Oil Spills

The United States produces, distributes, and consumes large quantities of oil every year to fuel the Nation's factories and homes, to produce plastics and pharmaceuticals, to provide transportation, and to provide fuel for a small number of power plants. In 2013, the US consumed 18.49 million barrels of oil per day[29], or 283.5 billion gallons per year. From the production, storage, transport, and use of oil, an estimated 18,000-24,000 oil spills are reported and 10-25 million gallons of oil (or .003% - .009% of oil consumed) are spilled annually. The average size of a spill is 50 gallons.[30] The likelihood of a large spill is inversely proportional to the size of the spill.

All non-adversarial maritime oil spills are included in the Oil Spills national-level event. Also excluded from this analysis are large oil spills attributed to hurricanes. From 1964 to 2009, there were 2807 off shore spills greater than one barrel (42 gallons). Of those, 2175 events spilled an average of 3 barrels, 390 events spilled an average of 19 barrels, 210 events spilled an average of 186 barrels, and 32 events spilled an average of 16,052 barrels.[31] For comparison with pipeline spills, from 1968 to 2007, there were 7828 coastal and inland pipeline spills greater than one barrel. Of those, 16% were 10 barrels or less, 40% were 100 barrels or less, 84% were 1000 barrels or less, and 99% were 10,000 barrels or less.[32]

For the purpose of this risk assessment, we have divided oil spills into two categories: small oil spills ranging in size from 25 barrels but less than 2500 barrels, and large oil spills that are greater than 2500 barrels. Small oil spills create significant cleanup costs, particularly when they occur near coastlines. Large oil spills require contingency / surge operations to mitigate the effects of the spill, perhaps before it reaches a coastline.

Small oil spills in the maritime domain are often overlooked due to their localized effects and create a unique challenge due to containment issues, weather, geography, currents, waterways, and other factors. Although not given much national attention, smaller scale oil spills happen frequently with substantial economic impacts. For example, a 100 foot fishing vessel can hold thousands of gallons of fuel. In the event of sinking or grounding, most of this oil is frequently spilled.

Large scale oil spill events are infrequent but cause significant impacts to human health and safety, the environment, the economy, and surrounding communities. Large oil spills may or may not be declared a Spill of National Significance, as this designation reflects a determination of the potential magnitude and impact of the disaster which depends on multiple factors (in particular, location), not a release volume threshold fixed by plan or statute.

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29 http://www.eia.gov/countries/index.cfm?view=consumption

30 Dagmar Schmidt, Etkin, "Analysis of Oil Spill Trends in the United States and Worldwide," Environmental Research Consulting, Presented at 2001 International Oil Spill Conference, p.1291.

31 Anderson, Mayes, LaBelle, "Update of Occurrence Rates for Offshore Oil Spills," Department of the Interior, June 2012, p. 38.

32 Dagmar Schmidt Etkin, "Analysis of U.S. Oil Spillage," Environmental Research Consulting, API Publication 356, August 2009, p. 40.

Event Background

Oil releases in maritime environments threaten public health and safety by fouling drinking water, causing fire and explosion hazards, diminishing air and water quality, compromising agriculture, destroying recreational areas, and wasting nonrenewable resources. Oil spills also have a severe environmental impact on ecosystems by harming or killing wildlife and plants, and destroying habitats and food.

The severity of impact of an oil spill depends on a variety of factors, including characteristics of the oil itself. Even large spills of refined petroleum products, such as gasoline, evaporate quickly and cause only short-term environmental effects. On the other hand, crude oils, heavy fuel oils, and water-in-oil mixtures may sink or cause widespread and long-lasting physical contamination of shorelines. Natural conditions, such as water temperature and weather, also influence the behavior of oil in the marine environment.

The rate at which an oil spill spreads is a primary determinant of its effect on the environment. Most oils tend to spread horizontally into a smooth and slippery surface, called a slick, on top of the water. Oil spilled immediately begins to move and weather, breaking down and changing its physical and chemical properties. Crude oil spilled at sea may mix with sea water and become submerged as a cloud. This occurred in during the Deepwater Horizon oil spill in 2010.[33]

After oil is spilled, the most volatile and toxic substances in it evaporate quickly. Therefore, plant, animal, and human exposure to the most toxic substances are reduced rapidly with time, and are usually limited to the initial spill area. However, although some organisms may be seriously injured or killed very soon after contact with the oil in a spill (lethal effects), chronic toxic effects are more subtle and often longer lasting. For example, marine life on reefs and shorelines is at risk of being smothered by oil that washes ashore, or of being slowly poisoned by long-term exposure to oil trapped in shallow water or on beaches.

Catastrophic oil spills, where large amounts of oil can freely flow into the environment for days or weeks, can occur at sea when an oil well or tanker fails. While minor oil spills occur hundreds of times a year, spills of 10,000 barrels or more occur only a couple of times a decade, and the United States has experienced only three spills of 100,000 barrels or more in the past 40 years.[34]

Assumptions

Many of the assumptions used in this assessment are included in the footnotes.

The SNRA project team used the following to estimate health and safety consequences resulting from major oil spills ranging from catastrophic events (all off shore) to smaller pipeline and rail events.

- Historical Events: The SNRA project team analyzed a set of four historical maritime events in which large amounts of oil were spilled. A detailed listing of these events is found in

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[33] Ramseur, Jonathan L.; Hagerty, Curry L. (31 January 2013). Deepwater Horizon Oil Spill: Recent Activities and Ongoing Developments, CRS Report for Congress, Congressional Research Service, R42942.

[34] Exxon Valdez in March 1989, Mega Borg in June 1990, and Deepwater Horizon in 2010. A fourth large spill occurred in the Gulf of Mexico in June 1979 when the Mexican IXTOC 1 well ruptured. Since this was not a U.S. spill, it is not included in the analysis in this report.

Table 9 under "Additional Relevant Information." Additionally, the analysis does not take into account possible higher-consequence events that have not yet occurred, but rather assumes maximum fatalities and injured counts from the Exxon Valdez oil spill, the Deepwater Horizon oil spill, and the Mega Borg oil spill.

Environmental Impact

Large oil spills on the scale of those from the Exxon Valdez and Deepwater Horizon are among the most catastrophic environmental hazards in the homeland security mission space. By reference to these rare, large events, small oil spills as a national-level event typically have a much smaller environmental impact, as these events include oil spill incidents occurring dozens of times every year.

Potential Mitigating Factors

Maritime oil spills are becoming less frequent and less severe overall,[35] but catastrophic risk remains due to continued increase in oil imports and explorations in deeper water, as exemplified by the Exxon Valdez event and the Deepwater Horizon event. Much of this decrease is due to preventive actions put in place in the 1970s, 1980s, and 1990s. These improvements include double hulled ships and the use of GPS, RADAR, and SONAR for navigation.

While much of the responsibility for the response and recovery for an event rests within the private sector, state and territorial governments and the Federal Government also coordinate responses through the US Coast Guard (USCG) for off-shore spills and spills in the Great Lakes, and the US Environmental Protection Agency (EPA) for inland waterways. Specific activities include cleaning up the spill on land, removing soil exposed to oil, and cleaning up the spill on water by removing oil from water using controlled burns, or dispersing agents and sunlight to evaporate the spill.

Several methods exist for mitigating the effects of oil spills in the aquatic environment include rapidly containing and cleaning up the spills. Mechanical equipment, such as booms and skimmers, is often used to block the spread of oil, concentrate it into one area, and remove it from the water. Chemical and biological treatment of oil can be used in place of, or in addition to, mechanical methods, especially in areas where untreated oil may reach shorelines and sensitive habitats in which cleanup becomes difficult and expensive.

Cleaning shorelines after an oil spill is a challenging task. Factors that affect the type of cleanup method used include the type of oil spilled, the geology of the shoreline, and the type and sensitivity of biological communities in the area. Natural processes such as evaporation, oxidation, and biodegradation help to clean the shoreline. Physical methods, such as wiping with sorbent materials, pressure washing, and raking and bulldozing can be used to assist these natural processes.

In addition, the application of reparations for economic damages to individuals and businesses have been effective means of reducing the frequency and magnitude of events.

[35] Etkin, D.S., Environmental Research Consulting, "Analysis of U.S. Oil Spillage", August 2009.

Additional Relevant Information

Table 9 lists the maritime events analyzed and includes total fatalities and injuries for each event.

Table 9: List of Analyzed Events

#	Event	Date	Fatalities	Injuries
1	Ixtoc 1 Well[36]: 39.9 million gallons of oil, 1100 square miles, 162 miles of US shoreline	6/3/1979	0	0
2	Exxon Valdez Ship[37]: 11 million gallons of oil, 11,000 square miles, 1,300 miles of US shoreline	3/24/1989	0	0
3	Mega Borg Ship[38]: 4.6 million gallons, 300 square miles, little shoreline impact	6/08/1990	4[39]	17[22]
4	Deepwater Horizon[40]: 210 million gallons, 68,000 square miles, 1,074[41] miles of shoreline impact	4/20/2010	11[42]	17[43]

[36] Linda Garmon (25 October 1980). "Autopsy of an Oil Spill". Science News 118 (17). pp. 267–270.
[37] "Questions and Answers". History of the Spill. Exxon Valdez Oil Spill Trustee Council.
[38] Leveille, Thomas P. "The Mega Borg Fire and Oil Spill: A Case Study." U.S. Coast Guard Marine Safety Office Oil Spill Conference (1991): n. pag.ioscproceedings.org. Web. 21 Jan. 2014.
[39] Belkin, Lisa (June 11, 1990). "Flaming Oil Is Spilled Into Gulf as Blasts Rack Tanker". New York Times.
[40] "On Scene Coordinator Report on Deepwater Horizon Oil Spill," September 2011. http://www.uscg.mil/foia/docs/dwh/fosc_dwh_report.pdf
[41] Polson, Jim (15 July 2011). "BP Oil Still Ashore One Year After End of Gulf Spill". http://www.bloomberg.com/news/2011-07-15/bp-oil-still-washing-ashore-one-year-after-end-of-gulf-spill.html
[42] Kaufman, Leslie (24 April 2010). "Search Ends for Missing Oil Rig Workers". The New York Times. p. A8.
[43] Brenner, Noah; Guegel, Anthony; Hwee Hwee, Tan; Pitt, Anthea (22 April 2010). "Coast Guard confirms Horizon sinks". Upstream Online (NHST Media Group). http://www.upstreamonline.com/live/article212769.ece