



Oil spillage

Oil spillage is a release of a liquid petroleum hydrocarbon into the environment due to human activity, and is a form of pollution. The term often refers to marine oil spills, where oil is released into the ocean or coastal waters. Oil spills include 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 by- products, and heavier fuels used by large ships such as bunker fuel, or the spill of any oily white substance refuse or waste oil. Spills may take months or even years to clean up. Oil also enters the marine environment from natural oil seeps.

Numerous factors determine the extent of damage to be expected from any spill. These include:

- 1) **Type of oil spilled.**
- 2) **The dose or amount of oil spilled.**
- 3) **The physical features of the region of the spill.**
- 4) **The biota of the region.**
- 5) **The season of year.**
- 6) **The previous exposure of the region to oil spills.**
- 7) **The present exposure of the region to other pollutants.**
- 8) **The treatment that was given to the spill.**

3.8.1 The Environmental risk when transporting oil and gas

1. Transport by tanker

Tanker trucks provide flexibility, linking extraction sites and refineries to pipelines and rail terminals. Unlike other modes of transport, trucks are primarily used to transport oil for relatively short distances because long distance transport by truck is not an economical option.

❖ Associated Risks:

- a) **En route collision:** Tanker trucks operate in close proximity to the general public and operate in densely populated areas. This increases the risk of accidents, including collisions and accidents at crossings. Collisions may involve multiple vehicles and can occur at high speeds, which may increase the risk of fire and explosion.



- b) **Inadequate Infrastructure:** poorly maintained and monitored infrastructure at delivery points and fuel loading terminals could contribute to accidents, including fire and explosion.
- c) **Truck Design:** Tanker trucks are typically loaded through bottom lines, which do not drain completely into the tank because they are at the lowest point on the container. The structurally fragile bottom lines can contain more than 50 gallons of the oil, referred to as 'wet-lines,' and may contribute to an event leading to fire and explosion.
- d) **Many other factors significantly reduce the environment's natural self-regulating ability:** the specific climatic conditions, the amount of available daylight, the nature of heat transfer between the ocean's surface and the layers situated underneath and the atmosphere, the configuration of the bottom, the types of coast and shallow tides.

2. Transport by pipeline

Earthworks are a main source of impact on the marine environment when constructing an underwater pipeline. This includes sinking trenches and access channels, deepening and backfilling pipelines, and dumping soil. These pipes stretch over hundreds and thousands of kilometers. The extent of the damage will depend on the size of the leak and pose a risk to coastal marine ecosystems when these take place near, or at river intersections.

❖ Associated Risks:

- a) **Pipeline Quality:** Over time the quality of pipeline performance declines due to material deterioration, cracks from corrosion, erosion and defective welding.
- b) **Natural Hazards and Extreme Weather Conditions:** Pipelines damage from ice, currents, floods and lakebed erosion, which can have detrimental effects on the pipeline infrastructure.
- c) **Monitoring:** Pipelines require constant monitoring and accidents may result from undetected failures due to insufficient or delayed monitoring.
- d) **Out-dated Regulatory Regime:** The inability to provide up-to-date data and sporadic monitoring lapses may exacerbate the risks from pipeline spills. For example, studies show that upgrading pipeline infrastructure with automatic shut-off valves can reduce potential risks, the current regulations do not enforce such upgrades .
- e) **Physical Environment:** pipelines run through diverse ecological areas that may be home to endangered species and are sensitive to environmental degradation. These conditions must be considered when evaluating the potential risks of pipeline spills.

3. Transport by railway

The reason that oil shipping by rail has expanded is due to the ability of rail to quickly respond to increased production in the oil fields. However, the increased volume of rail transport has also led to a surge in oil spill incidents via this mode. The following have been identified



among the reasons for accidents and incidents resulting in the leaking of petroleum products or crude oil from railway tank wagons:

- 1) Infringements of regulations concerned with handling dangerous loads.**
- 2) Human error and bad management.**
- 3) Derailments, as a result of unfavorable natural climatic conditions.**
- 4) Train collisions.**
- 5) Mechanical impact on the train.**
- 6) Collapsing bridges.**
- 7) Sparking, with the subsequent ignition of the contents of the wagons.**

3.8.2 What happens when oil spills?

There are a number of processes that can occur when oil spills, depending on the water source and the type and amount of spilled oil.

- 1.** The most common effect is the spreading of the oil over the surface of the water. Most oil is less dense than water, so when oil spills, it spreads across the water surface. Oil spreads very quickly, with lighter oils, like gasoline, spreading faster than heavy crude oils. Currents, wind and warm temperatures will cause the oil to spread faster. For this reason, it is important for oil spills to be contained as quickly as possible.
- 2.** Oil can settle to the bottom of the water. While the density of oil ranges from 0.85 g/cm³ to 1.04 g/cm³, most oil densities fall into the 0.90 to 0.98 g/cm³ range. Ocean water has a density between 1.02 and 1.03 g/cm³, depending on the salt concentration. River water, however, has a density of 1.0 g/cm³. This means that a heavy oil, with a density of 1.01 g/cm³, would float in ocean water, but sink in a river.
- 3.** The oil can be moved, with currents, tides and the wind. This can be a significant problem in rivers, because the currents can carry the oil a great distance from its origin. It can also cause substantial damage in oceans, because the tide can carry the oil to beaches and intertidal zones, which are especially sensitive to oil pollution.
- 4.** Natural bacteria can digest the hydrocarbons and convert them to carbon dioxide and water. This is called biodegrading, and is a natural process that can clean water and sediment after an oil spill.
- 5.** Some oil will evaporate. Up to 50 percent of the volume of most oil spills can evaporate. Light fuels, such as gasoline, will almost entirely evaporate within one or two days.
- 6.** Natural physical, chemical and biological processes can cause the oil to weather, changing the characteristics of the oil.



7. Oxidation is a chemical reaction that can occur between oxygen and hydrocarbons, and is a natural process that slowly breaks down the hydrocarbons.
8. Emulsification is the combination of two liquids, when one is suspended in the other. Between water and oil, the combination can be water-in-oil or oil-in-water; water-in-oil is a stable mixture and can persist for years. Water-in-oil often consists of 50 to 80 percent water, and the water appears reddish-brown and feels greasy, due to the presence of oil.

3.8.3 The damage of oil pollution

Oil pollution can damage ecosystems, including plants and animals, and contaminate water for drinking and other purposes.

- 1) **Environmental Effects:** The feathers and fur of birds and marine animals can become coated in oil; when the animals are covered in oil, they can no longer insulate themselves against the cold water, and birds have difficulty flying. Furthermore, when the animals clean themselves, they ingest some of the oil. Fish can be suffocated by the thick sludge of oil on the water surface, and bottom-dwelling fish can develop liver disease, as well as reproductive problems. Plants that grow in or near the water can be harmed by oil pollution. An oil spill can block the sunlight that plants need for photosynthesis, which kills plants growing in the water. Oil spills can result in closed beaches and harbours. Oil pollution affects fishing and hunting, which is especially detrimental for people who rely on hunting and fishing, such as many rural communities.
- 2) **Effect on Economy:** The second major effect of the oil spill is on the economy. When crude oil or refined petroleum is lost, it affects the amount of petroleum and gas available for use. This means more barrels have to be imported from other countries. Then comes the process of cleaning the oil spill, which requires a lot of financing. The company responsible for the oil spills and their effects has to clean it up and pay for the workers who will face tremendous health problems which effect on the economy of the company.

3.8.4 Treatment of the oil pollution

There are several clean-up methods that can be used, depending on the type and amount of spilled oil, the water location and local weather conditions. Recovery times can range from weeks to decades. Along bedrock shorelines, where there are high-energy waves, the region may recover within several weeks. Exposed beaches generally recover within a matter of months, but marshes and salt flats may take years or even decades to recover from an oil spill.

1. Natural Methods:

The natural environment can effectively remove contaminants from the water and soil. There are microorganisms that are present in the environment that can break down many harmful



chemicals, including gasoline and oil. To increase the rate at which the microorganisms work, nutrients, such as nitrogen or phosphorus, are often added. After the majority of the oil spill is cleaned up manually, biological processes break down the trace amounts that could not be removed. These biological processes, together with evaporation, oxidation, weathering and other natural processes, will break down the oil and naturally clean up the environment.

2. Booms:

Because oil spreads very quickly, the most important primary step is to contain the spill to as small of an area as possible. Booms are one of the most commonly used tools, because they can contain the oil to keep it from spreading. There are three main types of booms:

- a) Hard boom is a piece of plastic with a cylindrical float at the top and weighted bottom, so that it floats on the surface with an underwater “skirt”.
- b) Sorbent booms are made from materials that can absorb oil, and are most effective on thin, light oil slicks. Great caution must be taken when removing sorbent booms, so that the oil is not squeezed back into the water. Booms can also be used to prevent oil from running into storm drains when oil spills on pavement.
- c) Fire booms are the third type of boom, but are not used as much as hard and sorbent booms. A fire boom is very similar to a hard boom, but is made of metal, so that it is fire resistant. Fire booms are used to contain oil spills until they can be lit on fire.

3. Chemical Dispersants

Chemical dispersants can be successful in cleaning up oil spills. Dispersants are chemicals that are applied to the surface of the water, usually by a low-flying plane. Oil can eventually break down naturally, and chemical dispersants act to speed up the natural process. The oil binds to the dispersant, and is able to move further down the water column, meaning that the oil disperses into the water. The water dilutes the oil to a concentration that is less harmful to aquatic life in the region.

4. Detergent

Dish detergent is a common household item that can illustrate how chemical dispersants work, because grease and oil bind to dish detergent and are washed away. However, chemical dispersants are not applied to shallow water near shores, marshes, near coral reefs, or other sensitive areas.

5. Skimmers

Skimmers are boats that can skim oil from the water surface. An advantage of using a skimmer to remove oil from water is that it doesn't change the physical or chemical properties of the oil, as methods such as using chemical dispersants do. Skimmers often have attached settling tanks, so that the oil and water can be separated in the tank. If the oil is



relatively fresh, it can be refined. In other instances, the oil is burned. The success of skimming depends on the type and thickness of the oil spill, the amount of debris in the water, the location and the weather conditions (skimming works best in calm weather).

6. Sorbents

In addition to using sorbent materials as booms, to contain and soak up oil spills, sorbents can also be applied to the water surface as powders. Sorbents are often the final step of clean-up, because they can absorb trace amounts of oil that could not be skimmed off. Commonly used sorbents include natural organic materials, such as peat moss and sawdust, or synthetic organic materials, such as polypropylene, polyester foam or polystyrene. Sorbents are generally applied by hand, and recovered with the use of nets and rakes.

7. Burning

Burning is a method that is often used to remove oil from the surface of the water. Oil may also be burned after skimmers remove the oil from the water surface. The burning of oil releases nitrogen and sulphur, which in turn causes acid rain. While burning can remove the oil from the water surface quickly and efficiently, it causes additional pollution. Thus, there are some ways of cleaning up after oil spills that are more beneficial than others.

8. Beach Clean-up

Areas near shore that are contaminated with heavy concentrations of thick oil are often cleaned up manually, using shovels and trucks. Manual recovery can also be used to pick up oiled beach sand and gravel, to remove it from the beach and transport it to alternate locations for treatment. Vacuum trucks can vacuum the oil up, right off of the beach. Pressurized hoses can also be used to wash oil off of beaches, into the water, where it will be dispersed and diluted in the water.