



Cluett Consulting Newsflash

Topic: Oil Contamination of the Environment

Contamination of soil and water by oil is recognised as a significant risk to the environment and carries legal penalties. However, oil spills are observed at operations and other facilities where oil is stored and used. Indeed, it may be something you observe regularly at garages, shopping centres or even your home. This article will form the basis of a series on oil contamination. This article describes why contamination of the environment by oil is a problem and why it should be avoided. Following this we will be publishing articles on best practice for your oil storage facilities and tool box talks that you may use or develop for your organisation.

First we'll get back to basics, the term 'oil' describes a variety of substances that have a high hydrogen and carbon content and, thus, are also referred to as hydrocarbons¹⁰. They include crude oil and petroleum products, as well as vegetable oils, animal fats and other non-petroleum oils¹⁰. There are certain characteristics that most oils have in common. Oils are generally liquid at room temperature, slippery to the touch and flammable. They are non-polar substances. Water is a polar substance and, following the principle of like attracts like, it is for this reason that oil and water do not mix (oils are known to be hydrophobic, meaning water-fearing). However other non-polar substances, such as grease, will mix in oil and these substances are called lipophilic (or fat-loving). Toxic substances such as PCBs are non-polar substances which means that they are soluble in oil. Oils are also generally less dense than water which means they will float on top of it, although this is not an absolute rule. Oil may disperse over the surface of water as a very thin layer, thus a small amount of oil can contaminate a large area of water. These are the general properties that most oils have in common, however each type of oil has particular physical and chemical properties and these will affect the way oil will spread and breakdown and its toxicity, especially to human and environmental health¹⁰.

It is commonly said that 1 litre of oil will contaminate almost a million litres of water, but what does this mean and what are the real consequences of oil contamination of soil and water for the environment and us as a component of that environment?

When oil is released it can exist in two forms – “bounded” and “migrating”. Bounded oil is that which has been adsorbed (taken up or bound) to a substance⁶. In soil, oil may bind to soil particles, in water, oil will look for something to bind to and this can include the feathers or fur of birds, mammals or other organisms⁶ (oil separating machines are based on this principle). Migrating oil is that which moves freely around soil particles or across other substances such as water bodies¹. As oil and water do not mix, when oil comes into contact with water it will generally not bond with it and instead will exist in its migratory form on the surface of the water. Exceptions to this exist where the oil is denser than water in which case it will sink and collect on the bottom of the water body, generally as globules of oil or, as mentioned, when oil finds another substance to bind to^{3,6}.

Where oil exists in its migratory form in water it may be capable of spreading long distances and subsequently contaminating the environment, especially ground water and surface water including rivers, dams and the sea.

Oil contamination has been shown to create anaerobic environments in both soil and water² by reducing the flow of oxygen through the oil to the substance below. This is harmful for both terrestrial and aquatic environments, for example it may cause fish and other water-dwelling organisms to suffocate and it may affect microbes in soil that can have significant effects for the entire food chain⁵. It has also been shown to block the entry of light into water and as such may inhibit photosynthesis in plants and other organisms^{3,5}. As mentioned, oil may also bond with substances on top of water such as on the feathers of birds^{3,5,9}. This causes the feathers to mat and separate and may have significant repercussions for these birds in that this will decrease their ability to fly and will decrease their waterproofing making them sensitive to changes in temperature^{3,5,9}.



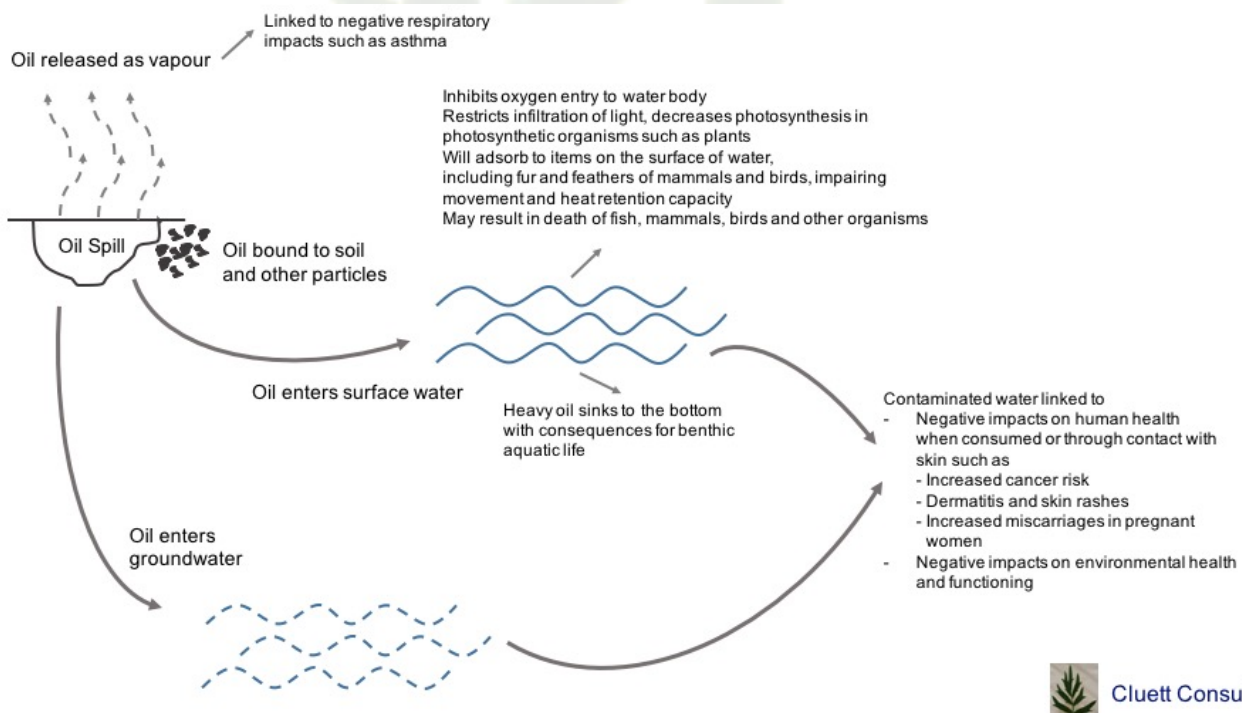


Birds may also ingest oil during the process of preening (or cleaning their feathers). This can have severe health consequences for the birds^{3,5,9} and may result in their death.

In addition, the consequences of oil pollution are not all visible, bioaccumulation may occur through which oil and other oily substances may build up in the fatty tissue of animals such as fish^{5,6,7}. This fish may then be consumed by humans, where it may build up in our fatty tissue⁷.

Human exposure to oil may happen through a variety of pathways - through respiration, eating and drinking oil contaminated substances and bathing^{4,6} (absorption through the skin). Human health has been shown to be affected by oil contamination, with the effects including increased risks of various cancers, respiratory effects (associated with the inhalation of oil fumes), skin irritation and negative consequences for pregnant women, including an increased risk of miscarriage^{5,6,8}.

The remediation of oil-contaminated soil or water is often very costly and energy intensive. It is always better to stop a problem at its source or before it occurs. We, therefore, encourage all operational personnel to be aware of the risks relating to storage of new and used oil, to include oil-associated activities and aspects, and the consequent impacts, in their risk assessments and to consider their handling of oil both at the workplace and at home.



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