Emergency Sea Protection: New Technologies During Oil Spill

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1 Introduction

Every day, hundreds, if not thousands, of oil spills are likely to occur worldwide in many different types of environments, on land, at sea, and in inland freshwater systems.

The spills are coming from the various parts of the oil industry, mainly during:

- Oil exploration and production activities.
- Oil transportation in tank ships, pipelines, and railroad tank cars.

The sea environment is particularly subjected to oil pollution. It is estimated that approximately 706 million gallons of waste oil enter the ocean every year[1]. According to the data of oil spills in the United States published by the Environmental Research Consulting (ERC), large spills (over 30 tons), which the 0,1% are incidents, represent the 60% of the total amount of oil spilled. Despite the latter information, 72% of spills are of smaller amount (0.003 to 0.03 ton or less) as shown in (Figure 1-1).

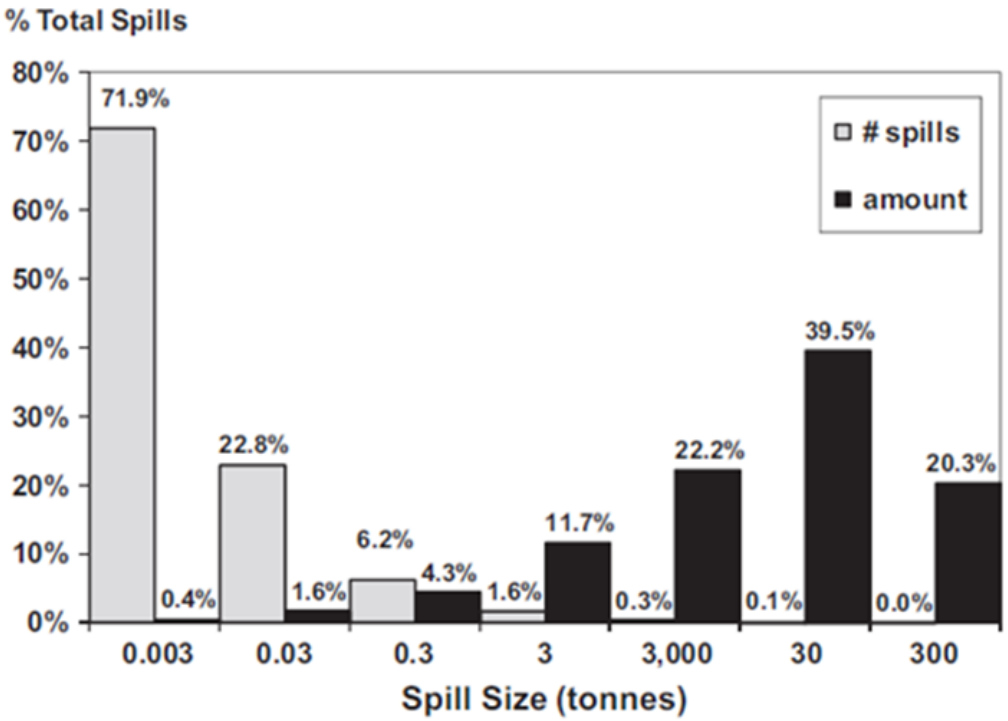

Figure 1-1 Size classes of U.S. marine oil spills, 1990 e 1999 (ERC data) [2].

Naturally, the relatively rare large spill incidents get the most public attention owing to their greater impact and visibility, for this reason it is impossible to measure the entity of damage only considering the size of spillage. Location and oil type are extremely important. Significant efforts have been made to study oil spills after the Exxon Valdez spillage of 1989 (Figure 1-3). However, such knowledge has not kept pace with the growth of oil and gas development[3]. In 2010, in the Gulf of Mexico, took place the Deepwater Horizon oil spill (Figure 1-3) considered one of the most catastrophic environmental disasters in human history. In such occasion, over 4.9 million barrels of crude oil were released involving 180,000 km^2 of ocean[4].

Timely and highly efficient responses can lead to more hopeful outcomes with less overall damage to the environment. The most

used clean response devices and techniques[5] are (Figure 1-2):

- **Manual recovery**, mainly used for costal oil cleanup, involves a team of workers/volunteers using tools like rakes and shovels to collect the oil into buckets and drums for transfer it to a processing station.
- **Booms**, mechanical barriers that protect natural resources from spreading crude oil. They are very useful to confine the oil spill facilitating the cleaning operations.
- **Skimmers**, mechanical devices designed to remove oil from the water surface without causing changes to its physical or chemical properties and transfer it to storage tanks. Skimmers are usually used together with booms.
- **Sorbents**, materials that can soak up oil from the water by either absorption or adsorption.
- **In situ burning**. It is a cleaning technique which consists in a controlled burning of the oil that takes place at, or near, the spill site.
- **Dispersants** are chemical spill treating agents, similar to emulsifiers, that accelerate the breakdown of oil into small droplets that "disperse" throughout the water. Dispersants are used to reduce the impact to the shoreline and to promote biodegradation of oil.
- **Bioremediation**. It consists of the introduction of a microbial population (bio-augmentation) together with nutrients (bio-stimulation), to enhance the rate of oil biological degradation.

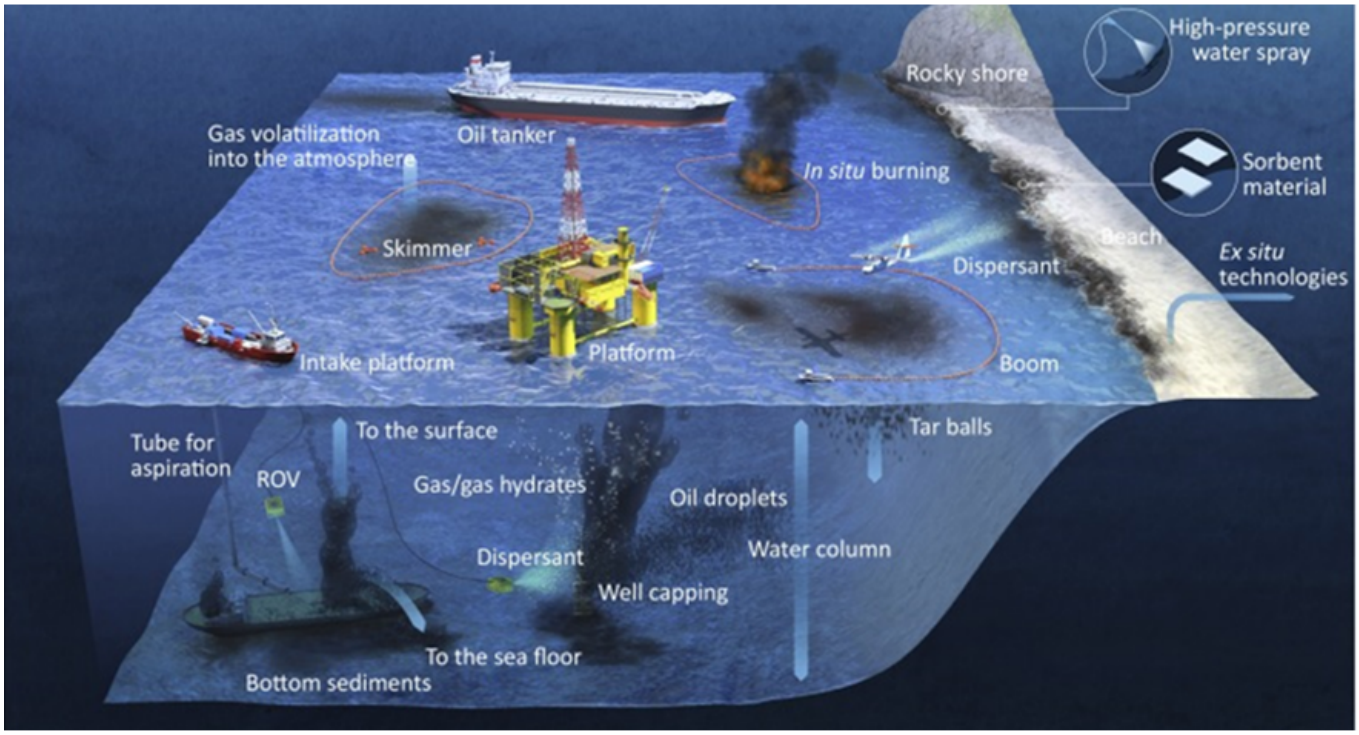

Figure 1-2 A visual overview of all the oil spill response techniques[6].

The detection and monitoring of oil spillage are of fundamental importance to perform a rapid response. Innovations on sea protection involve, in fact, both oil spill monitoring and response techniques.

Figure 1-3 BP Deepwater Horizon blowout 2010 (left), Exxon Valdez spillage (right)[7][8].

[1]

http://www.waterencyclopedia.com/Oc-Po/Oil-Spills-Impact-on-the-Ocean.html

[2] D. Schmidt-etkin, *Spill Occurrences: A World Overview*. D.S. Etkin, 2011.

[3] Li, P., Cai, Q., Lin, W., Chen, B., & Zhang, B. (2016). Offshore oil spill response practices and emerging challenges. *Marine Pollution Bulletin*, *110*, 6–27.

[4] Griggs, J. W. (2011). BP Gulf of Mexico oil spill. *Energy Law Journal*, *32*, 57.

[5] B. Chen, X. Ye, B. Zhang, L. Jing, and K. Lee, Marine Oil Spills – Preparedness and Countermeasures, Second Edition. Elsevier Ltd., 2019.

[6] F. Mapelli et al., "Biotechnologies for Marine Oil Spill Cleanup: Indissoluble Ties with Microorganisms," Trends Biotechnol., vol. xx, pp. 1–11, 2017.

[7] https://www.hakaimagazine.com/news/wounded-wilderness-the-exxon-valdez-oil-spill-30-years-later/

[8] https://it.wikipedia.org/wiki/Disastro_ambientale_della_piattaforma_petrolifera_Deepwater_Horizon

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