

Yellowstone River 2011: Silvertip Pipeline Spill Light Crude Oil Information for Health Professionals



About Light Crude Oil

Crude oil is a naturally occurring liquid composed mostly of hydrogen and carbon. It is usually found underground but can also be found above ground in oil seeps or tar pits. [1] Crude oil is called “liquid petroleum” as it comes out of the ground. Light crude oil is a complex mixture containing thousands of different chemicals. Light crude is relatively fluid (low viscosity) and will float on water (low specific gravity). The crude oil spilled into the Yellowstone River has been described as a “light sweet crude oil”. Light crude oil has a high proportion of light hydrocarbons. It has a high American Petroleum Institute (API) gravity, which means it is lighter than some other types of oils. Sweet crude oil is low in sulfur compounds that can generate a foul odor like rotten eggs.

When an Oil Spill Occurs

Light crude contains volatile organic compounds which evaporate. Thus, light crude oil will lose up to 10 to 15% of its volume immediately, and up to 25% of its volume within 24 hours. How much of its volume is lost depends on the surface-to-volume ratio of the bulk oil. Events that disperse the oil, such as a river in flood, can affect this.

Thus, crude oil in a pool or tank will retain more of its volatile components than crude spread out in an oil slick. [2] Factors like air temperature and water temperature are also important in how fast a light crude oil will lose these volatile compounds.

When oil is spilled into a stream, it initially spreads primarily on the surface of the water. How much it spreads depends on its relative density and composition of the oil. The oil slick formed may remain cohesive, or, if the water is rough like in rapids, it may break up. In a river, oil will follow the water and may collect in areas where the current slows down, like in sloughs or eddies. The banks of a river may also help to contain the spill. If the banks are porous like sand, then the oil may move slowly sideways into the groundwater along the river. The speed at which the oil moves through the ground is much slower than in the river. That means the oil will not spread out as far or as fast underground as it does on the surface.

Oil that contains volatile organic compounds partially evaporates, losing 20 to 40 percent of its mass and becoming denser and more viscous. A small percentage of oil may dissolve in the water. The oil residue also can spread almost invisibly in the water or combine with water to form a thick mousse-like substance. Some of the discharged oil waste will sink with suspended particulate matter; some may mix with the water, and some will stick to debris (leaves, branches), which will eventually be deposited along the river bank. Over time, oil waste





deteriorates (weathers) and disintegrates because of exposure to sunlight (photolysis) and biodegradation. The rate of biodegradation depends on the availability of nutrients, oxygen, and microorganisms, as well as temperature. [3]

Oil Residue and Health

Although not recommended, for most people, an occasional brief contact with a small amount of crude oil will do no harm. However, some people are especially sensitive to chemicals, including the hydrocarbons found in crude oil and petroleum products. They may have an allergic reaction, or develop dermatitis or a skin rash, even from brief contact with oil. In general, dermal contact with oil should be avoided.

If contact occurs, wash the area thoroughly. Use soap and water; baby oil; petroleum jelly; or a widely used, safe cleaning compound such as the hand cleaning paste sold at auto parts stores. You may need to wash the area more than once to remove all of the oil residue.

When cleaning skin, avoid using solvents, gasoline, kerosene, diesel fuel, or similar products on the skin. These hydrocarbon-based products, when applied to skin, may present a greater health hazard than the oil itself. [3]

Prolonged skin contact

Prolonged skin contact with crude oil and petroleum products can cause skin erythema (reddening), edema (swelling), and burning. The skin effects can worsen by subsequent exposure to sunlight, because trace contaminants in the oil, such as the Polynuclear Aromatic Hydrocarbons (commonly referred to as PAHs), are more toxic when exposed to light. Skin contact can result in defatting of the skin, increasing the possibility of dermatitis and secondary skin infections.

Some persons may be, or may become, sensitive to the crude oil. Depending on the amount and duration of exposure, skin contact with crude oil may be mildly to moderately irritating; in a sensitive individual, the skin effects may be more pronounced after a smaller or shorter exposure.

If there is an open wound like a cut or scrape, the injury should be completely cleaned of the oil product. Then normal precautions should be taken, like the use of bandages, antiseptic or antibiotic ointments and the like to keep the wound clean until healed.

Ingestion

Swallowing crude oil, unless in large quantities (e.g., > eight ounces) is unlikely to result in more than transient nausea, possibly vomiting, gastrointestinal tract disturbances, and self-limiting diarrhea. However, vomiting and subsequent aspiration of hydrocarbons such as crude oil may result in significant lung injury. [2]

Inhalation

Inhalation of fresh crude oil could result in inhalation of associated volatile hydrocarbons. Symptoms including headache, dizziness, confusion, nausea, or vomiting, may occur from breathing vapors given off by crude oil. Inhalation of weathered crude oil is of less concern because of the loss of volatile hydrocarbons. Remove the patient to a clear area and provide supplemental oxygen if needed.

Other Care Issues

Skin Contamination: Generally, the presence of crude oil on the patient should present no major complications; it can be wiped off whenever convenient in the treatment process. Even so, two warnings should be noted:

- Oil and oxygen-enriched atmospheres are potentially explosive. Hands oily from removing oily clothing from patients can be sufficiently contaminated to contaminate also fittings on oxygen-using treatment equipment, with potentially disastrous consequences. Oil on the face of a patient does not contraindicate O₂ treatment, but it is important to remove oil-contaminated clothing and wipe the oil from the head, neck, and chest of the patient before placing the O₂ mask. Because an oxygen-enriched atmosphere may exist for up to one foot from a nasal cannula or face mask, sources of ignition should not be used near oil-contaminated persons or clothing. In particular, before using a defibrillator, excess oil should be wiped off of the patient, particularly from the trunk and neck areas.
- Oil-contaminated clothing removed from patients, and oily cloths or rags used to wipe off patients, represent a potential fire hazard due to the risk of spontaneous combustion. Such material should be stored in a metal container with a tight lid. Contaminated clothing and rags should not be left to accumulate but should be disposed of frequently.

Wound Contamination: Current industrial practice for external and superficial wound cleaning is being modified to include use of waterless hand cleaners, white petrolatum, mineral oil, corn oil, or antibiotic ointment. These agents must be removed as completely as possible from within the wound after efforts to remove the crude oil have been completed.

Ocular Exposure: Ocular exposure can result in slight stinging and temporary redness. No permanent damage should result. The immediate treatment is to flush the eye with copious amounts of water for 15 minutes. If the person wears contacts, these should be removed first.

Ingestion Exposure: Following ingestion of a small amount of crude oil clinical signs of toxicity are generally limited to mild stomach disturbances. The main danger of swallowing crude oil is that it can also get into the lungs causing chemical pneumonitis for example if ingested oil is vomited and subsequently aspirated into the lungs. To treat patients exposed via ingestion, do not induce vomiting as this may lead to aspiration of the crude oil into the lung.

References

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