



UVF METHOD PERFORMANCE TABLES

TOTAL PETROLEUM HYDROCARBONS, AS COMBINED GASOLINE RANGE AND DIESEL RANGE ORGANICS

Sitelab's UVF-Trilogy analyzer uses ultraviolet fluorescence to determine the concentrations of Total Petroleum Hydrocarbons (TPH) to detect Gasoline Range Organics (GRO) and Diesel Range Organics (DRO) separately and adding the concentrations together to report TPH. Specifically, these methods detect monoaromatic hydrocarbons in the C6 to C10 gasoline range and polycyclic aromatic hydrocarbons in the C10 to C36 diesel and oil range. UVF is not sensitive to aliphatic hydrocarbons.

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Sitelab UVF-Trilogy Analyzer with EDRO Module Inserted



GRO Module Detects C6-C10 Range
EDRO Module Detects C10-C36 Range



GRO and EDRO Calibration Kits in Methanol or Hexane Solvent

TABLE 1

FLUORESCENCE RESPONSE COMPARING GRO AND DRO CONTENT IN FUEL AND OILS

UVF-Trilogy using GRO and EDRO UV Modules, Calibrations and Analysis in Methanol Solvent	Source	CAS No.	Gasoline Range, Diesel Range,	Gasoline Range, Diesel Range,
			GRO CAL-025M	EDRO CAL-042M
			Fluorescence Response (%)	Fluorescence Response (%)
GRO and DRO Content in Gasolines and Aviation Fuels:				
Gasoline, Regular 87 Octane	Retail	8006-61-9	27	0.7
50% Weathered Gasoline	CRM	8006-61-9	58	6.0
Weathered Gasoline, UST Site	NAPL	N/A	75	10
Kerosene	CRM	8008-20-6	20	1.8
JP-5 Jet Fuel	CRM	8008-20-6	18	4.5
JET-A Jet Fuel	CRM	8008-20-6	25	5.0
GRO and DRO Content in Diesel Fuels and Heating Oils:				
Ultra-Low Sulfur Diesel Fuel	CRM	68476-34-6	29	7.5
Highway Diesel, Ultra-Low Sulfur	Retail	68476-34-6	30	18
No. 2 Diesel Fuel, High Sulfur	CRM	68334-30-5	30	62
Weathered Diesel, UST Site	NAPL	N/A	20	90
No. 2 Fuel Oil	CRM	68476-30-2	25	68
No. 4 Fuel Oil	CRM	68476-31-3	16	158
No. 6 Fuel Oil	CRM	68553-00-4	8	265
GRO and DRO Content in Other Oils:				
Vacuum Pump Oil	Retail	64741-88-4	1.1	1.7
Transformer Oil	CRM	64742-53-6	14	10
Light Crude Oil, NIST 2779	SRM	8002-05-9	15	75
GRO Standard Response for Comparison:			100	
EDRO Standard Response for Comparison:				100

This data is provided for guidance purposes only. Fluorescence response was calculated by dividing sample readings by the concentration of the standard used and shown as a percentage. Response in GRO and DRO content varies in fuels and oils due to differences in aromatic composition. Samples consisted of Certified Reference Materials (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 2

TOTAL PETROLEUM HYDROCARBONS IN WATER, AS COMBINED GASOLINE AND DIESEL
RANGE ORGANICS, TESTING TWO LOTS OF ERA CRM 794 PROFICIENCY SAMPLES

UVF-Trilogy Calibrations and Sample Analysis in Hexane Solvent	GRO Result mg/L	DRO Result mg/L	TPH Result mg/L	Certified TPH Value mg/L	%R
Lot 1 Water Study:					
1. TPH Water Standard, ERA 794, Lot P315-794	3.10	3.00	6.10	6.21	98%
2. AccuStandard Standards, Weathered Gas and Diesel	3.50	0.58	4.08	6.21	66%
3. Sitelab Standards, GRO and EDRO	2.20	0.36	2.56	6.21	41%
	ERA TPH in Water Proficiency Study Mean Result (Based on 1 Lab Test):		5.52	6.21	89%
	QC Performance Acceptance Limits:		1.58 – 9.07		
	PT Performance Acceptance Limits:		0 – 10.9		
Lot 2 Water Study:					
1. TPH Water Standard, ERA 794, Lot P321-794	2.54	2.80	5.34	5.45	98%
2. AccuStandard Standards, Weathered Gas and Diesel	3.18	0.54	3.72	5.45	68%
3. Sitelab Standards, GRO and EDRO	2.00	0.34	2.34	5.45	43%
	ERA TPH in Water Proficiency Study Mean Result (Based on 2 Lab Tests):		3.86	5.45	71%
	QC Performance Acceptance Limits:		1.38 – 7.96		
	PT Performance Acceptance Limits:		0 – 9.6		

This data is provided for guidance purposes only. Environmental Resource Associates (ERA) 794 contains variable mixtures of 50% weathered gasoline and ultra-low sulfur diesel used to validate the Texas TX-1005 Method.

Calibrations 1 performed with ERA 794 CRMs using the fuel concentrations in each lot for GRO and DRO calibration: TPH composition in ERA 794 Lot 1 contains 3.5 mg/L weathered gasoline and 2.71 mg/L diesel fuel. TPH composition in ERA 794 Lot 2 contains 2.66 mg/L weathered gasoline and 2.79 mg/L diesel fuel.

Calibrations 2 performed using AccuStandard's 50% weathered gasoline standard, p/n GA-W50-10X for GRO analysis and No. 2 diesel fuel, p/n FU-009-40X for DRO analysis.

Calibrations 3 performed using Sitelab's GRO standard, p/n CAL-025H for GRO analysis and EDRO standard, p/n CAL-042H for DRO analysis.

TABLE 3

TOTAL PETROLEUM HYDROCARBONS IN SOIL, AS COMBINED GASOLINE AND DIESEL RANGE ORGANICS, TESTING ERA CRM 796 AND 797 PROFICIENCY SAMPLES

UVF-Trilogy Calibrations and Sample Analysis in Methanol Solvent	GRO Result mg/Kg	DRO Result mg/Kg	TPH Result mg/Kg	Certified TPH Value mg/Kg	%R
Texas Low-Level Fuels (TPH) in Soil: ERA 796, Lot D115-796					
1. AccuStandard Standards, Weathered Gas and Diesel	23	27	50	63.3	79%
2. Sitelab Standards, GRO and EDRO	15	17	32	63.3	51%
	ERA TPH in Soil Proficiency Study Mean Result (Based on 4 Lab Tests):		82.3	63.3	130%
	QC Performance Acceptance Limits:		26.0 – 91.8		
	PT Performance Acceptance Limits:		9.5 – 108		
Texas High-Level Fuels (TPH) in Soil: ERA 797, Lot D116-797					
1. AccuStandard Standards, Weathered Gas and Diesel	3,300	1,200	4,500	7,760	58%
2. Sitelab Standards, GRO and EDRO	2,200	750	2,950	7,760	38%
	ERA TPH in Soil Proficiency Study Mean Result (Based on 4 Lab Tests):		9,300	7,760	120%
	QC Performance Acceptance Limits:		4,200 – 10,200		
	PT Performance Acceptance Limits:		2,690 – 11,800		

This data is provided for guidance purposes only. Environmental Resource Associates (ERA) 796 and 797 contain variable mixtures of 50% weathered gasoline and ultra-low sulfur diesel used to validate the Texas TX-1005 Method.

Calibrations 1 performed using AccuStandard’s 50% weathered gasoline standard, p/n GA-W50-10X for GRO analysis and No. 2 diesel fuel, p/n FU-009-40X for DRO analysis.

Calibrations 2 performed using Sitelab’s GRO standard, p/n CAL-025M for GRO analysis and EDRO standard, p/n CAL-042M for DRO analysis.

TPH composition in ERA 796 contains 32.6 mg/Kg weathered gasoline and 30.7 mg/Kg diesel fuel.
TPH composition in ERA 797 contains 565 mg/Kg weathered gasoline and 7,190 mg/Kg diesel fuel.

TABLE 4

TOTAL PETROLEUM HYDROCARBONS IN SOILS, AS COMBINED GRO AND EDRO, FROM U.S. AIR FORCE BASE JET FUEL SITE COMPARED TO MADEP VPH/EPH METHOD

Concentrations in mg/Kg	UVF GRO	Lab GC Total VPH	UVF EDRO	Lab GC Total EPH	UVF TPH	Lab GC TPH	RPD
Soil 1	6.0	8.0	1.0	ND <0.4	7.0	8.0	15%
Soil 2	4,760	1,100	680	4,400	5,440	5,500	1%
Soil 3	6,270	4,200	700	5,000	6,970	9,200	28%
Soil 4	7,797	6,500	950	6,700	8,747	13,200	41%
Soil 5	9,763	3,900	1,175	7,000	10,938	10,900	0.4%
Soil 6	16,380	6,000	1,800	12,000	18,180	18,000	1%

Correlation Coefficient: $R^2 = 0.972$;
 $y = 0.8962x$

This data is provided for guidance purposes only. UVF performed using GRO and EDRO optics, calibrated to Sitelab's GRO and EDRO standards testing soils with methanol. UVF TPH reported as sum of GRO and EDRO concentrations. Laboratory used MADEP VPH/EPH GC Method; TPH reported as the sum of Total VPH and Total EPH concentrations testing split samples. Example data shows TPH accuracy testing contaminated soils from low to high concentrations.

Despite the poor correlation testing the GRO and EDRO concentrations, good correlation was exhibited for TPH concentrations with relative percent difference (RPD) values <50% compared to the lab's TPH results. Jet fuels are made with kerosene and contain high compositions of aliphatic hydrocarbons which do not fluoresce. Additionally, aromatic hydrocarbons that do exist are abundant near the C10 to C12 carbon range, the cutoff point where the GRO/EDRO and VPH/EPH test methods can overlap.

TABLE 5

SPIKE RECOVERY TESTING GASOLINE RANGE AND DIESEL RANGE ORGANICS IN
WATER USING JP-5 JET FUEL LABORATORY CONTROL SAMPLES

UVF-Trilogy Calibrations and Analysis in Hexane	Samples 1 10 Minutes mg/L	Samples 2 1 Hour mg/L	Average Result mg/L	JP-5 Jet Fuel LCS Standard Response mg/L	%R
Water Samples with 10 mg/L JP-5 Jet Fuel:					
GRO Calibration, Sitelab CAL-025H	1.44	1.60	1.52	1.80	84%
EDRO Calibration, Sitelab CAL-042H	0.35	0.37	0.36	0.40	90%
	Total Petroleum Hydrocarbons:		1.87	2.22	84%
Water Samples with 20 mg/L JP-5 Jet Fuel:					
GRO Calibration, Sitelab CAL-025H	3.20	3.40	3.30	3.60	92%
EDRO Calibration, Sitelab CAL-042H	0.76	0.80	0.78	0.80	98%
	Total Petroleum Hydrocarbons:		4.08	4.40	93%
Water Samples with 40 mg/L JP-5 Jet Fuel:					
GRO Calibration, Sitelab CAL-025H	7.10	7.12	7.11	7.20	99%
EDRO Calibration, Sitelab CAL-042H	1.61	1.59	1.60	1.60	100%
	Total Petroleum Hydrocarbons:		8.71	8.80	99%

This data is provided for guidance purposes only. UVF performed using GRO and EDRO optics, calibrated to Sitelab's GRO and EDRO standards. Samples extracted and analyzed 10 minutes and 1 hour after preparation to check aqueous stability. Total Petroleum Hydrocarbons reported as average sum of GRO and DRO concentrations. Percent recoveries (%R) exhibited were >50% compared to the LCS standard responses.

TABLE 6

TOTAL PETROLEUM HYDROCARBONS, AS COMBINED GRO AND EDRO, TESTING BLIND
U.S. EPA PROFICIENCY EVALUATION SOILS AND LIQUID NEAT SAMPLES

Contaminant, Matrix	U.S. EPA Sample ID Number	Certified Value mg/Kg	UVF TPH Result mg/Kg	Lab GC TPH Result mg/Kg	Acceptance Limits mg/Kg
Weathered Gasoline, Low Soil Samples	PE S27	0	1.1	5.12	0 – 2
	PE S28	0	1.1	13.1	0 – 2
	PE S29	0	2.1	13.5	0 – 2
Weathered Gasoline, Medium Soil Samples	PE S30	1,090	520	702	389 – 1,548
	PE S31	1,090	490	743	389 – 1,548
	PE S32	1,090	590	671	389 – 1,548
Weathered Gasoline, High Soil Samples	PE S63	2,780	1,660	1,740	992 – 3,950
	PE S64	2,780	1,610	1,980	992 – 3,950
	PE S65	2,780	1,530	2,050	992 – 3,950
	PE S36	3,120	1,450	1,880	1,110 – 4,430
	PE S37	3,120	1,600	2,020	1,110 – 4,430
	PE S38	3,120	1,650	2,180	1,110 – 4,430
	PE S66	37.3	17.9	12.0	18.1 – 47.4
No. 2 Diesel Fuel, Low Soil Samples (For MDL Study)	PE S67	37.3	18.9	16.5	18.1 – 47.4
	PE S68	37.3	17.5	13.7	18.1 – 47.4
	PE S69	37.3	15.8	16.4	18.1 – 47.4
	PE S70	37.3	18.1	17.4	18.1 – 47.4
	PE S71	37.3	19.0	17.2	18.1 – 47.4
	PE S72	37.3	18.5	14.8	18.1 – 47.4
	No. 2 Diesel Fuel, Medium Soil Samples	PE S80	454	290	226
PE S81		454	300	265	220 – 577
PE S82		454	300	267	220 – 577
No. 2 Diesel Fuel, High Soil Samples	PE S86	3,920	2,800	2,480	1,900 – 4,980
	PE S87	3,920	3,050	2,890	1,900 – 4,980
	PE S88	3,920	2,600	2,800	1,900 – 4,980
	PE S101	4,320	2,870	2,700	2,100 – 5,490
	PE S102	4,320	3,340	2,950	2,100 – 5,490
	PE S103	4,320	3,100	3,070	2,100 – 5,490
Weathered Gasoline, Liquid Neat Samples	PE L119	814,100	606,770	656,000	N/A
	PE L120	814,100	574,880	611,000	N/A
	PE L121	814,100	576,200	677,000	N/A
No. 2 Diesel Fuel, Liquid Neat Samples	PE L116	851,900	719,800	1,090,000	N/A
	PE L117	851,900	762,200	1,020,000	N/A
	PE L118	851,900	737,400	1,160,000	N/A

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

TABLE 7

TOTAL PETROLEUM HYDROCARBONS, AS COMBINED GRO AND EDRO,
TESTING BLIND U.S. EPA PROFICIENCY EVALUATION WEATHERED GASOLINE SOILS
WITH SPIKED ADDITIVES AND INTERFERENCES

Contaminant, with Spike Added	U.S. EPA Sample ID Number	Certified Value mg/Kg	UVF TPH Result mg/Kg	Acceptance Limits without Spiked Additives mg/Kg
Weathered Gasoline with 1,100 ppm MtBE	PE S39	2,830	1,320	1,010 – 4,020
	PE S40	2,830	1,370	1,010 – 4,020
	PE S41	2,830	1,560	1,010 – 4,020
Weathered Gasoline with 1,760 ppm MtBE	PE S42	2,490	890	889 – 3,540
	PE S43	2,490	1,030	889 – 3,540
	PE S44	2,490	1,030	889 – 3,540
Weathered Gasoline with 2,900 ppm Stoddard Solvent	PE S51	2,770	1,580	989 – 3,930
	PE S52	2,770	1,580	989 – 3,930
	PE S53	2,770	1,490	989 – 3,930
Weathered Gasoline with 15,400 ppm Stoddard Solvent	PE S54	2,730	1,650	970 – 3,880
	PE S55	2,730	2,490	970 – 3,880
	PE S56	2,730	2,010	970 – 3,880
Weathered Gasoline with 2,810 ppm Tetrachloroethylene	PE S45	3,030	1,660	1,080 – 4,300
	PE S46	3,030	1,910	1,080 – 4,300
	PE S47	3,030	1,500	1,080 – 4,300
Weathered Gasoline with 13,100 ppm Tetrachloroethylene	PE S48	2,800	1,300	1,000 – 3,980
	PE S49	2,800	1,380	1,000 – 3,980
	PE S50	2,800	1,490	1,000 – 3,980
Weathered Gasoline with 2,730 ppm Turpentine	PE S57	2,950	1,530	1,050 – 4,190
	PE S58	2,950	1,410	1,050 – 4,190
	PE S59	2,950	1,240	1,050 – 4,190
Weathered Gasoline with 12,900 ppm Turpentine	PE S60	2,950	1,530	1,050 – 4,190
	PE S61	2,950	1,410	1,050 – 4,190
	PE S62	2,950	1,240	1,050 – 4,190

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

TABLE 8

TOTAL PETROLEUM HYDROCARBONS, AS COMBINED GRO AND EDRO,
TESTING BLIND U.S. EPA PROFICIENCY EVALUATION DIESEL FUEL SOILS
WITH SPIKED ADDITIVES AND INTERFERENCES

Soil Contaminant with Spike Added	U.S. EPA Sample ID Number	Certified Value mg/Kg	UVF TPH Result mg/Kg	Acceptance Limits without Spiked Additives mg/Kg
No. 2 Diesel Fuel with 3,650 ppm Stoddard Solvent	PE S01	3,920	2,860	1,900 – 4,980
	PE S02	3,920	3,080	1,900 – 4,980
	PE S03	3,920	2,830	1,900 – 4,980
No. 2 Diesel Fuel with 18,200 ppm Stoddard Solvent	PE S04	3,920	2,830	1,900 – 4,980
	PE S05	3,920	2,510	1,900 – 4,980
	PE S06	3,920	2,570	1,900 – 4,980
No. 2 Diesel Fuel with 3,850 ppm Turpentine	PE S07	3,920	2,830	1,900 – 4,980
	PE S08	3,920	2,840	1,900 – 4,980
	PE S09	3,920	2,720	1,900 – 4,980
No. 2 Diesel Fuel with 19,600 ppm Turpentine	PE S10	3,920	2,270	1,900 – 4,980
	PE S11	3,920	2,250	1,900 – 4,980
	PE S12	3,920	2,150	1,900 – 4,980
No. 2 Diesel Fuel with 3,350 ppm 1,2,4-Trichlorobenzene	PE S89	3,920	2,590	1,900 – 4,980
	PE S90	3,920	2,690	1,900 – 4,980
	PE S91	3,920	2,660	1,900 – 4,980
No. 2 Diesel Fuel with 16,600 ppm 1,2,4-Trichlorobenzene	PE S92	3,920	2,420	1,900 – 4,980
	PE S93	3,920	2,300	1,900 – 4,980
	PE S94	3,920	2,400	1,900 – 4,980
No. 2 Diesel Fuel with 3,940 ppm Humic Acid	PE S95	3,920	2,430	1,900 – 4,980
	PE S96	3,920	2,750	1,900 – 4,980
	PE S97	3,920	2,860	1,900 – 4,980
No. 2 Diesel Fuel with 19,500 ppm Humic Acid	PE S98	3,920	2,560	1,900 – 4,980
	PE S99	3,920	2,430	1,900 – 4,980
	PE S101	3,920	2,480	1,900 – 4,980
Humic Acid Only 3,940 ppm	PE S104	0	11	N/A
	PE S105	0	12	N/A
	PE S106	0	13	N/A
Humic Acid Only 19,500 ppm	PE S107	0	45	N/A
	PE S108	0	35	N/A
	PE S109	0	32	N/A

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