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Protection of Jeita Spring

SPECIAL REPORT NO. 14

Environmental Risk Assessment of the Fuel Stations in the Jeita Spring Catchment – Guidelines from the Perspective of Groundwater Resources Protection

Raifoun
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Environmental Risk Assessment of the Fuel Stations in the Jeita Spring Catchment
–
Guidelines from the Perspective of Groundwater Resources Protection

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List of Abbreviations and Acronyms

AVSI	Italian NGO
BGR	Federal Institute for Geosciences and Natural Resources
BMZ	German Ministry of Economic Cooperation and Development
CDR	Council for Development and Reconstruction
COM	Council of Ministers
CS	Coalescence separator
DV	Divertion valve
EIA	Environmental impact assessment
EIB	European Investment Bank
FAO	Food and Agriculture Organization
FC	Financial cooperation
FG	Floor Gully
GW	Groundwater
Horizon 2020	The Frameork Programme for Research and Innovation
ILO	International Labour Office
KfW	German Bank for Reconstruction and Development
MoE	Ministry of Environment
MoEW	Ministry of Energy and Water
MoI&M	Ministry of Interior and Municipalities
MS	Mineral oil seperator
Pre-WWTP	Pre-Wastewater Treatment Plant
RB	Retention basin
SB	Silt retention basin
ST	Silt Trap
SPZ	Spring Protection Zone
TC	Technical cooperation
UNDP	United Nations Development Program
UST	Underground Storage Tanks
WEBML	Water Establishment Beirut and Mount Lebanon
WW	Wastewater
WWTP	Wastewater Treatment Plant

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1	Site Selection for Wastewater Facilities in the Nahr el Kalb Catchment – General Recommendations from the Perspective of Groundwater Resources Protection	January 2011
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3	Guideline for Environmental Impact Assessments for Wastewater Facilities in Lebanon – Recommendations from the Perspective of Groundwater Resources Protection	November 2011
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7	Groundwater Vulnerability Mapping in the Jeita Spring Catchment	April 2012
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1	Artificial Tracer Tests 1 - April 2010 (prepared with University of Goettingen)	July 2010
2	Artificial Tracer Tests 2 - August 2010 (prepared with University of Goettingen)	November 2010
3	Practice Guide for Tracer Tests	Version 1 January 2011
4	Proposed National Standard for Treated Domestic Wastewater Reuse for Irrigation	July 2011
5	Artificial Tracer Tests 4B - May 2011 (prepared with University of Goettingen)	September 2011
6	Artificial Tracer Tests 5A - June 2011 (prepared with University of Goettingen)	September 2011
7	Mapping of Surface Karst Features in the Jeita Spring Catchment	October 2011
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9	Soil Survey in the Investigations in the Groundwater Contribution Zone of Jeita Spring	First Draft November 2011
10	Mapping of the Irrigation System in the Jeita Catchment	First Draft November 2011
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13	Micropollutant Investigations in the Groundwater Contribution Zone of Jeita Spring	May 2012
14	Guideline for Gas Stations - Recommendations from the Perspective of Groundwater Resources Protection	June 2012
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17	Monitoring of Spring Discharge in the Groundwater Contribution Zone of Jeita Spring	In Progress
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1	Quantification of Infiltration into the Lower Aquifer (J4) in the Upper Nahr Ibrahim Valley	May 2012
1 - 1	Addendum No. 1 to Main Report [Quantification of Infiltration into the Lower Aquifer (J4) in the Upper Nahr Ibrahim Valley]	June 2012
2	Locating the Source of the Turbidity Peaks Occurring in April - June 2012 in the Dbayeh Drinking Water Treatment Plant	June 2012
Reports with KfW Development Bank (jointly prepared and submitted to CDR)		
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2	Jeita Spring Protection Project - Feasibility Study - Rehabilitation of Transmission Channel Jeita Spring	May 2012

Report No.	Title	Date Completed
	Intake – Dbaye WTP	
3	Jeita Spring Protection Project - Environmental Impact Assessment for the Proposed CDR/KfW Wastewater Scheme in the Lower Nahr el Kalb Catchment	In Progress

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0 Executive Summary

This report has been prepared by the BGR Technical Cooperation (TC) Project Protection of Jeita Spring to provide guidance to the petroleum sector stakeholders and to gas station operators in the effort to reach an improved protection of soil, groundwater, and surface water resources. It is based on a field assessment of the actual situation of gas stations in Lebanon with particular attention to those located in the Jeita Spring groundwater catchment.

Jeita spring is fed by limestone aquifers which are highly karstified. The vulnerability of these aquifers to pollution is rather high and travel times in the unsaturated zone and in groundwater are extremely fast, as investigations by the BGR project have shown. The water supply of the Greater Beirut Area depends to a very large degree on Jeita spring. A fuel or oil contamination in the Jeita groundwater catchment could thus lead to a tremendous impact on the water supply of the capital. This may even go unnoticed because hydrocarbons are not and can even currently not be analyzed at the Dbayeh treatment plant. Currently there are 83 stations in the groundwater catchment, an extremely high number. The field assessment showed that current operational practices lead to a very high risk of contamination from gas stations. Contaminations by hydrocarbons are, however, difficult to treat and clean up. As some of the involved hydrocarbons are detrimentous to human health, there is an urgent need to act.

The BGR project is currently delineating groundwater protection zones for Jeita spring, which will be the first in Lebanon. Landuse restrictions will be declared in those protection zones for all pollution sources, among them gas stations. This will affect in particular applications for new gas stations; however, a clear and present danger will remain concerning the existing gas stations.

Currently the regulatory framework and responsibilities for the petroleum sector are scattered over different Ministries and government authorities. The same applies for the permitting process and the control function. The field assessment of the project showed that because of this fragmentation there is basically no enforcement of the existing laws and regulations in this sector. Also gas stations can practically be established anywhere in the catchment, a practice that needs to be stopped because there is no consideration of environmental protection needs.

The existing laws and regulations, however, need to be improved. In karstic areas such as Lebanon, double-layer tanks are an important means to detect leakages, but currently those are only installed on a volutary basis by some fuel providers. Wastewater, such as car wash water and surface drainage, and waste, especially waste oil, needs to be properly collected, separated, treated and disposed of, which is currently not the case.

The report lists several recommendations what needs to be done to come to an efficient protection of the enviornment, especially to the vital water resources.

1 Introduction

The assessment presented in this report was conducted in the framework of the German-Lebanese Technical Cooperation project *Protection of Jeita Spring* in February –April 2012.

The German-Lebanese Technical Cooperation (TC) Project *Protection of Jeita Spring* is funded by a grant of the German Government (Ministry of Economic Cooperation and development, BMZ). This project aims to "reduce important risks for the drinking water supply of Beirut through measures implemented in the Jeita catchment". It is implemented by the Federal Institute for Geosciences and Natural Resources (BGR) in collaboration with the Council for Development and Reconstruction (CDR), the Ministry of Energy and Water (MoEW) and the Water Establishment of Beirut and Mount Lebanon (WEBML).

The groundwater resources of Jeita spring are endangered by several pollution sources. Apart from the widespread microbiological pollution from wastewater, the contamination risk related to hydrocarbons from gas stations, generators, quarries, residential buildings and car repair workshops is most severe. In the framework of the BGR project, several hazards assessments were carried out in the Jeita groundwater catchment. This report, deals only with the contamination risks related to the fuel stations located in the concerned area.

The extremely high number and dense spacing of gas stations in the Jeita catchment (Figure 1; 83 gas stations are located in an area of 406 km²) is in complete disregard of this area's richness in surface and groundwater resources and their importance for water supply. The geological underground's karstic nature (ABI RIZK & MARGANE, 2011) leads to a high vulnerability of the water resources to pollution. Because flow velocities in the unsatureated zone and groundater are very fast, there is an imminent danger of a quick transfer of any groundwater contamination (MARGANE et al., in progr.), a fact that would dramatically affect the water source of 50% of the population living in Lebanon.

As detailed by ABDULRAZZAK & KOBEISSI (2010), the quality of groundwater in Lebanon is affected by human activities that include the leakage of gasoline from gas station underground tanks in addition to the uncontrolled dumping of waste oil and petroleum by-products that are also contributing to groundwater pollution. Unfortunately there are still no substantial investigations concerning the extent of contamination from petroluem, petroleum by-products and waste oil and even the drinking water supply montoring does not comprise these components.

The report at hand addresses the environmental protection requirements especially with regards to those arising from gas stations. Waste products generated at those stations need to be collected, separated, treated and disposed of in order to protect the environment.

The report illustrates international practices and appropriate ways of waste prevention, correct waste disposal, proper storage and handling of oil and fuel substances that might endanger the water resources, as well as the proper infrastructure (drainage, storage facilities, etc.) that should be in place.

The report compares this with the local practice and lists the ruling laws and guidelines (environmental, water protection etc.) and what is the procedure to obtain a permit for

establishing and operating gas stations in Lebanon. Furthermore, it details who is responsible for granting the gas station establishment and operation permits, and who is assigned by the Government to carry out inspections.

However, the ruling regulations and guidelines established by the Lebanese government are far from being sufficient and being applied on the ground.

This report presents the findings of an assessment of environmental risk management at service stations that engage in the retail sale of petroleum products. The project assessed, in the Jeita catchment, the practices of underground petroleum storage systems and management of environmental risks by operators of liquid fuel service stations.

Currently a comprehensive guidance document covering all environmental risks for this industry is unavailable in Lebanon. In the absence of such a document, the assessment was conducted based on the enacted environment protection regulations in the country, Lebanon's environmental protection policies, and ruling relevant codes of practice, which were then compared to European Standards and guidance documents.

In this respect, findings are based on information gathered at: governmental institutions (MoEW: Directorate of Oil, MoE, MoI&M, General Directorate of Urbanism, Mount Lebanon Governorate (Muhafaza), etc.) involved in issuing the operation permit for fuel stations; main importing and distributing petroleum products companies in Lebanon; and some fuel stations operating in the study area. Many stakeholders are involved in issuing the installation and operation permits related to the liquid fuel stations. The role of each is detailed in the present report.

Based on the field assessment and the ensuing analysis, the study listed the conclusive characteristics of the Lebanese liquid fuel stations sector and the main challenges it is currently facing. It concludes that this sector is suffering from combined technical, legal, administrative and financial problems that have worsened over the years.

Old steel tanks without proper protection are generally believed to present the greatest risk of developing leaks. These are present in most of the stations established before the nineties in the Jeita catchment in particular and in Lebanon in general.

The majority of fuel stations use inventory control as sole means of leak detection (mainly to perform a financial control). Many different methods of inventory control, of varying accuracy, are being used. However, many gas stations operators do not even carry out a regular inventory control.

High risks to surface and groundwater as a result of inadequate spill management provisions were identified, e.g.: at several sites, operators wash effluent from the station's activities (carwash, etc.) directly into the environment.

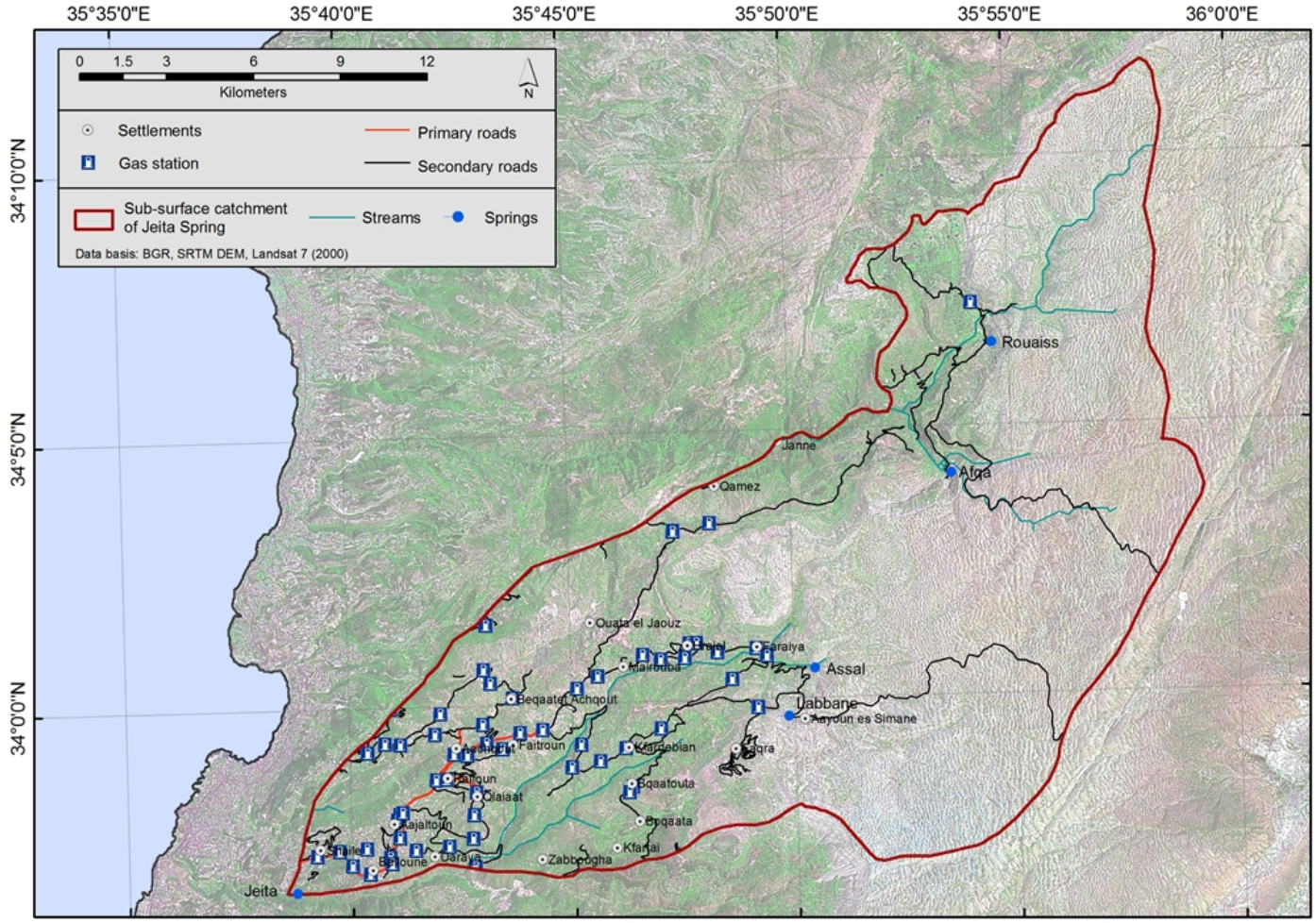


Figure 1: Distribution of Gas Stations in the Jeita Catchment

Authorities need to step in to regulate gas stations and to control the application of the ruling regulations to ensure that further and more severe damages to soil and groundwater are avoided.

The recommendations included in this report state the standard of leak detection that is required for underground petroleum storage systems and provide details on measures that can meet this standard. They also recommend a proper drainage system and waste management to be adopted in liquid fuel stations.

2 Purpose of the Assessment

In line with the main objective of protecting the Jeita groundwater against any kind of contamination, and considering the great danger that a groundwater contamination by petroleum products can cause; the project answered the urging need to address this matter.

In this framework, aiming at estimating the risk of such contamination, to highlight the most vulnerable zones and to propose solutions, a field assessment came to study in detail the ruling Lebanese regulations, the stakeholders involved in their application, and to provide proper accessible, realistic recommendations based on a field assessment of the actual environmental management practices in this sector within Jeita catchment.

Since the contamination risk by hydrocarbons is, after wastewater, the second most important, it was documented in a separate report. All other hazards to groundwater will be summarized in a second groundwater hazards report together with the groundwater hazards map and risk assessment (RAAD et al., in progr.).

3 Risk of Groundwater Contamination by Petroleum Products

It was widely proven that One of the major contamination sources of the soil, air, underground and surface water has been related to liquid fuel tank leakings, processed chemical products, toxic chemical products and diluted rejects (MOSCHINI ET AL, 2005). As of 1985, fuel underground storage tanks became a priority in the United States, leading to the regulation, by the Environmental Protection Agency (EPA) of prevention, detection and fixing of leaking in the tanks, as well as to the creation of a specific agency (Office of Underground Storage Tanks) to supervise these aspects (EPA, 1984; 1985a;b).

One of the best known classes of groundwater contaminants includes petroleum-based fuels such as gasoline and diesel.

Main hazardous substances used and generated by gas stations are displayed in table 1:

Table 1: Main Hazardous Substances used and generated by Gas Stations

Waste generated by gas station	Hazardous Components
Antifreeze	methanol, ethylene glycol
Battery acid	sulfuric acid
Lubricants, degreasers	petroleum solvents, alcohols, glycolether, volatile organic compounds
Engine & radiator flushes	chlorinated hydrocarbons, toluene, phenols
Hydraulic (brake) fluid	dichloroperchloroethylene
Used and or waste oils : Motor oil, grease, lubes etc.	hydrocarbons, fluorocarbons
Gasoline (gasoline, diesel, petrol, kerosene etc.)	Hydrocarbons
Fuel	Hydrocarbons, Methyl Tert Butyl Ether, Heavy metals, etc.
Rustproofers	Hydrocarbons
Transmission fluid (automatic)	Hydrocarbons
Car wash detergent	phenols, heavy metals
Car wax or polish	petroleum distillates, xylene
Equipment from the replacement & decommissioning of tanks & pipe work	hydrocarbons, fluorocarbons
Oily sludge from oil tank cleaning & oil/water separators	hydrocarbons, fluorocarbons, heavy metals

Source: Connecticut Department of Environmental Protection (2005) and EBRD (2009)

We notice here that using decommissioned oils or fuel tanks for irrigation water storage (which is commonly spread in Lebanon) generates potential contamination risks to the soil and groundwater.

3.1 Fuel Composition

The specifications of Fuel and diesel oil used in Lebanon are established by decree law 8442 dated August 13, 2002 as displayed in the following tables 2, 3 and 4.

By comparing the Lebanese standards to the EU environmental specifications for Market Fuels to be used for vehicles equipped with positive ignition engines (Annex 1) we notice a lack of details in the Lebanese decree in regard of specifying the limits for several hazardous components such as; olefins, aromatics and oxygenates (e.g. iso butyl alcohol,).

As shown in table 4 related to the automotive diesel limits specifications, the guidelines do not specify the limits related to hazardous elements to public health e.g, ethylbenzene, etc.

Table 2: Standards defining the Characteristics of Automotive Gasoline 95 Octane

PROPERTY	LIMITS for Gasoline 95 Octanes	
Research Octane Number	Min. 95	
Motor Octane Number	Min. 85	
Lead, g/L	Max. 0.013	
Benzene, %v/v	Max. 5.0	
Methanol, %v/v	Max. 3.0	
MTBE %	Max 10.0	
Total Organic Oxygen %m/m	Max. 2.5	
Sulfur % m/m	Max. 0.05	
Distillation at 760 mm Hg evaporated At 70°C, % v/v At 100°C, % v/v At 180°C, % v/v Final boiling point °C Residue, % v/v	 Min 10 40-70 Min.85 Max. 215 Max.2	
Reid Vapor pressure at 37.8°C, kPa	Summer (April-October inclusive) Max 65	Winter (November & March inclusive) Max 80
Copper corrosion, (3hrs @ 50°C)	Max 1	
Existent gum, mg/100 ml	Max 5	
Oxidation stability, minutes		Min. 360
Color		Light green
Density at 15°C, Kg/L		0.730- 0.780

Source: Lebanese Decree Law 8442 dated August 12, 2002

Table 3: Standards defining the Characteristics of Automotive Gasoline 98 Octane

PROPERTY	LIMITS for Gasoline 98 Octanes
Research Octane Number	Min. 98
Motor Octane Number	Min. 87
Lead, g/L	Max. 0.005
Benzene, %v/v	Max. 5.0
Methanol, %v/v	Max. 3.0
Ethanol, %v/v	Max. 5.0
Isopropyl Alcohol % v/v	Max. 5.0
Tertiary Butyl Alcohol % v/v	Max. 7.0
Ethers containing five or more C atoms % v/v	Max. 10.0
Other Organic Oxygenates % v/v	Max. 7.0
MTBE %	Max 10.0
Total Organic Oxygen %m/m	Max. 2.5
Sulfur % m/m	Max. 0.05
Distillation at 760 mm Hg evaporated At 70°C, % v/v At 100°C, % v/v At 180°C, % v/v	 10-45 40-70 Min.85

Final boiling point °C Residue, % v/v	Max. 215 Max.2	
Reid Vapor pressure at 37.8°C, kPa	Summer (April-October inclusive) Max 65	Winter (November -& March inclusive) Max 80
Volatility (10VP + 7 evaporated 70)	Summer (April - October) Max 965	Winter (November - March) Max 1115
Copper corrosion, (3hrs @ 50°C)	Max 1	
Existent gum, mg/100 ml	Max 5	
Oxidation stability, minutes		Min. 360
Color		Light blue
Density at 15°C, kg/L		Min. 720

Source: Lebanese Decree Law 8442 dated August 12, 2002

3.1.1 Gasoline Composition

Gasoline is composed of more than 70 hydrocarbons, including aliphatic hydrocarbons, such as pentane and butane, and aromatic hydrocarbons, such as benzene, toluene and xylene, usually categorized as BTX substances.
In leaking conditions, these by-products can contaminate the soil and underground water, or, when in the volatile form in the atmosphere, they can be a risk to public safety and health (BRUELL AND HOAG, 1984).
Gasoline is predominantly a mixture of paraffins (alkanes), naphthenes (cycloalkanes), and olefins (alkenes). Most of these hydrocarbons are highly volatile and evaporate easily. Solubility in water is mostly relatively low (Benzene: 1.8 g/L). Some of the components are toxic. Benzene (C_6H_6), an aromatic component of gasoline, is considered to cause cancer in humans, whereas other gasoline components, such as toluene, ethylbenzene, and xylene, are not believed to cause cancer in humans (www.atsdr.cdc.gov) but may be toxic in other ways. Because of its toxicity, many countries have introduced regulations aiming to reduce the content of aromatics in gasoline. Gasoline contains so-called antiknocking additives to raise the octane number, many of which are carcinogenic.

Unleaded gasoline contains at least 15 hazardous chemicals occurring in various amounts (www.msds.com), including benzene (up to 5% by volume), toluene (up to 35% by volume), naphthalene (up to 1% by volume), trimethylbenzene (up to 7% by volume), methyl tert-butyl ether (MTBE) (up to 18% by volume, in some countries; 10% in Lebanon), and others. Hydrocarbons in gasoline generally exhibit low acute toxicities, with LD50 of 700 – 2700 mg/kg for simple aromatic compounds. Benzene and many antiknocking additives are carcinogenic (Wikipedia).

One important property of gasoline is that it is less dense than water (Benzene: 0.877), so that it, like all light non-aqueous phase liquids (LNAPLs), tends to float on top of the water table.

Gasoline underground storage tanks represent a potential source of contamination, in which the level and type of risk depend on the way the fuel is managed, as well as on

the landscape structural characteristics (soil type, river network, etc) of the urban area where they are (MOSCHINI ET AL, 2005).

3.1.2 Diesel Fuel Composition

Petroleum-derived diesel is composed of about 75% saturated hydrocarbons (primarily paraffins including n, iso, and cycloparaffins), and 25% aromatic hydrocarbons (including naphthalenes and alkylbenzenes) (ATSDR, 1995).
Diesel fuel is a compound that contains several toxic chemicals including Ethylbenzene, Benzene and Toluene. It also contains Polycyclic Aromatic Hydrocarbons (PAHs). PAHs and Benzene are both known to cause cancer. Diesel fuel in water used for human consumption is toxic and can cause poisoning (WATER POLLUTION LAWYERS www.waterpollutionlawyers.com).

Table 4: Standards defining the Characteristics of Diesel Fuel composition to be used as Automotive Fuel

PROPERTY	LIMITS for Diesel Fuel
Flash Point Pensky Martens, °C	Min 55
Water and sediment by centrifuge % vol.	Max 0.05
Cold Filter Plugging point , °C	Max -5 (Nov- March inclusive) Max 0 (April-October inclusive)
Distillation temperature, at 760 mm Hg, recovered: At 250 °C vol% At 350 °C vol% At 370 °C vol%	 Max 65 Min 85 Min 95
Kinematic Viscosity at 40°C, cSt	Min 2.00 Max 4.50
Color	Orange (actually it is green)
Ash % Mass	Max 0.01
Sulfur % Mass	Max 0.035
Corrosion, copper strip (3 hrs at 50 °C)	Max 1
Cetane Number	Min 49
Cetane Index	Min 46
Mamsbottom Carbon Residue (on 10% residuum), % wt	Max 0.3
Density at 15°C, Kg/m820-860	820-860
Oxydation stability g/m3	Max 25

Source: Lebanese Decree Law 8442 dated August 12, 2002

Ethylbenzene can quickly contaminate groundwater because it doesn't bind to soil. This means that it can seep into groundwater when spilled, or when it is injected into water supplies like other hydraulic fracking chemicals.
Ethylbenzene enters the body rapidly, through vapors, or through contaminated food and water. When someone drinks water contaminated with ethylbenzene, it enters the body through the digestive tract quickly.
People that are exposed to toluene are at risk of serious health complications. Damage to the central nervous systems (CNS) is the most common side effect of both short and

long term exposure. Toluene exposure has been linked to: Central nervous system (CNS) dysfunction, Narcosis, CNS depression, Upper respiratory tract irritation, Cardiac arrhythmia.
According to the Environmental Protection Agency (EPA), people that ingest toluene are also at risk of constriction and necrosis of myocardial fibers, swollen liver, congestion and hemorrhage of the lungs, and tubular kidney necrosis.
Symptoms of exposure include: Fatigue, Headaches, Nausea, Soar throat, Eye irritation. When a pregnant woman is exposed to toluene, her baby is at risk of suffering birth defects, including attention deficits, craniofacial and limb anomalies and CNS dysfunction. Pregnant women also carry an increased risk of sudden abortion when exposed to toluene (www.waterpollutionlawyers.com).

According to Robert P Chilcott of the Health Protection Agency (2006), diesel is:
- Dangerous for the environment. It is flammable, its vapour / air mixtures may be explosive.
- Can cause: eyes irritations, chemical pneumonitis following aspiration or inhalation of aerosol (or aspiration of liquid) during manual siphoning, skin irritation following skin exposure and possibly cancer.

The oral toxicity of diesel is relatively low, with two studies reporting LD50 values of 7.5 g/kg (BECK, HEPLER & HANSEN (1984).) and 16 ml/kg in the rat.

There are several symptoms that can point to toxic exposure to diesel fuel.

Diesel fuel toxicity has serious consequences when there is long term exposure. Repeated skin contact to diesel fuels can lead to severe irritation and may increase the risk of skin cancer. Long-term exposure can lead to lung cancer, kidney damage, and can affect the blood's ability to clot. (HEALTH PROTECTION AGENCY, 2006).

3.2 Underground Storage Tanks and Fuel Distribution Systems

Above-ground and underground storage of liquid-petroleum products such as motor fuel and heating fuel presents a potential threat to public health and to the environment.

3.3 Contamination Risk Related to Underground Storage Tanks and Fuel Distribution Systems

According to investigations of the U.S. Environmental Protection Agency (UNIVERSITY OF MICHIGAN, 1995), the potential for leaking increases dramatically when underground petroleum tanks are more than 20 years old, especially if they are not protected against corrosion (which is widely the case in the Jeita catchment). Newer tanks and piping can leak too, especially if they weren't installed properly. Figure 2 sketches the origin of fuel hazards at the petrol stations; e.g. spillage during tank filling, spillage during fuel transfer, in addition to leakage through pipes and UST walls.

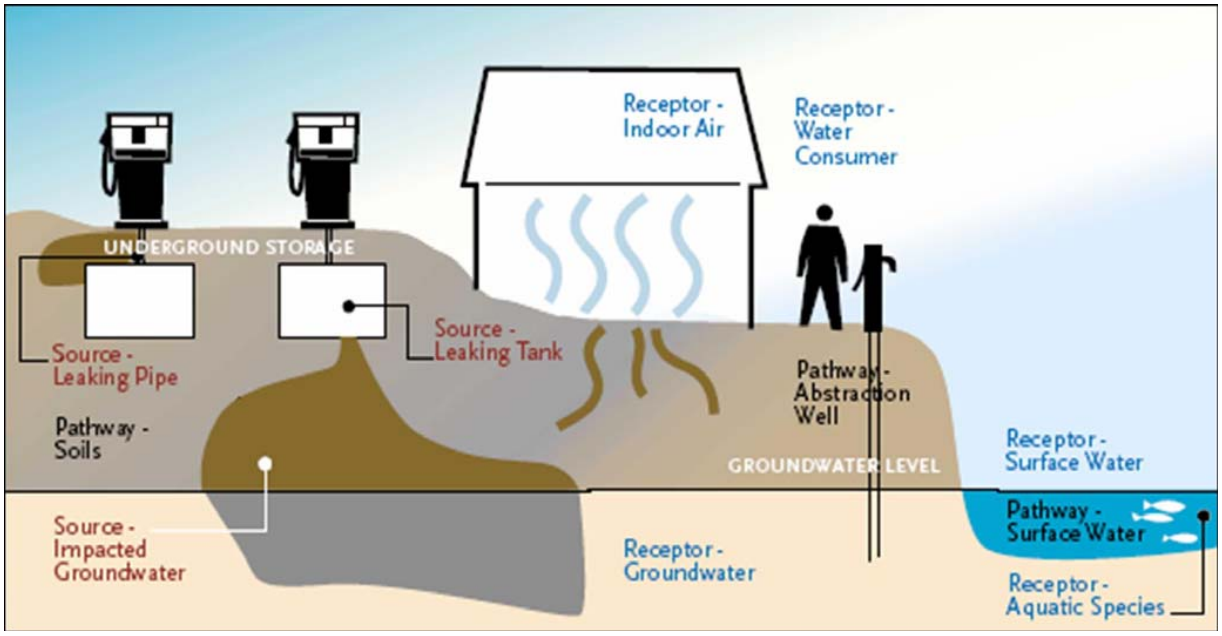


Figure 2: Contamination of groundwater due to improper fuel storage and transfer (UNIVERSITY OF MICHIGAN, 1995)

Even a small gasoline leak of one drop per second can result in the release of about 1500 liters of gasoline into the groundwater in one year. Even a few quarts of gasoline in the groundwater may be enough to severely pollute water resources. At low levels of contamination, fuel contaminants in water cannot be detected by smell or taste, yet the seemingly pure water may be contaminated to the point of affecting human health (UNIVERSITY OF MICHIGAN, 1995). **One drop of fuel can contaminate about 300 cubic meters of water** (www.deq.louisiana.gov).

The petroleum component's density determines how contaminants move through an aquifer (STEWART et al., 2008).

Figure 3 and 4 display how the density of different fuel components (LNAPL and DNAPL) affects their motion through an aquifer.

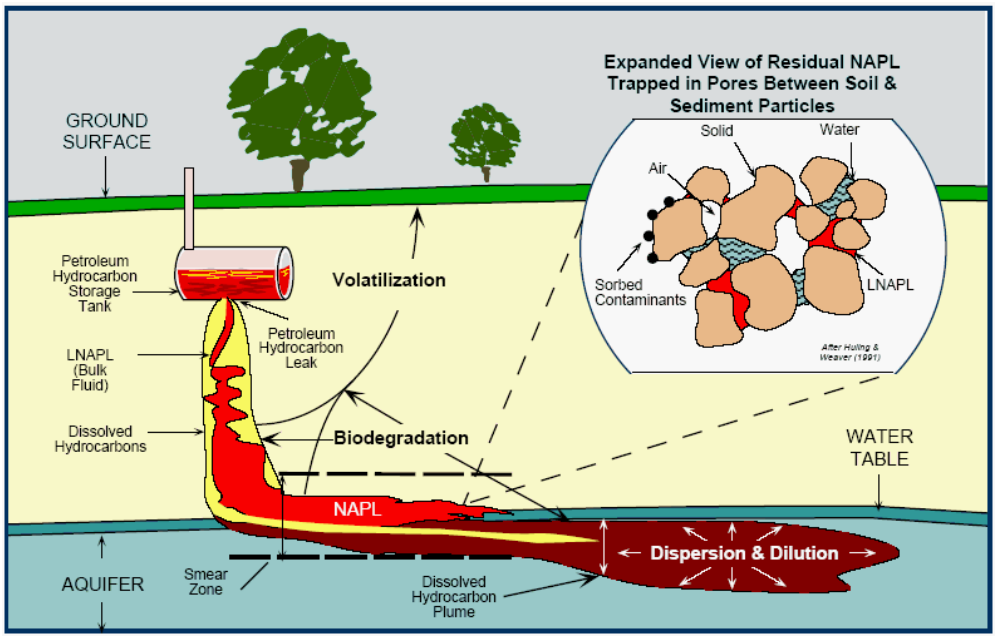


Figure 3: Density effects on the hazards contamination trajectory.
(Light Non-Aqueous Phase Liquids=LNAPL such as gasoline float on water; STEWART et al., 2008)

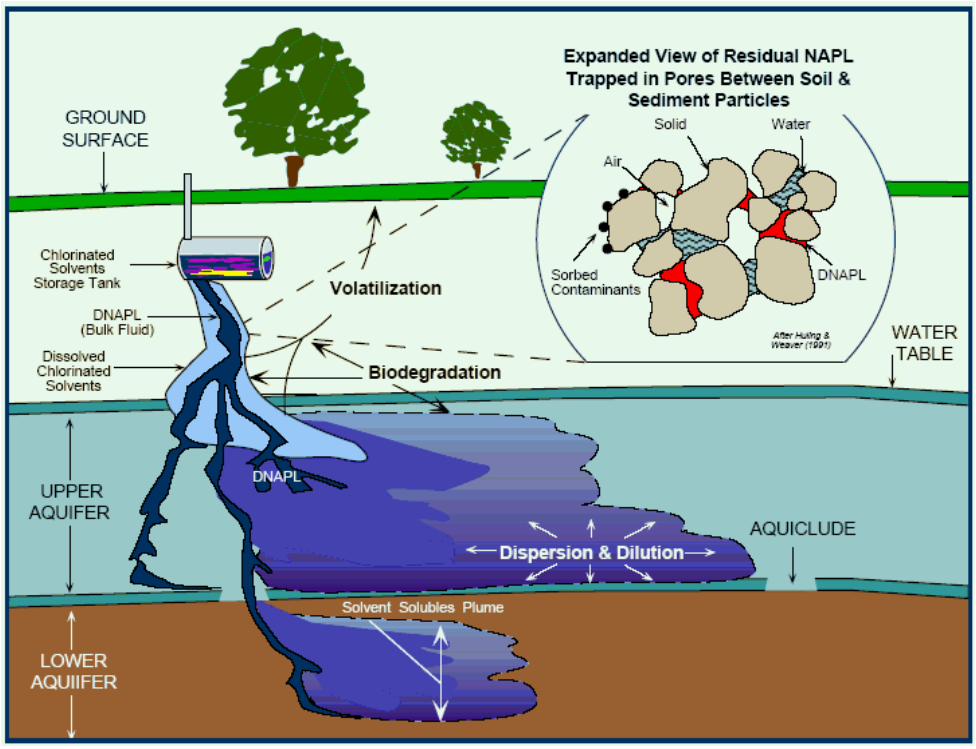


Figure 4: Density effects how contaminants move through an aquifer.
(DNAPL= Dense Non-Aqueous Phase Liquids; STEWART et al., 2008).

However, it is important to notice that soil characteristics are important in determining whether a contaminant breaks down to harmless compounds or leaches into groundwater. Because most breakdowns occur in the soil, there is a greater potential for groundwater contamination in areas where contaminants are able to move quickly through the soil layers.

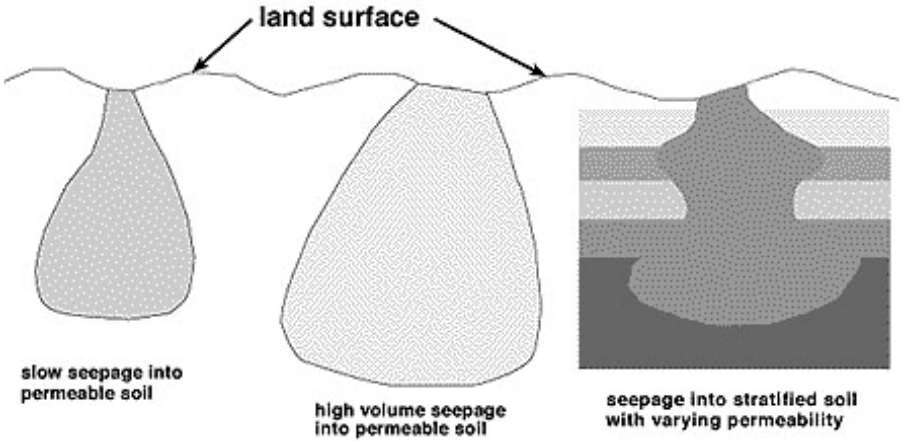


Figure 5: Petroleum Product Seepage into Soils (EPA Washington, 1987).

Sandy soils have large "pore" spaces between individual particles, and the particles provide relatively little surface area for "sorption," or physical attachment of most contaminants. Large amounts of rainfall can percolate through these soils, and dissolved contaminants can move rapidly down through the soil and into groundwater.

Clay soils, on the other hand, are made up of extremely small particles that slow the movement of water and dissolved contaminants through the soil. Contaminants also stick tightly to clay surfaces.

While held securely to soil particles, contaminants are broken down by bacteria and other soil organisms and by chemical reactions with minerals and natural chemicals in the soil. Most of this chemical and biological breakdown takes place in the loose, cultivated surface layers where the soil tends to be warm, moist, high in organic matter and well aerated.

Finally, soil organic matter is important in holding contaminants. Soils high in organic matter provide an excellent environment for chemical and biological breakdown of these contaminants - before they reach groundwater.

Furthermore, subsurface and geologic materials affect largely the potential for groundwater contamination.

Lebanon’s karstic nature, widely developped in Jeita catchment, favors very quick groundwater contamination. Movement of pollutants in fractured karst is unpredictable, and pollutants can readily spread over large areas. Where bedrock material contains significant cracks and fractures, such as in Jeita catchment, the depth and characteristics of soil and superficial geologic deposits largely determine the potential for groundwater contamination.

Preventing tank spills and leaks is especially important because of how rapidly gasoline, diesel and fuel oil can move through surface layers and into groundwater. Furthermore, vapors from an underground leak that collect in basements, sumps or other underground structures could explode.

Many petroleum-derived compounds such as benzene and toluene are persistent and mobile in many aquifers. Groundwater flows much slower than rivers or surface streams. Contamination of aquifers by petroleum-derived hydrocarbons often takes many years or even decades to cause noticeable impact. By the time the impact is detected, cleanup of the aquifer is often very expensive or otherwise unfeasible.

Petroleum fuels contain a number of potentially toxic compounds, including common solvents such as benzene, toluene and xylene, and additives such as ethylene dibromide (EDB) and carbon-based lead compounds. EDB is a carcinogen (cancer-causing) in laboratory animals, and benzene is considered a human carcinogen.

Methyl tert -butyl ether (MTBE) is used almost exclusively as a gasoline additive as antiknocking agent and to help reduce harmful tailpipe emissions from motor vehicles. It readily dissolves in water and can move rapidly through soils and aquifers. Because it is resistant to microbial degradation, MTBE migrates faster and farther in the ground than other gasoline components, thus making it more likely to contaminate public water-supply systems. According to the USGS, the vulnerability of aquifers to MTBE contamination appears to be most dependent on the chemical's use, the population density, and the presence of industry, commerce, and gasoline stations in an area.

There is widespread concern about MTBE in drinking-water sources because of potential detrimental human-health effects and its offensive taste and odor.

Accidental release of fuel from a gas station may occur due to:

- Leaks from storage tanks and connecting pipework arising from damage, aging or improper installation;
- Small spills during unloading or vehicle filling which are not cleaned up;
- Failure or absence of oil/water separators on drainage systems;
- Failure to control rainwater run-off by appropriate drainage;
- Failure to drain tanks and pipework adequately prior to maintenance and repair work;
- A major spill, such as a tank failure or overfilling.

In Lebanon, various laws attempt to prevent land and water pollution, and to clean up contaminated areas when they occur. However, we are less likely than developed nations to assess the risk of groundwater contamination by land-use activities, especially when it is related to a contamination by petroleum products

Jeita groundwater covers around 70% of water supplied in the Greater Beirut Area.

Dbaye treatment plant, the only available drinking water treatment unit of Beirut and Mount Lebanon Water Establishment, treats only contamination generated by biological and physical agents. It is not equipped to remedy petroleum contamination which is not even assessed at regular basis.

In the past 10 years there have been major advances in technology in the world for removal of petroleum products from subsurface zones at and above the water table. Nevertheless, Lebanon is still far from being able to apply such techniques. However,

new regulations, tank testing and old tanks removal programs would greatly decrease the annual rate of leakage into the subsurface.

Contamination of aquifers by petroleum-derived hydrocarbons often takes many years or even decades to cause noticeable impact. By the time the impact is detected, a large part of the Lebanese population (directly supplied by Jeita spring water) would be dramatically affected and the cleanup of the aquifer is not only very expensive but rather unfeasible. In this regard it is paramount to introduce protective measures and reduce pollution risks as soon as possible.

3.4 Recommended Site Considerations for Storage and Distribution of Petroleum Products

The following criteria are suggested to be used in Lebanon for the granting of permissions and renewal of permissions to operate a gas station. Those considerations are divided into:

- general criteria, such as topography and buffer distances from critical places,
- geoscientific criteria related to geohazards (risk of impact by flooding, landslides, earthquakes, tectonic movements, land subsidence, soil stability).
- geoscientific criteria related to impact on water resources.

3.4.1 Topographic Conditions and Buffer Distances

Sites for storage and distribution of petroleum products must be protected against impacts from accidents and intentional damage. Concerning accidental damage, the topography at the intended site plays a major role.

Gas stations should not be located:

- in road turns (minimum distance: 100 m from inflection point; all road sections with curvature > 30°) ,
- on road sections with slopes > 10% ,
- near schools, mosques, churches, monasteries, municipalities, supermarkets (> 250 m²) (minimum distance: 250 m) ,

3.4.2 Geoscientific Site Criteria Related To Geohazards

Gas stations might be damaged by geohazards and could then develop severe leakages of petroleum products into the environment (air, soil, water).

To avoid such environmental impact, gas stations should not be located:

- less than 50 m from the embankment of river courses (flooding risk),
- less than 50 m from tectonic faults with identified vertical displacement of > 1 m (tectonic risk; earthquake risk),
- less than 50 m from slopes > 30% (landslide risk; rock fall risk),
- in areas of unstable underground (liquefaction risk, risk of land subsidence).

A geotechnical site investigation is needed to exclude related risks and must be made obligatory for new permits and renewal of existing permits.

3.4.3 Geoscientific Criteria Related To Impact On Water Resources

To avoid such environmental impact, gas stations should not be located:

- less than 200 m from the center of river courses (horizontal distance; pollution risk for surface water resources);
- in designated protection zones 2 of groundwater resources (pollution risk for groundwater resources);
- less than 500 m upstream of springs and wells if used as drinking water [if consumption less than 5 Million m³ /a] (circular radius, 90° pie with central axis parallel to assumed general groundwater flow direction; pollution risk for drinking water resources);
- less than 1000 m upstream of springs and wells if used as drinking water [if consumption more than 5 Million m³ /a] (circular radius, 90° pie with central axis parallel to assumed general groundwater flow direction; pollution risk for drinking water resources);
- in the surface catchment of a dam used for drinking water supply or irrigation;
- less than 50 m upstream of an irrigation canal or irrigation pond.

A groundwater and hydrological study is needed to exclude related risks and must be made obligatory for new permits and renewal of existing permits.

4 Ruling Environmental Regulations Related to Fuel Stations in Lebanon

In the legal framework for protecting the environment from anthropogenic hazards, the Ministry of Environment presented several laws and decisions that were enacted by the Lebanese Council of Ministers.

- Law No. 64/88 of August 12th 1988 aiming at preserving the environment against noxious waste and hazardous substances. This law states that municipalities are responsible for the collection and disposal of household wastes (SABBAGH, 2010). Furthermore, this state law stipulates fines and imprisonment up to 3 years with a possibility of hard labor and death penalty (MOGHAIZEL LAW OFFICES, 2002).
- Resolution no. 52/1 (and its Exhibits no. 9,11,12,13 and 14), dated June 29, 1996: Aimed at the determination of the specifications and special ratios to reduce air, water and soil pollution (MOGHAIZEL LAW OFFICES, 2002).
- Decree No. 4917 of March 24th 1994: Amending the classification of the dangerous, hazardous to health and disturbing establishments.

- Resolution Number 5/1 dated12/1/2001, defining the Environmental Guidelines for the Establishment and/or Operation of Liquid Petrol Filling Stations (Annex 3).This resolution defines the general pollutants generated by the activities of liquid petrol filling stations in addition to the general environmental guidelines to be followed by gas stations such as:
  - Wastewater Management
    Separate sanitary wastewater from other types of wastewater and dispose it in the sewer network (In the absence of a sewer network, a septic tank should be built in reference to the design illustrated in Figure 6.

SCHEMATIC DIAGRAM OF A SEPTIC TANK OR SEPARATOR

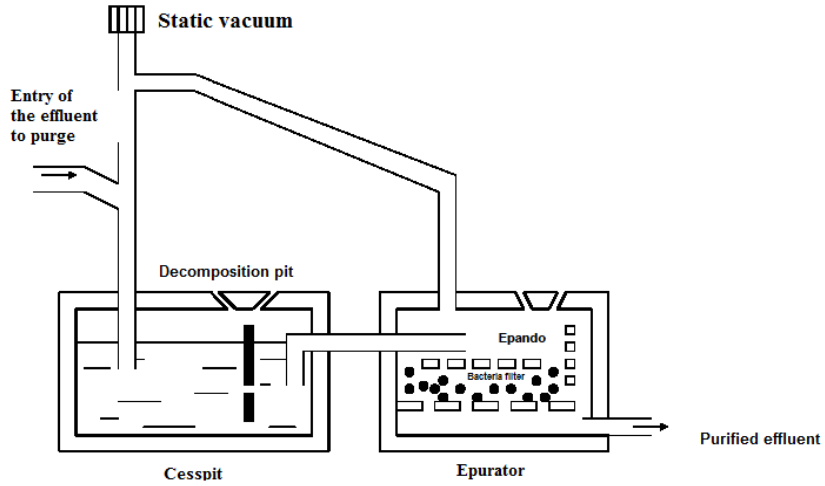


Figure 6: Schematic diagram of the separator.
(Illustrated as annexed part to the resolution 5/1)

Connect the rainwater network and the car wash waters to a special wastewater treatment unit before discharging it into the sewer network.
Design and build the wastewater treatment unit in a way to produce effluents that comply with the related set of national environmental standards.

- Air Pollution Management
  Regular checks of the fuel tanks vent pipes' valves to ensure their proper operation.
  Equip the fuel filling nozzle with a special rubber fitting that firmly closes the vehicle reservoir's opening, to prevent the release of gasoline vapors into the atmosphere by preventing any pressure decline.
  Place the power generators in an independent room, and equip them with exhaust silencers (muffler) and filters.

- Used Oils Management
  Never dispose used oil in the sewer network or in the septic tank.
  Aspirate the used oil from vehicle engines' using special pumps whenever possible.
  Collect the used oil in special tanks that do not leak, and send it to classified and licensed oil recycling establishments.
  Place the used tanks in larger anti-corrosive (stainless steel) tanks to hold any leakage.
  Label used oil tanks describing their content. Furthermore, these tanks must be equipped by a level indicator showing the content of oil.
  Never dispose used oil, empty oil containers and oil filters in the environment and water courses. But collect them in special containers preventing their mixture with water or other wastes, and later on, deliver them to licensed collection companies in order to treat and recycle them.
- Car Wash
  Use biodegradable and environmentally sound biodegradable cleaning agents
  Design the car washing unit in a way ensuring the collection and disposal of washing water into the treatment unit.
- Fuel Tanks
  Ensure that, at purchase, the fuel tanks are new and appropriate for storage by getting related affidavits from the manufacturing company.
  Conduct regular yearly leakage tests on the fuel tanks, starting from the fifth year of the purchase to be sure of the absence of leakage.
  The Ministry of Environment holds the right to ask, at any time, for the leakage tests reports.

  Place the underground fuel tanks in other tanks or in cement pit and ensure painting its walls with insulating waterproof materials preventing leakages.
  Furthermore, this resolution details required General Safety Criteria and requests to continuously apply the sound environmental management guidelines in gas stations.

- Resolution No 8/1 dated 30/1/2001. That defines the guidelines and ranges related to air pollutants, liquid wastes and wastewater treatment plants. The Annex 5 of this resolution specifies the environmentally sound ranges limits of wastewater composition at its disposal in the wastewater network. (Annex 4).
- Resolution no. 27/1, dated December 6, 1995: The importation of the petroleum coke substance.
- Decree No 8442 dated August 13, 2002: that defines quality standards for all major types of fuels, not only unleaded gasoline, but also fuel oil (e.g., maximum allowable sulphur content), diesel for transport vehicles, and diesel oil used as automotive fuel. Furthermore, in August 2002, the Government introduced an incremental cost through which unleaded fuel has been made cheaper than leaded by around 5%. Besides, following the Council of State's request the Council of Ministers approved, on March 7, 2012, a project decree amending the

decree No 8442 in regard of changing the colors adopted of some petroleum products in a way to ease control operations and prevention of common cheat practices carried out by mixing some petroleum products.

- Law No.444 (dated 29/7/2002): Environmental Protection Law including surface and groundwater protection – fundamental principles and public rules, EIAs, Responsibilities, fines and other institutional regulations (MOGHAIZEL LAW OFFICES, 2002. However, this law was not backed with required relevant implementation decrees.

From its side, the Ministry of Energy and Water also refers to environmental considerations for issuing the installation and the operations permits of the gas stations.

- The Decree No 5509 dated on August 11, 1994, on which the MoEW bases its approval, states the general requirements for category A and category B stations selling liquid fuel in Lebanon, and includes a part dedicated to guidelines aiming at the protection of the environment.

These guidelines are sketched in the following figures 7, 8, 9 and 10:

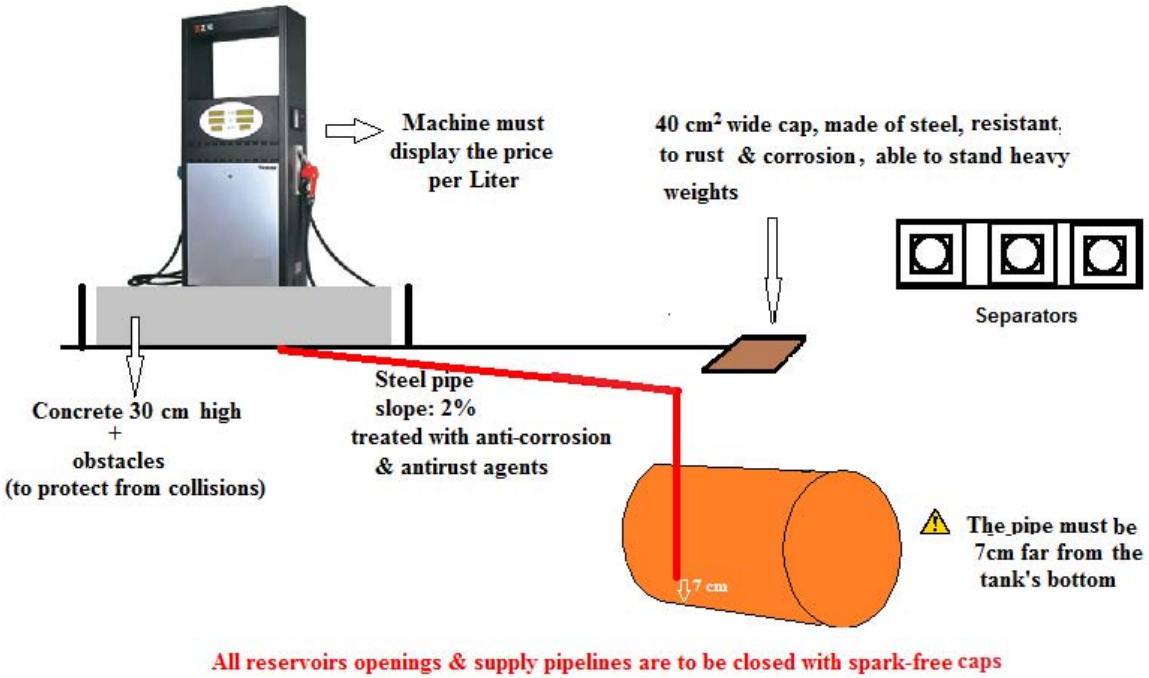


Figure 7: Guidelines for Technical considerations as detailed in law decree 5509/94 related to fuel storage and distribution installations in gas stations in Lebanon

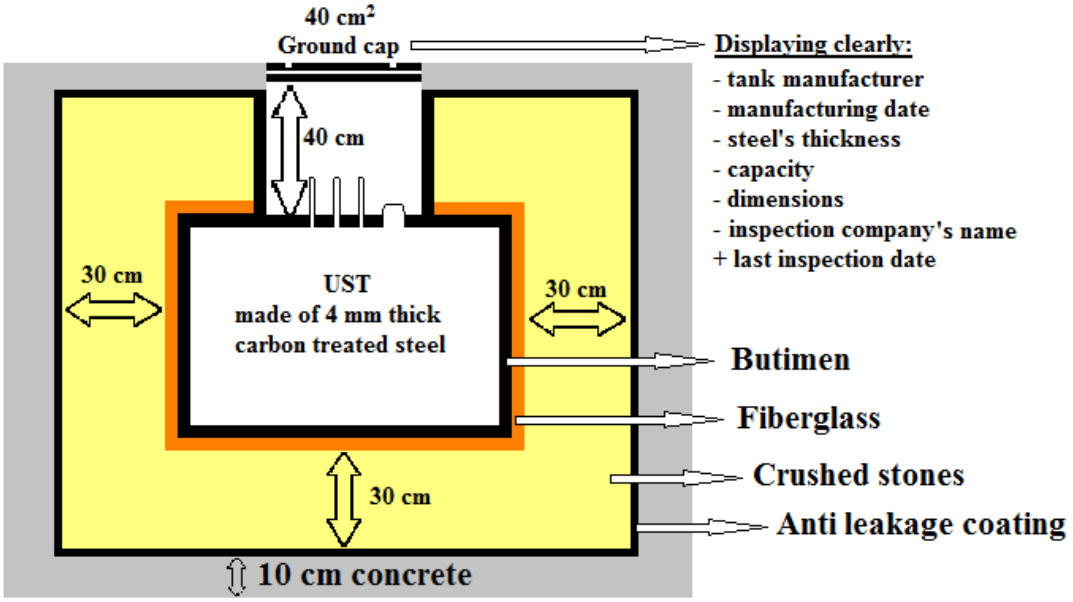


Figure 8: UST installation requirements and guidelines as detailed in the Lebanese law decree 5509/94

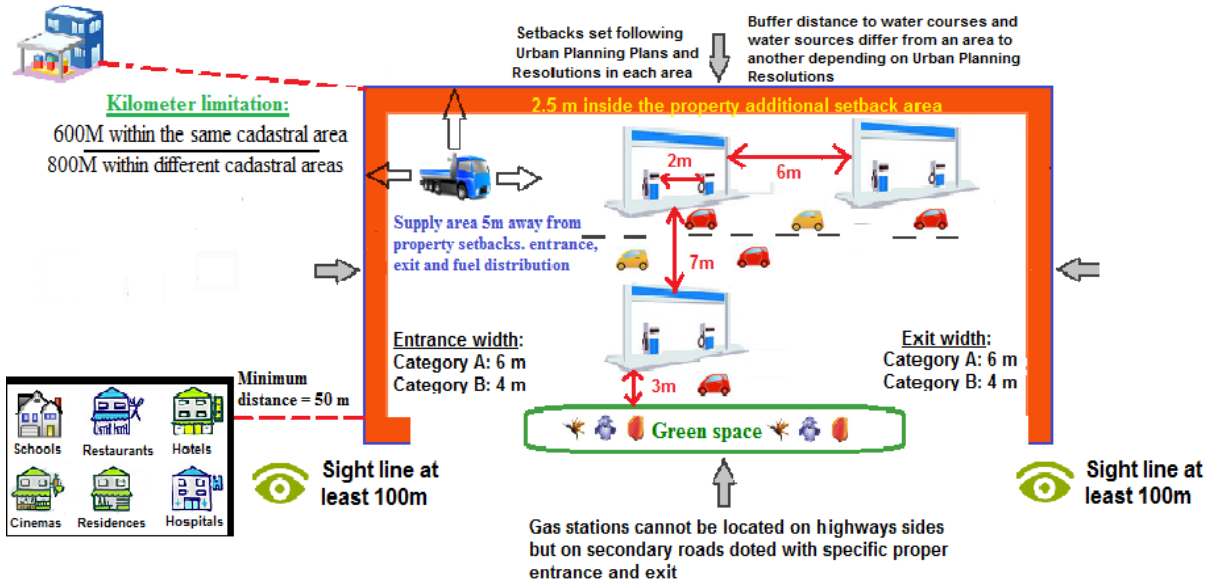


Figure 9: Guidelines related to the service station location and distances considerations as detailed in the Lebanese decree- law 5509/94

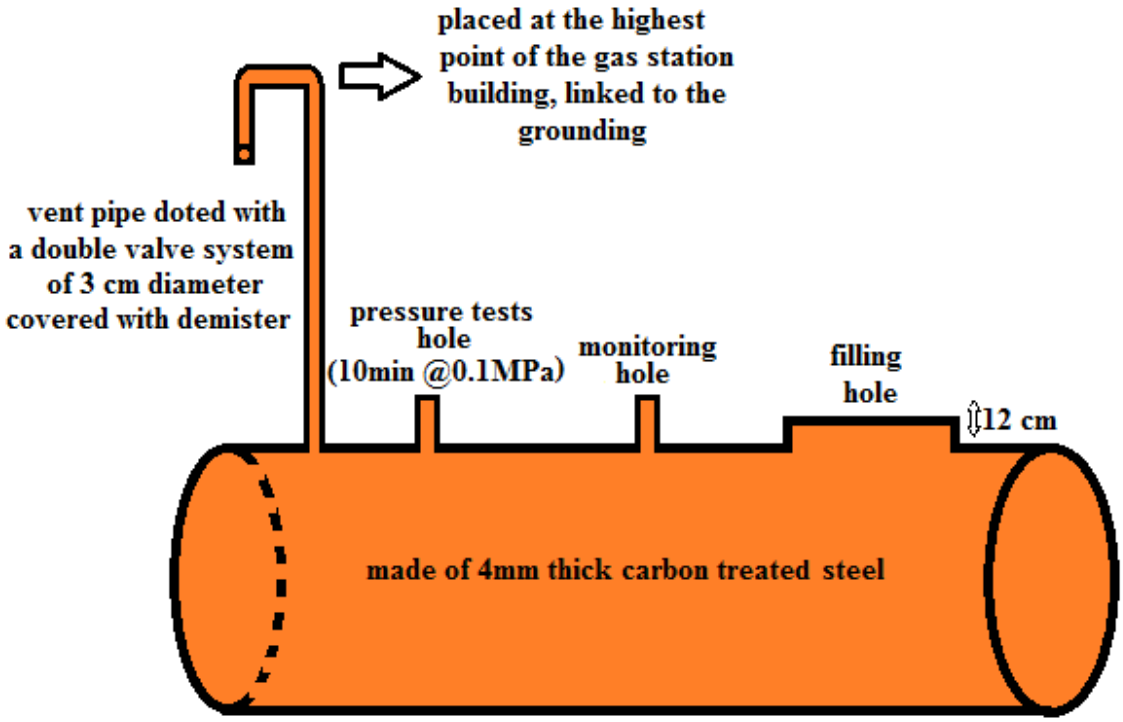


Figure 10: Guidelines related to the UST components as detailed in the Lebanese decree- law 5509/94

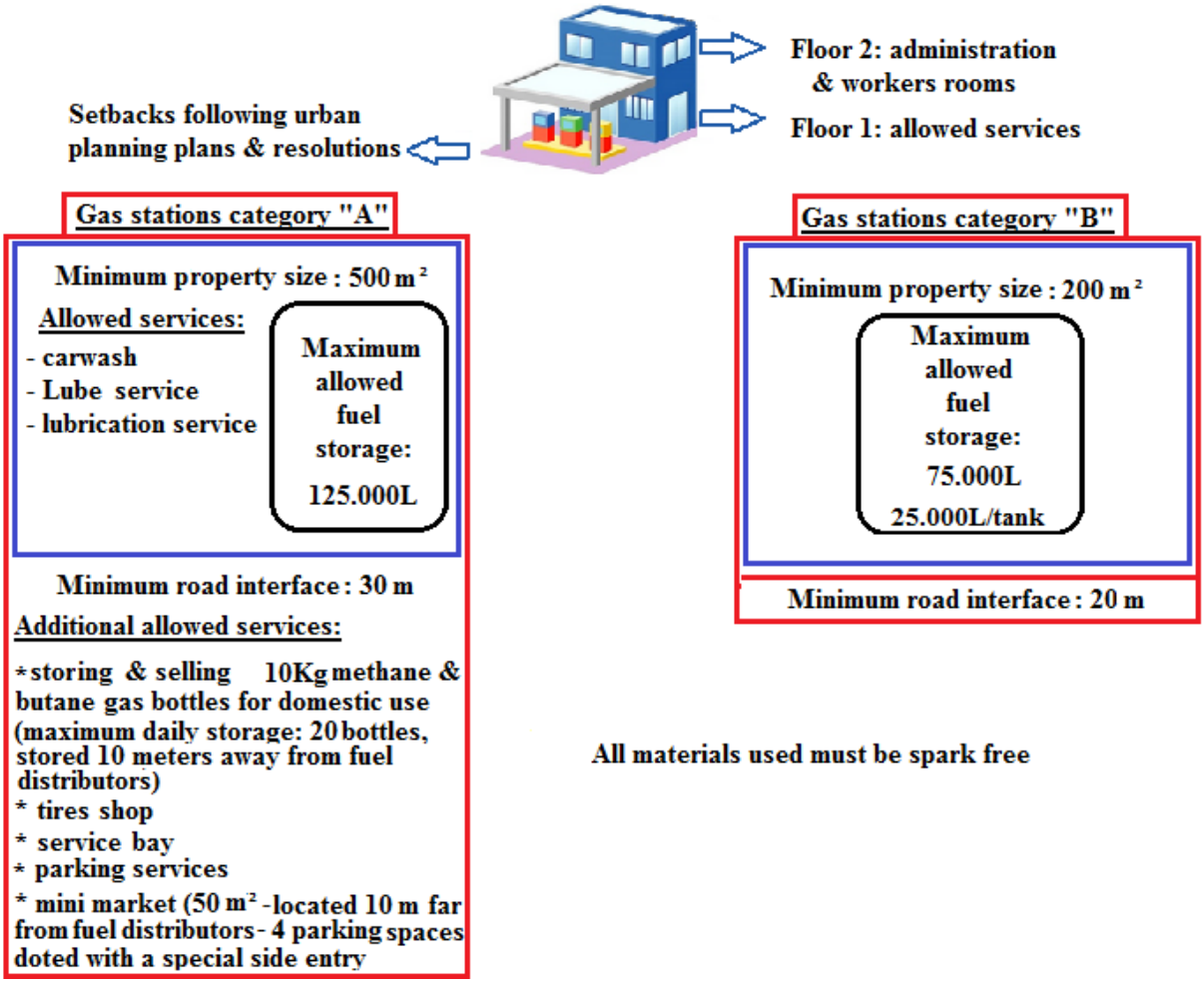


Figure 11: Guidelines related to the characteristics of the two categories of gas stations as detailed in the Lebanese decree- law 5509/94

5 Sector Stakeholders and Role

In Lebanon, gas station establishment and operation permits are issued by the responsible Governor following a mandatory decision of the Directorate of Oil, of the Ministry of Energy and Water following a long process of discourse within other governmental institutions (Figure 12 and 13). As displayed in these Figures, several other governmental institutions are by law involved in the permitting process. A list of the documents to be presented in addition to these document templates is available in the annexed CD.

Figure 12 displays the steps to be followed to issue a permit for a gas station. Apart from the governor, only the decision of MoEW is mandatory, while the decision of MoE is not considered by decision makers as being mandatory. This means that in practice environmental considerations do not play any role in the licensing process. The same is

valid for the municipalities, where the decision is not considered being mandatory, a fact that contradicts enacted legislation (Municipal law and the terms of reference of MoE).

During the assessment of the permitting procedure, the project noticed a severe overlapping of responsibilities between different stakeholders in addition to a lack in understanding of the roles and powers of each involved entity. A constructive dialogue and environmental awareness training for all stakeholders at all levels is urgently needed.

The poor definition of roles and responsibilities of the related governmental institutions leaves ample space to personal interpretations, finally leading to contradictions and power conflicts between concerned governmental entities.

Each entity (MoEW, MoE, governorate, municipality, etc.) defines the permitting process steps in a different way. Each of them has its own interpretation which facts should be relevant for the decision.

The process illustrated in Figures 12 and 13 was based on an interview with Mrs. Nahla Husseik, responsible person for gas stations permits at the Mount Lebanon Governorate.

The operation permit of gas stations is provided for 30 years and has to be renewed on time. It is obtained after having received the installation permit, the construction permit, the full equipment of the gas station and the occupation permit (this process is the same followed for any construction activity; see below).

It is noticed that at this level the MoEW is not involved in the permitting decision, it is only informed following the issuance of the operation permit by the Governor. The latter follows up in general the steps illustrated in Figure 13.

In the current absence of related legislation or guidelines, the renewal of the operation permit is following the same process as for licensing the operation of new gas stations. This comes following a related request of MoEW to the governorate.

A corresponding draft decree was presented to the Council of Ministers (COM) for approval; however it is not enacted yet. (A copy of this draft decree is available in the annexed CD).

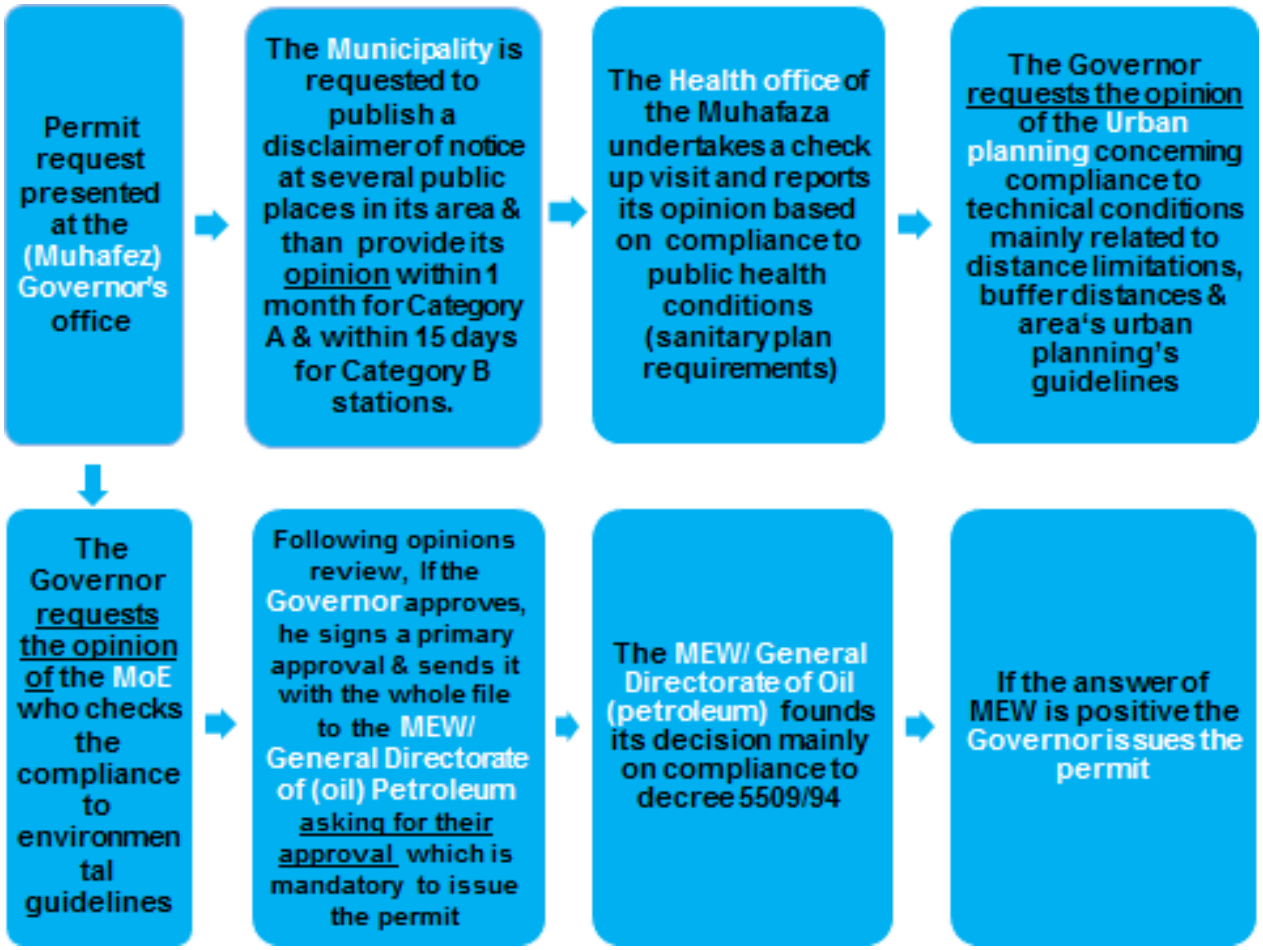


Figure 12: Licensing Process for Establishment of New Gas Stations in Lebanon.

(Based on project assessment).

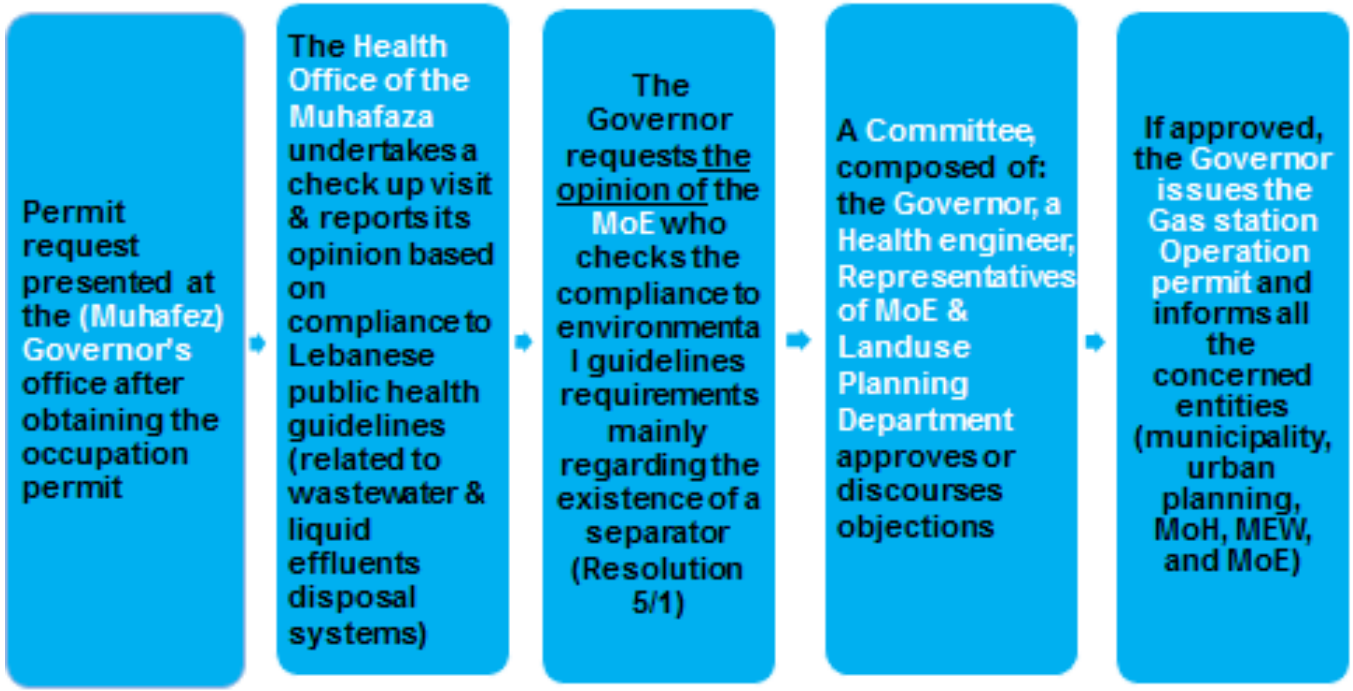


Figure 13: Steps followed to issue Operation permits of newly established gas stations in Lebanon.

(Based on project assessment).

5.1 Ministry of Energy and Water, Directorate of Oil (Petroleum)

According to ABI SAID (2005), Lebanon imports the totality of its needs from the petroleum market.

Until 1988, the Government retained monopoly over the petroleum sector (import and storage). However, the Government has since licensed 11 private companies to import, store and distribute petroleum products (TANNOUS, 2011).

Hydrocarbons specifications including Gasoil, HFO, and LFO are issued by the *Petroleum Directorate at MoEW* (MoEW Decision 56/1997) which oversees the quality of all petroleum products entering the country (MoEW 2011). *LIBNOR* (Norme Libanaise), the *Lebanese standards institution* under the aegis of the *Ministry of Industry*, amended in 2001 the specifications for Residual Fuel Oil (including Heavy Fuel Oil; NL-501:2001).

Finally, in 2002, the COM enacted Decree 8442 (dated 13/08/2002) which defines standards for gasoline (92, 95 and 98 Octane) and Diesel oil used in vehicles.

Thus, specifications of products are prepared and issued by the Ministry of Energy and Water (MoEW)/ Directorate General of petroleum.

Prices are also fixed by MoEW and reflect international prices.

Also according to TANNOUS (2011), in terms of fuel quality, the Petroleum Directorate is working with six private laboratories to check the quality of hydrocarbons entering the country. Three samples are taken from the top, medium and bottom of the tanker ship before unloading operations; specifications must comply with MoEW Decision 56/1997 and LIBNOR NL-501:2001.

The directorate of oil is a mandatory decision maker in issuing the permit for installing new gas stations in Lebanon. For this issue, the MoEW follows mainly the decree No 5509 (Annex 5).

While the person in charge at the MoEW- General Directorate of Oil assured that they also decide on the renewal of gas station operation permits, the person in charge of gas stations issues at the Mount Lebanon Governorate assured they **MoEW is only involved in the decision making of installing new gas stations while they are only informed by the Governor following his renewal of a gas station operation permit.** According to this, even MoEW's opinion is not requested for the renewal of gas stations operation permits.

5.2 Ministry of Economy and Trade (MoET)

As the Petroleum Directorate of MoEW has no jurisdiction over fuel quality stored by private sector fuel stations, the Consumer Protection Directorate at the Ministry of Economy and Trade (MoET) has attempted to monitor fuel quality at these farms but results of fuel samples analysis from different laboratories have been disparate and therefore inconclusive. This is impeding the implementation of a strict quality control program (TANNOUS, 2011).

5.3 Ministry of Environment

A review of the acted regulations shows that MoEW does not specifically regulate retail fuel outlets; Whilst MoE can take enforcement action against the owners and operators of fuel stations that cause or allow breaches of the Environment (Resolution 5/1 and subordinate legislation as detailed in the present report).

Further than emitting the ruling laws and regulations supposed to ensure the protection of the environment, the ministry of environment in Lebanon interferes at three main phases:

For giving the construction permit, controllers from this ministry visit the intended site to check if it fits the site requirements (Annex 5) and the urban planning's considerations related mainly to environmental issues (proximity to rivers, etc.)

During the operation of the liquid fuel station: at this level, the ministry's controllers check if the station has functional separators and check the existence of public safety requirements. However, due to lack of staff and means, this ministry is not able to carry on a complete control on all the existing liquid fuel stations in the Lebanese territory.

At the renewal request of the operation permits: they carry on control visits when the operator request for the renewal of the station's permit, to check its compliance to the acted regulations (mainly existence of separators, and adopted wastewater system).

In response to a claim presented against a specific station.

Nevertheless, the listed checks by the person interviewed at the ministry did not mention any tank leakage check up e.g.

5.4 Municipalities

The article 48 of the Municipal Decree-law no. 118 dated 30/6/1977 states that the rules promulgated by the Municipal Council regarding the issues falling within its competence shall be compulsory within the municipal area.

Hence, the *decision of the municipality should be part of the permitting procedure* for obtaining the permit related to the establishment of a liquid fuel station within the concerned municipality's area (see Annexed CD). However, Municipal councils answer to the Muhafez (governor). Therefore, the latter is not obliged to consider their opinion as mandatory.

When a gas station request reaches the governor's office, he sends it to the municipality. The latter publish it at the concerned location and in several public places of the municipality (church or mosque and municipality entrances, etc.) for a period of fifteen days for category B stations and one month for category A stations, in order to allow the presentation of possible existing objections. Then, the municipality considers its municipal decisions before giving its approval. That must be sent within the mentionned limited period of time to the governor's office. Any delay in answering can be considered as an official approval.

5.5 Muhafez or Governor

Lebanon is divided into six governorates (mohafazat): Beirut, North Lebanon, Mount Lebanon, South Lebanon, Bekaa, and Nabatiyah. Each governorate is administered by a governor (muhafez) appointed by the council of ministers (COM) upon a proposal from the Ministry of the Interior. The Governor (muhafez) represents all the Ministries, apart from the Ministries of Justice and of Defense.

Jeita catchment falls in Mount Lebanon's area and is under the subordination of Mount Lebanon's governor.

Before giving its approval for installing a new gas station, the Muhafez theoretically gets the opinion of the Municipality, the Public health office, the Urban planning department and the Ministry of Environment, in addition to the approval of the Ministry of Energy and Water. Only the later is mandatory for his decision while the others are only considered as advices

For issuing the operation permit of a new gas station and for the renewal of operation permit of an operating gas station, the Governer's decision is taken following opinions collected from the Public health office and the Ministry of environment. These opinions (approvals or objections) are discussed in a committee chaired by him and containing a representative of each of the aforesaid entities and of the urban planning department (Figure 13). It is noticed that MoEW is not part of this committee.

5.6 Public Health Office of the Muhafaza

Based on our assessment, this office plays the main role in issuing the establishment and the operation permits. It also plays a role at the renewal of the later (following 30 years of operation).

In the past a health technician, and recently a health engineer visits the site before issuing the permit related to the construction of the fuel station. They check the site's compliance to the sanitary requirements. After the construction, this representative checks the availability of the required septic tanks, the separators (Figure 6) and the procedure for discharge of carwash water and used oils.

Also, this office is supposed to carry out regular control visits to the stations to ensure their fulfillment to public health and general safety guidelines. However, due to lack of staff, this follow-up is rarely carried out. Our assessment showed that relevant staff is not aware of their actual duties. Asked on the issues they check, staff in charge of a certain important Public Health office stated that they usually check the compliance to decree 5509/94 instead of mentioning checking the public safety requirements. This fact underlines a poor definition and understanding of their tasks, leading to ineffective performance.

5.7 Directorate General of Urbanism

Landuse planning in Lebanon is traditionally practiced at the central level of government by key ministries (such as Ministry of Public Works, Ministry of Interior and

Municipalities, etc.) and Councils (such as the Higher Council for Urban Planning and the Council for Development and Reconstruction, CDR).

Traditionally, human settlements planning have been exercised at the central level with very limited involvement of local communities. This often generates obstacles during the implementation phase.

The Directorate General of Urbanism (DGU), created in 1959 in the Ministry of Public Works, was entrusted with the planning of the development of land through the preparation of comprehensive master plans for the urban and regional development of Lebanon.

However, only after more than 50 years of its inception, the DGU produced several localized master plans for the purpose of managing urban growth. These master plans addressed landuse and parceling Floor to Area Ration (F.A.R), building heights, and setback regulations, with little concern to the general strategic master plan of the region, such as specifying where industrial or commercial activities could be allowed. Furthermore, little volumetric, and environmental issues were considered. The later concerning Jeita spring catchment are detailed in the followings.

The approval of the Directorate General of Urbanism on the establishment of a gas station is based on Decree No. 1008 of March 2nd 1978, allowing the establishment of stations distributing liquid petroleum products in extension areas and residential areas within the organized cities and villages. However, specific regulations and guidelines were issued in 1997.

The Directorate General of Urbanism has issued on December 17, 1997, a ratified Resolution setting general design guidelines and regulations for the Nahr el Kalb Valley (which is in some of its parts within the Jeita groundwater catchment; see annexed CD for a detailed Arabic copy of this Resolution). However, this resolution only limits the establishment of category B stations (Figure 11) in some areas while category A stations are allowed in all categorized areas (annexed CD).

This Resolution sets general guidelines regarding the minimum surface of the investments areas, the setbacks from roads, in addition to specific conditions regarding the areas categorization. Moreover, the visit to the urban planning offices allowed detecting the very bad status of their maps registry: no digital records, the area categorization is in some places very strange such as having a property not exceeding 1000 m^2, considered as located in 3 different urban categories. This fact leaves plenty of room for personal interpretation in the permitting process.

Furthermore, the permit approval for gas stations is always depending in the first place on the distance limitation between two stations, which is 600 m if the stations are located within different cadastral areas and 800 m if they are within the same cadastral unit.

UN HABITAT (2008) notice that the absence of a national urban development strategy and the devastating consequences of 20 years of war resulted in: Conflicting landuses which are consequently prompting the deterioration of physical and environmental conditions; urban sprawl without adequate provisions of roads and infrastructure, open public spaces, parking facilities, etc; loss of agricultural land; disappearance of coastal land; in addition to destruction of natural and archeological sites.

However, we notice that Urban planning's opinion is considered at all kinds of gas stations permits processes (installation, operation, and renewal of operation permits).

5.8 Fuel Companies in Lebanon

All main petroleum products companies active in Lebanon are gathered in the "Association of Petroleum Importing Companies APIC", which was officially announced on 14/03/2007.

APIC includes 14 oil companies that are active in importing and distributing petroleum products in the Lebanese Market. APIC is a non-governmental association that was founded, according to the APIC website, based on the following main objectives:

- To help improving the standards of the Oil sector in Lebanon, and consequently improve the quality of related services;
- To join the economical bodies as an active member in order to contribute to the development of the national economy;
- To play a proactive role with the national administration and legislative bodies in order to modernize the laws and regulations related to the oil Industry in Lebanon.

Furthermore, also according to its website (http://www.apic.org.lb/), APIC is planning to play an active role to improve the regulations and legislations as well suggesting new laws that match the global development in this sector.

Personal communication with several importing fuel companies' representatives showed that they currently import fuel by shipment from European countries since Tripoli and Tyre's refineries have stopped refining. They set their fuel composition requirements in compliance with the ranges set by the Lebanese government in Decree 8442 (Annex 2). Samples taken from each shipment are submitted to laboratory analysis before getting the approval (from MoEW) to discharge the shipment inside the country.

The importing companies sell their fuel to private owned retail stations and to individuals at retail stations owned or managed by the importing company itself.These fuel providers store their imported fuel in huge dedicated above ground reservoir (all outside Jeita spring catchment) before distributing it to retail fuel stations using specific cisterns. The latter are supposed to be in compliance with specific guidelines detailed Decree 5509 (detailed decree available in the annexed CD drive).

Furthermore, each company sets its own environmental and managerial rules when dealing with a considered retail fuel station. The rules can differ with the type of management of the station and its location. However, they usually always involve regular check-ups of tanks, pipes, pumps and distributors.

MEDCO

The MEDCO stations technical responsible stated that before installing any new station, the company carries out site soil analyses to determine the type of soil, density, resistively, bearing capacity (however they don't consider assessing the depth of water

table). In general, MEDCO uses double-layered steel tanks only where aggressive soils are detected.

Furthermore, according to the MEDCO technical head supervisor, they supervise the installation of the underground tanks, in a way to ensure the installation compliance to Decree 5509 requirements. In addition they carry out rigid regular (weekly) check-up on the stocks inventory (now automated in many MEDCO stations), and on the state and performance of the distribution system components (pumps, pipes, etc) as well as waste disposal practices. The company collects used oils from all MEDCO stations who store them in transportable specific plastic containers.

TOTAL

From his side, the head of the environmental and development division at TOTAL Company stated that they try to spread environmental awareness at the station's operational level. However, they are confronted with major economic problems while requesting the use of environmentally sound tanks (double layered) and equipments (leakage alarm, etc); especially when the station is not owned and operated directly by the company, or is located in an area where the market study predicts only moderate incomes. Furthermore, he stated that the company insists on the compliance of the stations that hold its name to the Lebanese regulations and guidelines (Decree 5509). Also, being aware of the danger of disposing used oils in the nature, Total is collecting in collaboration with ECOLIB used oils from all Total stations.

However, he stated that the level of environmental management at the stations widely depends on its ownership and its operation contract.

Following the field assessment, we can distinguish several management cases;

1. The station is owned and directly operated by the importing fuel company (best environmental management).
2. The station is owned by the importing fuel company but the operation is carried out by another individual who bought from the company the right of operation and uses only their fuel (in this case the environmental management is up to the operator's choice)
3. The station is owned by another entity but is operated by the importing company (in this case there is a relatively proper environmental management).
4. The station is owned and operated by another individual or entity with reference to a specific company (generally weak environmental management)
5. The station is owned and operated independently by an individual or an entity without any dependence of any company (weakest environmental management practices).

When a station holds the name of a fuel company, (being its unique fuel provider), the latter conducts regular check-ups on the used equipments: pumps, pipes, fuel composition in the tanks, etc.

From our field survey, we noticed that companies that operate a large number of petrol stations generally consider environmental risks and legal liabilities better than single site operators.

However, as detailed hereafter, the present management conditions of the gas stations in the Jeita catchment is far from being environmentally sound.

5.9 Fuel Stations Owners/Operators

TANNOUS (2011) highlighted the potential environmental impacts of petrol stations in Lebanon throughout: spillage, fugitive gas emissions, underground fuel tank leakage, ground pollution, sludge disposal and waste disposal.

The impact depends on the site vulnerability and on the environmental management practices applied by the petrol station operator.

These practices depend widely on the willingness of the operator to apply environmentally sound practices, especially in the absence of efficient environmental control from the part of the government.

5.10 Approved Certification Institutions

Decree 5509 states that fuel storage tanks must be submitted to a pressure test (0.1 MPa = 1bar for 10 minutes and to physical inspection of anti-corrosive treatment) before their installation in a properly prepared pit.

The metallic cover of the pit where the fuel storage tank is placed must display the following: name of the tank manufacturer, manufacturing date, tank capacity, tank dimensions, steel thickness, name of the certification firm, and certification date.

For the inspection and certification of the fuel storage tanks in respect to Decree 5509, the Lebanese government has accredited the following six private independent certification firms:

- Blue Tech (ISO 9001-2008 certified company),
- Management Integrated consultants (MIC),
- Lebanese International Inspection Sarl,
- Petrol Survey & Technics Sarl,
- Technomar Liban Sarl,
- Navy Group Limited,

And a public institution, named IRI (Industrial Research Institute), which is the most adopted one.

According to a letter addressed from the Minister of Energy and Water to the Minister of Environment in April 2008, these inspection firms must carry out field inspection and proper pressure tests following Decree 5509, before issuing an official certificate

displaying the test and the field assessment results that is to be submitted to the competent authority.

However, in practice, these institutions are inspecting the tanks at the manufacturor's workshop and not at installation, discarding by this the transport damage risks and its related leakage potential.

5.11 Tanks Manufacturers

There are few petroleum products storage tanks manufacturers in Lebanon. In general, except for one located in the South, they have rudimentary workshops with very limited equipment and technical capacities.

A visit to a petroleum storage tanks manufacturing workshop, was carried out in the framework of the present assessment in order to evaluate the compliance of the manufacturing process to the quality criteria required to reach a safe storage of petroleum products.

The field assessment showed that in most cases, tanks used in petrol stations in Lebanon are single-walled tanks made from rolled carbon steel plates, welded together, and then painted with bitumen (Figure 14).

Figure 14: Two fuel storage tanks, one covered by bitumen while the other is not covered yet.

The fabrication process can be summarized as follows:
Rolled carbon steel plates of 6 mm or 8 mm (chosen according to the required final tank capacity) thickness are cut at the required length (Figure 15) following the designed capacity of the tank.

Figure 15: Roll of carbon steel plates to be cut at the required length.

In respect to the Decree 5509, the minimum required steel thickness, is 4 mm. Nevertheless, according to the manufacturing workshop operator the commonly adopted steel thickness is 6 mm for tanks of 25,000 L and of 30,000 L capacity and 8 mm for 50,000 L capacity.

The adopted tank capacity depends mainly on the station classification. Decree 5509 limits the maximum allowed fuel storing capacity to 125,000 L at “Category A” fuel stations, and to 75,000 L only at “Category B” gas stations. However, it also depends on the fuel importing company that will provide the fuel to the gas station.

Table 5 displays the commonly used tank capacities with regards to main fuel providing companies, and a rough price estimate based on a quotation provided in February 2012.

Table 5: Adopted Tank Volumes adopted by the Main Fuel Providing Companies, with a corresponding Price Estimate.

Company	Capacity in L	Price in USD excluding VAT
MEDCO	25,000	3,500
	50,000	6,700
HYPCO	30,000	3,600
UNITED	25,000	3,500
	30,000	3,600
MOBIL	30,000	3,600
	50,000	6,700

(Source= Field assessment)

The workshop manager stated that TOTAL company requirements are not easily met by Lebanese manufacturers. As TOTAL usually requests double-layered tanks that are difficult to manufacture with the equipment and tools available in common tank manufacturing workshops in Lebanon.
The carbon steel plates are cut at the required length and joined together by manual metal arc welding (MMAW) or stick welding to form the required tank volume (Figures 16 and 17).

Figure 16: Carbon steel plates cut at the required length,

The tank extremities are concave and their steel plate components go from each side around 3cm inside the tank.

Figure 17: Joining the tank concave extremity by welding.

Before joining the second extremity part, uncorrosive treated carbon steel bars are fixed inside the tank, creating a sort of ladder that would ease maintenance processes (i.e. cleaning; Figure 18).

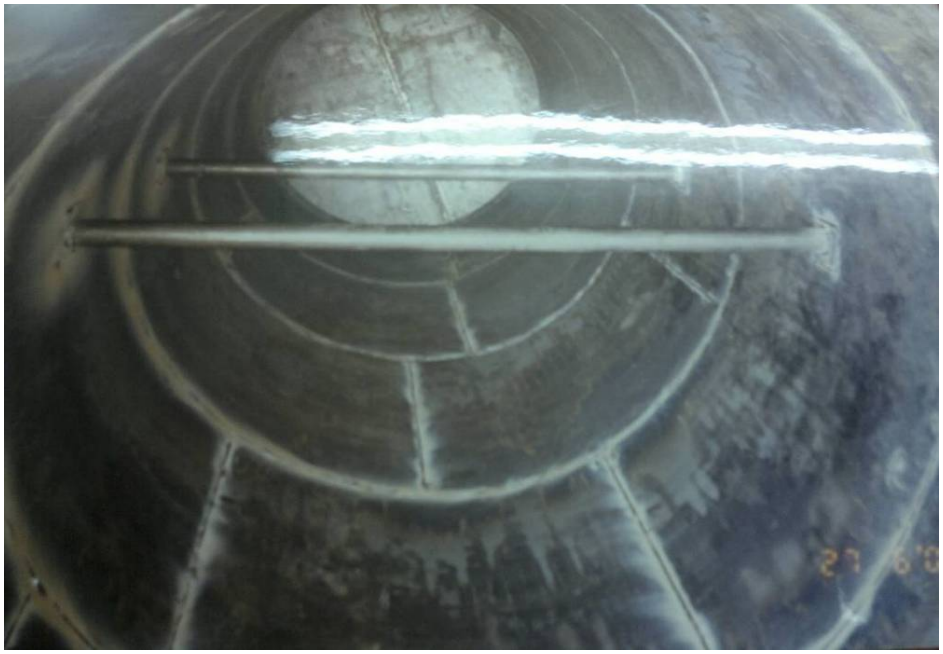


Figure 18: Internal shape of a tank shot taken during the welding process

Once all the tank parts are joined together, it is painted by bitumen in order to protect it from outside corrosion. One tank consists of approximately 8 or 9 parts (depending on its storage capacity) and has thus many seams. Those are the weakest points of the tanks where corrosion and thus leakage would start.

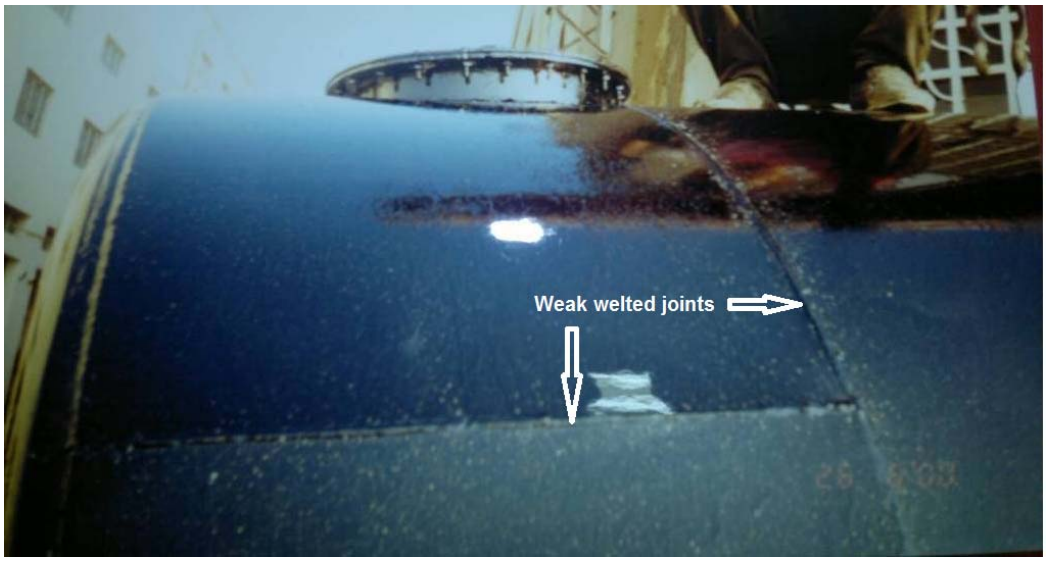


Figure 19: Outside view of a tank ready for use, showing the weak welted joints.

Figure 20: A fuel tank ready for transportation and installation

6 EU Regulations

According to EU regulations, in the gas stations permitting process, an Environmental permit is required with particular attention to the Environmental impact on streams, lakes, ponds, aquifer, etc., is required and is seriously taken into consideration (http://europa.eu/youreurope/business/search/index_en.htm?Do%20petrol%20sations%20require%20an%20environmental%20permit%3F).

Vulnerability maps of the Jeita groundwater catchment are in course of preparation in the framework of BGR Project Protection of Jeita Spring (MARGANE et al., in progr.). Once completed, an evaluation of the environmental impact of the existing gas stations will be carried out and published by the project in a separate report.

In the present section the site considerations for establishing a gas station in addition to general environmental requirements for storage facilities and for the drainage system inside a gas station are addressed.

6.1 Site Considerations for Storage and Distribution of Petroleum Products

The following criteria are suggested to be used in Lebanon for the granting of permissions and renewal of permissions to operate a gas station. Those considerations are divided into:

- general criteria, such as topography and buffer distances from critical places and
- geoscientific criteria related to geohazards (risk of impact by flooding, landslides, earthquakes, tectonic movements, land subsidence, soil stability)
- geoscientific criteria related to impact on water resources

a- Topographic Conditions and Buffer Distances

Sites for storage and distribution of petroleum products must be protected against impacts from accidents and intentional damage. Concerning accidental damage, the topography at the intended site plays a major role.

Gas stations should not be located:

- in road turns (minimum distance: 100 m from inflection point; all road sections with curvature > 30°)
- on road sections with slopes > 10%
- near schools, mosques, churches, monasteries, municipalities, supermarkets (> 250 m²) (minimum distance: 250 m, while in the Lebanese guidelines this buffer distance is limited to 50 m)

b- Geoscientific Site Criteria Related To Geohazards

Gas stations might be damaged by geohazards and could then develop severe leakages of petroleum products into the environment (air, soil ,water).

To avoid such environmental impact, gas stations should not be located:

- less than 50 m from the embankment of river courses (flooding risk)
- less than 50 m from tectonic faults with identified vertical displacement of > 1 m (tectonic risk; earthquake risk) (not mentioned yet in the Lebanese regulation).
- less than 50 m from slopes > 30% (landslide risk; rock fall risk)
- in areas of unstable underground (liquefaction risk, risk of land subsidence) (must be included in the Lebanese regulation).

A geotechnical site investigation is needed to exclude related risks and must be made obligatory for new permits and renewal of existing permits.

6.2 Geoscientific Criteria Related To Impact On Water Resources

To avoid such environmental impact, gas stations should not be located:

- less than 200 m from the center of river courses (horizontal distance; pollution risk for surface water resources);
- in designated protection zones 2 of groundwater resources (pollution risk for groundwater resources);
- less than 500 m upstream of springs and wells if used as drinking water [if consumption less than 5 Million m³ /a] (circular radius, 90° pie with central axis parallel to assumed general groundwater flow direction; pollution risk for drinking water resources);
- less than 1000 m upstream of springs and wells if used as drinking water [if consumption more than 5 Million m³ /a] (circular radius, 90° pie with central axis parallel to assumed general groundwater flow direction; pollution risk for drinking water resources);
- in the surface catchment of a dam used for drinking water supply or irrigation;
- less than 50 m upstream of an irrigation canal or irrigation pond.

A groundwater and hydrological study is needed to exclude related risks and must be made obligatory for new permits and renewal of existing permits.

6.3 Storage of Lubricants, Fuel

Table 6: Storage Tank Sizes found in Lebanon

Storage tanks, vessels and containers and associate pipelines	Volume (L)
Vessels, containers	20 to 450
Small Tanks	450 to 2,000
Medium Tanks	2,000 to 30,000

Figure 21: Sample of vessels placed on a trip pan

Table 7: Storage Requirements for Petroleum Products in SPZs (GITEC and BGR, 2012)

	Spring Protection Zone 2	Spring Protection Zone 3
1.	Vessel containing petroleum substances must be in good order (e.g. not corroded) and the vessels must be stored visible so that any leakages can be visually detected. Collecting trip pans are required: Trip pans are recommended in all cases since they are also an ideal measure to prevent accidents	
	For total stored volume a) not exceeding 1,000 liters	
	Size of trip pan at least or bigger than the biggest container stored above.	Storage rooms with watertight concrete floor and no drainage outlet in the floor. Minimal storage volume up the overflow edge (e.g. door sill) must be equal to the biggest container stored in the room.
	b) volume > 1,000 < 5,000 liters (e.g. tanks for heating fuel)	
	Separate retention basin with holding volume of at least 50%	Separate retention basin with holding volume of at least 25 %
	c) volume above 5,000 liters	
	Separate retention basin with holding volume of 100 %	Separate retention basin with holding volume of at least 50 %
2.	The products shall be abstracted with hand pumps. Siphoned abstraction is not permitted since the hose pipe may fall down and the content of the vessel or tank might flow out.	
3.	The containers must be stored in lockable rooms, to avoid access of unauthorized persons.	
4.	Rooms below terrain must be secured against flooding during heavy rainfall.	
5.	Rooms above ground level must be protected against rainwater spillage into the room.	
6.	In operating premises like workshops, containers can be stored without trip pans provided the area has water tight concrete floor and no drainage outlet in the floor. The minimal storage volume up the overflow edge (e.g. door sill) must be equal to the biggest container stored in this premises	
	N.B: Materials of different chemical properties must be stored duly separated from each other (as fire fighting requirements and measures to avoid environmental pollution may be different).	

6.4 Storage of Tires and used Oil

The storage of greater volumes of tires and used oil is very problematic in case of fire, since the used water is highly polluted with toxic substances. For this reason tires and used-oil must be kept in storage rooms which can provide a certain amount of retention for the used fire fighting water. The retention volume can be achieved by a watertight concrete basin and depending on the amount of water to be withheld an appropriate door sill, approach ramps or specially inserted gates to withhold the water.

To minimize the pollution risk the quantity of stored tires and used oil shall be limited:

For Spring Protection Zone 2	to 1 ton per storage place
For Spring Protection Zone 3	to 2 tons per storage place

Adjoining storage places must be spaced at least 150 m from each other.

6.5 Requirements for Drainage System

For Fuel with additives like ethanol, urea, bio diesel

- **Design principles:**

  With the introduction of fuel additives like ethanol, urea, bio diesel the previously utilized oil / petrol separators are of no use anymore since the additives change the fuels properties. The fuel with additives becomes water soluble and can no more be separated into two fractions (water / oil phase) a requirement for withholding fuel in an oil / petrol separator.

  The only technical solution available is to withhold any spillage and leakages in a retention basin and to dispose of collected fuel through an appropriate collection system (tankers).

  The size of the roofing must be designed so that the amount of splash water falling onto the fuel handling area is minimized. The roofing required for fuel stations, dispensing fuel with additives is considerably larger than that for fuel stations dispensing fuel without additives.

  The roof eaves must be more than 0.6 * H (H - clear height of roof above ground).

  Surface runoff must be kept away from the fuel handling area with the assistance of different slopes, swellings or drainage gutters.

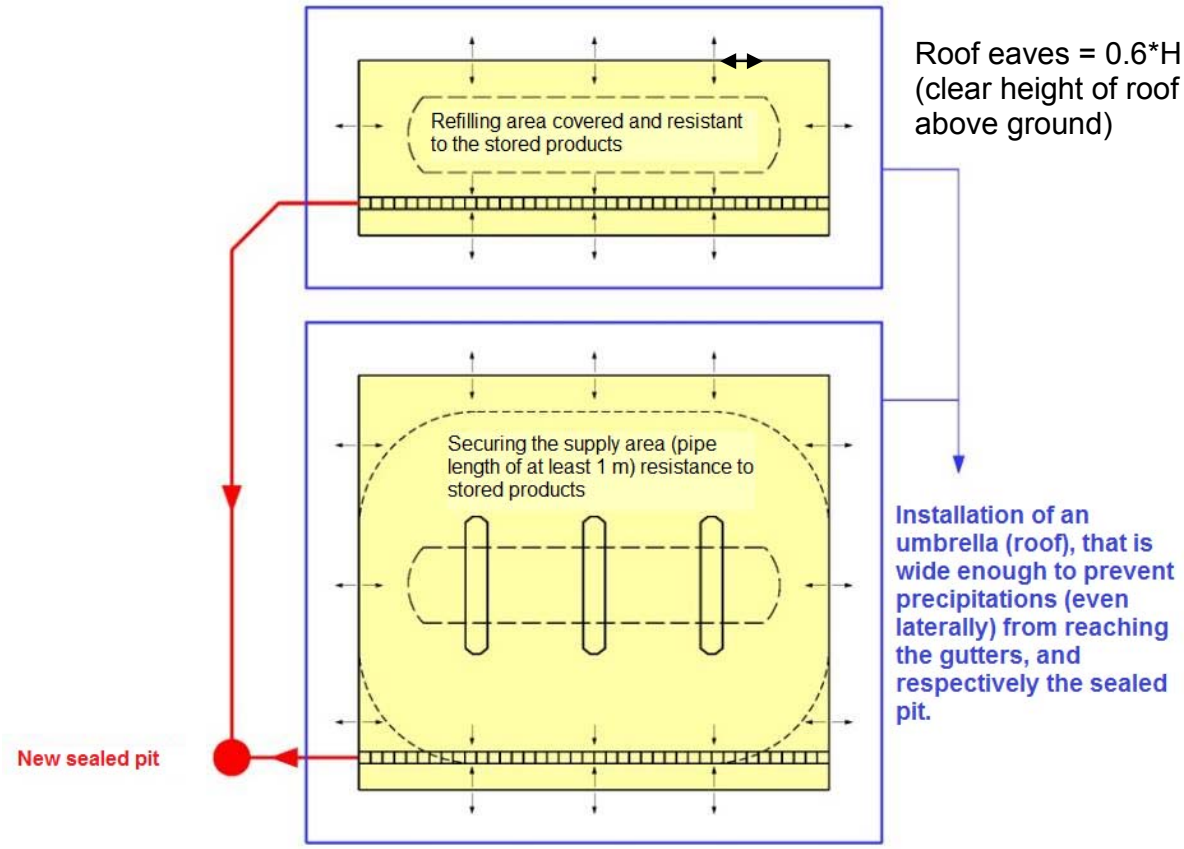


Figure 22: Collection of Fuel Spillage for Fuel with Additives

The size of retention basin depends on several factors such as:

- Size of bulk delivery tank
- If fuel dispensers are equipped with automatic overfill shut-off valves
- If the fuel dispensers are equipped with a fuel amount restrictor e.g. in excess of 100 litres the pump stops (important in case of damaged / broken hose pipe).

- **Recommended minimum size of retention basin is:**

Places receiving and selling petrol	5 to 6 m^3 retention basin
Places receiving and selling diesel only	1 m^3 retention basin

As shown in Figure 23, it is possible to upgrade existing petrol stations to handle fuel with additives. However, this requires trained staff able to activate the required fuel retention measures in case of an accident.

(a) Installation of a retention basin: fuel stations that are already equipped with a retention basin require the installation of the diversion valve only.

(b) Installation of a diversion valve e.g. in a chamber in order to redirect the flow into the basin. The valve will be activated during bulk delivery of fuel and in case of an accident at the fuel dispensers.

Diversion valves should be automatically operated from a central point e.g. office. However the valve is located in an explosion zone due to the presence of fuel, only pneumatic valves (no electrical wiring is permitted) can be utilized.

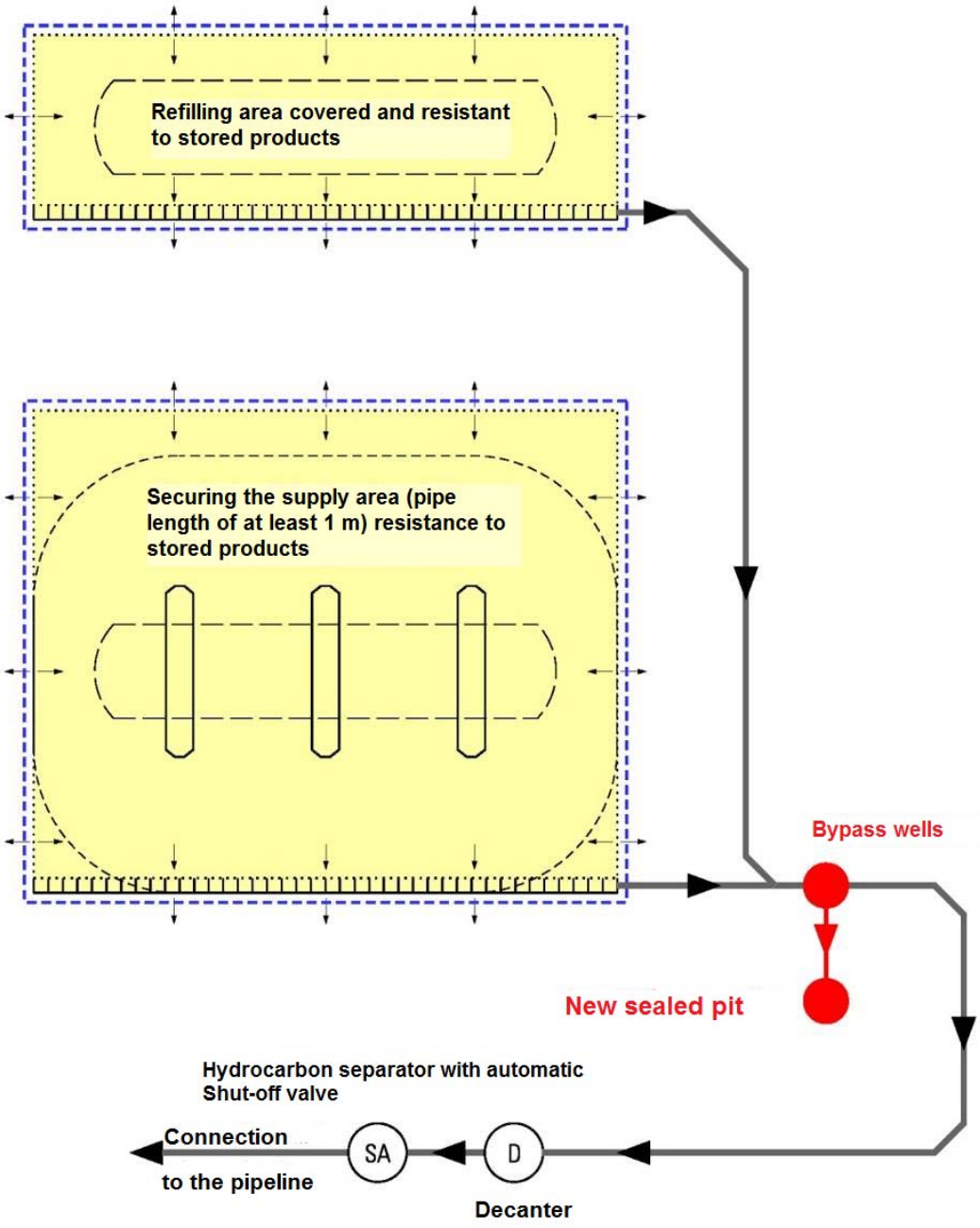


Figure 23: Upgrading of existing Petrol Station to handle Fuel with Additives

For Fuel without additives

- **Design principles (GITEC, 2012):**

1. The area used for cars and vehicles refilling must be roofed; minimum dimension: The length of the filling hose pipe (fully detracted) must be over than 1 meter. The areas should be designed and constructed without any outflow.
2. Surface runoff must be kept away from the fuel handling area with the assistance of different slopes, swellings or drainage gutters.
3. For covered areas fulfilling the requirement as described in Point 1 the wastewater and leakage pretreatment arrangement is as illustrated in Figure 24 A or 24 C. Concerning the size of the mineral oil separator there are no special requirements, since only splash and dripping water from the vehicles will be drained off.
4. If an oil / petrol retention basin is required, it depends on the annual turnover of petrol products (e.g. more than 1,000 m^3/a). However, it is strongly recommended to install a retention basin at all commercial filling stations with more than two fuel dispensers (Figure 24 C).
5. If it is not possible to provide appropriate sized roofing, the storm water runoff for the whole area serving as loading and/or unloading for fuel products must be drained to an appropriately sized mineral oil separator. The size of the mineral oil separator would depend on the loading and unloading area. Henceforth it is rewarding to keep this area as small as possible. There are two possibilities regarding the sizing of the mineral oil separator:

(a) Preferred solution:

The mineral oil separator must be able to handle the complete storm water runoff of the loading and unloading area. The separator must in this case be dimensioned for a design flow of:

$$\underline{\text{Loading / unloading area in } m^2 \times 0.03 \text{ l/(s } m^2\text{)}}$$

At this flow rate the separator must fulfil the legal requirements on efficiency of withholding petroleum products (Figure 24 A).

(b) Alternative solution:

This solution is applicable only when rehabilitating existing fuel stations. The separator must in this case be dimensioned for a design flow of:

$$\underline{\text{Loading / unloading area in } m^2 \times 0.003 \text{ l/(s } m^2\text{)}}$$

(where we have continuous low intensity rainfall)

At this flow rate the separator must fulfil the legal requirements on efficiency of withholding petroleum products. The surplus stormwater is

discharged directly into stormwater drainage without passing through a mineral oil separator (stormwater by-pass).

Note: The installation of oil / petrol retention basins for insufficiently covered fuel handling areas is not very effective, except if unloading of bulk deliveries will be carried out only during times of no rainfall.

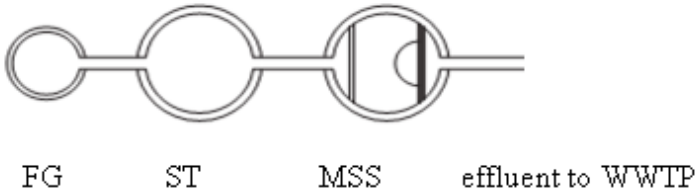
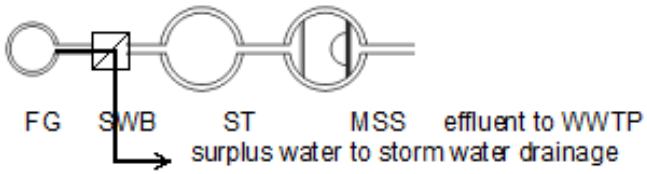
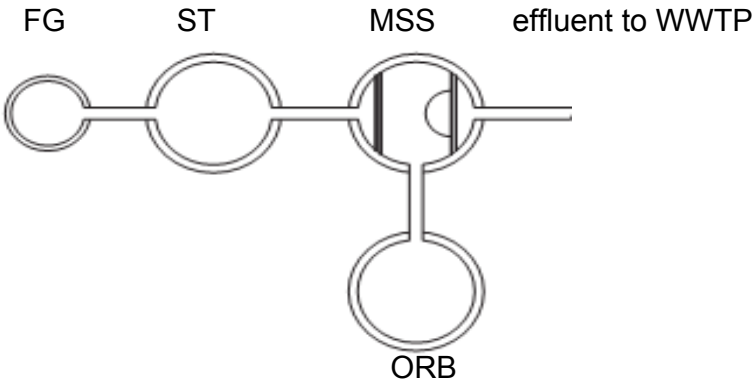
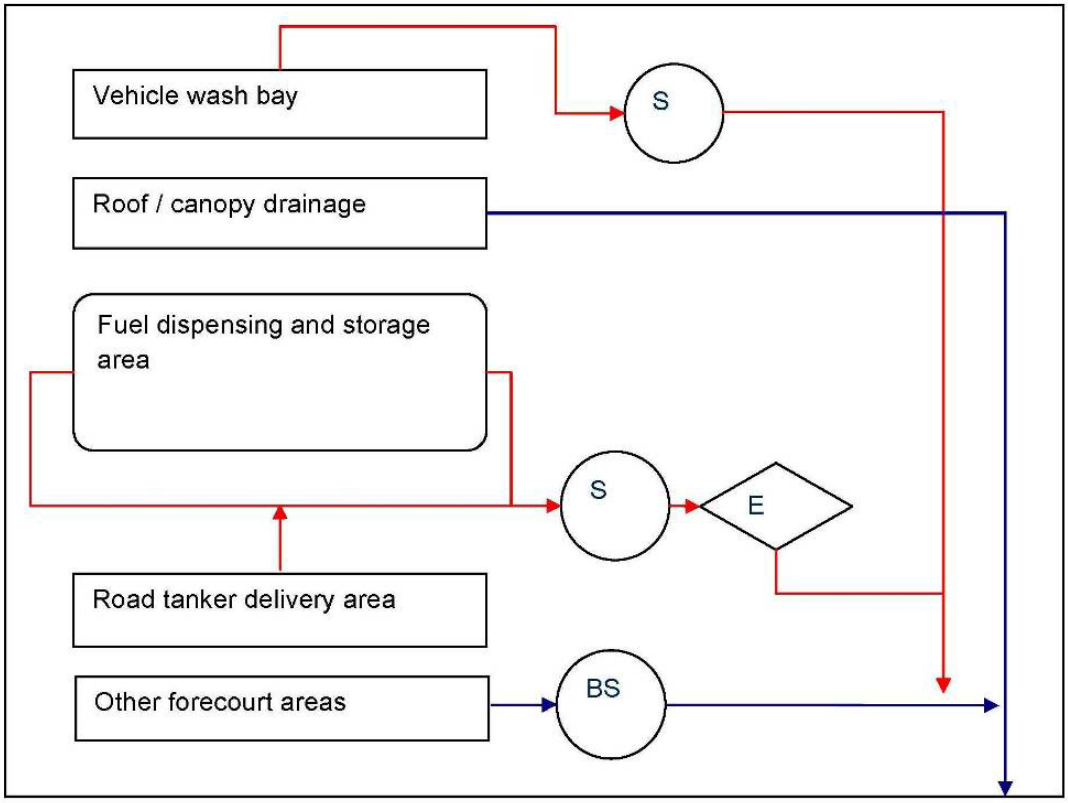
A) Vehicle and equipment filling area only without stormwater by-pass) (Petrol and Diesel)	 Figure 24 A
B) Vehicle and equipment filling area only with stormwater by-pass) (Petrol and Diesel)	 Figure 24 B FG **F**loor **g**ully ST Mud and **s**ilt **t**rap MSS **M**ineral oil **S**eparator with automatic **S**hut-off valve ORB **O**il / Petrol **r**etention **b**asin WWTP Wastewater Treatment Plan SWB **S**torm**w**ater **b**y-pass
C) Transfer site for bulk deliveries (Petrol and Diesel)	 Figure 24 C

Figure 24: Design Principles for Drainage System of Gas Stations



S= Class 1 interceptor
E = Emergency shut off valve
BS = By-pass separator

Red = Foul drains connecting to local sewage treatment works
Blue = Surface drains connecting in to watercourses

Figure 25: Typical site drainage plan for a refuelling facility
(Environment Agency for England and Wales, the Northern Ireland Environment Agency and the Scottish Environment Protection Agency, 2011)

An up-to-date drainage plan of the gas station site will help stopping pollution. The plan must include:

- the location of and direction of flow for all sewers and drains on the site;
- the location of all drain covers and gullies;
- all surface water drain outfalls;
- the destination of all foul sewers or combined drains;
- the location of all pollution control facilities, for example oil separators.

6.6 Requirements for Structures and Pavement

All gullies, chambers, aprons and pretreatment facilities must be either made of media resistant material or, if concrete is used, the concrete structures must be lined with a resistant liner.

The bulk delivery area as well the fuel handling areas which are susceptible to contamination must be provided with a pavement which is impermeable to hydrocarbons and other liquids. Seepage through the pavement or below the surface is not allowed. Typically, concrete (recommended minimum 180 mm thick, laid in accordance with recognized standards e.g. BS 5328) or similar highly impermeable such as sealed block paving will fulfil this requirement provided any associated jointing material is also impermeable and resistant to attack by motor fuel. Other areas outside the fuel handling area, may be surfaced with materials such a hot rolled asphalt, macadam etc.

It should be recognised that hard-standing areas do mot remain impermeable over a long period of time. They can be compromised by pipework repair, subsidence or wear and tear along pavements expansion joints. In general, extent of cracking, multiple joints and pavements subsidence are a good indication that potential contamination pathways exist.

Sealed joints in good conditions

Sealed joints in good conditions

Holes for screw anchor not plugged!

Damaged (leaking) joints along drainage channel


Leaking joint around cover and pedestal


Leaking joints at intersection of different material


Damaged pavement in filling area


Damaged pavement and oil / fuel spill


Damage pavement at a floor gully


Damage pavement at a floor gully

Figure 26: Example of pavements at Fuelling Stations
Source of pictures: Union Professionelle Suisse de l'Automobile UPSA (www.agvs.ch)

6.7 Requirements for Primary and Secondary Security Components at Gas Stations

The following recommendations were adopted from a proposal to the Ministry of Water and Irrigation (MWI) in Jordan prepared in 2007 by the Techncial Cooperation Project *Groundwater Resources Management,* that was implemented by BGR between 2002 and 2010. The aim of this proposal was to improve protection of groundwater reosurces angainst pollution from petroleum products.

The petroleum products storage and distribution entities must foresee several components of *primary security*, which are the technical mechanisms that enclose intended water-endangering materials, and the components of *secondary security*. The latter are technical measures that serve to retain water-endangering materials of leaking components deriving from primary security measures. This includes the outside wall as well as the double-layered retaining device, tanks and pipes.

Retaining devices are e.g. impounding basins, catch pans, catch-ate, traps, pipes, protective pipes, tanks or surfaces, in/up those materials can be held back. Retaining devices consist in accordance with the definition of the TRwS 786 to one or more sealed surfaces: e.g. safety devices, leakage recognition systems, alarm devices for leaks.

Alarm devices for leaks are devices for double-layered tanks and pipes, which indicate leakages automatically.

Overflow safety devices are devices, which interrupt the filling procedure before reaching the permissible rate of admission of the container automatically or give alarm.

Components of primary security must be resistant and impermeable against physical, e.g. mechanical and thermal, as well as chemical influences. Subsurface single layered components like tanks and pipes must be designed in a manner that leaking substances do not penetrate into the soil and waters.

Chemical resistivity of the components is to be proven for the intended lifetime of the device. Chemical resistivity is given if components are protected by suitable interior coatings or linings. The chemical resistivity of the lining/interior coating is to be proven for the intended lifetime. All risks pertaining from various types of corrosion are to be excluded.

Furthermore, components of primary security must have the stability corresponding to expected loads for the intended lifetime of the installation.

They must be founded, installed and set up in a manner that misalignments and inclinations, which can endanger the security and the tightness of the components, are impossible. The calculation of structural analysis has to be enclosed within the description of the installation.

The following stresses/loads are to be considered for underground components:

- dead weight
- earth loads and loads deriving from groundwater
- traffic loads
- operating and test loads, like liquid pressures, operating pressures, test pressures, operating temperature
- lift loads deriving from groundwater

- assembling loads
- influence of the water-endangering materials, the groundwater and the soil
- transport and installation
- leaking of the internal wall and/or the leakage protection lining
- leaking of the outside wall (only with internal bowl resistant to bending)
- setting differences
- single-sided decreased earth pressure

In areas where special loads are to be expected, additional loads (e.g. inundations, land slides or earthquakes) must be considered.

Furthermore, components of primary security must be protected against mechanical damage to a necessary extent.

To protect components against endangerments by traffic they are to be set up outside of streets or be protected by bumpers or buffers.

Moreover, leaking water-endangering materials have to be recognized fast and reliably and have to be retained. Therefore the retaining will be done in suitable construction.

The retaining function must be guaranteed by its material composition and the operational controls and measures of the retention device. Materials, which can interact in a manner that the retaining function is affected, must be collected separately.

Retention devices have to be constructed in a way that in case of losses leaking water-endangering materials are surely captured within the device. The design is to be specified individually as a function of the operational conditions.

Retention devices have to be spatially assigned to the associated installation.

Drainages to remove precipitation, cleaning and fire fighting waters in retention devices must be locked. They may be opened according to the wastewater technical regulations.

The retention capacity is sufficient, if the retention device is dimensioned to hold the withdrawing quantity of water-endangering materials of a developing leakage up to its removal. According to the German legal regulations either the retention capacity has to be large enough to capture all contaminated water from the first leakage up to the moment where suitable safety precautions are taking effect (R 1) or a retention capacity, without counter measures is considered (R2). For a stock of barrels or tanks the necessary retention capacity is determined as follows:

If retention of liquid volumes is considered without countermeasures (R2), the volume of the largest fixed unit resource has to taken as basis.

R2 of aboveground tanks with one stationary tank corresponds to the volume of this tank, in case of several tanks to that of the largest tank. Interconnected tanks are considered as one tank.

If a retention device serves several installations, the necessary retention capacity (R 1 and/or R2) is to be determined for each installation. The volume of the retention device must correspond to the largest of the individual retention capacities.

If the retention devices are not covered, an additional retention volume for precipitation water is to be included beside the retention capacity R. If it is guaranteed that the

precipitation water is eliminated within 72 hours, 50 l per m² is usually sufficient. The surfaces draining to the catching area are to be taken into consideration.

Retention devices with coated concrete have to prove that fractures in the underground remain so small that they can be bridged by the coating system. If the underground consists of cleaned brick-work, the underground is to be lined e.g. with plastic liners.

Components of primary security must be protected against mechanical damage to a necessary extent. To protect components against endangerments by traffic they are to be set up outside of traffic routes or be protected by bumpers or buffers so that they would not be affected in case of accidents.

If double-layered tanks and pipes with an alarm device for leaks are used, a retention device is not necessary.

We mention that double-layered tanks are tanks, which are provided with a second layer reaching up at least to the highest permissible charging level. Single-layered tanks, which are provided with a leakage protection lining at least to the highest permissible charging level, are considered equal to double-layered tanks. Below the permissible charging level the tanks may not have connecting pipes or passage affecting the double-layered properties.

The gap between outer and inner layer or outside wall and insert of the leakage protection lining must be suitable for monitoring and have to be arranged in a manner that the passage of the leakage indicator medium is ensured and granted. The supervision room has to be equipped with 2 connections to supervise.

Pipes
Double-layered pipes are pipes, which have a second layer covering the entire tubing extent. The pipes should not have any connecting pipes or passages affecting the double-layer properties.

Distances
Single-layered tanks, pipes and other components must have a defined distance from walls, other construction units and amongst themselves that leakages can be recognized and condition control of the retention devices is possible at any time.

Concerning tanks the following requirements are to be fulfilled:

a. The distance between the wall of the tank and the wall of the catching area must be at least 40 cm. For maintenance and operation reasons larger distances can be deemed necessary.

b. The distance between tank bottom and retention device must be one fiftieth of the diameter of a cylindrical tank or one fiftieth of the smallest edge length of the soil of a square tank, or least 10 cm.

(3) Smaller distances are allowed, if the retention device within the not observable area is supervised by a leakage recognition system detecting possibly leaking substances or shows a sufficient downward gradient to the observable side, so that possibly leaking substances can be recognized immediately.

(4) Flat bottom tanks made of metallic materials have to follow the regulation TRwS 133 "flat bottom tanks for the storage of water-endangering liquids". For flat bottom tanks made of plastic the above mentioned distance between tank bottom

and retention device can be neglected, if the plastic tanks are installed on a foundation with additional closing and glide layer (one-piece plastic board out e.g. polyethylene, minimum thickness 2 mm).

(5) The distances for plastic tanks installed in plastic traps may be reduced to at least 10 cm between tanks and trap, if the following conditions are kept:

a. The height of the trap must reach at least the maximum level in the tank, decreased by the distance between tanks and trap within the upper range.

b. The area between tank and trap must be controlled by a suitable leakage probe, which releases an optic and acoustic alarm if the liquid level rises to 5 cm from the bottom of the trap.

c. It is to be guaranteed by structural measures that leaking substances pass at the leakage probe.

d. The leakage probe must be operated in permanent alert stand-by.

The minimum distance of 10 cm and the leakage probe can be omitted if the traps are translucent. The leakage probe is not necessary, if at one side a minimum distance of 40 cm between the trap and the walls of the room or other construction units exists.

(6) A distance to the walls of the catching area of 40 cm for two bordering plastic tanks. The plastic tanks used for fuel oil or diesel have a volume of up to 10,000 liters each in closed areas and/or a total volume of 25,000 liters with tank systems. The distance between the remaining sides and among themselves must be at least 5 cm. A special distance to the soil must not be considered. Tank systems with a volume of more than 10,000 l must be installed within a catching area resembling "cups" with an edge height of at least 2 cm.

(7) Movable tanks with a volume up to 1,000 L may be set up without special distances, if the retention device is sufficiently controllable by inspection.

Safety devices

Leakage monitoring devices must be suitable to indicate leakages in both walls automatically (from walls from tanks/containers to permissible level of liquid).

Leakage monitoring devices for the exclusive monitoring of flat resting tank bottoms need to indicate only leakages of both walls of the double bottom. Leakage protection linings (inserts adapted to the form of the tank) must be suitable for the production of a leakage monitoring area of single layered tanks.

Leakage monitoring devices are suitable, if they correspond to the permission principles for leakage monitoring devices of the DIBt.

Leakage monitoring devices consist of all components necessary for the leakage identification at containers and pipes, leakage protection linings, leakage indicators and if necessary leakage indicator media, like the monitoring areas of double layered systems.

If the facility is installed bellow surface, water-endangering substances /materials may not be used as leakage indicator medium as well as negative pressure systems for the leakage announcement. If the installation is aboveground also materials of the water

endangering class 1 are permitted as leakage indicator medium given a volume of the facility of up to 1000 liters.

Leakage recognition systems

Leakage recognition systems must recognize all water-endangering materials / substances possibly leaking out in its area. It should release an optical and/or acoustical alarm if the liquid height arises 5 cm from the low point of the soil below the retention device.

Overflow safety devices

Overflow safety devices are suitable, if they correspond to the permission principles for safety devices of containers and pipes of the DIBt.

Tapping valves

Tapping valves are suitable, if they comply with the necessary building code.

Protection against overflow

It has to be assured by suitable measures that pipe connections above the permissible level of liquid of the tank, over which the tank is normally operated, are not emptied by an unintentional overflow of the tank. This does not apply, if a sufficiently large retention device is available

Protective pipes

The specifications made in sections 6.5 apply to the protective pipes.

Enclosures

Enclosures must be liquid-impermeable as well as easily accessible and easy to handle for the intended lifetime of the installation.

Relief valves, breaker plate

Relief valves and breaker plates are to be installed in such a way or provided with additional devices that inevitably leaking liquids can be caught without losses.

6.8 Car and Equipment Washing Facilities

Car and equipment washing and cleaning should be carried out in roofed washing facilities or washing cubicles. Cleaning of open chassis, not encased engines, gear boxes and hydraulic equipment e.g. like dumper, excavators, communal machines,

agricultural and forestry equipment result in heavy polluted wash water as compared to closed chassis like passenger cars, buses etc.

Wash water form open chassis cleaning must undergo special treatment before it can be discharged into the public sewers.

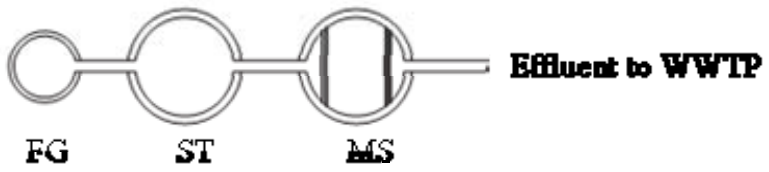
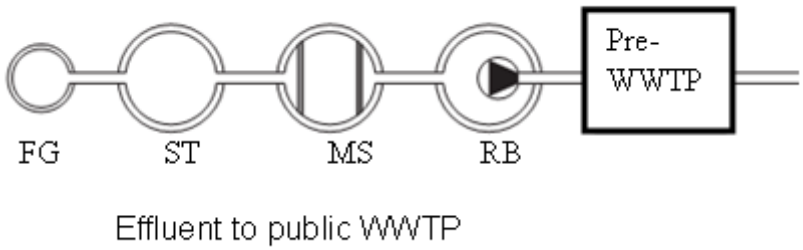
Henceforth it is in the interest of the washing facilities operator to decide which kind of cleaning are to be carried out in his establishment.

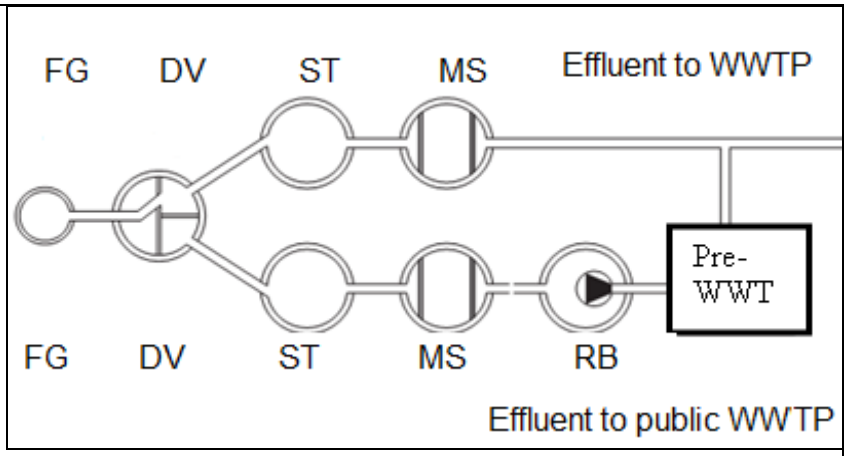
The use of high pressure to clean the chassis is an effective and water saving method.

For greater numbers of cars and washing and cleaning of equipment it is worthwhile to consider the installation of wash water recycling in order to save water. Such recirculation facilities can also be fed with rainwater.

This factor will become important with the introduction of a wastewater tariff based on water consumption by WEBML.

Table 8: Wastewater Pretreatment Plants for Car Washing Facilities (Category A Stations)

Variant 1: Closed chassis cleaning of: • Passenger cars • Utility/ commercial vehicles • Wheels, rims etc. Without the use of washing detergents and maximal water pressure 10 bars	
Variant 2: Cleaning of car and vehicles: • Engine / open chassis • Wheels, rims etc. With the use of washing detergents Cleaning of wheels and rims with acid washing detergent.	 **Not recommended** since the produced wastewater must be disposed as hazardous waste, if no wastewater treatment is available. Such wastewater must be treated at the spot e.g. by neutralizing the pH to a value between 6.5 and 9.0.

Variant 3 combination of Variant 1 + 2	 It is probably more economical building two different car wash cubicles for the different washing requirements and its indivdual treatment facilities than buiding the above illustrated solution. Furthermore the above installation requires that the wastewater is directed to the specific treatment in the switch-over chamber, which requiries skilled staff. Pretreated wastewater can be used again for washing purpose (re-circulation) Besides chemical wastewater pretreatment systems there are also biological wastewater pretreatment plants available.
Variant 4: Closed chassis cleaning of: Passenger cars Utility / commercial vehicles Wheels, rims etc. Without the use of washing detergents and high water pressure	
Cleaning of construction plants, lorries etc.	When cleaning plants and equipment used on construction sites great quantities of sludge are generated. The cleaning process should be carried out following two steps: **Step 1:** Washing and removing of all soil / earth material, but not washing engines, hydraulic, gearboxes etc. if they are dirty from oil spills. For this kind of cleaning floor gully and mud / silt traps of usual dimension will no more be approprate. It is recommended to build a sludge pit of appropriate dimension e.g. to be emptied by an excavator. **Step 2:** Chassis cleaning at special assigned places according to the posssibilities descriebed above.
Cleaning of Workshops, Garage floors etc.	Cleaning water must be disposed through a wastewater pretreatment plant. If this is not available it is recommended to clean the areas with dry materials e.g. saw dust and dispos it via the normal garbage collection system.

Abreviations used in this table:

WWTP	Wastewater Treatment Plant	ST	Mud and silt trap without submerged outlet
Pre-WWTP	Wastewater Pretreatment		

	Plant, mostly ultrafiltration, cracking plants, biological treatemt	STS	Mud and silt trap with submerged outlet (keeping flooting material back)
FG	Floor Gully	SB	Silt retention basin
CS	Coalescence separator	RB	Retention basin
MS	Mineral oil seperator	DV	Divertion valve (re-direction of flow)

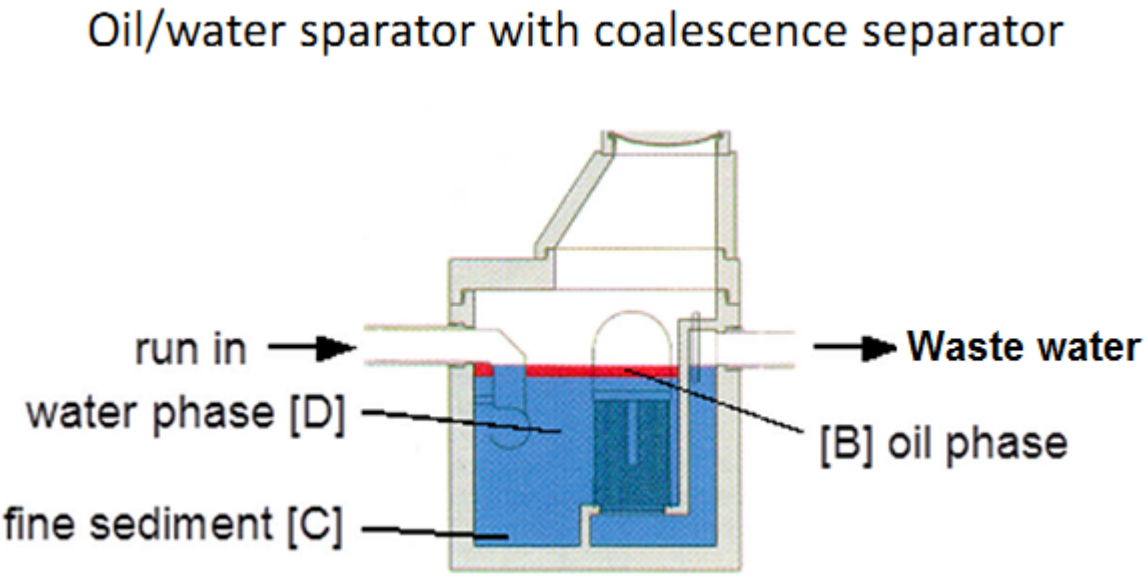


Figure 27: Coalescence separator

7 Actual Situation: Compliance to Lebanese Regulations and to International Guidelines

Lebanon relies on petroleum products as major source of energy. Green cars are not yet spread in the country and diesel is largely used for heating in residential buildings and as fuel for trucks. Power plants, like the Zouk Mkayel power plant run on heavy fuel oil.

Diesel is used in transport, industry, heating, and mainly in thousands of private generators, complementary to the very limited electricity produced by EDL which continuously experiences failures and shortages.

The quality of the diesel imported to Lebanon is very low. Additionally, there is no enforcement of a regular maintenance for vehicles using diesel fuel. This increases the emissions and pollution caused by those vehicles. For heating purposes, diesel is burned in primitive units that do not have any sort of emissions treatment. The case is similar for the generators providing industry and households with electricity. (GREEN LINE ASSOCIATION, 2007).

Furthermore, homes store heating oil in underground tanks or in basement tanks. Underground tanks tend to cause groundwater contamination because small leaks often go undetected.

The latter don't follow any type of control by any governmental institution.

In addition to the huge reservoirs related to the use of the electricity generators and those of the ready cement confectioning factories spread in Jeita catchment, these reservoirs might be considered as presenting a high contamination risk especially that they are free of any type of control.

However, these hazard risks will be detailed in separate reports. Only gas stations hazards risks are discussed in the present study. In this framework, the assessment of the gas stations operating in Jeita catchment is summarized as follows and in Tables 8 and 9.

According to EU regulations, in such vulnerable conditions (highly karstified geological context rich in water resources within absence of majopr protective cover) as those existing in the Jeita spring groundwater catchment, an environmental impact assessment is to be implemented before installing the station. However, this assessment is until now absent in Lebanon, and is not even requested by the ruling regulations.

Decree 5509 (Annex 5) states that the tank must have a protective coating. As a minimum requirement, the tank shall be made of 4 mm steel painted with a primer, and then coated with epoxy, coal tar epoxy or similar bituminous coating. However, in Lebanon in general and in particular in old stations of Jeita catchment, old steel tanks (more than 20 years old and sometimes even older than 40 years) without protection are very common, and are generally believed to present the greatest risk for developing leaks, due to a fatal lack of environmental awareness of the station operators.

Certification of the tanks maintenance is practically absent. Gas stations operators in the Jeita catchment never clean their UST and never apply any maintenance to these storage facilities.

However, when leakage is detected (which might occur even weeks after it starts, at least two weeks would be needed to be able to replace it). There are no means to pump the leaked fuel into a retention bassin so that leaking fuel will probably quickly reach the groundwater considering the karstic nature of the area.

Moreover, at the UST installation level, the certification required by Decree 5509 is not carried out on site or following inspection of the tank and its installation procedure.

The field assessment showed that in contradiction with the ministerial resolution dated April 1 2008, the certification institutions are not carrying out any site inspections. Their certification is only based on a pressure test carried out at the manufacturing workshop. This fact disregards the possible risk of damage during the transportation, installation and of the improper preparation of the drilling walls and bottom that might not compile with the regulations and the requirements for a proper maintenance of the UST.

In addition it was observed that environmentlly sound practices are not applied. Numerous pollution risks arising from the operational practice at gas stations were identified: spills (Figures 28 and 29), fuel overfills and water intrusion (Figure 30), and the disposal of the wastes and carwash water directly in the nature, or in better conditions, without any previous treatment, inside leaking cesspits.

Figure 28: Spills while filling underground fuel tanks

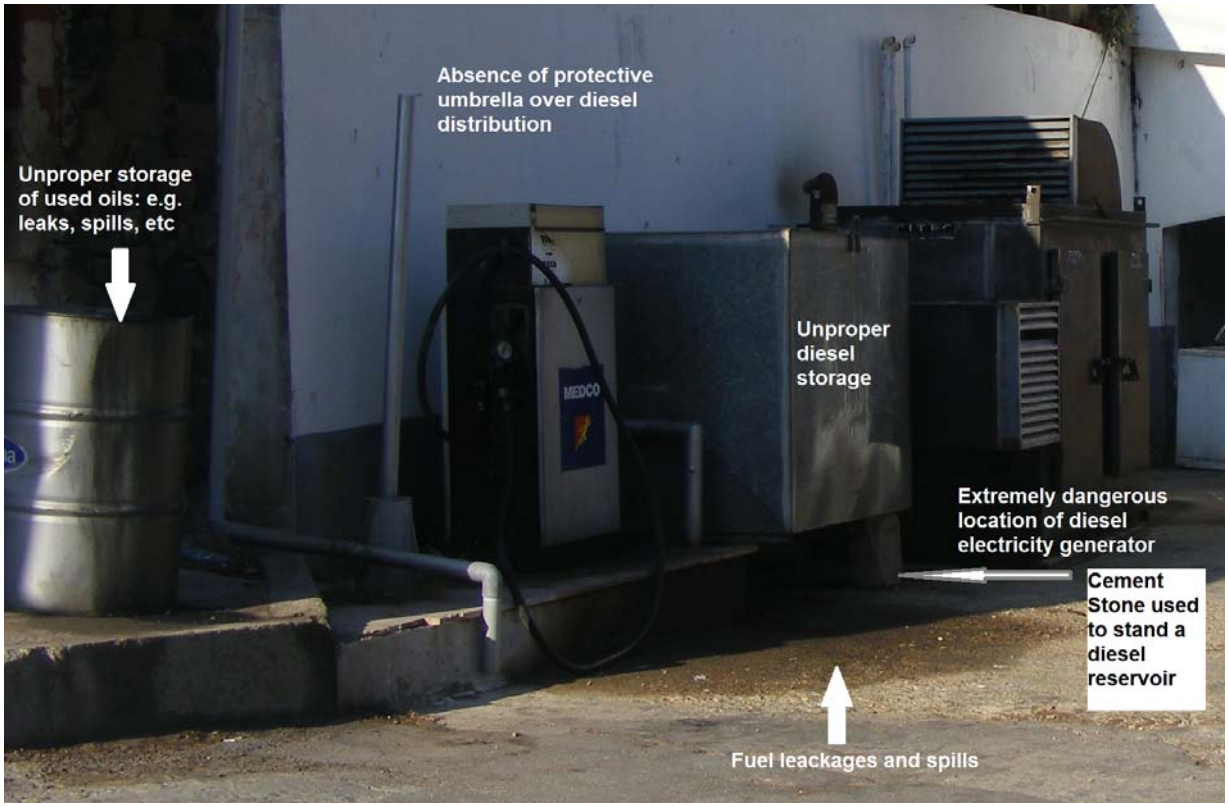


Figure 29: Frequently detected spills and major issues at gas stations

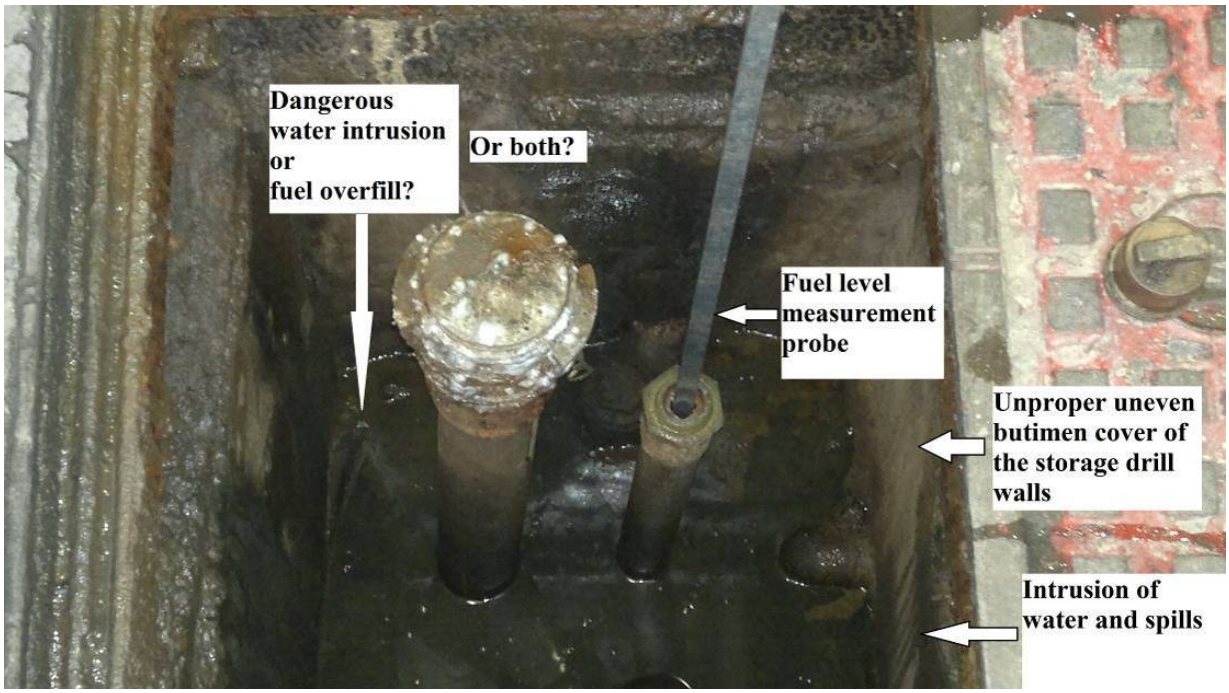


Figure 30: Common situation: water and fuel spills intrusion to the fuel storage tanks drills, improper anti leakage treatment of the drill walls, overfill of the fuel storage tank.

Until now, unfortunately the Lebanese government is unable to control the gas stations' sector. The unsound operational practices detected during our risk assessment may have severe consequences on the environment, and specifically on groundwater resources.

This is due to several reasons of which we mention, following the findings of our field assessment:

- lack of technical staff able to follow to the high number of gas stations densely spread everywhere in the country (without any respect to protection areas, etc),
- lack of ability to enforce the acted environmental regulations for political considerations,
- lack of incentives at the level of the available assigned staff,
- lack of some specific environmental management sound consideration in the ruling regulations, etc)
- overlapping responsibilities between several governmental institutions,

8 Requirements from the Perspective of Water Resources Protection

8.1 Surface water

Table 9 displays the environmental hazards that can impact on surface and groundwater from operational practices at gas stations. Furthermore, it shows the corresponding best practice for managing each of the potential hazard cause and the related practices actually observed during the gas stations assessment implemented in the framework of the present study.

Table 9: Main environmental hazards that can impact on surface and groundwater from operational practices at gas stations (layout modified after EPA VICTORIA, 2003; results of the field assessment in the Jeita groundwater catchment)

Environmental Hazard	Potential pollution risks	Best practice for mitigating potential pollution risks	Practices Observed in Jeita Catchment
Surface water contaminated by petroleum products		UST design incorporating overfills protection.	**Best** practice was demonstrated at 1 of 15 assessed sites. **Poor:** USTs without overfill protection 13 of 15 assessed sites.
		Fill point spill containment of 15 liters per fill point.	**Poor:** Fill points not surrounded by spill containment observed in all sites which use dispose only of a bucket which is completely inefficient as spill containment
		Clearly marked emergency stop buttons in console areas.	**Poor:** No emergency stop button in console area or the interviewed site staff was not aware of its location in all the surveyed sites.
	Spills during vehicle filling	Spill kits containing absorbent pillows, booms and granules easily accessible to site staff.	**Poor:** Spill kit unavailable or site staff unaware of its location at all the surveyed sites. What they have is only some limited amount of sand, that they use to avoid cars slipping in case of major spills
		Vehicle filling area graded to drain to spill containment device.	**Poor:** Drains directly to storm water or to what is called separators in best cases while these separators are not regularly cleaned and maintained, when they are, the resulting waste is disposed in the nature or in the municipal wastes which induces a high contamination risk .
		Non-latching triggers on bowser hose nozzles.	**Best** practice was demonstrated at all the 15 assessed sites. No Latching triggers on diesel hoses were found only in one of the assessed sites.
	Spills during vehicle filling (continued)	Diesel drips cleaned regularly enough to prevent movement to stormwater system.	**Poor:** Diesel drips allowed to accumulate and to wash into stormwater system or even sometimes directly to the nature at all the assessed sites.
		Canopy covering entire vehicle filling area, including area that hoses extend to.	**Best** practice was demonstrated at some sites (6 out of 15 assessed). **Basic**: Canopy covers bowsers but not the area that hoses extend to was detected in 7 of the 15 the assessed sites. **Poor:** Canopy does not cover all bowsers found at two assessed stations.

Environmental Hazard	Potential pollution risks	Best practice for mitigating potential pollution risks	Practices Observed in Jeita Catchment
Surface water contaminated by petroleum products	Inadequate surface water management	Line drains or change of surface gradient divert clean stormwater away from vehicle filling area.	**Best** practice was demonstrated at all the 15 surveyed sites.
		Grated drains inspected and cleaned regularly to maintain clear of litter, soil and debris.	**Best** practice was demonstrated at only 4 of the 15 surveyed sites. **Basic**: Cleaned when the need noticed observed in 8 of the 15 surveyed stations. **Poor:** Litter, soil and debris allowed to build up in drains noticed in 3 of the 15 surveyed gas stations.
	Spill due to collision with bowser	Vehicle collision protection that prevents impact with bowsers.	**Best** practice, being protection of bowser sides as well as ends, were found in 3 of 15 assessed sites. **Basic:** Bowsers protected at ends noticed at 11 of the 15 assessed sites. **Poor:** Bowsers not protected. (observed only in 1 of the 15 assessed sites).

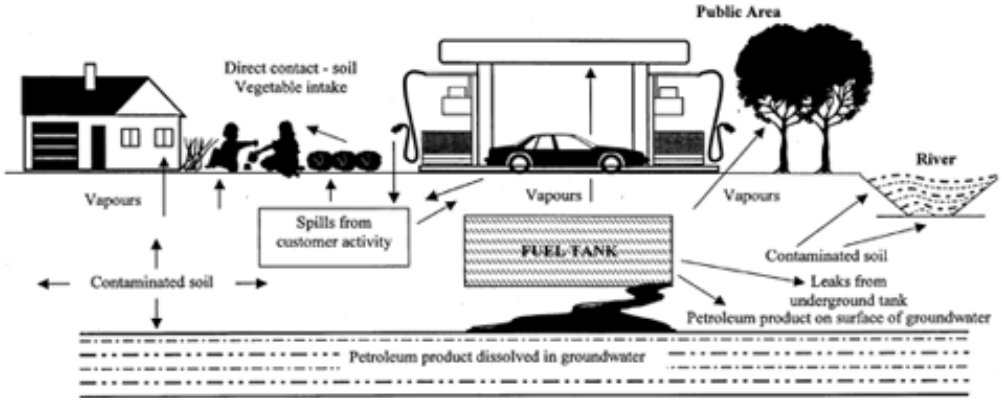


Figure 31: Contamination of groundwater and surface water due to gas station hazards (EBRD 2009).

Table 10: List of main environmental hazards that can impact on surface and groundwater from operational practices at ga stations (EPA VICTORIA, 2003 and results of the field assessment at Jeita groundwater catchment)

Environmental Hazard	Potential pollution risks	Best practice for mitigating potential pollution risks	Practices Observed in Jeita Catchment
Soil and groundwater contaminated by petroleum products	UPSS constructed of materials having potential to develop leaks (single layered tanks)	Double skinned fiberglass underground storage tanks with flexible lines that have joins only at the tank and the bowsers and have sumps beneath the joins.	**Basic:** Steel prevented from corroding by cathodic protection that is regularly checked. **Poor:** Steel without cathodic protection or with cathodic protection that was not regularly checked. Actually in none of the 15 surveyed stations have implemented a regular pressure test of the UPSS. They all have single layered steel storage tanks some of them (4 out of 15.have UST aged of more that 50 years.
	UPSS lacking design elements for minimizing potential to develop leaks	Bowsers operated by pressure pumps.	**Basic:** Suction pumps regularly inspected for leaks especially at the stations directly managed by importing companies such as Total, Medco, United, etc. **Poor:** Suction pumps without sumps or with sumps that were not regularly inspected spread in the stations that are not supplied by a specific fuel company.
	Inadequate leak detection equipment or systems	System that detects a release of 0.76L/hour (18L/day) with greater than 95% confidence and less than 5% chance of a false positive (USEPA standard).	**Acceptable** practice was demonstrated at few sites (3 of 15) (mainly those directly managed by Importing fuel companies namely MEDCO), being: (1) Statistical inventory analysis that meets European standards; and (2) Automatic tank Gauge with continuous statistical leak detection combined with interstitial monitoring and ground monitoring wells. **Basic:** Inventory control computed daily and analyzed for trends over a month or several months Carried out by 9 of the 15 surveyed sites. **Poor:** Inventory control analyzed only monthly. Even, in some of the inspected sites, this control is not done at all due to wrong concepts such as s that state that regular measurement of the actual available volume in a UPSS can induce leakage.
Air pollution by petroleum vapors	Vapor emissions during fuel transfer	Stage 1 vapor return system (VRS) used during all deliveries, i.e., vapors displaced from underground storage tank returned to tanker.	**Poor:** Stage 1 VRS not available.

Environmental Hazard	Potential pollution risks	Best practice for mitigating potential pollution risks	Practices Observed in Jeita Catchment
		Stage 2 VRS, , i.e., vapors displaced from vehicle fuel tank returned to underground storage tank, fitted to bowsers.	Stage 2 VRS was not available at any of the premises inspected.
Land or water pollution by waste	Inappropriate and/or illegal disposal of wastes.	Used contents of spill kits disposed of to appropriately licensed sites in accordance with EPA transport certificate system and the required paperwork maintained.	**Acceptable** practice was demonstrated at the sites owned and managed by fuel importing companies as they collect the plastic containers and the used oils. However, even in these stations, some wastes contaminated by petroleum products are disposed at the municipal wastes (3 of 15) **Poor:** Disposal as general garbage of oil empty containers
Land, groundwater or surface water pollution by petroleum products or waste	Lack of understanding of environmental risks and environmental risk management	Membership of one or more appropriate industry group.	**Basic:** Regular communication with member of appropriate industry group only noticed at the stations directly managed by fuel importing companies. **Poor:** No way of obtaining information updates regarding retail petroleum industry at the level of individuals managing their own gas stations.
	Incompetence of staff delegated responsibility for managing environmental risks	Formal training program and documented procedures for activities with potential for environmental impact.	**Poor:** Insubstantial or verbal training of the staff managing all the 15 assessed stations. While a high environmental management capacity was assessed at the level of the importing companies headquarters.

9 Recommendations

9.1 Recommendations for Existing Gas Stations

The survey of local practices at existing gas stations revealed major deficits concerning the following points:

Fuel unloading

- inappropriate transfer from fuel tanker to UST
- missing UST gauging devices

Fuel storage

- inappropriate material (leading to corrosion) and testing of tightness of USTs
- lacking containment basins and leakage protection for USTs
- installation of inappropriate leakage detection systems in USTs (no double-layer tanks)
- lack of inventory monitoring

Fuel distribution

- Lack of fuel spills prevention means and practice knowledge.

Car Wash

- no collection of car wash water and treatment

Car Service

- inappropriate collection, storage and disposal of waste oil

Because most tanks used in Lebanon are composed of bare steel, tank corrosion or piping problems will cause leaks sooner or later. If the tank is more than 20 years old, a prompt effort is needed to determine whether leaks exist.

The tank integrity can be tested through such methods as precision testing/tightness testing, pressure testing and volumetric analysis.

Moreover, even when a tank has been tested and proven tight, existing regulations and good practice require that gas station managers follow specific methods for regular monitoring and detection of leaks.

It is recommended to install such internal or external monitoring methods as groundwater monitoring wells, vapor monitoring, automatic tank gauging or other approved methods.

Measuring tank inventories is an inexpensive and easy way to help detect leaks. Leaks exist when there is any decrease in level over time without any withdrawal of fuel, or if there is an increase in water in the tank. Although inventory measurement will not detect small leaks, it will provide a warning that further investigation may be necessary.

A common misconception encountered in the Jeita catchment is that when using a measuring stick to measure the tank content, this might puncture or damage the bottom of the tank.

Environmental improvements can be reached by applying the following (DEFRA, 2007):

- Provide secondary containment for storage tanks, such as double skinned tanks, vaults or membranes;
- Install leak detection systems on tanks and pipework;
- Install devices to prevent spills and overfills, e.g. alarms to warn of overfilling and automatic shut-off devices;
- Consider the use of corrosion protection in steel tanks and piping such as coating with suitable material;
- Implement procedures to compare fuel deliveries with fuel sales to check for product loss (already existing in some operating stations)
- Consider installation and use of groundwater monitoring points on site to check for contamination;
- Replace any bare soil or broken hardstanding in the vicinity of the fuel unloading and dispensing points with unbroken hardstanding engineered to withstand the weight of heavy vehicles;
- Separate clean and potentially contaminated drainage, the latter should be passed through oil/water separators known as oil/water separators prior to discharge;
- Ensure that the hardstanding directs all rainwater falling on it to drains fitted with oil/water separators;
- Ensure oil/water separators are properly designed, operated and maintained in order to achieve the required level of water treatment;
- Ensure that wastewater from oil/water separators is discharged to the foul sewer system for further treatment at a municipal wastewater treatment works;
- Install roofs or covers to reduce rainwater falling on potentially contaminated hardstanding;
- Ensure interceptors are regularly inspected, cleaned and maintained;
- Implement robust procedures to control storage tank filling;
- Consider automation to switch off pumps when the tank is full;
- Ensure untreated wastewater from a carwash is not discharged to watercourses;
- Prevent carwash wastewater from discharging via oil/water separators because the detergents present would inhibit their operation;
- Recycle carwash water to reduce volumes used and discharged;
- Install silt traps prior to discharge of wastewater. Ensure these are regularly cleaned;
- Implement procedures to ensure that any residual fuel is removed from tanks and connecting pipework prior to their upgrade or removal.
- Restrict access to working in confined spaces through a permit to work system.
- Install protective measures to shield tanks, pumps and staff from damage from vehicles or fire such as barriers or walls around tanks and pumps;
- Provide emergency equipment, e.g. fire suppression equipment, spill kits and review placement of equipment. Train staff in the correct use of this equipment;
- Train staff in health and safety precautions and procedures;
- Improve signage to customers and visitors regarding prohibited activities, i.e. use of mobile phones, smoking ban, engines to be switched off;

- Prepare emergency contingency plans for spills and fires. These should include immediate action and automated alert of emergency services. Provide regular training and practice in their use;
- Consider painting ASTs with white or light colored paints to reduce heat absorption and reduce risk of VOC emissions;
- Consider use of VOC emissions controls at unloading point,
- Consider use of VOC emissions controls at vehicle filling points,
- Provide proper grounding for tanks to avoid static electricity and thus facilitate corrosion.
- Tanks no longer in service must also be handled properly. If a tank is to be disposed of, perforate it in a number of places to rid it of flammable vapors and to make it unfit for further use (Michigan State University (1992).

The main risks to the community arise from spills, fires and explosions. Well run facilities pose little risk but an emergency response plan should be prepared that considers the role of communities and community infrastructure in the case of an incident.

9.2 For new Gas Stations

Site selection criteria must be introduced for gas stations because severe risks can emanate from damages to such structures caused by accidents, intentional damage and geohazards.

An environmental impact assessment of the site, including a geotechnical study and a hydrogeological and hydrological study, must be carried out before permission of the installation of a new gas station is granted. This evaluation must include mainly three parts:

1. general criteria, such as topography and buffer distances from critical places and
2. geoscientific criteria related to geohazards (risk of impact by flooding, landslides, earthquakes, tectonic movements, land subsidence, soil stability)
3. geoscientific criteria related to impact on water resources

9.3 For the Control of the proper Application of the Regulations and Guidelines

A clear description of tasks and responsibilities of each involved governmental institution is required to overcome the existing overlap.

It must be ensured that a well trained staff is able to cover by means and number all the Lebanese territory for enforcement of the regulations. Proper capacity building needs to be provided to the currently available staff dealing with this sector.

It is recognized that there is a clear need to carry out regular environmental awareness raising campaigns at all levels, at the decision making level, the managerial level, the operational level and the control level. In order to be successful it will be important to involve the importing companies in the awareness campaign and collaborate with them for spreading sound environmental management practices.

If granted the possibility to have well trained staff; municipalities would be extremely efficient in controlling the waste disposal of the gas stations and their operation practices. In the long-term, however, an environmental police force should be established that would be able to enforce compliance with regulations in this sector. A similar effort was made in Jordan in 2006 with the formation of the Environmental Rangers, which are a large enough police task force, have received a sufficient level of training and equipment, supported by foreign assistance and are, as being part of the Ministry of Interior, able to carry out environmental policing tasks.

At present some municipalities staff show a dramatic lack of environmental awareness and are in some cases involved in the environment contamination by facilitating or even practicing hazardous waste disposals.

It is worthwhile mentioning that a decree related to the creation of an environmental control entity is currently under preparation by the Lebanese Ministry of Environment.

10 Conclusions

It is necessary to recognize and identify gas stations as a potential source of environmental contamination for the management of hazardous substances from the environment and public safety points of view for a better environmental and water quality. The number of gas stations in the Jeita Spring catchment is relatively high, the majority of which operating from more than 15 years, located in soils that present a potential risk of underground water contamination; a large Karstic area that facilitates the infiltration of pollutants to ground waters; a high concentration of gas stations in areas with a mean and relatively low population density, some of which presenting potential risks to the users of public areas such as schools, restaurants and hospitals.

Although the results presented in this paper cannot be considered important for the prevention of fuel leaking into the soil and water, they are significant to evaluate the potential risks related to gas stations in the Jeita Spring catchment. They revealed the urgency of both establishing public policies designed to the environmental planning, and of improving rules and laws related to the control and prevention of leakage and dispersion in fuel underground storage tanks. Attention should be devoted to reinforce public policies and research agencies regarding gas stations, as well as the need of bringing to the community knowledge of the environmental problems and risks that gas stations may pose.

However, for a precise environmental diagnosis of the gas stations potential risks of the jeita catchment, it is necessary to conduct an environmental audit for each station to assess the existence of leakage in underground fuel tanks. In this subject, BGR project Protection of Jeita Spring has foreseen an assessment of a possible existence of MTBE contamination in Jeita Spring Waters.

The gas stations impact assessment proved that severe pollution risks may arise from either underground storage of hydrocarbons or from associated activities such as transportation, delivery and fuel dispensing. The aim of environmental regulations and

guidelines related to gas stations is to prevent pollution of water sources. However, the Lebanese enacted regulations show overlapping responsibilities, a clear lack for concerted efforts, and a lack of capacity and funds. Important aspects which could strongly improve the environmental situation related to fuel products and lead to an improved protection of water resources are:

- clear criteria for the establishment of gas stations (based on topography, buffer distances, geological underground and geohazards, vulnerability of groundwater and surface water resources);
- a straight permitting process, which would chiefly look at avoidance of environmental risks and would not leave any loopholes that could be breached by Wasda, as currently is the case;
- improved regulations for storage, handling and dispensing (introducing leakage detection systems);
- improved drainage collection (e.g. of water from car wash), waste oil collection and separator systems;
- a proper collection and disposal system for waste oil products;
- a working monitoring and control mechanism that would lead to a true enforcement of the required protective systems and
- a reliable impact monitoring concerning water resources used for drinking purposes or irrigation at the level of the Water Establihsments.

Due to the fact that not all issues related to this sector are in the same hand, and that there is an overwealming lack of enforcement and control, it was observed in this study that in reality most of the existing regulations are not applied by service stations operators.

This total absence of control places the water resources of Jeita spring, used for drinking water supply of the Greater Beirut Area and thus the population being served by it at a severe risk. For many years to come Beirut will depend on this important water resource. As investigations into the vulnerability of the groundwater resources have shown, the intensive karstification of the aquifer leads to a very fast transfer of pollution over large distances (MARGANE et al., in progr.). The open karst together with the negligible retention and attenuation of contaminants in a very thin soil layer facilitate infiltration into this aquifer from almost any point in the groundwater catchment so that pollution by petroleum product could become difficult to clean up.

The ruling regulations foresee fines and criminal responsibilities of any person inducing contamination, but they are not applied and polluters are not pursued.

The release of petroleum hydrocarbons also poses a risk of fire or explosion, and if hydrocarbons are allowed to come into contact with water pipes, they could also directly contaminate drinking water supplies.

The field surveys also showed that there is an urgent need to train gas stations managers and operators concerning environmentally sound practices. More efforts should be undertaken by the fuel providers to assist the station managers in this process.

The present assessment concludes that in spite of the important improvement in the regulations related to gas stations made in recent years, Lebanon is far from reaching proper environmentally sound management in this sector in comparison to international standards.

As in many other sectors, the institutional set-up in Lebanon needs reforms to surpass overlapping responsibilities, inefficient coordination among government agencies, and insufficient means of action for policy implementation. The Lebanese Government has carried out a number of institutional and legal steps to improve the institutional setup, whilst enforcement remains the major challenge of the environmental control system. Sufficient resources need to be made availabe and skills be developed in the environmental sector.

11 References

ABDULRAZZAK M. & KOBEISSI L. (2010): UNDP-ESCWA Initiative on National Policy Framework for Water Resources Management in Lebanon, 23 p.; Beirut.

AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY (ATSDR). (1995). Toxicological profile for fuel oils.: U.S. Department of Health and Human Services, Public Health Service- Atlanta, GA United States

AHLBAECK J. (2011): UNV Green Jobs UNDP and ILO, Green Jobs Assessment in Lebanon- Preliminary assessment Waste Management – 41 p.

AVSI (2009): The Study of Nahr el Kalb – Results. – Final Project Report, 148 p.; Beirut.

BECK, L. S., HEPLER, D. I. & HANSEN, K. L. (1984): The Acute Toxicity of Selected Hydrocarbons. – In: Applied Toxicology of Petroleum Hydrocarbons. Volume VI. Ed. H.N. MacFarland, C.E. Holdsworth, J.A. Macgregor, R.W. Call And M.L. Kane. Princeton Scientific Publishers.

BRUEL C. J. & HOAG, G. E. (1984): Capillary and Packed – Column Gas Chromatography of Gasoline Hydrocarbons and EDB. Conference and Exposition on Petroleum Hydrocarbons and Organic Chemicals in Ground Water- Prevention, Detection and Restoration. National Water Well Association, pp. 5-7; Brazil.

BGR (2007): Gas Station Design Standards in Germany. - Jordanian–German Technical Cooperation Project Groundwater Resources Management, Advisory Document, 8 p.; Amman.

CHERRY A. J. (1987): Groundwater Contamination by Petroleum Products, Institute for Groundwater Research, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada- 12th World Petroleum Congress, April 26 - May 1, 1987, 10 p.; Houston, USA.

HEALTH PROTECTION AGENCY (2006): COMPENDIUM OF CHEMICAL HAZARDS: DIESEL. PREPARED BY: CHILCOTT P. R CHEMICAL HAZARDS AND POISONS DIVISION (HQ), CHILTON, DIDCOT, OXFORDSHIRE, OX11 0RQ, UNITED KINGDOM. WWW.HPA.ORG.UK

CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION (2005): Pit Stops Fact Sheets: Environmental Regulations and Pollution Prevention Opportunitiesfor the Vehicle Service Industry- [http://www.dep.state.ct.us/wst/p2/vehicle/abindex- May 2004/Revised July 2005, 73p; Connecticut, USA]

DEFRA (2002): Groundwater Protection Code: Petrol stations and other fuel dispensing facilities involving underground storage tanks, Department for Environment, Food and Rural Affairs., Crown copyright, November 2002, 56 p., London, United Kingdom.

EUROPEAN BANK FOR RECONSTRUCTION AND DEVELOPMENT ((EBRD) (2009): Sub-sectoral Environmental and Social Guidelines. - Petrol/Gasoline Retailing, 41p.

ENVIRONMENT AGENCY FOR ENGLAND AND WALES, THE NORTHERN IRELAND ENVIRONMENT AGENCY AND THE SCOTTISH ENVIRONMENT PROTECTION AGENCY (2011): Pollution Prevention Guidelines: The safe operation of refueling facilities. - PPG 7-July 2011, 30 p.; United Kingdom.

EPA VICTORIA (2003): Environmental Audit- Environmental Risk Management at Retail Fuel Outlets. - Publication 903, 38 p., Victoria- Australia [ISBN 0 7306 7632 3].

GITEC and BGR (2012): Storage and Handling of Substances which are endangering the physical properties of water- Jeita Spring Protection Project, Phase I report- 25 p , Lebanon.

GREEN LINE ASSOCIATION (2007): Status and Potentials of Renewable Energy Technologies in Lebanon and the Region (Egypt, Jordan, Palestine, Syria) - Desk Study, 89 p.; Beirut.

MOGHAIZEL LAW OFFICES (2002): Environmental Law Matrix and Practice Skills,. - LEX MUNDI, 25 p.; Lebanon.

HORIZON 2020 (2006): Support to DG Environment for development of the Mediterranean De-pollution Initiative “HORIZON 2020” - No 070201/2006/436133/MAR/E3, 18 p.; LEBANON.

MOSCHINI L..E ET AL (2005): Environmental Diagnosis of Risk Areas Related to Gas Stations, Brazilian archives of Biology and Technology, an international Journal, Vol.48, n. 4: pp. 657-666, Brasil,

MICHIGAN STATE UNIVERSITY (1986): Handling and Underground Storage of Fuels - Cooperative Extension Service, Bulletin WQ1, 7 p.; Michigan, USA.

MICHIGAN STATE UNIVERSITY (1992): Handling and Underground Storage of Fuels - Cooperative Extension Service, Bulletin WQ01, 2 p.; Michigan, USA.

MICHIGAN STATE UNIVERSITY (1995): Assessing the Risk of Groundwater Contamination from Petroleum Product Storage. - Extension Service, Publication WQ654, 9 p.; Michigan, USA.

MINISTRY OF INTERIOR AND MUNICIPALITIES- DIRECTORATE GENERAL OF MUNICIPALITIES (2009): Municipal Act - Decree-law no. 118 Dated 30/6/1977 & its amendments until 2008 [Translation done with the support of the Embassy of Italy. - Lebanon- Italian Cooperation for Development Office, 30 p., Beirut.

STEWART R. ET AL., (2008), Environmental Science in the 21st Century: A New Online Environmental Science Book for College Students. Department of Geosciences, Texas A&M University. [http://oceanworld.tamu.edu/resources/environment-book/groundwatercontamination.html]

TANNOUS N (2011): State and Trends of the Lebanese Environment. Chapter 9: Energy Crisis. - pp. 300-339; Beirut.

UN-HABITAT (2008): Country Programme Document 2008 – 2009: Lebanon. - United Nations Human Settlements Programme, Regional Office for Africa and the Arab States, 28 p.; Beirut.

US EPA (1987): Underground Tank Corrective Action Technologies. - EPA/625/6-87-015, Hazardous Waste Engineering Research Laboratory-Office of Solid Waste and Emergency Response, 212 p.; Washington.

ANNEX 1: Directive 2009/30/: ENVIRONMENTAL SPECIFICATIONS FOR MARKET FUELS TO BE USED FOR VEHICLES EQUIPPED WITH POSITIVE-IGNITION ENGINES

Type: Petrol

Parameter (1)	Unit	Limits (2)	
		Minimum	Maximum
Research octane number		95 (3)	_
Motor octane number		85	_
Vapour pressure, summer period (4)	kPa	—	60,0 (5)
Distillation:			
— percentage evaporated at 100 °C	% v/v	46,0	—
— percentage evaporated at 150 °C	% v/v	75,0	—
Hydrocarbon analysis:			
— olefins	% v/v	—	18,0
— aromatics	% v/v	—	35,0
— benzene	% v/v	—	1,0
Oxygen content	% m/m		3,7
Oxygenates	% v/v		3,0
— Methanol	% v/v		10,0
— Ethanol (stabilising agents may be necessary)	% v/v	—	12,0
— Iso-propyl alcohol	% v/v	—	15,0
— Tert-butyl alcohol	% v/v	—	15,0
— Iso-butyl alcohol	% v/v	—	22,0
—			

Ethers containing five or more carbon atoms per molecule	% v/v	—	15,0
Other oxygenates (6)			
Sulphur content	mg/kg	—	10,0
Lead content	g/l	—	0,005

ANNEX 2: Decree 8442 dated August 12 2002: Lebanese Guidelines for the composition of unleaded Fuel 92, 95 and 98 octanes in addition to diesel oil for automobiles

مرسوم رقم ٨٤٤٣

يتعلّق بمواصفات البنزين ٩٢ و ٩٥ و ٩٨ أوكتان من دون رصاص والديزل اويل (المازوت) لاستخدامها في المركبات الآلية

إنّ رئيس الجمهوريّة
بناء على الدستور ،

بناء على القانون رقم ٢٤٧ تاريخ ٢٠٠٠/٨/٧ (دمج والغاء وانشاء وزارات ومجالس) ،

بناء على القانون المنفّذ بالمرسوم رقم ٦٨٢١ تاريخ ١٩٧٣/٣/٢٨ (تحديد مهام وملاكات وزارتي الاقتصاد والتجارة والصناعة والنفط) ،

بناء على المرسوم رقم ٧٢٩٤ تاريخ ١٩٧٤/٣/١ (تحديد مهام الوحدات الادارية في ملاك وزارة الصناعة والنفط) ،

بناء على القانون رقم ٣٤١ تاريخ ٢٠٠١/٨/٦ (التخفيف من تلوث الهواء الناتج عن قطاع النقل وتشجيع الاتجاه الى استعمال الوقود الاقل تلويثاً) ولا سيما المادة الرابعة منه ،

بناء على اقتراح وزراء الطاقة والمياه والصناعة والبيئة ،

بعد استطلاع رأي مجلس شورى الدولة (الرأي رقم ٢٣٩ /٢٠٠١ - ٢٠٠٢ تاريخ ٢٠٠٢/٧/٨) ،

وبعد موافقة مجلس الوزراء بتاريخ ٢٠٠٢/٨/٨ .

يرسم ما يأتي :

المادة الاولى : تحدّد مواصفات البنزين ٩٢ و ٩٥ و ٩٨ أوكتان من دون رصاص والديزل أويل (المازوت) لاستخدامها في المركبات الآلية للجداول رقم (١) و (٢) و (٣) المرفقة .

المادة الثانية : يمنع استعمال اي وقود مخالف لهذه المواصفات .

المادة الثالثة : تلغى جميع النصوص المخالفة لاحكام هذا المرسوم .

المادة الرابعة : ينشر هذا المرسوم ويعمل به فور نشره في الجريدة الرسمية .

بعبدا في ١٣ آب ٢٠٠٢
الامضاء : اميل لحود

صدر عن رئيس الجمهورية
رئيس مجلس الوزراء
الامضاء : رفيق الحريري

وزير البيئة
الامضاء : ميشال موسى

وزير الصناعة
الامضاء : جورج افرام

وزير الطاقة والمياه
الامضاء : محمد عبد الحميد بيضون

جدول رقم ٢ - أ -

UNLEADED PETROL

GASOLINE 95 (Regular) OCTANE

The present standard defines the characteristics of Automotive Gasoline.

PROPERTY	LIMITS		METHOD
Research Octane Number	Min. 95		ASTM D- 2699
Motor Octane Number	Min. 85		ASTM D-2700
Lead, g/L	Max. 0.013		ASTM D- 3237
Benzene, %v/v	Max. 5.0		ASTM D- 3606 or D-5580
Methanol, % v/v	Max. 3.0		ASTM D-4815
MTBE % v/v	Max. 10.0		ASTM D-4815
Total Organic Oxygen % m/m	Max. 2.5		Calculated
Sulfur % m/m	Max. 0.05		ASTM D- 2622
Distillation at 760 mm Hg, evaporated At 70°C, % v/v At 100°C, % v/v At 180°C, % v/v Final boiling point, °C Residue, % v/v	Min. 10 40-70 Min. 85 Max. 215 Max. 2		ASTM D- 86
Reid Vapor pressure at 37.8 °C, kPa	**Summer** Max 65	**Winter** Max 80	ASTM D-4953
Copper corrosion, (3 hrs @ 50°C)	Max. 1		ASTM D- 130
Existent gum, mg/100 ml	Max 5		ASTM D-381
Oxidation stability , minutes	Min. 360		ASTM D- 525
Color	Light Green		Visual
Density at 15°C, Kg/L	0.730-0.780		ASTM D-1298

1- Winter: November -March inclusive.
2- Summer: April-October inclusive.

جدول رقم ٢- ب -

UNLEADED PETROL

GASOLINE 98 (Premium) OCTANE

The present standard defines the characteristics of Automotive Gasoline.

PROPERTY	LIMITS		METHOD
Research Octane Number	Min. 98		ASTM D- 2699
Motor Octane Number	Min. 87		ASTM D-2700
Lead, g/L	Max. 0.005		ASTM D- 3237
Benzene, %v/v	Max. 5.0		ASTM D- 3606 or D-5580
Methanol, % v/v	Max. 3.0		ASTM D-4815
Ethanol, % v/v	Max. 5.0		ASTM D-4815
Isopropyl Alcohol % v/v	Max. 5.0		ASTM D-4815
Tertiary Butyl Alcohol % v/v	Max. 7.0		ASTM D-4815
Ethers containing five or more C atoms % v/v	Max. 10.0		ASTM D-4815
Other Organic Oxygenates % v/v	Max. 7.0		ASTM D-4815 or D-5599
Total Organic Oxygen % m/m	Max. 2.5		Calculated
Sulfur % m/m	Max. 0.05		ASTM D- 2622
Distillation at 760 mm Hg, evaporated At 70°C, % v/v At 100°C, % v/v At 180°C, % v/v Final boiling point, °C Residue, % v/v	 10-45 40-70 Min. 85 Max. 215 Max. 2		ASTM D- 86
Reid Vapor pressure at 37.8 °C, kPa	Summer Max 65	Winter Max 80	ASTM D-4953
Volatility (10 VP + 7 evaporated 70)	Summer Max 965	Winter Max 1115	Calculated
Copper corrosion, (3 hrs @ 50°C)	Max. 1		ASTM D- 130
Existent gum, mg/100 ml	Max 5		ASTM D-381
Oxidation stability , minutes	Min. 360		ASTM D- 525
Color	Light Blue		Visual
Density at 15°C, Kg/m^3	Min. 720		ASTM D-1298

1- Winter: November -March inclusive.
2- Summer: April-October inclusive.

AUTOMOTIVE FUEL

DIESEL OIL

The present standard defines the characteristics of Diesel oil to be used as Automotive Fuel.

PROPERTY	LIMITS	METHOD
Flash Point Pensky Martens, °C	Min 55	ASTM D-93
Water and sediment by centrifuge, % vol	Max 0.05	ASTM D-2709
Cold Filter Plugging point, °C	Max -5 (Nov-March Inclusive) Max 0 (April-October Inclusive)	IP-309
Distillation temperature, at 760 mm Hg, recovered : At 250°C, vol% At 350°C, vol% At 370°C, vol%	 Max 65 Min 85 Min 95	ASTM D-86
Kinematic Viscosity at 40°C, cSt	Min 2.00 Max 4.50	ASTM D-445
Color	Orange	Visual
Ash % Mass	Max 0.01	ASTM D-482
Sulfur % Mass	Max 0.035	ASTM D-2622
Corrosion, copper strip (3 hrs at 50°C)	Max 1	ASTM D-130
Cetane Number	Min 49	ASTM D-613
Cetane Index	Min 46	ASTM D-976 o D-4737
Ramsbottom Carbon Residue (on 10% residuum), % wt	Max 0.3	ASTM D-524
Density at 15°C, kg/m^3	820-860	ASTM D-4052
Oxidation stability, g/m^3	Max 25	ASTM D-2274

ANNEX 3: Environmental Guidelines for the Establishment and/or Operation of Liquid Petrol Filling Stations

Translation of the Decision No. 5/1- Issued on 12/1/2001

The Minister of Environment,

- Based on law No. 216 dated April 2nd 1993 (establishment of the Ministry of Environment), amended by law No. 667 dated December 29th 1997,
- Based on: Decree No. 4336 dated October 26th 2000 (appointment of Government Cabinet);
- Based on: Legislative Decree No. 16 dated June 30th 1932 (Public Health Rules);
- Based on: Resolution No. 75/L.R dated April 13th 1940 (Establishments selling liquid petroleum products and its amendments)
- Based on: the Law implemented by decree no. 8735 dated August 23rd 1974 (Conservation of public hygiene);
- Based on: Decree No. 1008 of March 2nd 1978 (Allowing the establishment of stations distributing liquid petroleum products in extension areas and residential areas within the organized cities and villages);
- Based on: Decree No. 2289 of September 14th 1979 (Setting the conditions related to the establishment of category A liquid petroleum stations, their general safety terms, and the basis for calculating the distances between them) and its amendments;
- Based on: Law No. 64 of August 12th 1988 (Preservation of the environment against pollution from hazardous wastes and dangerous materials)
- Based on: Decree No. 4917 of March 24th 1994 (Amending the classification of the dangerous, hazardous to health and disturbing establishments) and specifically articles no. 166 and 189;
- Based on: Decree No. 5509 of August 11th 1994 (Complexes, Tankers, Filling Distributing and Storing petroleum products'; stations);
- Based on: Decree No. 2678 of March 21st 2000 (acceptance of a grant from the European Union to the Ministry of Environment through the United Nations Development Programme for the implementation of the" Strengthening the Permitting and Auditing Systems in Industries" project;
- Based on the Director General's proposal,

The followings were decided:
The Ministry of Environment gives, from an environmental perspective, its approval to the establishment and/or operation of distributing liquid petroleum products stations that fulfill specific environmental requirements (defined in article 2). This for: the conservation of the environmental safety, the sustainability of natural resources and for minimizing the hazards generated by these stations (defined in article 1).

Article 1:

Definition of the general pollutants generated by the activities of liquid petrol filling stations

1-1 Water

Large quantities of water are used in the activities of distributing liquid petroleum products stations, especially in car wash operations. This can lead to waste this natural resource without the application of a sound environmental management rationalizing its use.

1-2 Wastewater

Large quantities of wastewater are produced by car wash operations. They contain suspended solids and residues of cleaning agents, in addition to organic particulates (oil and grease)

1-3 Used Oils

Stations distributing liquid petroleum products produce large quantities of used oils. Disposing used oil in sewer networks or in nature would pollute the environment. Therefore, strict sound environmental management measures are to be adopted in managing used oils.

1-4 Air Pollution

Most of petroleum products evaporate. A profusion of volatile petroleum products leads to air pollution.

1-5 Leakage of Petroleum Products

Any leakage from petroleum tanks would pollute soil and eventually pollute groundwater.

Article 2: General environmental conditions required in the liquid petrol filling stations

2.1 Wastewater Management

2.1.1 Separate sanitary wastewater from other types of wastewater and dispose it in the sewer network (if sewer networks do not exist, a septic tank should be built in reference to the design illustrated in Figure 1).

2.1.2 Connect the rainwater network and the car wash waters to a special wastewater treatment unit before disposing it in the sewer network.

2.1.3 Design and build the wastewater treatment unit in a way to produce effluents that comply with the related set national environmental standards.

2-2 Air Pollution Management

2-2-1 Regular checks of the fuel tanks vent pipes' valves to ensure their proper operation.

2-2-2 Equip the fuel filling nozzle with a special rubber fitting, that firmly closes the vehicle reservoir's opening, to prevent the release of gasoline vapors into the atmosphere by preventing any pressure decline.

2-2-3 Place the power generators in an independent room, and equip them with exhaust silencers (muffler) and filters.

2-3 Management of Used Oil

2-3-1 Never dispose used oil in the sewer network or in the septic tank.

2-3-2 Aspirate the used oil from vehicle engines' using special pumps whenever possible.

2-3-3 Collect the used oil in special tanks that do not leak, and send it to classified and licensed oil recycling establishments.

2-3-4 Place the tanks mentioned in section 2-3-3 in larger anti-corrosive (stainless steel) tanks to hold any leakage.
2-3-5 Label used oil tanks describing their content. Furthermore, these tanks must be equipped by a level indicator showing the content of oil.
2-3-6 Never dispose used oil, empty oil containers and oil filters in the environment and water courses. But collect them in special containers preventing their mixture with water or other wastes, and later on, deliver them to licensed collection companies in order to treat and recycle them.

2-4 Car Wash

2-4-1 Use biodegradable and environmentally sound biodegradable cleaning agents
2-4-2 Design the car washing unit in a way ensuring the collection and disposal of washing water into the treatment unit mentioned in section 2-1-3

2-5 Fuel Tanks

2-5-1 Ensure that, at purchase, the fuel tanks are new and appropriate for storage by getting related affidavits from the manufacturing company.
2-5-2 Conduct regular yearly leakage tests on the fuel tanks, starting from the fifth year of the purchase to be sure of the absence of leakage.
2-5-3 The Ministry of Environment holds the right to ask, at any time, for the leakage tests reports
2-5-4 Place the underground fuel tanks in other tanks or in cement pit and ensure painting its walls with insulating waterproof materials preventing leakages.

2-6 General Safety Criteria

2-6-1 Make sure that vehicle engines are not running while filling up vehicles' reservoirs and the fuel tanks with petroleum products.
2-6-2 Total forbid of smoking within the station, and display clearly "No Smoking" signs all over the site.
2-6-3 Supply the station with ozone friendly fire fighting equipments and train the workers on their use.
2-6-4 Label the underground and aboveground pipes describing the type of liquid passing through and its direction. Labels must be placed every other meter on the pipe.
2-6-5 Clean continuously the oil change area to prevent accidents such as slipping, etc.
2-6-6 continuously apply the sound environmental management guidelines in the station

2-7 Aesthetic trends

2-7-1 Use environmentally friendly construction materials
2-7-2 Install planters within the legal return boundaries of the station interface and plant trees around the site

2-8 Other conditions (mandatory)

2-8-1 Cover all water tanks to avoid insects development and water pollution.

2-9 Other conditions (optional)

2-9-1 Use solar energy for water heating
2-9-2 Buy primary materials in large quantities (bulk) to reduce wastes production

Article 3:

The Ministry of Environment specifies the final required environmental conditions for the establishment of a liquid petrol filling station based on its considered location, and the pollutants that would be generated from its daily operation (through modification of some conditions stated in article 2).

Article 4:

The Ministry of Environment reserves its right to: impose additional environmental requirements when needed, perform regular monitoring and the right to request the permit termination in the event of failure to implement (or continue the implementation) the requested environmental conditions.

Article 5:

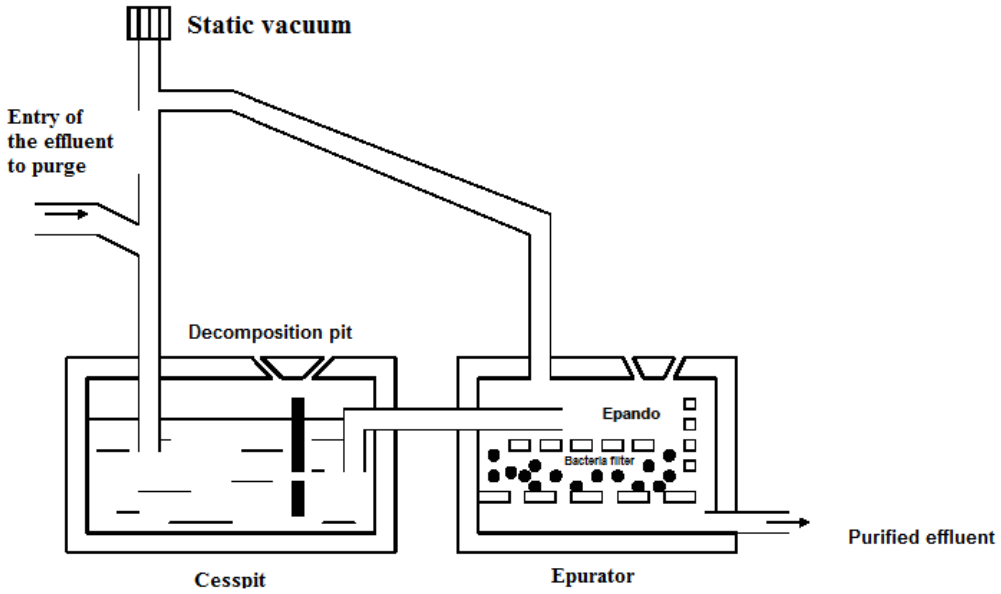
Figure 1 is an integral part of this resolution

Article 6:

This Resolution enters into force on the date of its publication in the Official Gazette.

Antelias, January 12th 2001
Minister of Environment
Dr. Michel Moussa

SCHEMATIC DIAGRAM OF A SEPTIC TANK OR SEPARATOR



ANNEX 4: Specifications and standards for air pollutants, effluents and wastewater treatment units - Resolution No. 8/1 dated 30/1/2001

المواصفات والمعايير المتعلقة بملوثات الهواء والنفايات السائلة ومحطات معالجة المياه المبتذلة
قرار رقم 1/8 - صادر في 2001/1/30

ان وزير البيئة،
بناء على القانون رقم 216 تاريخ 1993/4/2 (احداث وزارة البيئة) المعدل بالقانون رقم 667 تاريخ 1997/12/29،
بناء على المرسوم رقم 4336 تاريخ 2000/10/26 (تشكيل الحكومة)،
بناء على المرسوم رقم 4917 تاريخ 1994/3/24 (تعديل تصنيف المؤسسات الخطرة والمضرة بالصحة والمزعجة)،
بناء على المرسوم رقم 2678 تاريخ 2000/3/21 (قبول هبة من الاتحاد الاوروبي عبر برنامج الامم المتحدة الانمائي الى وزارة البيئة لتنفيذ مشروع تقوية نظام الترخيص والمراقبة في المصانع)،
بناء على اقتراح المدير العام،
يقرر ما ياتي:

المادة 1- تعدل المادة الاولى من القرار رقم 96/1/52 المتعلق بتحديد المواصفات والنسب الخاصة للحد من تلوث الهواء والمياه والتربة بحيث تلغى الملاحق التالية:
ملحق رقم 1:«المواصفات المتعلقة بمياه الشرب»؛
ملحق رقم 2:«المتطلبات النوعية للمياه العذبة السطحية المستعملة او المعدة للاستعمال لانتاج المياه الصالحة للاستهلاك البشري»؛
ملحق رقم 6:« مستويات الحد الادنى لنوعية مياه الصرف المنزلية بعد المعالجة»؛
ملحق رقم 7:« المواصفات المسموح بها لتصريف او طمر نفايات سائلة او صلبة في المياه السطحية، الجوفية ومياه البحر داخل الحدود الدولية (نفايات لايعتد بضررها)»؛
ملحق رقم 8:« المواصفات لبعض المواد الضارة عند صرفها في البيئة البحرية داخل الحدود الدولية (نفايات سائلة غير منزلية)»؛
ملحق رقم 9:« الحدود القصوى لملوثات الهواء داخل اماكن العمل»؛
ملحق رقم 11:« الحدود القصوى المسموح بها لملوثات الهواء في الانبعاثات الناجمة عن حرق الزيوت المستعملة»؛
ملحق رقم 12:« الحدود القصوى المسموح بها لملوثات الهواء في الانبعاثات الناجمة عن حرق النفايات المنزلية»؛
ملحق رقم 13:« الحدود القصوى المسموح بها لملوثات الهواء من الانبعاثات في معامل الترابة».

وتعرف الملاحق المتبقية وفقا للتالي:
ملحق رقم 3:« النوعية المطلوبة للمياه الصالحة للحياة المائية» يعرف بالملحق رقم 1؛
ملحق رقم 4:« مواصفات المياه الصالحة للسباحة: احواض، انهار، بحيرات وبحار» يعرف بالملحق رقم 2؛
ملحق رقم 5:« مواصفات المياه المبتذلة الحضرية» يعرف بالملحق رقم 3؛
ملحق رقم 10:«الحدود المسموحة لشدة الصوت ومدة التعرض الامن له» يعرف بالملحق رقم 4؛
ملحق رقم 14:« الحدود القصوى لملوثات الهواء الخارجي» يعرف بالملحق رقم 5.

المادة 2- تحدد المواصفات الواجب التقيد بها بالنسبة لملوثات الهواء والنفايات السائلة المتولدة عن المؤسسات المصنفة ومحطات معالجة المياه المبتذلة والمستشفيات وفق المعدلات والقيم الحدية البيئية، الواردة في الملحقات التالية:
ملحق رقم 1:«القيم الحدية العامة للانبعاثات المتعلقة بالملوثات الهوائية»؛

ملحق رقم 2:«القيم الحدية الخاصة للانبعاثات المتعلقة بالملوثات الهوائية المتولدة من قطاعات وصناعات ومصادر تلوث مختلفة؛
ملحق رقم 2-1:«قطاع الطاقة»؛
ملحق رقم 2-2:«معامل الترابة»؛
ملحق رقم 2-3:«معامل الزجاج»؛
ملحق رقم 2-4:«معامل تصنيع البطاريات»؛
ملحق رقم 2-5: «معامل الطلاء الكهربائي»؛
ملحق رقم 2-6:«معامل تصنيع الاولومنيوم»؛
ملحق رقم 2-7:«معامل الاغذية»؛
ملحق رقم 2-8:«محارق النفايات المنزلية»؛
ملحق رقم 2-9:«المولدات التي تعمل على الزيوت اكبر من 0.5 ميغاوات»؛
ملحق رقم 3:«القيم الحدية البيئية للنفايات السائلة المصرفة في البحر»؛
ملحق رقم 4:«القيم الحدية البيئية للنفايات السائلة المصرفة في المياه السطحية»؛
ملحق رقم 5:«القيم الحدية البيئية للمياه المبتذلة عند صرفها في شبكة الصرف الصحي»؛

المادة 3- تحتفظ وزارة البيئة فرض معايير ومواصفات جديدة او تعديل اي منها عندما تدعو الحاجة، خصوصا فيما لو تبين ان المؤسسة المصنفة، ورغم استخدامها للتقنيات الفضلى المتاحة (Available Technology Best)، لم تتمكن من الالتزام ببعض او كل هذه المواصفات والمعايير.

المادة 4- تعتبر ملحقات هذا القرار جزءا لا يتجزأ منه.
المادة 5- يعمل بهذا القرار فور نشره في الجريدة الرسمية.

انطلياس في 30 كانون الثاني 2001
وزير البيئة
د. ميشال موسى

ملحق رقم 1: القيم الحدية العامة للانبعاثات المتعلقة بالملوثات الهوائية

يضم الجدول رقم I تقسيم الملوثات الى مجموعات مؤلفة من ملوثات جزيئية غير عضوية، ملوثات غازية غير عضوية، وملوثات مسرطنة.
يضم الجدول رقم II لائحة وتصنيف الملوثات الغازية العضوية.
يضم الجدول رقم III القيم الحدية العامة للانبعاثات. هذه المعايير صالحة لجميع المؤسسات الصناعية، والتي يعتبر قطاع الطاقة جزءا لا يتجزأ منها، طالما انه لا يوجد قيم محددة لكل قطاع على حدة. ان القيم الحدية للانبعاثات مذكورة بشكل التدفق الكتلي ونسب التركيز. في حال كانت قيم التدفق الكتلي اقل من القيم المذكورة في العمود الثالث، لايعتد لها قيم حدية بيئية. اما اذا كانت قيم التدفق الكتلي اكثر من القيم المذكورة في العمود الثالث يجب اعتماد قيم نسب التركيز المذكورة في العمود الثاني.

جدول I: تصنيف الملوثات الى مجموعات
(ملوثات غير عضوية، ملوثات غازية غير عضوية)

الملوثات الصلبة غير العضوية			
المجموعة I	المجموعة II	المجموعة III	المجموعة IV
كادميوم CD، زئبق Hg، ثاليوم Tl	زرنيخ As، كوبلت Co، نيكل Ni، سيلينيوم Se، تيللوريوم Te	أنتيمون Sb، رصاص Pb كروم Cr، سيانيد CN، فليور F، نحاس Cu،	-

منغنيز Mn، بلاتين Pt،
بالاديوم Pd، روديوم Rh،
فاناديوم V، قصدير Sn

الملوثات الغازية غير العضوية

المجموعة I	المجموعة II	المجموعة III	المجموعة IV
مركبات هيدروجين الفلور، هيدروجين الفوسفور	مركبات هيدروجين البروم، هيدروجين الكلور، هيدروجين غير المذكور في المجموعة I	أكاسيد الكبريت، أكاسيد النيتروجين	

الملوثات المسرطنة

المجموعة I	المجموعة II	المجموعة III	المجموعة IV
الأسبستوس، مركبات البنزو (أ) بيرين، بيريليوم ومركباته القابلة للاستنشاق والمحتوية على بيريليوم، ثنائي بنز (أ، هـ) أنتراسين، 2 - نافتيل أمين	أكاسيد الزرنيخ، مركبات الكروم III وIV، كوبلت، نيكل ابوكسي بروبان (إيبيكلورو هيدرين)، ومركباته القابلة للاستنشاق والمحتوية على نيكل، 3.3 ثنائي الكلوروبنزيدين، ثنائي كبريتات المثيل، اثيلينيمين	أكريلونيتريل، بنزين، 1، 3 بيوتاديين، 1 كلور - 3.2 - إيبوكسيبروبان، 1.2 ثنائي برومو ميثان، 1.2 - أوكسيد الاثيلين، هيدرازين، كلوريد الفينيل.	-

جدول II: تصنيف الملوثات الى مجموعات (ملوثات غازية عضوية)

الملوثات الغازية العضوية	الصيغة الكيميائية	المجموعة
1.1.1 ثلاثي كلورو إيثان	$C_2H_3CL_3$	II
1.1.2 - ثلاثي كلورو إيثان	$C_2H_3CL_3$	I
1.1 - ثنائي كلورو إثيلين	$C_2H_2L_2$	I
1.1 - ثنائي كلورو إيثان	$C_2H_4CL_2$	II
1.2 - ثنائي كلورو إثيلين	$C_2H_2CL_2$	III
1.2 - ثنائي كلورو إيثان	$C_2H_4CL_2$	I
1.2 - ثنائي كلورو بنزين	$C_6H_4CL_2$	I
1.4 ثنائي أوكزان	$C_4H_8O_2$	I
1.4 - ثنائي كلورو بنزين	$C_6H_4CL_2$	II
2.2 - إيمينو ثنائي إثانول	$C_4H_{11}NO_2$	II
2.4 - كزيلينول	$C_8H_{10}O$	II
2.6 ثنائي مثيل هبتان -4- أون	C_7H_2O	II

2 - إيتوكسي إيثانول	$C_4H_{10}O_2$		II
2 - بروبين -1- أول	C_3H_4O		I
2 - بوتانون	C_4H_8O		III
2 - بوتكسي إيثانول	$C_6H_{14}O_2$		II
2 - فور آلدهيد	$C_5H_4O_2$		I
2 - كلورو - 1.3 - بوثان	C_4H_5CL		II
2 - كلورو بروبان	C_3H_7CL		II
2- كلوروبري (أنظر 2 - كلورو - 1.3 - بوتاديين)			
2 - ميتوكسي إيثانول	$C_3H_8O_2$		II
4 - مثيل -2- بنتانون	$C_6H_{12}O$		III
4 - مثيلين فنيل ثنائي إيزو سيانات	$C_9H_6N_2O_2$		I
4 - هيدروكسي - 4 مثيل - 2 بنتانون	$C_6H_{12}O_2$		III
أثير (أنظر ثنائي إثيل أثير)			
إثيل إستر (انظر إثيل آسيتات)			
إثيل آسيتات	$C_4H_8O_2$		III
إثيل آكريلات	$C_5H_8O_2$		I
إثيل آمين	C_2H_7N	I	
إثيل بنزين	C_8H_{10}	II	
إثيلين غليكول	$C_2H_6O_2$		III
إثيلين غليكول أحادي إثيل اثير (أنظر 2- إيتوكسي إيثانول)			
إثيلين غليكول أحادي مثيل اثير (أنظر 2- ميتوكسي إيثانول)			
إثيلين، كلوريد (أنظر كلور إيثان)			
آزوت، آزوت - ثنائي مثيل فورم آميد	C_3H_7NO	II	
آزوت - مثيل بيروليدون	C_5H_9NO		III
إستيل آلدهيد	C_2H_4O		I
آسيتون	C_3H_6O		III
آكروليين (أنظر 2 - بروبينال)			
آكريل أثيل أستر (أنظر أثيل آكريلات)			
آكريل مثيل أستر (أنظر مثيل آكريلات)			
ألفا - كلوروطولوين	C_7H_7CL	I	
أنهيدريد حمض الماليك	$C_4H_2O_3$		I
اورثو - طولويدين	C_6H_7N	I	
آنيلين	C_7H_9N		I
إيثانول (أنظر إثيل كحول)			
إيزو بروبيل بنزين	C_9H_{10}	II	

إيزو بوتيل مثيل سيتون (أنظر 4- مثيل -2- بنتانون)	C_9H_{12}	II	
بركلورو إثيلين (أنظر رباعي كلورو إثيلين)			
بروبين آلدهيد (بروبانال)	C_3H_6O		II
بنزيل كلوريد (انظر ألفا - كلورو طولويين)			
بوتيل آسيتات	$C_6H_{12}O_2$		III
بوتيل آلدهيد	C_4H_8O		II
بوتيل غليكول إستر (أنظر 2- بوتوكسي إيثانول)			
بيردين	C_5H_5N		I
بينين	$C_{10}H_{16}$		III
ثلاثي إثيل آمين	$C_6H_{15}N$		I
ثلاثي كلورو اثيلين	C_2HCL_3	II	
ثلاثي كلوروفليوروميثان	CCL_3F		III
ثلاثي كلوروفينول	$C6H_3OCL_3$		I
ثلاثي كلورو ميثان	$CHCl_3$	I	
ثلاثي مثيل بنزين	C_9H_{12}		II
ثنائي إثيل أثير	$C_4H_{10}O$		III
ثنائي إثيل آمين	$C_4H_{11}N$		I
ثنائي أوكتيل فتالات (أنظر ثنائي - (2 - إثيل هكزيل) فتالات)			
ثنائي إيثانول أمين (إنظر 2.2 إيمينو ثنائي إيثانول)			
ثنائي إيزو بروبيل أثير	$C_6H_{14}O$		III
ثنائي إيزوبوتيل سيتون (أنظر ثنائي 2.6 - ثنائي مثيل هبتان -4- أون)			
ثنائي الفنيل	$C_{12}H_{10}$		I
ثنائي بوتيل أثير	$C_8H_{18}O$		III
ثنائي سولفيد الكربون	CS_2		II
ثنائي فنيل (أنظر ثاني فنيل)			
ثنائي كلور ثنائي فليورو ميثان	CCL_2F_2		III
ثنائي كلورو فينول	$C_6H_4CL_2O$	I	
ثنائي كلورو ميثان	CH_2CL_2	III	
ثنائي مثيل أثير	C_2H_6O		III
ثنائي مثيل آمين	C_2H_7N		I
ثنائي - (2- إثيل هكزيل فتالات)	$C_{24}H_{38}O_4$		II
ثيو إثيرات			I
ثيو كحولات			I
حمض الآستيك (الخليك)	$C_2H_4O_2$		II
حمض الآستيك إثيل إستر			

(أنظر إثيل آسيتات)		
حمض الآستيك بوثيل إستر		
(أنظر بوثيل آسيتات)		
حمض الآستيك فينيل آستر		
(أنظر فينيل آسيتات)		
حمض الآستيك مثيل إستر		
(أنظر مثيل آسيتات)		
حمض الأكريليك	$C_3H_4O_2$	I
حمض الفورميك (النمليك)	CH_2O_2	I
حمض بروبيونيك	$C_3H_6O_2$	II
حمض كلورو آستيك	$C_2H_3ClO_2$	I
حمض متاكريليك مثيل أثير		
(أنظر مثيل ميتاكريلات)		
رباعي كلوروإيثان	$C_2H_2CL_4$	I
رباعي كلورميثان	CCL_4	I
رباعي هيدروفوران	C_4H_8O	II
ستيرين	C_8H_8	II
سيكلوهيكزانون (هيكزانون حلقي)	$C6H_{10}O$	II
طولوين	C_7H_8	II
طولوين -2.4- ثنائي إيزو سيانات (أنظر		
4- مثيلين فنيل ثنائي إيزو سيانات)		
فورفورال، (أنظر 2- فور آدهيد)		
فورم آلدهيد	CH_2O	I
فورميك مثيل أستر (أنظر مثيل فورمات)		
فينول	C_6H_6O	I
فينيل أسيتات	$C_4H_6O_2$	II
كحول ألكيلي		III
كحول ثنائي آسيتون		
(أنظر 4- هيدروكسي -4 مثيل -2 بنتانون)		
كحول فورفورال (فورفوريل كحول)	$C_5H_6O_6$	II
كريزول	C_7H_8O	I
كزيلين	C_8H_{10}	II
كزيلينول (باستثناء 2.4 -كزيلينول)	$C_8H_{10}O$	I
كلورو آستيل آلدهيد	C_2H_3ClO	I
كلورو إيثان	C_2H_5CL	III
كلوروبنزين	C_6H_5CL	II
كلوروفورم (أنظر ثلاثي كلورومثان)		
كلورومثان	CH_3CL	I
كومول (أنظر إيزوبروبيل بنزين)		
مثيل إثيل سيتون (أنظر بوتانون)		
مثيل آسيتات	$C_3H_6O_2$	II

مثيل آكريلات	$C_4H_6O_2$		I
مثيل آمين	CH_5N		I
مثيل إيزو بوتيل سيتون (أنظر 4- مثيل -2- بنتانون)			
مثيل بنزووات	$C_8H_8O_2$		III
مثيل غليكول أثير (أنظر 2- ميتوكسي إيثانول)			
مثيل فورمات	$C_2H_4O_2$		II
مثيل كلوروفورم (أنظر 1.1.1 - ثلاثي كلورو إيثان)			
مثيل ميثاكريلات	$C_5H_8O_2$		II
مثيل هيكزان حلقي (سيكلوهكزان)	$C_7H_{12}O$		II
مثيلين كلوريد (أنظر ثنائي كلوروميثان)			
مركابتان (أنظر ثيوكحولات)			
مركبات الرصاص الألكيلية			I
مركبات هيدروكربونية أوليفينية (باستثناء 1.3 - بوتاديين)			III
مركبات هيدروكربونية بارافينية			III
ميثانول (أنظر كحول ألكيليك)			
نفتلين	$C_{10}H_8$		II
نيتروبنزين	$C_6H_5NO_2$		I
نيتروطولوين	$C_7H_7NO_2$		I
نيتروفينول	$C_6H_5NO_3$		I
نيتروكريزول	$C_7H_7NO_3$		I

جدول III: القيم الحدية البيئية العامة للانبعاثات المتعلقة بالملوث الهوائية

1	2	3
المؤشر (الملوث)	القيمة الحدية للانبعاثات	ملاحظات
غبار (ملغ/م3)	200 (منشآت جديدة)، 500 (منشآت قائمة)	لا تحتوي على مواد خطرة
ملوثات صلبة غير عضوية (ملغ/م3)		
	مجموعة I 1	تدفق كتلي أكبر من 5غ/سا
	مجموعة II 10	تدفق كتلي أكبر من 25غ/سا
	مجموعة III 30	تدفق كتلي أكبر من 50غ/سا
الملوثات الغازية غير العضوية (ملغ/م3)		
	مجموعة I 1	تدفق كتلي أكبر من 50غ/سا
	مجموعة II 5	تدفق كتلي أكبرمن 300غ/سا
	مجموعة III 30	تدفق كتلي أكبر من 1غ/سا
	مجموعة IV 500	تدفق كتلي أكبر من 10غ/سا
الملوثات الغازية العضوية (ملغ/م3)		
	مجموعة I 20	تدفق كتلي أكبرمن 500غ/سا
	مجموعة II 100	تدفق كتلي أكبر من 4 غ/سا
	مجموعة III 200	تدفق كتلي أكبر من 6غ/سا

الملوثات المسرطنة (ملغ /م3)	
مجموعة I 0.2	تدفق كتلي أكبرمن 5 غ/سا
مجموعة II 2	تدفق كتلي أكبر من 10غ/سا
مجموعة III 10	تدفق كتلي أكبر من 50غ/سا

ملحق 2- القيم الحدية
للانبعاثات المتعلقة بالملوثات الهوائية المتولدة من قطاعات وصناعات ومصادر تلوث مختلفة

2-1 قطاع الطاقة

2-1-1: المعامل التي تحرق الزيوت (الفيول أويل): المراجل، إنتاج البخار، انتاج الطاقة ذات قدرة حرارية أكبر من 1 ميغاوات واصغر من 50 ميغاوات

2-1-2: المعامل التي تحرف الزيوت (الفيول اويل) ذات قدرة حرارية أكبر من 50 ميغاوات

2-1-2-1: متطلبات اضافية للمعامل ذات القدرة الحرارية أكبر من 50 ميغاوات واصغر من 100 ميغاوات

2-1-2-2: متطلبات اضافية للمعامل ذات القدرة الحرارية أكبر من 100 ميغاوات واصغر من 300 ميغاوات

2-2 معامل الترابة

2-3 معامل الزجاج

2-4 معامل تصنيع البطاريات

2-5 معامل الطلاء الكهربائي

2-6 معامل تصنيع الالومنيوم

2-7 معامل الاغذية

2-8 محارق النفايات المنزلية

2-9 الموالدات التي تعمل على الزيوت (الفيول أويل) أكبر من 0.5 ميغاوات

تعطي الجداول التالية القيم الحدية البيئية للانبعاثات من المداخن الخاصة بهذه المعامل. تم اعداد هذه القيم بناء على المرحلة الاولية من التصنيع داخل هذه المعامل. ففي الواقع من المحتمل وجود أكثر من مرحلة واحدة ضمن القطاع الواحد. في هذه الحالة تستخدم الانظمة التي تحدد القيم الحدية الخاصة بكل مرحلة. في حال لم تذكر المادة الملوثة في الانظمة المحددة تتبع الانظمة او القيم الحدية العامة.

ملاحظة:
تحسب حدية أكاسيد الكبريت على اساس ثاني أكسيد الكبريت اذا لم يتوفر جهاز يقيس كل نوع بمفرده.
تحسب حدية أكاسيد النيتروجين على أساس ثاني أكسيد النيتروجين اذا لم يتوفر جهاز يقيس كل نوع بمفرده.

ملحق 2-1
قطاع الطاقة

جدول 2-1-1: المعامل التي تحرق الزيوت (الفيول أويل): المراجل، إنتاج البخار انتاج الطاقة ذات قدرة حرارية أكبر من 1 ميغاوات واصغرا من 50 ميغاوات

المؤشر	المنشآت الجديدة	المنشآت القائمة
تصحيح الأوكسجين	%3	%5
الغبار (ملغ/م3)	150	500
اول اوكسيد الكربون (ملغ/م3)	250	1.000
اكاسيد النيتروجين (ملغ/م3)		
ديزل (وفقا للمعايير الاوروبية)	300	800
وقود آخر	500	1.000
أكاسيد الكبريت (ملغ/م3)		
ديزل (وفقا للمعايير الاوروبية)	-	-

وقود آخر	1.700	3.500

جدول 2-1-2: المعامل التي تحرق الزيوت (الفيول أويل)
ذات قدرة حرارية أكبر من 50 ميغاوات

المؤشر	المنشآت الجديدة	المنشآت القائمة
تصحيح الأوكسجين	%3	%5
الغبار (ملغ/م3)	50	250
الزرنيخ، الرصاص، الكادميوم، الكروم، كوبلت، نيكل (ملغ/م3)	5	15
أول أكسيد الكربون (ملغ/م3)	250	1.000
أكاسيد النيتروجين (ملغ/م3)	500	1.000
أكاسيد الكبريت (ملغ/م3)		
ديزل (وفقا للمعايير الاوروبية)	-	-
وقود آخر	2.500	3.500

جدول 2-1-2-1: متطلبات اضافية للمعامل ذات القدرة الحرارية أكبر من 50 ميغاوات واصغر من 100 ميغاوات

المؤشر	المنشآت الجديدة	المنشآت القائمة
أكاسيد الكبريت (ملغ/م3)		
ديزل (وفقا للمعايير الاوروبية)	-	-
وقود آخر	2.000	3.500

جدول 2-1-2-2: متطلبات اضافية للمعامل ذات القدرة الحرارية اكبر من 100 ميغاوات واصغر من 300 ميغاوات

المؤشر	المنشآت الجديدة	المنشآت القائمة
أكاسيد الكبريت (ملغ/م3)		
ديزل (وفقا للمعايير الاوروبية)	-	-
وقود آخر	2.000	3.500
حمض الهيدروكلوريك	100	200
حمض الفليوروهيدريك	10	20

ملحق 2-2
معامل الترابة

معامل الترابة

المؤشر	المنشآت الجديدة	المنشآت القائمة	ملاحظات
تصحيح الاوكسجين	-	-	غير ضروري

أكاسيد النيتروجين (ملغ/م3)			1.500	2.500 في حال استعمال مسخن متقدم مصبع الاشعال
			2.000	في حال استعمال مسخن متقدم مخروطي
أكاسيد الكبريت (ملغ/م3)	800			850

ملحق 2-3
معامل الزجاج

معامل الزجاج

المؤشر	المنشآت الجديدة	المنشآت القائمة	ملاحظات
تصحيح الاوكسجين	%13	%13	
أكاسيد النيتروجين (ملغ/م3)	1.200	4.000	أفران Harbour
	1.600		أفران Tubs
	2.000		أفران U-Flame- Tubs
	3.500		أفران Cross-over- Flame Tubs
أكاسيد الكبريت (ملغ/م3)	1.300	3.500	أفران Harbour
	2.000		أفران الانصهار

ملحق 2-4
معامل تصنيع البطاريات

المؤشر	المنشآت الجديدة	المنشآت القائمة	ملاحظات
تصحيح الاوكسجين	-	-	غير ضروري
الغبار (ملغ/م3)	0.5	10	غبار يحتوي على معادن ثقيلة
حمض الكبريتيك (ملغ/م3)	1	10	

ملحق 2-5
معامل الطلاء الكهربائي

المؤشر	المنشآت الجديدة	المنشآت القائمة	ملاحظات

تصحيح الاوكسجين	-	-	غير ضروري
الغبار (ملغ/م3)	20	50	غبار يحتوي على مواد خطرة

ملحق 2-6
معامل تصنيع الالومنيوم

المؤشر	المنشآت الجديدة	المنشآت القائمة	ملاحظات
تصحيح الاوكسجين	-	-غير ضروري	
الغبار (ملغ/م3)	40	150	
الكلور (ملغ/م3)	5	10	
اجمالي الكربون العضوي (ملغ/م3)	150	150	
ديوكسين وفوران نانوغ/م3	1	1	عمليات الصهر، غازات العدم أكبر من 0.5 غ/سا

ملحق 2-7
معامل الاغذية

المؤشر	المنشآت الجديدة	المنشآت القائمة	ملاحظات
تصحيح الاوكسجين	-	-	غير ضروري
انبعاث الروائح	عدم اطلاق روائح قوية	عدم اطلاق روائح قوية	
الغبار/ملغ/م3)	100	200	

ملحق2-8
محارق النفايات المنزلية

المؤشر	المنشآت الجديدة
تصحيح الاوكسجين	%11
قدرة اصغر من 0.75 طن/ سا	
الغبار (ملغ/م3)	30
اول اوكسيد الكربون (ملغ/م3)	100
الكربون الاجمالي من الملوثات العضوية (ملغ/م3)	20
اكاسيد الكبريت (تحسب على اساس ثاني اوكسيد الكبريت اذا لم يتوفر جهاز يقيس كل نوع بمفرده) (ملغ/م3)	100
حمض الهيدروكلوريك (ملغ/م3)	50
حمض الفليوروهيدريك (ملغ/م3)	2
قدرة اكبر من 0.75 طن / سا	
الغبار (ملغ/م3)	30
اول اوكسيد الكربون (ملغ/م3)	100

الكربون الاجمالي من الملوثات العضوية (ملغ/م3)		20
اكاسيد الكبريت (تحسب على اساس ثاني اوكسيد الكبريت اذا لم يتوفر جهاز يقيس كل نوع بمفرده) (ملغ/م3)		200
اكاسيد النيتروجين (تحسب على اساس ثاني اوكسيد النيتروجين اذا لم يتوفر جهاز يقيس كل نوع بمفرده) (ملغ/م3)	400	
حمض الهيدروكلوريك (ملغ/م3)		60
حمض الفليوروهيدريك (ملغ/م3)		4
زئبق (ملغ/م3)		0.05
مجموع كادميوم وثاليوم (ملغ/م3)		0.05
مجموع انتيمون (اثميد) وزرنيخ ورصاص وكروم وكوبلت ونحاس ومنغنيز ونيكل وفاناديوم وكبريت (ملغ/م3)	0.5	
ديوكسين (نانو غ/م3)		0.1
فوران (نانو غ/م3)	0.1	

ملحق رقم 2-9
المولدات التي تعمل على الزيت (الفيول اويل) اكبر من 0.5 ميغاوات

مولدات تعمل على الزيوت (الفيول اويل) اكبر من 0.5 ميغاوات

المؤشر	المنشآت الجديدة	المنشآت القائمة	ملاحظات
تصحيح الاوكسجين	%5	%5	
الغبار (ملغ/م3)	20	20	عند استعمال فلتر
	150	150	الشحتار ديزل
	250	250	غيره من الوقود
اول اوكسيد الكربون(ملغ/م3)	800	1.500	
اكاسيد النيتروجين (ملغ/م3) اذا كان اصغرمن 3 ميغاوات	4.000	6.000	
قدرة حرارية اذا كان اكبر من 3 ميغاوات	2.000	6.000	
قدرة حرارية اكاسيد الكبريت (ملغ/م3) ديزل (وفقا للمعاييرالاوروبية)			
وقود آخر	3.000	3.000	

1 يستخدم للمولدات القيم الحدية البيئية او مبدأ الحد الادنى لارتفاع المدخنة مبدأ «الحد الادنى لارتفاع المداخن» الذي يطبق على المولدات لتحقيق متطلبات التخفيف من الانبعاثات الناتجة عن المولدات التي تعمل على الزيت (الفيول اويل) ذات قدرة اكبر من 0.5 ميغاوات يخير صاحب الشأن بالتقيد بالقيم الحدية البيئية المذكورة بالملحق 2-9 او باعتماد مبدأ الحد الادنى لارتفاع المدخن لاطلاق غازات العدم.
اما معادلة تحديد ارتفاع المدخنة فهي على الشكل التالي:

$$H = h + (0.2 \times kVA)$$

H: ارتفاع المدخنة الكلي بالامتار
h: ارتفاع الابنية المجاورة الكلي بالامتار
KVA: القدرة الاجمالية للمولدات كالمنشآت القائمة -kVA = kW، اي القدرة الاجمالية المعرفة بكمية الفيول (الطاقة القصوى المستعملة

امثلة عن احتساب الحد الادنى لارتفاع المدخنة

قدرة المولد الاجمالية (kVA = kW)	500	1.000	2.000	2.500	3.000	3.500	14.000		
ارتفاع المباني ضمن دائرة قطرها 50م او معدل ارتفاع المباني في الجوار (م)	15	15	15	15	15	15	15	15	15
الحد الادنى لارتفاع المدخنة فوق سطح الارض (م)	19	21	23	25	26	27	39		

ان الحد الادنى لارتفاع المدخنة مرتبط بالشروط التالية:
نطاق التطبيق: اكبر من 500 قدرة المولد الاجمالية (kVA = kW)
الحد الادنى للارتفاع: 1م + ارتفاع الابنية المجاورة (م) (داخل دائرة قطرها 50م من المدخنة او معدل ارتفاع المباني في الجوار)
السرعة الدنيا لغازات العدم: 15م/ثا
اكثر من مولد واحد: القدرة الاجمالية
ملاحظة:
في حال كانت قدرة المولد الاجمالية اصغر من 500 kW يكون ارتفاع المدخنة المطلوب يساوي مترا واحدا اضافة لاتفاع مكان المحرك.

ملحق 3: القيم الحدية البيئية للنفايات السائلة المصرفة في البحر.

يبين العمود الاول مؤشرات التلوث المطلوب مراقبتها، اما العمود الثاني فيعطي القيم الحدية لصرف المنشآت القائمة والعمود الثالث لصرف المنشآت الجديدة. ان معايير الصرف المذكورة في العمود الثاني ستلغى عندما تصدق الجمهورية اللبنانية على تعديلات بروتوكول التلوث من مصادر برية ضمن اطار اتفاقية برشلونة. عندما تصبح القيم الحدية المذكورة في العمود الثالث هي المعتمدة في جميع المنشآت.
ان تصميم منافذ الانابيب على الشواطئ وتحديد طولها وعمقها يجب ان يتم وفقا لما يلي:

1-3 معلومات عن قاع البحر

1-1-3 مستويات القاع
2-1-3 تربة القاع
3-1-3 ثبات او حركة القاع

2-3 معلومات بيئية

1-2-3 تواتر سرعة الرياح واتجاهها
2-2-3 الطوبوغرافيا المحلية والتأثير على التيارات، الرياح والامواج
3-2-3 الملاحة، رفع الرمل من قاع البحر، الصيد صيد الصدف، السباحة وغيرها من النشاطات
3-3 معلومات عن المواد المتدفقة

4-3 ميزات المياه المستقبلة

1-4-3 الوقت اللازم لموت البكتيريا (T90)
2-4-3 عوامل الانتشار الافقي والجانبي
3-4-3 عامل الانتشار العمودي
4-4-3 الحرارة، الملوحة والكثافة

جدول القيم الحدية البيئية للنفايات السائلة المصرفة في البحر

1	2	3
المؤشر	القيم الحدية البيئية للمنشآت القائمة	القيم الحدية للمنشآت الجديدة
الاس الهيدروجيني pH	9-5	9-6
الحرارة	35 درجة مئوية	35 درجة مئوية
الحاجة البيولوجية للاوكسجين بعد الحضن لمدة 5 ايام (اوكسجين ملغ/ل)	100	25
الحاجة الكيميائية للاوكسجين (اوكسجين ملغ/ل)	250	125
اجمالي الحديد (Fe) (ملغ/ل)	5	5
اجمالي الزئبق (Hg) (ملغ/ل)	0.05	0.05
اجمالي النحاس (Cu) (ملغ/ل)	1.5	1.5
اجمالي النيكل (Ni) (ملغ/ل)	2	0.5
الومينيوم (A1) (ملغ/ل)	10	10
امونيا (+ NH4) (ملغ/ل)	10	10
انتيمون (اثميد) (Sb) (ملغ/ل)	0.3	0.3
اجمالي الرصاص (Pb) (ملغ/ل)	0.5	0.5
اجمالي الفوسفور (فوسفور ملغ/ل)	16	10
اجمالي القصدير (Sn) (ملغ/ل)	2	2
اجمالي الكربون العضوي (ملغ/ل)	75	75
اجمالي الكروم (Cr) (ملغ/ل)	2	2
اجمالي النيتروجين (ازوت)2 (نيتروجين ملغ/ل)	40	30
اجمالي زنك (Zn) (ملغ/ل)	10	5
باريوم (Ba) (ملغ/ل)	10	2
بكتيريا كوليفورم 3 بالحضن على 37 درجة مئوية في 100مل	2000	2000
دليل الفينول (ملغ/ل)	0.3	0.3
زرنيخ (As) (ملغ/ل)	0.1	0.1
زيت وشحم (ملغ/ل)	30	30
سالمونيلا	غياب كامل	غياب كامل
سولفات (-- SO4) (ملغ/ل)	1000	1000
سولفيد (--S) (ملغ/ل)	5	1
سيانيد (-CN) (ملغ/ل)	0.1	0.1
فضة (Ag) (ملغ/غ)	0.1	0.1
فليوريد (-F) (ملغ/ل)	25	25
فوسفات (--- PO4) (ملغ/ل)	5	5
كادميوم (Cd) (ملغ/ل)	0.2	0.2
كروم سداسي التكافؤ (Crvi) (ملغ/ل)	0.5	0.2
كلور نشط (Cl2) (ملغ/ل)	1	1
كوبلت (Co) (ملغ/ل)	0.5	0.5
مانغنيز (Mn) (ملغ/ل)	1	1
مركبات هيدروكربونية (ملغ/ل)	20	20
منظفات (ملغ/ل)	3	3

مواد صلبة عالقة (ملغ/ل)	200	60
نيترات (NO3) (ملغ/ل)	90	90
AOX (المركبات الهالوجينية العضوية)	5	5

2 مجموع نيتروجين كجلداهل (النيتروجين العضوي+ الامونياك) والنيتروجين النيتراتي (NO3) والنيتريتي (NO2).
3 للنفايات المصرفة على مقربة من مياه الاستحمام وجب اعتماد قيم حدية بيئية اكثر صرامة.

ملحق 4: القيم الحدية البيئية للنفايات السائلة المصرفة في المياه السطحية

يبين العمود الاول مؤشر التلوث، ويعطي العمود الثاني القيم الحدية للمنشآت القائمة، اما العمود الثالث فيعطي القيم للمنشآت الجديدة. القيم الحدية البيئية في العمود الثاني سوف تلغى عندما تصدق الجمهورية اللبنانية على تعديلات بروتوكول التلوث من مصادر برية ضمن اتفاقية برشلونة. عندها تعتمد القيم في العمود الثالث بصورة تلقائية ولجميع المنشآت.
تعرف المياه السطحية بانها المياه الموجودة على سطح اليابسة وهي تتدفق اما بشكل دائم او مؤقت عبر مجرى او مباشرة من الينابيع. يسمح بصرف النفايات السائلة في المياه السطحية شرط ان يكون الحد الادنى لتدفق المياه السطحية 0.1م3/ثا.

القيم الحدية البيئية للنفايات السائلة المصرفة في المياه السطحية

1	2	3
المؤشر	القيم الحدية البيئية للمنشآت القائمة	القيم الحدية للمنشآت الجديدة
الاس الهيدروجيني pH	9-5	9-6
الحرارة	30 درجة مئوية	30 درجة مئوية
الحاجة البيولوجية للاوكسجين بعد الحضن لمدة 5 ايام (اوكسجين ملغ/ل)	100	25
الحاجة الكيميائية للاوكسجين (اوكسجين ملغ/ل)	250	125
اجمالي الحديد (Fe) (ملغ/ل)	5	5
اجمالي الرصاص (Pb) (ملغ/ل)	0.5	0.5
اجمالي الزئبق (Hg) (ملغ/ل)	0.05	0.05
اجمالي الزنك (Zn) (ملغ/ل)	5	5
اجمالي القصدير (Sn) (ملغ/ل)	2	2
اجمالي الكروم (Cr) (ملغ/ل)	2	2
اجمالي النحاس (Cu) (ملغ/ل)	1.5	0.5
اجمالي النيكل (Ni) (ملغ/ل)	2	0.5
الومينيوم (A1) (ملغ/ل)	10	10
امونيا (+NH4) (ملغ/ل)	10	10
انتيمون (اثميد) (Sb) (ملغ/ل)	0.3	0.3
اجمالي الفوسفور (فوسفور ملغ/ل)	16	10
اجمالي الكربون العضوي (ملغ/ل)	75	75
اجمالي النيتروجين (ازوت) (ملغ/ل)	40	30
باريوم (Ba) (ملغ/ل)	2	2
بكتيريا كوليفورم بالحضن على 37 درجة مئوية في 100مل	2000	2000
دليل الفينول (ملغ/ل)	0.3	0.3
زرنيخ (As) (ملغ/ل)	0.1	0.1
زيت وشحم (ملغ/ل)	30	30
سالمونيلا	غياب كامل	غياب كامل
سولفات (-- SO4) (ملغ/ل)	1000	1000
سولفيد (--S) (ملغ/ل)	1	1
سيانيد (-CN) (ملغ/ل)	0.1	0.1
فضة (Ag) (ملغ/غ)	0.1	0.1
فليوريد (-F) (ملغ/ل)	25	25

فوسفات (--- PO4) (ملغ/ل)	5	5
كادميوم (Cd) (ملغ/ل)	0.2	0.2
كروم سداسي التكافؤ (Crvi) (ملغ/ل)	0.5	0.2
كلور نشط (Cl2) (ملغ/ل)	1	1
كوبلت (Co) (ملغ/ل)	0.5	0.5
منغنيز (Mn) (ملغ/ل)	1	1
مركبات هيدروكربونية (ملغ/ل)	20	20
منظفات (ملغ/ل)	3	3
مواد صلبة عالقة (ملغ/ل)	200	60
نترات (NO3) (ملغ/ل)	90	90
AOX (المركبات الهالوجينية العضوية)	5	5

4 مجموع نيتروجين كجلداهل (نيتروجين عضوي+ امونياك) ونيتروجين نيتراتي (NO3) ونيتريتي (NO2).
5 للنفايات المصرفة على مقربة من مياه الاستحمام وجب اعتماد قيم حدية بيئية اكثر صرامة.

ملحق 5: القيم الحدية البيئية للمياه المبتذلة عند صرفها في شبكة الصرف الصحي

يبين العمود الاول مؤشر التلوث، ويعطي العمود القيم الحدية للمنشآت القائمة والجديدة.
يمكن لاصحاب العلاقة بصرف النفايات السائلة في شبكات الصرف الصحي ان يتفقوا على نطاق من قيم حدية بيئية لهذا الامر وذلك بالتعاون مع الفريق العامل في محطة المعالجة طالما ان القيم الحدية البيئية سوف تحترم وتطبق على المياه الخارجة من هذه المحطة.

القيم الحدية البيئية للمياه المبتذلة عند صرفها في شبة الصرف الصحي

1	2
المؤشر	القيم الحدية البيئية للمنشآت القائمة والجديدة
الاس الهيدروجيني pH	9-6
الحرارة	35 درجة مئوية
الحاجة البيولوجية للاوكسجين 6 بعد الحضن لمدة 5 ايام (اوكسجين ملغ/ل)	125
الحاجة الكيميائية للاوكسجين 7 (اوكسجين ملغ/ل)	500
اجمالي الحديد (Fe) (ملغ/ل)	5
اجمالي الرصاص 8 (Pb) (ملغ/ل)	1
اجمالي الزئبق (Hg) (ملغ/ل)	0.05
اجمالي الزنك 9 (Zn) (ملغ/ل)	10
اجمالي القصدير (Sn) (ملغ/ل)	2
اجمالي الكروم (Cr) (ملغ/ل)	2
اجمالي النحاس 10 (Cu) (ملغ/ل)	1
اجمالي النيكل 11 (Ni) (ملغ/ل)	2
الومينيوم (A1) (ملغ/ل)	10
امونيا 12 (+ NH4) (ملغ/ل)	-

6 افتراض تركيز 25 (ملغ/ل) عند المنفذ وقدرة تنظيفية 80%
7 افتراض تركيز 125 (ملغ/ل) عند المنفذ وقدرة تنظيفية 75%
8 القيمة الحدية البيئية 0.5 ملغ/ل عند منفذ محطة المعالجة.
9 القيمة الحدية البيئية 5 ملغ/ل عند منفذ محطة المعالجة
10 القيمة الحدية البيئية 0.5 ملغ/ل عند منفذ محطة المعالجة
11 القيمة الحدية البيئية 0.5 ملغ/ل عند منفذ محطة المعالجة
12 افتراض الاتصال بمحطة بيولوجية. فعالية 70 -80%، القيمة الحدية البيئية عند المنفذ 15 ملغ/ل نيتروجين

1	2
المؤشر	القيم الحدية البيئية للمنشآت القائمة والجديدة
انتيمون (الاثميد) (Sb) (ملغ/ل)	0.3
اجمالي الكربون العضوي (ملغ/ل)	750
اجمالي النيتروجين 13 (ملغ/ل)	60
اجمالي فوسفور 14 (فوسفور ملغ/ل)	10
باريوم (Ba) (ملغ/ل)	2
دليل الفينول (ملغ/ل)	5
زرنيخ (As) (ملغ/ل)	0.1
زيت وشحم (ملغ/ل)	50
سلمونيلا	غياب كلي
سولفا (-- SO4) (ملغ/ل)	10.000
سولفيد (--S) (ملغ/ل)	1
سيانيد (-CN) (ملغ/ل)	1
فضة (Ag) (ملغ/ل)	0.1
فليوريد (-F) (ملغ/ل)	15
فوسفات 15 (--- PO4) (ملغ/ل)	-
كادميوم (Cd) (ملغ/ل)	0.2
الكروم السداسي التكافؤ (Crvi) (ملغ/ل)	0.2
كوبلت (Co) (ملغ/ل)	1
مركبات هيدروكربونية (ملغ/ل)	20
المنغنيز (Mn) (ملغ/ل)	1
مواد صلبة عالقة (ملغ/ل)	600
نيترات 16 (NO3) (ملغ/ل)	-
AOX (المركبات الهالوجينية العضوية)	5

13 افتراض الاتصال بمحطة معالجة بيولوجية. فعالية 70 - 80% القيمة الحدية البيئية عند المنفذ 15 ملغ/ل نيتروجين
14 افتراض تركيز 2 (ملغ/ل) عند المنفذ وقدرة تنظيفية 80%
15 على ان تحترم القيمة الحدية البيئية لاجمالي الفوسفور
16 على ان تحترم القيمة الحدية البيئية لاجمالي النيتروجين.

ANNEX 5: Extract of decree DECREE 5509 dated August 11, 1994

المرسوم رقم 5509 تاريخ 1994/8/11

الشـروط التنظيميــة العامــة

لمحطات توزيع المحروقات السائلة من الصنفين الاول والثاني

محطات توزيع المشتقات النفطية فوق سطح الارض

1/7 التعريف

يطلق اسم محطة محروقات سائلة على جميع الانشاءات التي يتم فيها تموين المركبات الآلية بالمحروقات السائلة بواسطة اجهزة توزيع ثابتة متصلة بخزانات مطمورة تحت سطح الارض.

2/7 الموقع

تنشأ محطات توزيع المحروقات السائلة فوق سطح الارض على ان لا يعلوها أي بناء سكني او تجاري او صناعي .

3/7 تصنيف المحطات

تصنف محطات توزيع المحروقات السائلة الى فئتين:

<u>1/3/7 محطات فئة اولى:</u>

يجب ان تتوفر في هذه الفئة،الشروط التالية:

1/1/3/7- يجب ان لا تقل مساحة العقار عن 500 مترا مربعا وذات واجهة على الطريق العام لا تقل عن 30 مترا.

في حال تركيز المحطة على زاوية شارعين او اكثر يجب ان لا تقل احدى الواجهات عن 30 مترا.

2/1/3/7- لا يسمح بتخزين كميات اجمالية للمحروقات السائلة تتعدى 125000 ليترا.

3/1/3/7- يجب توفر التجهيزات اللازمة لعمليات غسيل وتنظيف وتشحيم وغيار زيت المركبات الالية .

4/1/3/7- يجب انشاء بيت خلاء للعموم عدد 2.

يسمح في هذه الفئة من المحطات بمزاولة الاعمال التالية :

- بيع قوارير الغاز السائلة سعة 10 كلغ على ان لا يتعدى مخزونها عن 20 قارورة يوميا ويجب ان تخزن هذه القوارير في الطابق الارضي وفي مكان بمستوى سطح الارض الخارجية وبتهوئة كاملة وعلى مسافة لا تقل عن 10 امتار عن اجهزة التوزيع ومكان التعبئة.
- تصليح وبيع اطارات المركبات الالية .

- استثمار مرآب للمركبات الالية.
- بيع قطع الغيار وكافة لوازم المركبات الالية.
- انشاء واستثمار ميني ماركت ضمن الشروط التالية:

- بناء من طابق ارضي فقط لا تتعدى مساحته 50 مترا مربعا على الا يتعارض مع قوانين التنظيم المدني.
- يبعد هذا البناء عشرة امتار على الاقل عن تجهيزات المحطة ويجهز بمدخل جانبي وبموقف خاص لاربعة مركبات على الاقل.
- يمنع في هذا المحل بيع أي سلع او مأكولات غير معلبة او غير مغلفة.
- يمنع استعمال أي تجهيزات او معدات تولد شعلة مكشوفة.

2/3/7 محطات فئة ثانية:

يجب ان تتوفر في هذه الفئة الشروط التالية:

1/2/3/7- يجب ان لا تقل مساحة العقار عن 200مترا مربعا وذات واجهة على الطريق العام لا تقل عن 20 مترا.

2/2/3/7- لا يسمح بتخزين كمية اجمالية للمحروقات السائلة تتعدى 75000 ليترا وعلى ان لا تتعدى سعة الخزان الواحد 25000 ليترا.

3/2/3/7- يجب انشاء بيت خلاء للعموم عدد 2.

4/7 شروط العقار

1/4/7- يمنع انشاء محطة توزيع محروقات سائلة على مسافة تقل عن 50 مترا من الابنية العامة والمدارس والمستشفيات والملاهي ودور العبادة والمطاعم ودور السينما.
تحسب المسافة اعلاه بين اقرب نقطتين من العقارين.

2/4/7- يمنع انشاء محطة على الطريق في الجهة المقابلة لطريق متفرعة عنها وفي هذه الحالة يسمح بانشاء محطة محروقات على ان يبعد اولها 50 مترا زائد نصف عرض الطريق الفرعية .

3/4/7- يمنع انشاء محطة محروقات سائلة قبل او بعد مكان مرتفع ما لم يمتد النظر منها الى مسافة تزيد على مئة متر على الاقل في الاتجاهين .
تحسب هذه المسافة بامتداد النظر على طول محور الطريق .

4/4/7- يمنع انشاء محطة محروقات سائلة على جانبي طريق سيار (اوتوستراد).

5/4/7- يسمح فقط بانشاء محطة محروقات سائلة على طريق متفرعة عن الاوتوستراد ذات مدخل ومخرج خاص على ان تكون واجهة المحطة مفتوحة فقط على الطريق المتفرعة من الاتوستراد .

5/7 التركيز داخل المحطة:

1/5/7- ينشأ بناء المحطة وفقا للقوانين العامة للتنظيم المدني شرط ان لا يزيد البناء على طابقين فقط طابق ارضي يستعمل لجميع الاعمال التجارية المسموح مزاولتها في المحطة وطابق اول يستعمل مكاتب لادارة المحطة وغرف لاستراحة العمال.

2/5/7- يمنع تركيز خزانات المحروقات السائلة ضمن التراجع القانوني وفي مطلق الاحوال يجب ان لا تقل المسافة بين الخزانات وحدود عقار المحطة عن 2.5 مترا ويعتبر التراجع القانوني حدود العقار .

3/5/7- تركز اجهزة توزيع المحروقات السائلة سواء كانت ثابتة على سطح الارض او معلقة بسقف الشمسية او المظلة على مسافة

لا تقل عن 3 امتار عن حدود التراجع المطلوب من جهة واجهة المحطة وعلى مسافة لا تقل عن 2.5 مترا عن حدود
عقار الجار على ان لا تتعارض هذه المسافات مع قوانين التنظيم المدني .
4/5/7- يسمح فقط في كل قاعدة اوجزيرة بتركيز جهازي توزيع بخرطومين لكل منهما او اربعة اجهزة توزيع بخرطوم واحد .
5/5/7- يجب تأمين مسافة لا تقل عن 7 امتار بين قاعدتي توزيع مركزتين على خطين متوازيين .
6/5/7- يجب تأمين مسافة لا تقل عن 6 امتار بين قاعدتي توزيع مركزتين على صف واحد .
7/5/7- يجب تأمين ممر للمركبات الالية بعرض 3 امتار على الاقل اعتبارا من حائط قاعدة جهاز التوزيع لكل جهة تعتمد لتموين
المركبات لالية .
8/5/7- يجب تأمين مسافة لا تقل عن مترين بين جهازي توزيع مركزين على صف واحد .
9/5/7- تنشأ الشمسية او المظلة وفقا لقوانين التنظيم المدني سواء كانت من الخرسانة المقواة من الفولاذ.
10/5/7- تخصص كل محطة بمدخل ومخرج للمركبات الالية بعرض لا يقل عن 6 امتار للفئة الاولى و4 امتار للفئة الثانية.
11/5/7- ينشأ مركز تموين المحطة بما فيه موقف الصهريج عند الطرف الداخلي للعقار على مسافة لا تقل عن 5 امتار عن مداخل
ومخارج المحطة وعن ممرات المركبات الالية وعن اجهزة التوزيع وعن حدود العقار .
12/5/7-يخصص التراجع القانوني العائد لواجهة المحطة لانشاء حديقة زهور ذات تصوينة ويمنع بالتالي منعا باتا استعمال هذا
التراجع لمرور او توقيف المركبات الالية.

6/7 الشروط التقنية

1/6/7- تركز الخزانات في حفرة تحت سطح الارض ذات ارضية وجدران من الخرسانة المقواة المعالجة بمواد مانعة للنش
والتسرب ويجب ان تتحمل هذه الجدران ضغط التراب الخارجي .
2/6/7- يثبت الخزان تثبيتا محكما على ارتفاع لا يقل عن 10 سم عن ارضية الحفرة .
3/6/7- يجب تأمين فراغ لا يقل عن 30 سم بين جدران الحفرة وجوانب الخزان.
4/6/7- يملأ الفراغ حول الخزان وحتى سقف البلاطة برمل او بحصى ناعمة.
5/6/7- تغطى هذه الحفرة ببلاطة من الخرسانة المقواة تبعد مسافة لا تقل عن 30 سم عن سطح الخزان .

6/6/7- يصنع الخزان :
- بصفائح فولاذ بسماكة لا تقل عن 4 مم ،ويطلى من الخارج بمواد مانعة للصدأ والتآكل .
- وبمادة الياف الزجاج (الفيبر غلاس) المقوى وفقا للمواصفات المحددة في ASTM ,ASME .

7/6/7- يخضع الخزان قبل طمره بالرمل او بالحصى الناعمة لفحص ضغط هوائي او مائي للتأكد من قوة احتماله ومن عدم وجود
أي تسرب او زربان ويجب الا يقل هذا الضغط عن 0.1 ميغا باسكال لمدة عشرة دقائق .
8/6/7- ينفذ هذا الفحص من قبل معهد البحوث الصناعية او بواسطة شركة متخصصة ومعتمدة على ان يصدر شهادة رسمية بنتيجة
الفحص ترفع الى المراجع المختصة .
9/6/7- تركز انابيب الفولاذ التي تؤمن سحب المشتقات النفطية من الخزانات الى اجهزة التوزيع تحت سطح الارض وتطلى بمواد
مانعة للصدأ والتآكل ويؤمن لها انحدار يعادل 2% على الاقل اعتبارا من مركز اجهزة التوزيع.
10/6/7- يمكن استعمال انابيب من الياف الزجاج (الفيبر غلاس) المقوى وفقا المواصفات -2996-2310 .2992-ASTM-D
11/6/7- يجب ان يرتفع انبوب سحب المشتقات المركز داخل الخزان مسافة لا تقل عن 7 سم عن قعر الخزان تلافيا لسحب رواسب
المشتقات النفطية .

12/6/7- يجهز كل خزان من الاعلى بفتحة تنظيف بقطر 56 سم على الاقل ولا يزيد ارتفاع عنقها على 12 سم وتقفل بغطاء محكم.
13/6/7- يجهز كل خزان بفتحة لقيس كمية المحروقات المخزونة بواسطة مسبار من معدن خاص لا يولد شرارة عند الاحتكاك .
علما بانه يمكن اعتماد أي جهاز متطور مقبول من السلطات اللبنانية لقيس كمية المخزون .
14/6/7- يجهز كل خزان بفتحة خاصة لاجراء فحص الضغط .
15/6/7- يجهز كل خزان بانبوب للتهوئة متصل بصمام مزدوج بقطر لا يقل عن 3 سم وبارتفاع لا يقل عن ارتفاع اعلى نقطة في
بناء المحطة يتصل هذا الانبوب بمأخذ تأريض ويعكف طرفه نحو الارض ويركز على هذا الطرف غطاء من نسيج
معدني (DEMISTER) غير قابل للصدأ .
16/6/7- تقفل جميع فتحات الخزانات وانابيب التموين اقفالا محكما بواسطة اغطية لولبية خاصة لا تولد شرارة عند الاحتكاك وتقفل
بواسطة مفتاح .
17/6/7- ينشأ في بلاطة كل خزان فتحة بضلع يساوي تقريبا 40 سم .يركز في هذه الفتحة جميع الفتحات العائدة للخزان (فتحة
صمام انبوب السحب ،فتحة التعبئة ،فتحة القيس) يصنع باب وجوانب هذه الفتحة من الفولاذ وبسماكة تتحمل ثقل المركبات
الآلية ، كما تعالج ارضيتها بمواد مانعة للنش والتسرب وتؤخذ الاحتياطات اللازمة لمنع تسرب المياه الى داخلها .
18/6/7- تنشأ جميع ابنية المحطة بمعدات ومواد غير قابلة للاحتراق وبالتالي يمنع استعمال الخشب واللدائن (بلاستيك) .
19/6/7- يجب ان يذكر سعر كل نوع من المحروقات السائلة داخل جهاز التوزيع على اساس سعر الليتر الواحد .
20/6/7- تركز اجهزة التوزيع على قاعدة من الخرسانة المقواة ذات ارتفاع لا يقل عن 30 سم وتنشأ عوائق حول اجهزة التوزيع
لحمايتها من الارتطام .
21/6/7- يثبت باللحام ، في الفتحة البلاطة ، لوحة حديدية تحمل المعلومات التالية : اسم الشركة صانعة الخزان ، تاريخ الصنع
وسماكة الفولاذ والسعة الاعتبارية وابعاد الخزان واسم الشركة الفاحصة وتاريخ الفحص .

7/7 السلامة العامة :

1/7/7- تأمينا للسلامة العامة يجب التقيد بالشروط التالية اثناء عملية تفريغ المحروقات السائلة من الصهريج في خزانات
المحطة .
2/7/7- تعزل منطقة التفريغ بواسطة حواجز نقالة تبعد مترين عنها وتعتبر منطقة خطرة طيلة عملية التفريغ .
3/7/7- على السائق توقيف الصهريج باتجاه مخرج المحطة كما عليه ايقاف المحرك طيلة عملية التفريغ .
4/7/7- على السائق توقيف مقدمة الصهريج على مسافة لا تقل عن مترين من فوهة تعبئة الخزانات ووضع مساند امام وخلف عجلة
خلفية واحدة على الاقل .
5/7/7- طيلة هذه العملية يجب ان يتواجد السائق مع عامل من المحطة بالقرب من الصهريج لمراقبة عملية التفريغ وتأمين السلامة
العامة في الجوار والتدخل السريع في الحالات الطارئة . لذلك يركز في هذا الموقع مطفأة عدد 2 سعة 6 كلغ .
6/7/7- الزاميا يجب اقفال المحطة خلال عملية التموين في حال عدم توفر مساحة كافية للصهريج ومركز التموين وفقا لما ورد
اعلاه .

7/7/7- يمنع مرور انابيب خطوط الكهرباء داخل حفر الخزانات .
8/7/7- يزود راس خرطوم التعبئة بجهاز من المطاط يغلق باحكام فوهة خزان المركبة الآلية منعا لتسرب ابخرة المشتقات .
9/7/7- يمنع منعا باتا مد خرطوم التعبئة على الارض تفاديا لمرور المركبات الآلية فوقه .
10/7/7- يجب ان يتواجد عامل التعبئة او سائق المركبة قرب فوهة تعبئة المركبة طيلة عملية التموين .
11/7/7- يعلن داخل المحطة وفي عدة امكنة ظاهرة عن وجوب توقيف المحرك واطفاء أي شعلة او قبل الشروع بعملية تموين
المركبة الآلية
12/7/7- توضع لوحات ممنوع التدخين في عدة امكنة ظاهرة .
13/7/7- تجهز كل محطة بعلبة اسعاف اولية .
14/7/7- على كل صاحب محطة اجراء تأمينات ضد كافة المخاطر : الحريق والمسؤولية المدنية والمسؤولية تجاه الغير وحوادث
السير وطوارىء العمل على الا تقل تغطية التأمين عن المبالغ التي تحدد دوريا من قبل السلطات المسؤولة .
15/7/7- يجب تنظيف الخزانات من الرواسب النفطية عند الحاجة ويجب اجراء فحص مقاومتها للانضغاط مرة واحدة على الاقل
سنويا للتاكد من قوة احتمال الخزانات ومن عدم وجود أي تسرب او زربان .
16/7/7- يمنع استبدال وجهة استعمال الخزان قبل الحصول على ترخيص رسمي من وزارة الطاقة والمياه-المديرية العامة للنفط .

8/7 المحافظة على البيئة

1/8/7- يجب ان لا يعيق مخرج ومدخل المحطة جريان مياه الشتاء على جوانب الطرقات .
2/8/7- يجب تجهيز كل محطة بحفرة خاصة SEPARATEUR لفصل مياه غسيل السيارات ومياه تنظيف المحطة من المشتقات
النفطية قبل صرفها الى حفرة الامتصاص .
3/8/7- يمنع طرح الزيوت المستعملة ونفايات الشحوم والمواد النفطية على انواعها في الطبيعة او في حفرة الامتصاص او في
المجرور العام بل يجب تجميعها في مستوعبات خاصة والتخلص منها بطريقة لا تتناقض مع مضمون المرسوم 8735
تاريخ 1974/8/23 الرامي الى المحافظة على النظافة العامة تحت طائلة العقوبات المنصوص عنها في هذا المرسوم .
4/8/7- يجب تجميع النفايات الصلبة والملوثة في مستوعبات او مراكز منيعة على التسرب .

9/7 مكافحة الحريق

1/9/7- يؤمن طيلة مدة دوام العمل في المحطة وجود مسؤول مدرب من قبل الدفاع المدني على تدابير الوقاية وعمليات مكافحة
الحريق .
2/9/7- تجهز كل محطة في اماكن سهلة الوصول ،بكمية من الرمل الجاف قدرها متر مكعب توضع في صندوقين سعة كل صندوق
نصف متر مكعب وبالقرب منهما رفشين لفلش الرمل .
3/9/7- تجهز كل محطة بعدد من المطافىء اليدوية بمعدل مطفأتين لكل خرطوم تعبئة سعة كل مطفأة6 كلغ .كما تجهز منطقة
التفريغ بمطفأة عدد 2 سعة الواحدة 6 كلغ .
4/9/7- تجهز كل محطة من الفئة الاولى بمطفأة كيمائية على عربة عدد 2 سعة 50 كلغ .
5/9/7- تجهز كل محطة من الفئة الثانية بمطفأة كيمائية على عربة عدد 1 سعة 50 كلغ .

6/9/7- تجهز المحلات التجارية داخل المحطة بالعدد المناسب من المطافىء اليدوية بمعدل مطفأة سعة 6 كلغ لكل 20 متر مربع .
7/9/7- تحفظ كافة المطافىء بحالة جيدة ويجري عليها كشفا دوريا من قبل شركة متخصصة .

المستندات المطلوبة (المادة 4 من المرسوم 2289 تاريخ 1979/9/14)
يقدم الطلب الى امانة سر المحافظة على ثلاث نسخ مرفقا بالمستندات والمعلومات التالية :
-1- اسم طالب الرخصة مع صورة عن تذكرة هويته وعنوانه ومحل اقامته ، واذا كان طالب الرخصة شركة فنسخة عن اذاعتها التجارية
-2- موقع انشاء المحطة ورقم العقار والشارع والمحلة .
-3- -أ- خريطة مساحة بمقياس 500/1 تبين موقع المحطة بالنسبة لمحطات ومحلات بيع وتوزيع المحروقات السائلة في العقارات
المجاورة ضمن الحدود الدنيا للمسافات المحددة في المادة الحادية عشرة من المرسوم 79/2289 ،والطرقات والمفارق
والمباني العامة والمسارح ودور السينما والابنية الدينية والمدارس ضمن 150 مترا على الاقل ،على ان تتضمن هذه
الخريطةجميع التخطيطات المصدقة والملحوظة على العقار ترفق بافادة تخطيط من التنظيم المدني لا يعود تاريخها لاكثر من
شهرين .
-ب- الخرائط المطلوبة للحصول على رخصة بناء مع خريطة مقطع بمقياس 100/1 تبين البناء واجهزة التوزيع مع
الخزانات تحت سطح الارض وحدود سطح الطريق والرصيف .
-4- -أ- خريطة تفصيلية بمقياس 100/1 تبين محتويات البناء بكامله مع بيان امكنة اجهزة التوزيع والتمديدات واجهزة ضغط
الهواء وآلات العمل والمداخل والمخارج وموقع الخزانات والتجهيزات الصحية .

-ب- خريطة مقطع تبين سماكة حديد الخزانات وكيفية صنعه وضمان متانته لتحمل كمية المحروقات المخزونة فيه .
-5- بر اءة ذمة من البلدية عن العقار .
-6- براءة ذمة عقارية عائدة للعقار معطاة من الدوائر المختصة في المحافظة لا يعود تاريخها الى اكثر من سنة .
-7- وثيقة رسمية تثبت قانونية اشغال العقار (سند تمليك ، افادة عقارية ، عقد ايجار ، عقد اتفاق) .
-8- افادة تخطيط وتصنيف من الدوائر الفنية في التنظيم المدني .
-9- ايصال من الخزينة يثبت دفع مصاريف التحقيق في الطلب ...

شرط المسافة :
(الفقرة الاولى من المادة 11 من المرسوم رقم 1979/2289 المعدلة بالمرسوم رقم 1982/5394، والتي اعيد العمل باحكامها بموجب المرسوم 6543 تاريخ 1995/3/21)
" مع مراعاة احكام المرسوم رقم 13886 تاريخ 1970/2/21 ،يجب ان لا تقل المسافة بين محطة بيع محروقات سائلة من الصنف الاول وبين محطة اومحل بيع وتوزيع محروقات سائلة عن **/800/ م** (ثمانماية متر) . ويمكن ان تخفض هذه المسافة الى **/600/ م** (ستماية متر اذا كان الانشاء سيتم في منطقتين عقاريتين مختلفتين " .

ANNEX 6: Requirements of the Muncipality for Approving a Gas station Permit

الجمهورية اللبنانية

وزارة الداخلية والبلديات

الترخيص لمحلات ومحطات توزيع المحروقات السائلة
(ان طلب هذا الترخيص يقدم في مركز المحافظة)

المستندات المطلوبة: (مرسوم 79/2289، المادة 4)
طلب موقع من صاحب العلاقة أو من ينوب عنه قانوناً.
اسم طالب الرخصة مع صورة عن تذكرة هويته وعنوانه ومحل إقامته وإذا كان طالب الرخصة شركة فنسخة عن إذاعتها التجارية.
موقع إنشاء المحطة ورقم العقار والشارع والمحلة.
الخرائط:
- خريطة بمقياس 500/1 تبين موقع المحطة بالنسبة لمحطات ومحلات بيع وتوزيع المحروقات السائلة في العقارات المجاورة.
- الخرائط المطلوبة للحصول على رخصة البناء مع خريطة بمقياس 100/1 تبيين البناء وأجهزة التوزيع مع الخزانات تحت سطح الأرض وحدود سطح الطريق والرصيف.
- خريطة تفصيلية بمقياس 100/1 تبين محتويات البناء بكامله مع بيان امكنة أجهزة التوزيع والتمديدات وغيره.
- خريطة مقطع تبين سماكة حديد الخزانات وكيفية صنعه وضمان متانته لتحمل كمية المحروقات المخزونة فيه.
براءة ذمة عقارية لا يعود تاريخها لأكثر من سنة.
وثيقة رسمية تثبت قانونية إشغال العقار(سند تمليك– افادة عقارية– عقد ايجار– عقد اتفاق).
إيصال من الخزينة يثبت دفع مصاريف التحقق في الطلب وقدرها 500.000 ل.ل فئة اولى و400.000 ل.ل فئة ثانية.
افادة تخطيط من التنظيم المدني لا يعود تاريخها لاكثر من شهرين.

ملاحظة: إن هذه المعاملة يجب أن تقترن بموافقة المجلس البلدي المختص قبل إعادتها إلى المحافظ.

الرسوم المتوجبة: قانون رقم 88/60 المادة 51 (قانون الرسوم والعلاوات البلدية وتعديلاته) والمرسوم الاشتراعي رقم67/67، الجدول رقم1 و2 (رسم الطابع المالي وتعديلاته) والقانون رقم 93/221
الحد الأقصى
رسم الترخيص لمحلات ومحطات توزيع المحروقات السائلة: 200,000 ل.ل.
رسم التعمير : رسم اضافي على رسم ترخيص استثمار محطات توزيع المحروقات السائلة 15 %.
رسم الاستثمار السنوي عن كل عداد: 100,000 ل.ل.
رسم طابع مالي (إنشاء): 750,000 ل.ل
رسم طابع مالي (استثمار) 25,000 ل.ل.
رسم التحقيق يدفع لخزينة الدولة الفئة الأولى: 500،000 ل.ل.
الفئة الثانية: 400،000 ل.ل.
مهلة الإنجاز: مرسوم اشتراعي 21/ل، سنة 1932، المادة 7 و9. : اربعة اشهر ما عدا المهلة التي تأخذها المعاملة امام اللجنة الصحية.

ملاحظات: قرار LR /75 سنة 1940 المواد 9 -16 و 30 و مرسوم 5509/ 94 المادة 6.
لا يجوز لأحد أن يخزن محروقات سائلة برسم البيع بالمفرق ما لم يحصل على رخصة من المحافظ.

يزول مفعول القرار المرخص فيه بفتح محل لبيع المحروقات السائلة اذا لم يفتح المحل خلال سنة او إذا لم يستثمر خلال سنتين متواليتين.
لا يجوز أن تحتوي الأبنية التي تقام في محطة توزيع إلا على طابق أرضي وطابق أول يستعمل مكاتب للمحطة. يجب أن تجري جميع العمليات المرخص بإجرائها في أبنية المحطة خارج حدود الطريق العمومية.
تطبق الشروط التنظيمية العامة لمجمعات المشتقات النفطية السائلة وصهاريج النقل ومحطات التوزيع وتخزين وتعبئة المحروقات المسيلة اعتباراً من تاريخ نشر هذا المرسوم في الجريدة الرسمية. وفقاً للجدول رقم 1 الملحق بالمرسوم 94/5509. (مرسوم 94/5509، المادة 1).

الجمهورية اللبنانية
وزارة الداخلية والبلديات

6

محافظة :
قضاء :
بلدية :

إستمارة ترخيص لمحلات ومحطات توزيع المحروقات السائلة

تاريخ تقديم طلب الترخيص :_____ رقمالرخصة :_____

إسم المكلف:_____ صفة المكلف* :_____
رقم الهوية / السجل التجاري:_____
عنوان المكلف :_____ رقم الهاتف_____

المنطقة العقارية:_____ رقم العقار :_____ رقم القسم :_____
العنوان :_____

إسم الشركة :_____
رسم الترخيص :_____ قيمة رسم الإستثمار السنوي عن كل عداد :_____
عدد العدادات :_____
تاريخ بدء الإستثمار :_____ تاريخ انتهاء الإستثمار:_____

رسم الإستثمار / السنوي:_____ **رسم التعمير:**_____

رقم المكلف :_____ رقم الإستمارة :_____
رقم البيان :_____ تاريخ البيان :_____
رقم الإيصال :_____ تاريخ الإيصال :_____
إسم مدخل المعلومات :_____ تاريخ إدخال المعلومات :_____
إسم معبئ الإستمارة :_____ إمضاء معبئ الإستمارة :_____

16- مؤسسة ذات منفعة عامة 11- قاضي 12-جمعية تعاونية 13-بلدية 14-طائفة معترف بها 15-جمعية 16-مؤسسات لا تتوخى الربح 17-جمعيات الخدمات الاجتماعية 18-جمعيات رعاية المعوقين

الجمهورية اللبنانية
وزارة الداخلية والبلديات
كيفية تعبئة الإستمارة

إستمارة ترخيص لمحلات ومحطات توزيع المحروقات السائلة (6)

أ- تاريخ المعاملة

تاريخ تقديم طلب الترخيص: يذكر تاريخ تقديم طلب الترخيص.
رقم الرخصة: يذكر رقم الرخصة.

ب- معلومات عن المكلف

إسم المكلف: يذكر إسم الشاغل.

صفة المكلف: تذكر الصفة الموافقة لأحد الأرقام التالية: من 1 إلى 18 حسب الشرح الوارد في أسفل الاستمارة أمام نجمة واحدة.

رقم الهوية / السجل التجاري: في حال كان المكلف فرد يذكر رقم الهوية إذا أمكن أما إذا كان المكلف مؤسسة أو شركة يذكر رقم السجل التجاري.

عنوان المكلف: يذكر عنوان المكلف الحالي أي العنوان الذي يتلقى مراسلاته عليه.

رقم الهاتف: تذكر أرقام الهاتف التي تمكن من الاتصال بالمكلف.

ج- معلومات عن العقار

المنطقة العقارية: يذكر إسم المنطقة العقارية التي يقع فيها العقار.

رقم العقار: هو رقم العقار حسب الصحيفة العينية للعقار.

رقم القسم: في حال تم إفراز العقار إلى أقسام، يذكر رقم القسم المقصود.

العنوان: يقصد به عنوان العقار، البلدة، الحي، الشارع، رقم البناء إذا وجد أو أي دلالة للعقار كإسم البناء أو غيره.

د- معلومات خاصة بالرسم

تملئ الخانات التالية فقط:

إسم الشركة: يذكر إسم الشركة التي توزع المحروقات السائلة أو التي تستثمر هذا المحل أو المحطة.

عدد العدادات: يذكر عدد العدادات المستعملة في أجهزة التوزيع.

تاريخ بدء الإستثمار: يذكر تاريخ بدء الإستثمار.

تاريخ انتهاء الإستثمار: يذكر تاريخ انتهاء الإستثمار.

ANNEX 7: MEDCO GASOIL COMPOSITION

The present standard defines the characteristics of Gasoil.		
PROPERTY	LIMITS	METHOD
Density at 15 °C	0.876 Kg/l max.	D-1298
Color	Red	
Kinematic Viscosity at 40 °C, cSt	3.5 cst max	D-445
Kinematic Viscosity at 40 °C, cSt	1.9 cst min	D-445
Flash point Pensky Martens, °C	Min 55	D-93
Cloud point	+2 °C max	D-2500
Pour Point	-9 °C max	D-97
Distillation 250 °C	65% max. (vol)	D-86
Sulfur % Mass	0.5% max. (wt)	D-129
Water	0.1% max. (vol)	D-95
Sediments	0.01% max. (wt)	D-473
Water + Sediments	0.1% max. (vol)	D-1796
Carbon Residuc (conradson)	0.35% max.(vol)	D-189
Sodium + Potassium (NA+ K)	0.5 ppm max. (wt)	D-1318
Lead (Pb)	1 ppm max.	
Vanadium (V)	0.5 ppm max.	D-1548
Calcium (Ca)	1 ppm max	
Zinc (Zn)	2 ppm max.	
Ash content	100 ppm max	D-482
Lower Heating Value (LHV)	41500 Kj/kg min	D-240

Source : http://www.medco.com.lb/gazoil.aspx

ANNEX 8: MEDCO's Gasoline 98 octane Composition

The present standard defines the characteristics of Automotive Gasoline.			
PROPERTY	LIMITS		METHOD
Research Octane Number	Min 98		ASTM D-2699
Motor Octane Number	Min. 87		ASTM D-2700
Lead, g/L	Max 0.005		ASTM D-3237
Benzene, % v/v	Max. 5.0		ASTM D- 3606 or D-5580
Methanol, % v/v	Max. 3.0		ASTM D- 4815
Ethanol, % v/v Max. 5.0	Max. 5.0		ASTM D- 4815
Isopropyl Alcohol % v/v Max. 5.0	Max. 5.0		ASTM D- 4815
Tertiary Butyl Alcohol % v/v Max. 7.0	Max. 7.0		ASTM D- 4815
Ethers containing five or more C atoms % v/v	Max. 10.0		ASTM D- 4815
Other organic Oxygenates % v/v	Max 7.0		ASTM D- 4815 or D-5599
Total Organic Oxygen % m/m	Max. 2.5		Calculated
Sulfur % m/m Max. 0.05	Max. 0.05		ASTM D- 2622
Distillation at 760mm Hg, evaporated: At 70 °C, % v/v At 100 °C, % v/v At 180 °C, % v/v Final boiling point, °C Residue, % v/v	10 - 15 40 - 70 Min 85 Max. 215 Max. 2		ASTM D-86
Reid Vapor pressure at 37.8 °C, KPa	Summer Max 65	Winter Max 80	ASTM D- 4953
Volatility (10 VP + 7 evaporated 70)	Summer Max 965	Winter Max 1115	Calculated
Copper corrosion, (3 hrs@ 50 °C)	Max. 1		ASTM D- 130
Existent gum, mg/100 ml	Max. 5		ASTM D- 381
Oxidation stability, minutes	Min. 360		ASTM D- 525
Color	Light Blue		Visual
Density at 15°C, Kg/m^3	Min 720		ASTM D- 1298

Source : http://www.medco.com.lb/Gazoline98.aspx

ANNEX 9: MEDCO's Gasoline unleaded 95 Octane Composition

The present standard defines the characteristics of Automotive Gasoline.			
PROPERTY	LIMITS		METHOD
Research Octane Number	Min 95		ASTM D-2699
Motor Octane Number	Min. 85		ASTM D-2700
Lead, g/L	Max 0.013		ASTM D-3237
Benzene, % v/v	Max. 5.0		ASTM D- 3606 or D- 5580
Methanol, % v/v	Max. 3.0		ASTM D- 4815
MTBE % v/v	Max. 10.0		ASTM D- 4815
Total Organic Oxygen % m/m	Max. 2.0		Calculated
Sulfur % m/m	Max. 0.05		ASTM D- 2622
Distillation at 760mm Hg, evaporated: At 70 °C, % v/v At 100 °C, % v/v At 180 °C, % v/v Final boiling point, °C Residue, % v/v	Min. 10 40 - 70 Min 85 Max. 215 Max. 2		ASTM D-86
Reid Vapor pressure at 37.8 °C, KPa	Summer Max 65	Winter Max 80	ASTM D- 4953
Copper corrosion, (3 hrs@ 50 °C)	Max. 1		ASTM D- 130
Existent gum, mg/100 ml	Max. 5		ASTM D- 381
Oxidation stability, minutes	Min. 360		ASTM D- 525
Color	Light Green		Visual
Density at 15°C, Kg/m^3	0.730 – 0.780		ASTM D- 1298

Source: **http://www.medco.com.lb/Gazoline95.aspx**

ANNEX 10: MEDCO's Automotive Diesel oil Composition

The present standard defines the characteristics of Diesel oil to be used as Automotive Fuel.		
PROPERTY	LIMITS	METHOD
Flash point Pensky Martens, °C	Min 55	ASTM D-93
Water and sediment by centrifuge, % vol	Max 0.05	ASTM D-2709
Cold Filter Plugging point, °C	Max -5 (Nov-March inclusive) Max 0 (April-Oct inclusive)	IP-309
Distillation temperature, at 760mm Hg, recovered: At 250 °C, vol % At 350 °C, vol% At 370 °C, vol%	 Max 65 Min 85 Min 95	ASTM D-86
Kinematic Viscosity at 40 °C, cSt	Min 2.00 Max 4.50	ASTM D-445
Color	Orange	Visual
Ash % Mass	Max 0.01	ASTM D-482
Sulfur % Mass	Max 0.035	ASTM D-2622
Corrosion, copper strip (3 hrs at 50 °C)	Max 1	ASTM D-130
Cetane Number	Min 49	ASTM D-613
Cetane Index	Min 46	ASTM D-976 or D-4737
Ramsbottom Carbon Residue (on 10% residuum), % wt	Max 0.3	ASTM D-524
Density at 15 °C, Kg/m^3	820-860	ASTM D-4052
Oxidation stability, g/m^3	Max 25	ASTM D-2274

Source : http://www.medco.com.lb/DieselOil.aspx

ANNEX 11: Photos

Photo 1: Gas station installed inside a grocery and a residence, located on a road turn

Photo 2: Gas station uncompleant to any kind of consideration or guidelines (public health, public safety, urban planning, etc)

Photo 3: No umbrella to protect diesel oil distributors from rainfall waters…

Photo 4: Gas station selling fuel 95 and 98 octane including only one fuel storage reservoir

Photo 5: Gas station including a drainage system able to collect carwash waters. However, the laters are conveyed to a hole leading to a leaking cesspit on the opposite side of the location.

Photo 6: Hole in the wall and carwash waters flowing towards a cesspit instead of towards the existing separators.

Photo 7: Opening of the cesspit collecting carwash effluents, located on a road's limits.

Photo 8: If this is the status of the visible spills and leaks at this gas station, what would be the status of its USTs?

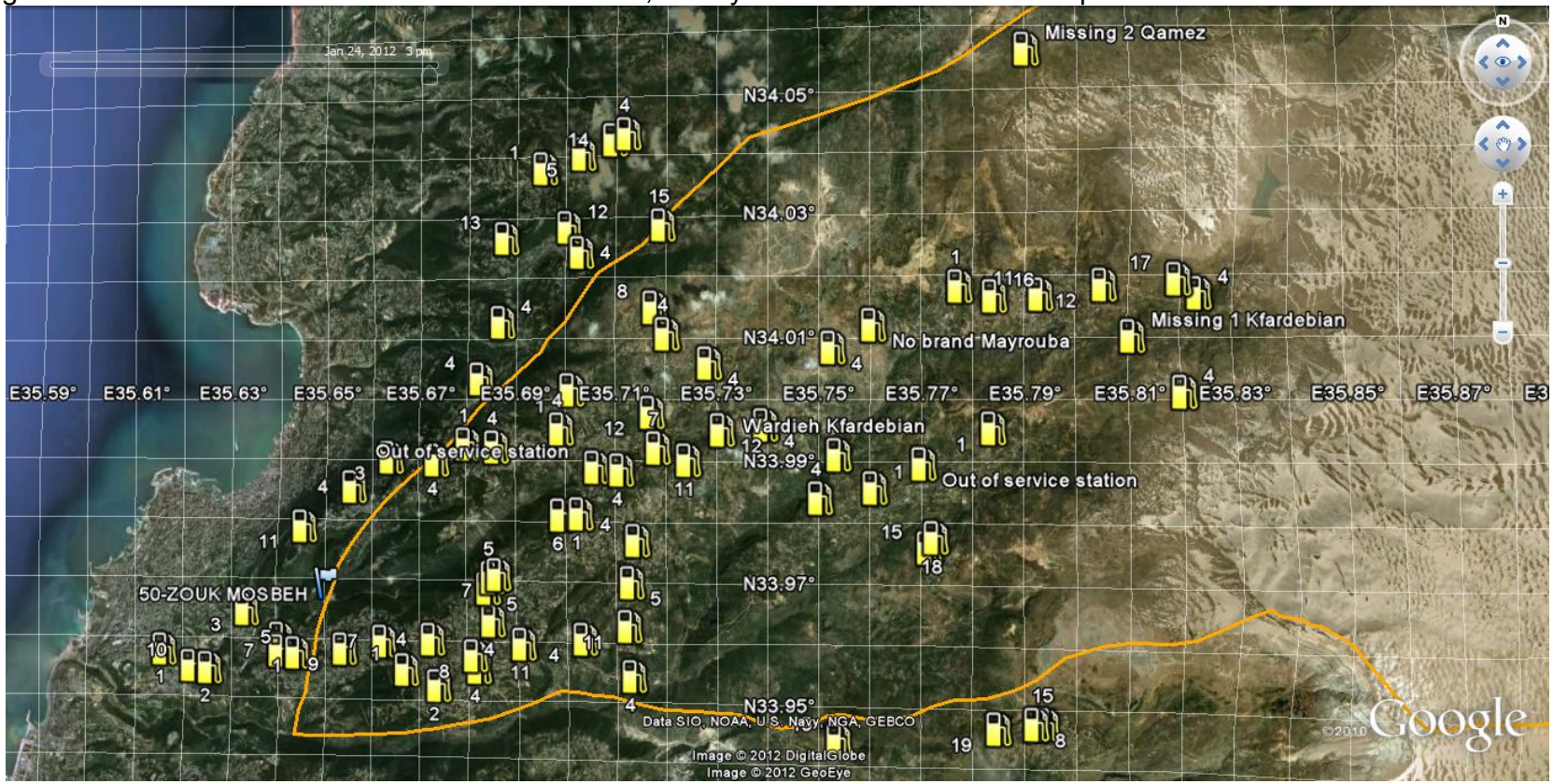
Photo 10: Hole in the wall leading to a leaking cesspit used to evacuate lube change cleaning effluents at a gas station located in the Jeita groundwater Catchment, and piece of cloth contaminated by oil spills.

Photo 10: Buffer distance to residences= Zero?

Photo 11: Uncoated pipes commonly used in gas stations in Lebanon, leading to frequent breaks and fuel leakages.

ANNEX 12: Gas stations locations in the Jeita groundwater catchment

Showing the existence of 83 sations in an area of 406 km^2, mainly concentrated in the lower part of the catchment



1= Medco, 2= Total, 3= Hypco, 4= United, 5= Coral, 6= Phoenicia, 7= Mobil, 8= Lalipco, 9= Malapco, 10= Liquigas, 11= IPT, 12= ENJM, 13= Epco, 14= Metra, 15= Jirco, 16= Narco, 17= Levant oil, 18= Effimax, 19= No brand