LEGISLATION ON OIL POLLUTION PREVENTION AND CONTROL DURING PETROLEUM PRODUCTION

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Synopsis

Malaysia has long been victim of oil pollution well before the start of her own offshore exploitation of oil. With the effort to exploit offshore oil and gas, Malaysia has now become causer of pollution herself. Legislation existed for oil pollution prevention and control, along each and every stage of offshore petroleum operations which include exploration, development, production, transportation, treatment and storage. But procedures to explain the existing legislation is lacking and hence it is important to expound the existing legislation for controlling and preventing oil pollution from offshore operation in line with current practices around the world.

Introduction

Malaysia is both a victim and a causer of oil pollution. As a victim of pollution, Malaysia has long been exposed to the oil tanker traffic and the risk of oil tanker accidents. When the exploration and exploitation of hydrocarbons in the offshore area started, Malaysia has since become the causer of oil pollution, hence exposing the coastal and marine environment to this contamination.

And currently, oil exploitation activities offshore Malaysia are confined to the South Chine Seaf off the east coast of Peninsular Malaysia, Sarawak and west Sabah[1] as shown in Figure 1. Beside the oil producing platforms, there are two floating marine terminals and three crude oil land terminals carrying out the crude treatment and storage or export functions. Together with the production activities, maintenance and servicing operations, the combined picture for offshore petroleum operation is indeed busy. So the risk of operation mishaps resulting in oil pollution is great.

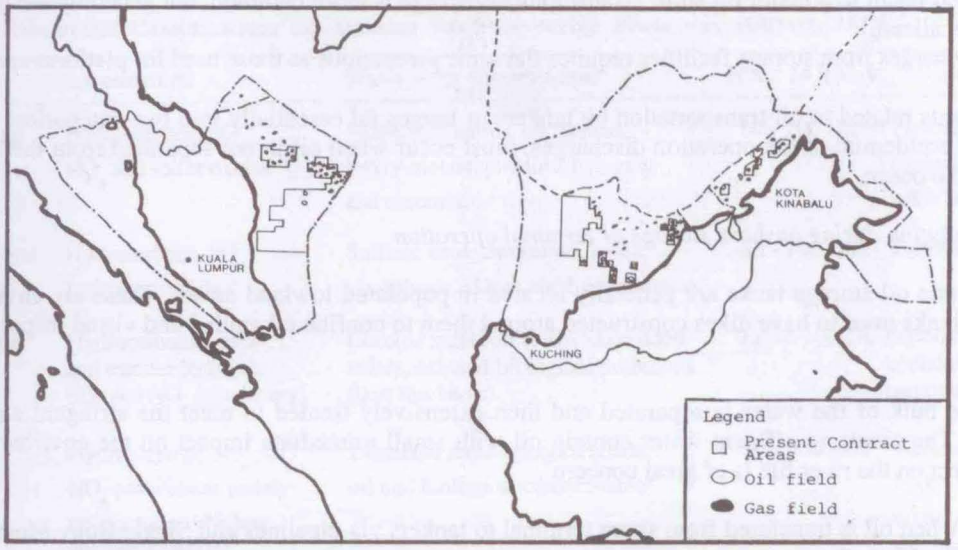

Figure 1 Offshore production areas in Malaysia

This paper attempt to examine the enviroment impact in term of oil pollution potential of various phases of petroleum exploitation, the legislation that prevent and control oil pollution from petroleum exploitation and finally the monitoring activities carried out to ensure that the legislations are abide to.

Potential impact of oil pollution during petroleum exploitation[2]

The exploitation of petroleum will inevitably effect the environment and every phase of exploitation has its own impact on the environment and this will be discussed in detail.

Potential impact of oil pollution during drilling stage

Many of the environment concerns associated with drilling are common to both exploratory and development phases. Before a drilling rig is selected to drill in a particular marine environment, its strength and water depth capability must be matched to that of the environment to ensure safe operations.

Once the drill bit penetrates the ocean floor, the most important aspect of drilling operations is well control to prevent a blowout which could result in oil spill. And various types of waste are produced while drilling. Drilling wastes include drilling mud residues (with or without free oil and toxic chemicals) and drilling cuttings (with or without oil and chemicals), need proper disposal to minimize impact on the environment. Deck drainages should ensure that direct discharge of oil and chemicals into the sea is avoided.

After the discovery of a field, platforms are installed and the impact of discharges from a platform during development drilling are similar to those during exploratory drilling. The only difference is that wells are drilled from a permanent platform and several wells will be drilled from the same location. Although this multiplies the discharges of drilling mud residues and cuttings, the effects are restricted to the vicinity of the platform.

Potential impact of oil pollution during production operations

After development wells are drilled, the drilling rig is removed from the platform and replaced with oil and gas production and processing equipment. Water is normally produced in conjunction with the oil and gas, the amount increasing as the reservoir becomes depleted of oil and gas. The produced water is either separated in processing vessels on the platform or sent with the oil to onshore separating facilities. On the marine terminal, the bulk of the water is separated in the separation system and then further treated in the corrugated plate interceptor[3]. Primary effects of the water discharged into the sea after treatment on the marine terminal are related to its oil content (normally about 100 to 1000 ppm) and the total produced volume.

Other normal discharges from a production platform a production platform are deck drainage (with or without oil) and solid waste (with or without oil and chemicals). Water treating fluids (with or without oil and chemicals) are being used throughout production life of a field. Damage to platform and facilities is rare but could result in a major oil spill.

Potential impact of oil pollution during offshore storage or transportation

Most offshore oil is transported by pipeline from the production platform to shore for storage, but when transfer is by ship, offshore storage facilities are needed. Environmental impact from storage facilities occurs mainly from damage to the storage unit and through spills during transhipment of oil from well to storage or storage to tanker. Damage to storage facilities and pipelines are rare but could result in a major oil spill. Transhipment leakage is more common, but generally the quantities are small and the impact is localized.
Prevention of chronic discharges from storage facilities requires the same precautions as those used for platform operation.

Potential pollution incidents related to oil transportation by tankers or barges fal essentially into two categories. Operational (deliberate discharge) or accidential of the operation discharges, most occur when oil in not separated from the ballast water before it is released into the ocean.

Potential impact of oil pollution during onshore storage or terminal operation

Pipeline landfalls and crude oil storage tanks are generally located in populated lowland areas. These are environmentally sensitive areas. Storage tanks need to have dikes constructed around them to confine oil spilled and visual inspection is made regularly.

At the land terminal, the bulk of the water is separated and then extensively treated to meet the stringent environmental discharge requirement. The resulting effluent water contain oil with small immediate impact on the environment but the cumulative long term effect on the river life is of great concern[4].

During export operation when oil is transfered from shore terminal to tankers via pipelines and Single Bouy Mooring System, the potential oil spill is through leakage.

Total impact of oil pollution during petroleum exploitation

At the present time it is not feasible to specify the relative significance of each of these impacts, or their summed effect upon the receiving environment. Although the sources of impact can be identified evaluating their real impact is largely speculative. One point that clearly emerges from the above somewhat general appraisal of impact of offshore petroleum exploitation is that the threat of oil pollution on the environment is great. So great care should be taken to prevent and control oil pollution and this could only be possible through stringent legislation and monitoring activities. The potential environmental effects from petroleum exploitation is shown in Table 1.

Table 1a Potential Environmental Effects from Offshore Oil and Gas Operations (Gilbert, 1982)

Activity	Source	Potential impact
Seismic surveying	Ship traffic and explosives	Disturb fisheries and fishing gear
Bootom sampling	Sea-bottom disturbance	May localize on bottom communities

Activity	Source	Potential impact
Drilling	Drilling cuttings	Alters bottom substrates
	Drilling muds	Causes turbidity and sedimentation
	Drilling-mud chemicals	Creates toxicity and/or bioaccumulation
Presence of platform	Physical disturbance	Disturbs bottom community and shading
	Artificial reef effect	Affects fishing
	Competition for space	Disrupts commercial fishing
	Noise, vibration and lights	Hinders animal migrations and recreation
Produced water discharge	Salinity	Changes normal populations
	Hydrocarbons	Creates tainting and possibly toxicity
	Temperature	May exceed critical limits locally
	Nutrients	May stimulate plant growth
	Metals and/or nucleids	If present, may bioaccumulate
	Low dissolved oxygen	Kills fish
Accidental petroleum discharge	Oil spills (blowouts)	Impacts and depends on quantity and condition; can be severe
	Fuel oils (ship and motor fuels)	Usually small spills with only acute impacts
Other discharge from platforms	Kitchen and human wastes	Causes organic loading; can impact recreation
	Biocides from waste treatment	Can cause acute effects if dilution is not sufficient
	Sacrificial anodes	May bioaccumulate metals
	Debris	Mutilates fishing gear
	Exhaust gases and flares	Lowers the aesthetic value and pollutes the air
Dredging	Change in bathymetry	Alters current patterns and salinity regimes
	Disposal of dredge spoil	Smothers benthic animals and modifies other environs
Shoreline modifications	Jetties, bulkheading, etc.	Alters current patterns, erosion potential and natural habitat

Table 1b Environmental Considerations for Onshore Facilities during Production (Gilbert, 1982)

Type of facility	Air emissions	Waste-water contaminants	Noise 24 hr/day	Solid wastes
Partial processing facilities	Hydrocarbons, SO_x, NO_x and sulfur oxides	Suspended solids, oil, grease, heavy metals, phenols, halogens and chromium	80 - 100 Db	Periodic disposal of sludge containing oil, acids and heavy metals
Gas processing and treatment plants	Hydrocarbons, SO_x hydrogen sulfide	Sulfuric acid, chromium, zinc phosphates, sulfite and hydrocarbons	80 - 100 Db	Periodic sludge disposal
Marine terminals	Hydrocarbons (tank and transfer leakage), SO_x and NO_x (machinery)	Chronic small oil spills, suspended solids, oil, and biological pollutants (boat discharge)	Up to 100 Db	Periodic sludge disposal containing oil, sulfur compounds and heavy metals
Refineries	Hydrocarbons, SO_x, CO NO_x particulates (catalytic-cracking vehicles) and hydrocarbons	Dissolved and suspended solids, oil and biological contaminants	80 - 100 Db	Residues contaminated by oil, hydrocarbons, sulfides, iron compounds, copper compounds calcium and fluorides
Petrochemical plants	Depends heavily on products and configuration of plant; hydrocarbons, particulates NO_x and SO_x are common to all	Same as refineries	79 - 98 Db	Biological contaminants, suspended solids, chromium and zinc
Liquefied natural	Similar to gas processing plants	Anticorrosion and anticlogging chemicals	Information not available	Large quantities of contaminated chemical wastes

Environmental Policy and Legislation [5]

Malaysia's overall environmental policy is to ensure that as far as possible, all man's activities are in balance with his environment. In the attainment of this objective, legislation and regulations that have been promulgated to ensure sound environmental conditions as a result of the oil and gas exploitation are:

from offshore activities. But the dual role of PETRONAS as a custodian as well as a Contractor could be conflicting. Hence the role of the National Petroleum Advisory Council should be important i.e. pooling of expert in the scope of petroleum pollution to work with the Department of Environment in formulation rules and regulation faster to ensure that our environment is not contaminated the longer the rules and regulation is delay, the more the environment get battered probably to a point of no return.

Table 2 Environmental Quality (Sewage and Industrial Effluents) Regulations 1978.

ENVIRONMENTAL QUALITY ACT 1974
ENVIRONMENTAL QUALITY (SEWAGE AND INDUSTRIAL EFFLUENTS) REGULATIONS 1978
[Regulation 8 (1), 8 (2), 8 (3)]
PARAMETER LIMITS OF EFFLUENT OF STANDARDS A AND B

	Parameter	Unit	Standard	
			A	B
	(1)	(2)	(3)	(4)
(i)	Temperature	C	40	40
(ii)	pH Value	-	6.0 - 9.0	5.5 - 9.0
(iii)	BOD_s at 20^0C	mg/l	20	50
(iv)	COD	mg/l	50	100
(v)	Suspended Solids	mg/l	50	100
(vi)	Mercury	mg/l	0.005	0.05
(vii)	Cadmium	mg/l	0.01	0.02
(viii)	Chromium, Hexavalent	mg/l	0.05	0.05
(ix)	Arsenic	mg/l	0.05	0.10
(x)	Cyanide	mg/l	0.05	0.10
(xi)	Lead	mg/l	0.10	0.5
(xii)	Chromium, Trivalent	mg/l	0.20	1.0
(xiii)	Copper	mg/l	0.020	1.0
(xiv)	Manganese	mg/l	0.20	1.0
(xv)	Nickel	mg/l	0.20	1.0
(xvi)	Tin	mg/l	1.0	1.0
(xvii)	Zinc	mg/l	1.0	1.0
(xviii)	Boron	mg/l	1.0	4.0
(xix)	Iron (Fe)	mg/l	1.0	5.0
(xx)	Phenol	mg/l	0.001	1.0
(xxi)	Free Chlorine	mg/l	1.0	2.0
(xxii)	Sulphide	mg/l	0.50	0.50
(xxiii)	Oil and Grease	mg/l	Not Detectable	10.0

Monitoring the Application of Legislation to prevent and Control Oil Pollution during Oil Exploitation

Rules and regulations is no enough to ensure control but monitoring, that is, abiding to the rules and regulations is important. Again vesting the role of a watch dog to PETRONAS could be conflicting to its dual role so the Department of Environment (DOE) along with the other authorities i.e. the Marine Dept., the Marine Police, the Navy should be requested in monitoring. Monitoring does not stop at checking whether the laws are being abided to but it also encompassed the study of the long term effect of pollution to the environment whether the existing laws is enough to safeguard minimal changes to the environment. As a comparison *baseline* study should be carried out as a reference to future conditions.

Laboratory studies are needed to determine the toxicity level acceptable to the environment. Toxicity level studies should not only be restricted to the contribution from oily water effluent but should encompassed the whole range of requirement interms of the parameters stipulated in the EQA Act, 1974.

Oil Spill Contigency Plans

Accidents do occur no matter how stringent the preventive measures and safety precautions are. It is to this anticipation and preparation when preventive measure fail and emergency situation develops that contiguency plans are formulated and organized. These plans have come in different levels of preparedness in accordance with the expected scale and magnitude of the oil spills. They are company-based, national and regional.

If the company-based contingency plan has failed to cope with the scale and magnitude of any spill, National Contigency Plan would have to be invoked. At present only the Straits of Malacca is covered but study is undertaken to extend it to the South China Sea where the bulk of the offshore activities is taking place. The National Contingency Plan of Malaysia is intended primarily to take care of pollutions originated from seaborne vessels.

i) Merchant shipping Ordinance, 1963, allows for control and prevention of pollution from offshore installation.

ii) Continental Shelf Act, 1966 (revised 1972) Part 6F provides for control of pollution of the territorial waters of Malaysia.

iii) Petroleum Mining Act, 1966 (revised 1972) Part 12 (1) E provides for control of effluent in the vicinity of the exploration area.

iv) Water Enactment. Section 7A provides for control of pollution rivers.

v) Environmental Quality Act, 1974 is the most comprehensive legislation for the control of pollution of inland waters and air. Control can be by way of licence with attached conditions or by way of limits for discharge or emission. Two sets of regulations apply; Environmental Quality (Clean Air) Regulations 1978 and Environmental Quality (Sewage and Industrial) Regulations, 1979. Section 27 also relates to control of discharge of oily mixture while Section 29 deals with discharge of wastes into the Malaysia territorial water. No set of regulation is available.

vi) Exclusive Economic Zone Act, 1984. Section 10 provides for control pollution of the water 200 miles off the territorial waters of Malaysia. The effluents limit is 100 ppm for offshore waters.

vii) Petroleum Development Act, 1974 is the legislative in instrument vesting in PETRONAS the entire ownership, exclusive rights, powers, liberties and previlages of exploring, exploiting and obtaining petroleum in the country. Through the Production Sharing Contract, the contractors should take necessary precautions for the prevention of pollution in accordance with existing standards or guidelines designated by PETRONAS.

viii) Intergovernmental Maritime Consultative Organisation Treaty, implements international standards and regulations for safety of shipping and environmental protection.

ix) Local Government Act, 1976. Provision in Part VIII for control of pollution of streams within local authority areas.

Application of Legislations to prevent and Control Oil Pollution During Oil Exploitation [6]

Legislation for land based facilities i.e. crude oil terminal is governed by numerous regulations especially the Environmental Quality Acts on Ocean Air Regulations and the Sewege and Industrial Regulations as shown in Table 2. The stipulated level of hydrocarbon (oil) content in the effluent is 10 ppm. But the final target should be Standard A inline with advancement of treating facilities and practices of other nations of the world. The continuous dumping of effluent containing oil into the environment in the long term would effect the surrounding environment in term of water life and plant growth. For offshore based facilities, there is no rules or regulations made subsequent to the main legislation. A number of rules and regulations is on the drawing board to control is on the drawing board to control discharges of oily mixture and solid waste into Malaysian water. The various Acts are interrelated and implementation of rules and regulations when they existed should be coordinated to ensure uniformity. Although there is no legal requirement of stipulated oil content level in the effluent disposed offshore, standard industrial practice in other part of the world has been adopted and imposed by PETRONAS. The oil content in the effluent disposed offshore has been set at 100 ppm. Generally the legal requirement on effluent quality is more lax at location offshore than onshore is due to restricted platform space and dilution factor on the open sea. The final objective is to reduce this criteria to reflect the advancement in treating technologyar Some of our platforms are near the shoreline hence this should be taken into consideration in future rules and regulations. As a guideline, the effluent limit should be in line with the Paris Convention requirement of 40 ppm (monthly)[7].

Rules and regulations implemented should reflect those existing in neighbouring countries. There is no physical boundary existing that could stop pollution from one country entering into neighbouring countries. There should be closer regional cooperation to set up uniform rules and regulations. PETRONAS as the custodian of our petroleum resources should take active participation in ensuring rules and regulations pertaining to prevention of pollution from oily mixture and solid waste

Realising the gaps of oil spills rising out of offshore hydrocarbon exploitation hitherto left unattended, the regional countries of ASCOPE have gotten together to fromulate an ASCOPE Contingency Plans to deal specifically with spills from offshore petroleum operation.

Conclusion

The exploration or exploitation for hydrocarbon is still actively moving on and a certain degree of oil pollution is inevitable. There always exist a potential risk of oil spillage in every phase of petroleum exploration or exploitation.

Malaysian policy on the ennvironment is clear - to maintain a healthy environment. And legislation implemented show our seriousness especially regulations pertaining to land based operations. Onshore based operation is covered by detailed regulation but for offshore based operations detailed regulations is non existence. Regulations should be uniformed with neighbouring countries.

Monitoring in terms of compliance is necessary to ensure the quality of the environment is maintained at an acceptable level.

Malaysia has a good degree of confidence when faced with an eventual situation of a major spill.

Acknowledgements

I would like to thank PETRONAS and the Department of Environment for informatin on existing situation with respect to legislation on hydrocarbon exploitation or exploration.

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