Hydrocarbon Forensics – Test Guide 2016

LEGEND LIGHT DISTILLATES = MEDIUM/HEAVY DISTILLATES =

CCME Petroleum Hydrocarbons (BTEX, F1 to F4)

Test Name: PHC Quantitative Assessment

Resulting Parameters	Matrix	Test Code	Notes
BTEX and F1	Soil	Local Test Codes apply (CCME quantitative and regulatory 19 min run).	The F1 to F4 chromatograms provide quantitative information for compliance purposes, applicable in Ontario, Prairie provinces and Federal properties. Product characterization is performed by comparing chromatograms to a library of standard reference materials that Maxxam maintains.
	Water		
	Product		
F2 to F4	Soil		
	Water		
	Product		

Gasoline and Light Distillates

Test Name: Gasoline VOCs

Resulting Parameters	Matrix	Test Code	Notes
Open characterization of gasoline VOCs	Soil, water and product	Local Test Codes apply.	Forensic fingerprinting of volatile components includes diagnostic BTEX ratios, as well as the presence of gasoline additives such as MTBE and lead scavengers. Comparison of the data with other samples can lead to establishing the possible contaminant source and assess weathering.

Test Name: Gasoline Components

Resulting Parameters	Matrix	Test Code	Notes
Paraffins, isoparaffins, aromatics, naphthenes and olefins (PIANO)	Product	PIONAUX-L	The test provides characterization of non-additive components found in gasoline by classes, including paraffins, isoparaffins, aromatics, naphthenes and olefins. This is an efficient fingerprinting tool for establishing degree of weathering (i.e.. biodegradation, solubilization and evaporation), providing an indication of octane rating or fuel grade, and potentially determining refining method and/or origin.

Heating Oils and Heavy Distillates

Test Name: Heating Oils/Diesels Weathering Package

Resulting Parameters	Matrix	Test Code	Notes
Select n-Alkanes and Isoprenoids Biomarkers	Soil	FOREXTFI-S	The extended run GC/FID method provides information on a specific group of compounds, including n-Alkanes and isoprenoids;.The data is reported as diagnostic ratios that can be used to evaluate degree of weathering and potentially estimate age.
	Water	FOREXTFI-W	
	Product	FOREXTFI-O	

Test Name: Heating Oils/Motor Oils Biomarkers Package (Basic or Extended Packages)

Resulting Parameters	Matrix	Test Code	Notes
Select n-Alkanes, Isoprenoids and Heavy Biomarkers (bicyclic sesquiterpanes, hopanes, steranes & terpanes; naphthalenes & phenanthrenes)	Soil	FOREXTMS-S	The extended GC/MS full scan analysis (open scan or SIM) can be used to target specific aliphatic and aromatic groups, as well as characteristic biomarkers. **Basic Biomarker Package** includes chromatograms and diagnostic ratios of select n-alkanes, **isoprenoids** and **bicyclic sesquiterpanes.** The **Extended Biomarker Package** also includes chromatograms and diagnostic ratios of select **terpanes, hopanes, steranes, napthalenes and phenanthrenes,** in addition to the components of the Basic Package.
	Water	FOREXTMS-W	
	Product	FOREXTMS-O	

Test Name: Heavy Distillates Custom Biomarkers

Resulting Parameters	Matrix	Test Code	Notes
Diagnostic ratios or fingerprinting patterns for non-routine biomarkers	See above.	See above.	This option can be used for any particular biomarker or set of biomarkers that is not offered in the routine packages. Other biomarker parameters that are available include **Adamantanes, Diamantanes** and **Alkyl Cyclohexanes.**

Test Name: Alkylated PAHs

Resulting Parameters	Matrix	Test Code	Notes
Parent and alkylated PAHs	Product	PAHALKAB-O	Target analytes include the regular suite of parent PAHs and alkylated homologous PAHs (C8 to C40 hydrocarbons). This method can be used for quantification, diagnostic ratios and fingerprinting of petroleum hydrocarbons. The determination of both parent and alkylated PAH compounds provides an additional useful fingerprinting tool, particularly when the alkane pattern of the product has been extensively impacted by weathering processes.
	Soil	PAHALKAB-S	
	Liquids	PAHALKAB-W	

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Other Specialized Forensics

Test Name: Stable Isotopes

Resulting Parameters	Matrix	Test Code	Notes
Carbon Stable Isotopes	**Product Samples:** Crude oil, saturated & aromatic fractions, gasolines, diesels & PAH samples	Subcontracted (University of Oklahoma or Pace Zymax)	The ratio of ^{13}C to ^{12}C, ^{1}H to ^{2}H and ^{37}Cl to ^{35}Cl in key components / compounds, can vary between sources of crude or the degree of biodegradation. This ratio provides a "fingerprint" to help identify and differentiate petroleum products from a variety of sources.
	Groundwater samples: Routine contaminants, like BTEX, MTBE, TBA and chlorinated solvents		
	Natural Gas Samples		
Hydrogen Stable Isotopes	**Product Samples:** Crude oil, saturated & aromatic fractions, gasolines, diesels & PAH samples		
	Groundwater samples: Routine contaminants, like BTEX, MTBE, TBA and chlorinated solvents		
	Natural Gas Samples		
Chlorine Stable Isotopes	**Groundwater samples** (chlorinated solvents: TCE / PCE)		

Gasoline and Light Distillates

Test Name: Total Lead

Resulting Parameters	Matrix	Test Code	Notes
Total Lead	**Product** (Sladeview, Mississauga or Edmonton) **Soil, Water** (local lab)	Sladeview or Edmonton Petroleum (for product) Local test codes for Soil/ Water (ICP/MS)	Total Lead analysis may serve as a quick and inexpensive screening tool, when trying to determine the possible presence of a leaded gasoline product. The presence of detectable concentrations in product, or elevated concentrations in soil/water, may warrant additional Organic Lead testing.

Test Name: Organic Lead

Resulting Parameters	Matrix	Test Code	Notes
Tetramethyl Lead (TML), Tetraethyl Lead (TEL) & MMT	Product, Soil, Water	Subcontracted to RPC (Fredericton)	Analysis of tetramethyl lead (TML), Tetraethyl Lead (TEL) & MMT can help identify old gasoline releases and differentiate them from recent or current releases.

Test Name: Total Sulfur

Resulting Parameters	Matrix	Test Code	Notes
Total Sulfur (low level)	**Product** (Sladeview, Mississauga or Edmonton) **Soil, Water** (local lab)	Sladeview or Edmonton Petroleum (for product-UV, LL) Local test codes for Soil/Water	Total Sulfur analysis may serve as an additional tool in attempting to characterize potential or suspected middle distillate fuels, such as diesels / fuel oils. Based on the measured concentrations of total sulfur in product, comments may be made as to the relative age (i.e. recent low sulfur fuel vs historic higher sulfur content fuels).

Forensics Reporting and Consulting Services

Service	Expert	Notes
Forensics Consultation	Professional or Chartered Chemist	Maxxam provides scientific and consulting services, including written summaries of preliminary findings and recommendations for forensic evaluation, such as chromatogram interpretation, by senior chemists. Analysis includes rationalization of additional testing, while determining methods for minimizing unnecessary costs. The basic analytical report assumes 4 hours to complete; additional time required beyond this may be added, as required.
Basic Analytical Report	Chartered Chemist	

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