excluding those used in foundry operations
B2020	Glass waste in non-dispersible form: • Cullet and other waste and scrap of glass except for glass from cathode-ray tubes and other activated glasses
B2030	Ceramic wastes in non-dispersible form: • Cermet wastes and scrap (metal ceramic composites) • Ceramic based fibres not elsewhere specified or included
B2040	Other waste containing principally inorganic constituents: • Partially refined calcium sulphate produced from flue-gas desulphurisation (FGD) • Waste gypsum wallboard or plasterboard arising from the demolition of buildings • Slag from copper production, chemically stabilised, having a high iron content (above 20%) and processed according to industrial specifications (e.g., DIN 4301 and DIN 8201) mainly for construction and abrasive applications • Sulphur in solid form

	• Limestone from the production of calcium cyanamide (having a pH less than 9) • Sodium, potassium, calcium chlorides • Carborundum (silicon carbide) • Broken concrete • Lithium-tantalum and lithium-niobium containing glass scraps
B2050	Coal-fired power plant fly-ash, not included on list A (note the related entry on list A A2060)
B2060	Spent activated carbon resulting from the treatment of potable water and processes of the food industry and vitamin production (note the related entry on list A A4160)
B2070	Calcium fluoride sludge
B2080	Waste gypsum arising from chemical industry processes not included on list A (note the related entry on list A A2040)
B2090	Waste anode butts from steel or aluminium production made of petroleum coke or bitumen and cleaned to normal industry specifications (excluding anode butts from chlorine alkali electrolyses and from metallurgical industry)
B2100	Waste hydrates of aluminium and waste alumina and residues from alumina production excluding such materials used for gas cleaning, flocculation or filtration processes
B2110	Bauxite residue ("red mud") (pH moderated to less than 11.5)
B2120	Waste acidic or basic solutions with a pH greater than 2 and less than 11.5, which are not corrosive or otherwise hazardous (note the related entry on list A A4090)
B3	**Waste containing principally organic constituents, which may contain metals and inorganic materials**
B3010	Solid plastic waste: The following plastic or mixed plastic materials, provided they are not mixed with other wastes and are prepared to a specification: • Scrap plastic of non-halogenated polymers and co-polymers, including but not limited to the following[137]: -ethylene -styrene -polypropylene -polyethylene terephthalate -acrylonitrile -butadiene -polyacetals -polyamides -polybutylene terephthalate -polycarbonates -polyethers -polyphenylene sulphides -acrylic polymers -alkanes C10-C13 (plasticiser) -polyurethane (not containing CFCs) -polysiloxanes

[137] It is understood that such scraps are completely polymerised.

	-polymethyl methacrylate -polyvinyl alcohol -polyvinyl butyral -polyvinyl acetate • Cured waste resins or condensation products including the following: -urea formaldehyde resins -phenol formaldehyde resins -melamine formaldehyde resins -epoxy resins -alkyd resins -polyamides -Waste shall not be mixed -Problems arising from open-burning practices to be considered • The following fluorinated polymer wastes[138] -perfluoroethylene/propylene (FEP) -perfluoroalkoxy alkane (PFA) -perfluoroalkoxy alkane (MFA) -polyvinylfluoride (PVF) -polyvinylidenefluoride (PVDF)
B3020	Paper, cardboard and paper product wastes The following materials, provided they are not mixed with hazardous wastes: Waste and scrap paper or cardboard made from: • unbleached paper and cardboard or corrugated paper and cardboard • other paper or cardboard, made mainly of bleached chemical pulp, not coloured in the mass • paper or cardboard made mainly of mechanical pulp (for example, newspapers, journals and similar printed matter) • others, including but not limited to 1) laminated cardboard 2) unsorted scrap.
B3030	Textile wastes The following materials, provided they are not mixed with other waste and are prepared to a specification: • Silk waste (including cocoons unsuitable for reeling, yarn waste and garnetted stock) -not carded or combed -other • Waste of wool or of fine or coarse animal hair, including yarn waste but excluding garnetted stock -spools of wool or fine animal hair -other wool waste or fine animal hair waste -coarse animal hair waste • Cotton waste (including yarn waste and garnetted stock) -yarn waste (including thread waste) -garnetted stock -other

[138] Post-consumer wastes are excluded from this entry

	• Flax tow and waste • Tow and waste (including yarn waste and garnetted stock) of true hemp (Cannabis sativa L.) • Tow and waste (including yarn waste and garnetted stock) of jute and other textile bast fibres (excluding flax, true hemp and ramie) • Tow and waste (including yarn waste and garnetted stock) of sisal and other textile fibres of the genus Agave • Tow, noils and waste (including yarn waste and garnetted stock) of coconut • Tow, noils and waste (including yarn waste and garnetted stock) of alpaca (Manila hemp or Musa textilis Nee) • Tow, noils and waste (including yarn waste and garnetted stock) of ramie and other vegetable textile fibres, not elsewhere specified or included • Waste (including noils, yarn waste and garnetted stock) of man-made fibres -of synthetic fibres -of artificial fibres • Worn clothing and other worn textile articles • Used rags, scrap twine, cordage, rope and cables and worn out articles of twine, cordage, rope or cables of textile materials -sorted -other
B3040	Rubber wastes The following materials, provided they are not mixed with other waste: • Waste and scrap from hard rubber (e.g., ebonite) • Other rubber waste (excluding such waste specified elsewhere)
B3050	Untreated cork and wood waste: • Wood waste and scrap, irrespective of logs, briquettes, pellets or similar forms • Cork waste: crushed, granulated or ground cork
B3060	Wastes arising from agro-food industries provided it is not infectious: • Wine lees • Dried and sterilised vegetable waste, residues and by-products, irrespective of in the form of pellets, of a kind used in animal feeding, not elsewhere specified or included • Degras: residues resulting from the treatment of fatty substances or animal or vegetable waxes • Waste of bones and horn-cores, un-worked, de-fatted, simply prepared (but not cut to shape), treated with acid or de-gelatinised • Fish waste • Cocoa shells, husks, skins and other cocoa waste • Other waste from the agro-food industry excluding by-products which meet national and international requirements and standards for human or animal consumption
B3070	The following waste: • Human hair waste • Waste straw • Deactivated fungus mycelium from penicillin production to be used as animal feed

B3080	Waste parings and scrap of rubber
B3090	Paring and other waste from leather or leather composition unsuitable for the manufacture of leather articles, excluding leather sludge, not containing hexavalent chromium compounds and biocides (note the related entry on list A A3100)
B3100	Leather dust, ash, sludge or flours not containing hexavalent chromium compounds or biocides (note the related entry on list A A3090)
B3110	Fellmongery waste not containing hexavalent chromium compounds or biocides or infectious substances (note the related entry on list A A3110)
B3120	Waste consisting of food dyes
B3130	Waste polymer ethers and waste non-hazardous monomer ethers incapable of forming peroxides
B3140	Waste pneumatic tyres, excluding those destined for Annex IVA operations
B4	**Waste which may contain either inorganic or organic constituents**
B4010	Waste consisting mainly of water-based/latex paints, inks and hardened varnishes not containing organic solvents, heavy metals or biocides to an extent to render them hazardous (note the related entry on list A A4070)
B4020	Waste from the production, formulation and use of resins, latex, plasticizers, glues/adhesives, not listed on list A, free of solvents and other contaminants to an extent that they do not exhibit Annex III characteristics, e.g., water-based, or glues based on casein starch, dextrin, cellulose ethers, polyvinyl alcohol (note the related entry on list A A3050)
B4030	Used single-use cameras, with batteries not included on list A

B. Operations which may Lead to Resources Recovery, Recycling Reclamation, Direct Re-use or Alternative Uses

Section B encompasses all such operations with respect to materials legally defined as or considered to be hazardous waste and which otherwise would have been destined for operations included in Section A.

R1 Use as a fuel (other than in direct incineration) or other means to generate energy
R2 Solvent reclamation/regeneration
R3 Recycling/reclamation of organic substances which are not used as solvents
R4 Recycling/reclamation of metals and metal compounds
R5 Recycling/reclamation of other inorganic materials
R6 Regeneration of acids or bases
R7 Recovery of components used for pollution abatement
R8 Recovery of components from catalysts
R9 Used oil re-refining or other reuses of previously used oil
R10 Land treatment resulting in benefit to agriculture or ecological improvement
R11 Uses of residual materials obtained from any of the operations numbered R1-R10
R12 Exchange of waste for submission to any of the operations numbered R1-R11
R13 Accumulation of material intended for any operation in Section B

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