



Deepwater Horizon Oil: Characteristics and Concerns

Oil spilled from the Deepwater Horizon wellhead has been accumulating in the environment of the Gulf of Mexico since April 20. This document describes the potential forms the oil may take over time as it weathers and degrades; its chemical makeup; its hazards to humans and the environment, especially on beaches and land; and the cleanup protocols most likely to be effective in removing it. Table 1 (next page) summarizes this information.

Chemical nature of the oil

Mississippi Canyon Block 252 (MS252) oil is a South Louisiana sweet crude oil (crude oil is termed *sweet* if it is low in sulfur). Like all crude oils, MS252 oil is a complex mixture of thousands of chemical compounds. Of those thousands of compounds, several classes are of special importance in considering persistence and toxicity in the environment. Compared with other crude oils, MS252 oil is relatively high in *alkanes*. Because alkanes are made up of single-bonded carbon chains that microorganisms can readily use as a food source, MS252 oil is likely to biodegrade more readily than crude oils generally. MS252 oil is less toxic than crude oils generally because it is relatively much lower in *polyaromatic hydrocarbons* (PAHs). PAHs are highly toxic chemicals that tend to persist in the environment for long periods of time, especially if the spilled oil penetrates into the substrate on beaches or shorelines. Like all crude oils, MS252 oil contains *volatile organic compounds* (VOCs) such as benzene, toluene, and xylene. Some VOCs are acutely toxic but because they evaporate readily, they are generally a concern only when oil is fresh.

Weathering processes

As MS252 oil reaches the surface and spreads out across the water, its lighter components, including VOCs, soon evaporate, leaving heavier components behind. Some of the remaining MS252 oil will become *sheen*, a very thin layer of floating oil (less than 0.0002 inches or 0.005 mm) that can be transparent, grey, silver, or rainbow-colored. MS252 oil will also mix with water to form a sticky, pudding-like water-in-oil emulsion, or *mousse*, typically brown, reddish, or orange in color. Typically, crude oil emulsifies on the sea surface as winds and waves mix it with water, but MS252 oil also appears to be incorporating water as it rises to the surface through 5,000 feet of water. Winds and waves tear oil and mousse patches into smaller pieces, eventually producing tarballs. MS252 tarballs typically are in the form of small, hard, black pellets. Tarballs can be very persistent in the marine environment.

Hazards and cleanup methods

MS252 oil poses physical and chemical hazards to people and the environment. On beaches and land, fresh or emulsified oil can smother plants, birds, and animals and can create a skin contact hazard for people. VOCs can pose an inhalation hazard to people working near fresh oil, sheen, or mousse. PAHs can cause a persistent environmental hazard if the oil penetrates substrates or is not removed from beaches. A variety of standard cleanup protocols are appropriate for removing MS252 oil from beaches, shorelines, and adjacent waters (see Table 1).

TABLE 1. Forms of Mississippi Canyon 252 oil likely to be found on Gulf Coast beaches and shorelines: characteristics, hazards, and cleanup protocols likely to be most effective.

OIL TYPE	DESCRIPTION	CHEMICAL CHARACTERISTICS	ENVIRONMENTAL & HEALTH HAZARDS	CLEANUP PROTOCOLS
Fresh oil	Black or dark brown, thick, sticky liquid with petroleum odor. On open water, floats and spreads quickly. In intertidal zone, may pick up silt and sediment and sink. On beach, may release sheen when washed by tides or waves. May penetrate beach substrate.	Mixture of 1,000s of chemical compounds. Some compounds evaporate quickly, others can persist for years. High in alkanes, VOCs; flammable. MC252 oil is low in sulfur and relatively low in PAHs.	Smothering of plants, birds, and animals is major concern. PAHs are toxic to fish eggs, larvae. Human health hazard via inhalation, skin contact, and (less likely) ingestion. VOCs are acutely toxic.	On water: disperse, skim, burn On land: sorbent pads, manual recovery, flushing with water, possible use of chemical shoreline cleaning agents
Mousse (emulsified oil or oil/water mixture)	Brown, rust, or orange in color. Pudding-like, sticky. May de-emulsify on beach in hot sun, releasing fresh oil which could penetrate substrate. If not de-emulsified, unlikely to penetrate substrate. Little odor.	Consists of various percentages of water in emulsion with fairly fresh oil. Reduced VOC content. Water content reduces ignitability & biodegradability.	Sticky, can smother plants, birds, and animals. Human health hazard via inhalation, skin contact, and (less likely) ingestion. VOCs are acutely toxic.	On water: skim On land: sorbent pads, manual recovery
Sheen	Very thin layer of fresh oil. May be transparent, rainbow, grey, or silvery in color. May be associated with adjacent fresh oil or mousse.	Most VOCs evaporated. Low levels of PAHs may be present.	Light sheens will degrade quickly. Heavier sheens may concentrate on shorelines. Human health hazard from skin contact, inhalation, and (less likely) ingestion.	Light sheens very difficult to recover. Heavier sheens may be picked up with sorbent boom or sorbent pads.
Tarballs	MC252 oil will weather to form small, hard, floating, black pellets or chunks of oil. May be highly persistent and travel long distances. On beach, may soften in hot sun. In intertidal waters, may pick up sediment or silt and sink.	Asphalt-like tar. VOCs evaporated. PAHs still present.	May soften in hot sun, posing hazard to birds and animals. Prolonged skin contact may cause allergic reaction or rash. May be a concern for recreational shorelines.	On water: snare boom On land: snare boom, manual removal, beach cleaning machinery
Burn residue (floating or on land)	Brittle, hard, asphalt-like, typically mixed with unburned fresh oil. May be mistaken for tarballs.	Asphalt-like tar. VOCs evaporated. PAHs still present.	Little or no acute aquatic toxicity. Very localized smothering impacts. Because controlled burning is conducted well offshore, human health concern on land is minimal.	Collect residue manually from water or land