



Petroleum Chemistry Laboratory Fingerprinting

Overview Background:

The California Department of Fish and Wildlife's (CDFW) Petroleum Chemistry Lab (PCL) near Sacramento is staffed with chemists whose primary task is to figure out where spilled oil came from. They do this by comparing the chemical properties of the oil samples collected at the scene by CDFW employees to known sources. Hundreds of oil spills occur in the state annually, with incidents ranging from tanker truck rollovers to pipeline leaks to natural offshore seeps.

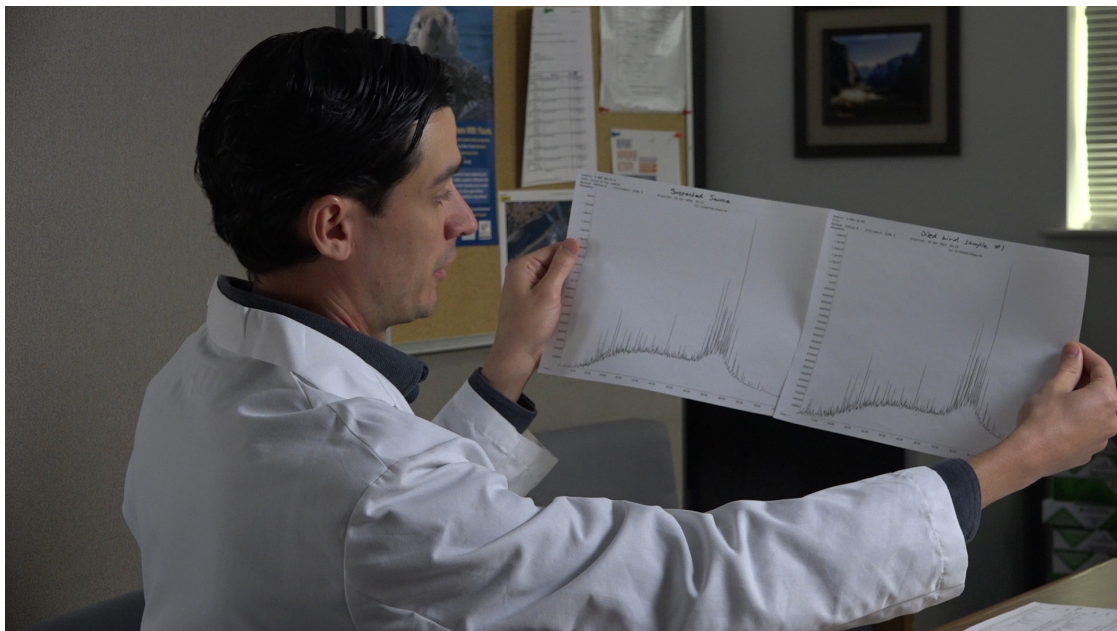
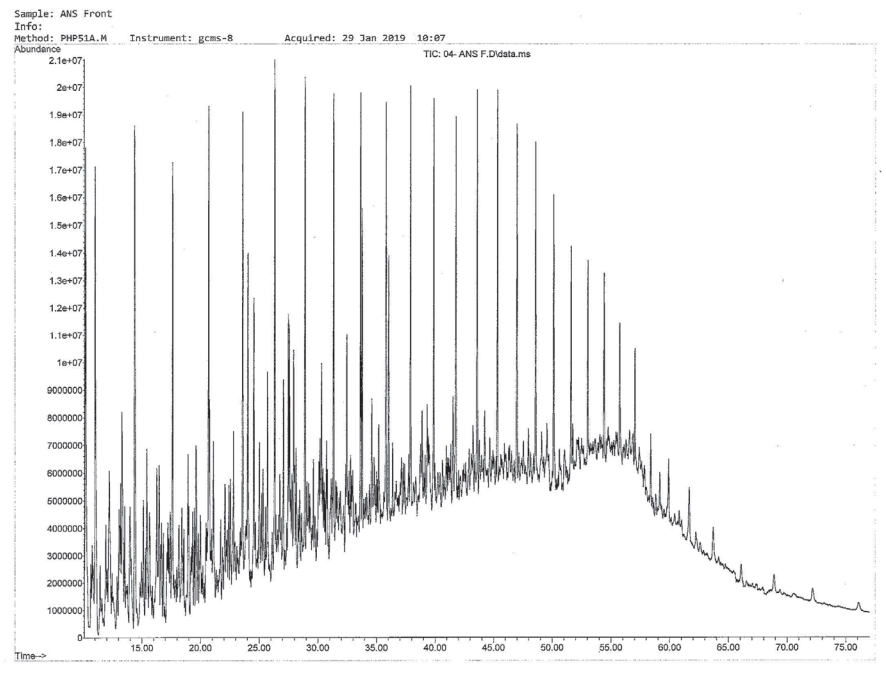
Petroleum is a complex mixture comprised of many thousands of individual components. The relative concentrations of these components in a specific oil sample are a function of many factors that include the geographic location, age, thermal characteristics, and the contributing organisms of an individual geologic oil reservoir. These factors create unique fingerprints of oils produced from different geographic areas that can be used to compare and differentiate samples.

Process: Samples are collected under chain of custody and transported to the laboratory. To prepare the samples for analysis, they are extracted with solvent and adjusted to a constant concentration. The prepared samples are analyzed on a gas chromatograph coupled to a mass spectrometer (GC/MS) using the industry standard American Society for Testing and Materials (ASTM) method 5739-D to visualize the fingerprint and determine if they are consistent with a common source.

This approach utilizes various techniques to separate the individual components of oil from each other so they can be observed and characterized on instrumentation using mass fragments that are specific to each component, resulting in a visual fingerprint for comparison. The individual components of two samples can be compared directly in this manner, considering factors like weathering and washing. Interpretations of these comparisons are used to draw a conclusion as to whether or not the samples in question are consistent with a common source.

The CDFW Petroleum Chemistry Laboratory is one of only several throughout the country that examine dozens of samples of oil a year. It has been instrumental in identifying the source of petroleum contaminating waterways and wildlife for more than 20 years. You can see a video on the lab here:

https://www.youtube.com/watch?v=RgyGc_Vb7Ms



Top, gas chromatography/mass spectrometry is used to separate complex mixtures, such as petroleum, into a series of individual components that can be analyzed for similarities and inconsistencies. Depending on the factors programmed into the instrument, the results can appear as a series of peaks on a chromatogram. CDFW staff chemist Joe LaCalle, above, uses the information produced to compare the chemical fingerprints from a pair of samples.