



Sitelab's UVF-Trilogy analyzer uses ultraviolet fluorescence to determine the concentrations of Gasoline Range Organics (GRO) in the C6 to C10 carbon range, which includes BTEX (benzene, toluene, ethylbenzene, and xylenes) and other volatile petroleum hydrocarbons (VPH). Specifically, this method detects monoaromatic hydrocarbons only and does not detect polyaromatic hydrocarbons, including Diesel Range Organics (DRO) or other hydrocarbon ranges above the C10 carbon number. UVF is not sensitive to aliphatic hydrocarbons.

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Sitelab UVF-Trilogy Analyzer with GRO UV Module Inserted



GRO UV Module is Fitted with 255nm LED and Optical Filters



Sitelab GRO Calibration Kits: CAL-025M, CAL-025H

TABLE 1

## GRO FLUORESCENCE RESPONSE OF MONOAROMATIC HYDROCARBONS

UVF-Trilogy with GRO Module, Calibration and Analysis in Methanol Solvent				Factory Calibration, Sitelab GRO Standard Part No. CAL-025M
Example Compounds in the C6 to C10 Range	CAS Number	Molecular Weight (g·mol <sup>-1</sup> )	Carbon Number	Fluorescence Response (%)
Benzene	71-43-2	78	C6	28
Toluene	108-88-3	92	C7	114
Ethylbenzene	100-41-4	106	C8	82
m-Xylene	108-38-3	106	C8	98
o-Xylene	95-47-6	106	C8	125
p-Xylene	106-42-3	106	C8	180
1,2,4-Trimethylbenzene	95-63-6	120	C9	34
1,3,5-Trimethylbenzene	108-67-8	120	C9	140
Naphthalene (2-Ring PAH Compound)	91-20-3	128	C10	0
Sitelab GRO Standard Response for Comparison:				100

This data is provided for guidance purposes only. Examples shown here compare the fluorescence of monoaromatic hydrocarbons measured using Sitelab's GRO standard used to factory calibrate the UVF-Trilogy analyzer. This product contains a mixture of BTEX compounds. Samples supplied in methanol using Certified Reference Materials (CRMs) made by AccuStandard, Inc.

Fluorescence response was calculated by dividing sample readings by the concentration of the standard used and shown as a percentage. Response varies depending on the size and shape of each molecule.

TABLE 2

## GRO FLUORESCENCE RESPONSE OF FUELS AND OILS

UVF-Trilogy with GRO Module, Calibration and Analysis in Methanol Solvent	CAS No.	Source	Fluorescence Response (%)
			Factory Calibration, Sitelab GRO Standard Part No. CAL-025M
Automotive Fuels with Low to High GRO Content:			
Gasoline, Regular Unleaded	8006-61-9	CRM	22
Gasoline, Regular 87 Octane	8006-61-9	Retail	27
Highway Diesel, Ultra Low Sulfur	68476-34-6	Retail	30
No. 2 Diesel Fuel, High Sulfur	68334-30-5	CRM	30
50% Weathered Gasoline	8006-61-9	CRM	58
Weathered Gasoline, UST Site	N/A	NAPL	75
Aviation Fuels with Low to High GRO Content:			
JP-5 Jet Fuel	8008-20-6	CRM	18
Kerosene	8008-20-6	CRM	20
JET-A Jet Fuel	8008-20-6	CRM	25
JP-4 Jet Fuel	50815-00-4	CRM	28
JP-8 Jet Fuel	82863-50-1	CRM	30
Other Fuels and Oils with Low to High GRO Content:			
Naphtha, Oil Refinery Site	N/A	NAPL	3.2
No. 6 Fuel Oil	68553-00-4	CRM	8
Transformer Oil	64742-53-6	CRM	14
Light Crude Oil, NIST 2779	8002-05-9	SRM	15
No. 2 Fuel Oil	68476-30-2	CRM	25
Heat Transfer Fluid	101-84-8	Retail	200
Sitelab GRO Standard Response for Comparison:			100

This data is provided for guidance purposes only. Response in fuels and oils varies in GRO content, shown here calibrated to Sitelab's GRO standard. Samples consisted of CRMs, Non-Aqueous Phase Liquids (NAPL) collected from oil recovery wells, light crude oil and other samples collected from retail stores or manufacturers for comparison.

TABLE 3

## GASOLINE RANGE ORGANICS IN WATER TESTING ERA 762 PROFICIENCY SAMPLE

UVF-Trilogy with GRO Module Comparing 4 Calibrations, Samples Tested in Hexane	Sample 1 µg/L	Sample 2 Duplicate µg/L	Average Result µg/L	Certified Value µg/L	%R
1. GRO Water Standard, ERA 762, Lot P321-762	2,000	2,060	2,030	2,210	92%
2. 50% Weathered Gasoline, AccuStandard GA-W50-10X	1,470	1,760	1,615	2,210	73%
3. GRO Calibration Standard, Sitelab CAL-025H	920	1,100	1,010	2,210	46%
4. Fresh Gasoline, 87 Octane, Gas Station, Massachusetts	3,500	4,180	3,840	2,210	174%
ERA Proficiency Study, Lot P321-762 Gasoline Range Organics Mean Result: (Based on 60 Lab Tests)			2,380	2,210	108%
QC Performance Acceptance Limits:			1,320 – 3,540		
PT Performance Acceptance Limits:			815 – 3,890		

This data is provided for guidance purposes only. UVF performed using four calibrations using different standards available for comparison.

Samples spiked 1:1000 in tap water using Environmental Resource Associates (ERA) 762 GRO in Water Certified Reference Material (CRM). Samples extracted using hexane. Sample 1 was extracted 15 minutes after preparation; Sample 2 was extracted 1 hour after preparation.

GRO analysis results performed best using ERA's 762 standard and AccuStandard's weathered gasoline calibrations. Both contain 50% weathered gasoline, but are manufactured differently. Concentrations exhibited are within ERA's QC and PT Performance Acceptance Limits. Calibrations using Sitelab GRO and fresh, unweathered gasoline produced lower and higher percent recoveries (%R) due to the higher and lower aromatic composition in the standards.

TABLE 4

## GASOLINE RANGE ORGANICS IN SOIL TESTING ERA 763 PROFICIENCY SAMPLE

UVF-Trilogy with GRO Module Comparing 4 Calibrations, Samples Tested in Methanol	Sample 1 mg/Kg	Sample 2 Duplicate mg/Kg	Average Result mg/Kg	Certified Value mg/Kg	%R
1. GRO Water Standard, ERA 762, Lot P321-762	450	430	440	599	73%
2. 50% Weathered Gasoline, AccuStandard GA-W50-10X	320	295	308	599	51%
3. GRO Calibration Standard, Sitelab CAL-025M	200	184	192	599	32%
4. Fresh Gasoline, 87 Octane, Gas Station, Massachusetts	760	700	730	599	122%
	ERA Proficiency Study, Lot D115-763 Gasoline Range Organics Mean Result: (Based on 85 Lab Tests)		414	599	69%
	QC Performance Acceptance Limits:		184 – 797		
	PT Performance Acceptance Limits:		59.9 – 875		

This data is provided for guidance purposes only. UVF performed using four calibrations using different standards available for comparison.

Two soil samples containing 10 grams each were extracted in 20 mL methanol for 24 hours.

GRO analysis performed best using ERA's 762 standard and AccuStandard's weathered gasoline calibrations. Both contain 50% weathered gasoline, but are manufactured differently. Percent recovery (%R) values are within ERA's QC and PT Performance Acceptance Limits. Calibrations using Sitelab GRO and fresh, unweathered gasoline produced lower and higher recoveries due to the higher and lower aromatic composition in the standards.

TABLE 5

GASOLINE RANGE ORGANICS IN SOILS TESTING BLIND U.S. EPA PROFICIENCY  
EVALUATION SAMPLES SPIKED WITH WEATHERED GASOLINE

Contaminant, Matrix	U.S. EPA Sample ID Number	Certified Value mg/Kg	UVF GRO Result mg/Kg	Lab GC GRO Result mg/Kg	UVF to Lab GC RPD
Weathered Gasoline, Low Soil Samples	PE S27	0	<0.2	<0.54	0%
	PE S28	0	<0.2	<0.54	0%
	PE S29	0	<0.2	<0.54	0%
Weathered Gasoline, Medium Soil Samples	PE S30	1,090	490	575	16%
	PE S31	1,090	460	623	30%
	PE S32	1,090	560	544	3%
Weathered Gasoline, High Soil Samples	PE S63	2,780	1,660	1,400	17%
	PE S64	2,780	1,610	1,510	6%
	PE S65	2,780	1,530	1,600	4%
	PE S36	3,120	1,380	1,590	14%
	PE S37	3,120	1,530	1,760	14%
	PE S38	3,120	1,570	1,820	15%

This data is provided for guidance purposes only. Data cited in source: U.S. EPA Publication EPA/600/R-01/080.

UVF performed using GRO optics calibrated to Sitelab CAL-025M. Certified laboratory performed EPA Method 8015 to detect gasoline range organics. Data shows accuracy compared to Lab GC results testing triplicate samples spiked with low to high concentrations with weathered gasoline; relative percent difference (RPD) values were <50%.

TABLE 6

**GASOLINE RANGE ORGANIC RESULTS COMPARED TO TWO LABORATORY GC METHODS TESTING SOILS FROM UNDERGROUND STORAGE TANK GASOLINE SITE**

Soils with Low to High GRO Concentrations	Sample No.	UVF GRO Result mg/Kg	Lab GRO Method 8015		Lab Total VPH MADEP Method	
			mg/Kg	RPD	mg/Kg	RPD
	1	176	260	39%	292	50%
	2	666	1,500	77%	886	28%
	3	1,481	1,500	1%	1,526	3%
	4	3,037	2,300	28%	2,665	13%
	5	5,570	8,000	36%	8,103	37%
	6	5,704	6,000	5%	7,025	21%
	Correlation Coefficient:		R <sup>2</sup> = 0.9564, y = 0.8105x		R <sup>2</sup> = 0.9788, y = 0.7677x	

## Composition of VPH in Samples Reported by Lab:

Sample No.	C5-C9 Aliphatics mg/Kg	C9-C12 Aliphatics mg/Kg	C9-C10 Aromatics mg/Kg	MtBE + BTEX Compounds mg/Kg	Total VPH mg/Kg
1	45	110	130	6	292
2	140	350	380	16	886
3	99	560	730	137	1,526
4	320	1,000	1,300	45	2,665
5	1,900	2,300	2,400	1,503	8,103
6	1,900	1,700	2,500	925	7,025

This data is provided for guidance purposes only. UVF performed using GRO optics calibrated to Sitelab CAL-025M. Laboratory performed U.S. EPA Method 8015-GRO and MADEP VPH Method in split samples. Total VPH calculated as the sum of aliphatic and aromatic fractions plus target compounds. Example data shows accuracy testing contaminated soils from low to high concentrations.