Tools for Controlling Oil Spills

Oil spills happen to behave differently from case to case. Even during one spill response operation, the conditions change from area to area and also over time. Therefore you cannot count on – for instance in a marine spill - one specific type of boom, or one type of skimmer, for the collection and recovery of the oil. Mainly for marine spills, but also for land spills, you must have at your disposal a selection of equipment and products which combined will meet the demands for a well prepared contingency.

Therefore this handbook will describe the most common types of oil spill equipment , -tools , and -products, such as the most relevant types of booms, skimmers, pumps, dispersants, absorbents, storage facilities, vessels, etc.

1.Booms:

Oil boom is a floating barrier, which is used in cleaning up oil on the surface of the water. Boom is used to contain oil, to collect oil, as a barricade to exclude oil from a certain area; to absorb oil; and to deflect oil.

Floating booms are mechanical barriers that extend above and below the surface of the water to stop the flow of oil. They can be used in three ways:

- to surround a slick completely and reduce its spread
- to protect harbour entrances or biologically sensitive areas
- to divert oil to an area where it can be recovered.

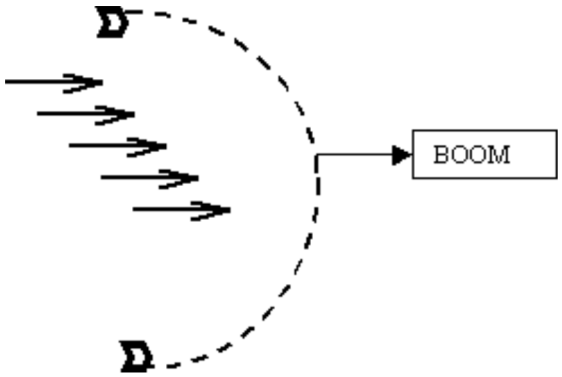

Figure 1. General Boom Layout to control dispersing of oil.

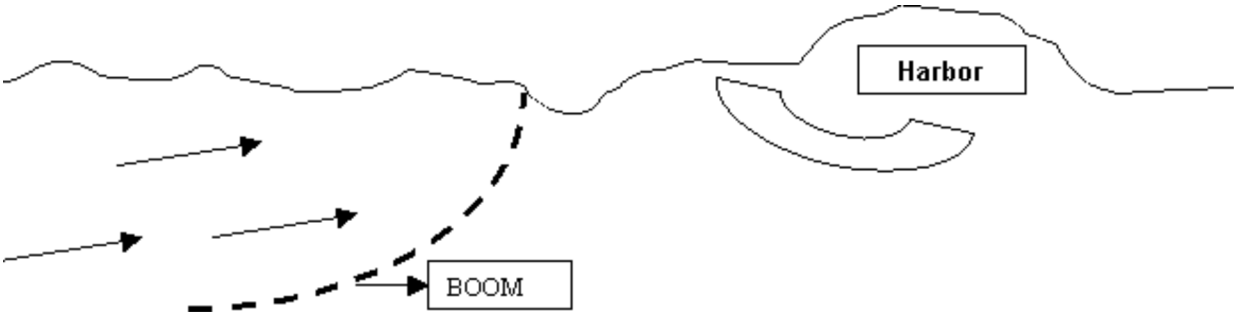

Figure 2. Boom used to divert oil.

Containment booming is the process of preventing the spread of an oil spill by confining the oil to the area in which it has been discharged. The purpose of containment is not only to localize the spill and thus minimize pollution but also to assist in the removal of the oil by trying to concentrate

it in thick layers on the surface of the water.

Boom can also be used to divert pollutant to areas where cleanup can be conducted and to protect specific areas such as entrances to harbors and rivers or environmentally or economically sensitive areas.

The most important characteristic of a boom is its oil containment or deflection capability, determined by its behavior in relation to water movement. It should be flexible to conform to wave motion yet sufficiently rigid to retain as much oil as possible. No boom is capable of containing oil against water velocities much in excess of 1 knot acting at right angles to it. The escape velocity for most booms is around .7 knots, irrespective of skirt depth.

Oil Spill Skimmers:

Skimming is a process of removing oil from the top of the water surface. This is achieved by the use of various mechanical devices such as pumps, vacuum systems etc. The efficiency of a skimmer depends upon the sea and weather conditions. As the water conditions become rougher the skimmer starts to pull in more water along with oil.

Major types of skimmers are:

Vacuum

- Vacuum trucks
- Tractor PTO Operated Vacuum Carts
- Drum or Tank Mounted Vacuum Systems

Shoreside/Vessel of Opportunity

- Wier
- Disk/Metal Tape
- Rope Mop
- Skimming Barrier
- Weir-Screw-Pump
- Weir Screwpump-water Mover
- Weir-Paddle- Watermover-Debris collecting
- Weir/Disk Sorbent Belt, with or without water mover- debris collecting
- Brush
- Dynamic inclined plane
- Vortex

Single Purpose Dedicated Skimming Vessel

- Weir
- Weir-oil water separator
- Sorbent belt
- Dynamic inclined plane
- Brush systems

Multipurpose Skimming Vessels

- Dredges
- Buoy Tenders
- Tankers

Once oil is contained by the booms, it has to be removed from the water.

Skimmers are used to remove oil from water without changing the chemical or physical properties of the oil. How well a skimmer works depends on the type of oil spilled, the thickness of the slick and, again, the weather.

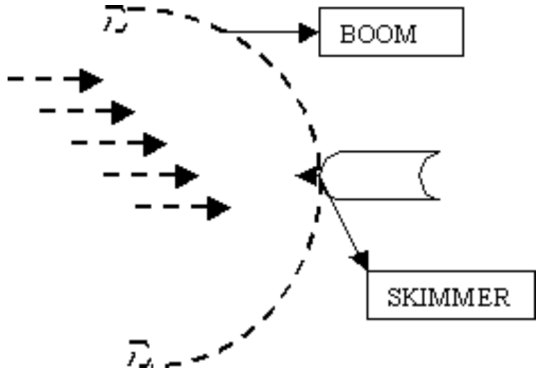

Figure. Skimmer in action

Dispersants

Dispersants are chemicals, which have components of surface-active agents called surfactants. The dispersants aids in the breaking up of the oil slick into smaller droplets.

Chemical dispersants remove the oil from the surface of the water and into the water column by enhancing the natural chemical and physical breakdown of oil. Once in the water column, the dilution of oil is greatly facilitated and hence the toxicity level is reduced. Eventually, these dispersants and oil droplets are food sources for bacteria in the ocean. By removing the oil from the water surface, birds, marine mammals, turtles, and sensitive coasts are protected. Chemical dispersants do not cause the oil to sink, but remain in suspension in the water column.

The disadvantages of chemical dispersants are that they are toxic in certain ways. As an added precaution, chemical dispersants are not applied to shallow near-shore waters, mangrove areas, marshes, or waters over coral reefs and sea grass beds.

Sorbents:

Sorbent booms and barriers are used to absorb a moving oil slick. They only work well when a slick is thin, because once their surfaces are saturated, they can't absorb anymore.

Sorbents recover oil either through absorption (the oil is drawn into porous materials) or adsorption (the oil sticks to the surface of the sorbents). They're used in the final mopping up because they get at trace amounts of oil left after skimming and can be sent into areas where skimmers can't reach.
Sorbents come in two basic types: natural organic materials like peat moss and sawdust; and synthetic organic sorbents like polypropylene, polyester foam, polystyrene and polyurethane. Both types are usually applied by hand, and recovered with nets, rakes, forks and pike poles.

In-situ Burning:

Through controlled burning of the oil can effectively remove the oil slick. This method is called in-situ burning. In-situ burning can approximately remove around 100-gallons/day/square foot of surface area under excellent weather conditions. In this way, bird, marine mammals, turtles and sensitive coast areas are being spared from the effects of the spill.

In-situ burning is only conducted when the winds are blowing away from or at a safe distance from the populated areas. The reason is that, during burning, tons of black smoke is being produced and this plume could travel miles from its source. The black smoke is mainly carbon dioxide and around 5-10 percent particulate with small amounts of carbon monoxide, nitrous oxide and sulphur dioxide. These are seen as major air pollutants and hence must be adequately contained through downwind dispersion and dilution.

However, there are some restrictions to in-situ burning. Only for sea levels of two to three feet or less, can in-situ burning be possible. Sea levels higher that that, in-situ burning would be discontinued. Another factor is the weather conditions. Only under, good weather conditions can this burning can be carried out.

Bioremediation

Oil, like many natural substances, will biodegrade over a period of time into simple compounds such as carbon dioxide, water and biomass. Bioremediation is the term used to describe a range of processes, which can be used to accelerate natural biodegradation. More specifically biostimulation is the application of nutrients, and bioaugmentation or seeding is the addition of microbes specially selected to degrade oil.
Biodegradation occurs as a result of the oxidation of certain components of spilled oil by microbes such as bacteria, fungi, unicellular algae and protozoa. The rate at which this natural process occurs is limited by several factors including the temperature, and the levels of microbes, nutrients and oxygen present in the immediate environment. Other factors such as the chemical composition and the amount of weathering of the spilled oil are also important.
Although Bioremediation presents a good picture it is a very slow process and takes a long time to work fully. It can work effectively only on oil which is spread as a thin layer on water.

Bioremediation is not suitable for removing large amounts of oil and should only be considered where the concentration of oil is low as a final polishing technique.

Manual Cleanup:

The other best way to clean up oil once it has hit the shore is by manual cleanup. Since oil has chances of spreading and getting mixed with the soil or sand on the shore, the best method to contain oil spread is by manual methods.

These methods are by using buckets, shovel and carts, manual scraping of oil on rocks, and using other methods.

Manual recovery of oil with buckets and shovels is common, especially when the oil has made it close to shore. Viscous oils are more easily removed by manual methods than more fluid oils.