



Co-funded by the
Erasmus+ Programme
of the European Union



UNIVERSITI
TEKNOLOGI
PETRONAS

PDB1012/PEB1012
Introduction to Oil & Gas Industry and
Sustainable Development

Marine Pollution Control and Management



Introduction to Oil & Gas Industry and Sustainable Development



- These lecture materials are for the Marine Coastal and Delta Sustainability for Southeast Asia (MARE) (Project No. 610327-EPP-1-2019-1-DE-EPPKA2-CBHE-JP).
- This project has been funded with support from the European Commission. This publication reflects the views only of the authors, and the Commission cannot be made responsible for any use which may be made from the information contained herein.
- Students are reminded that any file or attachment shared with you by your course lecturer is SOLELY for educational purposes and/or your personal and private study ONLY, and therefore cannot be shared with or disseminated to anyone else or uploaded on any website without the permission or authorisation of the copyright owner.



Co-funded by the
Erasmus+ Programme
of the European Union



Introduction to Oil & Gas Industry and Sustainable Development



UNIVERSITI
TEKNOLOGI
PETRONAS

By

IR. HAIZATUL HAFIZAH HUSSAIN

haizatulhafizah.hus@utp.edu.my



Introduction to Oil & Gas Industry and Sustainable Development



UNIVERSITI
TEKNOLOGI
PETRONAS



Impacts of Oil and Gas Activities on The
Marine Environment



Awareness on the Effects of
Hydrocarbon Exploration



An Overview of the Rules and
Regulations in Marine Pollution
Management

Lecture Contents



Impacts of Oil and Gas Activities on The Marine Environment



Impacts of Oil and Gas Activities on The Marine Environment



UNIVERSITI
TEKNOLOGI
PETRONAS

- Environmental impacts of oil and gas operations may influence species, populations, assemblages, or ecosystems by modifying a variety of ecological parameters (e.g., biodiversity, biomass, productivity, etc.).
- At the project level, potential impacts are generally assessed through some type of formal process, termed an **environmental impact assessment (EIA)**.
- These typically involve the identification, prediction, evaluation, and mitigation of impacts prior to the start of a project.



Picture Credit: pinterest

Impacts of Oil and Gas Activities on The Marine Environment



- Key standard components of an EIA include:
- (i) description of the proposed development, including information about the size, location, and duration of the project,
- (ii) baseline description of the environment,
- (iii) description of potential impacts on the environment,
- (iv) proposed mitigation of impacts, and
- (v) identification of knowledge gaps.



Impacts of Oil and Gas Activities on The Marine Environment

Exploration Phase

- Indirect disturbance – sound and traffic
- Direct physical disturbance – anchor chains, drill cuttings, drilling fluids.

Production Phase

- Direct physical impacts occur as pipelines are laid, volume of discharged production water increases.

Decommissioning

- Direct physical impacts on the sea floor and can re-introduce contaminants to the environment.



Impacts of Oil and Gas Activities on The Marine Environment

- Impacts during seismic surveys include **underwater sound** and **light emissions** and increased **vessel activity**.
- Sound levels produced during seismic surveys vary in intensity, but in some cases, soundwaves from these surveys have been detected almost 4000 km away from the survey vessel.
- Impact assessments of acoustic disturbance have primarily focused on marine mammals.
- Reported effects include **disruption of behaviour** (e.g., feeding, breeding, resting, migration), **masking of sounds** used for communication and navigation, **localized displacement**, **physiological stress**, as well as **physical injury** including temporary or permanent hearing damage.

Impacts of Oil and Gas Activities on The Marine Environment



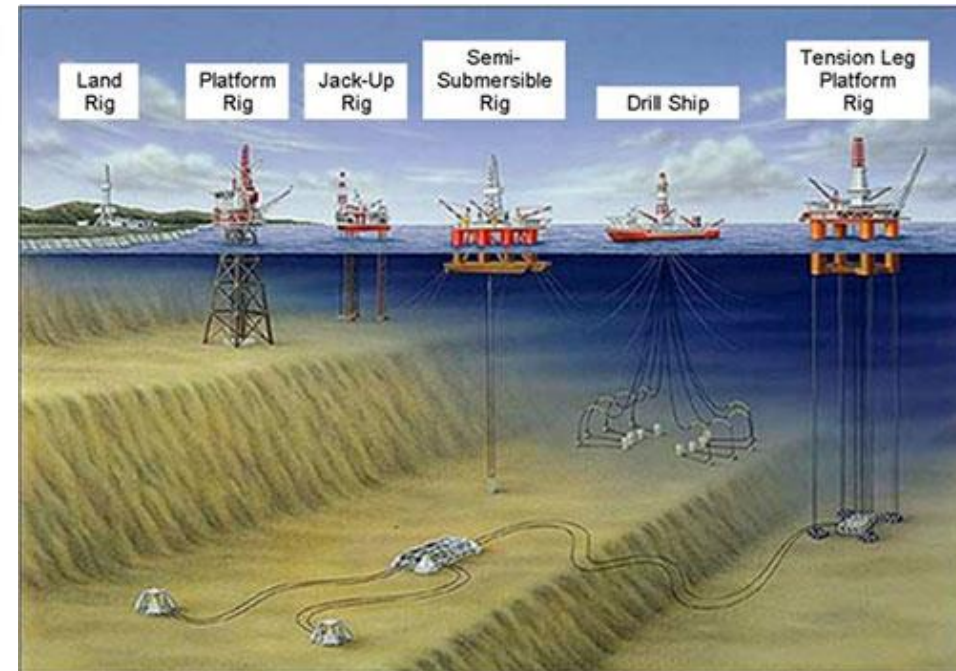
- The potential effects of sound on fish and invertebrates remain poorly understood, but may be significant. For example, significant **developmental delays** and **body malformations** have been recorded in scallop larvae exposed to seismic pulses.
- Operations at oil fields introduce considerable amounts of **artificial light** (e.g., electric lighting, gas flares) that can potentially affect ecological processes in the upper ocean.
- Once the installation of infrastructure commences, **direct impacts on habitats and associated fauna** increase.
- Placement of infrastructure on the seafloor, such as anchors and pipelines, will directly **disturb the seabed** and cause a transient increase in local sedimentation.

Impacts of Oil and Gas Activities on The Marine Environment

- Typically, 8 – 12 anchors are used to moor a semi-submersible drilling rig. The spatial extent of anchor impacts on the seabed varies depending on operating depth, but is typically between **1.5 and 2.5 times** the water depth of the operation (Vryhof Anchors BV, 2010).
- As anchors are set, they are dragged along the seabed, **damaging benthic organisms** and **leaving an anchor scar** on the seafloor. The impact of anchors in the deep sea is of greatest concern in biogenic habitats, such as those formed by corals and sponges.



Picture Credit: rigzone



Common Types of Drilling Rigs
Source: The National Petroleum Council (NPC.org)



Impacts of Oil and Gas Activities on The Marine Environment

- The laying of pipelines also alters local seabed habitat conditions.
- **Corrosion and leakage of pipelines** also poses the risk of exposing deep-sea fauna to potentially damaging pollution.
- The drilling process involves the **disposal of waste**, including drill cuttings and excess cement, fluids (drilling mud), produced water, and other chemicals that may cause detrimental ecological effects.
- Potential impacts on seabed communities can result from both the **chemical toxicants** and the **physical disturbance**.



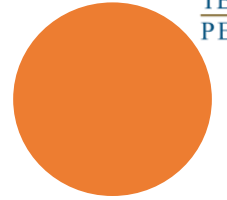
Picture Credit:
petroskills.com



Picture Credit:
corrosionpedia.com



UNIVERSITI
TEKNOLOGI
PETRONAS





Impacts of Oil and Gas Activities on The Marine Environment




UNIVERSITI
TEKNOLOGI
PETRONAS

VIDEO

What happens
after an oil spill?

[Video 1](#)



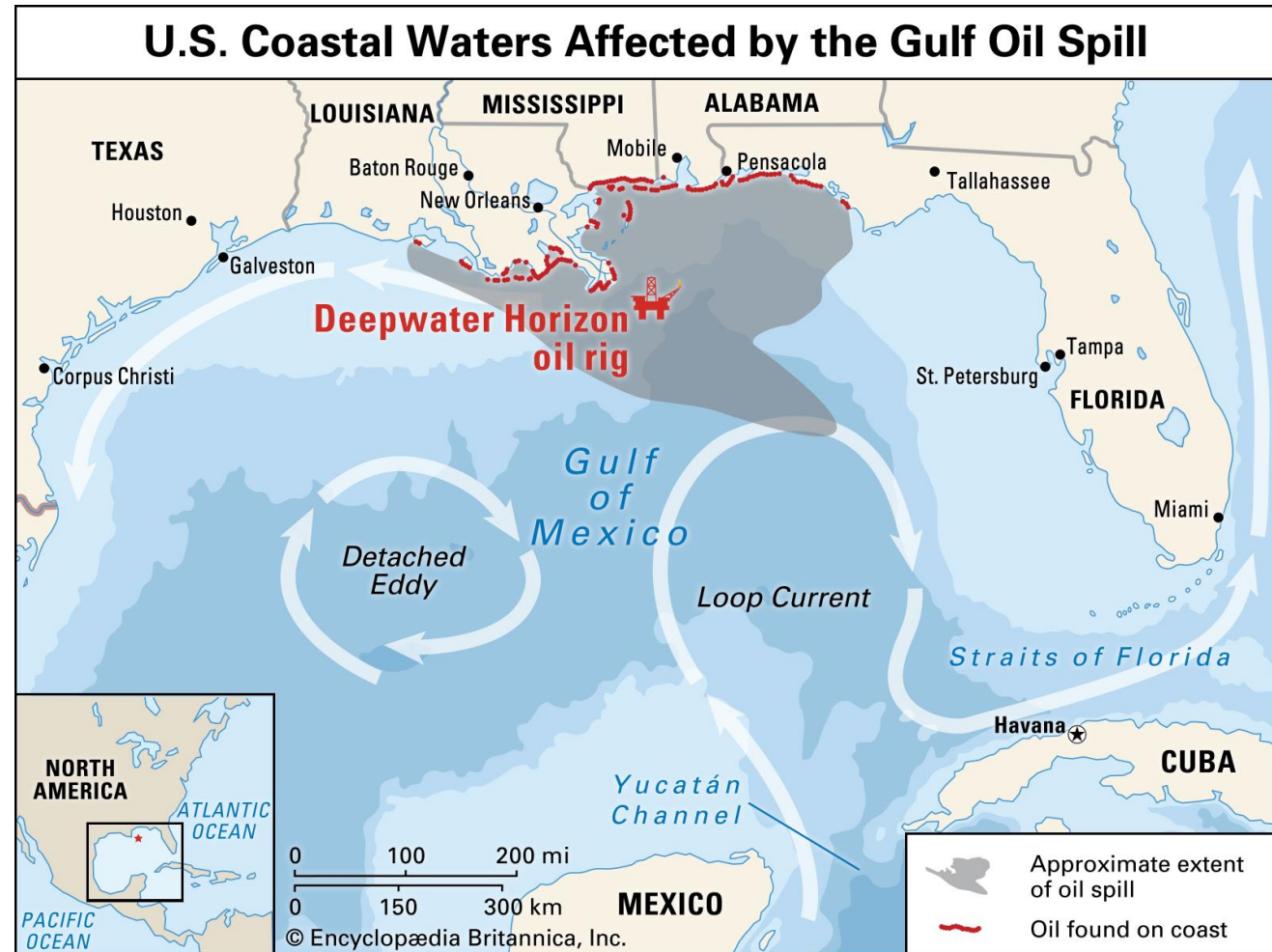


Awareness on the Effects of Hydrocarbon Exploration



Awareness on the Effects of Hydrocarbon Exploration

- **Deepwater Horizon oil spill**, also called **Gulf of Mexico oil spill**, is the largest marine oil spill in history.
- It was caused by an **April 20, 2010**, explosion on the Deepwater Horizon oil rig located in the Gulf of Mexico, approximately 41 miles (66 km) off the coast of Louisiana - and its subsequent sinking on April 22.



Picture Credit: www.britannica.com

Awareness on the Effects of Hydrocarbon Exploration

- The Deepwater Horizon rig, owned and operated by offshore-oil-drilling company **Transocean** and leased by oil company **BP**, was situated in the Macondo oil prospect in the Mississippi Canyon, a valley in the continental shelf.
- On the night of **April 20** a surge of natural gas blasted through a concrete core recently installed by contractor **Halliburton** in order to seal the well for later use. Both cores were likely too weak to withstand the pressure because they were composed of a concrete mixture that used nitrogen gas to accelerate curing.



Picture Credit: Britannica



Awareness on the Effects of Hydrocarbon Exploration



UNIVERSITI
TEKNOLOGI
PETRONAS

DEEPWATER HORIZON OIL SPILL TIMELINE

- **December 1998:** Construction begins on the Deepwater Horizon oil rig in Ulsan, South Korea.
- **20 April 2010:** Explosion and fire on the BP-licensed Transocean drilling rig Deepwater Horizon in the Gulf of Mexico. 11 people are reported missing and approximately 17 injured. A blowout preventer, intended to prevent release of crude oil failed to activate.
- **22 April 2010:** Deepwater Horizon rig sinks in 5,000ft of water. Search-and-rescue operations begin.
- **23 April 2010:** The rig is found upside down about a quarter-mile from the blowout preventer.
- **24 April 2010:** Oil is found to be leaking from the well.





Awareness on the Effects of Hydrocarbon Exploration



- **25 April 2010:** US coast guard remote underwater cameras report the well is leaking 1,000 barrels of crude oil per day (bpd).
- **28 April 2010:** The coast guard says the flow of oil is 5,000bpd.
- **29 April 2010:** Louisiana declares a state of emergency due to the threat to the state's natural resources, as the oil slick approaches land.
- **30 April 2010:** BP chairman Tony Hayward says the company will take full responsibility for the spill, paying for all legitimate claims and the cost for the cleanup. Conservationists warn of impending disaster for wildlife in the area of the spill.





Awareness on the Effects of Hydrocarbon Exploration



- **7 May 2010:** A fishing ban for federal waters off the Gulf is extended to 17 May.
- **18 May 2010:** As the spill continues to spread, the no fishing zone is doubled to 19% of the Gulf waters.
- **20 September 2010:** BP's clean-up costs following the explosion of Deepwater Horizon nears \$10bn.
- **23 September 2010:** Scientist estimate that a total of 4.4m barrels of oil were released into the Gulf of Mexico during the nearly three months of the well leaked.
- **6 January 2011:** The White House oil commission concludes that the oil spill in the Gulf of Mexico was the result of systematic management failure at BP, Transocean and Halliburton.



Picture Credit: Britannica

Awareness on the Effects of Hydrocarbon Exploration

VIDEOS

Oil Pollution in Our Oceans

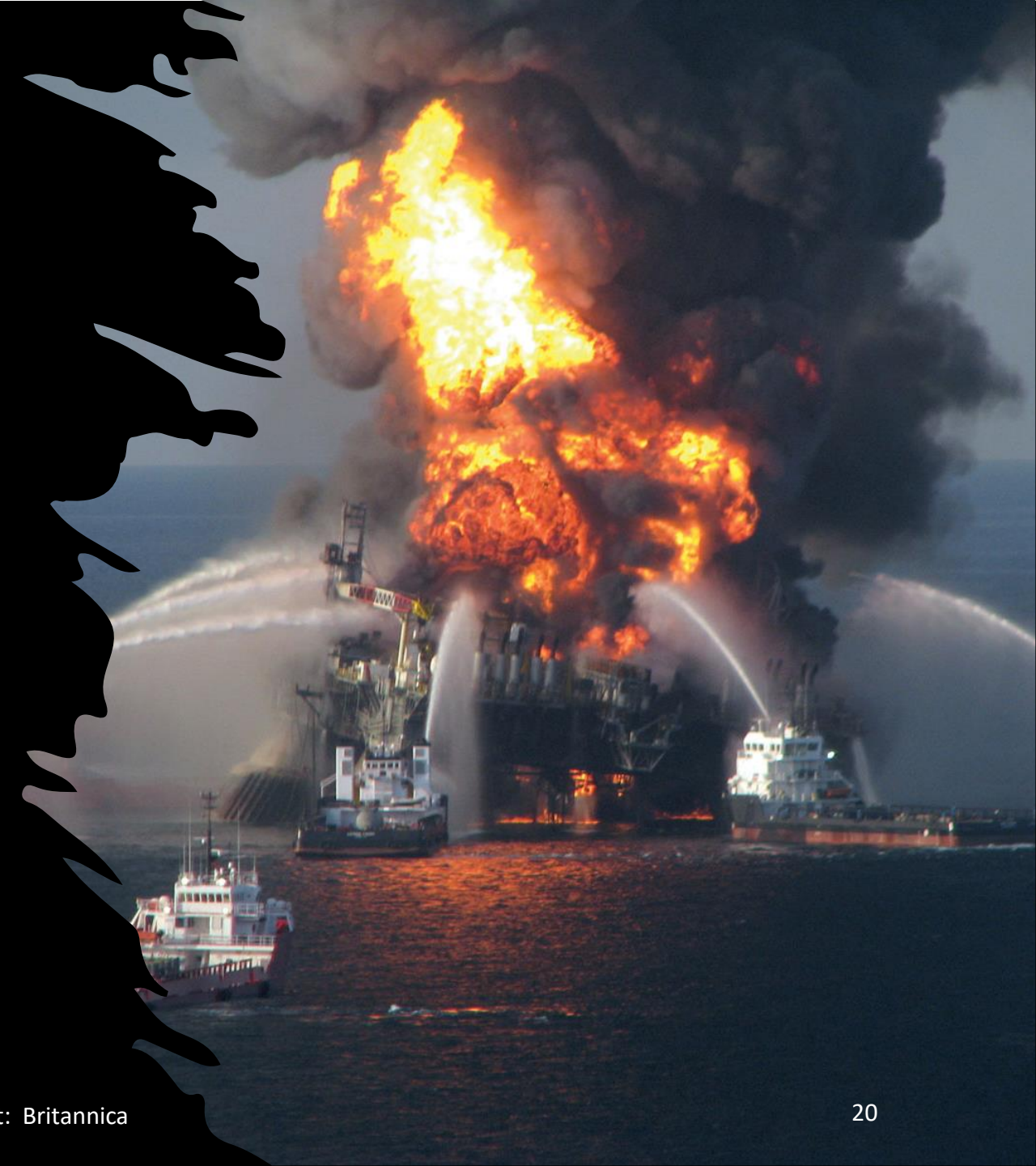
[Video 2](#)

How Do We Clean Up Oil Spills?

[Video 3](#)

BP Oil Spill 5 Years Later

[Video 4](#) and [Video 5](#)





An Overview of the Rules and Regulations in Marine Pollution Management



An Overview of the Rules and Regulations in Marine Pollution Management

- **The Straits of Malacca** is most susceptible to vessel-based marine pollution such as oil and grease especially in recent years due to the heavy volume of shipping that uses it.
- By nature, oil is toxic to marine life. If oil spill reaches the shoreline, it interacts with sediments, vegetation, and habitats of wildlife and humans, causing erosion and contamination.
- **Law** can be considered as an **important means of controlling pollution** and have been relied on by Malaysia in dealing with marine pollution.



Picture Credit: <https://www.worldatlas.com/maps/malaysia>



An Overview of the Rules and Regulations in Marine Pollution Management



UNIVERSITI
TEKNOLOGI
PETRONAS

LEGAL CONTROL OF MARINE POLLUTION

- The main legislation in Malaysia to control marine pollution from land-based sources is the **Environmental Quality Act 1974**.
- This Act can be considered as the most comprehensive legislation introduced to deal with environmental protection and pollution control including that of marine pollution.
- Under this Act, the control of pollution is done through the application of ambient environmental quality standards, or acceptable conditions.



Picture Credit: Krohne



An Overview of the Rules and Regulations in Marine Pollution Management

- Under the **Environmental Quality Act 1974 section 25**, those who discharge effluents into inland waters without any licence may be held liable for an offence. The section imposes penalty in the form of fine of up to **Ringgit Malaysia (RM) 100 000** or imprisonment of up to five years to any person found guilty of the offence.
- *The term “inland water” is extensively defined by this Act to include “any reservoir, pond, lake, river, stream, canal, drain, spring or well, or any part of the sea above the low water line along the coast, or any other body of natural or artificial surface or subsurface water”.*



Picture Credit: <https://2b1stconsulting.com/>



UNIVERSITI
TEKNOLOGI
PETRONAS

An Overview of the Rules and Regulations in Marine Pollution Management

- Specifically, under the **Environmental Quality Act 1974 section 27**, it **prohibits any person from discharging or spilling any oil or mixture containing oil into Malaysian waters.**
- Anyone who contravenes this prohibition shall be subjected to a fine of up **to half a million ringgit**, or imprisonment of up to five years or both. However, under certain circumstances, special defenses are granted to any person against the imposition of liability under section 27.
- *They include situations where discharge or spillage was done for the purpose of securing the safety of the vessel; for purposes of saving human lives; as a result of damage to the vessel; as a result of a leakage; or as a result of an effluent produced by operation for the refining of oil.*



Picture Credit: <https://www.velaw.com/industries/maritime-offshore/>



An Overview of the Rules and Regulations in Marine Pollution Management

- With regards to the **Environmental Quality Act 1974 section 29**, a prohibition is imposed on any person against discharging environmentally hazardous substances, pollutants or wastes into the Malaysian waters.
- The terms “environmentally hazardous substance”, “pollutants”, and “wastes” are given their respective definitions by the Act to ensure comprehensive coverage of discharges that may cause pollution to the marine environment.
- *Penalty similar to that of section 27 will be imposed on anyone who contravenes section 29.* However, unlike section 27, no defence are allowed for the contravention of section 29.

MARITIME
LAW



An Overview of the Rules and Regulations in Marine Pollution Management



UNIVERSITI
TEKNOLOGI
PETRONAS

- With regards to the **Environmental Quality Act 1974 section 34B**, it concerns on prohibiting against the depositing scheduled wastes.
- It is a prohibition to discharge oil tanker sludges and oil water mixture such as ballast water into the Malaysian waters without written approval from the relevant authority.
- Penalty imposed to any person who contravene this prohibition is a fine not exceeding **Ringgit Malaysia (RM) 500000**, or to jail for term of up to five years, or both.



An Overview of the Rules and Regulations in Marine Pollution Management

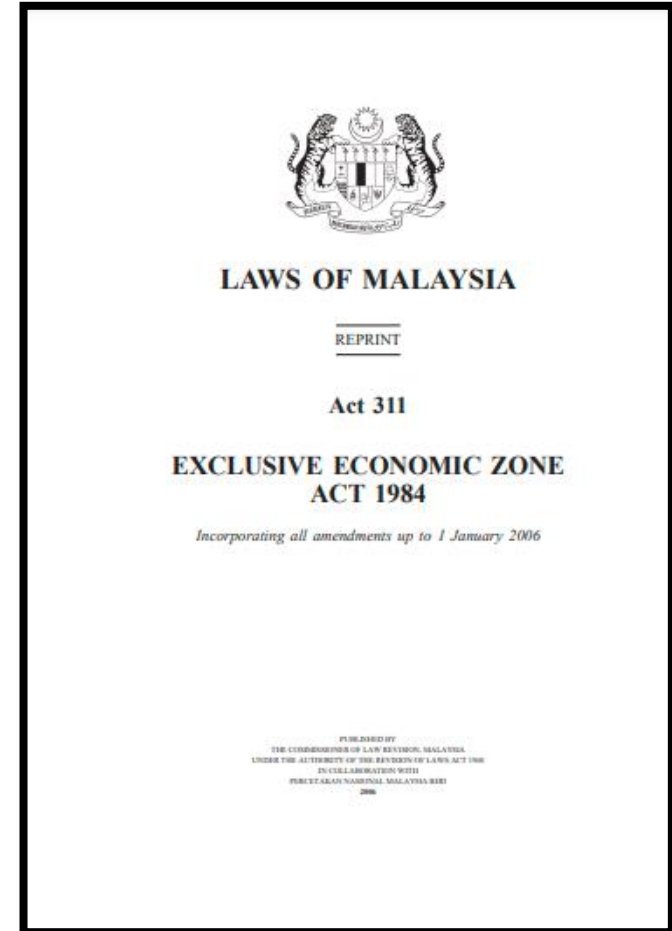


- Nonetheless, petroleum upstream activities can cause serious environmental concern, including that of marine pollution.
- At present, the regulation of such activities is within the scope of the **Environmental Quality Act 1974 through section 34A** on the requirement of Environmental Impact Assessment (EIA).
- Under this section, activities including **oil and gas field developments, and construction of off-shore and on-shore pipelines** would require the submission of the EIA report to the relevant authority for approval.
- It is an offence if any person failed to submit such report or failed to abide by conditions stipulated in the report. Criminal sanction will be imposed on those who contravene this section in a form of a fine of up to **Ringgit Malaysia (RM)100 000**, or jail of up to five years, or both.

An Overview of the Rules and Regulations in Marine Pollution Management

Exclusive Economic Zone Act 1984

- The enforcement power of the Environmental Quality Act 1974 is restricted only to the Malaysia's territorial water of **within 12 nautical miles**. Thus, the Act is not enforceable on any pollution offences committed beyond that boundary.
- Nevertheless, the control of marine pollution that took place beyond that territorial limit and up to 200 nautical miles of Malaysia's maritime territory is regulated under a different legislation, namely the **Exclusive Economic Zone Act 1984**.

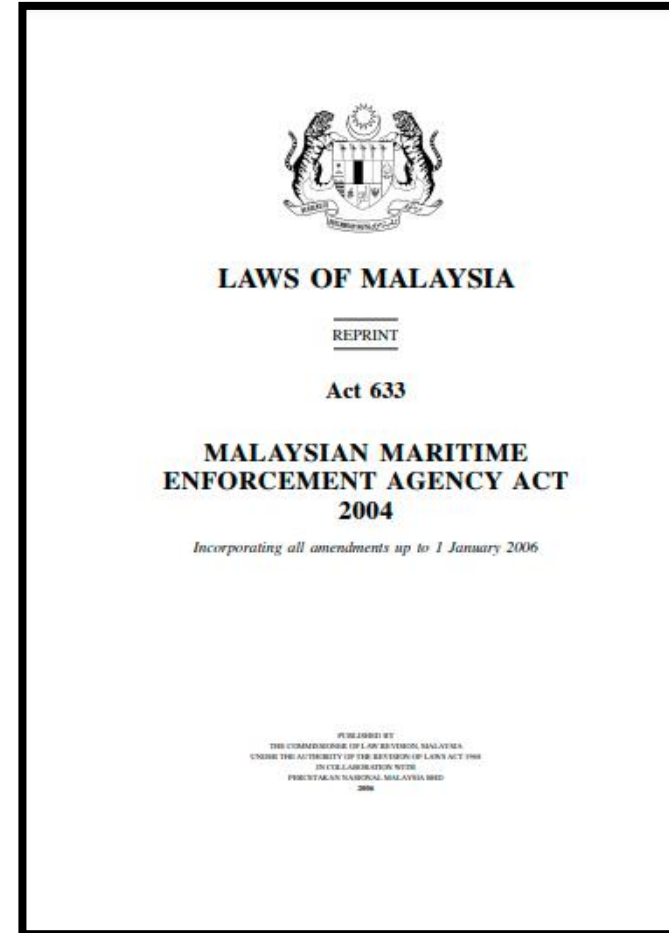


Picture Credit: <https://www.kpdnhep.gov.my/>

An Overview of the Rules and Regulations in Marine Pollution Management

Maritime Enforcement Agency Act 2004

- To provide for the **establishment of a sole marine enforcement agency** with the task of ensuring the safety and security of the Malaysian Maritime zone and protecting maritime and other national interests.
- The enactment of this Act is commendable as it seeks to complement and harmonize the enforcement of existing maritime legal regime through the establishment of an agency known as the Malaysian Maritime Enforcement Agency.
- The Agency is also responsible for the **control and prevention of maritime pollution** and is given the **power to enforce law and order under any federal law of Malaysia**. The Agency also has a crucial role to play in consolidating and enforcing all the laws regarding marine pollution.



Picture Credit: <https://www.kpdnhep.gov.my/>

Introduction to Oil & Gas Industry and Sustainable Development

Summary



Impacts of Oil and Gas Activities on The
Marine Environment



Awareness on the Effects of
Hydrocarbon Exploration



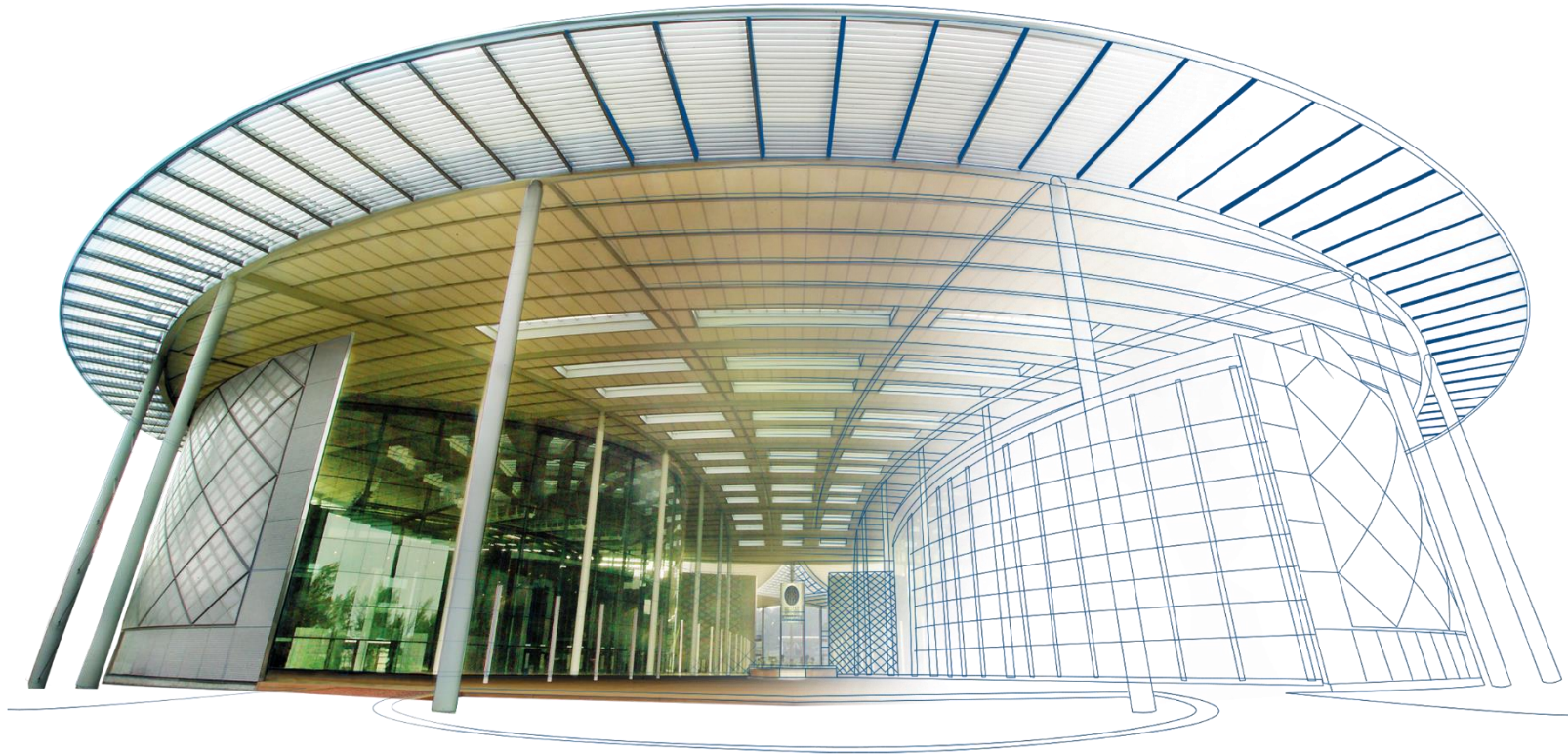
An Overview of the Rules and
Regulations in Marine Pollution
Management



Introduction to Oil & Gas Industry and Sustainable Development



Please answer the Learning Satisfaction Poll and Questionnaire in ULearn after this lecture.



THANK
YOU

Get Connected with



Scan the QR code or go to <https://bit.ly/2Ra323b>



www.utp.edu.my



UTPOfficial