



What Type of Oil Spilled at Refugio State Beach?

The oil released from the pipeline at Refugio State Beach near Santa Barbara, California, was a blend of crude oils being transported from the Heritage, Harmony, Hondo, and Holly oil production platforms.

In this coastal region, oils from platforms even in close proximity can vary significantly in their composition and properties.

Crude oils vary widely in their chemical composition, depending on their geographical origin and the particular compounds mixed with the petroleum products to aid in pumping and transportation.

Hydrocarbons are by far the most abundant compounds in crude oils, accounting for 50 to 98 percent by volume. All crude oil blends also contain lighter “fractions” of chemicals, such as benzene and toluene, as well as heavier tars and wax-like hydrocarbons.



What are general characteristics of the spilled oil?

Based on information about the platforms supplying oil to the pipeline, it is believed the spilled oil is a medium to heavy crude with an API¹ of less than about 20 and high in sulfur (as much as 5 percent). The oil is viscous (thick and slow to flow) and will become more viscous as it weathers, possibly becoming semi-solid after several days. As the oil weathers, its density is expected to remain less than seawater and to float unless it attaches to sand and sediment.

What is known about the oil fields in the area?

The general oil production area is referred to as the Santa Ynez Unit. The fields within this area are located in the outer continental shelf of the Santa Barbara Channel in 800 to 1,200 feet of water. There are several active oil fields (Hondo, Pescado, and Sacate) that primarily draw from the Monterey Formation. According to industry sources, the overall API gravity is about 19°, but published data range from 9°–36°.

What happens to oil as it “weathers”?

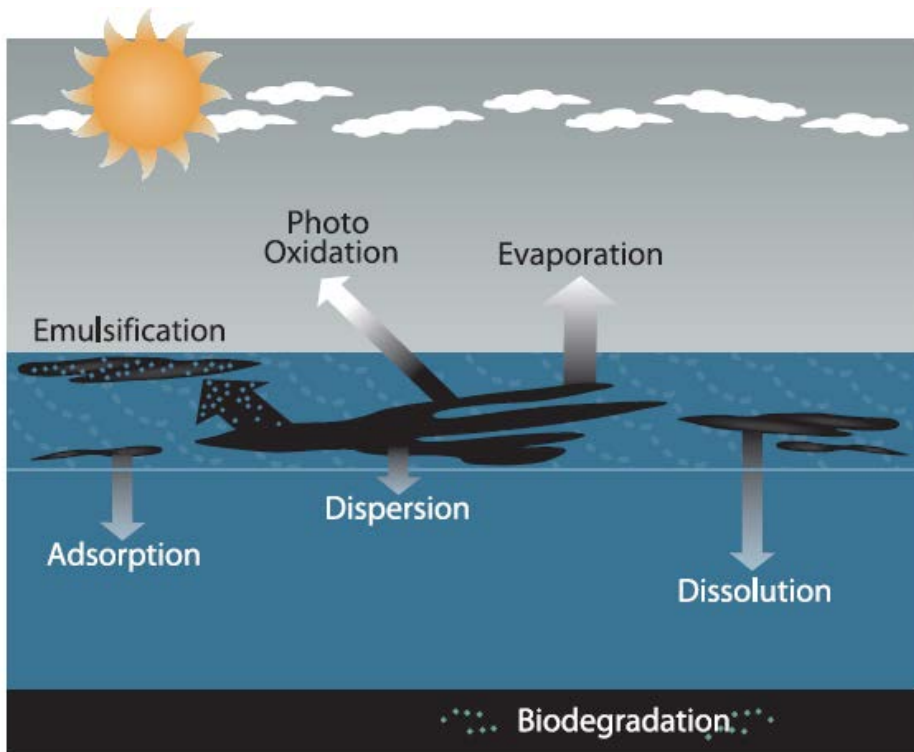
Spilled oil is subject to a variety of weathering processes that can change the oil’s characteristics and behavior. The same processes that weather oil from natural seeps in the region are also the dominant process affecting the spilled oil at Refugio State Beach. These processes are as follows:

- **Evaporation:** Oils from this region have volatile components which are expected to evaporate. Up to about 20 percent of the oil was expected to evaporate within the first couple days of release. This can significantly alter remaining oil by lowering its viscosity and increasing tarball formation.
- **Emulsification:** Certain oils tend to emulsify, or suspend tiny droplets of oil within seawater, forming a stable emulsion (or mousse). These emulsions can contain up to 75 percent water,

¹ The API gravity is used to classify oils as light, medium, heavy, or extra heavy. The higher the number, the lighter the oil. The “weight” of an oil is the largest determinant of its market value, but also has implications for its behavior when spilled. The API values for each “weight” are as follows: Light – API > 31.1, Medium – API between 22.3 and 31.1, Heavy – API < 22.3, Extra Heavy – API < 10.0. Oils with API gravities less than 10 are heavier than water and will sink.

increasing the slick volume four-fold and dramatically changing its appearance and physical characteristics. The rate of emulsification is not well understood for this incident. However, government and university labs are working on the chemical characterization of the spilled oil, which will help improve understanding in this and other areas.

- **Dispersion:** The distribution of oil droplets into the upper layers of the water column by natural wave action is known as dispersion. Some of the smaller droplets will remain suspended in the sea water while the larger ones will tend to rise back to the surface. They may then reform a slick or spread out to form a very thin film.
- **Dissolution:** Water soluble compounds in oil may dissolve into the surrounding water. Components that are most soluble in seawater are the light aromatic hydrocarbon compounds such as benzene and toluene. However, these compounds are also first to be lost through evaporation, a process which is 10–1,000 times faster than dissolution.
- **Photo-oxidation:** This sunlight-induced process, in which oxygen in the air chemically reacts with oil, can have a large impact on oil composition and properties. Plastic-like skins can form quite quickly under sunny conditions.
- **Adsorption:** As oil adheres to particles of sand and sediment suspended in the water, it can be transported to seafloor sediments. This can be a major means by which oil leaves the sea surface.
- **Biodegradation:** Seawater contains a wide range of microorganisms that use hydrocarbons as a source of energy and can partially or completely degrade oil to water-soluble compounds and eventually to carbon dioxide and water. Some components of oil are resistant to biodegradation and may persist in the environment for many years; however, these components are often the least toxic components of the oil.



For more information about NOAA's Office of Response and Restoration, visit response.restoration.noaa.gov or call (301) 713-2989.