TYPES OF OIL: NONFLOATING OIL

Nonfloating oil (NFO) is a term used to describe the behaviour of a group of oils, rather than a specific type of oil. NFOs may sink just below the water's surface, suspend in the water column, or deposit on the seafloor.

This could occur because the initial density of the oil is heavier than that of the receiving water or because weathering or sediment interaction cause changes in the oil's density. Other environmental factors as well as how the oil is discharged into the water could also cause these oils to sink or submerge.

WHAT TYPE OF OIL IS NONFLOATING OIL?

Oils that could be categorized as nonfloating include diluted bitumen (dilbit), Group V Residual Fuel Oils (GPVRFO), Low API Oil (LAPIO), asphalt and asphalt products, among others. NFOs are generally considered to be persistent oils. The exact physical-chemical properties of an NFO are determined by the geographic source of the original deposit from which the oil was extracted, combined with the production year and the blending ratio of the final product.

WHAT TYPES OF VESSELS TRANSPORT OR USE NONFLOATING OILS?

NFOs are typically transported by crude tanker or tank barge. Certain NFOs, such as fuel oil no. 5 and fuel oil no. 6, are used to fuel steam-powered vessels or deep-sea cargo vessels

WHAT HAPPENS WHEN NONFLOATING OILS SPILL IN SEA WATER?

Only true LAPIOs experience rapid sinking upon discharge in sea water. Less dense oils generally take several days to transform into a nonfloating product, depending on the physical characteristics of the spill site and the initial density of the oil relative to the density of the receiving sea water. As the oil weathers due to turbulence, temperature, winds, currents and wave action, and evaporation of the lighter elements occurs, the oil can become denser than the receiving body of water. This can cause submersion just below the water's surface, suspension in the water column or sinking to the seafloor.

NFOs often move between phases in response to changes in weathering and environmental conditions. In the submerged phase, oils are neutrally buoyant or have slight negative buoyancy, allowing them to lie below the surface and migrate vertically in the water column. This suspension may be temporary in response to turbulence—in the absence of mixing energy, the oil could refloat or sink to the bottom. In the sunken phase, NFOs fall to the seafloor.

Oils that are heavier than water will sink where turbulence and currents are weak, and will accumulate as bulk oil on the seafloor. Oils that are lighter than water will sink after mixing with sand, and will form oil-sediment mats on the seafloor. This type of oil could refloat if the oil separates from the sand as currents and turbulent conditions change. Oils that become heavier than water due to the formation of oil-particle aggregates under turbulent conditions will eventually settle on the seafloor in calm areas. In all cases, sunken oils in both nearshore and offshore areas can be buried by sediments.

If an NFO approaches shoreline habitats or nearshore seabed habitats in areas where current flow is minimal, the oil will sink and pool on the seabed. NFOs are less likely to strand on rocky shorelines, but the oil that does strand is typically stickier and thicker. On beaches, NFOs are less likely to penetrate porous sediments and often strand as tar balls (small, compact masses of heavily weathered oil).

HOW DOES NONFLOATING OIL AFFECT MARINE FLORA AND FAUNA?

NFOs tend to weather slowly, which can result in remobilization of the product for long periods of time and at great distances from the release site. This weathering timeline increases the risk of exposure for wildlife and habitats.

Spilled NFOs primarily affect water column and seabed habitats, particularly where significant amounts of oil have accumulated on the seafloor. In these cases, smothering and coating of seabed habitats, such as coral reefs, can be heavy, but bioavailability varies depending on the product and spill conditions. Risks to fish, shellfish and seabed-feeding mammals (such as whales) from chronic exposure and sediment accumulations can be high.

The impact to birds are less immediately acute as NFOs typically submerge or sink below the sea's surface. Less oil will remain on the surface of the water and instead tends to form fields of submerged tar balls. Oil that is stranded on shorelines or is present on oiled debris that has been deposited on banks and islands can pose a risk to wildlife.

HOW IS NONFLOATING OIL CLEANED UP?

In the initial period after a spill, brush skimmers, sorbent booms and sorbent pads have proven very effective in removing heavy or very heavy oils from the sea's surface. If the oil begins to display nonfloating characteristics, a variety of detection and recovery techniques can be used.

Detection methods could include the use of sonar systems, underwater visualization systems, diver observations, sorbents, laser fluorosensors, visual observations, water column sampling, bottom sampling and induced polarization. Suction drudge, diver-directed pumping and vacuuming, mechanical removal, sorbent/V-SOR, trawls and nets, manual removal and removal by remotely-operated underwater vehicles are some of the recovery methods that may be employed. Additional techniques, including environmental clamshell dredges, manual shovel pits, agitation/refloating and enhanced passive sediment accumulation, could also be used. NFOs that have stranded on the shoreline can be recovered using standard manual and mechanical methods.

Sources

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