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# Oil spill in maritime field: An urgent problem in Vietnam

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**Abstract**
According to the statistics of the International Association of Oil Tankers, of the 39 listed countries, Vietnam is one of the three countries (along with China and the United States) that have the highest number of oil spills with the number of 10 incidents or more, from 2005 to 2014. Facing the situation of oil spill incidents in Vietnam in recent years, especially oil spill incidents at sea According to statistics, from 1992 to now, there have been 190 oil spills in Vietnam, of which 37 offshore cases accounted for 19%, 88 coastal cases accounted for 47% and 65 onshore cases accounted for 34%. Coastal oil spills occur the most (47%) due to the higher risk in this area, the density of large vessels, the risk of ship collision, or ship collision into the wharf. Shallow much higher than at sea. Land spills account for 34% is not a small number. Especially the oil spill occurred at sea "is not necessarily correct, because in terms of the number of oil spills occurred at sea only accounted for 19%. In recent years, we also see oil spill on the coast of many provinces in the Central and the South.

**Keywords:** oil spill, recovery, marine environment

## 1. Introduction
Oil spills are the release of liquid petroleum hydrocarbons into the environment due to human activities and cause environmental pollution. The term often refers to oil spills that occur in a marine or river environment. Oil may include various types from crude oil, refined petroleum products (such as gasoline or diesel oil), vessels' oil tanks, waste oil or oily waste. This release may take months or even years to clean up. Oil is also released into the environment due to natural leaks from the seabed geological structures. Most human oil pollution comes from ground-based operations, but the outstanding issues are especially geared towards shipping of oil at sea. The oil seeps through the feathers of seabirds, reduces their isolation, and thus makes them vulnerable to abnormal temperature changes and reduces their buoyancy. It also reduces birds' ability to fly, making them more difficult to escape predators. When trying to preen, birds often swallow oil in the stomach, leading to kidney damage, altering lung function, and stimulating the digestive system. These problems and limited ability to absorb food cause dehydration and metabolic imbalances. Changes in hormone balance including luteinizing protein may also occur in some birds when exposed to oil. Most birds affected by the spill will die, unless human intervention is involved. Oil-affected marine mammals are similar to birds. The oil that covers the coat of otters and seals reduces metabolism and reduces body temperature. When ingested oil, animals will suffer from dehydration and reduce the ability to digest. Because oil floating on the water causes light to decrease when it penetrates into the water, it limits photosynthesis of marine plants and phytoplankton. This reduces the number of individuals of the fauna and affects the food chain in the ecosystem. An oil spill is the release of a liquid petroleum hydrocarbon into the environment due to human activity, and is commonly a form of pollution. Oil spills can arise from a number of different sources ranging from oil loading, unloading or pipeline operation, and from a collision or grounding of vessels carrying crude oil and product in local ports or coastal waters. They can also arise from tankers or barges operating on inland waterways, or from exploration and production operation and tankers operating in international waters.

There are also other nonoperational sources such as urban runoff and natural seepage. Oil spills are a major ecological and environmental problem. Often the term refers to marine oil spills, where oil is released into the ocean or coastal waters. The oil may be a variety of materials, including crude oil, refined petroleum products, or oil mixed in waste. Oil is the most common pollutant in the oceans. More than 3 million metric tons of oil contaminate the sea every year. The majority of oil pollution in the oceans comes from land. Runoff and waste from cities, industry, and rivers carries oil into the ocean. Ships cause about a third of the oil pollution in the oceans when they wash out their tanks or dump their bilge water. Oil spills account for less than 15% of the total oil in the oceans but are probably the most obvious form of oil pollution. The damage caused by oil spills is certainly seen right away. We've all seen images of the water's surface and shoreline covered with oil and dying animals and plants. Oil spills will continue to be problem and source of pollution as long as ships and barges move most of our petroleum products around the world. When oil leaks or spills into water it floats on the surface of both freshwater and saltwater. Oil floats because it is less dense than water. Density is a property of every liquid, solid, and gas. Density tells how much mass is in a specific volume (mass divided by the volume) of a material. It may help to think of density as the relative heaviness of a material or how compact or crowded the molecules are in the material. Denser materials have larger number values than less dense materials. For example, oil has a density of 0.85 g/cm$^3$ and seawater has a density of 1.02 g/cm$^3$. When these two liquids are mixed together, the denser seawater forms a layer underneath the less dense oil. It's much easier to clean-up an oil spill because of oil's lower density. You can imagine how difficult it would be to clean-up a spill if oil was denser than water and formed a layer along the bottom instead of the surface. We humans have come up with some pretty creative ways to clean-up spilled oil and we've described some of the major methods below.

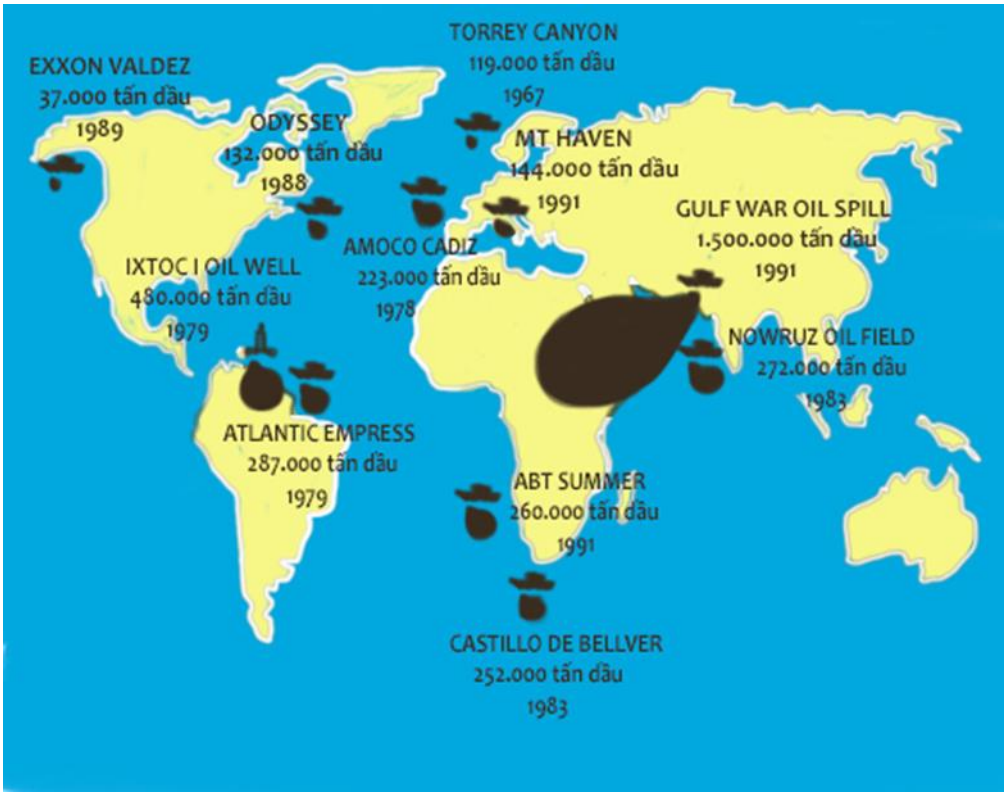


**Fig. 1:** Large oil spill in the history

Oil spills occur in oceans, lakes, and rivers all over the world. Some of these spills are large and very damaging to nature while some are small and occur regularly. Examples of small spills are: used oil from automobiles that is poured down storm drains and the discharge of oil from outboard motors on boats. The extent of damage a spill does to the environment is related to the oil type, size of the spill, weather conditions, location of the spill, and the timing of the spill. Winds, tides, and waves will all have an effect on where the oil goes and how much damage it does. The oil from a spill can affect the marine environment by coating the substrate and organisms living on nearby shorelines with oil, evaporating into the atmosphere to become an aerosol that is transported by the wind, breaking into smaller particles in the water that are ingested by zooplankton and small fishes and enters the food chain, coating the fur and feathers of mammals and birds, destroying their insulating ability, reducing buoyancy, and harming the animals when the oil is ingested as they clean themselves. Oil spills can come from a variety of sources such as tankers, oil exploration and storage facilities. Oil spills from tankers are usually caused by cracks, leaks in the hull or collision. Serious oil spills, such as the one on the Lebanese coast in 2006 or the 2002 Prestige accident off the Spanish coast, can be a serious threat to marine, aquatic and marine ecosystems. Oil spills often happen to attract public attention, but such incidents actually account for only a very small fraction of the total amount of oil pollution. According to a 2003 National Research Council (NRC) report, Oil in the Sea III: Inputs, Fates, and Effects

(70%, Source of Sea III: Generating Source, Fate and Impact), 70% Oil enters the sea due to human activity; In North America this rate is nearly 85%. Much of the oil flowing into the ocean is related to its use on land, especially from the transportation industry - a prime example of a diffuse pollution source.

**2. Solutions**

Humans are not the only agents responsible for oil pollution in the ocean. The NRC estimates that nearly half of the oil entering the ocean is a result of natural processes, including natural leakage. Although a large amount of oil enters the ocean from this relatively unknown and seemingly harmless phenomenon, it also changes the natural environment. However, over time, the organisms living in these areas will gradually adapt and create ecosystems that can survive or even develop. Scientists are continuing to study this phenomenon to better understand how oil changes the way in which an organism lives. The most effective and important measure is to prevent the source from arising in the first place. In the United States, the Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) collaborate to prevent and treat oil pollution in ocean areas. International cooperation organizations, such as the United Nations MARPOL 73/78 Agreement (Marine Pollution), which came into effect in 1983, have contributed to reducing the amount of oil pollution originating in the shipping industry.

Just one year after the 1989 Exxon Valdez oil spill, the US passed the Oil Pollution Control Act of 1990, requiring the petroleum industry to be more cautious to avoid the oil spill and have a plan to respond. Emergency response to deal with spills. In addition, in 2015, all tankers operating in US waters must be designed with double hulls, so if the outer hull is broken, the inner hull will contain fuel. International associations and more stringent legal documents have proven effective, since 1989, oil spills have been fewer and fewer. Another method is to improve tanker positioning devices - especially the emergence of global positioning systems. However, just like the design of a double hull, the technology only helps prevent incidents if used properly. Planning for an oil spill emergency helps minimized potential danger to human health and the environment by ensuring a timely and coordinated response. Well-designed local, regional and national contingency plans can assist response personnel in their efforts to contain and clean up oil spill by providing information that the response team will need before, during and after spills, occur. Developing and exercising the plan provides opportunities for the response community to work together as a team and develop the interpersonal relationship that can mean so much to the smooth functioning of a response. Because the approached and methods for responding to oil spills are constantly evolving and each oil spill provides an opportunity to learn how to better prepare for future incidents , contingency plans are also constantly evolving and improving – ensuring increased protection for human health and environment from these accidents.

**Fig. 2:** Oil spill trace

Mechanical recovery constitutes the most common approach for combat of marine oil spills. The mechanical recovery operation will typically involve the following components: Booms for containment of oil Skimmers for recovery of oil Pumps Oil/water separators Temporary storage Vessel for towing of booms and operation of

recovery units the operation may involve three or two vessels, depending on how the boom is deployed. The purpose of the boom is to concentrate the oil to a thick enough layer for effective recovery to take place. The effectiveness of booms to accumulate the oil is highly dependent on wave conditions, tow speed, boom configuration. Shoreline cleanup by mechanical removal involves a wide range of different tools and techniques, reflecting the highly variable conditions that a shoreline area can represent. Techniques may be ranging from manually removal of oil using sorbents of simple tools to the use of more advances beach cleaning machinery. Here is only listed a number of techniques/tools commonly applied to remove oil at a shoreline: Manual sorbent application; Manual removal of oiled materials (hand, shovel, rakes); Manual cutting of vegetation; Low pressure flushing at ambient temperature; Vacuum trucks; Warm water / low pressure washing; High pressure flushing; Manual scraping; Beach cleaners. Over the five years since the Deepwater Horizon oil spill, numerous new techniques, materials and approaches to cleaning up oil. Most likely spawned by the immense need to find a better way to clean polluted water and land than using things like chemical dispersants, these ideas started being tested and developed. Hopefully, when another disaster occurs, we'll be better prepared so that the impact is far less severe. The smart filter technology is able to essentially strain the oil from the water because of a novel nanomaterial coating that repels oil, but attracts water. To test the material, the team dipped postage stamps and small scraps of polyester in the solution, cured them with ultraviolet light and tested them in various oil and water mixtures and emulsions, including things like mayonnaise. Amazingly, with 99.9 percent efficiency the material was able to separate out all the different oil and water combinations. Published in the journal Energy & Fuels in 2012, scientists from Penn State reported that they had demonstrated a "complete solution" for oil spill cleanup. It's a super absorbent polymer material that can soak up 40 times its own weight in oil. The material could then be shipped to an oil refinery for recovery of the absorbed oil. The material that they call PETROGEL transforms the absorbed oil into a soft, solid oil-containing gel. The scientists say that one pound of the material can recover about 5 gallons of crude oil. It's strong enough to be collected and transported where it can then be converted to a liquid and refined like regular crude oil.

The newest innovation in oil spill cleanup is this oil-trapping mesh developed by researchers at Ohio State University. The stainless steel mesh stops oil, but allows water to go through and its design was inspired by the lotus leaf. Lotus leaves are covered in tiny bumps that are tipped with even tinier hairs, which cause water to bead up and roll off when it lands on the surface – oil, however, isn't affected in the same manner. The scientists altered the design of the mesh so that oil was repelled, but water was not. Tests showed that when oil contaminated water was poured onto a piece of the mesh, the water flowed through while the oil was stuck on top. The researchers believe that large nets made from the mesh could be used to gather crude oil from sea water and then the oil could be used.

Scientists are reporting development and successful testing of the first self-propelled “microsubmarines” designed to pick up droplets of oil from contaminated waters and transport them to collection facilities, These tiny technological marvels could propel themselves through water and absorb oil and when the job's done, gather at a collection area, guided by magnetic or electrical fields. The microsubmarines are based on microtube engines that were created to deliver medicine through the bloodstream of the human body. The submarines are eight micrometers long -- ten times smaller than the width of a human hair -- and are propelled by an inner layer of hydrogen peroxide that reacts with the liquid they're submerged in to produce bubbles and shoot them forward. The submarines have a cone-shaped front end and are coated with a "superhydrophobic,” or extremely water-repellent and oil-absorbent, coating that helps them to glide through the water but also absorb any oil droplets along the way. In small-scale tests, the microsubs were able to successfully gather and transport oil in water. A lot of lessons have been learned about how to handle the oil spill since the Exxon Valdez incident. For example, some of the cleaning methods used after the Valdez oil spill accidentally caused additional damage; In particular, hot water pressures with high pressure have destroyed both sediments and nutrients that support ecosystem restoration. To prevent the spillover effects of the incident, we can crank up the oil by using an absorbent barrier or by using a boat to scoop the oil off the surface. Another useful method is local burning, the oil will be burnt right in the water. New biological treatment technologies are constantly being developed using microorganisms to convert hydrocarbons into less toxic compounds. Scientists are studying new ways to limit the effects of the oil spill; there are even studies that use proteins from horse sweat to mitigate environmental damage. Since it is not possible to completely eliminate the risk of oil spills during the extraction, processing and transportation of oil, a detailed plan is needed to clean up and limit negative impacts. However, with increasingly stringent rules and regulations, along with the constant development of scientific research, the number of oil spills and the serious damage have been significantly reduced.

## 3. Conclusion

Oil spills often have serious consequences, polluting the environment, affecting the ecological environment, aquatic resources, water and land in a wide area, causing damage to economic activities. , especially exploitation and use of aquatic resources. For birds, oil spills make the feathers "wet" making birds vulnerable, reducing their ability to fly. When the birds preen as well as eating oily food causes them to stimulate the digestive system, reduce lung function, metabolic imbalance ... if not saved and "washed" in time will be dead. For mammals, when their skin and hair get oily, their ability to retain heat is reduced. Oil absorbed into the body as well as into the stomach will clean the hair itself, leading to reduced digestive function, dehydration. Crude oil is mainly composed of hydrocarbons with many components that have not been removed such as sulfur, nitrogen and many heavy metals. When oil slicks, reducing light penetrates into the water, limiting the photosynthesis capacity of marine plants, affecting the food chain in the ecosystem. Each year, about 200 million tons of oil is transported through the waters off Vietnam, by sea from the Middle East to Japan, Korea ... In the process of shipping and exploiting offshore, it is possible that incidents (caused by humans, natural disasters

...) lead to spillage of oil into the sea, causing pollution of the marine environment. According to the statistics of the Ministry of Natural Resources and Environment, the National Committee for Search and Rescue, in the last 20 years, about 10 major oil spills have been recorded every year, especially, in 2012 there were 12 cases, affecting the environment. Estuaries and coastal areas of our country. In particular, in January 2005 the tanker KASCO Monrovia collided with Cat Lai Jetty, on the Saigon River spilling 518 tons of DO oil. From the end of 2006-2007, a series of localities along the coast of Vietnam has appeared clumping oil phenomena such as Quang Nam, Vung Tau, Thua Thien - Hue, affecting coastal ecosystems as well as areas. Coastal resort...

**References**


1. Doggett T (1999) Decade After Valdez Oil Spill, Only Two Species Have Recovered. Pub. Reuters Limited, Feb. 9,1999
2. Etkin, D,S (1998) Oil Spills from Production and Exploration Activities - White Paper Series Vol. II, No.8 Oil Spill Intelligence Report Oct 1998. Pub. Cutter Info. Corp.
3. AMSA, (1998) Annual Report of the National Plan to Combat Pollution of the Sea by Oil and Other Noxious and Hazardous substances 1997-98, Pub. AMSA pp 11-12.
4. Gilbert, T.D. (1996) New Technologies to Assist Oil Spill Response in Australia. Proceedings of the 6th International Oil Spill Conference, 9-12 Sept. 1996, Melbourne.
5. Gilbert, T.D. (1998) Maritime Response Operations-Requirements for Met/Ocean Data and Services. In proceedings of the Conference on Meteorological and Oceanographic Services for Marine Pollution Emergency Operations (MARPOLSER 98) July 13-17, 1998, Townsville, Pub WMO/IMO.
6. Gilbert, T.D. (1997) Remote Sensing and Surveillance of Oil Spills, In Proceedings of 7th National Plan Scientific Support Coordinators Workshop, 22-26 September 1997, Darwin. Pub. AMSA.
7. Sloan, S.L., K.R. Bitting, and A.B. Nordvik, Phase 1: Oil Containment Boom at Sea Performance Tests, MSRC Technical Report Series 94-007, Marine Spill Response Corporation, Washington, DC, 85 p., 1994.
8. Smedley, J.B., “Assessment of Aerial Application of Oil Spill Dispersants”, in Proceedings of the 1981 International Oil Spill Conference, American Petroleum Institute, Washington, DC, pp. 253-257, 1981.
9. Smith, G.F. and H.W. Lichte, Summary of U.S. Environmental Protection Agency’s OHMSETT Testing, 1974-1979, EPA report number EPA-600/9-81-007, Cincinnati, OH, 1981.
10. Smith, J.B.H., C. McLellan, and L.R. Pintler, “Development of an Oil Skimming System to Meet Navy Specifications”, in Proceedings of the 1989 International Oil Spill Conference, American Petroleum Institute, Washington, DC, pp. 91-94, 1989.