Return To How Much Oil Remains

Fingerprinting Oil

The chemical composition of oil found in the environment yields important clues about where it came from. The process of determining where an oil residue originated is what scientists call "fingerprinting" or "source fingerprinting." Source fingerprinting is a complex procedure that is part art and part science, relying both on the experience of the analytical chemist and on the results of ratios between certain components in a mix. Similar to the literal uses of fingerprinting, experienced chemists can analyze the evidence left at a "crime scene" (spill site) to make a reasonable determination of "whodunit"—that is, if a residue is, in fact, oil, where it might have originated, and, possibly, who spilled it. For example, the U.S. Coast Guard uses such forensic methods to determine whom the "responsible party" is when an oil spill with no known source washes up on a shoreline.

This photograph shows a heavily impacted rocky beach in Prince William Sound showing pools of unweathered surface oil just days after the spill. (Photo credit: OR&R, NOAA)

Most of the oil residue scientists find in Prince William Sound originated with the *Exxon Valdez* spill. Other potential sources that scientists have identified include diesel fuel, nonspecific combustion sources that could include anything from wood stoves to vessel exhaust, and spilled oil not linked to the *Exxon Valdez*.

Weathering

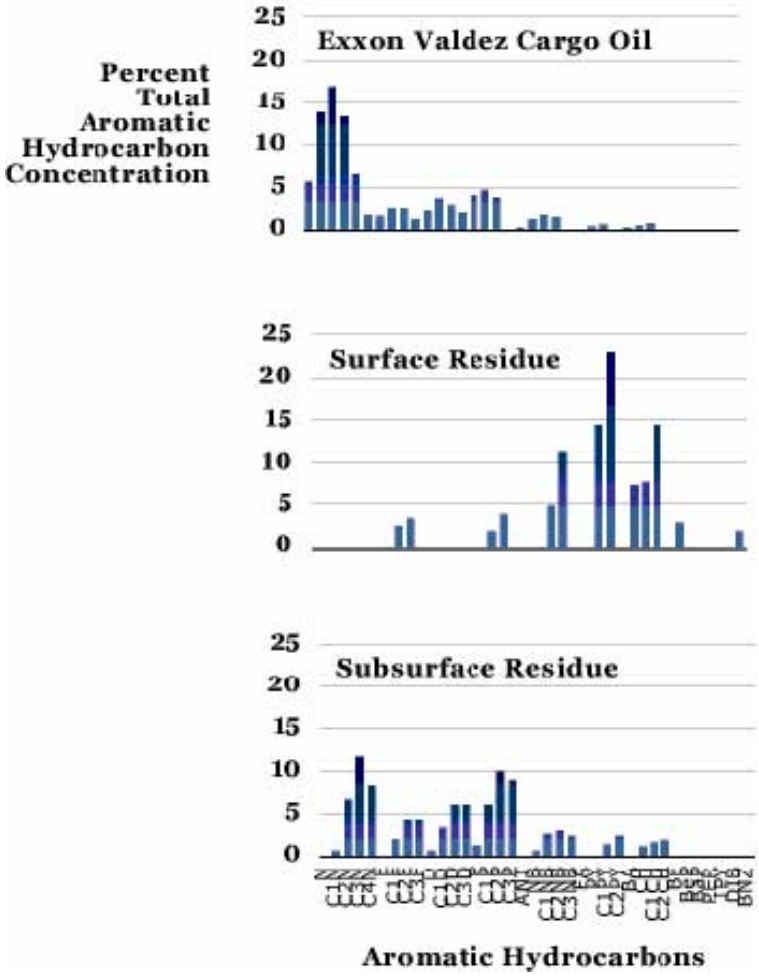
Oil is a mixture of many different chemicals. Not only does each chemical have its own toxicity, but each also behaves differently in the environment.

- Some components are much more volatile than others, and so they tend to evaporate more rapidly when oil is spilled.
- Some components of oil are more easily broken down by microorganisms on the beaches.
- Sunlight can also degrade oil components (called photolysis).

The sum of these physical and

biological processes results in what scientists call "weathering" of the oil, which is reflected in the changes in chemical composition of oil residues over time. The more closely the chemical composition of a residue resembles that of the unspilled oil, the "fresher" it is. In Prince William Sound, chemists tell us that the remaining *Exxon Valdez* oil ranges from very weathered to relatively fresh. What does this mean? In general, scientists have found that the more exposed to the elements the oil is, the more rapidly it weathers. Accordingly, the least weathered oil can still be found under the surface, or as buried residues of the original oil.

(top)



Differences in composition of oil from the *Exxon Valdez* tanker, and surface and below surface (subsurface) residues found in 1994. Notice that the subsurface oil, buried and thus protected from many weathering processes, resembles the original oil much more than the surface residue. Also notice that oil is composed of a mixture of chemicals (each bar is a different hydrocarbon).