

## Responding to the oil spill, oil slick incident in order to protect the ocean

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**Abstract:** In many waters of many countries with sea, the phenomenon of "black tide" is very common. There are many causes of this situation such as collision, accident of water transport means (especially oil tankers), oil rig incident, oil spill incident due to geological changes. On the sea, oil spills cause adverse impacts on the environment related to navigation activities. Recently, as inland waterway traffic is increasing and inland waterway transport is becoming increasingly important, accounting for a high proportion of the shipping industry, the number of waterway accidents as well as incidents Large, serious oil spills are also increasingly becoming a painful problem. The phenomenon of leaking or spilling oil on the river greatly affects the water ecosystem, the life of people living on both sides of the river. Oil spill incidents often leave very serious consequences, which can pollute the environment, affecting the ecological environment, aquatic resources, water resources, and land resources in a relatively large area, causing damage to the environment.

**Keywords:** oil spill, oil slick, ocean environment.

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### 1. Introduction

There are many causes of this situation such as collision, accident of water transport means (especially oil tankers), oil rig incident, oil spill incident due to geological changes. Economic activities, especially activities related to the exploitation and use of aquatic resources. Normally, when the ship arrives at the port of loading and unloading of goods to shore, the ship will be cleaned to prepare for the new batch. This work often generates a lot of waste in the form of sludge. Depending on the load and technical state of the vessel, the amount of sludge generated more or less. In particular, a number of Vietnamese river ships due to old equipment, backward risk of causing oil pollution also occurs in larger proportion. River boats also often cause local pollution by rinsing toilets where they dump right there. On 23/6/2010, barge Huynh Nhi 01, registration number BL-0304, load 250 tons suddenly sank across the area under Ton Duc Thang bridge (Bac Lieu 2 bridge) in ward 1, town Bac Lieu, Bac Lieu province when the barge was trying to "pass dry" on the river Bac Lieu - Ca Mau to the loading docks, the obstacles in the riverbed sank. Oil reservoirs on the barges have spilled into the water, polluting the local aquaculture water supply. On 27/4/2010, from the mouth of the river to the sea, to anchor position A12 (in the sea of Sao Mai, Ward 5, Vung Tau City, more than 1 km from the mainland), the ship Bien Dong 50, Changsha Sea Cargo Oil has suddenly sunk in the Vung Tau Sea. In the incident, the Bien Dong 50 carried more than 370 tonnes of DO and more than a dozen empty tanks. Immediately after sinking, the oil has spread out to the sea surface and floating off the surface. After only a few hours, the oil was spread across the sea in long strides. Around the location of the sinking ship with the smell of oil rising. The above are just two of the latest examples of oil spills among the major oil spills in Vietnam.

According to statistics from the HCM City Department of Natural Resources and Environment, an average of one year on the Saigon River occurred more than one oil spill caused by collision or leakage. Especially, along the Saigon River there are many units operating in the oil and gas industry, potential oil spill causing environmental pollution. Meanwhile, the Saigon River along the Dong Nai River system is the source of clean water for the localities of Ho Chi Minh City, Dong Nai and Tay Ninh. Cat Lai Oil Refinery, Cat Lai Petroleum Factory (District 2, HCMC), Petechim - Nha Be Petroleum Enterprise, Petrochemical Products Trading Company Limited and Hiep Phuoc Thermal Power Plant Nha Be) is on the list of potential oil spills. In addition, Ganh Rai Bay (an area bordered by Ho Chi Minh City and Ba Ria - Vung Tau Province) is also on the list, as there are more than 40 gasoline transport barges on the river every day. Moving at high risk. The danger is that these old barges are old lack of equipment to help safe circulation ... Oil Spill Solution? In many countries in the world as well as in Vietnam, measures are often applied to overcome oil spills are: mechanics, chemistry, physics, biology ... In which, mechanical methods Is the number one priority in protecting the coast from the effects of oil. Preventive and recovery devices include a variety of oil floats, oil fences, hand oil pumps, natural and synthetic adsorbents. Mechanical oil separators are used to draw and store oil until it is removed. The advantage of this measure is to prevent, control and quickly collect oil spills in the field. Chemical treatment is used with or without mechanical and oil spill over a long period of time. Agitators and dispersants are used to prevent oil from entering the coast and other biologically sensitive areas. Physical

measures are often used to clean the coast. Biological methods are the use of microorganisms that break down oils such as bacteria, yeast, etc. The antiseptic technique is also used to protect birds and animals by isolating them from the area, affected by the oil spill. However, when oil spills occur, mechanical measures are considered as a priority for responding to oil spills in rivers and seaports. In addition, in order to meet the oil spill incident in a professional manner, it is necessary to equip a specialized oil spill response vessel. In recent years, it has been shown that the application of environmental remediation or the liability to pay for damages caused by an oil spill is often based on the cause of the oil spill incident. Specifically, the subject causing the incident is the business. The general solution to the above problem is that the law enforcement agency should force the polluter first to fully implement measures to overcome pollution and restore the environment. In cases where they fail to take such measures, the State management bodies in charge of environmental protection shall determine the damage so that the polluters must pay compensations strictly according to the provisions of law. Trung Thanh - Lam Anh Responsibilities of organizations and individuals for oil spills On 12 May 2005, the Prime Minister signed the Decision No. 103/2005/QĐ-TTg promulgating the Regulation on Resilience Oil spills, clearly defining the contents of activities and responsibilities of organizations and individuals in coping with and overcoming the consequences of oil spill incidents nationwide. In particular, the establishment owner shall be responsible for developing a plan to respond to the oil spills and submit them to the competent authority for approval. Conduct the oil spill response agreements and contracts with appropriate agencies and units. At the same time, they shall be responsible for the oil spills caused by their establishments; To actively and positively mobilize resources, organize by themselves, command timely and effective response to oil spills. The facility owner is also responsible for compensating for the damage caused by the spill incident as prescribed. Equipment and equipment capable of causing oil spills must be insured for environmental pollution corresponding to the risk of spillage.

The ships under Regulation 26, Annex I of the International Convention for the Prevention of Pollution from Vessels, which Vietnam is a participating member state, must have an oil pollution response plan approved by a competent authority. People's committees of provinces and cities under central authority (referred collectively to as provincial level), National Committee for Search and Rescue, relevant ministries and agencies, regional oil spill incident response centers, economic organizations - Other societies must strictly abide by the provisions of this Regulation. The Vietnamese State encourages and creates favorable conditions for domestic and foreign organizations and individuals to invest in infrastructure and equipment in service of oil spill incident response and environmental protection activities. Schools in Vietnam in accordance with the law, carry out the mobilization of the National Committee for Search and Rescue, the People's Committees of the localities

## **2. The consequences of marine pollution caused by oil spills**

The Vietnamese waters are an open ocean linking the Pacific Ocean and the Indian Ocean, which is one of the navigable maritime tracts of which 70% are oil tankers.

Although it has not yet been classified as a serious pollutant, it has also been warned that there is a high risk of future pollution, as the industry is booming in coastal areas, plus exploration and mining activities. Oil and gas exploration and exploitation in the region is on the increase, while the area is often a dangerous disaster at sea.

According to the Vietnam Institute of Marine Science and Technology - Vietnam Academy of Science and Technology: From 1989 to now, Vietnam's sea area has about 100 oil spills caused by ship accidents. Pour into the sea from a few tens to hundreds of tons of oil. Oil spills usually occur in March and April each year in Central Vietnam; From May to June in the North.

Statistics show that, in the period 1992-2008, the oil spill in the sea of Vietnam comes from many different causes. Specifically, oil spills of 7,700 metric tons are usually concentrated mainly due to ship stranding. Oil spills in excess of 700 tons are mainly due to oil transport and ship collisions.

Oil spills pollute the marine environment, seriously affecting ecosystems. Especially ecosystems of mangroves, seagrasses, sandy tidal areas, lagoons and coral reefs. Oil pollution reduces the resilience, flexibility and resilience of ecosystems. Oil content in the water is high, oil films reduce the oxygen exchange capacity between air and water, reducing oxygen in water, causing the balance of oxygen in the ecosystem to be upset. In addition, oil spills contain toxins that damage the ecosystem, which can cause ecological degradation. Because oil contains many different components, transforms, destroys the cellular organism structure, sometimes causing the whole population to die. Oil seeped into the sand and coastal mud can affect for a very long time. There have been many cases where organisms die massively due to the effects of an oil spill.

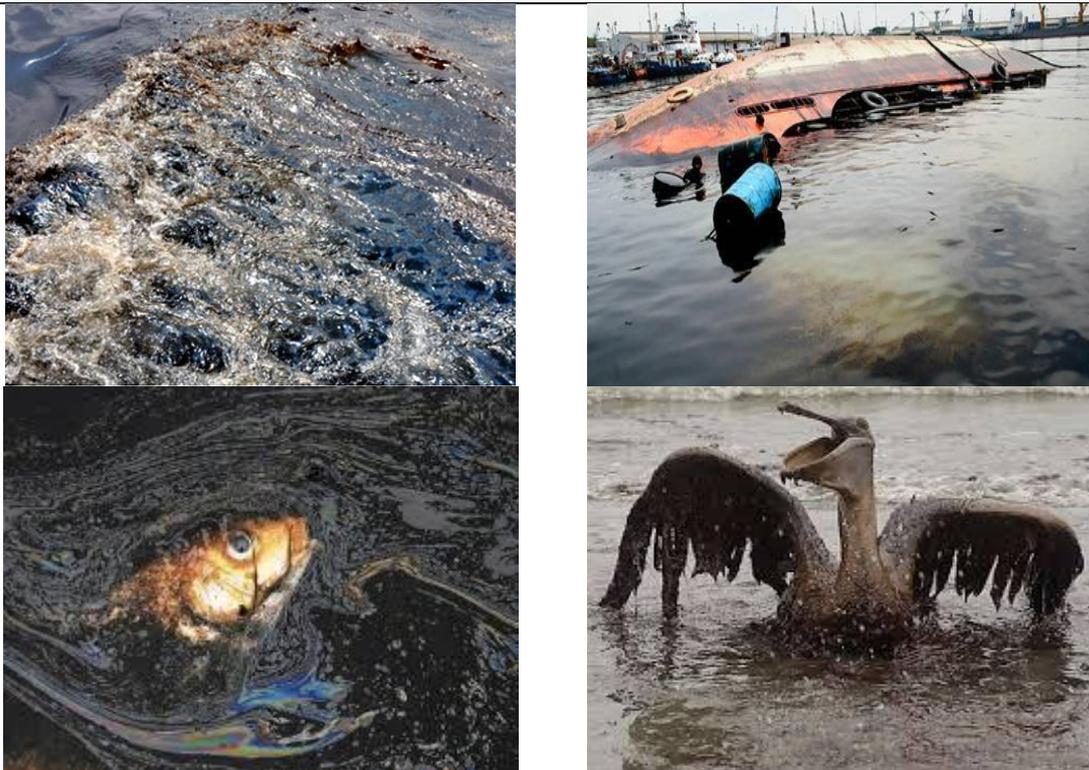


Figure 1. The effect of oil spill, oil slick on the environment and sea lives

It is also alarming that the oil spreading at sea and washed ashore for long periods of time without collection will reduce the number of organisms that cause damage to the fishing and aquaculture industries. Oil contaminates the water environment causing the fish to die massively due to lack of dissolved oxygen. The oil clinging to the soil, rock embankment, island coasts make beauty look, causing bad smell to the revenue of the tourism industry was also severely damaged. Oil spills also affect the operation of fishing ports, ship building and repair facilities. As oil drift breaks down machinery, equipment for resource extraction and shipping.

Through surveys at Lach Bang fishing port, Tinh Gia district, Thanh Hoa province, where frequent anchorage of thousands of fishing vessels from different regions. The environmental pollution of the water here is due to the sludge of the ship "careless" discharge into a large black area. If 10 years ago this estuary was home to a rich ecosystem of mangroves, now almost the entire area of mangroves infected with oil is dying to death, leading to the real Brackish water is almost extinct. This is also a continuous incident of oil pollution causing hundreds of hectares of aquaculture lost, so many households forced to quit.

Consequently, the oil spill incident can be considered as one of the types of breakdown that causes the greatest economic loss, in the type of human-induced environmental breakdown. Currently, the location of oil spill and overcome this problem in Vietnam still have many limitations, both legal basis and specialized equipment and technical means to overcome oil spill pollution.

### 3. The process of transformation of the oil spill incident at sea

As oil spills over the sea, it experiences a lot of physical and chemical fluctuations. Some of these changes lead to the oil being removed from the surface of the sea water, while others make the oil still on the surface. The process of transformation of oil spill on the sea together with the conditions of wind waves, flow ... will undergo the transformation process as follows:

#### The process of diffusion

Petroleum and petroleum products are liquids with very low solubility in water, especially sea water. Therefore, when the oil enters the water, there will be a phenomenon spreading on the surface of the water. Sea surface spill distribution takes place under the influence of gravity. It is controlled by oil and water surface tension. This process is especially noted for effective oil spill response. In static conditions, one ton of oil can spread over 12km<sup>2</sup> of water, a drop of oil produces a 20m<sup>2</sup> oil film with a thickness of 0.001mm, which is capable of contaminating a ton of water. Due to the evaporation and dissolution processes, the density, viscosity increases, the surface tension decreases until the thickness of the oil reaches the minimum, the flowing process

terminates. In the absence of disturbance factors, the oil diffuses into a circle, covering a maximum area of:  $S_{max} = R^2 \max$ . In fact, the process of ocean flow is heavily influenced by wave, wind and tidal elements.

### **Evaporation process**

In parallel to the diffusion process, the oil evaporates depending on the boiling temperature and the partial pressure of hydrogen and carbon in the oil as well as the external conditions: temperature, wave, wind speed and area. The oil between the oil and the air. Hydrogen and carbon have the lower boiling point, the higher the evaporation rate. Under normal conditions, the components of the oil with boiling point lower than 200 ° C will evaporate within 24 hours. Light products such as kerosene, gasolol can evaporate for hours. Light crude oils evaporate about 40%, while heavy crude or heavy oils are less volatile, and do not even evaporate. The evaporation rate decreases over time, reducing the amount of oil, reducing the possibility of fire and toxicity, while evaporating also increases the viscosity and density of the remaining oil, resulting in speed. Diffusion decreases.

### **Diffusion process**

This is the process of mixing water and oil. Oil- and oil-laden oil-streaks, which produce particles of different sizes, in which particles are small enough and durable enough to mix relatively reliably into water. This increases the surface area of the oilseed, stimulates the deposit of the oil to the bottom or helps the oil's ability to contact with the oxidizing agent, decomposes the oil, accelerates the decomposition of the oil. This phenomenon usually occurs in places where the waves break and depends on the nature of the oil, the thickness of the oil as well as the sea conditions. Under normal conditions, light-weight, light-weight oil particles can disperse over a period of several days, while large-volume or low-oil emulsions are dispersed.

### **Dissolution process**

The solubility of the oil in the water is limited to light components. The rate of dissolving depends on the composition of the oil, its degree of spread, its temperature and its ability to diffuse the oil. FO oils are less soluble in water. The most soluble in water is gasoline and kerosen. However, in any case, the oil content soluble in water always does not exceed 1 ppm (1 mg / liter). The dissolution process also increases the biodegradability of the oil. But this is the factor that increases the oil's toxicity to water, smells, poison the ecosystems of plants and animals in water, especially for animals, oil directly and slowly into the organism leading organisms. To deteriorate food quality.

### **Emulsification process**

This is the process of forming glue particles between oil and water or water and oil. Water-based glue: is a colloidal bead oil, which is water; Are hydrated oil seeds that increase the volume of the oil mass 3-4 times. The particles are quite durable, hard to break to separate water. This type of glue has a very high viscosity, high adhesion, obstruct the collection, difficult to clean the coast. Water-based glue: Water-based glue is an oil that is made of high viscosity oil particles under the long-term effects of waves, especially broken waves. This glue is less durable and easier to extract water. Emulsification depends on the composition of the oil and the turbulent state of the seawater. Wind level 3, 4 after 1-2 hours create a lot of oil emulsion particles. High viscosity oils are easy to create oil emulsion. The most stable emulsion contains 30-80% water. Emulsifying reduces the rate of decomposition and oil weathering. It also increases the amount of pollutant load and increases the work to be done to prevent pollution.

### **Process of depositing**

Because the density is less than 1, oil and petroleum products often float to the surface without sinking to the bottom. Emulsions after absorbing physical or biological matter can become heavier than water and then sink. There are also some suspended particles, further absorb the scattered particles and sink gradually deposited to the bottom. There is also the process of encapsulation, ie the process of accumulation of many small particles into large array.

### **Oxidation**

In general, the hydrocarbons in the oil are quite stable with oxygen. But in reality the oil exists in water or the air is still oxidized to a very small fraction (about 1% of mass). These processes occur due to oxygen, sunlight (ultraviolet rays of the solar spectrum) and are catalysed by a number of elements and the inhibition (slowing) of the sulfur compounds forming hydroperoxides and Other products are usually soluble in water.

### **Biodegradation process**

There are many different types of microorganisms that can consume certain segments. Each type of microorganism is only capable of decomposing a particular group of hydrocarbons. However, in the river water there are many strains of bacteria. Therefore, very few types of hydrocarbons can withstand this decomposition. Microorganisms can decompose 0.03-0.5g of oil per day per square meter. When the oil falls into the water, the strain of microorganism is active. The diffusion process occurs well, the process of oil ingestion also occurs strongly. The condition that oil-eating microorganisms can develop is that they must have oxygen. Therefore, it is easy to decompose on the surface of the water, but when sinking to the bottom it is difficult to break down in this way.

#### 4. Some solutions for treating and recovering the oil spill and slick

Preventing and responding to oil spill problems is a complex but difficult and difficult task, requiring swift organization, coordination and the application of appropriate techniques.

Oil spill containment can be carried out using high or simple technical tools such as use of specialized oil separators or using bamboo to make buoys and then quickly collect them all the way from the pump. Sucking until hand picking; It is possible to use straw or porous materials that are soaked in oil that is dropped into the oil for oil to penetrate, then picked up and picked up in a safe place.

In offshore, offshore oil spills, consideration may be given to using oil dispersants to prevent oil from spreading to the shore, as these areas are often sensitive areas, where The living of plants and animals, coastal nature reserves and mangroves should be prioritized for protection.

When the oil has spread and washed ashore, all means, from raw materials (such as shovels, buckets, pots ...) to modern ones (urchin, oil pump, Bulldozers, trucks ...) organize the collection of oil scum, oil sludge.

Oil spills, oil dregs and other oil-based materials (such as soil, sand, branches, garbage, etc.) need to be gathered in one place, preventing the seepage from seeping into the surrounding environment. Specialized instruction manual.

In addition to the above-mentioned emergency measures, advanced countries have used supportive tools to assist in more effective incident recovery such as using satellites to track oil spills in the direction of Wind or tide for timely measures. Using specialized vessels and floats to disperse dispersions or prevent oil spills makes collection easier.

In addition to scattered chemicals, another method is to use microorganisms or biological agents to disperse or decay the oil.

#### 5. Conclusion

Oil spill seriously affects the environment and ecology in any location. Its effects and damage to the environment are difficult to assess. The cost of overcoming oil spills is huge, sometimes up to billions of dollars, depending on severity. According to the assessment, the cost of overcoming oil spills depends on the type of oil spill and, depending on whether the area is offshore or offshore. It is estimated, to handle and fix a barrel of crude oil at \$300- \$600 in relatively low standard conditions. In other places it can be up to \$1200-2400 for a barrel of crude oil at the same conditions.

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