



# Hydrocarbon Forensics

## TECHNICAL BULLETIN

Hydrocarbon Forensics is an important field of study related to the characterization of oil, gasoline and diesel contamination in soil, sediment and groundwater. For the last several decades, it has primarily been used to resolve liability issues when a leak occurs or contamination is discovered (e.g. when a commercial, residential or industrial property changes hands). In recent years, however, this science has emerged as a powerful planning tool to aid in effective remediation design, risk assessment studies and when developing a comprehensive site closure strategy.

### Background

When petroleum and petroleum-related products are released into the environment, numerous biochemical and physical processes begin to change the composition almost immediately. Given this complexity, a variety of analytical methods have been developed to help customers evaluate and resolve site-specific issues. Maxxam's scientific experts work with clients to design forensic analytical approaches to identify:

1. What contaminants are present?
2. What is the source of the leak?
3. What is the age and type of oil, diesel or gasoline at the site?

When selecting the appropriate tests to apply to a project it is important to clarify the ultimate objective of the forensic examinations. Maxxam's hydrocarbon forensic analytical packages have been tailored to various scenarios depending on the type of sample, suspected contaminant, and level of qualitative or quantitative analysis required.

### Petroleum Hydrocarbons

Analysis of petroleum hydrocarbons (PHCs) can be conducted for both volatile and semi-volatile components in solid, water and product samples. A **CCME PHC Quantitative Assessment** provides information for compliance purposes applicable in Ontario, the Prairie

Provinces and Federal properties. This method can also provide valuable qualitative information for product characterization when compared to a library of standard reference materials maintained by Maxxam.

### Gasoline & Light Distillates

Maxxam provides two hydrocarbon forensics tests tailored specifically for gasoline and light distillate contaminants.

The **Gasoline Volatile Organic Compounds (VOCs)** test includes analysis of specific volatile compounds and other distinct additives, such as oxygenators and lead scavengers. The data can be used to determine the degree of weathering and establish a potential source.

The **Gasoline Components** test provides a more in-depth analysis with results that include hundreds of different parameters, making up the Paraffins, Isoparaffins, Aromatics, Naphthenes and Olefins group (aka **PIANO**). Results are used to determine the degree of weathering, specific pathways (biodegradation, solubilization and evaporation), and octane rating or fuel grade. In some cases, the refining method may also be determined with this test.

### Heating Oils & Heavy Distillates

For heating oils and heavier distillates, Maxxam offers several tests targeting semi-volatile hydrocarbons in the C10 to C50 range.

The **Weathering Package** provides information on straight chain hydrocarbon compounds (n-Alkanes and Isoprenoids) to determine the degree of weathering and potentially estimate age.

The **Biomarker Package** provides more detailed information by targeting specific biomarker compounds (bicyclic sesquiterpanes, steranes and hopanes) to identify potential sources of contamination. Customers may also choose to request a **Custom Biomarkers** test if seeking particular biomarker compounds that aren't provided in our standard package.

## Other Specialized Forensics

Specialized forensics analyses are sometimes required as additional lines of evidence when definitive answers are hard to reach using the methods outlined above.

In situations where weathering processes have significantly altered the composition of the contaminating material, Maxxam's **Alkylated polycyclic aromatic hydrocarbon (PAH)** analysis provides quantitative information on a specific list of parent and alkylated PAH compounds. These compounds are generally more recalcitrant and resistant to biodegradation.

The **Gasoline Leads** test provides information on presence and concentration of tetraethyllead (TEL) and tetramethyllead (TML) in gasoline contaminants. Organic lead was used beginning in the 1920s as an anti-knock additive in automotive gasoline until it was phased out in Canada by the early 1990s. Analysis of TML and TEL can help identify old gasoline releases and differentiate them from recent or current releases.

Additionally, Maxxam offers Carbon Isotopes testing which can be used to determine the degree of biodegradation and differentiate the contaminant from other sources based on the ratio of  $^{13}\text{C}$  to  $^{12}\text{C}$ .

## Working with Maxxam

Regardless of the complexity of the situation, Maxxam provides all the analytical tools and support required for a complete and accurate assessment of petroleum hydrocarbon impact. In the event that additional technical support is required, Maxxam offers Forensics Consultation services with our Senior Scientists. Upon request, we can also prepare a detailed analytical report, signed and validated by one of our Chartered Chemists.

## About Us

Maxxam is a leading North American provider of analytical services and solutions to the energy, environmental, food, Industrial Hygiene and DNA industries. We are a member of the Bureau Veritas Group of companies – a world leader in testing, inspection and certification services. We support critical decisions made by our customers through the application of rigorous science and the knowledge and expertise of over 2,500 employees.

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