Heavy Fuel Oil Spills

Definition

Heavy fuel oils (HFO) are dense, viscous oils. They are produced by blending heavy residual oils (a by-product of producing the light products that are the primary focus of a refinery) with a lighter oil to meet specifications for viscosity and pour point.

Properties

The specific gravity of a particular HFO can vary from 0.95 to greater than 1.03. Thus, spilled oil can float, suspend in the water column, or sink. Small changes in water density may dictate whether the oil will sink or float.

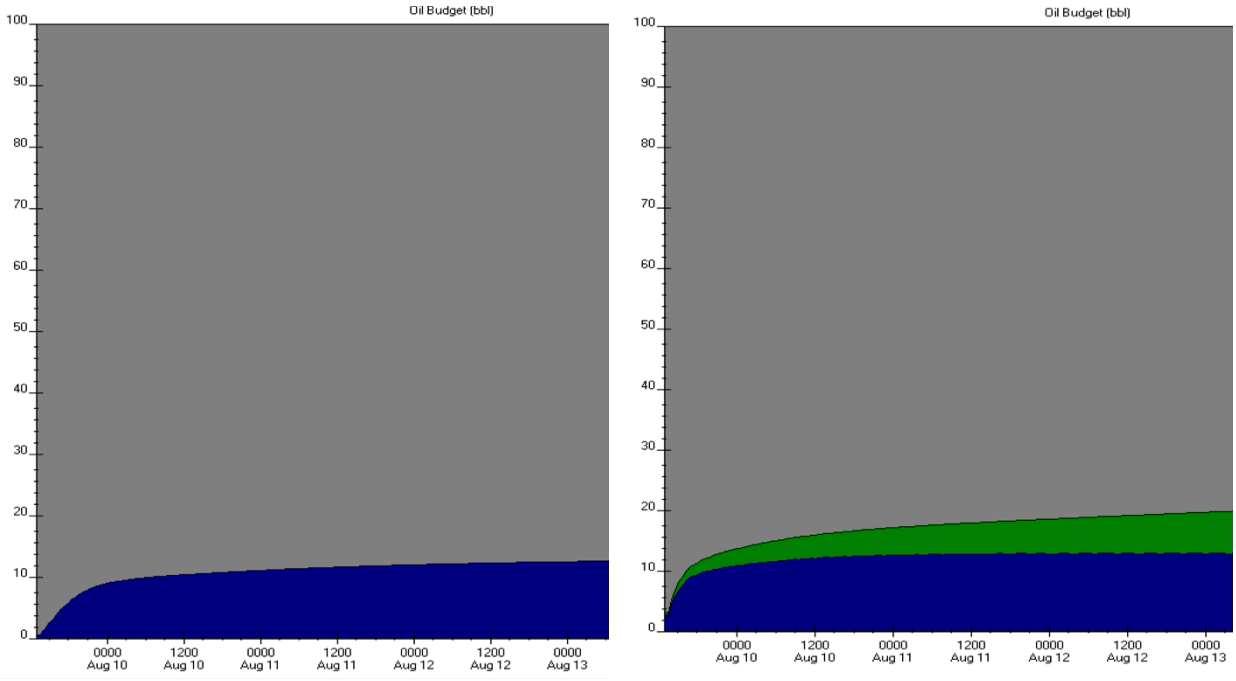
Environmental Behavior

- When spilled on water, HFO usually spreads into thick, dark-colored slicks, which can contain large amounts of oil. The most viscous oils will often breakup into discrete patches and tarballs, instead of forming slicks. Oil recovery by skimmers and vacuum pumps can be very effective, early in the spill. Very little of this viscous oil is likely to disperse into the water column.
- HFO is a persistent oil; only 5-10% is expected to evaporate within the first hours of a spill (see ADIOS® oil weathering plots on the next page). Consequently, the oil can be carried hundreds of miles in the form of scattered tarballs by winds and currents. The tarballs will vary in diameter from several feet to less than 1 inch, and they may be very difficult to detect visually or with remote sensing techniques.
- These oils can occasionally form an emulsion, but usually only slowly and after a period of days.
- Because of its high viscosity, beached HFO tends to remain on the surface rather than penetrate sediments. Light accumulations usually form a “bathtub ring” at the high-tide line; heavy accumulations can pool on the surface.
- Floating oil in a high sediment environment (rivers, beaches) could potentially sink once it picks up sediment, resulting in subsurface tarballs or tarmats.
- Shoreline cleanup can be very effective before the oil weathers and becomes very sticky and viscous.

Environmental Effects

- The greatest hazard of heavy fuel oil spills to biological resources is smothering.
- Adverse effects of floating HFO are related primarily to coating of wildlife dwelling on the water surface, smothering of intertidal organisms, and long-term sediment contamination.
- Direct mortality rates can be high for seabirds, waterfowl, and fur-bearing marine mammals, especially where populations are concentrated in small areas, such as during bird migrations or marine mammal haulouts.
- Direct mortality rates are generally less for shorebirds and wading birds, because they rarely enter the water. Shorebirds, which feed in intertidal habitats where oil strands and persists, are at higher risk of sublethal effects from either contaminated or reduced populations of prey.

- The most important factors determining the impacts of HFO contamination on marshes are 1) the extent of oiling on the vegetation and 2) the degree of sediment contamination from the spill or disturbance from the cleanup. Many plants can survive partial oiling; fewer survive when all or most of the above-ground vegetation is coated with oil. However, unless the substrate is heavily oiled, the roots often survive and the plants can re-grow.
- When released to water, dissolution of water-soluble constituents in HFOs will depend on environmental factors affecting water column mixing and oil weathering. Due to the low water solubility of their chemical constituents, the toxicity of HFOs to aquatic organisms is expected to be lower than that of other petroleum products including diesel. Chronic toxicity associated with residual oil associated with sediments may be of greater concern.



ADIOS model output for an IFO 380 heavy fuel oil, with winds of 5 knots (left) and 20 knots (right). ***Blue = evaporated****;* ***green = dispersed****;* ***grey = remaining.*** *Note that there is very little natural dispersion, even at wind speed of 20 knots.*

ADIOS (Automated Data Inquiry for Oil Spills) web link: https://response.restoration.noaa.gov/adios