



Forensics Analysis – Gasoline Releases

NEMC 2025

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SGS

Agenda

- Introduction
- Two Tracks of Data Collection
- Analytical Tiers
- Methods
- Matrices
- Sample Collection and Shipping
- Laboratory Information (Data Presentation)
- Summary



Introduction



Introduction

- Whole Oil Analysis
- PIANO Analysis
- Additives – Alkylated Leads, Oxygenates, Halogens, Thiophenes
- Isotopic Analysis
- Interpretation



Two Tracks of Data Collection

Two Tracks of Data Collection

- Regulatory Aspects
- Determination of Source/ Multiple Sources





Analytical Tiers



Analytical Tiers

- Tier I – GC/FID*
- Tier II – GC/MS (PIANO)
- Tier III – CSIA (Carbon Stable Isotope Analysis)
- All 3 Tiers Offered at SGS
- *Products comparison
- Whole Oil Analysis (GC/FID)
- Other Parameters... additives, metals, wear metals, sulfur, organic Pbs, Mn etc..
- P (Paraffins), I (Isoparaffins), A (Aromatics), N (Naphthenes), O (Olefins)



Methods

Methods

- ASTM Methods
- ASTM D7900 (Detailed Hydrocarbon Analysis (DHA))
- ASTM D6730 Mod. (DHA Analysis)
- ASTM D8003 HPLIS (n-C1 through n-C24)
- ASTM D3328 (whole Oil)
- Physical Parameters by ASTM methods





Methods - SGS Scott

- GC Methods
- SW846 8015 Mod. (whole Oil)
- Ethanol
- GC/MS Methods
- SW846 8260 Mod. (PIANO)
(Oxygenates, Thiophenes, Halogens)
- SW846 8270 Mod., - Organic Leads (5)
- SW846 6010D for metals - Pb, Cr, Ni, V
including Sulfur



Matrices

Matrices

- Pure Product
- NAPL (Nonaqueous Phase Liquids) (Light and Dense)
- Soils & Sediments
- Water
- Matrix Combinations

Method Choice based on Matrix
(ASTM or EPA)

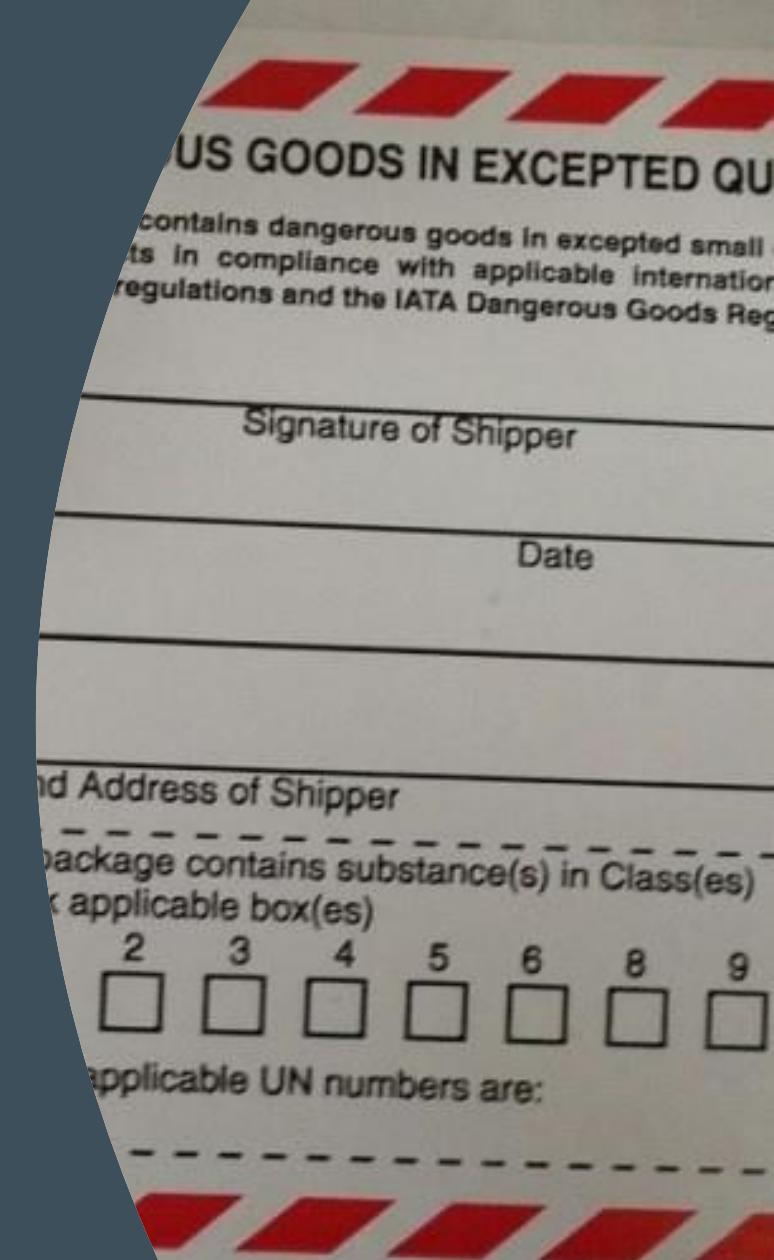


Sample Collection and Shipping



Sample Collection and Shipping

- Normal Sample Collection Protocols
- GW & Soils – Regular Protocols
- Product Samples - Special Handling
- DOT Shipping Rules
- Exempted Quantity Shipping
- 30 ml VOA Vials
- No more than 300 ml in a Shipment
- Requires Exempted Quantity Label on the outside of the Shipment



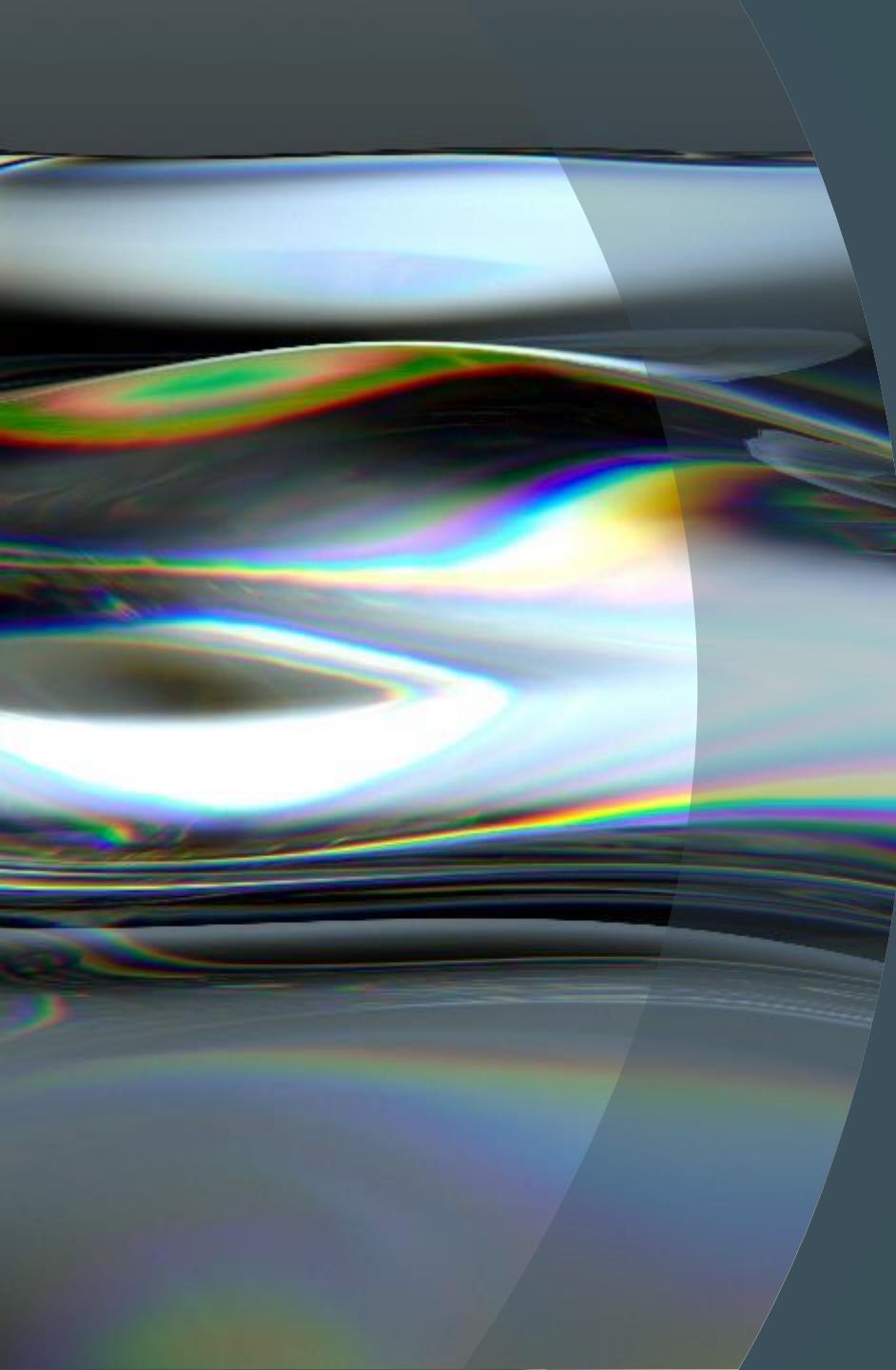


Laboratory Information (Data Presentation)

Laboratory Information

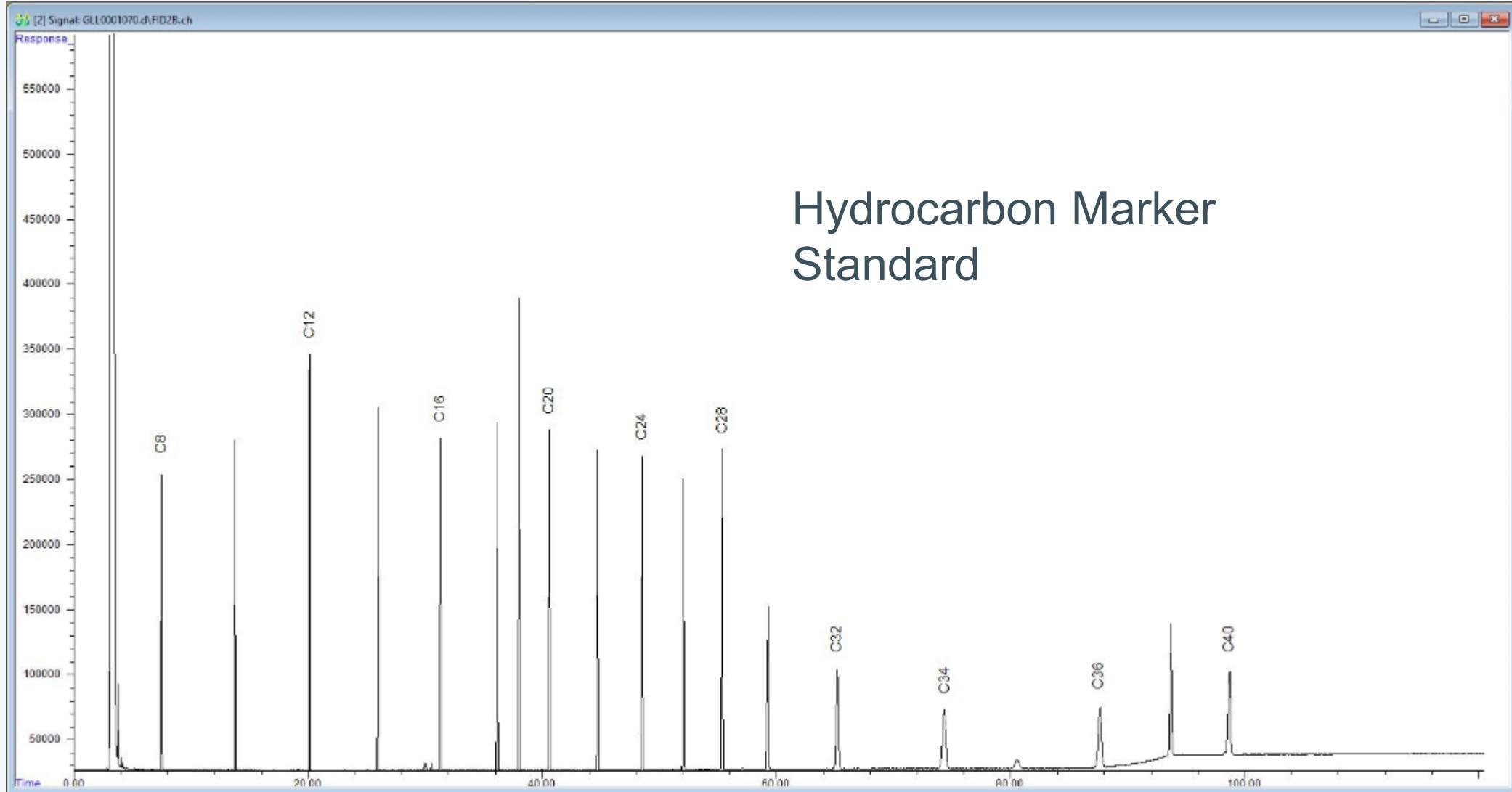
- GC/FID traces
- Total Ion Chromatograms
- Overlays based on Source Product or SGS Library
- Overlays comparison over time
- Overlays based on excavations at various intervals
- Diagnostic Ratios
- Radar Plots
- Data Interpretation Reports





Whole Oil Analysis Forensics

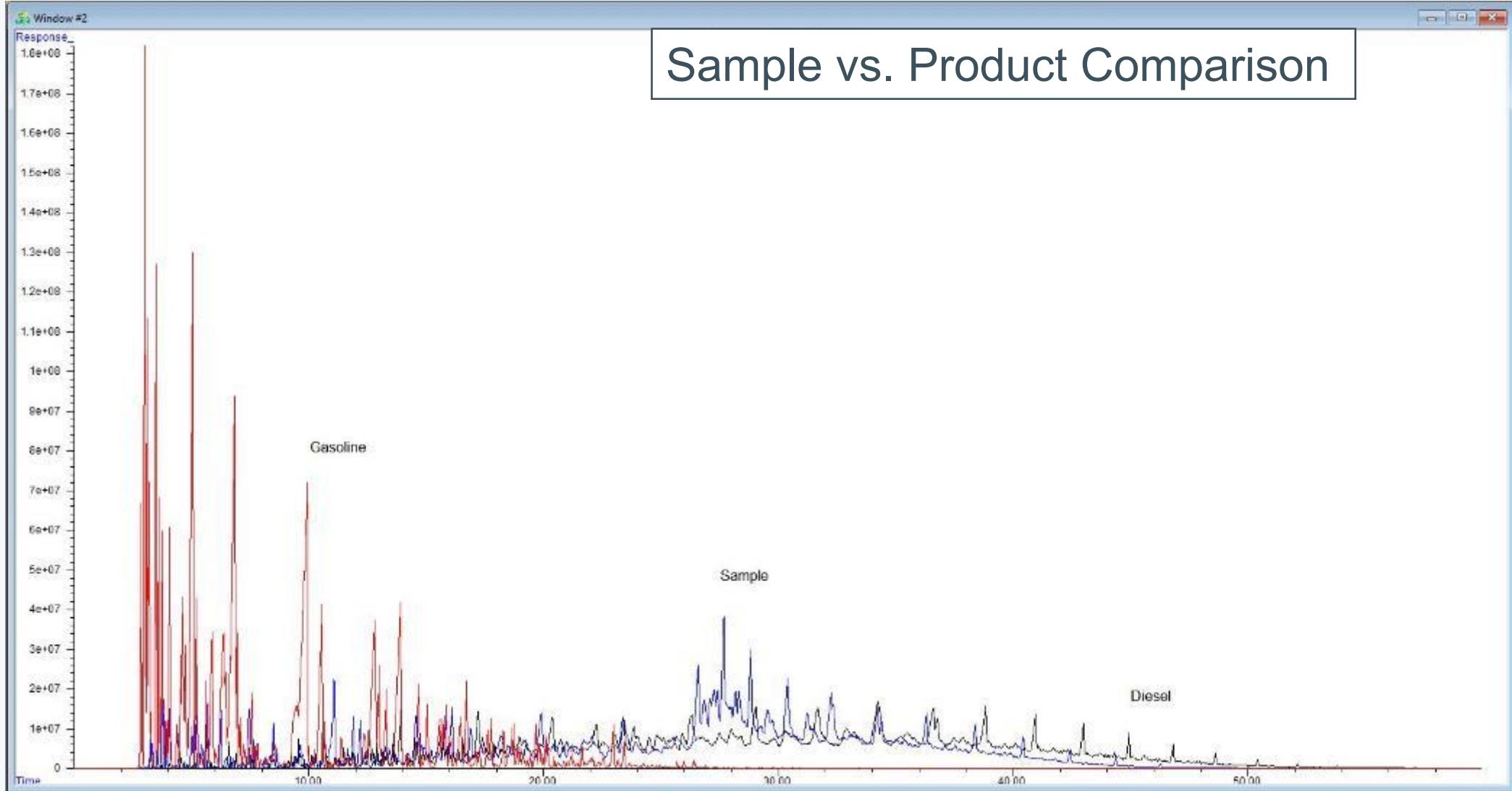
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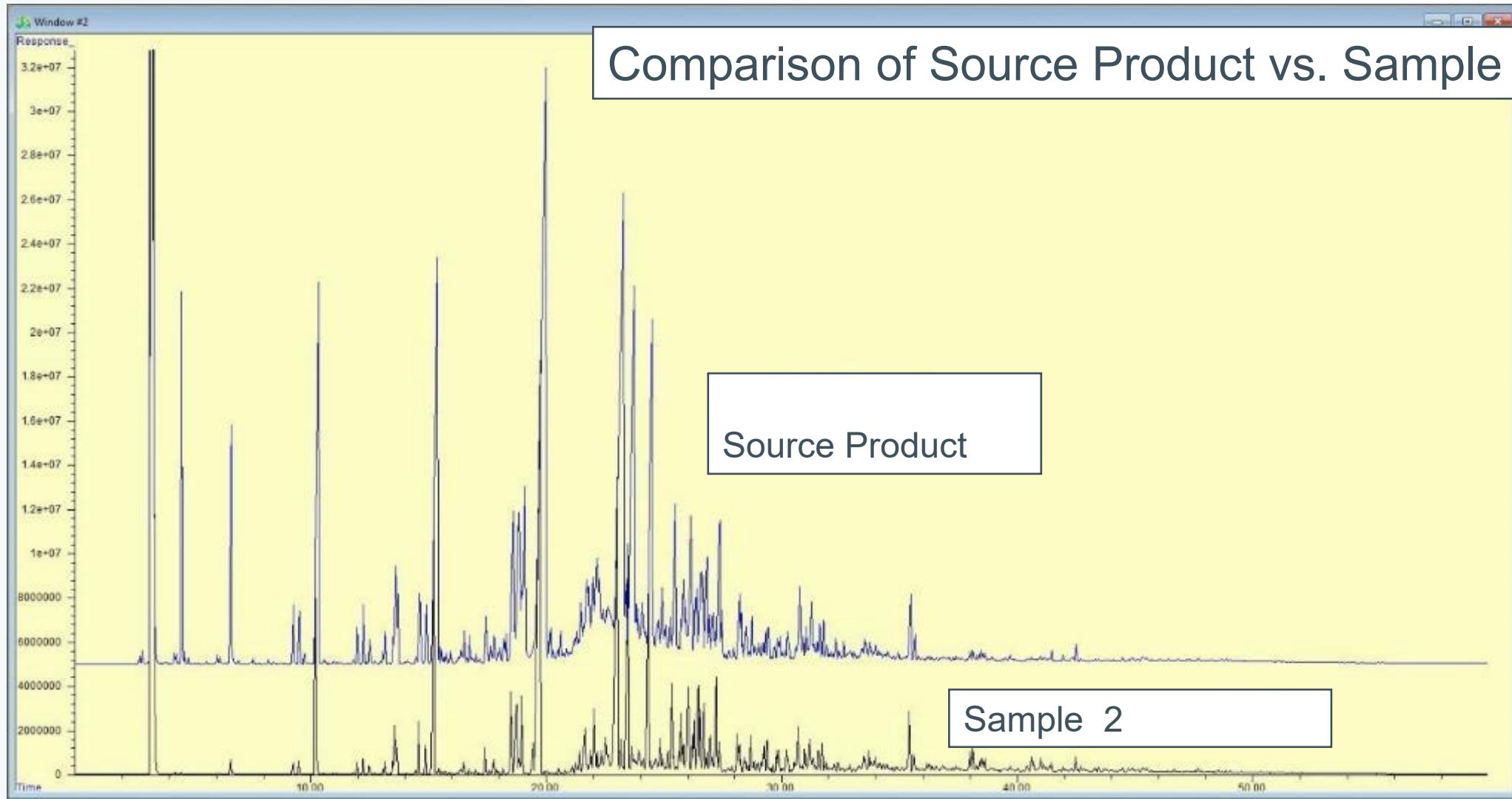
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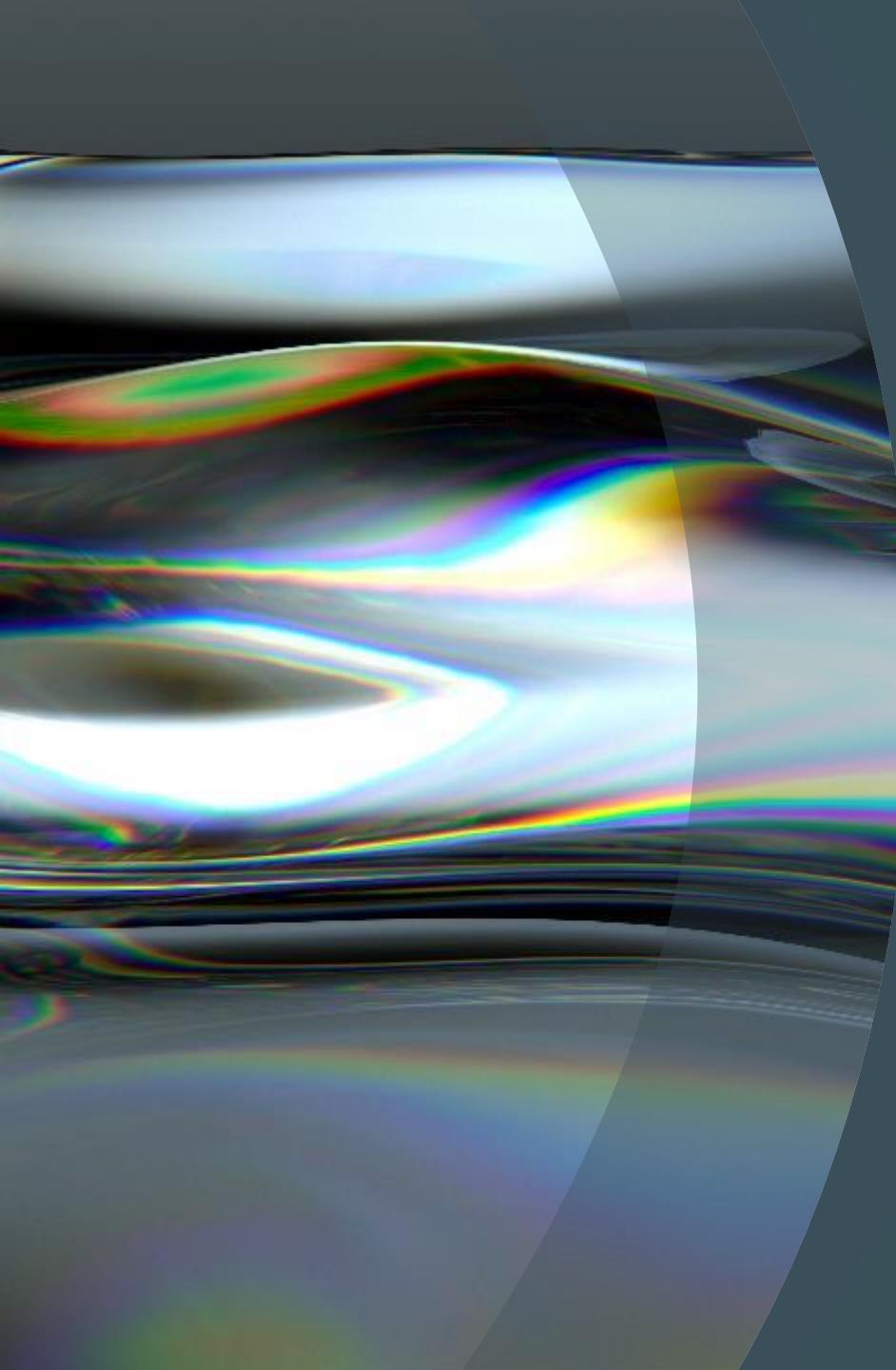


Sample vs. Product Comparison



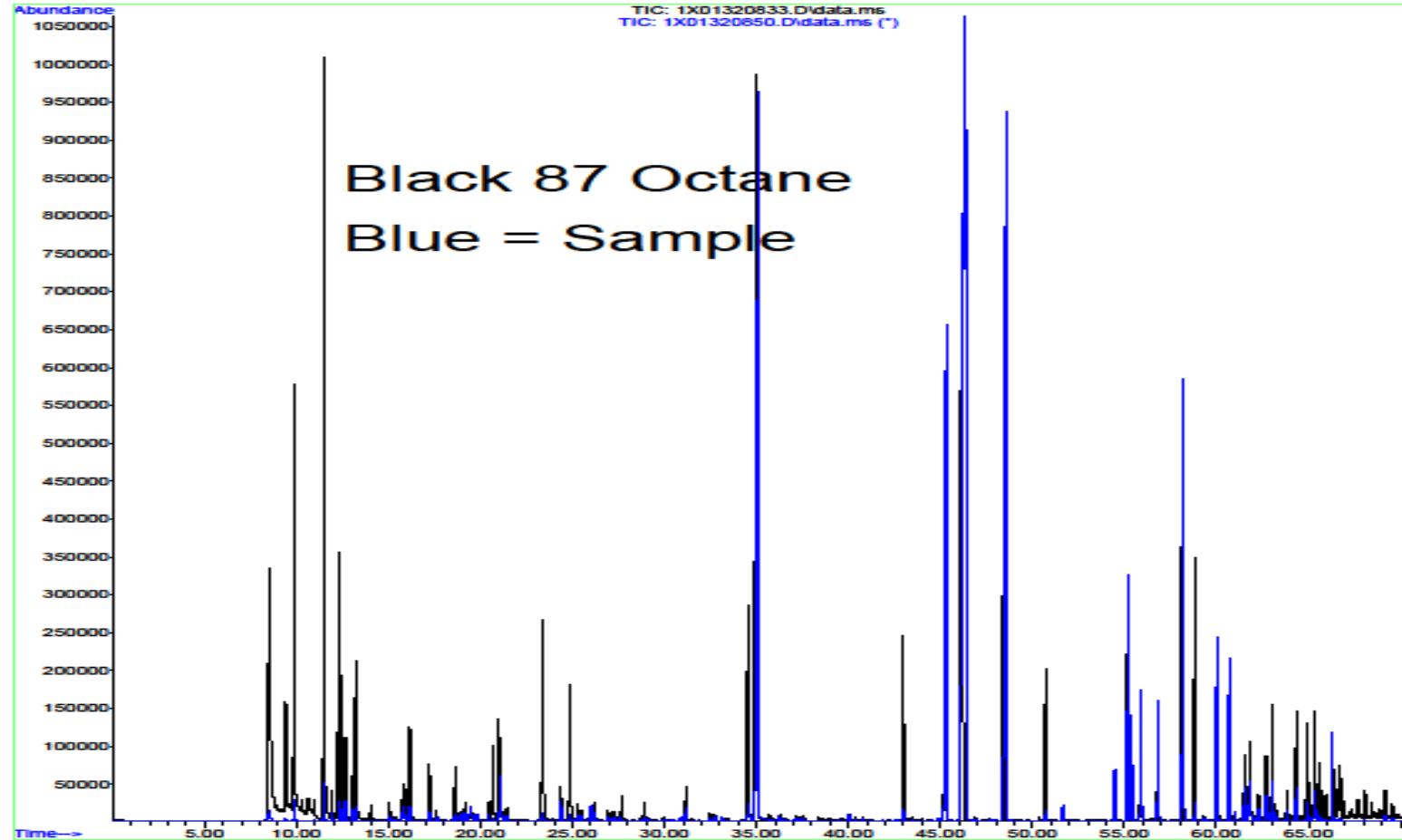
Laboratory Information





PIANO Analysis

PIANO Analysis – Sample vs. Product Comparison



Laboratory Information - PIANO DIAGNOSTIC RATIOS



PIANO Composition		%Makeup	
Total Parafins		185.84	12.98
Total Isoparafins		538.99	37.66
Total Aromatics		559.02	39.06
Total Napthenes		69.97	4.89
Total Olefins		77.39	5.41
Total		1431.20924	
DIAGNOSTIC Ratios			
Isomerization		Ratio	
Isopentane/Pentane		2.76	
2-Methylpentane/3-Methylpentane		1.8	
Evaporation			
n-Pentane/n-Heptane		16.43	
2-Methylpentane/2-Methylheptane		16.84	
Water Washing			
Benzene/Cyclohexane		4.09	
Toluene/Methylcyclohexane		12.09	
Aromatics/Parafins		3.01	
Aromatics/Napthenes		7.99	
Benzene/Toluene		0.33	
Toluene/Total Xylenes		0.94	
Biodegradation			
(C4 to C8 Parafins + Isoparafins) / C4-C8 Olefins		9.35	
3-methylhexane/n-Heptane		0.91	
Methylcyclohexane/n-Heptane		1.44	
Isoparaffins+Napthenes/Parafins		3.28	
Octane Rating/Aalkylation			
2,2,4-Trimethylpentane / Methylcyclohexane		0.16	
Refining Ratios			
2,2,4-TMP+Toluene / n-C7+n-C8		13.58	
2,2,4-TMP / (2,2,4-TMP + 2,2,3 - TMP + 2,3,4-TMP + 2,3,3-TMP)		0.15	
i-C5 / (i-C5 + n-C5)		0.73	
Naphthalene / n-C12		0.08	

87 Octane Gasoline

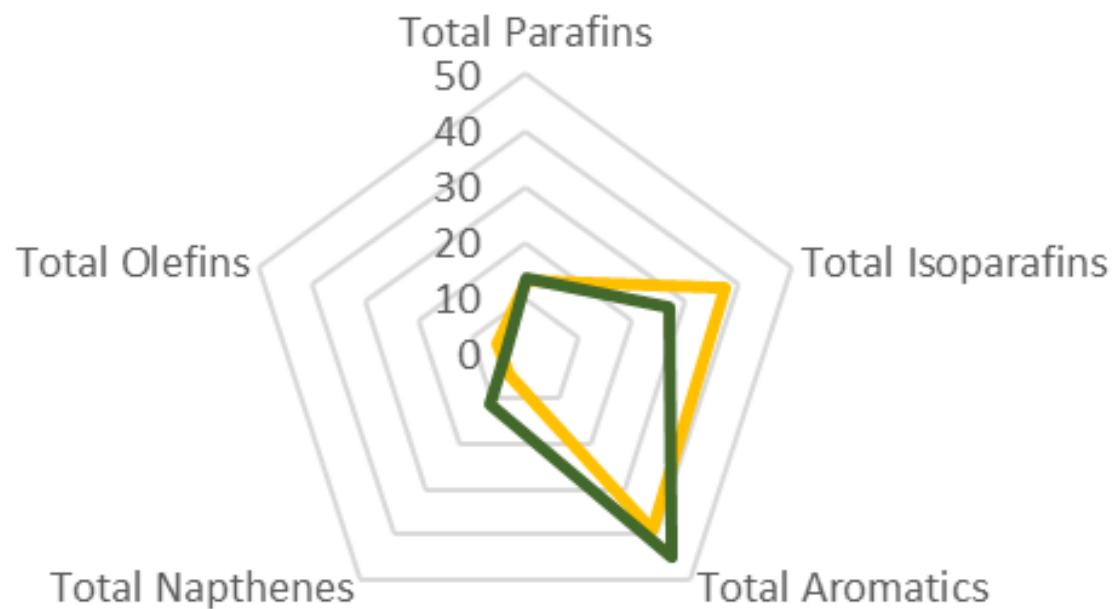


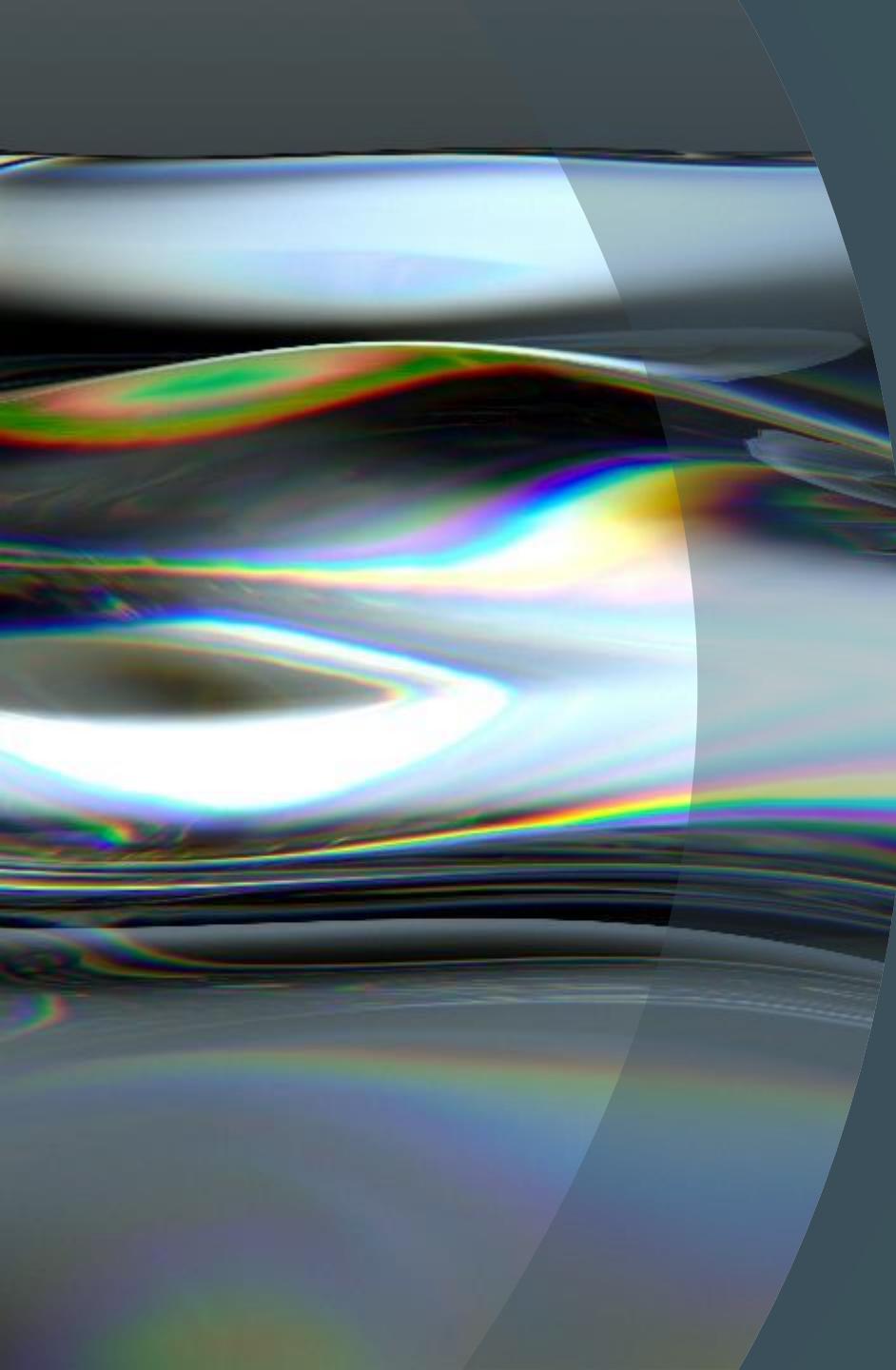
Laboratory Information - PIANO Fractions



PIANO FRACTIONS - GASOLINE COMPARED TO SAMPLE

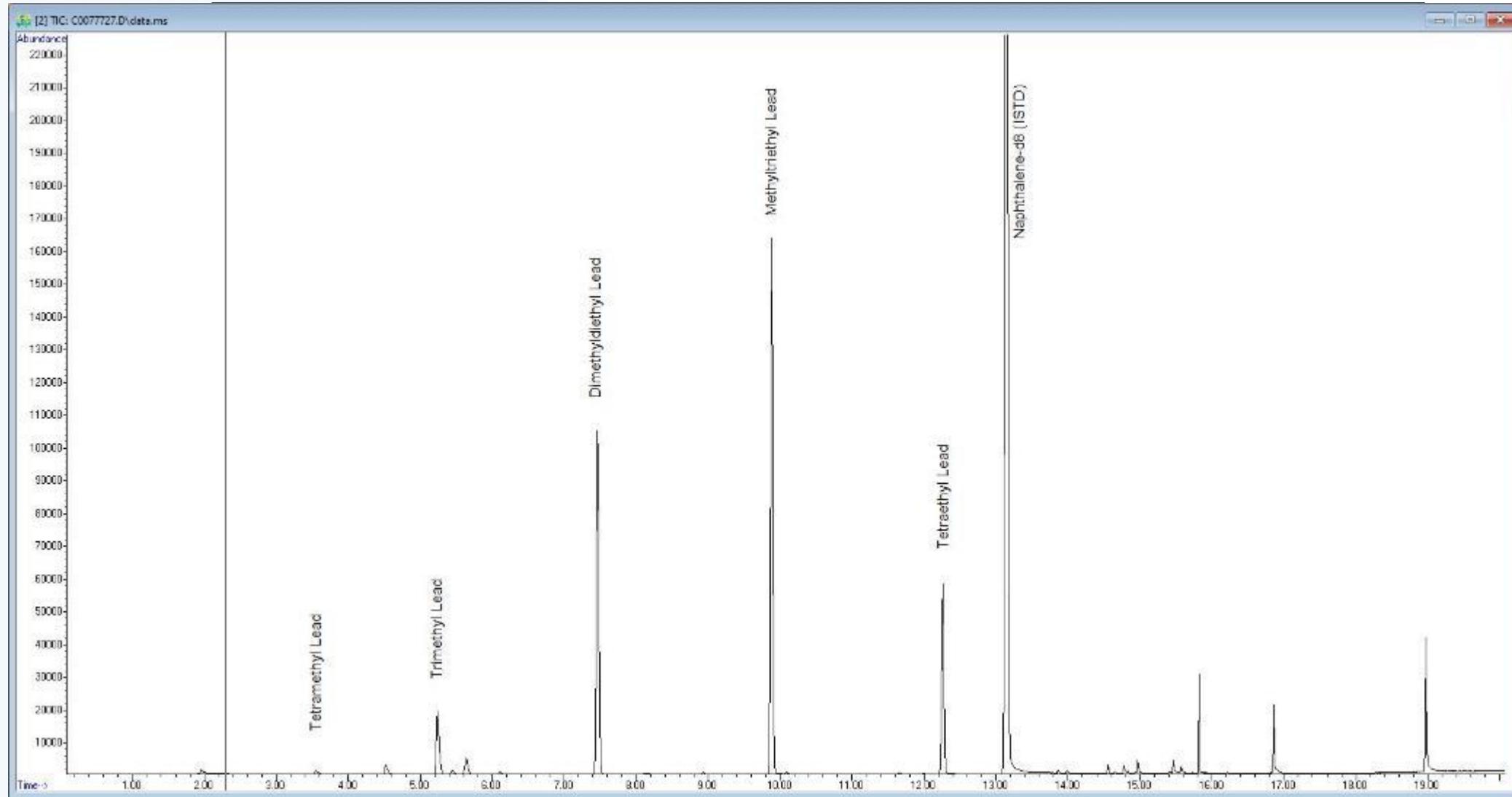
— Gasoline — Sample





Alkylated Leads

Laboratory Information – Alkylated Leads



Summary



Summary

- Whole Oil Analysis
 - GC/FID
- PIANO Analysis
 - GC/MS SW846 8260 Mod.
 - Oxygenates (Various time periods)
 - Thiophenes
 - Halogenated Additives
- Alkylated Leads
 - 5 Isomers
 - Isomers added at different points in time (1923-1992)



A large, semi-transparent circular overlay on the left side of the slide features a photograph of two hands cupping a bright, glowing light source, possibly a candle or a small fire, against a dark, hazy background. The hands are positioned in the lower-left quadrant of the circle.

Thank you!

Do you have any questions?

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