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OVERVIEW ON THE LEBANESE ENVIRONMENTAL GOVERNANCE SYSTEM: MAIN HAZARDS IN THE OIL AND GAZ SECTOR

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Abstract

Due to harsh environment and vulnerability of marine ecosystems, many challenges are faced regarding offshore oil and gas activities. Many steps are currently undertaken to overcome such challenges.

As Lebanon is inside the new oil and gas sector in its offshore region, plans should be made to address environmental challenges that may occur in this sector. The Lebanese environmental governance system meets international standards in various aspects but some gaps are addressed to manage such risks that may be encountered with oil and gas activities in the Lebanese offshore. This article ends by a fast run through environmental regulatory authority, environmental legislations, risk assessments and environmental permits.

Keywords

Middle East, Lebanon, Oil and Gas, Environment, Risks and Management, Hazards, Governance System, Legislations and Regulations

1. INTRODUCTION

In Lebanon, many existing legislations cover the majority of environmental issues related to the oil and gas sector but some requirements are missed like drilling fluid and cuttings management and disposal, produced water, and NORM wastes, which are the main pollutant streams that arise from the offshore petroleum sector.

These missed issues can be overcome by completing the environmental legislation framework with additional important decisions that clearly delineate the roles of relevant Lebanese institutions in environmental management and strengthen the capacity of these institutions, especially that of the Ministry of Environment.

2. ENVIRONMENTAL RISKS

A. During Exploration Phase

The major environmental threats encountered by different offshore exploration phase are:

1) Noise effects from seismic and drilling activities

The main environmental threats during exploration phase include the effect of noise generating activities. Sound is transmitted underwater and there is potential for noise produced by seismic sources to have adverse impacts on marine animals. The use of underwater sound is essential for marine mammals to navigate, and communicate effectively. The introduction of any additional noise into the marine environment could potentially interfere with these animals' ability to indicate the presence of predators, food, and underwater land features and as a result could cause short-term behavioral changes.

During exploratory drilling, sound levels resulting from offshore installations are dependent on the type of platform. The installation of Semi-submersible rigs usually creates more radiated sound than fixed installations when using thrusters to maintain position. In addition, helicopters increase localized underwater noise levels. The majority of sound will be reflected off the sea surface and consequently affect animals. Moreover, low frequency noises from drilling wells, and all associated vessels will add to the ambient noise in the exploration area (Richardson et al., 1995, Coull et al., 1998, Gordon et al., 2004, Evans, 1998).

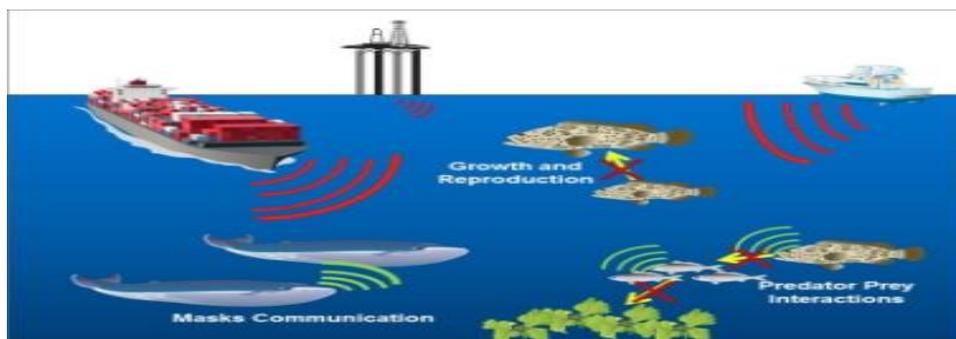


Fig.1: Marine Seismic Survey Noise

2) Risks to human health and the environment from atmospheric emissions

Emissions exhausted from ships include air pollutants, greenhouse gases, and ozone-depleting substances that cause risks to human health and the environment.

The impacts of these emissions are generally mitigated circumstantially by the open and dispersive environment offshore. The main causes of atmospheric emissions from drilling activity will be from drilling rigs and associated vessels and aircraft support. Rigs are powered by diesel engines that emit air pollutants like CO, SO_x, NO_x, particulate matter, volatile organic compounds, and greenhouse gases, primarily CO₂. Support vessels and helicopters will also emit air pollutants from the combustion of diesel and aviation fuel.

3) **Impacts on fishing, shipping, and marine features due to survey vessels and drill and support vessels**

The presence of the drill and the support vessels will interface with other sea users. During exploratory drilling, the exclusion zone surrounding the drilling rig while on site is patrolled by a safety standby vessel. This will cause temporary loss of fishing access and will require other vessels to avoid the area. Furthermore, migrating birds will be disoriented by extreme light sources at night.



Fig.2: Marine Pollution by Ship Vessels

4) **Effects of exploration drilling operations on seawater quality**

Discharges during seismic surveys and exploratory drilling include treated sewage and domestic wastes, deck drainage, and bilge and ballast water. These are subject to MARPOL regulations. Such discharges may affect concentrations of solids suspended, nutrients, chlorine, as well as generating biological oxygen demand. Such discharges are expected to be diluted in the open sea; however, discharges in sensitive areas must be avoided.

During exploration and appraisal wells drilling, drill cuttings and muds require disposal. Cuttings and particulate material from water-based muds used to drill the top-hole sections are deposited on the sea bed near to the wellhead. Cuttings generated from certain sections of a well are polluted with residual drilling muds and associated chemicals.

Chemicals added to drilling muds and to cement may be toxic to marine organisms when discharged therefore needs to be assessed and policies need to be put in place to avoid their negative impacts. In many laws, when oil-based mud or synthetic-based mud is used, discharges are not allowed into the sea and onshore disposal is required.

5) **Hydrocarbon Spills**

When oil is released into a marine environment due to an accidental blowout, it undergoes a number of physicochemical changes, which assist in the degradation of the spill, while others may cause it to persist. Evaporation and dispersion are two main mechanisms that remove oil from the sea surface.

If the spilled oil contains a high percentage of light hydrocarbon fractions, like diesel, a huge part of the spilled oil will evaporate more quickly in comparison to heavier oil. After the light fractions have evaporated from the slick, the degradation process decreases and natural dispersion becomes the prevailing mechanism in reducing slick volume. Water soluble components of the oil will dissolve in seawater, however the immiscible components will either emulsify or disperse as small droplets in the water column or aggregate into tight water-in-oil emulsions. The rate of this emulsification is dependent upon the oil type and the thickness of the oil slick.

One of the areas that are mostly affected after an oil spill is the shoreline. The oil washes up on the beaches leaving the sand, rocks, and plants coated with oily residue. Consequently, wildlife may eat the contaminated vegetation and die.

Moreover, recreational areas that are covered with oil are not appealing to tourists and touristic towns may find themselves in a difficult financial situation.

Property values may drop drastically after an oil spill as well as restaurants, hotels, and retail establishments. After a spill it can take months or years to attract tourists back to an area that has been affected by a spill.



Fig.3: Marine Oil Spill

6) Gas blowout

A gas blowout occurs when a drilling pipe encounters a shallow or a deep pressurized gas zone in the subsurface without being prepared to counter the pressure. This causes the gas or the fluid from the rock layer to enter the drilling pipe and leak toward the surface. Any gas zone penetrated before a blowout preventer installation is called a shallow gas blowout.

As a result, atmospheric emissions may occur as a result of a blowout in an emergency situation. Emissions would be methane with smaller proportions of volatile organic compounds. Carbon dioxide and carbon monoxide will be emitted in many cases and a result causes serious



Fig.4: Gas blowout on Total's Elgin field

B. During Development and Production Phase

During development drilling and production activities many threats exist that endanger wildlife and humans.

1) Atmospheric emissions

Major sources of atmospheric emissions from the operation of rigs will be from power generation on the platform and associated vessels and aircraft. Most of the platform equipment are powered by diesel engines or natural gas that emit air pollutants including CO, NO_x, SO_x, PM, VOCs, and greenhouse gases such as CO₂ and CH₄. Another source of emissions is flaring into the atmosphere. This practice is a major source of wastes, as well as a significant source of GHG emissions.

2) Animals impacted by the physical presence of the production facilities and support vessels

Sea floor-disturbing activities during production facilities installations will re-suspend bottom sediments, crush benthic organisms, and produce turbidity.

The main concern with regard to these impacts is the placement of structures in areas where sensitive benthic communities, coral communities, and areas of special marine biodiversity importance are present.

Production facilities may remain in place for many years. Noise and lights may cause several behavioral changes in marine mammals and sea turtles. Benthic communities may be affected by pipelines presence and sloughing of organic debris.

Like during exploratory drilling, the presence of platforms and support vessels may interact with shipping and marine transport and trade. This will lead to the loss of fishing access, and will require other vessels to avoid the area.

3) Drilling discharge effects on sea floor and water quality

The impacts of drilling discharges during development drilling would be qualitatively similar to those during exploratory drilling. However, the greater number of wells during production increases the severity of benthic. The accumulation of drilling fluids and cuttings on the sea floor will result in changes in bottom contours, grain size, barium concentrations, and concentrations of other metals.



Fig.5: Water Contamination by Spills

The produced water refers to water found in reservoirs along so when oil or gas is extracted, produced water is associated with it. The water produced is a combination of formation water, condensed water, brine, injection water, oil, natural hydrocarbons, inorganic salts, and other chemicals. The discharge of this produced water has the highest portion of wastes arising from offshore hydrocarbon production operations and influences the environment through the drill cuttings and the drilling fluid used to lift the cuttings from the well (Harkouss, 2020).

4) Jiyeh power station oil spill

The Jiyeh Power Station oil spill is an environmental disaster caused by the release of heavy fuel oil into the eastern Mediterranean after storage tanks at the thermal power station in Jiyeh, Lebanon, 30 km south of Beirut, were bombed by the "Israeli" Air force on July 14 and July 15, 2006. The plant's damaged tanks leaked up to 30,000 tons of oil into the eastern Mediterranean Sea, A 10 km wide oil slick covered 170 km of coastline, and threatened Turkey and Cyprus. This slick killed so many fish, threatened the habitat of endangered sea turtles, and potentially increased the risk of cancer.



Fig.6: Jiyeh Oil Spill

Moreover, the spill affected one-third of Lebanon's coastline. Beaches and rocks were covered in a black sludge up to Byblos, north of Beirut and extended into the southern parts of Syria.

A total amount of \$2,919,400 was paid by many donor countries and non-profit organizations to solve the problem. Cleanup work was funded by two countries; Japan through the UNDP and Norway through the Higher Relief Commission in Lebanon. In addition to that, a waste management project was also implemented in order to safely collect and transport the polluting material from the shorelines to temporary storage sites.

As another ecological disaster, not to forget the oil spill that blackened the shores of South Lebanon on 16 February 2021 caused by hundreds of tons of tar coming one more time from the occupational state "Israeli" offshore. These deposits severely impacted Tyre Cost Nature Reserve in Lebanon with around two tons of tar with much of which hidden under the sand. This maritime pollution was described as the worst natural disaster in the Mediterranean Sea from years where important habitats of turtles and other maritime creatures with many coral reefs were heavily destroyed.

3. OIL AND GAS SECTOR BEST INTERNATIONAL PRACTICES FOR ENVIRONMENTAL MANAGEMENT

Several management systems concerning environmental practices for offshore petroleum activities are adopted worldwide. Many countries adopt such regulation like Norway, United States, Ireland, United Arab Emirates and Qatar that can be relied on for Lebanon's case. These management systems include environmental regulatory authority, legislation, environmental risk assessment, environmental permits, monitoring and emergency preparedness and response.

1) Environmental Regulatory Authority

The world over, petroleum producing states have government agencies which oversee extractive operations, each of which has their own set of prerogatives and authority. By assessing such agencies, it is possible to compare and better assess the regulatory regime in Lebanon.

In the United States, the Bureau of Safety and Environmental Enforcement is responsible for the safety and environmental enforcement functions formerly under the Minerals Management Service. The BSEE's functions include the development and enforcement of safety and environmental regulations; permitting offshore exploration, development, and production; oil spill response and training; and environmental compliance programs. BSEE has the authority to inspect, investigate, produce evidence cancel or suspend activities and removal preparedness. The US Environmental Protection Agency has the primary role of enforcing many environmental regulations. It is responsible for regulating certain environmental activities in the Outer Continental Shelf, specifically concerning air quality, water quality, and waste.

Norwegian Environment Agency is responsible for managing Norwegian nature and preventing contamination of the environment. The NEA's work includes monitoring

the state of the environment, exercising authority, overseeing and guiding regional and municipal authorities, cooperating with relevant industry authorities, acting as an expert advisor, and assisting in international environmental efforts.

In Ireland, the Environmental Protection Agency is at the front line of environmental protection and policing. Its primary responsibilities include environmental licensing, enforcement of environmental law, monitoring, and reporting on the environment.

In UAE (Abu Dhabi), the ADNOC acts as the de-facto regulator of health, safety, and environment matters in the oil and gas industry and has established a Memorandum of Understanding with the Abu Dhabi Environment Agency whereby the EAD only interferes where projects may affect protected areas. In the other UAE emirates, the environmental department of the respective municipality acts as the environmental regulator.

In Qatar, the Ministry of Environment is the ultimate authority responsible for environmental management. It reviews and approves all EIA studies prepared by oil and gas companies in Qatar and monitors their implementation through the issuance of consent to build and consent to operate.

It can be concluded that in all benchmark countries except for UAE (Abu Dhabi), the environmental regulatory authority is independent from the oil and gas licensing authority. This is essential to ensure the independence of the opinion of the environmental regulatory authority, avoid conflicts of interest, and ensure that environmental measures are implemented.

2) Environmental Legislation

The main pieces of legislation related to the offshore oil and gas industry in the US are: The National Environmental Policy Act, 30 CFR 250/550 'Oil and gas and Sulphur operations in the Outer Continental Shelf', and 40 CFR 'Protection of the environment' under EPA, Clean Water Act, and Clear Air Act.

Main relevant legislation in Norway includes the Petroleum Activities Act, Pollution Control Act, and general pollution and waste regulations.

Relevant legislation in Ireland includes the Petroleum and Other Minerals Development Act, Protection of the Environment Act, Dumping at Sea Act, Waste Management Act, and Petroleum Safety Act.

In the UAE, the Federal Environmental Law, Federal Petroleum Resources Conservation Law, UAE Cabinet Regulation for the Protection of Maritime Environment, and local environmental regulations as dictated in every emirate are the main legislation applicable to the offshore O&G industry. Additionally, ADNOC in Abu Dhabi has issued several codes of practice, including those on the environment, to be implemented by oil and gas companies.

In Qatar, general laws apply to the offshore oil and gas industry. These include: The Natural Resources Law, Environmental Protection Law, and Law on Exploitation and Protection of Marine Life. The MOE also recently issued a modern law for the management of NORM wastes.

General environmental legislation applies to the oil and gas sector in all benchmark countries, yet specific petroleum sector legislation includes certain environmental provisions and requirements such as those related to flaring and venting.

3) Environmental Risk Assessment

Environmental studies, whether environmental impact statements, environmental area assessments, or EIAs are required for all phases of oil and gas operations. In the US, the NEPA requires that federal agencies incorporate environmental considerations into their planning and decision-making. The NEPA process is made up of evaluation of the environmental impacts of a federal undertaking. Accordingly, an undertaking is either determined to have no significant environmental impact or requires an environmental evaluation or environmental effect statement.

In Norway, an environmental judgment is required by law for opening new areas for petroleum activities and in connection with developing an oil and gas field and as a part of submitting a plan for development and operation of an oil or gas field.

In Ireland, a strategic environmental assessment and environmental area assessment are required during the exploration phase and an environmental impact statement is required during production.

In the UAE, EIAs must be undertaken for oil and gas projects, and in Qatar, an EIA is required before undertaking any kind of development enterprise or other industrial activities that may have a harmful impact on the environment.

4. ENVIRONMENTAL GOVERNANCE SYSTEM FOR LEBANON

1) Environmental Regulatory Authority

The Ministry of Environment is the main body responsible for environment protection and management in Lebanon. The role of the MOE in the oil and gas sector is explicitly defined in the Offshore Petroleum Resources Law No. 132/ 2010 and the Petroleum Activities Regulations Decree No. 10289/2013 in several provisions. The ministry is tasked with supervising the conduct of petroleum activities and ensuring its overall compliance with environmental standards and regulations.

Different departments of the Ministry of Energy will be involved with petroleum activities, particularly the Department of Natural Resources Protection, Department of Ecosystems, Department of Chemical Safety, Department of Air Quality, Department of Integrated Environmental Systems, and the Department of Monitoring and Statistics, in addition to other departments.

The new petroleum sector will require capacity building of existing departments at the Ministry of Energy to cater to new arising requirements introduced by the petroleum sector. The need to initiate a new dedicated department for oil and gas needs to be assessed against empowering specific departments in the existing structure. At the very least, the capacity of a dedicated team from the MOE needs to be strengthened, particularly in the areas of EIAs, mitigation and monitoring, environmental audits and inspections of oil and gas facilities and assets, and environmental emergency preparedness and response.

Another main stakeholder in environmental management of petroleum activities in Lebanon is the Lebanese Petroleum Administration which was established on December 2012, to be the official regulatory body in charge of managing the petroleum sector in Lebanon. The QHSE Department within LPA is responsible for all issues related to the quality of operators' systems and the extent of their adherence to the conditions of health, safety, and environment, and particularly responsible for studying applications for licenses, studying plans on quality of performance, monitoring the compliance of operators with various regulations, assessing the impact of operations on occupational and environmental health, and monitoring capabilities to ensure compliance with environmental, health, and safety issues.

Other stakeholders involved in the environmental regulations and management of the petroleum sector include the Ministry of Energy and Water, Committee for Field Emergencies for Energy and Water, National Emergency Response Committee, National Council for Environment, Ministry of Public Works and Transport, Ministry of Defense, Lebanese Ministry of Finance, Lebanese Standards Institution – LIBNOR (NL TC 67 committee: Materials, Equipment and Offshore Structures for Petroleum, Petrochemical and Natural Gas Industries- established in February 2019 and chaired by Dr. Harkouss), Disaster Risk Reduction Lebanese Atomic Energy Commission, and CBRN National Team. The above indicates that there are various authorities that have specific roles in environmental protection in Lebanon, although the main competent authority is the Ministry of Energy. A fair distribution of roles is critical to avoid major environmental impacts that are resulted from oil and gas operations.

2) Main Legislation

Lebanon has ratified various conventions related to the protection of the environment and marine environmental resources. The MOE or MOPWT is the focal point for maritime conventions and protocols while the MOE is the focal point for other environmental conventions.

In the event of discoveries of hydrocarbons in offshore Lebanon, activities in the Mediterranean Sea are expected to increase significantly, making implementation of the requirements of these conventions more challenging and resource-intensive. Effective coordination between both ministries is key to properly implementing these conventions.

Existing legislation including general environmental regulations and signed conventions in addition to the OPRL and the PAR covers the majority of environmental issues. However, there are some requirements that existing legislation does not cover such as the management and disposal of drill cutting and fluids, produced water, and NORM wastes, which are the main pollutant streams that arise from the offshore petroleum sector.

Additionally, some requirements referred to in existing legislation are yet to be specified or issued by decrees, such as: A decree to determine which industrial institutions require a permit for releasing emissions into the air and to specify the mechanism for granting a permit, which is referred to in Decree No. 2275/2009 A decree to specify the list of materials allowed to be discharged in the sea referred to in Article 30 of Law No. 444/2002 COM Decrees mentioned in Articles 40 and 44 of Law 444/2002 related to dangerous or hazardous wastes Decree to set the standards for the management of solid waste streams expected from the oil and gas sector (pursuant to ISWM Draft Law) Application of MOE Decision No. 99-1/2013, which sets the guidelines for submitting information on greenhouse gas emissions by companies and industrial and commercial institutions

3) Monitoring/Enforcement/Assurance Mechanics

Responsibilities and mechanisms for environmental monitoring, auditing, inspection, and reporting shall be defined between different stakeholders. This can be achieved by signing MoUs between the LPA and concerned ministries, particularly the MOE.

4) Emergency Response

Lebanon is committed to several international conventions and treaties that require the establishment of measures for dealing with offshore pollution incidents, nationally and internationally. Such conventions include: IMO International Convention on Oil Pollution Preparedness, Response, and Co-operation ILO, C174 - Prevention of Major Industrial Accidents Convention 2002 Emergency Protocol of the Barcelona Convention

5. CONCLUSION AND RECOMMENDATIONS

In many aspects, the Lebanese environmental governance system should be considered to meet international standards. However, there are various gaps that need to be addressed to ensure the Lebanese government is ready to manage the environmental risks associated with offshore oil and gas activities. A National Oil Spill Contingency Plan is being prepared by the LPA to organize environmental emergency responses related to activities from the petroleum sector.

1) Environmental Regulatory Authority

The main environmental regulator for the oil and gas sector in Lebanon is independent of the oil and gas licensing authority, which is in line with international best practices.

Although the role of the MOE in the oil and gas sector is explicitly defined in the Offshore Petroleum Resources Law No. 132/2010 and the Petroleum Activities

Regulations Decree No. 10289/2013 in several provisions, there are gray areas that need to be better defined.

These include responsibilities and mechanisms for environmental monitoring, auditing, inspection, and reporting. This can be achieved by signing MoUs between the LPA and the MOE. Other entities also have specific environmental management roles such as the Ministry of Energy and Water (MOEW), which is the focal point of important international conventions related to the environment or LAEC, which has specific authority over NORM. MoUs between the MOE and these agencies are encouraged to ensure responsibilities are clearly delineated and to promote coordination and cooperation.

With regard to the capacity of institutions, existing institutions do not currently have the needed capacity to deal with the requirements of the petroleum sector. Training need assessment studies should be performed for different institutions that will have an environmental role in the petroleum sector, and required training and capacity building should be implemented. The needed equipment for monitoring the change in environmental indicators/parameters should be made available. The Norwegian government is supporting the LPA in building the capacity of relevant stakeholders in the oil and gas sector, including the MOE, through the Oil for Development Program. It is also recommended that an institutional assessment be conducted to evaluate the feasibility and need of establishing a dedicated oil and gas service or department at the MOE and possibly at other ministries with specific environmental management roles, such as the Ministry of Public Works and Transport. The use of third parties for EIA reviews, inspection, and auditing can be an option, especially in the short term until existing institutions gain the capacity to conduct such work. In this case it is recommended that procedures to prequalify competent firms be put in place.

2) Environmental Legislation

Existing legislation, including general environmental regulations and signed conventions in addition to the OPRL and the PAR, covers the majority of environmental aspects related to the oil and gas sector. However, there are some requirements that existing legislation does not cover such as the management and disposal of drill cutting and fluids, produced water, and NORM wastes, which are the main pollutant streams that arise from the offshore petroleum sector. Legislative action covering these aspects must be done. Sampling procedures should also be set. These could take the form of decisions made by the MOE.

It is highly recommended that specific limits and targets regarding GHG emissions be established, along with specific guidelines for the oil and gas sector.

The Sustainable Oil and Gas Development in Lebanon project managed by the United Nations Development Program is supporting the LPA and relevant stakeholders, including the MOE, to strengthen the legal framework in line with the requirements of the oil and gas sector.

3) Environmental Risk Assessment

With regard to EIA studies, it should be decided whether a new EIA decree specific to oil and gas activities should be issued as allowed by Article 29.3 of Law 132/2010. It is, however, the author's opinion that the existing EIA decree provides a good framework for environmental assessments of oil and gas activities. It can be complemented by guidelines for the preparation of EIA studies for specific oil and gas activities. EIA procedures should also be developed to standardize the way risks are assessed and quantified. It is also important to agree on whether an EIA shall be required for the exploration phase, and particularly for exploratory drilling activities. According to international best practice, it is recommended that an EIA be required since environmental impacts from exploratory drilling can be significant if not properly managed. Mishandling of this issue could lead to major public opposition and delays in the exploration phase.

4) Environmental Permits

Although the requirements for different types of permits are included in Lebanese legislation, the limits, conditions, and procedures for issuing these permits have yet to be specified.

According to existing legislation, different ministries have roles in issuing related permits. The MOE can issue emissions permits, the minister of public works and transport can authorize disposal in territorial waters and under the seabed in territorial waters, and the MEW can issue flaring and venting permits.

It is recommended that MoUs be signed between these ministries to establish a permitting system with clear responsibilities and procedures. It is recommended that the MOE be responsible for issuing discharge permits, emissions permit, and waste disposal permits.

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