

Oil Spills and the Exxon Valdez Tragedy

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Abstract

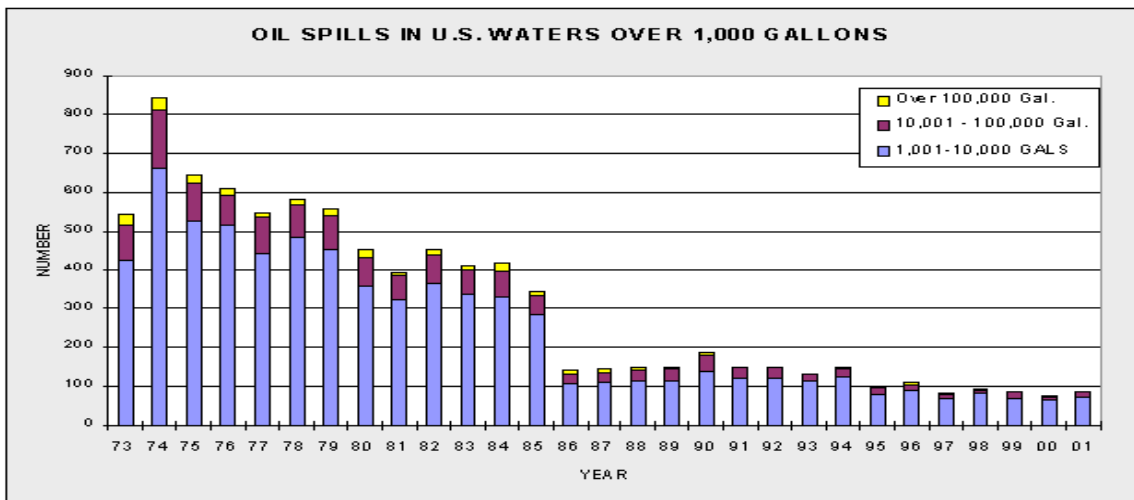
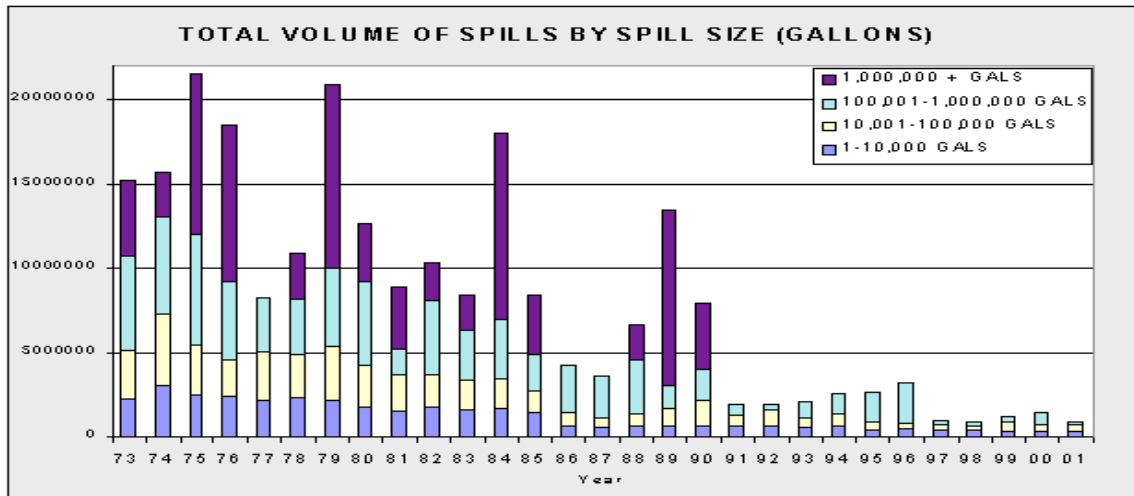
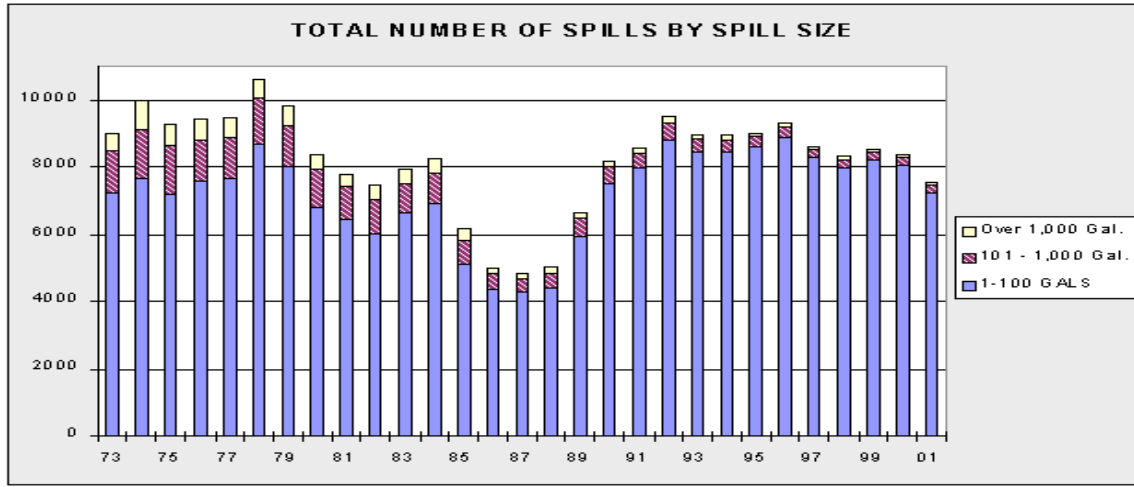
Oil spills are fairly common and pose a large threat to marine ecosystems. I feel that it is important to be conscious of the impacts and understand ways to prevent extensive environmental damage. In this paper I will briefly discuss the techniques used in preparing for oil spills, how spills can occur, where they occur, cleanup strategies and prevention methods. I will then provide an in depth analysis of the Exxon Valdez accident in Prince William Sound, Alaska of 1989. After reading this paper you should have an overview of oil spills and oil slicks and a good understanding of the Exxon Valdez incident. Although this paper focuses on oil spills in terms of crude oil, it should be known that other petroleum byproducts are often spilled into our water sources as well. Products such as vegetable oil are transported much like crude oil in large tankers. Spills involving products other than crude oil are just as hazardous, but for the purposes of this paper the focus will be on crude oil spills and their affects.

Since the industrial revolution and the inception of gas powered apparatus, oil production and consumption have increased drastically. However, oil has been leaking into water sources for millions of years. Human caused spills on the other hand are more of a recent problem, Today in the United States alone we consume more than 250 billion gallons of oil and petroleum products each year. The increasing rates of production and consumption have led to a need for rapid transport of petroleum products from the source to the consumer. Although oil pipelines may be the safest method, oil tankers are necessary to transport oil across vast bodies of water. Due to formidable oceanic conditions – as well as human error - such as high seas, torrential rain, strong winds, icebergs, rocks and other unkind forces, shipping accidents are inevitable and often result in the discharge of oil. The ensuing long term cleanup efforts and environmental impacts

are often costly. However, since oil spills are unavoidable to date, the best defense is a speedy cleanup so as not to allow detrimental environmental damage.

Once petroleum is recovered from the earth and refined the various byproducts are shipped for consumption via pipeline, tanker, barge or any number of other ways. Pipelines are the cheapest and safest method for transporting large quantities of petroleum. In the U.S. there are around 230,000 miles of pipeline. Through the pipelines, petroleum is pushed using a pumping apparatus at speeds up to 5 mph. For the most part, pipelines are buried and it is often difficult and costly to build them across large bodies of water. For that reason, barges, tankers and other ships are used to transport oil across oceans. The majority of large-scale oil spills are caused by enormous oil tankers traversing oceans. However, this does not mean that the majority of spills are tanker spills, if you consider spills of all magnitudes. In 1999 - the latest year with oil spill statistical analysis – 32 million gallons of oil were spilled in 257 incidents, but only 6.6 million gallons and 11 incidents were a result of tankers. In comparison 25 incidents were barges, freighters or other vessels accounting for 1.5 million gallons, and 18 accidents were a result of trucks or railroad transports (500,000 gallons). The majority of spills involved pipeline or fixed facility accidents (197 spills and 23.5 million gallons of oil). As usual the statistics vary from year to year but it is uncommon for tanker spills to be more prevalent than other types of spills. (Below you can see that most oil spills from 1971-1999 are of the 1,000-10,000 gallon variety. In addition, the number of oil spills has been decreasing over that same period due to stricter regulations and better technology. Also shown is a chart of the percentage of spills from different sources).
(www.uscg.mil/hq/g-m/nmc/response)

Graphs courtesy of U.S. Coast Guard



After discussing the source of oil spills it should be noted where they occur.

Since 1960, oil spills greater than 10,000 gallons have been reported in the waters of 112 different countries. However, there are certain locations known as oil spill hot spots.

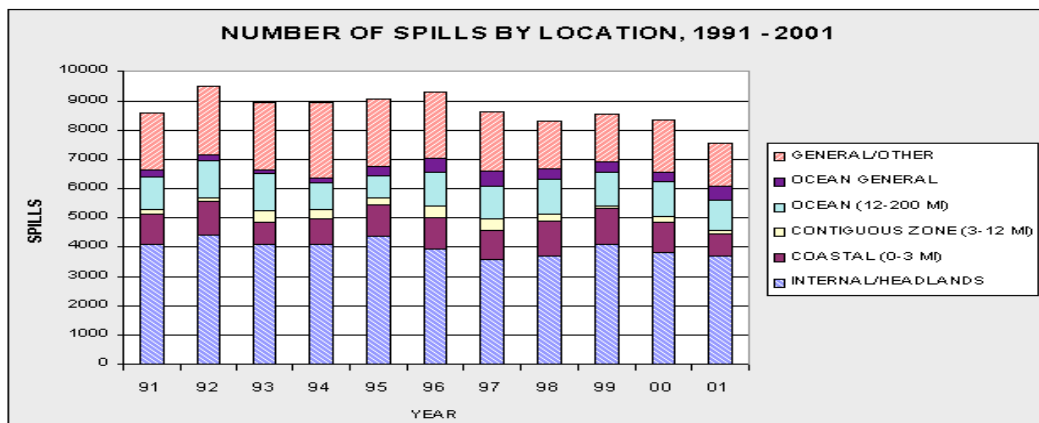
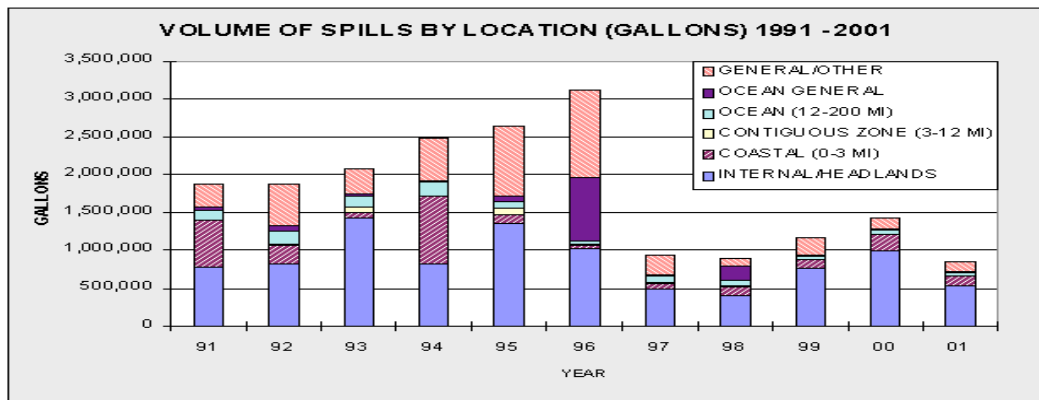
Some of the notable hot spots are; The Gulf of Mexico (267 Spills), the Northeastern U.S.

(140 Spills), the Mediterranean Sea (127 Spills), the Persian Gulf (108 Spills) and Japan

(60 spills). When looking at the oil hot spots, notice that all are heavily industrialized

areas, major thoroughfares or large oil producing areas. (Two USCG charts are shown

below indicating the number of spills by location and the volume of spills by location).



As is customary, once an accident occurs, mitigation of disaster is a vital element of reducing damage. When an oil spill occurs, factors such as amount of oil, chemical

properties of oil, weather and oceanic conditions, and whether the oil remains at sea or comes ashore are all taken into account before a cleanup plan is devised (www.itopf.com/f&e.html). A marine oil spill and an oil spill on land will result in different cleanup techniques. However, in both instances aerial photography and thorough investigation of the affected surroundings is key (In both instances international authorities will be notified as well; such as the U.S. Coast Guard, the Oil Spill Response Ltd - owned and operated by 26 of the world's oil companies - the World Wildlife Fund, the EPA and other economic and environmental groups). The most common methods for recovering oil from marine environments are the use of booms and skimmers, collecting the oil directly from the surface, and the use of oil dispersants, chemicals that break the hydrocarbon bonds (www.itopf.com/containment.html). Booms and skimmers are positioned to envelop the desired spill area and pump the oil into tanks for later disposal. Unfortunately, due to the chemical properties of petroleum and its tendency to spread in water, spills will often cover several square miles within hours of the incident. Booms and skimmers, however, move at a slow pace and are only capable of covering a few square meters at a time. An ideal situation would be for the spilled oil to remain at sea in close proximity to the wreckage site, but this is rarely the case. Most often a portion of the petroleum will make its way to coastal areas where it inflicts the most damage to the environment and the economy.

Courtesy of <www.itopf.com>



When petroleum inundates coastal areas the cleanup efforts require less advanced equipment, but the cleanup strategy is more important than that of marine spills. Sandy beaches, bays and rocky coastal areas are cleaned using vacuum pumps and containment apparatus to remove the oil, and are also often treated with chemicals after initial cleanup to break down the remaining oil. Fragile ecosystems such as tidal swamps, marshes and mangroves are commonly left untouched after spills since human intervention is more harmful than the oil itself. Of course it is important to cleanup the most heavily impacted areas first but unlike marine spills, coastal spills often include opportunities for oil to seep into crevices, nooks and crannies and result in long term contamination. As a result, coastal areas are more susceptible to long-term damage because it is near impossible to contain all of the oil. The remaining oil can attach to organisms or wash down the coast, thus affecting a larger breadth of the environment.

Images courtesy of <www.itopf.com>



Regardless of where the oil is spilled or the speed of cleanup, ecosystems will be affected to some extent. A common image that comes to mind is that of birds and seals washed up on beaches, coated in oil and struggling to stay alive. A coat of oil is extremely harmful to almost any animal, especially birds, because it impairs their ability to keep their body temperature constant. Some other species affected by oil spills include fur seals, dolphins and fish. However, if an oil spill covers a large area it is possible for the spill to influence all species in the food chain since predators will be preying on defenseless oil contaminated species, in turn contaminating themselves. Birds are usually the hardest hit species because when they are coated in oil they have a natural tendency to preen themselves to try to remove the oil. In doing so, they ingest the harmful substances, inflicting immense damage to internal organs which often leads to death. Another impact of oil on birds is a result of the coating of their feathers. Their feathers are needed for flight and buoyancy in addition to warmth (www.irrbc.org/oil_affects.html).

Due to the regularity of oil spills and the detrimental effects on birds and wildlife, several organizations have been created to protect these endangered creatures. In the past 30 years significant efforts have been made to protect wildlife from oil spills. One prominent group is the International Bird Research Rescue Center. In the history of the center it has cared for more than 140 species of birds, mammals, reptiles and amphibians. Their method for rehabilitating contaminated species is fairly simple and includes multiple soap baths (www.ibrrc.org/history.html). The key in treating the species is not to shock them. In many cases the recovered animals will be in very poor condition – suffering from hypothermia, hyperthermia, damage to lungs, infection, stress, damage to red blood cells, organ damage and various other problems (<http://www.amsa.gov.au/marin.asp>). However, through continuous efforts to rehabilitate these disabled species, recovery rates are gradually increasing and previously contaminated wildlife often become healthy in no time at all.

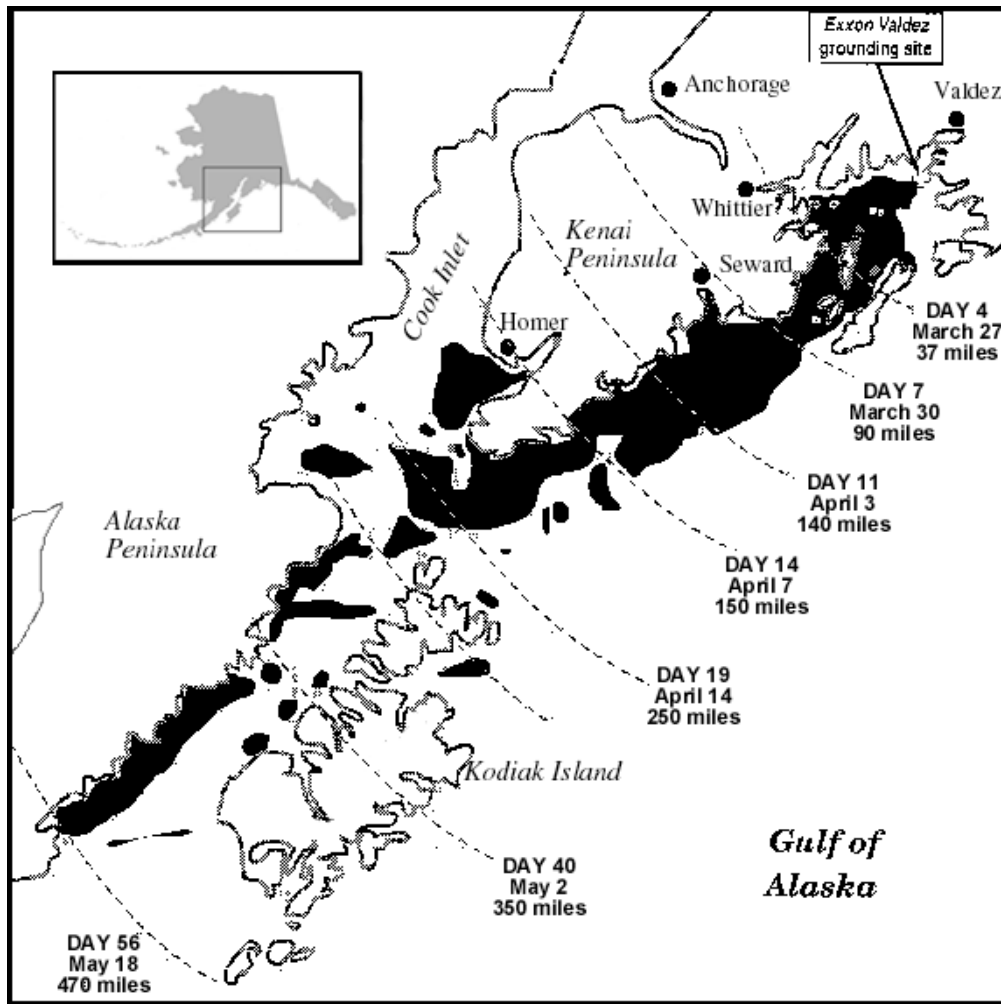
Though oil often naturally leaks from the ground and contaminates the surroundings, it is large -scale human spills that cause ecosystem altering events such as the Exxon Valdez spill of 1989. The Exxon Valdez oil tanker departed from the Trans Alaska Pipeline terminal on the evening of March 23, 1989 carrying approximately 53,000,000 gallons of oil. In command of the vessel were expert ship pilot William Murphy, captain Joe Hazelwood and helmsman Harry Claar (there is some dispute whether Captain Hazelwood was intoxicated at the time since he was seen at a local bar hours before the departure). The vessel was departing through a shipping lane and encountered icebergs not far from port. Before leaving the deck, Hazelwood ordered Claar and third mate Gregory Cousins to head to the right of the shipping lane to avoid

the icebergs and return to the safety of the lane as soon as they passed the obstructions. For reasons still unknown today Cousins did not return to the original course in time. Instead, the Valdez headed right into the shallow water of Bligh Reef and punctured 8 of 11 cargo tanks. The vessel ended up perched on the reef facing southwest. Captain Hazelwood, potentially drunk, struggled to dislodge the vessel from the reef for almost an hour before calling the coastguard to notify them of their predicament. Most likely unaware of the severity of the accident, Hazelwood nonchalantly continued to maneuver the vessel in an attempt to get off the reef. There was little he could do at that point to salvage the situation and it was ultimately the inability of authorities to facilitate a large-scale cleanup in the early stages of the leakage that was most harmful.

It is thought that over 5.8 millions of oil spilled from the Exxon Valdez in the first 3-4 hours after landing on the reef. It was days before cleanup efforts began and a total of 10.8 million gallons of oil seeped out of the vessel in all. While the crews were being assembled the oil dispersed from the wreckage into all parts of Prince William Sound. (Upon later investigation it was discovered that oil had reached over 1,300 miles of coastline. However, only 200 miles of coastline were heavily oiled, but it should be noted that in the spill area there is over 9,000 miles of coastline). The cleanup included the use of high-pressure hoses, mechanical tools (booms and backhoes), chemical agents and hot water treatment. During the peak of the cleanup efforts up to 10,000 workers, 1,000 boats and 100 airplanes and helicopters were working together to remove the oil (www.evostc.state.ak.us/facts.html). Many believe that the strong winter storms and large waves did more to cleanse the beaches than all the other efforts combined. Exxon spent more than 2 billion dollars on cleanup, including stiff fines paid to state and federal

environmental agencies. The cleanup efforts consisted of thousands of volunteers and lasted 4 summers before it was finally abandoned. Nonetheless, even through cleanup efforts and the passage of time, oil can still be found today in Prince William Sound and along the neighboring coastline. Below is a map of the spill area courtesy of

<http://www.evostc.state.ak.us/facts/spillmap.html>.



The Prince William Sound region of Alaska is known for its untouched natural beauty and plethora of wildlife, birds and fish. One reason the Exxon Valdez accident received so much attention was the impact on the wildlife and disruption of the pristine

environment. After the spill, carcasses of many species were washing ashore, causing an uproar among environmental groups. Upwards of 35,000 birds, 1,000 sea otters, 300 harbor seals, 250 bald eagles, 22 killer whales and millions of salmon and herring were found dead after the spill. Estimates suggest that the number of fatalities were much higher but continuous recovery efforts have helped to boost affected populations throughout the area. Bird species were hit the hardest and some rare birds still have not bounced back from the spill. The Exxon Corporation paid over 100 million dollars to aid in the recovery of affected species but no amount of money could cure everything that happened to the wildlife or the ecosystem as a whole.

Fortunately, since the accident many changes have been made to prevent future spills of great magnitude. The U.S. Coast Guard now monitors vessels via satellite and accompanies tankers with two ships to guide them safely out to sea. Skilled marine pilots are aboard vessels exiting Prince William Sound to navigate vessels during severe weather conditions. Today, considerably more equipment is available for deployment - capable of containing 12.8 million gallons of oil in a fraction of the time it would have taken in 1989. Other improvements include government regulations on hull thickness and mandatory unannounced practice drills. Complacency and human error are still thought to be one of the largest causes of spills, but employees receive extensive training, participate in spill simulations and must pass random examinations (www.evostc.state.ak.us/facts/prevention). To date, the safety regulations and training have been successful as there have been no spills in the region of comparable size since the Valdez incident. The true test, however, will not come until another large-scale accident occurs.

Oil spills - and the Exxon Valdez accident specifically – have had extreme environmental impacts since oil has been mass-transported. However, the bigger concern to me is why we don't prevent these types of accidents from occurring. And in studying energy policy and resources it becomes clear that the world of energy (and possibly American society as a whole) is reactionary. Until something goes wrong, why mess with it? Unfortunately, applying this methodology we have polluted the air, the water, and depleted many of our non-renewable resources in an energy sense and allowed for many other catastrophes when considering the reactionary tendencies of our society. It can be said, however, that we learn from our mistakes and adjust to prevent similar mishaps in the future. It is hard to say what we should have done and it's always easy to critique the action of those before us. The U.S. is making an attempt to make the transport and use of energy more efficient and safer through government regulations and other programs. It is unfortunate, yet seemingly inevitable that accidents will occur, oil will spill, wildlife will die and the world will be polluted. But, as long as our reactionary tendencies allow for a quick response and the best damage control possible, I suppose that is all we can ask.

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