**Oil Spills: Impact and Clean-up Techniques**

By: Osman Hamed

PhD Candidate, University of Wolverhampton

1. Introduction

Oil spills are the harmful release of oil into the environment, usually in the water, sometimes oceans or rivers. Oil spills can have serious impact on the environment, especially if not managed properly. It can harm wildlife, change the balance of the ocean, and have a big impact on coastal economies such as tourism and fishing. There are a few different types of oil that cause oil spills, and the way that a spill is cleaned up often depends on the type of oil that is spilled. There are a number of ways that oil spills can be cleaned up. Some of the most common methods include: using skimmers that collect the oil off the surface of the water; using booms, large floating barriers, to keep oil in one place. Nowadays many scientists and oil companies are looking for new techniques to clean up oil spills, such as using peat moss to soak up oil, or using dispersants - chemicals that break down the oil into smaller particles and help it to be broken down. There is also a lot of research going on into techniques for cleaning up oil on the ice and snow - such as burning the oil. Over the years, after a number of oil spills, scientists have been able to see the long-term effects of oil spills on the environment. This means that today, we know much more about the potential damage that oil spills can do. Also, a lot of research has been put into finding out the best ways to clean up after a spill. This means that the clean-up operation from an oil spill can be much more efficient and effective than it used to be. But, the real key to help the planet in the long run is to try and prevent oil spills from happening in the first place. By making changes, both big and small, to how we find, transport, and use oil, we can help to protect the environment from this type of pollution.

1.1 Definition of Oil Spills

There is no denying the fact that prevention is better than cure. The occurrence and effect of oil spills can be greatly reduced through taking good precautions and regular monitoring, which will reduce the risk of accidents. Also, rapid response measures should be in place when a spill occurs to speed up the cleanup process and prevent further damage. These are some of the methods that are being used to prevent or control oil spills. For instance, the International Maritime Organization (IMO) lays down the rules to ensure that all activities relating to an oil spill response are carried out to a suitable standard.

On the other hand, different approaches are used to clean up oil spills in the marine environment. These methods may include containing the oil with booms and using skimmers to collect the oil from the water's surface, applying dispersants, bioremediation through the use of fertilizer, seeding, chemical binding, and natural recovery through physical recovery of the oil and weathering.

Oil spills represent a massive environmental disaster that can persist for decades and affect birds, fish, marine animals, and the environments in which they live. Some of the harmful and immediate effects of oil spills are mainly on the marine environment, where the oil causes physical smothering and heating of natural materials like plants and animals, as well as chemical poisoning. Marine activities that may be affected by an oil spill include fishing, tourism, mariculture, and transport.

An oil spill occurs when liquid petroleum is released into the environment, specifically the marine ecosystem. Oil spills can occur due to releases of crude oil from tankers, offshore platforms, drilling rigs, and wells, as well as spills of refined petroleum products (such as gasoline, diesel) and their byproducts, heavier fuels used by large ships such as bunker fuel, and other chemical products. Spills take place during various stages of the oil industry, including extraction, transportation, and storage of oil.

1.2 Types of Oil Spills

There are various forms of oil spills affecting our seas and oceans. Based on the reason for the spill or the origin of the spill, we can classify them into different categories. The most common kind of oil spill is caused by accidents. These can happen in a variety of ways, including when two ships collide, when ships run aground, and when a ship is leaking oil while it is being refueled. For example, an oil spill caused by accident would be an oil leak from a tanker after it crashed into another vessel. The spilled oil from these accidents is frequently classified as "crude oil" because that is the type of oil that's typically being transported from one area in the world to another. Another category is the operational oil spills. Ships and other vessels constantly produce waste oil through bilge water and oil tank leaks. Most of this sort of oil enters the ocean as a result of the activities of ordinary, law-abiding commercial and recreational boaters. Generally speaking, the amount of oil entering the ocean from routine operations, boater discharge, and natural seepage far surpasses the amount released in spills. This type of oil is typically referred to as "petroleum products" and includes a variety of different kinds of oil like diesel or mineral oil. However, the most common waste oil from boats is a dark, smelly, used oil also known as "bilge oil". The third kind of oil spill is named as the closed drain oil spills. Often found in industrial settings, a closed drain spill includes oil or other hazardous materials accidentally spilled to a sewer, storm sewer, or drain that connects to the local water supply. In institutions like the University, where hazardous materials are used and stored, special precautions need to be followed to reduce the potential of an accidental spill coming into contact with the local water supply. These precautions are detailed in the Storm Water Pollution Prevention Plan.

1.3 Environmental Impact of Oil Spills

In contrast to spills of refined oil products that sink, the chief concerns with most crude or fuel oil spills are the economic impact on humans and the immediate impact on bird and aquatic wildlife. Due to the swirling nature of the spill, oil can often move around at the surface of the water in the environment. This results in the coating of plants and animals, as well as the immediate impact on waterfowl, otters, turtles, and dolphins. The main types of impact include dissolution and the formation of emulsions. The toxins within oil can move through the food chain, starting with the very smallest organisms. When organisms come into direct contact with oil, smothering is the major problem that they will encounter. This essentially blocks the free movement of the external organs, usually gills or air passages, so that transferring oxygen in and waste gases out is severely diminished. While this has a very devastating effect at an individual level, fortunately, most, if not all, species are unlikely to be wiped out by just one oil spill. However, the area local to the spill will see a marked decrease in the number of individuals, and this is certainly very detrimental for some sub-species that are already on the verge of extinction. When water-soluble and emulsifiable fractions of a crude oil or fuel oil are released into the environment, the process and the end result are very much the same. As oil is released over water, a slick very quickly forms on the surface of the water. The rate of spreading is dependent on a number of factors, including the type of water body and tidal currents. Soon, a very thin layer will cover the entire surface of the water, and this is generally accepted as the very start of the contamination of the environment by the oil.

2. Cleanup Techniques

2.1 Mechanical Methods

2.1.1 Containment Booms

2.1.2 Skimmers

2.1.3 Sorbents

2.2 Chemical Methods

2.2.1 Dispersants

2.2.2 In-situ Burning

2.2.3 Bioremediation

3. Case Studies

3.1 Exxon Valdez Oil Spill

3.2 Deepwater Horizon Oil Spill

3.3 Prestige Oil Spill

4. Prevention and Future Outlook

4.1 Regulations and Policies

4.2 Advances in Technology

4.3 International Cooperation