Hope Bay Project
Patch Lake Facility Final Closure Plan

Hope Bay, Nunavut, Canada

Prepared for:

Hope Bay Mining Ltd.

Prepared by:

SRK Consulting
Engineers and Scientists

Project Reference Number
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1 Introduction

1.1 Background

The Patch Lake facilities are part of the Hope Bay Regional Exploration Project, which is located on Inuit Owned Land (IOL) administered by the Kitikmeot Inuit Association (KIA), in the West Kitikmeot Region of Nunavut, approximately 160 km southwest of Cambridge Bay. The facility is further authorized by the Nunavut Water Board in Type B Licence 2BEHOP0712, which also addresses closure of the Patch Lake tank farms. The Hope Bay Regional Exploration Project is operated by Hope Bay Mining Limited (HBML) a wholly owned subsidiary of Newmont Mining Corporation (NMC).

The Patch Lake facility was used as a maintenance yard and workshop for exploration drilling by Major Drilling, a contractor first for BHP Billiton in 1998/1999, followed by Miramar Hope Bay Mining 2000 to 2007, and finally for NMC HBML for a brief period in 2008. In addition, this facility formerly sequentially housed two different fuel tank farms which supported regional exploration activities for the central and northern areas of the Hope Bay belt. The site is located on a bedrock ridge that is largely covered in fine marine sediments, 10 m to 14 m above the high water mark, and 60 m west from the shoreline of Patch Lake, as illustrated in Figure 1.

The maintenance yard and workshop at Patch Lake were decommissioned in October 2008 and many of the buildings and equipment were demobilized from site during the 2009 sealift. The fuel tanks were relocated to the Doris site for storage in June 2010 until the new Windy Camp is ready to receive them. As of December 2010 closure of the secondary containment facility and remediation of hydrocarbon contaminated soils remains to be completed. This closure plan assumes that current contaminated soils and disturbed areas at the site will be remediated starting in 2011 and that site closure works will be largely completed by the end of winter 2014. Upon completion of site closure works reclamation maintenance and monitoring during the post closure period will occur.

A Phase II Environmental Site Assessment (ESA) at the existing Windy Camp site was conducted in 2009 (WESA 2009a). Risk-based hydrocarbon remediation criteria were also developed in 2009 (WESA 2009b). The Phase 2 ESA Report (WESA 2009a) indicated that the primary sources of petroleum hydrocarbon contamination at the Patch Lake site were F3 and F4 hydrocarbon fractions (lubricating oils). In 2010 EBA Engineering Consultants evaluated a range of remediation options for hydrocarbon contaminated soils (EBA 2010).These three reports are provided in Appendix B of this report.

Additional hydrocarbon characterization is slated for the summer of 2011 prior to finalizing the hydrocarbon remediation plan. The KIA has requested active involvement in the review of hydrocarbon remediation options as the land owner.

1.2 Closure Objective

This Final Closure Plan describes how the Patch Lake facilities will be permanently closed and reclaimed. The overall closure objective is to establish chemically and physically stable site conditions, which would ensure no adverse impacts to bird, aquatic, terrestrial and human life. To ensure that these conditions are met, the site will be subjected to a period of post closure care and maintenance, including environmental monitoring.

2 Scope of Work

2.1 Scope

The physical limits of the Patch Lake closure plan are illustrated on Figure 2. Final closure and reclamation of the Patch site will include:

- Phase 3 Environmental Site Assessment (ESA);
- Removal of remaining empty core boxes;
- Demolition of the secondary containment facility;
- Stabilization of Tank Farm spoil piles;
- Remediation of hydrocarbon contaminated soils;
- Rehabilitation of permafrost degradation areas; and
- Site re-vegetation and drainage control.

Appropriate environmental monitoring will be implemented at the completion of each phase to ensure conformance with the stated closure objectives.

2.2 Permits and Leases

The Patch Lake facility is operated in accordance with the Nunavut Water Board Licence No. 2BE-HOP0712, and a Land Use Licence with the KIA. Table 2.1 provides a Table of Concordance indicating how the conditions specified in the current licence for abandonment and closure of the site will be satisfied by the current closure plan.

Table 2.1: Table of Concordance for Final Closure of the Patch Lake Facility

Licence Ref	Licence Condition (2BE-HOP0712)	Closure Plan Ref	Closure Plan Response/Specification
Part I.1	Submit revised Abandonment and Reclamation Plan specified consistent with specified closure guidelines	N/A	Requirement satisfied by submission of this updated Final Closure Plan.
Part I.2	Revise plan if not approved by the NWB	N/A	Pending receipt of review comments from NWB once the Closure Plan has been submitted.
Part I.3	Revise plan based on operational/technology changes	N/A	Requirement satisfied by submission of this updated Final Closure Plan.
Part I.4	Complete restoration work prior to Licence expiration (June 30, 2012)	5.1	Closure works and soil remediation will be completed at the earliest opportunity as indicated in the proposed schedule.
Part I.5	Complete progressive reclamation of components no longer in use	5.1	Entire site will be reclaimed at the earliest opportunity as future use is not contemplated.
Part I.6	Backfill and restore sumps to pre-existing natural contours	3.3, 3.7	Areas of site disturbance will be filled and recontoured to be consistent with natural contours, provide geotechnical stability, and minimize erosion and sedimentation.
Part I.7	Remove site infrastructure and materials	3, 5	All site infrastructure and materials will be removed by Summer 2013.
Part I.8	Ensure all rinse water from drum cleaning meets effluent requirements	3.3	Rinse water from the washing process will be routed through an oil/water separator. Water that does not satisfy effluent discharge requirements will not be discharged but subjected to collection and further treatment as may be required.
Part I.9	Re-grade all roads and airstrip to match natural contours and reduce erosion	N/A	There are currently no roads or airstrips at the current site. However, the surface of the existing site pad will be ripped where necessary and graded to be consistent with natural contours, ensure geotechnical stability, and minimize erosion and sedimentation.
Part I.10	Remove culverts and re-establish drainage path of natural channel	N/A	It is not anticipated that culverts will have to be removed from the Patch Lake Facility. Disturbed areas will be regraded to ensure free-drainage of water.
Part I.11	All disturbed areas will be ripped, graded, or scarified to conform to natural topography and promote grow of vegetation	3.7	Areas of disturbance and permafrost degradation will be ripped where necessary and regraded to ensure positive drainage, be consistent with natural topography and encourage re-vegetation.
Part I.12	Remediation of hydrocarbon contaminated soils	3.4	Hydrocarbon contaminated soils will either be remediated in situ to achieve specified remediation criteria or removed from the site to a licensed disposal facility in southern Canada. Detailed characterization and soil remediation planning will commence in 2011.
Part I.13	Restore drill holes once drilling has been completed	3.7	Any remaining drill holes will be restored by installing a permanent seal and final surfaces contoured to ensure free-drainage.
Part I.14	Store dill core at least thirty (30) metres above ordinary high water mark of the adjacent lake	3.2	As of December 2010 all drill core had been removed from the Patch Lake Facility.
Part I.15	Contour and stabilize all disturbed areas once closure work has been completed	3.7	Areas of disturbance will be re-graded to ensure positive drainage, and to be consistent with natural topography.

3 Closure Activities

3.1 Phase 3 Environmental Site Assessment

A Phase 3 Environmental Site Assessment will be completed to delineate petroleum hydrocarbon impacts at the Patch Lake site, and to quantify volumes of contaminated soils to be remediated. Work will also include collection of site-specific information and site soils characterization to refine the range of possible remediation methods that might be considered including removal of contaminated materials to a licensed facility in southern Canada.

3.2 Removal of Empty Core Boxes

As of December 2010 all core at the Patch Lake site had been relocated to an approved permanent storage facility at the Doris North project area. Remaining empty core boxes will either be salvaged for reuse or relocated to the burn pan located near Quarry 2 at the Doris site. Prior to undertaking on-site burning appropriate approvals and permissions will be attained from the NWB to use the burn pan which is currently authorized under the Doris Type A Water Licence. Surface disturbance resulting from the core boxes previously stored at the site will be scarified and re-vegetated.

3.3 Demolition of Secondary Containment Facility

Contaminated materials located within the Secondary Containment Facility (SCF) will either be remediated at site using appropriate methods once detailed characterization of contaminated soils has been completed. Possible remediation options for various types of contamination are provided in Appendix B.1. Completion of detailed site contamination may also indicate the necessity for removal, package and transport of some fraction of contaminated soils to the Doris Waste Management Facility prior to transhipment either by air or water as is appropriate to a licensed facility in southern Canada. Once the existing liner has been exposed it will be hand-cleaned to wash off any hydrocarbon contamination then cut into manageable pieces for disposal at the proposed Quarry A landfill, which is still pending receipt of regulatory approval for the proposed landfill. Rinse water from the washing process will be routed through an oil/water separator which will not be discharged until treated water has been verified to satisfy effluent discharge water quality standards specified in the Water Licence. Once the secondary containment liner has been removed the foundation gravel layer will be tested for hydrocarbon contamination. Any additional contaminated materials will also be excavated and either remediated or packaged for disposal as previously indicated in this section. Once on contaminated materials have been removed the metal containment berm will be dismantled, crushed and stockpiled for disposal in an approved disposal facility in southern Canada. Any depressions left after the SCF has been removed will be backfilled and recontoured to establish free-drainage.

3.4 Remediation of Hydrocarbon Contaminated Soils

Preliminary site characterization studies were carried out in 2009 to determine the extent of hydrocarbon contaminated soils on the project site, and the complete study results are presented in Appendix B. Four areas on site were determined to have hydrocarbon concentrations exceeding Canadian standards, as indicated on Figure 2:

- The drill shop footprint (Area 1);
- The north laydown area, located to the north of the former drill shop (Area 2);
- The incinerator area (Area 3); and
- The former tank farm site (Area 4).

Subsequent characterization work completed by EBA in 2010 confirmed that the largest volume of known hydrocarbon contaminated soils were located at the drill/maintenance shop site (Area 1) at the Patch Lake site. Further characterization is necessary to complete delineation and quantification of hydrocarbon contaminated areas/materials – including those in the secondary containment facility - and to estimate weighted-average soil volume estimates for the F1 through F4 hydrocarbon fractions, diesel, waste oil, other types of hydrocarbons, or combinations of spills. This characterization and quantification will be completed during the Phase 3 ESA described in Section 3.1 of this Closure Plan.

Based on known levels of hydrocarbon contamination it is anticipated that a portion of the currently contaminated soils can be excavated and used as fill in an appropriately designed and designated landfill facility pending receipt of the necessary approvals from the NWB and the KIA. Contaminated soils and excavated materials from the secondary containment facility that exceed hydrocarbon remediation requirements will either be remediated in situ or excavated, packaged, and transported to the Doris Waste Management Facility prior to transhipment either by air or water as is appropriate to a licensed facility in southern Canada.

3.5 Stabilization of Tank Farm Spoil Piles

The Patch Lake site includes two unconsolidated rock spoil piles as illustrated in Figure 2. These piles consist of geochemically inert run-of-quarry blast rock mixed with frozen overburden soil which was excavated during foundation preparation for the active tank farm. Both spoil piles will be re-graded to ensure geotechnical stability and to promote positive drainage. Appropriate toe grading will be completed to ensure that water can flow freely around the piles. It is also possible that material from these piles could be used to fill in site depressions during final site regrading.

3.6 Remediation of Permafrost Degradation Areas

Operation of the Patch Lake facility over 10 years from 1998 to 2008 has resulted in four areas of permafrost degradation that require remediation. There areas are illustrated in Figure 2 and can be summarized as follows:

- The former fuel storage area at the southern limit of the site;
- Wheel tracks from the winter road track leading south-east from the site towards Patch Lake;
- Wheel tracks from the winter road track leading due west from the site towards Windy Camp; and
- Wheel tracks from the winter road track leading north-west from the site and ultimately curving east towards Patch Lake.

The former fuel storage area is an excavation into ice-rich permafrost soils. The area has been partially backfilled, but is not free-draining and as a result ponding occurs which exacerbates permafrost degradation. This area will be completely backfilled and covered by dozing material from the southern tank farm spoil pile over the area and doming it to ensure free draining conditions. This fill will be a minimum of 1 m thick to ensure permanent thermal stabilization.

The winter road wheel tracks will be remediated by one of two methods depending on the extent to which vegetation dieback has occurred. Areas where complete vegetation dieback has occurred and deep ruts with ponding are present will be backfilled with soil, rockfill or clean drill cuttings. The surface will be regraded to ensure positive drainage, and re-vegetation will be encouraged. Where only minor vegetation damage has occurred and where ponding does not occur, appropriate re-vegetation technology will be implemented.

3.7 Site Re-vegetation and Drainage Control

Once the site has been cleared of all debris, the areas will be re-graded to ensure free draining conditions to prevent ponding. In addition, any remaining drill holes will be restored by installing a permanent seal. No new disturbance will be created during this re-grading effort, and no excavation into permafrost soils will occur. If depressions remain that cannot be managed through re-grading, these depressions will be filled with material from the spoil piles. Where there is sufficient soil substrate to support re-vegetation, appropriate re-vegetation technology will be implemented. Since the tank farm was constructed on a bedrock foundation no re-vegetation requirement exists. Old Patch Lake Maintenance and the old Windy Camp will be used as test sites for re-vegetation research in the Hope Bay Belt.

4 Post Closure Monitoring

Monitoring to confirm that the closure plan and associated remediation techniques have achieved the stated closure objectives will be carried out as follows:

- Groundwater monitoring will be conducted during site characterization and is scheduled for completion two years after site soil remediation objectives have been met.
- Once closure activities have been completed, the site will be visually inspected by a qualified Professional Geotechnical Engineer annually for the first five years after completion of site remediation to ensure the following: physical stability has been attained; permafrost degradation areas have stabilized; and site drainage objectives have been met.
- The site will be inspected by an appropriate arctic vegetation specialist to confirm suitability of the re-vegetation efforts. Inspections should be completed at the following intervals, unless otherwise recommended by the vegetation expert: Year 1, Year 3, Year 7 and Year 10 post closure.

5 Cost Estimate

Appendix A provides details of the estimated closure costs for the Patch Lake site. This estimate includes costs for closure activities; including a description of the cost estimate, and estimating basis. The cost estimate includes an estimate for remediation of hydrocarbon remediated soils based on the soil characterization that has been completed to date. The estimated closure cost for the Patch Lake site is $1,609,000 in undiscounted 2010 CDN dollars. These costs assume that in addition to remediation of hydrocarbon contaminated soils and the ultimate landfilling of Phase I remediated soils, all salvageable equipment and infrastructure will be relocated to the Doris Camp site and all refuse transported to the Quarry A landfill.

5.1 Scheduling

Mobilization of equipment to site for Phase 1 work will occur in 2011 once the all weather road connecting to the Doris-Windy all weather road has been constructed. Phase 1 closure work will commence in 2011 once the snow on site has melted and is expected to take ten weeks. A summary of Phase 1 activities can be seen in Table 5.1.

Table 5.1: Schedule of Closure and Reclamation Activities

Activity	
Phase 3 ESA, and installation of ground water monitoring wells	Summer 2011
Demolition of secondary containment facility, hydrocarbon remediation, site grading and revegetation	Summer 2012-Summer 2013
Post closure monitoring (geotechnical and revegetation)	Summer 2013 –Summer 2023

This report, "**Hope Bay Project, Patch Lake Facility Final Closure Plan**," was prepared by SRK Consulting (Canada) Inc.

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Principal

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

Disclaimer

"This report and the opinions and conclusions contained herein ("Report") contains the expression of the professional opinion of SRK Consulting (Canada) Inc. ("SRK") as to the matters set out herein, subject to the terms and conditions of the agreement dated [HBML.BOC-CM.PSA.003] (the "Agreement") between Consultant and Hope Bay Mining Ltd. ("Hope Bay Mining"), the methodology, procedures and sampling techniques used, SRK's assumptions, and the circumstances and constraints under which Services under the Agreement were performed by SRK. This Report is written solely for the purpose stated in the Agreement, and for the sole and exclusive benefit of Hope Bay Mining, whose remedies are limited to those set out in the Agreement. This Report is meant to be read as a whole, and sections or parts thereof should thus not be read or relied upon out of context. In addition, this report is based in part on information not within the control of SRK. Accordingly, use of such report shall be at the user's sole risk. Such use by users other than Hope Bay Mining and its corporate affiliates shall constitute a release and agreement to defend and indemnify SRK from and against any liability (including but not limited to liability for special, indirect or consequential damages) in connection with such use. Such release from and indemnification against liability shall apply in contract, tort (including negligence of SRK whether active, passive, joint or concurrent), strict liability, or other theory of legal liability; provided, however, such release, limitation and indemnity provisions shall be effective to, and only to, the maximum extent, scope or amount allowable by law."

6 References

EBA Engineering Consultants Ltd. (2010). *Evaluation of Risk and Remedial Options for Contaminated Soil at Patch Lake Facility and Windy Lake Camp Hope Bay Gold Project, Nunavut*. Prepared for Newmont Mining Corporation. IFR version issued in October.

WESA Inc. 2009a. *Hope Bay Gold Project: Phase II Environmental Site Assessment of Patch Lake Workshop, Windy Camp, and Boston Soil Treatment Area*. Prepared for SRK Consulting (Canada) Inc. 27 November.

WESA Inc. 2009b. *Hope Bay Gold Project: Derivation of Risk-Based Hydrocarbon Remediation Criteria for Patch Lake workshop and Windy Camp*. Prepared for SRK Consulting (Canada) Inc. November.

Figures

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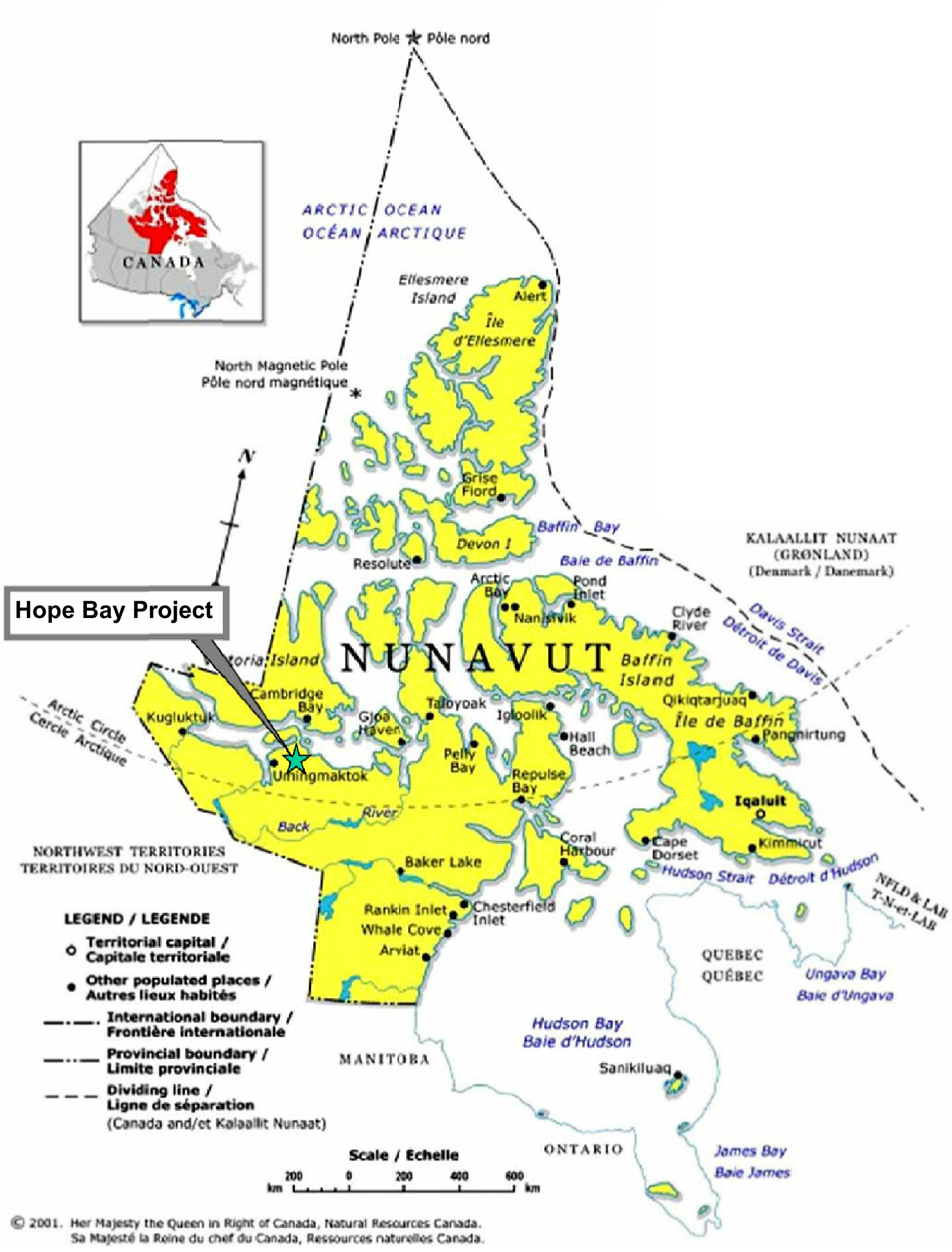
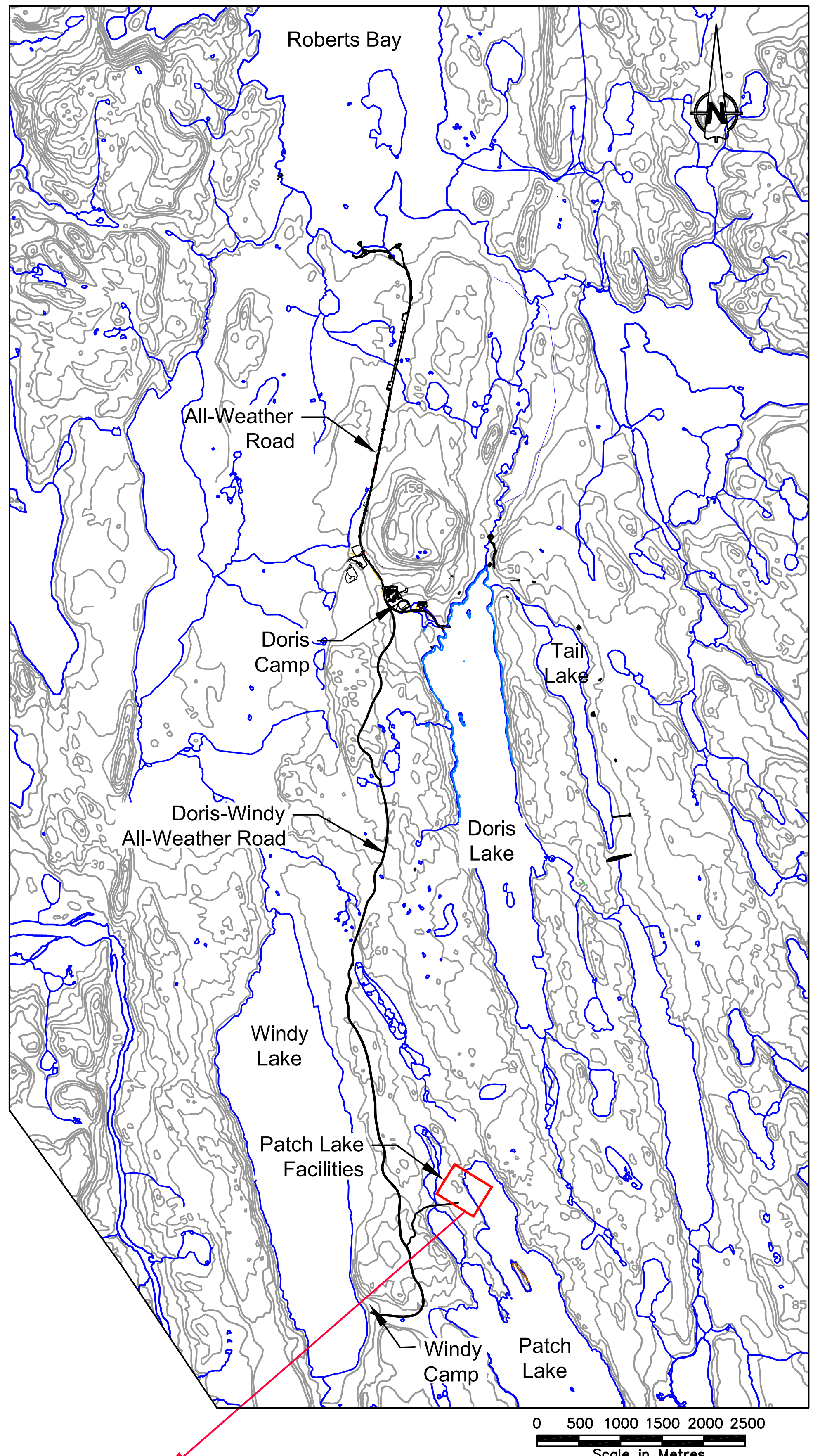


LOCATION MAP



NOTE:
Fuel tanks and site infrastructure removed prior to September 2010.

Topographic Information Supplied by BHP World Minerals Inc.
National Topographic Series (NTS) Maps
North American Datum (NAD) 1927

SRK Consulting Engineers and Scientists Vancouver	HOPE BAY MINING LTD.	Patch Lake Facility Final Closure Plan
SRK JOB NO.: 1CH008.036		Patch Lake Facility Location
FILE NAME: 1CH008_018-400-Patch-1.dwg	Hope Bay Project	DATE: Dec. 2010 / APPROVED: EMR / FIGURE: 1

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NOTE:
Fuel tanks and site infrastructure removed prior to September 2010.

LEGEND

Areas of Permafrost Degradation

Areas of Hydrocarbon Contamination

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SRK JOB NO.: 1CH008.036

FILE NAME: 1CH008_018-400-Patch-2010.dwg

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HOPE BAY PROJECT

Patch Lake Facility
Final Closure Plan

Patch Lake Facility Site Layout

DATE:	APPROVED:	FIGURE:
Dec. 2010	EMR	2

Appendices

Appendix A
Patch Lake Closure Cost Estimate

Table 1: Patch Lake Facilities Decommissioning Costs - Summary

Direct Costs		
Collection and Disposal of Hazardous Wastes	$	6,000.00
Collection and Disposal of Non-Hazardous Wastes	$	23,000.00
Remediation of Permafrost Degredation Areas	$	8,000.00
Stabilization of Tank Farm Spoil Piles	$	22,000.00
Site Re-vegetation and Drainage Control	$	7,000.00
Remediation of Hydrocarbon Contaminated Soils	$	500,000.00
Quarry #2 Landfill	$	3,000.00
TOTAL DIRECT COSTS	**$**	**569,000.00**

Indirect Costs		
Contingency	$	114,000.00
Patch Lake Mob-Demob	$	330,000.00
Winter Road Construction/Maintenance	$	32,000.00
Equipment stand-by	$	169,000.00
Administration Costs	$	117,000.00
Field Support	$	39,000.00
Hydrocarbon decontamination	$	100,000.00
Other	$	140,000.00
TOTAL INDIRECT COSTS	**$**	**1,041,000.00**
TOTAL:	***$***	***1,610,000.00***

Table 2: Patch Lake Facilities Decommissioning Costs

Work Area Code	Item	Task	Sub-task	Activity	Task	Quantity	Unit	SRK Cost Code	Unit Cost	Activity Total	Subtotals	Source / Comments
DIRECT COSTS												
Collection and Disposal of Hazardous Wastes											$6,228	
PLF	1	1	1	Consolidate and haul to jetty	Collect waste and place in suitable containers	0.5	m^3	C. 1.01	$ 1,923.51	$962		
PLF	1	1	2		Haul containers to jetty for shipping off-site	0.5	m^3	C.4.07	$ 527.03	$264		
PLF	1	2	1	Ship off-site for disposal	Ship hazardous waste by barge to Hay River	0.5	m^3	M.10	$ 5.51	$3		
PLF	1	2	2		Cost of disposal	0.5	m^3	M.09	$ 10,000.00	$5,000		
Collection and Disposal of Non-Hazardous Wastes											$23,166	
PLF	2	2	1	Site Debris Collection	Collect misc debris scattered around site and stockpile	6,216	m^2	C.2.06	$ 0.83	$5,157		
PLF	2	2	2		Load stockpiled debris into containter for transport (to landfill)	30	m^3	C.4.01	$ 9.00	$270		
PLF	2	1	1	Transport waste to landfill	Haul debris to staging area near Quarry #2	230	m^3	C.4.05	$ 15.82	$3,646		
PLF	2	1	2		Unload seacans	230	m^3	C.4.02	$ 3.90	$899		
PLF	2	1	3		Cost of disposal	230	m^3	-	$ 57.25	$13,194		
Remediation of Permafrost Degredation Areas											$7,893	
PLF	3	1	1	Regrade Old Tank Farm Area	Stake-out low-lying areas in summer to place fil	1	day	C. 5.09	$ 3,387.36	$3,387		For old tank farm and road restoration areas
PLF	3	1	2		Regrade spoil piles to ensure positive drainage	250	m^2	C. 5.04	$ 2.31	$579		Assumed 10% of total area
PLF	3	1	3		Fill in low-lying areas with rock fill to prevent ponding	75	m^3	C. 5.06	$ 10.03	$752		Assumes 10% of area requires 0.3m of fill
PLF	3	2	1	Erosion Control	Install erosion control measures (coco matting)	250	m^2	C. 5.07	$ 7.91	$1,977		Assumed 10% of total area
PLF	3	3	1	Regrade Winter Road Tracks	Fill in low lying areas (fill from spoil piles) - Road to Patch Lake	119	m^3	C. 5.06	$ 10.03	$1,197		Assumes 25% of area requires 0.3m of fill
Stabilization of Tank Farm Spoil Piles											$22,220	
PLF	4	1	1	Regrade	Regrade spoil piles to ensure positive drainage (w/ Excavator)	3,630	m^2	C. 5.05	$ 5.73	$20,785		
PLF	4	1	2	Erosion Control	Install erosion control measures (coco matting)	182	m^2	C. 5.07	$ 7.91	$1,436		Assumed 5% of total area
Site Re-vegetation and Drainage Control											$6,500	
PLF	5	1	1	Revegetate regraded areas	Revegetate old tank farm and regraded road surfaces	1	LS	-	$ 5,000.00	$5,000		SRK estimate from previous closure cost estimates
PLF	5	1	1	Drainage control	Construct thermal berms across flow paths and silt fencing	1	LS	-	$ 1,500.00	$1,500		Assumes 3 thermal berms cosntructed and 100 m of silt fencing installed
Remediation of Hydrocarbon Contaminated Soils											$500,000	
PLF	6	1	1	Treat hydrocarbon contaminated soils	Landfilling and landfarming of contaminated materials	1	LS	-	$ 500,000.00	$500,000		Based on cost estimate from EBA 2010
Quarry A Landfill											$2,940	
PLF	9	1	3	Place materials in landfill	Load, haul dump debris from staging area to landfill	230	m^3	C.4.08	$ 12.76	$2,940		
TOTAL DIRECT COSTS					**TOTAL DIRECT COSTS**						**$568,947**	
INDIRECT CLOSURE COSTS												
Contingency											**$113,789**	
-	1	1	-	Contingency	20% of direct costs	20	%	x	$568,947	$113,789.42		
Patch Lake Mobilization & Demobilization											$ 329,870	
-	2	1	1	Winter 2011 - Phase 1 Closure activities	Mobilization	1	LS	x	-	$82,761		
-	2	1	2		Demobilization	1	LS	x	-	$156		Split equally between Patch Lake and Windy Camp projects
-	2	2	1	Winter 2015 - Phase 2 closure activities	Mobilization	1	LS	x	-	$35,977		Only one excavator from Doris Camp
	2	2	2		Demobilization	1	LS	x	-	$35,977		Only one excavator from Doris Camp
	2	3	1	LTTD Plant	Mobilization	1	LS	x	-	$175,000		SRK estimate
Winter Road Construction/Maintenance											$31,900	
-	3	1	1	Construct and maintain Winter Road	Winter 2011	1.0	km	M.08	$ 15,950.00	$15,950		Strand equipment for closure works
-	3	1	2		Winter 2012	1.0	km	M.08	$ 15,950.00	$15,950		Equipment demob after completion of closure works
Equipment stand-by											$168,886	
	4	1	1	Stand-by time	Spring 2012	30.0	days	x	$ 1,125.91	$33,777		April 1st to April 30th
	4	1	2		Fall 2012	120.0	days	x	$ 1,125.91	$135,109		October 1st to January 31st
General and Administration costs											$ 116,700	
-	4	1	-	Travel allowance		12	person	x	$ 1,500	$18,000		Travel allowance for hydrocarbon decontamination crew
-	4	2	-	Communications		2.0	months	x	$ 1,000	$2,000		
-	4	3	-	Misc. Supplies		2.0	months	x	$ 500	$1,000		
-	4	4	-	Camp Cost		15	Man-month	x	$ 6,600	$95,700		Includes 12 man-months for hydrocarbons decontamination
Field support											$ 38,950	
-	5	1	-	Supervision		28	days	x	$ 529	$14,826		
-	5	2	-	Equipment maintenance support - Mechanic	10% of project duration	3	days	x	$ -	$0		
-	5	3		Helicopter Support		14	days	x	$ 1,723	$24,125		1 hr per day; No support required for landfill closure
Hydrocarbon decontamination											$ 100,000	
-	6	2		Engineering Design		1	LS	x	-	$50,000		
-	6	3		Confirmatory Sampling and Analysis		1	LS	x	-	$50,000		
Other											$ 139,749	
-	7	1	-	Contractor profit	% of direct and other indirect costs (excluding contingency)	10%		of	$ 1,255,254	$125,525		
-	7	2	-	Bonding	% of direct cost	2.5	%	of	$ 568,947	$14,224		
-	7	4	-	Freight costs (included in material costs)		15	%		-	$0		
Subtotal Indirect Costs											**$1,039,846**	
CLOSURE COSTS - TOTAL											**$1,608,793**	

Table 3: Indirect Cost Calculations

Indirect Unit Rates

Cost Code	Item	Unit rate	Unit	Source/comment
I.01	Communications	$ 1,000	month	SRK-Estimate
I.02	Bonding	2.5%	% of direct costs	SRK-Estimate
I.03	Miscellaneous Supplies	$ 500.00	month	SRK-Estimate
I.04	Camp Cost	$ 6,600.00	person-month	Newmont
I.05	Engineering Design	$ 15,000.00	LS	SRK-Estimate
I.06	Laboratory/Material Testing	$ 1,000.00	month	SRK-Estimate
I.07	Contractor Profit	10%	%	Of Direct and Indirect costs

Mob/Demob Costs

Crew mobilization costs included in loaded labour rates.
The barging fee for equipment is calculated on a square foot basis.

A.) 2011 Phase 1 Mobilization - Patch Lake

Equipment	No. of units	Footprint	Unit	Unit Rate	Cost	Notes
Loader (CAT 966)	1	109.8	m2	$ 51.20	$ 5,622.61	From Hay River to Roberts Bay
Dozer (D7)	1	218.0	m2	$ 51.20	$ 11,161.48	From Hay River to Roberts Bay
Excavator (CAT 330)	1	409.7	m2	$ 51.20	$ 20,976.64	From Hay River to Roberts Bay
Truck equipment to Hay River	3		each	$ 15,000.00	$ 45,000.00	Hauling trailers from Edmonton
Total					**$ 82,760.72**	

B.) Winter 2012 Phase 1 Demobilization - relocation between Patch Lake and Windy Camp

Equipment	No. of units	Distance	Unit	Unit Rate	Cost	Notes
Loader (CAT 966)	1	4.0	km	$ 13.37	$ 53.47	From Patch Lake to Windy Camp via Doris Camp
Dozer (D7)	1	4.0	km	$ 28.93	$ 115.73	From Patch Lake to Windy Camp via Doris Camp
Excavator (CAT 330)	1	4.0	km	$ 35.79	$ 143.14	From Patch Lake to Windy Camp via Doris Camp
Total					**$ 312.35**	
% Total allocated to Patch Lake Activities					**50%**	
Patch Lake Mobilization Cost:					**$ 156.18**	

C.) Winter 2015 Mobilization - Tank Farm Closure

Equipment	No. of units	Footprint	Unit	Unit Rate	Cost	Notes
Excavator (CAT 330)	1	409.7	km	$ 51.20	$ 20,976.64	From Doris Camp to Patch Lake
Truck equipment to Hay River	1		each	$ 15,000.00	$ 15,000.00	Hauling trailers from Edmonton
Total					**$ 35,976.64**	

D.) Winter 2016 Demobilization - Tank Farm Closure

Equipment	No. of units	Footprint	Unit	Unit Rate	Cost	Notes
Excavator (CAT 330)	1	409.7	km	$ 51.20	$ 20,976.64	From Patch Lake to Doris Camp
Truck equipment to Hay River	1		each	$ 15,000.00	$ 15,000.00	Hauling trailers from Edmonton
Total					**$ 35,976.64**	

Camp costs

Work Period - Description	Project Duration (weeks)	Crew Size	Person-Months	Camp Cost ($/month/person)	Cost	Notes
Summer 2011 - Site Clean-up and regrading	1	5	1.25	$ 6,600	$ 8,250	
Winter 2015 - Tank farm removal	1	5	1.25	$ 6,600	$ 8,250	
Hydrocarbon decontamination	6	8	12	$ 6,600	$ 79,200	
Total	**8**		**14.5**		**$ 95,700**	

Table 4: Unit Cost Inputs

Cost Code	Item	Unit rate	Unit	Comment	Source
Equipment					
E.01	Dozer (CAT D7)	$ 143.83	hr	hourly equipment rate (less operator)	2009 BC Blue Book + 10% Northern Allowance+ 10% rate increase to 2011
E.02	Dozer (CAT D4)	$ 74.80	hr	hourly equipment rate (less operator)	NUNA Logistics + 10% future rate increase correction
E.03	Truck (CAT 735)	$ 142.35	hr	hourly equipment rate (less operator)	2009 BC Blue Book + 10% Northern Allowance+ 10% rate increase to 2011
E.04	Excavator (CAT 330 CL)	$ 195.80	hr	hourly equipment rate (less operator)	NUNA Logistics + 10% future rate increase correction
E.05	Loader (CAT 966 F)	$ 110.74	hr	hourly equipment rate (less operator)	2009 BC Blue Book + 10% Northern Allowance+ 10% rate increase to 2011
E.06	Skidder (CAT 242B)	$ 87.43	hr	hourly equipment rate (less operator)	2009 BC Blue Book + 10% Northern Allowance+ 10% rate increase to 2011
E.07	Welding Equipment	$ 50.30	day	300 Amps, gas/diesel driven	2009 BC Blue Book + 10% Northern Allowance+ 10% rate increase to 2011
E.08	Power washer	$ 121.00	day	Hot water pressure washer - 3000 PSI	www.abtoolrentals.com/Painting-Pressure-Washing.page + 10% rate increase to 2011
E.09	Drum crusher	$ 34.06	hr	30 tones, mobile	RSMeans, 2005; adjusted to 2009 dollars based on CPI +10% rate increase to 2011
E.10	Oil-water separator	$ 1,327.99	LS	10 GPM, underground	RSMeans, 2005; adjusted to 2009 dollars based on CPI +10% rate increase to 2011
E.11	Air Track Drill	$ 194.98	hr		2009 BC Blue Book + 10% Northern Allowance+ 10% rate increase to 2011
E.12	Helicopter	$ 1,723.20	hr	All-inclusive	Alpen Helicopters, 2006; adjusted to 2009 dollars based on CPI + 10% rate increase to 2011
E.13	Crusher	$ 781.00	hr	200 tons/hr (cost less operator)	NUNA Logistics + 10% future rate increase correction
Materials					
M.01	Explosives	$ 18.59	m2	15% freight cost added	RSMeans, 2005; adjusted to 2009 dollars based on CPI
M.02	Liner - HDPE	$ 16.15	m2	15% freight cost added	Material Quote: Layfield, 2008; producitity/crew: RSMeans
M.03	Liner - geotextile	$ 4.43	m2	15% freight cost added	Material Quote: Layfield, 2008; producitity/crew: RSMeans
M.04	Fuel (Diesel)	$ 1.17	L	2008 Landed fuel cost at Hope Bay	Maritz (from Jeff Reinson @ Newmont)
M.05	Silt Fencing	$ 1.45	m	15% freight cost added	Material Quote: Layfield, Jan. 2008
M.06	Coco-matting	$ 6.33	m2	15% freight cost added	RSMeans, 2005; adjusted to 2009 dollars based on CPI
M.07	Seed/Fertilizer	$ 9.89	kg	15% freight cost added	John Brodie, 2006
M.08	Winter road	$ 14,500.00	km	open and maintain for 2 months	NUNA Logistics (from Court Smith)
M.09	Hazardous Waste Disposal fee (@Hay River)	$ 10,000.00	LS	Disposal + handling and cleaning fee	SRK estimate
M.10	Demolition Debris Disposal Fee (@Hay River)	$ 5.51	m3	Disposal + handling fee	Personal communication with Rob Jamieson@Hay River Disposals Ltd.
M.11	Landfill Dump Fee (@Quarry#2 landfill)	$ 57.25	m3	Dump fee = $71/t (0.733 t/m3 bulk density)	Maritz (from Newmont)
Labour					
L.01	Labour general	$ 40.02	hr		Yukon Gov. Fair Wage Sched. Apr. 2008 (82% Loading Rate Added)*
L.02	Labour - Trades	$ 55.48	hr	Electrician, Welder, Plumber, Carpenter etc.	Yukon Gov. Fair Wage Sched. Apr. 2008 (82% Loading Rate Added)*
L.03	Light Equipment Operator	$ 44.12	hr	Trucks	Yukon Gov. Fair Wage Sched. Apr. 2008 (82% Loading Rate Added)*
L.04	Heavy Equipment Operator	$ 49.73	hr	Dozer, excavator	Yukon Gov. Fair Wage Sched. Apr. 2008 (82% Loading Rate Added)*
L.05	Supervision	$ 70.07	hr		Yukon Gov. Fair Wage Sched. Apr. 2008 (82% Loading Rate Added)*
L.06	Engineer (Consultant)	$ 143.00	hr	Int./Junior Eng.	SRK-Estimate (all inclusive)
Shipping					
S.01	Outbound Shipping - Soils	$ 1,406.60	m3	1.7 t/m3 bulk density	$ 0.3791 per pound minus 10% / source - personal communication with NTCL
S.02	Outbound Shipping - Haz Waste	$ 827.41	m3	1.0 t/m3 bulk density	$ 0.3791 per pound minus 10% / source - personal communication with NTCL
S.03	Outbound Shipping - Demolition	$ 606.77	m3	0.733 t/m3 bulk density	$ 0.3791 per pound minus 10% / source - personal communication with NTCL
CH Decontamination					
H.01	Excavate impacted soil	$ 19.18	m3		WESA estimate
H.02	Low temperature thermal desorption	$ 100.00	m3		WESA estimate
H.03	Rehydrate and backfill	$ 10.69	m3		WESA estimate
H.04	Regrade and reshape	$ 2.38	m2		WESA estimate
Stand by equipment rates					
SB. 01	Dozer (CAT D7)	$ 71.91	hr	50 % hourly equipment rate (less operator)	2009 BC Blue Book + 10% Northern Allowance+ 10% rate increase to 2011
SB. 02	Excavator (CAT 330 CL)	$ 97.90	hr	50 % hourly equipment rate (less operator)	NUNA Logistics + 10% future rate increase correction
SB. 03	Loader (CAT 966 F)	$ 55.37	hr	50 % hourly equipment rate (less operator)	2009 BC Blue Book + 10% Northern Allowance+ 10% rate increase to 2011
SB. 04	Skidder (CAT 242B)	$ 43.72	hr	50 % hourly equipment rate (less operator)	2009 BC Blue Book + 10% Northern Allowance+ 10% rate increase to 2011

Note: Loading Rate includes allowances for (EI, CPP, MSP/Benefits/Travel/OT)

Fuel Rate Calculations

Cost Code	HP	Fuel Consumption Factor (L/hr/HP)	Fuel Rate ($/hr)	Fuel Rate Source
E.01	240	0.135	$37.91	CAT Handbook
E.02	84	0.135	$13.27	CAT Handbook
E.03	435	0.065	$33.08	CAT Handbook
E.04	268	0.130	$40.76	CAT Handbook
E.05	283	0.121	$40.06	CAT Handbook
E.06	62	0.14	$10.16	CAT Handbook
E.07	N/A	-	$3.23	Estimated
E.08	11	0.1	$1.29	ABToolRentals Catalogue
E.09	N/A	-	$3.23	Estimated
E.10	0	0	$0.00	No power required
E.11	215	0.13	$32.70	CAT Handbook
E.12	-	-	$100.00	Estimated
E.13	200	0.13	$30.42	Estimated (Chris Eliott)

Table 5: Task Unit Rate Calculations

				Unit Rates				Labour					Equipment										Hauling	
													$ 37.91	$ 13.27	$ 40.76	$ 40.06	$ 33.08	$ 100.00	$ 32.70	$ 3.23	$ 1.29	$ 30.42		
								$ 40.02	$ 55.48	$ 143.00	$ 44.12	$ 49.73	$ 143.83	$ 74.80	$ 195.80	$ 110.74	$ 142.35	$ 1,723.20	######	$ 3.41	$ 12.10	$ 781.00	$ 0.88	$ 20.43
Cost Code	**Item**	**Unit**	**Productivity (Unit/hr)**	**Total Unit Cost**	**Material Unit Rate**	**Labour Unit Rate**	**Equipment Unit Rate**	**General Labour**	**Tradesman - Electrical**	**Engineer/ Technician**	**Light Equipment Operator**	**Heavy Equipment Operator**	**Dozer - CAT D7**	**Dozer - CAT D4**	**Excavator - Cat 330**	**Loader - CAT 966**	**Truck - CAT 735**	**Helicopter**	**Drill**	**Drum crusher**	**Power washer**	**Crusher**	**Skid - per km/m3**	**Skid per km**
Decontamination																								
C. 1.01	Collect hazardous chemical waste and place in suitable containers	m3	0.17	$ 1,923.51	$ -	$ 1,018.74	$ 904.77	3				1				1								
C. 1.02	Drain above ground fuel storage tank	each	0.5	$ 160.08	$ -	$ 160.08	$ -	2																
C. 1.03	Drain and power-wash empty fuel drums	each	12	$ 7.79	$ -	$ 6.67	$ 1.12	2													1			
C. 1.04	Operate oil/water separator	each	4	$ 33.36	$ -	$ 30.01	$ 3.35	3													1			
Demolition																								
C.2.01	Decomission above ground storage tanks	each	0.5	$ 271.03	$ -	$ 271.03	$ -	2	1															
C.2.02	Crush empty fuel drums	each	20	$ 14.36	$ -	$ 6.49	$ 7.87	2				1				1				1				
C.2.03	Cut Tank Farm geomembrane to manageable size	sq. m	80	$ 1.50	$ -	$ 1.50	$ -	3																
C.2.04	Expose and remove tank farm liner	m2	90.0	$ 3.63	$ -	$ 1.00	$ 2.63	1				1			1									
C.2.05	Demolish wooden buildings/ shop structures/ living quarters	m3	53	$ 10.42	$ -	$ 4.14	$ 6.27	3				2	1			1								
C.2.06	Collect miscellaneous debris from around site	m2	310.8	$ 0.83	$ -	$ 0.55	$ 0.28	3				1		1										
C.2.07	Demolish containment steel fence	Lm	25.00	$ 16.25	$ -	$ 6.79	$ 9.46	3				1			1									
Soil Remediation																								
C. 3.01	Field Investigation	each	0.05	$ 4,960.80	$ 500.00	$ 4,460.80	$ -	2		1														
Material Relocations																								
C.4.01	Load demolition debris/solid waste in containers	m3	48.00	$ 9.00	$ -	$ 2.07	$ 6.93					2	1			1								
C.4.02	Unload debris from containers	m3	132.8	$ 3.90	$ -	$ 0.75	$ 3.15					2	1		1									
C.4.03	Load large above ground storage tank on skid	each	0.5	$ 812.70	$ -	$ 339.58	$ 473.12	3				1			1									
C.4.04	Load generator on skid	each	8	$ 45.79	$ -	$ 16.22	$ 29.57	2				1			1									
C.4.05	Haul waste to Quarry #2 in 20 ft container (33.2 m3/container), round trip	m3		$ 15.82	$ -	$ -	$ -																18.0	
C.4.06	Haul one skid to Doris Camp (9 km), round trip	each		$ 367.70	$ -	$ -	$ -																	18.0
C.4.07	Haul one skid to Jetty (12.9 km), round trip	each		$ 527.03	$ -	$ -	$ -																	25.8
C.4.08	Load, haul, dump place: 2 trucks with <1.0km haul distance	m3	75	$ 12.76	$ -	$ 2.50	$ 10.26				2	2	1		1		2							
Earth works																								
C. 5.01	Drill and blast	m3	100	$ 24.69	$ 18.59	$ 2.31	$ 3.78	1.5		0.5		2				1			1					
C. 5.02	Install HDPE Liner	m2	175	$ 18.70	$ 16.15	$ 1.20	$ 1.35	4				1			1									
C. 5.03	Crusher: crush materials	m3	125	$ 11.10	$ -	$ 1.51	$ 9.59	1				3			1	1						1		
C. 5.04	Regrade surface - rough grading, D7	m2	100	$ 2.31	$ -	$ 0.50	$ 1.82					1	1											
C. 5.05	Regrade surface - with excavator	m2	50	$ 5.73	$ -	$ 0.99	$ 4.73					1			1									
C. 5.06	Backfill depressions	m3	20	$ 10.03	$ -	$ 2.49	$ 7.54					1				1								
C. 5.07	Install soil stabilization measures (straw/coconut matting)	m2	269	$ 7.91	$ 6.33	$ 0.71	$ 0.88	3.5				1			1									
C. 5.08	Trackpack using loaded rock truck	m2	100	$ 2.20	$ -	$ 0.44	$ 1.75				1						1							
C. 5.09	Delineation of low-lying areas	day	0.125	$ 3,387.36	$ 100.00	$ 1,464.16	$ 1,823.20	1		1								0.125						
C. 5.10	Install silt fencing	m	30	$ 4.12	$ 1.45	$ 2.67	$ -	2																
Equipment relocation																								
C. 6.01	Dozer relocation	km	8	$ 28.93	$ -	$ 6.22	$ 22.72					1	1											
C. 6.02	Excavator relocation	km	8	$ 35.79	$ -	$ 6.22	$ 29.57					1			1									
C. 6.03	Loader relocation	km	15	$ 13.37	$ -	$ 3.32	$ 10.05					1				1								

Table 5: Task Unit Rate Calculations

		= Fuel Rate [$/hr]
		= Equipment/Labor Hourly Rate [$/hr]
Cost Code	**Item**	**Note / Source**
Decontamination		
C. 1.01	Collect hazardous chemical waste and place in suitable containers	Includes all chemicals on site / jm_Estimate
C. 1.02	Drain above ground fuel storage tank	Drain fuel /source - SRK estimate
C. 1.03	Drain and power-wash empty fuel drums	Drain fuel and tripple-rinse drum (collect water for treatment)
C. 1.04	Operate oil/water separator	
Demolition		
C.2.01	Decomission above ground storage tanks	Disconnect all fuel lines and electrical parts
C.2.02	Crush empty fuel drums	Load/operate/unload drum crusher / source - SRK estimate
C.2.03	Cut Tank Farm geomembrane to manageable size	source - SRK estimate
C.2.04	Expose and remove tank farm liner	source - SRK estimate
C.2.05	Demolish wooden buildings/ shop structures/ living quarters	Demolish empty wood structures (offices, shacks, etc.)/ source - RSMeans
C.2.06	Collect miscellaneous debris from around site	
C.2.07	Demolish containment steel fence	
Soil Remediation		
C. 3.01	Field Investigation	20 hr field investigation
Material Relocations		
C.4.01	Load demolition debris/solid waste in containers	
C.4.02	Unload debris from containers	15 min to unload 1 seacan
C.4.03	Load large above ground storage tank on skid	
C.4.04	Load generator on skid	
C.4.05	Haul waste to Quarry #2 in 20 ft container (33.2 m3/container), round trip	Details - See Worksheet 5
C.4.06	Haul one skid to Doris Camp (9 km), round trip	Details - See Worksheet 5
C.4.07	Haul one skid to Jetty (12.9 km), round trip	Details - See Worksheet 5
C.4.08	Load, haul, dump place: 2 trucks with <1.0km haul distance	
Earth works		
C. 5.01	Drill and blast	source - RSMeans
C. 5.02	Install HDPE Liner	
C. 5.03	Crusher: crush materials	
C. 5.04	Regrade surface - rough grading, D7	source - RSMeans
C. 5.05	Regrade surface - with excavator	
C. 5.06	Backfill depressions	source - RSMeans
C. 5.07	Install soil stabilization measures (straw/coconut matting)	source - RSMeans
C. 5.08	Trackpack using loaded rock truck	source - SRKjm estimate
C. 5.09	Delineation of low-lying areas	1 day to stake low-lying areas in the field, material allowance included for stakes
C. 5.10	Install silt fencing	
Equipment relocation		
C. 6.01	Dozer relocation	
C. 6.02	Excavator relocation	
C. 6.03	Loader relocation	

Table 6: Relocation Unit Costs

Unit rate of hauling bulk materials from Patch Lake on winter road			
By Skid - SnowCAT (equivalent to D7)			Note: Cost of winter road not included
Equipment Cost	$ 143.83	per hr	Includes fuel
Labour Cost	$ 40.02	per hr	
Average speed	9	km/hr	Skids assumed as being available on site
Hauling capacity	1	skids	One container per skid
Cargo capacity	33.2	m^3	Standard 20 ft container
Space utilization ratio	0.7		
Load	23.24	m^3	CargoCapacity x #ofContainers x SpaceUtilizationRatio
Cost	**$ 0.88**	**per km*m^3**	**CostPerHour÷AvgSpeed÷Load**
Cost per skid	**$ 20.43**	**per km**	**CostPerHour÷AvgSpeed÷#ofSkids**

Table 7: Waste Volumes

DEMOLITION SUMMARY

Area	Item/Description	# of units	Unit Volume (m^3)	Total Volume (m^3)	Source
Tank Farm	Large fuel tank (70 m3)	4	70	280	Closure plan
	Large Fuel tanks (75 m3)	2	75	150	Closure plan
	Empty fuel drums (crushed)	100	0.35	35	Photos
	Fuel drum residual fuel	100	0.10	10	Est.
	Tank Farm Heating System	1			
	Tank Farm Electicity Generator	1			
	Hazardous waste	1	0.5	0.5	Est.
	Containment steel fence	1	5.0	5	
	LDPE liner	1	3.7	4	
Misc. Debris	Drilling Shop (Wood floor)	1	62.7	63	
	Helipad	1	18.8	18.75	
	Drill enclosure	1	10.8	10.8	
	Weather haven	1	5.7	5.7	
	Misc. wood enclosures (3)	3	17.3	52.0	
	Incinerator	1	6.6	6.6	
	Other misc debris allowance	1	30.0	30	
	Total waste to be hauled to landfill			**230**	includes misc debris items, tank farm containment system and empty fuel drums.

Quantity Calculations

Area	Structure	Height (m)	Length (m)	Width (m)	Area (m^2)	Wall Thickness (m)	Wall Volume (m^3)	Floor Thickness (m)	Floor Volume (m^3)	Roof Thickness (m)	Roof Volume (m^3)	Total Volume (m^3)	Loose Volume (m^3)
Tank Farm	Containment steel fence	0.45	147		66.15	0.05						3.31	5.0
	LDPE Liner				1652	0.75						1.24	3.72
	Empty fuel drums (crushed)	0.3			0.79							0.24	0.35
Misc. Debris	Drilling Shop (Wood floor)		22	6.33	139.26			0.3	41.778			41.78	62.7
	Helipad		5	5	25			0.5	12.5			12.5	18.8
	Drill enclosure	2	7	5	35	0.15	7.2	0	0	0	0	7.2	10.8
	Weather haven	2	3	3	9	0.05	1.2	0.3	2.7	0.05	0.45	4.35	5.7
	Misc. wood enclosures (3)	2	3	5	15	0.15	4.8	0.3	4.5	0.15	2.25	11.55	17.3
	Incinerator	3	2	2	4							6	6.6
	Other misc debris allowance				6216							20	30.0
Landfill	Bedding (crushed rock) (0.3m on each side of liner)	0.6			100							60.00	69.0
	Liner				110								
	Run-of-quarry cover	0.5			100							50	57.5

Demolition Bulking Factors	
Tents - Empty	1.3
Wood Structures - Empty	1.5
Wood Structures - w/ Interior Wall Allowance	2
Steel Structures - Empty	1.5
Steel Structures - w/ Interior Wall Allowance	2
Mechanical Equipment	1.1
Liners	3
Pipelines	3

Table 8: Reclamation Areas

Location	Length (m)	Width (m)	Area (m2)	Source
Tank Farm			2000	
Old Tank Farm			2500	
Main Tank Farm spoil pile			2545	ACAD-PL Closure Plan Fig. 4
Soil pile west of current tank farm			1085	
Road from Shop to Patch Lake			1592	Estimated disturbance from Autocad site photo
Winter trail west of facilities	2	935	1870	Estimated disturbance from Autocad site photo
Total Main site			6216	Estimated disturbance from Autocad site photo
Assumed Landfill area			100	Estimated based on demo volume from Patch lake

Appendix B
Hydrocarbon Contamination Evaluation and Remediation Reports

Appendix B.1
EBA 2010 - Evaluation of Risk and Remedial Options for
Contaminated Soil at Patch Lake Facility and Windy Lake Camp

This "Issued for Review" report is provided solely for the purpose of client review and presents our findings and recommendations to date. Our findings and recommendations are provided only through an "Issued for Use" report, which will be issued subsequent to this review. You should not rely on the interim recommendations made herein. Once our report is issued for use, the "Issued for Review" document should be either returned to EBA or destroyed.

Newmont Mining Corporation

ISSUED FOR REVIEW

EVALUATION OF RISK AND REMEDIAL OPTIONS FOR CONTAMINATED SOIL AT PATCH LAKE FACILITY AND WINDY LAKE CAMP HOPE BAY GOLD PROJECT, NUNAVUT

Y22101187

October 2010

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EXECUTIVE SUMMARY

The Patch Workshop and Windy Camp are mining exploration support facilities operated by Newmont Affiliate Hope Bay Mining Limited (HBML), located at 68º4'24"N, 106º35'25"W and 68º3'40"N, 106º37'0"W. As per the terms of the Nunavut Water Board Licence No. 2BE-HOP0712, HBML is currently preparing closure and reclamation plans for the two leased sites on Inuit-owned land. The primary contaminant of concern at both sites is petroleum hydrocarbons (PHC).

The sites are currently undergoing rehabilitation, including the removal of buildings and scrap. Planned works include the remediation of soil impacts and permafrost disturbances associated with past activities at the sites. The purpose of EBA's report is, with the input of affected stakeholders, the selection of site-specific practical soil remediation strategies that meet regulatory requirements and strike a balance between remediation costs, treatment duration, and post-remedial residual risk.

Environmental site assessments (ESAs) at the Patch Workshop and Windy Camp were conducted in 2008 and 2009. The Phase 2 ESA Report (WESA 2009b) indicated that the chemicals of potential concern include the petroleum hydrocarbon (PHC) fractions F2 (diesel fuel) and fractions F3 and F4 (lubricating oils), as well as chromium, copper, nickel and zinc.

PHC impacts at the Windy Lake Camp are predominantly the F2 hydrocarbon fraction (diesel fuel range) and the Phase 2 ESA estimate of soils requiring remediation was 2,000 m^3. Total petroleum hydrocarbon (TPH) concentrations within the impacted area were relatively low, ranging from 500 mg/kg to 2,000 mg/kg. Most of the hydrocarbon impacts were associated with the workshop and generator building and the former tank farm/land treatment area.

According to the Phase 2 ESA (WESA, 2009b), PHC impacts at the Patch Lake Workshop mainly were in the F3 and F4 hydrocarbon fraction range (lubricating oils). The largest volume of soil hydrocarbon impacts were located at the maintenance shop. Other impacted areas included the incinerator and the former tank farm site. In some areas, TPH concentrations are very high; up to 280,000 mg/kg at the former tank farm and approximately 80,000 mg/kg near the workshop.

The following remediation criteria were found to be suitable for Windy Camp and Patch Workshop, based on the conceptual site model data that were available for review:

REMEDIATION OBJECTIVES FOR WINDY CAMP AND PATCH WORKSHOP		
Hydrocarbon Fraction	Site-Specific Criterion	Pathway
F1 PHC Fraction (mg/kg)	350	Direct soil eco-contact
F2 PHC Fraction (mg/kg)	330/800*	Aquatic life/direct soil eco-contact
F3 PHC Fraction (mg/kg)	10,300	Direct soil eco-contact
F4 PHC Fraction (mg/kg)	18,500	Direct soil eco-contact
Total PHC	30,000	Direct soil eco-contact
Note: *330 mg/kg F2 for areas within 30.0 m of a water body, otherwise 800 mg/kg.		

Established soil treatment options that were evaluated for this report, from most rapid to the most prolonged, included physical treatments, such as dig and haul, incineration, thermal desorption, and biological/chemical treatments, such as bioaugmentation/biostimulation during composting, landfarming, or biopile remediation, surfactant addition, soil washing, and monitored natural attenuation. A summary of remediation options with arctic/Antarctic case studies was provided along with a listing of the advantages and disadvantages of each.

Based on the literature review and the site-specific information available, a probable range of remedial cost for Windy Camp hydrocarbon soil remediation for an estimated 1,000 m^3 of F2-impacted soils is between $150,000 and $200,000, with a remedial timeframe of one to three seasons. Bioremediation by landfarming was found to be the lowest cost option and the one that entailed the lowest risk.

At Patch Workshop, the estimated 3,400 m^3 F3-F4 hydrocarbon-impacted soils could be used as intermediate fill in the Camp Doris landfill intended for demolition wastes from Windy Camp. The Phase 2 ESA suggested that some soils only had the F3 and F4 hydrocarbon fractions, while other areas contained F2 as well as these heavier fractions. These F3-F4 soils co-contaminated with F2 could be landfarmed on-site to reduce the F2 fraction to less than the F2 remedial guideline (800 mg/kg) before disposing of the soils in the approved disposal location. Based on a landfill design of 21,000 m^3, potentially all of the F3-F4 impacted soils could be used as intermediate fill. With stakeholder acceptance, this option offers the lowest cost, the lowest risk, and the shortest remedial timeframe.

The Patch Workshop remediation would cost approximately $300,000 for either a landfilling or a biopile option, with the landfilling option being the fastest and the most certain to achieve remedial goals. Landfarming, chemical oxidation, and oxygen-release compound bioremediation would be the most expensive and most protracted remedial options, with the highest uncertainly in attaining remedial goals.

Based on the review of the site data and the literature study, EBA makes the following recommendations:

- Seek input and consensus from affected stakeholders including KIA to select the preferred remedial option(s) for both sites.

Windy Camp

- Delineate F2 hydrocarbon impacts in areas with limited or no hydrocarbon data.
- Collect site-specific information applicable to a bioremediation option, including soil type/texture, particle size analysis, soil moisture content and field capacity, soil organic carbon and other design parameters.
- Remediate F2 hydrocarbons to 800 mg/kg at locations greater than 30 m from shore. Remediate F2 hydrocarbons to 330 mg/kg in areas closer than 30 m from the shore, if further site characterization identifies such soils.

- Coordinate remedial activities with the proposed demolition of the site facilities such that one activity does not hinder or interfere with the other.
- Conduct groundwater monitoring in 2011.

Patch Workshop

- Conduct field screening combined with laboratory analyses to refine the hydrocarbon-affected soil volumes at Patch Workshop as well as determine the volume of soils contaminated with lube oils co-contaminated with lighter F2 hydrocarbons.
- Remediate F2 hydrocarbons to 800 mg/kg. Dispose of site soils as intermediate fill in the landfill, with stakeholder approval. Reclaim site as per the Water License requirements and other relevant permits.
- Conduct groundwater monitoring in 2011.

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APPENDICES

Appendix A Geo-environmental Report – General Conditions

1.0 INTRODUCTION

1.1 INTRODUCTION AND OBJECTIVES

The Patch Workshop and Windy Camp are mining exploration support facilities operated by Newmont Affiliate Hope Bay Mining Limited (HBML), located at 68º4'24"N, 106º35'25"W and 68º3'40"N, 106º37'0"W (presented on Figure 1). As per the terms of the Nunavut Water Board Licence No. 2BE-HOP0712, HBML is currently preparing closure and reclamation plans for the two leased sites on Inuit-owned land. The primary contaminant of concern at both sites is petroleum hydrocarbons (PHCs).

Windy Camp, located on the shores of Windy Lake approximately 10 km south of Hope Bay, is an exploration camp that supported the exploration of the Doris and Madrid deposits of the Hope Bay Project. An all-weather road is currently under construction to Doris Camp, and from there it is linked to Hope Bay by an all-weather road. The Windy Camp housed up to approximately 40 people. Other facilities included a generator, a helipad, and laydown areas containing scrap metal, barrels, and equipment. Drill core was stored at various locations around the camp.

The Patch Workshop is located on a bedrock ridge near the north end of Patch Lake. It is located about 2 km northeast of Windy Lake Camp and is close to the Madrid gold deposit. Facilities included a drill maintenance shop (now decommissioned), laydown areas, incinerator, and fuel storage facilities comprised of six above ground storage (AST) tanks.

The sites are currently undergoing rehabilitation, including the removal of buildings and scrap. Planned works include the remediation of soil impacts and permafrost disturbances associated with past activities at the sites.

The intended outcome of the information contained within this report is, with the input of affected stakeholders, the selection of site-specific practical soil remediation strategies that meet regulatory requirements and strike a balance between remediation costs, treatment duration, and post-remedial residual risk.

1.2 BACKGROUND INFORMATION

The Hope Bay Project is located on Inuit-owned land in the West Kitikmeot region of Nunavut, approximately 160 km southwest of Cambridge Bay. The nearest communities are Umingmaktok, 65 km west, and Bathurst Inlet, 110 km southwest. To date, three significant gold deposits have been discovered in this greenstone belt; Doris North, a few miles from the Arctic Ocean, Madrid, approximately five miles inland from Doris, and Boston, approximately 27 miles south of Madrid.

The Hope Bay Project is on Inuit-owned land administered by the Kitikmeot Inuit Association (KIA), with minerals development authority vested within Nunavut Tunngavik Inc. (NTI). Depending on the location of land within the Hope Bay project area, three entities administer surface and subsurface mine leases on behalf of the Inuit; the KIA (surface rights), the Nunavut Tunngavik Incorporated (subsurface rights), and the Government of Canada Department of Indian and Northern Affairs (both surface and subsurface rights). HBML has secured access and mineral rights to the Hope Bay Project through land use and commercial land leases negotiated with these stakeholders.

Newmont Mining Corporation acquired the Hope Bay Project in March 2008. Later that year, the airstrip for the new Windy Camp was constructed. Environmental assessment and rehabilitation of Windy Camp and Patch Workshop commenced in 2009. Other work in the area included the all-weather road between Doris Camp and Windy Camp, and the expansion of the capacity and facilities of the main Doris Camp.

Environmental site assessments (ESAs) at the Patch Workshop and Windy Camp were conducted in 2008 and 2009. The Phase 2 ESA Report (WESA 2009b) indicated that the chemicals of potential concern include the petroleum hydrocarbon (PHC) fractions F2 (diesel fuel) and fractions F3 and F4 (lubricating oils), as well as chromium, copper, nickel and zinc.

PHC impacts at the Windy Lake Camp are predominantly the F2 hydrocarbon fraction (diesel fuel range) and the Phase 2 ESA estimate of soils requiring remediation was 2,000 m^3. Total petroleum hydrocarbon (TPH) concentrations within the impacted area were relatively low, ranging from 500 mg/kg to 2,000 mg/kg. Most of the hydrocarbon impacts were associated with the workshop and generator building and the former tank farm/land treatment area. Concentrations of metals in five soil samples were less than the Canadian Soil Quality Guidelines for coarse-grained soil (CCME, 2007). The concentration of petroleum hydrocarbons in groundwater samples in 2009 (five wells) was less than the analytical detection limit for petroleum hydrocarbons.

According to the Phase 2 ESA (WESA, 2009b), PHC impacts at the Patch Lake Workshop mainly were in the F3 and F4 hydrocarbon fraction range (lubricating oils). The largest volume of soil hydrocarbon impacts were located at the maintenance shop. Other impacted areas included the incinerator and the former tank farm site. In some areas, TPH concentrations are very high; up to 280,000 mg/kg at the former tank farm and approximately 80,000 mg/kg near the workshop. Three soil sample locations (of 10 soil samples) suggested some limited surficial soil metal impacts, including chromium, copper nickel, and zinc, especially in the vicinity of the former maintenance shop and the north laydown area. The concentration of petroleum hydrocarbons in groundwater samples in 2009 (three downgradient wells) was less than the analytical detection limit for petroleum hydrocarbons.

1.3 SCOPE OF WORK

The scope of work described in EBA's July 5, 2010 submission Proposal to Evaluate Risk and Remedial Options for Contaminated Soil at the Patch Lake Facility and Windy Lake Camp Hope Bay Gold Project, Nunavut, involved the following tasks:

- Review previous information on the sites, specifically the final closure plans and the Phase II ESAs conducted for the two sites.
- Conduct a site-specific desktop study and evaluate potential remedial options using a decision analysis. This will include an evaluation of the likelihood of success and associated costs associated with each of the remedial options.
- Re-evaluate the site-specific risk-based criteria for the site to determine its applicability for the proposed cleanup criteria; adjust the criteria as applicable.
- Identify need for supplementary site characterization, field trial or bench scale studies to support viable remedial technologies.
- Prepare a report summarizing the aforementioned activities.

2.0 CONCEPTUAL SITE MODEL AND REMEDIAL OBJECTIVES

2.1 CONCEPTUAL SITE MODEL

A conceptual site model (CSM) represents characteristics of the site that show the possible relationships between chemicals of concern, pathways, and receptors. Its purpose is to inform stakeholders, identify field screening and sampling requirements identify potential regulatory drivers, select points of compliance, support cost estimates, evaluate/implement remedial alternatives, guiding sampling efforts, and support site closeout. The CSM also helps manage decision uncertainty, either qualitatively using a weight of evidence approach, or, it may be more quantitative and use statistical techniques.

The following site conceptual model is based on the American Society for Testing and Materials (ASTM) E1689-95 (ASTM, 1995), which includes identification of potential/known chemicals of concern, characterization of the contaminant source(s), identification of potential migration pathways through environmental media, establishment of background values for the identified chemicals of concern, identification of potential receptors (ecological, environmental or human), and determination of the study area.

2.1.1 Regional Site Characteristics

The regional information provided in Table 1 is applicable to both the Windy Lake Camp and Patch Workshop sites.

TABLE 1: REGIONAL SITE CHARACTERISTICS		
Feature	Description	Reference
Setting	The Hope Bay Project is a remote site in an arctic setting. Predevelopment land use can be classified as wildlife habitat with occasional use by Inuit people for subsistence hunting and fishing.	SRK, 2009b
Regional land use	Staged 2 development of Doris, exploration drilling Construction of a new road to Windy Camp, replacing the old camp, staging the fuel farm and constructing critical buildings and civil work. Nearby development plans include construction and start up of the small-scale Doris North underground mine and mill and tailings storage facility. Planning is underway for permits that are needed for the longer-term development of additional underground and surface mines in subsequent phases of the project.	Hope Bay Welcomed Cold, website article. http://www.newmont.com/features/our-business-features
Archaeological features	The west Kitikmeot has a diversity of archaeological and historic resources, and such resources comprise an important aspect of Inuit culture, spirituality, and perspectives with respect to relationships with the land. HBML has completed comprehensive baseline surveys for historic and cultural resources in the Hope Bay Project area.	SRK, 2009b
Climate	Frost-free months between June and September. Average temperature: -14.4°C, with 600 degree-days above 0°C. The mean annual precipitation is approximately 139 mm with roughly 50% occurring as rain between May and October and 50% as snow. The air temperature in the Hope Bay Belt may fall below 0°C on any day of the year. The monthly mean air temperature is typically above 0°C between June and September, with the peak in July, and is below freezing between October and May. The coldest day of the year typically occurs in February. Location is extremely windy.	Environment Canada data for Cambridge Bay.
Permafrost	Area of continuous permafrost (except for some lakes).	Thurber, 2003
Soils	Active layer is approximately 1.0 to 2.0 m in the region. Thinner active layers are present where an organic mat is present. Deeper active layers are present in bedrock outcrops. Active zone earth materials include frost-churned mineral and organic soils mantled by a thin cover of tundra. Soils are marine in origin and include clay, silt, and some sand.	

TABLE 1: REGIONAL SITE CHARACTERISTICS		
Feature	Description	Reference
Geology	The geology is dominated by Archean-age volcanic flows with some clastic rocks that have been significantly deformed by the intrusion of large granitic batholiths. Gold mineralization occurs in quartz veins and in carbonated and silicified zones associated with large shear zones. Numerous different styles of mineralization are known in the area. The Patch Workshop is located on a bedrock ridge.	Geological Survey of Canada 2003
Hydrology/ Hydrogeology/ Hydrogeochemistry	Drainage into Roberts Bay to the north. Peak freshet flows typically occur in June. Depth to groundwater information not available for the site monitoring wells; however, sampling was conducted on August 16, 2009, indicating that free-water is present at that time of year. Water pH ranged between 6.7 and 7.3. Water temperature was 6.5°C to 8.8°C. No routine water chemistry data was available for the monitoring wells. Water in nearby lakes is soft and neutral to acidic in pH, and buffering capacity is typically low. Chloride, sodium and potassium concentrations may be relatively high, reflecting the marine origin of the surficial materials.	WESA, 2009b AMEC, 2005

2.1.2 Windy Camp Conceptual Site Model

The Windy Lake Camp, contaminated areas, and former/current site facilities are presented on Figure 3. A summary of site-specific observations is provided in Table 2.

TABLE 2: WINDY CAMP		
Nearby facilities/operations	New Windy Camp to the north. Connected to Doris Camp by all-weather road. Adjacent to the proposed Naartok Pit (open pit mine).	Doris North Project, Stage 2 – Development Permit Site Plan, SRK Consulting, drawing dated June 2010.
Site access	All-weather road or helicopter.	Doris North Project, Stage 2 – Development Permit Site Plan, SRK Consulting, drawing dated June 2010. SRK 2009

TABLE 2: WINDY CAMP		
Site history and use	Site was used as the primary camp and included tents/offices, laydown areas, generators, incinerators fuel storage, and a sewage treatment plant. As of September 2009, site had five tidy tanks (with self-contained secondary containment). A spill of 19,000 liters of diesel fuel into Windy Lake occurred in June 2004. Other spills on the site are undocumented but are presumably associated with former activities and facilities. Length of use of the site is unknown.	WESA, 2009b
Background concentrations of identified chemicals of concern	Hydrocarbons do not occur naturally in the area. Heavy metals on the CCME list may occur naturally in the area, although no site-specific background data is available.	
Background water quality	Water in Windy Lake (1995 to 2000): - pH range 6.3 to 8.0; - Turbidity: 0.3 to 5.0 NTU; - Total aluminum: 9 to 147 µg/L; - Total arsenic: 0.20 to 5.0 µg/L; - Total chromium: <0.5 to 5.3 µg/L; - Total copper: 0.8 to 2.0 µg/L; - Total lead: 0.64 to 1 µg/L; and - Total selenium: <0.5 to 5.0 µg/L. Note that the maximum values of metals were recorded during times of open water (July to September).	AMEC, 2005
Relevant contaminant migration pathways	Surficial runoff to Windy Lake – likely during times of high runoff. Vertical migration through permafrost – possible, but highly unlikely.	WESA, 2009b
Relevant contaminant exposure pathways	Direct contact (soil and dermal contact). Protection of groundwater for aquatic life. Nutrient cycling. Ecological direct soil contact.	WESA, 2009a
Site receptors	Freshwater biota including fish. Mammals, birds, and insects. Tundra vegetation. Humans, during site remediation activities and possibly hunting.	WESA, 2009b
Particle size distribution	Unknown.	
Depth to Groundwater	Unknown.	

TABLE 2: WINDY CAMP			
Soil organic fraction	Unknown.		
Tank Farm Area and Downgradient (Areas 1 and 2)			
Chemicals of concern	F2 hydrocarbon fraction.		
Highest concentrations	Area 1: 292 mg/kg F2. Area 2: 1,060 mg/kg F2 and 321 mg/kg F3.		
Approximate size	1,200 m^3	Full Delineation	No
Depth of source	Unknown, assumed to be 1.0 m.		
Number of samples	Fourteen samples total, three higher than criteria.		
Comments	Anoxic conditions observed at 0.2 m to 0.3 m below grade at Area 1.		
Down-gradient of Helipad (Area 3)			
Chemicals of concern	F2 hydrocarbon fraction.		
Highest concentrations	1,970 mg.kg F2.		
Approximate size	300 m^3	Full delineation	No
Depth of source	Unknown, assumed to be 1.0 m.		
Number of samples	Five samples total, one higher than criteria.		
Workshop and Generator Building Area (Area 4)			
Chemicals of concern	F2 hydrocarbon fraction.		
Highest concentrations	1,280 mg/kg F2; and 589 mg/kg F3.		
Approximate size	250 m^3	Full delineation	No
Depth of source	Unknown, assumed to be 1.0 m.		
Number of samples	Eight samples total, one higher than criteria.		
Camp Tent Frames Area (Area 5)			
Chemicals of concern	Unknown, but probably F2.		
Approximate size	250 m^3	Full delineation	No
Depth of source	Unknown, assumed to be 0.5 m.		
Number of samples	None		

Notes:

Fraction 2 (F2): The range of equivalent carbon number (ECN) from >C10 to C16. It includes kerosene, jet fuel, and light fuel oils (No. 2 fuel oil, Arctic diesel) and represents the semi-volatile fraction of PHCs. The F2 fraction is comprised of aromatics and aliphatic sub-fractions in the ranges >C10 to C12 and >C12 to C16.

Fraction 3 (F3): The range of ECN from >C16 to C34 and includes medium fuel oils (No. 4 fuel oil, Bunker B), heavy fuels oils (Bunker C), and lubricating and motor oils. It is comprised of both aromatics

TABLE 2: WINDY CAMP
and aliphatic in the ranges >C16 to C21 and >C21 to C34. Contaminant concentration and volume information based on the Phase 2 ESA (WESA, 2009b). No groundwater impacts were detected in the 2009 field season (WESA, 2009b).

2.1.3 Patch Workshop Conceptual Site Model

The Patch Workshop, areas of concern, and former/current site facilities are presented on Figure 2. A summary of site-specific observations is tabulated below:

TABLE 3: PATCH WORKSHOP

Feature	Description	Reference
Nearby facilities/operations	Madrid resource, including the planned Madrid mill, Madrid airstrip, New Windy Camp, Planned Naartok Pit, and Rock quarries	Doris North Project, Stage 2 – Development Permit Site Plan, SRK Consulting, June 2010.
Site access	Winter road or helicopter.	Doris North Project, Stage 2 – Development Permit Site Plan, SRK Consulting, drawing dated June 2010. SRK 2009
Site history and use	Past facilities included a drill maintenance workshop, laydown areas, incinerator, and fuel storage facilities (six ASTs). Drill maintenance shop has been demolished (2009). Laydown areas and fuel storage will continue to be used for activities in the area. Spills on the site are undocumented but are presumably associated with former activities and facilities. Length of use of the site is unknown.	WESA, 2009b
Background concentrations of identified chemicals of concern	Hydrocarbons do not occur naturally in the area. Heavy metals on the CCME list may occur naturally in the area, although no site-specific background data is available.	
Background water quality	Water in Patch Lake (1995 to 2000): pH range 6.1 to 7.8 Turbidity: <1 to 12 NTU Total aluminum: 7 to 182 µg/L Total chromium: 0.5 to 2.4 µg/L Total copper: <0.5 to 7.0 µg/L Total cadmium: <0.05 to 0.2 µg/L Note that the maximum values of metals were recorded	AMEC, 2005

TABLE 3: PATCH WORKSHOP				
Feature	**Description**			**Reference**
	during times of open water (July to September), except for copper.			
Relevant chemical migration pathways	Surficial runoff to Patch Lake (60.0 m to the east) may occur for more readily-soluble compounds, such as F2 hydrocarbon fraction. F3 and F4 hydrocarbons are not expected to migrate via this pathway. Vertical migration through permafrost-possible but highly unlikely.			WESA, 2009b
Relevant chemical exposure pathways	Direct contact (soil and dermal contact). Protection of groundwater for aquatic life. Nutrient cycling. Ecological direct soil contact.			WESA, 2009a
Site receptors	Freshwater biota including fish. Mammals and birds. Tundra vegetation. Humans, during site remediation activities and possibly hunting.			WESA, 2009b
Particle size distribution	Unknown.			
Depth to Groundwater	Unknown.			
Soil organic carbon fraction	Unknown.			
Drill Shop Area (Area 1)				
Chemicals of concern	F2, F3, and F4. CCME metals (limited extent).			
Highest concentration in soil	790 mg/kg F2 74,900 mg/kg F3 8,110 mg/kg F4			
Approximate size	600 m^3	Full delineation	No	
Depth of source	Unknown, assumed to be 1.0 m.			
Number of samples	Nine samples total, five greater than criteria.			
North Laydown Area (Area 2)				
Chemicals of concern	F3 and F4. F2, CCME metals (limited extent).			
Highest concentration	27,100 mg/kg F2 60,200 mg/kg F3 20,800 mg/kg F4			
Approximate size	2,500 m^3	Full delineation	No	
Depth of source	Unknown, assumed to be 0.5 m.			

TABLE 3: PATCH WORKSHOP			
Feature	**Description**		**Reference**
Number of samples	Fifteen total samples, six greater than criteria.		
Incinerator Area (Area 3)			
Chemicals of concern	F2, F3, and F4. CCME metals (limited extent).		
Highest concentration in soil	13,200 mg/kg F2 26,500 mg/kg F3 4,700 mg/kg F4		
Approximate size	150 m^3	Full delineation	No
Depth of source	Unknown, assumed to be 0.5 m.		
Number of samples	Four total samples, one higher than criteria.		
Former Tank Farm Site (Area 4)			
Chemicals of concern	F3 and F4. CCME metals (limited extent).		
Highest concentration in soil	258,000 mg/kg F3 29,900 mg/kg F4		
Approximate size	150 m^3	Full delineation	No
Depth of source	Unknown, assumed to be 0.5 m.		
Number of samples	Two samples, one higher than criteria.		

Notes:

Fraction 2 (F2): The range of equivalent carbon number (ECN) from >C10 to C16. It includes kerosene, jet fuel, and light fuel oils (No. 2 fuel oil, Arctic diesel) and represents the semi-volatile fraction of PHCs. The F2 fraction is comprised of aromatics and aliphatic sub-fractions in the ranges >C10 to C12 and >C12 to C16.

Fraction 3 (F3): The range of ECN from >C16 to C34 and includes medium fuel oils (No. 4 fuel oil, Bunker B), heavy fuels oils (Bunker C), and lubricating and motor oils. It is comprised of both aromatics and aliphatic in the ranges >C16 to C21 and >C21 to C34.

Contaminant concentration and volume information based on the Phase 2 ESA (WESA, 2009b).

No groundwater impacts were detected in the 2009 field season (WESA, 2009b).

Although Windy Lake Camp will be replaced, EBA Engineering Consultants Ltd. (EBA) understands that the laydown areas and fuel storage facilities at the Patch Lake site will continue to be used for future exploration activities in the region.

2.2 SITE-SPECIFIC REMEDIATION CONSIDERATIONS

The site conceptual model presents the following site-specific remediation considerations:

Anaerobic Conditions and Hydrocarbon-Degrading Microbe Communities:

Arctic soils often have high moisture content, especially near the permafrost layer. Gleying of waterlogged soils causes the reduction of ferric iron to ferrous iron, changing the colour of the soil from reddish brown to blue-grey, especially in loamy and fine-textured soils. The aerial photographs and testpit logs from the Phase 2 ESA suggest that these saturated anaerobic subsurface conditions may be present at the Windy Lake Camp and Patch Workshop sites. Soils that are very wet or waterlogged may establish communities of predominantly anaerobic microorganisms, especially in older spills. There is some evidence that attempted treatment of previously-anaerobic soils by aerobic techniques, such as landfarming and biopiles, may not be successful due to the indigenous population of anaerobes established in the soil matrix (Powell et al, 2006). In general, the anaerobic degradation of hydrocarbons in polar climates is not well understood.

Saturated Soils:

Both low and high soil moisture inhibit intrinsic bioremediation, but wet conditions limit oxygen availability and inhibit aerobic hydrocarbon degradation pathways. Water contents of between 50% and 80% field capacity are generally seen as optimal for microbial activity (Morgan and Watkinson, 1989).

Nutrient Availability:

Elements, including nitrogen, potassium, and phosphorus, are usually low at Arctic sites because the nutrients are bound up by the living organic matter at the surface.

Cold:

Although cold-adapted indigenous microorganisms are important in situ hydrocarbon degraders in cold environments, the threshold for significant hydrocarbon biodegradation is generally considered to be around 0°C. The prevalent low soil temperatures slow natural attenuation by decreasing the rate of hydrocarbon volatilisation.

Soil Mineralization:

No site-specific information on the background chemistry of the surface soils and sediments was reviewed for this report; however, given the site location within the Archean greenstone belt, it is possible that that there is a natural enrichment in heavy metals of regulatory concern. Natural heavy metals enrichment of sediments and soils are not an environmental concern at these sites, but the use of remediation techniques that rely on strong oxidants or that leave the soil pH altered have the potential to dissolve and mobilize metallic minerals.

Salinity:

Given the marine origin of the overlying sediments, the soils and porewater at the two sites may contain naturally-elevated concentrations of chloride and sulphate salts. While the local microbial communities of hydrocarbon-degraders may be adapted to these conditions, the addition of more fertilizer salts to augment bioremediation could inhibit bacterial growth and metabolism by reducing the soil osmotic potential (Braddock, 1997).

Other Site-Specific Remedial Considerations:

The thermal regime of most Arctic soils is dependent on vegetation cover, soil moisture, thickness of snow cover, and the underlying permafrost; however, in general, soil temperatures rapidly reflect changing air temperatures, especially during cooling. Where the snow cover is thin, the subsoil cools rapidly as average air temperatures drop, resulting in a small or negligible thermal gradient.

The Phase 2 ESA indicates that the depth of soil to permafrost ranges between 0.1 m to approximately 1.0 m below grade at the Patch Workshop, and 1.2 m below grade at the Windy Lake Camp. At the Windy Lake Camp, depth to permafrost is generally related to proximity to the nearby lake. Based on the Phase 2 testpit logs, areas close to the bedrock ridge have a thinner active layer.

Permafrost can be ice-rich, wherein ice occupies a considerable percentage of its volume, or ice-poor. It is not uncommon for ice to constitute nearly half of the soil volume in northern latitudes. However, the volume of ice is highly variable, and it is often influenced by the overlying vegetation.

Melting ice-rich soils are prone to mass wasting, subsidence, and can become boggy. When there is a high ground ice content, steep terrain, and fine-grained soils, rapid thawing of permafrost can induce solifluction (Fenians, 1983); a type of soil creep characteristic of tundra regions. During summer, the weak and saturated active layer slowly moves downslope. Such soils also lose virtually all bearing strength. Solifluction related to human activities at the Windy Lake Camp has been documented, in particular in the vicinity of the fuel storage area.

Rapid thawing of ground ice also induces geochemical changes, such as increased nutrient availability, hydrologic changes, and thermal changes due to decreased albedo (Walker and Walker, 1991). Fine-grained soil sediments may not stabilize for 30 years and soil movement during the short growing season makes re-vegetation difficult or impossible (Hok, 1971). For these reasons, preserving the integrity of the permafrost during remedial activities is a major concern, especially at the Windy Lake Camp site.

2.3 REMEDIAL OBJECTIVES

The main chemicals of concern at both sites are petroleum hydrocarbons (PHC). PHC in soil is a concern on remote arctic sites because they can be toxic to plants and animals, mobile, and persist in the environment.

The PHC remediation guidelines in the Environmental Guideline for Site Remediation (Government of Nunavut, 2009) is based on the tiered remedial framework set forth in the Canada-Wide Standards for PHCs in Soil (CCME, 2008a).

The WESA risk assessment (WESA, 2009a) selected CCME remediation criteria for PHC from values published in various CCME reports. The authors indicated that given the vastness of the un-impacted surrounding land, the impacted areas would not adversely affect the viability of ecological communities in the area. The site-specific WESA values in Table 4 were based on professional judgement as opposed to calculations of risk. There is little information on terrestrial ecological contact values that are specific to northern climates, and there are concerns that the eco-toxicity data for southern invertebrate and plant receptors used to derive generic CCME PHC criteria may not be applicable to arctic environments (Rombke et al, 2006).

TABLE 4: CCME AND SITE-SPECIFIC REMEDIATION CRITERIA BY WESA (2009)

Hydrocarbon Fraction	Generic CCME	Site-Specific Criterion	Pathway
F1 PHC Fraction (mg/kg)	30	210	Direct soil eco-contact
F2 PHC Fraction (mg/kg)	150	260	Direct soil eco-contact
F3 PHC Fraction (mg/kg)	300	1,300	Direct soil eco-contact
F4 PHC Fraction (mg/kg)	2,800	5,600	Direct soil eco-contact

Golder Associates Ltd. (Golder, 2008 [draft]) and EBA Engineering Consultants (EBA, 2008) have developed hydrocarbon remediation protocols for northern abandoned military sites under the jurisdiction of Indian and Northern Affairs Canada (INAC). In addition to site-specific factors and cost considerations, guidelines were derived using the CCME framework (CCME, 2008a) using model parameters representative of arctic sites situated in areas of continuous permafrost (where more site-specific data was available).

In the case of the F1 and F2 hydrocarbons (the soluble fraction), the protection of aquatic life pathway was determined to be limited to areas within 30 m of a water body. In areas further than 30 m from shore, a different exposure pathway will likely drive the remediation criteria.

Hydrocarbon F3 and F4 remediation criteria in the Golder (draft) report were based on work conducted by Visser et al. included in Appendix G of the CCME technical supplement (CCME, 2008b), and supported by work published by Saterbak et al.(1999). The remediation criteria are for ecological direct soil contact (soil invertebrates and plants), and are related to three soil textures, including sand, loam, or clay.

Assuming the soils at the Windy Lake Camp and Patch Workshop facilities fall within the definition of loam (mixture of sand, slit, and clay), Table 5 lists remediation criteria that are suitable for Windy Camp and Patch Workshop, based on the conceptual site model data currently available:

TABLE 5: REMEDIATION OBJECTIVES FOR WINDY CAMP AND PATCH WORKSHOP		
Hydrocarbon Fraction	Site-Specific Criterion	Pathway
F1 PHC Fraction (mg/kg)	350	Direct soil eco-contact
F2 PHC Fraction (mg/kg)	330/800*	Aquatic life/direct soil eco-contact
F3 PHC Fraction (mg/kg)	10,300	Direct soil eco-contact
F4 PHC Fraction (mg/kg)	18,500	Direct soil eco-contact
Total PHC	30,000	Direct soil eco-contact
Note: *330 mg/kg F2 for areas within 30.0 m of a waterbody, otherwise 800 mg/kg.		

This approach was used by Senes Consultants Ltd. (2008) for the development of remediation criteria at INAC mines sites, including Silver Bear, Contact Lake, and El Bonanza. Although the remediation criteria are different from those proposed by WESA (2009), within the context of the CCME framework, they are equally protective of the environment.

The most recent hydrocarbon remediation protocol for INAC abandoned military sites (EBA, 2008) is based on human and ecological site assessments conducted by Jacques-Whitford in 2005 and 2006. For reasons including the limited areal extent of hydrocarbon-impacted areas relative to the surrounding local habitat, avoidance of tundra disturbance in areas beyond the original impacted areas, and economic considerations, the direct soil eco-contact pathway was excluded from the derived guidelines, which is not a recommended approach for the case of the Windy Lake Camp and the Patch Workshop. The EBA report (2008) corroborates the F2 remedial objective of 330 mg/kg F2 indicated in the Golder report (2008, draft), which is intended to be protective of freshwater aquatic life.

Figures 2 and 3 show revised hydrocarbon-impacted areas representing approximate areas requiring remediation based on the site criteria provided in Table 5. The areas are approximate only and based on limited Phase 2 soil data (WESA, 2009b). Three soil samples in two areas greater than 30 m from shore had F2 hydrocarbons greater than 800 mg/kg at Windy Camp, and all sampled locations within the 30 m from Windy Lake were less than 330 mg/kg F2. Eight locations at Patch Workshop had concentrations higher than the remedial objectives for F2, F3 and F4. A Phase 3 delineation study would be required at both locations to determine actual soil volumes and investigate potential hydrocarbon-impacted areas that were not sampled during the 2009 study.

3.0 REMEDIATION OPTIONS

3.1 CONTEXT

Established soil treatment options, from most rapid to the most prolonged, include physical treatments, such as dig and haul, incineration, thermal desorption, and biological/chemical treatments, such as bioaugmentation/biostimulation during composting, landfarming, or biopile remediation, surfactant addition, soil washing, and monitored natural attenuation. A summary of remediation options with arctic/Antarctic case studies is presented in Table 6 (in the Tables section), along with a listing of the advantages and disadvantages of each.

As per the Nunavut environmental guidelines, once remediation criteria have been determined, the next step is to prepare a Remedial Action Plan (RAP) for a preferred remediation method or treatment train. The current discussion of remedial alternatives is intended for the selection of an optimal remediation strategy that takes into account the site-specific conditions, stakeholder perspectives, and a consideration of the cost-time relationship in environmental clean-ups.

When no single technology is capable of treating all the chemicals of concern in a particular medium, the concept of "treatment trains" can also be considered for site remediation; meaning that two or more innovative and established technologies may be used together or sequentially to achieve remedial goals.

3.2 IN SITU TREATMENTS

The in situ remediation options under consideration include enhanced bioremediation and chemical oxidation.

3.2.1 Bioremediation

Bioremediation is a treatment process whereby chemicals such as petroleum hydrocarbons are metabolized into less toxic or nontoxic compounds by naturally occurring microorganisms. The microorganisms utilize the chemicals as a source of carbon and energy. The by-products are mainly carbon dioxide and water.

Hydrocarbon degradation is influenced by environmental conditions. Nutrient availability, temperature, and oxygen are usually the three most important limiting conditions at Arctic sites.

One way to increase hydrocarbon mineralization rates is biostimulation, which encourages biological metabolism by adding nitrogen to the soils as nitrate, ammonium, or commercial preparations, such as 20:20:20 fertilizer (ammonium nitrate, urea, and potassium phosphate). Another method is the manipulation of redox potential by the injection of air, heat, oxygen, and slow oxygen release compounds (ORCs) enhance aerobic biodegradation.

Surfactants are sometimes added to the soils because it is thought that the soil-bound hydrocarbons are subsequently more readily-available to microbes; however, there is very little literature evidence to support the purported benefits in the Arctic. The usefulness of surfactants to enhance bioremediation must be established based on the results of site-specific laboratory or field studies.

The presence of indigenous cold-adapted hydrocarbon-degrading microorganisms at many northern sites makes bioremediation through biostimulation, oxygen addition, and moisture adjustment a feasible approach (Braddock et al., 1997; Thomassin-Lacroix et al., 2002; McCarthy et al., 2004; and Paudyn et al., 2008). For many sites, it is a remedial approach with a high probability of success and one that offers a balance between cost, time, risk, and regulatory requirements.

3.2.2 In Situ Chemical Oxidation

In situ chemical oxidation (ICO) technology involves introducing reactive chemicals directly into soil or other media to oxidize organic chemicals to carbon dioxide and water, or transform them to other compounds, such as inorganic salts. The most common ICO treatments include Fenton's reagent, hydrogen peroxide, persulfate, and hypochlorite. In general, in situ chemical oxidation produces an exothermic reaction that could potentially contribute to permafrost melting. Other factors to consider prior to implementation include the potential mobilization of reaction by-products, and changes to soil pH, microbial communities, and soil structure.

One of the most commonly used in situ chemical oxidation process is the iron catalyzed hydrogen peroxide H_2O_2 oxidation system to produce the hydroxyl radical OH, which is a very strong and nonspecific oxidant. The two types of iron-catalyzed H_2O_2 oxidation processes include the Fenton oxidation, which utilizes soluble iron such as Fe^{2+}, and the Fenton-like process, which capitalizes on the naturally-occurring iron oxyhydroxides, such as goethite (–FeOOH) to catalyze the process.

RegenOx™ (Regenesis) is a proprietary solid alkaline oxidant containing sodium percarbonate complex. It is activated using a multi-part catalytic formula to maximize in situ performance. The product is delivered as two parts that are combined and injected into the subsurface using common drilling or direct-push equipment. Once in the subsurface, the combined product produces an effective oxidation reaction; however, it is not as exothermic as the Fenton's Reagent.

Successful implementation of chemical oxidation is highly dependent on being able to add the oxidant solutions to the affected soils. It does not work well in impermeable fine-grained soils such as clay. Also, some naturally-occurring minerals themselves exert a chemical oxidant demand, which can consume a large quantity of oxidants prior to achieving any remediation of the hydrocarbons. There is also the possibility that naturally-occurring heavy metals may be liberated into the surrounding environment when the treatment is conducted in situ.

There are few case studies of successful chemical oxidation techniques in the arctic. The cost of shipping large quantities of TDG-regulated chemicals to remote sites is often prohibitive. Further, the technique does not always achieve remedial objectives. For example, Ferguson et al (2004) found that the use of Fenton's reagent was not effective to reduce hydrocarbon concentrations at a site in the Antarctic. Worse, the authors found that the treatment caused the naturally-occurring community of hydrocarbon-degraders to be greatly diminished. EBA has had moderate success at the field-trial level using Regen-Ox to remediate diesel fuel in soil at a site in Baker Lake. At that site, the recommended dose of oxidants and activator to achieve a 1,000 mg/kg reduction in F2 hydrocarbon fraction was approximately 9 kg of chemicals per cubic metre of soil. Using this quantity as a rough estimate for the Windy Lake Camp site, approximately 20 tonnes of chemicals would be required. Actual recommended application rates would need to be determined in a site-specific field trial.

3.2.3 In Situ Enhanced Bioremediation Using Magnesium or Calcium Peroxides

Oxygen Release Compound (ORC®) is a proprietary formulation of phosphate-intercalated magnesium peroxide that, when hydrated, produces a controlled release of oxygen for periods of up to 12 months, according to its manufacturer Regenesis. When hydrated, it releases 10% of its weight as oxygen. The reaction by-product is $Mg(OH)_2$, commonly known as milk of magnesia. Magnesium peroxide is mainly used for the enhanced natural attenuation of pollutants in soil and groundwater, such as petrochemical spills and other aerobic biodegradable compounds.

ORC® Advanced is another proprietary formulation by the same company consisting of calcium oxyhydroxide ($CaO[OH]_2$), calcium hydroxide ($Ca[OH]_2$), and calcium carbonate ($CaCO_3$). It releases 17% of its weight as oxygen when hydrated.

A similar line of powder-form products based on calcium and magnesium peroxides (IXPER®) is offered by Solvay. IXPER® 75C calcium peroxide decomposes slowly in contact with water with the generation of oxygen. Typically, H_2O_2 is not generated under these conditions due to the high pH.

The rate of gaseous oxygen generation is influenced by the physical and chemical properties of the surrounding medium, such as pH and temperature.

Solvay also produces sodium percarbonate (OXYPER®), which dissolves in water to produce soda ash and hydrogen peroxide.

As in all cases of amendment addition, there is more risk in using generic or manufacturer-supplied application rates. Either too much or too little chemical delivered to the site is unwanted. Treatment success and optimal application rates are best determined by an initial field trial.

3.3 EX SITU REMEDIAL OPTIONS

Ex situ remediation options considered include excavation and off-site disposal, landfarming, and biopiles. Other treatment technologies that could be implemented ex situ include chemical oxidation and Mg- or Ca-peroxide addition. The advantage of ex situ technologies is greatly improved control over amendment addition, soil mixing, and enhanced oxygenation of the soil. Also, treatments are conducted in a managed treatment area, which eliminates the concern for in situ treatments to cause contaminant migration.

The engineering, construction, and operational costs associated with ex situ treatments usually make them more expensive than in situ counterparts, but remedial timeframes may be shortened because of the advantage of being able to control better environmental conditions and the aggressiveness of the remedial approach.

Ex situ remediation has the potential to cause permafrost degradation and slope movement (solifluction). Soil excavation leaves the underlying permafrost to be vulnerable to melting during the frost-free months.

3.3.1 Excavation and Landfill Disposal

EBA understands that there are plans for the construction of a domestic/demolition waste landfill at Quarry 2 near Doris Camp. With stakeholder agreement, F3-F4 hydrocarbon-impacted soils could be used for intermediate fill at this facility.

Based on the available information, the soils at the Patch Workshop are predominantly in the lubricating oil range (F3 to F4). EBA suggests that the landfilling option be considered for implementation for Patch Workshop remediation. The F3-F4 soils co-contaminated with F2 fraction would require pre-treatment (i.e., landfarming) to achieve the 800 mg/kg F2 criterion prior to landfilling.

3.3.2 Landfarming

One preferred method for the remediation of fuel contaminated soil at arctic sites is landfarming, particularly in remote areas, because the method requires minimal equipment and, consequently, it is usually the lowest cost option.

The term landfarming generally refers to the process whereby hydrocarbon affected soils are spread out in a layer about 0.3 m to 0.5 m thick, nutrients are added, and periodically the soils are mixed. Soil moisture may also be adjusted. Hydrocarbon concentrations decrease due to both volatilization and bioremediation. As is the case for other remediation techniques, landfarming and bioremediation trials in polar climates have not always been successful, depending on the characteristics of the soils to be treated; however, it has been successful at many northern sites over the past decade.

In some cases, the relative contribution of volatilization in above-ground landfarms and biopiles may be much greater than the contribution from biodegradation. For example, soil aeration alone using rototilling (every few days) removed 80% of the volatile hydrocarbons

(Paudynet al, 2008), although in this case the addition of nutrients resulted in active bioremediation and an even more rapid removal of petroleum hydrocarbons. Rototilling and volatilization of hydrocarbons as a remedial strategy would be more applicable to the Windy Lake Camp site (F2 diesel-range contamination) and the F2-impacted soils at the Patch Workshop. The F2-contaminated soils at the Patch Workshop are also co-contaminated with F3 and F4 hydrocarbon fractions, and these would not be effectively treated using a landfarm bioremediation process in the short term (two to three years).

Both sites have sufficient land for the construction of a landfarm. The size of the landfarm depends on the remedial objectives and the soil volumes as well as the remedial timeframe agreed upon by the stakeholders.

To remediate the Windy Lake Camp facility completely in one field season using landfarming would require an approximate area of 2,000 m^2, assuming an treatment soil volume of 1,000 m^3. This volume differs from the soil volumes reported in the WESA Phase 2 ESA (2,000 m^3) due to the revised remedial objectives proposed for the site.

At the Patch Workshop, remediation of the entire estimated soil volume (3,400 m^3) as reported in the Phase 2 ESA by landfarming would require approximately 7,000 m^2 of land and, given the high concentrations of F3 and F4 hydrocarbon fractions in the soils, the anticipated remedial timeframe at Patch Workshop would be five to ten years, dependent on the degree of mechanical energy and chemical inputs applied.

Chokshi and Nelson (2003) found that biological respiration (estimated by CO_2 production rates) in hydrocarbon-contaminated clay soil was very limited at TPH concentrations greater than 90,000 mg/kg. The study suggested that these hydrocarbon concentrations were lethal to microbial communities present, and that such a high hydrocarbon content potentially limits the oxygen permeability of the soils. If this option is selected for Patch Workshop, it would be prudent to exclude the soils with very high contamination (>50,000 TPH) from this treatment.

3.3.3 Biopiles

A biopile is one of the many bioremediation techniques, whereby the soil is piled over an air distribution system and aerated. The air distribution system can also be used to provide heat to the soil. However, heating the soil by forced air may cause excessive drying, which may inhibit microbial activity and promote volatilization of the hydrocarbons rather than their biodegradation.

One advantage of biopiles over landfarming is the segregated treatment of different types and concentrations of hydrocarbons, allowing for a staged meeting of remedial goals over the treatment timeframe. Treatment segregation according to chemical type and concentration also provides the option to change treatment strategy down the road for more recalcitrant hydrocarbon compounds, if required.

The other advantage offered by biopiles is that stockpiling soil reduces the rate of heat loss by increasing the volume/surface ratio, effectively extending the length of the treatment season. Some amendments increase biological hydrocarbon degradation to a degree that some heat is generated.

For a given volume of soils requiring treatment, biopiles also require less area than a landfarm, although they require engineering and entail higher construction/operation costs. Aeration can be forced or passive. Forced air generally reduces remedial timeframes but there is a requirement for a power supply. It is feasible to use wind energy to operate remediation equipment, as was done at the Saviktok former tank farm pad near the Hamlet of Tuktoyaktuk (Pouliot et al, 2004). A volume of 17,000 m^3 of hydrocarbon-impacted soils (diesel) was excavated and placed directly onto a treatment area where over 100 ventilation chimneys equipped with wind turbines were installed. This wind turbine-based aeration system produced a TPH removal efficiency of 85% over three treatment seasons (criterion of 2,500 mg/kg TPH).

3.4 EXCLUDED TECHNOLOGIES OR REMEDIAL STRATEGIES

Given the site-specific characteristics of the Windy Lake Camp and the Patch Workshop, some technologies have been excluded from the present discussion of viable remedial options for reasons related to high unit volume costs, requirements for large capital expenditures, lack of convincing scientific evidence/case studies to demonstrate viability, lengthy remedial timeframes, high energy or water use, or anticipated permitting difficulties. However, should conditions change, these options may be viable remedial options to consider in the future.

3.4.1 Surfactant Soil Washing

Soil washing involves an on-site set-up to agitate soils in a surfactant solution (or water) to remove PHCs. Soil washing can be less time-consuming than bioremediation and natural treatment systems, such as natural attenuation, which are largely affected by climatic factors. It is based on desorption of hydrocarbons from contaminated soils through the action of water or organic non-ionic or anionic surfactants. Surfactants can increase hydrocarbon solubility; however, remediation success is highly depended on the type of hydrocarbon contamination, the degree of hydrocarbon weathering, and the type of surfactant selected.

A major disadvantage of this technology is that the chemical inputs can disrupt soil properties and nutrient cycling. The technology produces a liquid stream that that must be treated separately. The resulting treated soil typically requires dewatering prior to backfilling, as it has little to no bearing strength post-treatment. The requirement for dewatering typically means that it is not suited to soils with any significant silt or clay content. The technology also has large manpower and energy requirements. For all of these reasons, it is not considered to be a suitable remediation option for the Windy Lake Camp and Patch Workshop sites.

An existing related technology is soil washing followed by chemical oxidation, although scientific studies have not proven or verified the effectiveness of this type of treatment train (Tsai et al, 2009).

3.4.2 In Situ Bioventing

An in situ treatment system vertical aeration wells installed in the undisturbed soil would also not be suitable to either the Windy Lake Camp or the Patch Workshop, owing to the silt/clay content of the soils, as well as shallow depth of soils in the active layers. Both characteristics limit the horizontal radius of influence of such an engineered system. Also, given the potential and concerns related to solifluction, the introduction of heat to the subsurface would not be recommended.

3.4.3 Monitored Natural Attenuation

Monitored natural attenuation may not be an appropriate management option because the rate of natural degradation is extremely low, while the concentrations at the Patch Workshop facility are very high (based on the analytical results of the Phase 2 ESA). In this case, the remediation timeframe is overly protracted, and for this reason, EBA does not recommend natural attenuation.

3.4.4 On-Site Disposal Facility

The Government of Nunavut suggests the selection of permanent remediation strategies as opposed to ones requiring long-term management and monitoring. An on-site facility is an ongoing environmental liability to all stakeholders. For this reason, and also because hydrocarbon impacts are generally amenable to chemical or biological treatment, EBA has not considered the option of an on-site disposal facility.

4.0 DISCUSSION AND REMEDIAL COSTS

In general, the soil remediation technology selected must be cost effective, adaptable to harsh climate and remote conditions, meet regulatory standards and remedial timeframes, require minimal supervision and maintenance, and be acceptable to the site stakeholders.

There are also varying degrees of risk and uncertainty associated with each proposed remedial option, such as the probability of remedial success, the potential to mobilize chemicals of concerns or cause harmful permafrost thawing, prospects of stakeholder acceptance, and the accuracy of forecasting remedial costs.

A summary of proposed viable remediation options, risks and anticipated conceptual costs (-15% to +30%) for both sites is provided on Table 7. The assumptions of the cost estimate are provided. The estimates do not include backfilling or material costs for supplementary backfill (if required), re-vegetation or other appropriate measures to reclaim the remediated areas. Landfilling or off-site costs for metals-impacted soils is not included. Contaminated soil volumes were assumed to be 1,000 m^3 at Windy Camp based on a revised soil F2 hydrocarbon criteria. Since the actual soil volume at Patch Workshop is uncertain, soil volumes were not revised at Patch Workshop for cost estimating purposes, and it is assumed that as much as 3,400 m^3 of soils could be used as intermediate fill at the Doris Camp landfill. It is not possible to accurately report the volume of F3-F4 versus

F3-F4 soils co-contaminated with F2, although this has been estimated to be 1,700m^3 each for cost estimating purposes.

Equipment rates were based on information provided in the Appendices to the Hope Bay Project Windy Camp Final Closure Plan (2009) by SRK Consulting (SRK, 2009a). The costs for some remedial options involving the input of nutrients (landfarming, in-situ biodegradation) could be reduced or eliminated by using chemicals or waste streams already available on the project site, such as ammonium nitrate. In addition to its benefit as a source of nitrogen, hydrating ammonium nitrate is an endothermic process: a beneficial characteristic when avoidance of permafrost thaw is desirable. Another potentially useful and no-cost source of nutrients for bioremediation is treated camp sewage, depending on effluent quality.

Based on the literature review provided in Table 6 and the cost estimates provided in Table 7, a probable range of remedial cost for Windy Camp hydrocarbon soil remediation is between $150,000 and $200,000, with a remedial timeframe of one to three seasons. Patch Workshop remediation would cost approximately $300,000 for either the landfilling or the biopile option, with the landfilling option being the fastest and the most certain to achieve remedial goals. Landfarming, chemical oxidation, and oxygen-release compound bioremediation would be the most expensive and most protracted remedial options, with the highest uncertainly in attaining remedial goals.

EBA makes the following additional comments as to the remedial options for the Patch Workshop and Windy Lake Camp:

Windy Lake Camp:

- There is a risk of permafrost degradation if an ex-situ remediation option is selected, although the areas requiring remediation are not within the identified areas of solufluction near shore.
- It is preferable that the soil excavations be backfilled as soon as possible to avoid harmful permafrost degradation.
- Given the diesel-range hydrocarbon fraction present and relatively low concentrations, remediation of the Windy Lake Camp using chemical or biological treatment is a reasonable goal that could be achieved in a relatively short timeframe (one to three seasons, depending on the remediation option selected).
- Bioremediation by landfarming is the lowest cost option and it entails low risk because the site soils should not require much remediation to achieve the remedial objectives indicated in Table 5 (1,100 mg/kg to 1,900 mg/kg F2 fraction to be reduced to 800 mg/kg). There is a risk that the soils may not respond well to aerobic bioremediation because of anaerobic site conditions; however even if bioremediation is not successful, regular tilling would volatilize the F2 hydrocarbons to the remedial objective.

- If it is preferable to stage the reclamation of the Windy Camp Site by demolishing/removing the infrastructure in 2011 and conducting soil remediation in 2012, it would be possible to conduct a simple and cost-effective in-situ trial of selected amendments in 2011 (no soil disturbance except scarifying the top layer). In this case EBA would suggest amendments be selected to evaluate the both the potential for anaerobic and aerobic biodegradation in-situ. Anaerobic biodegradation in the Arctic is poorly understood but holds promise, and the trial would constitute valuable original research.
- Some affected areas of Windy Camp have no or very little laboratory soil hydrocarbon data to delineate soil volumes. Careful soil volume estimates are less critical in this case, since if it is found that the capacity of the treatment area is insufficient to handle all the soils within one season, remediation may be continued the following season, as long as there is no risk to the lake receptor.
- It is possible that the new all-weather road was constructed overtop an area that has F2 hydrocarbon concentrations higher than the recommended remedial objectives.

Patch Workshop:

- Because the site is located on a bedrock outcrop, there is a lower risk of harmful permafrost degradation if an ex situ remediation option is selected.
- F3-F4 hydrocarbon-impacted soils could be used as intermediate fill in the Camp Doris landfill intended for demolition wastes from Windy Camp. With stakeholder acceptance, this option offers the lowest cost, the lowest risk, and the shortest remedial timeframe.
- For this option to be viable, a suitable transport route must be available for hauling soils. EBA understands that an all-weather road is currently under construction to Windy Lake Camp. A winter road or temporary all-weather road from Patch Workshop to the all-weather road to Doris Camp would be required to implement this remedial option.
- The Phase 2 ESA suggested that some soils only had the F3 and F4 hydrocarbon fractions, while other areas contained F2 as well as these heavier fractions. F3 and F4 soils co-contaminated with F2 could be landfarmed on-site to reduce the F2 fraction to less than the F2 remedial guideline (800 mg/kg) before disposing of the soils in the approved disposal location.
- Completing a Phase 3 ESA would determine the volumes and types of soil hydrocarbon impacts. However, F2 co-contamination in site soils could be identified the field using rapid, cost-effective screening methods, such as a total petroleum test (i.e., PetroFLAG® Hydrocarbon Test Kit for Soil) in conjunction with photoionization detector readings. This would be straightforward way of segregating F3 and F4 soils suitable for landfilling from the F3 and F4 soils co-contaminated with F2 hydrocarbon fraction that would require pre-treatment prior to landfilling.

- A very large estimated hydrocarbon-affected soil volume (3,400 m^3) was based on a relatively small number of soil samples. Because there is a large uncertainty associated with the soil volume, there is a corresponding large uncertainty with the estimated remediation cost. Improved delineation of F3-F4 hydrocarbon-impacted soils to refine contaminated soil volume estimates would be prudent if the landfilling option is chosen, since this option is equipment-intensive.
- The extraordinarily high F3 hydrocarbon concentrations (50,000 mg/kg to 260,000 mg/kg) recorded at some locations during the Phase 2 ESA are likely not representative of the bulk of the estimated contaminated soil volume (3,400 m^3). If bioremediation is chosen as the preferred option to reduce project risks, EBA suggests excluding for landfilling or off-site disposal all soils with a TPH concentration of more than 50,000 mg/kg.
- In an Arctic setting, remedial timeframes for a bioremediation option is very uncertain in the case of F3-F4 soils, and would be considered a high-risk remedial option. There is a chance that bioremediation would not be a successful approach at all within a reasonable remediation timeframe (10 years), although this uncertainty could be addressed by a bioremediation treatability study to estimate the bioremediation kinetics and suitable amendments. If bioremediation is the selected remedial option, improved project certainty would be gained by obtaining a weighted average of hydrocarbon concentrations in the contaminated soil volume, as opposed to basing remedial design and timeframes on the highest concentration sample. Obtaining this detailed information would require a Phase 3 ESA.
- A field trial to determine optimal bioremediation options would reduce project uncertainty by allowing a site-specific remedial design for diesel-fuel range F2 fraction, and the F3-F4 fractions as well, should bioremediation be the preferred option.

5.0 RECOMMENDATIONS

EBA makes the following recommendations:

- Seek input and consensus from affected stakeholders including KIA to select the preferred remedial option(s) for both sites.

Windy Camp

- Delineate F2 hydrocarbon impacts in areas with limited or no hydrocarbon data.
- Collect site-specific information applicable to a bioremediation option, including soil type/texture, particle size analysis, soil moisture content and field capacity, soil organic carbon and other design parameters.
- Remediate F2 hydrocarbons to 800 mg/kg at locations further than 30 m from shore. Remediate F2 hydrocarbons to 330 mg/kg in areas within 30 m of the shore, if additional site characterization identifies such soils.

- Coordinate remedial activities with the proposed demolition of the site facilities such that one activity does not hinder or interfere with the other.
- Conduct groundwater monitoring in 2011.

Patch Workshop

- Conduct field screening combined with laboratory analyses to refine the hydrocarbon-affected soil volumes at Patch Workshop as well as determine the volume of soils contaminated with lube oils co-contaminated with lighter F2 hydrocarbons.
- Remediate F2 hydrocarbons to 800 mg/kg. Dispose of site soils as intermediate fill in the landfill, with stakeholder approval. Reclaim site as per the Water License requirements and other relevant permits.
- Conduct groundwater monitoring in 2011.

6.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Newmont Mining Corporation and their agents. EBA does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than Newmont Mining Corporation, or for any project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in EBA's Services Agreement and in the General Conditions provided in Appendix A of this report.

7.0 CLOSURE

We trust this report meets your present requirements. Should you have any questions or comments, please contact the undersigned directly.

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TABLES

TABLE 6: CASE STUDIES OF REMEDIATION OPTIONS IN POLAR REGIONS WITH ADVANTAGES AND DISADVANTAGES

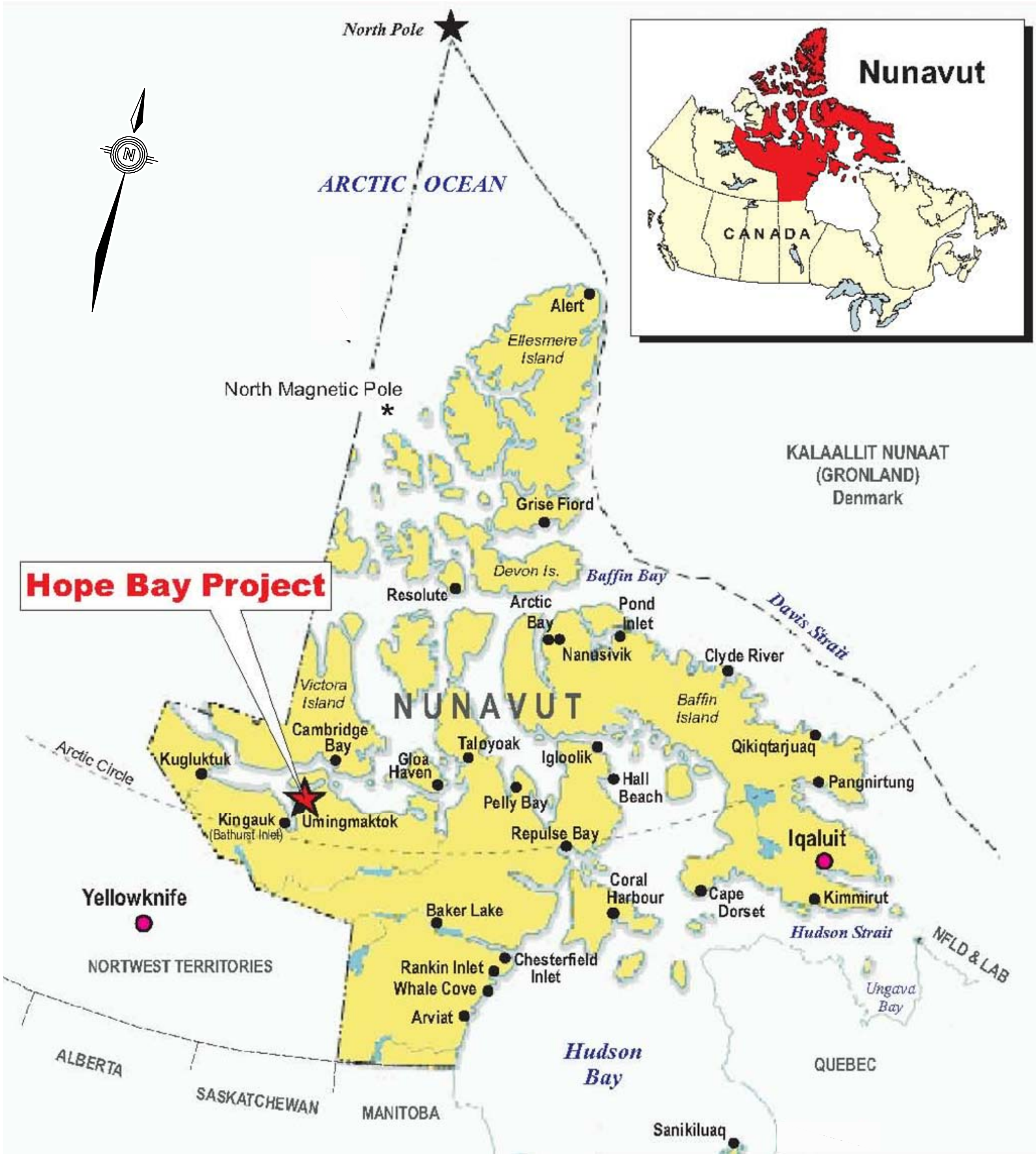
Treatment Option	Description	Case Study	Advantages	Disadvantages	Remediation Timeframe	Location	Lat.	Long.	Site Conditions	References
Landfarming/ biostimulation	Application of fertilizers (N, K and P), irrigation, and soil tilling.	TPH in soil reduced from 62,000 mg/kg to 280 mg/kg. Landfarm was built on a liner, leachate was recirculated for surface irrigation and for fertilization.	Very simple landfarming operation was successful at achieving remedial goals . Nutrient and oxygen addition achieved by infiltration gallery.	Relatively southern site. Saturated areas demonstrated relatively poor biodegradation rates.	70 days	Fairbanks, AK	64.8 N		Fairbanks International Airport CFR training site - generally underlain by grave that was 2 to 3 feet (0.5 to 1 m) thick. Other portions of the area were underlain by silt, sandy silt, sand, and silty sand.	Reynolds, C.M., Travis, M.D., Braley, W.A. and Scholze, R.J. (1994.) Applying field-experiment bioreactors and landfarming in Alaskan climates. In: Hinchee, R.E., Alleman, B.C., Hoeppel, R.E. and Miller, R.N., Editors. 1994. Hydrocarbon Bioremediation, Lewis Publishers, Boca Raton. pp. 100–106.
	Nutrient addition, pH adjustment, and tilling.	Acidic and N-deficient site soils contained indigenous populations of hydrocarbon-degrading microorganisms. Biostimulation with nitrogen and phosphorus nutrient amendments to achieve CTPH:N:P molar ratio of 100:9:1, and $CaCO_3$ amendment at 2,000 mg /kg for maintaining neutral pH, and periodic 10-day tilling, reduced total petroleum hydrocarbon (TPH) concentrations by up to 64% over a 60-day period. Residual TPH concentration was 500 mg/kg, and was predominantly associated with the 0.6 to 2.0 mm particle size fraction.	F2 and F3 hydrocarbon fractions biodegraded concurrently.	Possibly limited biodegradation of F3 fraction.	60 days	Resolution Island, NU	61°30' N	65°00'W	Sand and gravel (2.0 to 4.75 mm) 39% wt. , medium sand (0.6 to 2.0 mm) 59% wt, fine (0.075 to 0.6 mm) : 2% wt. organic content 2.4%, soil pH 4.3. Water content 11%.	Wonjae Chang, Michael Dyen, Lou Spagnuolo, Philippe Simon, Lyle Whyte, Subhasis Ghoshal, Biodegradation of semi- and non-volatile petroleum hydrocarbons in aged, contaminated soils from a sub-Arctic site: Laboratory pilot-scale experiments at site temperatures, Chemosphere, Volume 80, Issue 3, June 2010, Pages 319-326
	Pilot study of four plots: control plot, aerated daily, aerated every four days, and fertilizer added and aerated every four days.	Initial TPH 2,800 ppm, final was 200 ppm (decrease of 90%) in the fertilized plot that was tilled every four days. Reduction was 80% on the plot that had three years of tilling alone. Aeration appears the preferred management solution for cold soil temperatures.	As long as contaminants do not migrate and remediation time required is on the order of three to five years, aeration may be a good, cost-effective approach that minimizes site disturbance.	Long remediation timeframe. Much of the remediation achieved may be due to volatilization alone.	3 years	Resolution Island, NU	61°30' N	65°00'W	Sand and gravel, 10% particles < 75 um. Low plasticity, soil pH 5.8, organic content 1.1%	K. Paudyn, A. Rutter, R. Kerry Rowe and J.S. Poland, Remediation of hydrocarbon contaminated soils in the Canadian Arctic by landfarming, Cold Reg. Sci. Technol. 53 (2008). pp. 102–114.
	Landfarming, nutrient addition and tilling.	Landfarming operation included additions of nitrogen and phosphorus and an aggressive schedule of soil tilling. Moderate contamination of hydrocarbon can be effectively and economically remediated within a reasonable timeframe using landfarming.	Very simple landfarming operation was successful at achieving remedial goals (500 mg/kg TPH) TPH reduced from ~1,400 mg/kg to ~430 mg/kg. Remedation optimized adding 100 mg/kg N and 45 mg/kg P.	Too much fertilizer will inhibit microbial activity. Difficult to optimize hydrocarbon reduction schemes using ex-situ techniques because of inability to distinguish between abiotic and biodegradation losses.	55 days	Barrow, AK	71.3 N		Pad of coarse sand and gravel. Spill of JP-5 aviation fuel spill. Depth to tundra about 1.5 m below grade. Average monthly temperatures 1.3°C to 4.9 °C during June, July, and August. Application of a commercial fertilizer mix at a rate designed to approach soil concentrations of 100 mg N/kg soil and 50 mg P/kg soil, and an aggressive schedule of soil tilling using heavy equipment that was readily available from a local source. The operation was designed to continue through the brief thaw season.	McCarthy K, Walker, L., Vigoren, L., Bartel, J. 2004. Remediation of spilled petroleum hydrocarbons by in situ landfarming at an arctic site. Cold Regions Science and Technology. Volume 40. Issues 1-2. Dated November 2004. Pp. 31-39
Biopile with biostimulation	The experiment consisted of six small-scale biopiles, three inoculated with a hydrocarbon-degrading enrichment culture (live bacterial culture) and three control un-inoculated biopiles. The biopile size was approximately 1.0 m diameter × 0.5 m height, with a volume of soil of approximately 0.5 m^3. Inoculation with a high concentration of hydrocarbon degraders did not enhance either the rate or the final extent of TPH removal.	The fertilizers used were granular urea (46%) and diammonium phosphate (18% N, 46% P2O5). Urea and diammonium phosphate were used at concentrations of 1.04 kg and 0.14 kg, respectively, per cubic metre of hydrocarbon-contaminated soil. A surfactant (Biosolve, Westford Chemical) was added according to the manufacturer's recommendation at a final concentration of 1.25 l/m^3 of soil. Gro Brix (Gro Brix Distributors, Mississauga, Ont.), a cocoa-fiber bulking agent, was added to increase airflow and porosity of the soil. Hydrated Gro Brix was used at a ratio of 10% (vol/vol). The original source of the enrichment culture inoculum was soil from Alert, and the culture was grown on jet fuel at 7 °C.	Biopies designed to optimize factors potentially limiting hydrocarbon degradation. Inoculum demonstrated to be unlikely to cause environmental harm by disrupting natural soil communities.	Inoculum not found to enhance either the rate or final extent of petroleum biodegradation. Regulatory difficulties in using active bacterial cultures to enhance bioremediation. Treatment efficacy not demonstrated. Inoculum difficult and expensive to procure. Surfactants used but no evidence that they enhanced bioremediation.	65 days	Alert, on northeastern tip of Ellesmere Island, Nunavut	82°30'N,	62°20'W	Reduction of 85% in TPH (500 mg/kg). The fuel spilled appeared to be either Arctic diesel or jet fuel (10- to 18- carbon alkenes). Initial average contamination level of weathered total petroleum hydrocarbons (TPH) of 3,000 mg/kg of dry soil. The soil had a composition of 36.6% sand, 49.3% silt and 14.1% clay. Total organic carbon was 3.77%. Soil pH was 7.2, and the water content was 13%.	Thomassin-Lacroix, E., Eriksson, M., Reimer, K., & Mohn, W. (2002). Biostimulation and bioaugmentation for on-site treatment of weathered diesel fuel in arctic soil. Applied Microbiology and Biotechnology, 59(4-5). Pp. 551-556.

TABLE 6: CASE STUDIES OF REMEDIATION OPTIONS IN POLAR REGIONS WITH ADVANTAGES AND DISADVANTAGES

Treatment Option	Description	Case Study	Advantages	Disadvantages	Remediation Timeframe	Location	Lat.	Long.	Site Conditions	References
Biopile with heating	Active warming and biostimulation (fertilizer addition) of a biopile. The combination of insulation, the engineered heat mat and power utility optimization extended the period of annual treatment.	In situ/ex-situ biopile constructed. Affected tundra soil was mixed with gravel to form a blended biopile 49.0 m long, 40.0 m wide, and 2.4 m deep. Thermal insulation systems were developed and applied to insulate the biovented soil plume and extend the annual effective season of treatment. The project incorporated thermal insulation system (TIS) stress-strain analysis, two-dimensional thermal modeling of the contaminated soil volume, and monitoring and evaluation of subsurface soil gases, temperatures and microbiology.	Heating extends the treatment season and shortens the remediation timeframe. Capital cost reduced when using a thicker insulation layer and increased spacing of heating elements. Active warming of biopile was found to be cost-effective for this project.	Requires significant energy input.	22 months	Prudhoe Bay, AK	70°19'N	148°42'W	252 to 11,000 mg/kg gasoline and diesel fuel. with average of 2,000 mg/kg. Thermal envelope of 1.5 °C to 6.5 °C maintained.	Dennis M.Filler, Jon E. Lindstrom, Joan F. Braddock, Ronald A. Johnson, Royce Nickalaski, Integral biopile components for successful bioremediation in the Arctic, Cold Regions Science and Technology, Volume 32, Issues 2-3, September 2001, Pp. 143-156
Heated and humidified biopile	Field trial of using warm, moisture-laden air to enhance biodegradation in a biopile.	Three 4.0 m^3 biopiles were constructed. One biopile was heated with an aerating/heating system previously tested in the Arctic. A second biopile was also aerated and heated but received water by humidifying the air prior to entering the soil pile. A third biopile was passively aerated by pipes protruding from the soil pile. The humidified system maintained optimal soil moisture content and produced significantly lower final TPH than the other two treatments (~300 mg/kg dry weight).	Humidified biopile (optimum moisture content) produced best results. Heating the soil ion a biopile could enhance bioremediation, since laboratory studies have shown increased biodegradation rates in Arctic soils with increasing soil temperature.	Requires significant energy input and engineering design.	10 months	Kingston, Ontario			Field-scale experiments. Gravel: 5%, sand: 20%, silt/clay: 15 % TPH: 1,000 mg/kg, organic fraction 1.1%. Soil freshly contaminated with diesel fuel (initial total petroleum hydrocarbon concentration, [TPH] up to 11,000 mg/kg dry weight,	Sanscartier, D., Zeeb, B., Koch, I., Reimer, K., 2009b. Bioremediation of diesel contaminated soil by heated and humidified biopile system in cold climates .Cold Reg. Sci. Technol. 55, 167–173.
Wind-powered biopile	Wind-powered biopile remediation of a large tankfarm that supplied diesel fuel to some of the radar stations forming the Distant Early Warning (DEW) line in the Canadian Western Arctic.	A wind-powered biopile system was used to treat ~17,000 m^3 of PHC-contaminated soil at Savitok Point, North West Territories. Concentrations were reduced from ~7,000 to 800 mg/kg over a two year period (project completed by Biogenie).	Advantage taken of the prevailing windy conditions. Heat generated by microbes contributed to treatment. TPH removal efficiency of 85%n over three treatment seasons.	Very-site specific application based on prior treatability study and good characterization of the site.	24 months	Savitok Point, located on the eastern edge of the Mackenzie River Delta, near the Hamlet of Tuktoyaktuk (NT).	69°26'N	133°00'W	Dense granular fill (pad) consisting of sand, silt some clay, stones cobbles and small boulders. Well-drained, 140 mm precipitation, permafrost at 2 m below ground on pad, and a m below ground in tundra. Average temperature during summer months is 10°C	Pouliot, Y, Pokiak C., Moreau, N, Thomassin-Lacroix, E. and Faucher, C. 2004. Remediation of a Former Tank Farm Site in Western Arctic Canada. Remtech 2004 Conference Proceedings, Banff Springs, Alberta.
Soil washing followed by Fenton's reagent	Soil washing technology is the desorption of pollutants from contaminated soils through the action of water or organic surfactants (onionic or anionic).	No full-scale implementation found for polar regions. In laboratory studies the most influential parameters on oil removal were surfactant concentration and washing temperature. The soil caution exchange capacity and pH also influenced the removal of petroleum from the individual soils.	May be suitable for treating soils with high TPH. Less time involved compared with bioremediation and natural treatment systems, which are largely affected by climatic factors.	Site soils appear to have considerable silt and clay content, which makes dewatering the treated soils difficult. Fentons reagent is strongly exothermic. High safety concerns with the handling and transport of caustic chemicals. Post-remedial soil pH adjustment required. May liberate and solubilize naturally-occurring metals. Technology not proven/verified. Weathered contaminated soil may be more tightly bound to soil particles than laboratory experiments conducted with freshly-prepared contaminated soil.	Days to weeks	n/a	n/a	n/a	Sandy loam texture 60% sand, 35% silt, and 5% clay extractable iron and amorphous iron in soil were 22.3 g/kg and 3.5 g/kg. Initial soil TPH concentration was 4,950 mg/kg, dropped to 1,683 mg/kg.	T. T. Tsai, C. M. Kao, Rao Y. Surampalli, and S. H. Liang (2009). Treatment of Fuel-Oil Contaminated Soils by Biodegradable Surfactant Washing Followed by Fenton-Like Oxidation. , J. Envir. Engrg. 135, 1015 (2009), DOI:10.1061/(ASCE)EE.1943-7870.0000052
In situ chemical oxidation	Introduce reactive chemicals directly into contaminated soils, or other media to oxidize organic contaminants to carbon dioxide and water, or transform them to other environmentally harmless compounds, such as inorganic salts.	Two field trials that were undertaken to evaluate the feasibility of using a surface application of these oxidative treatments (Fenton's reagent, hydrogen peroxide and sodium hypochlorite) to remediate petroleum contaminated soil at Old Casey Station, East Antarctica. The near complete destruction of subsurface microbiota, coupled with a discolored orange soil residue and soil heating, caused the authors to prefer more environmentally sensitive techniques such as bioremediation. Fenton's reagent and hydrogen peroxide not found to decrease hydrocarbon concentrations. The soil temperatures before and after the addition of the oxidative treatments changed with the application of Fenton's reagent, where surface soil temperatures increased from about 8°C before treatment to between 35°C and 60°C.	Fast-acting and complete contaminant removal. Incomplete mineralization may produce other hydrocarbon products, but these shorter chain compounds may be more easily biodegradable.	With surface application, the infiltration and dispersion of reactive chemicals is critical. Hydroxyl radicals are quickly consumed close to the point of chemical application making it difficult to deliver the oxidants to the contaminant in situ. Reactions are exothermic and may melt the permafrost and cause contaminate migration /soil-fluction. Changes in pH may liberate and mobilize naturally-occurring metals. Requires soil pH adjustment post-treatment. May sterilize the soil for years following treatment. Incomplete mineralization may produce other toxic hydrocarbon end-products.	36 days, then sampled again three years later	Old Casey Station East Antarctica	66°17'S	110°110'E	Main contaminant was SAB diesel fuel, a light diesel designed for use in cold climates. Concentrations up to 47,631 mg/kg TPH to a depth of up to 1 m. Soil moisture approximately 9%. Poorly developed soils and aggregates.	Ferguson, S. H., Woinarski, A. Z., Snape, I., Morris, C. E., and Revill, A. T. 2004 . "A field trial of in situ chemical oxidation to remediate long-term diesel contaminated Antarctic soil." Cold Regions Sci. Technol. Pp. 40, 47–60.

TABLE 7: CONCEPTUAL COST ESTIMATE (-15% to +30%) FOR VIABLE REMEDIATION OPTIONS							
	Assumptions	Treatment Land Required	Estimated Remedial Timeframe	Confidence in Remedial Timeframe Estimate	Cost Estimate ($)	Effect of Project Unknowns on Cost Estimate	Chemical Inputs Required
Windy Camp							
Ex situ landfarming	Site characterization, remediation and confirmatory sampling in 2011. All affected soils excavated and treated in one season. Soils to be remediated are maximum 1,000 m^3. Construction of a landfarm, operation, and decommissioning. Tilling once per week until remedial objective achieved. Decommission groundwater monitoring wells in 2011.	2,000 m^2	Three months	High	$140,000 - $210,000	Low	Low
In situ aerobic biodegradation	Site characterization and field trial in 2011 Remediation start in 2012 and confirmatory soil sampling in 2015 (note: remedial objective may be achieved earlier). Two additional years of groundwater monitoring, then decommission wells in 2017.	None	Three seasons	Medium	$170,000 - $260,000	Low to moderate	Moderate
In situ anaerobic biodegradation	Site characterization and field trial in 2011 Remediation start in 2012 and confirmatory soil sampling in 2015 (note: remedial objective may be achieved earlier). Two additional years of groundwater monitoring, then decommission wells in 2017.	None	Three seasons	Medium	$165,000 - $250,000	Low to moderate	Low to Moderate
Patch Workshop							
Dig and haul with landfarm pre-treatment of F2 co-contaminated soils	Site characterization, construction of a landfarm and start remediation in 2011. Total contaminated soil volume is 3,400 m^3. 1,700 m3 of F3-F4 soils is co-contaminated with F2 (and requires landfilling prior to disposal). All affected soils excavated in 2011, and either landfilled or treated within one season. Operation in 2011,and decommissioning in 2012. Tilling one time per week until remedial objective(s) met. Nutrient/water addition assumed one time per month for two seasons. Decommission landfarm and groundwater monitoring wells in 2012.	3,000 m^3	Two seasons	High	$330,000 - $510,000	Low	Low
Ex situ chemical oxidation	Site characterization and field trial in 2011 Remediation start in 2012 and confirmatory sampling in 2015. Removal for off-site disposal of highly-contaminated soils. Three seasons of chemical inputs, add chemicals two times per year. Water soils three times per season. Two additional years of groundwater monitoring, then decommission wells.	5,000 m^3	Three seasons	Low	$850,000 - $1,300,000	High	High
Ex situ oxygen release compounds	Site characterization and field trial in 2011 Remediation start in 2012 and confirmatory sampling in 2015. Removal for off-site disposal of highly-contaminated soils. Three seasons of chemical inputs, add chemicals three times per year. Water soils six times per season. Two additional years of groundwater monitoring, then decommission wells.	5,000 m^3	Five seasons	Low	$700,000 - $850,000	High	High
Ex situ landfarm to treat all soils	Site characterization and landfarm construction in 2011. Assumes total contaminated soil volume is 3,400 m^3. Affected soils excavated and landfarmed according to severity of contamination. Removal for landfill/off-site disposal of highly-contaminated soils. Operation for eight years then decommissioning. Tilling once per two weeks until remedial objective achieved. Chemical inputs three times per season. Watering as required, assumed once per month. Chemical analysis of soils once per month, three months per year. Decommissioning of landfarm and backfilling soils in at end of 2018.	7,000 m^3	Eight seasons	Low	$530,000 - $815,000	High	Moderate
Biopile	Site characterization and biopile engineering/ construction in 2011. Removal for landfill/off-site disposal of highly-contaminated soils. Assumes wind power, no generator. Operation for three years then decommissioning. Tilling once per two weeks until remedial objective achieved. Chemical inputs three times per season. Watering as required, assumed once per month. Chemical analysis of soils once per month, three months per year. Decommissioning of biopile and backfilling soils in at end of 2013.	1,000 m^3	Three seasons	Medium to High	$280,000 - $430,000	Low	Low

FIGURES



NOTE: BASE DRAWING FROM ROSCOE POSTLE ASSOCIATES INC.

CLIENT

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Scale: 1: 20 000 (metres)

EVALUATION OF RISK & REMEDIAL OPTIONS FOR CONTAMINATED SOIL AT PATCH LAKE WORKSHOP & WINDY LAKE CAMP HOPE BAY GOLD PROJECT, NUNAVUT

HOPE BAY PROJECT LOCATION

PROJECT NO.	DWN	CKD	REV
Y22101187	TK	DF	0
OFFICE	DATE		
EDM	October 15, 2010		

Figure 1

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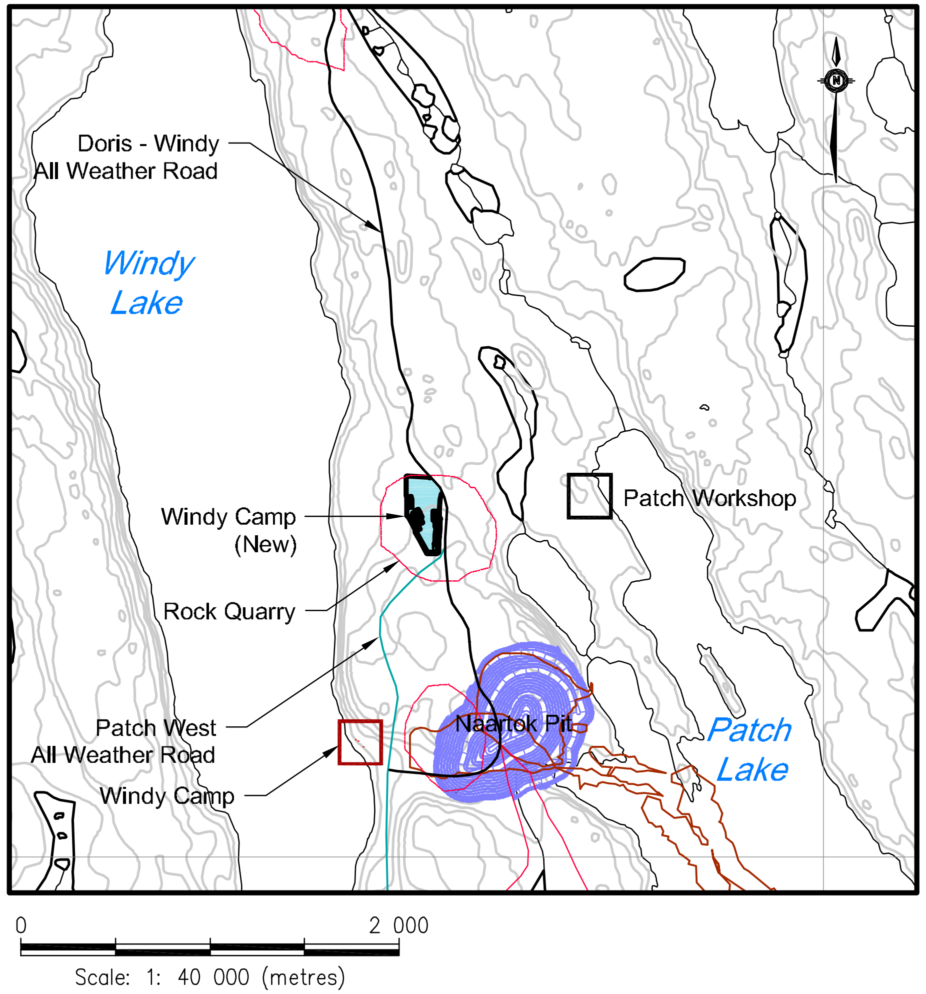
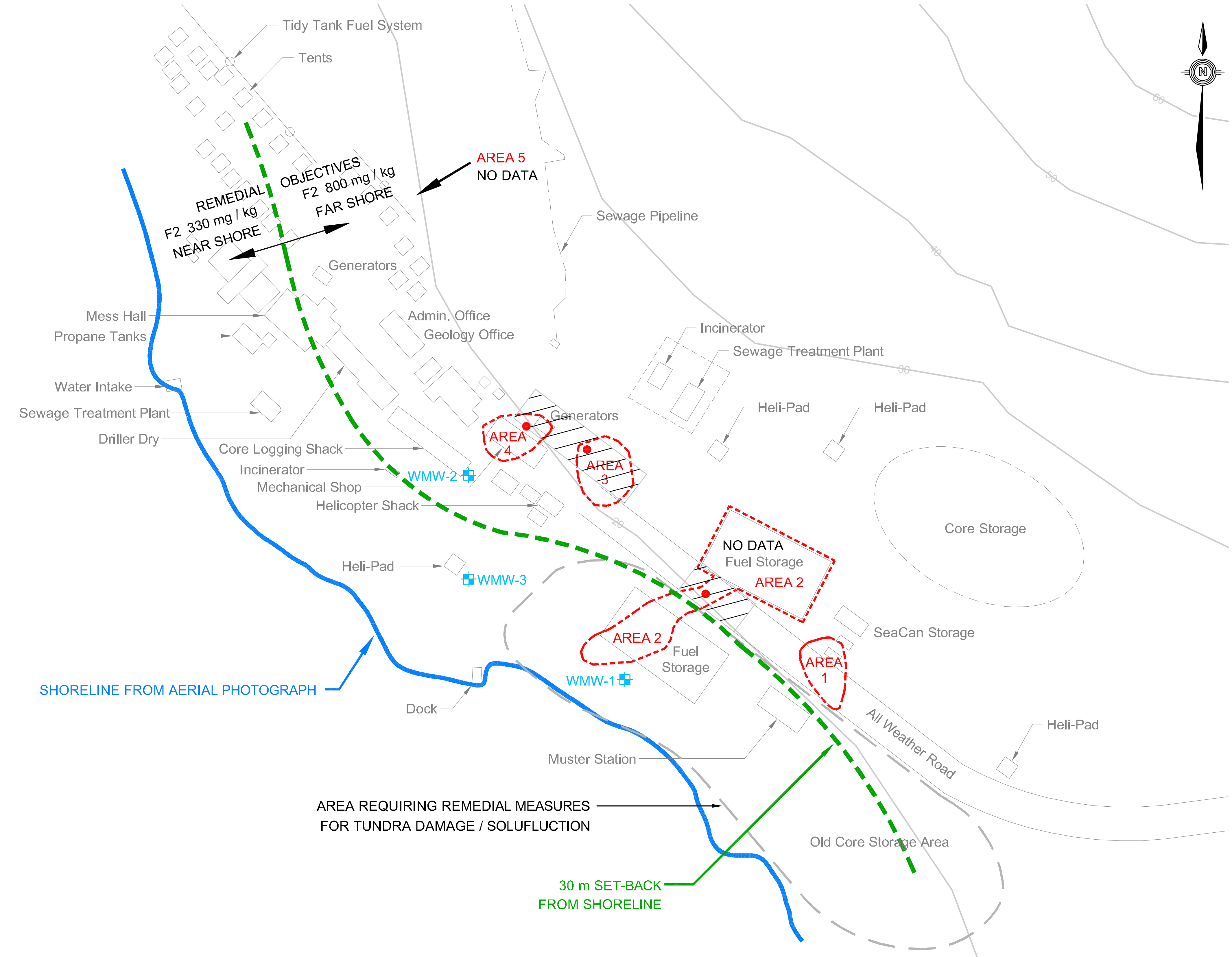


KEY MAP



NOTES:

1. Hydrocarbon Impacted Areas based on Phase II Environmental Site Assessment (WESA, 2009)
2. Delineation was based on limited soil data. Actual impacted soil volumes may differ.
3. Facility locations are approximate.
4. Facilities are slated for demolition.

0 50

Scale: 1: 1000 (metres)

Coordinate System: UTM NAD83, Zone 13

REFERENCE: Drawing Base - SKR Consulting, Stage 2 - Development Permit Site Plan, Project Number 1CH008.027, Drawing: DPSP-02, Dated: June 2010
Additional Information - SKR Consulting, Spill Contingency Plan, Project Number 1CH008.010-400, Figure 5, Dated: Aug 2009
Additional Information: WESA - Figures from Project Number Y-B7997 Report, October 2009

LEGEND:

- F2 PETROLEUM HYDROCARBON IMPACTED AREA IDENTIFIED BY WESA (F2> 150 mg / kg)
- SOILS REQUIRING REMEDIATION FOR F2 FRACTION, AREAS ARE APPROXIMATE
- SOIL F2 HYDROCARBONS GREATER THAN REMEDIAL OBJECTIVES
- MONITORING WELL LOCATION

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EVALUATION OF RISK & REMEDIAL OPTIONS FOR CONT SOIL AT PATCH LAKE WORKSHOP & WINDY LAKE CAMP HOPE BAY GOLD PROJECT, NUNAVUT

WINDY LAKE
SOIL HYDROCARBON IMPACTED AREAS

PROJECT NO.	DWN	CKD	REV
Y22101187	BR	DF	0
OFFICE	DATE		
EDM	October 2010		

Figure 2

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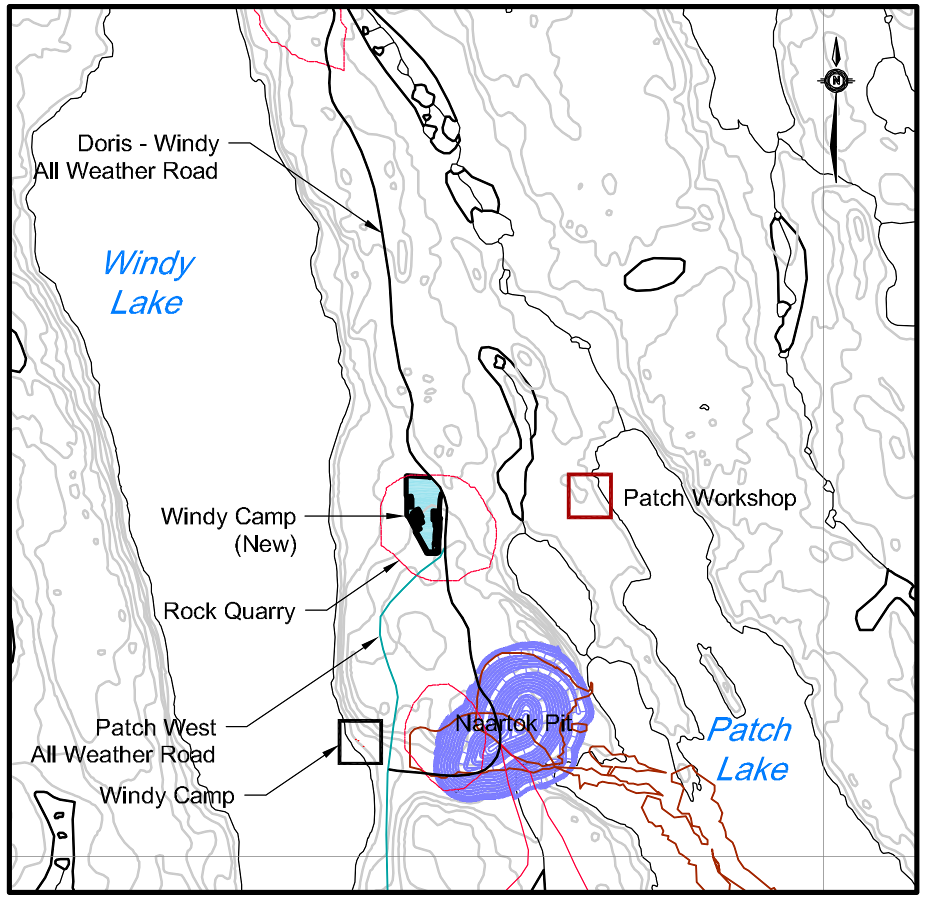

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Scale: 1: 40 000 (metres)

KEY MAP

REMEDIAL OBJECTIVES

F2 < 800 mg /kg
F3 < 10 300 mg /kg
F4 < 18 500 mg /kg
Total Petroleum Hydrocarbons < 30 000 mg / kg

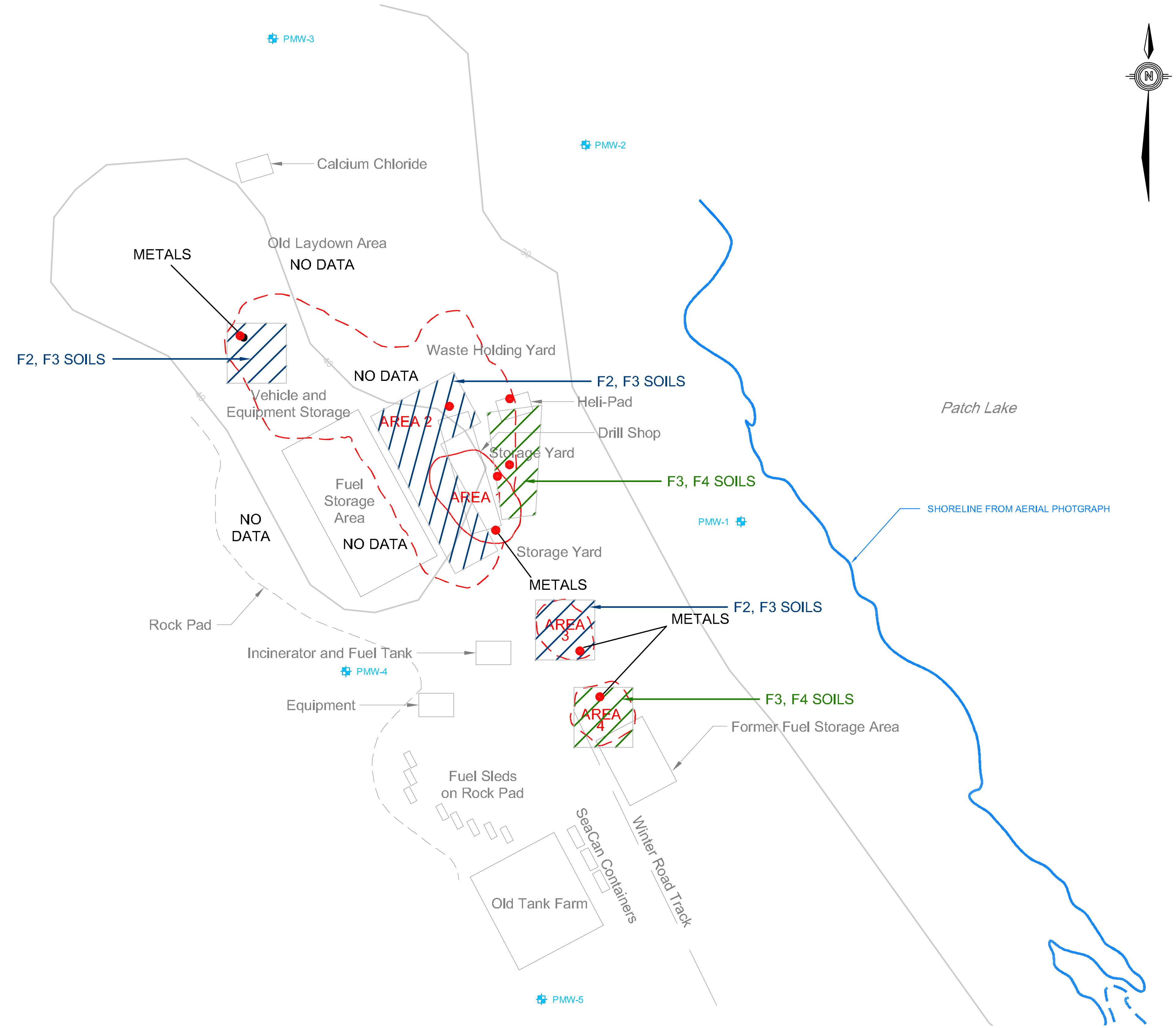
NOTES:

1. Hydrocarbon Impacted Areas based on Phase II Environmental Site Assessment (WESA, 2009)
2. Delineation was based on limited soil data. Actual impacted soil volumes may differ.
3. Facility locations are approximate.

0 50

Scale: 1: 1 500 (metres)

Coordinate System: UTM NAD83, Zone 13



LEGEND:

- PETROLEUM HYDROCARBON IMPACTED AREA IDENTIFIED BY WESA (2009)
- F2 and F3 SOIL PHC (REQUIRES TREATMENT PRIOR TO LANDFILLING), AREAS ARE APPROXIMATE
- F3 and F4 SOIL PHC (LANDFILL), AREAS ARE APPROXIMATE
- SOIL HYDROCARBONS GREATER THAN REMEDIAL OBJECTIVES
- MONITORING WELL LOCATION

REFERENCE: Drawing Base - SKR Consulting, Stage 2 - Development Permit Site Plan, Project Number 1CH008.027, Drawing: DPSP-02, Dated: June 2010
Additional Information - SKR Consulting, Spill Contingency Plan, Project Number 1CH008.010-300, Figure 4, Dated: Aug 2009
Additional Information: WESA - Figures from Project Number Y-B7997 Report, October 2009

CLIENT

NEWMONT

EBA Engineering Consultants Ltd.

EVALUATION OF RISK & REMEDIAL OPTIONS FOR CONT SOIL AT PATCH LAKE WORKSHOP & WINDY LAKE CAMP
HOPE BAY GOLD PROJECT, NUNAVUT

PATCH WORKSHOP
SOIL HYDROCARBON IMPACTED AREAS

PROJECT NO.	DWN	CKD	REV
Y22101187	BR	DF	0

OFFICE	DATE
EDM	October 2010

Figure 3

APPENDIX

APPENDIX A GEO-ENVIRONMENTAL REPORT – GENERAL CONDITIONS

GEO-ENVIRONMENTAL REPORT – GENERAL CONDITIONS

This report incorporates and is subject to these "General Conditions".

1.0 USE OF REPORT AND OWNERSHIP

This report pertains to a specific site, a specific development, and a specific scope of work. It is not applicable to any other sites.

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Appendix B.2
WESA 2009 - Phase II Environmental Site Assessment

2009

Hope Bay Gold Project: Phase II Environmental Site Assessment of Patch Lake Workshop, Windy Camp, and Boston Soil Treatment Area

Prepared for:

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WESA

A Better Environment For Business

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EXECUTIVE SUMMARY

Hope Bay Mining Limited (HBML) proposed to close out Patch Lake Workshop and Windy Camp and submitted Closure and Reclamation Plans to the Nunavut Water Board as required by Licence No. 2BE-HOP0712. The Closure and Reclamation Plans required characterization and delineation of all contaminated soils resulting from the mineral exploration; remediate contaminated soil to protect public health and the environment; and re-establish conditions to permit the land to return to a similar pre-exploration land use.

WESA Inc. was retained by SRK Consulting (Canada) Inc. on behalf of HBML to conduct a Phase II Environmental Site Assessment of hydrocarbon contamination of the Patch Lake and Windy Camp facilities, and Boston Soil Treatment Area. WESA completed the field program during August 12-17, 2009.

The Hope Bay project is located in the West Kitikmeot region of Nunavut approximately 135 km southwest of Cambridge Bay and 50 km east of Umingmaktok. It is centered at approximately 68º 09' N and 106º 40' W. There are facilities at several locations that extend from the head of Roberts Bay (an extension of Melville Sound) in the north to the Boston site located approximately 60 km to the south (SRK, 2009a).

At Patch Lake Facility (Figures 1 and 3), a total of fifty six (56) surface and shallow depth soil samples were collected and selected samples were analyzed for metals, F1-F4 Petroleum Hydrocarbons (PHCs), Benzene Toluene Ethylbenzene Xylenes (BTEX), Polycyclic Aromatic Hydrocarbons (PAHs), and Trichloroethylene (TCE). The primary contaminants of concern at the Patch Lake Facility are F2-F4 PHCs that are associated with fuel storage, work shop and lay down areas. Fifteen (15) soil samples exhibited PHC concentrations above the generic Canada-wide Standards for Residential and Parkland land use. Four (4) samples exceeded the Canadian Soil Quality Guidelines (R/P land use) for metals.

Five (5) groundwater samples were collected with select samples undergoing analysis for F1-F4 PHCs and BTEX. None of the samples exceeded the applicable criteria. The estimated volume of contaminated soil to be treated is presented in the following table.

Table A: Contaminated Soil Volume Estimate – Patch Lake Facility:

Area	Area of Impact	Volume of soil to be treated
1	Drill Workshop Area	600 m^3
2	North Laydown Area	2500 m^3
3	Incinerator Area	150 m^3
4	Former Tank Farm Site	150 m^3
	Total In-situ Volume Estimate	**3400 m^3**

1 – Assumes average depth of soil treatment of 1.0 m
2 – Assumes average depth of soil treatment of 0.5 m

At Windy Lake Camp (Figures 2 and 4), a total of thirty eight (38) surface and shallow depth soil samples were collected and selected samples were analyzed for metals, F1-F4 PHCs, BTEX, PAHs, and TCE. The primary contaminants of concern at the Windy Camp Facility are F2 PHCs that are associated with fuel storage and the lay down areas. Seven (7) soil samples exhibited PHC concentrations above the generic Canada-wide Standards for Residential and Parkland land use.

Three (3) groundwater samples were collected with select samples undergoing analysis for F1-F4 PHCs and BTEX. None of the samples exceeded the applicable criteria. The estimated volume of contaminated soil to be treated is presented in the following table.

Table B: Contaminated Soil Volume Estimate – Windy Lake Camp:

Area	Area of Impact	Volume of Soil to be Treated
1 & 2	Tank Farm Area & Downgradient[1]	1200 m^3
3	Downgradient of Helipad Area[1]	300 m^3
4	Workshop & Generator Building Area[1]	250 m^3
5	Camp Tent Frames Area[2]	250m^3
	Total In-situ Volume Estimate	**2000 m^3**

1 – Assumes average depth of soil treatment of 1.0 m
2 – Assumes average depth of soil treatment of 0.5 m

At Boston Soil Treatment Facility, a total of eleven (11) surface and shallow depth soil samples were collected and selected samples were analyzed for F2-F4 PHCs. The primary contaminants of concern at the Windy Lake Camp Facility are F2 and F3 PHCs. All eleven (11) soil samples exhibited PHC concentrations above the generic Canada-wide Standards for Residential and Parkland land use.

1.0 INTRODUCTION

1.1 BACKGROUND

Hope Bay Mining Limited (HBML) propose to progressively reclaim Patch Lake Workshop and Windy Camp facilities and submit updated Closure and Reclamation Plans to the Nunavut Water Board as required by Licence No. 2BE-HOP0712. The Closure and Reclamation Plans require characterization and delineation of all contaminated soils resulting from the mineral exploration; and the remediation of contaminated soil to protect human health and the environment.

WESA Inc. was retained by SRK Consulting (Canada) Inc. on behalf of HBML to conduct a Phase II Environmental Site Assessment of hydrocarbon contamination of the Patch Lake Workshop, Windy Camp, and Boston Soil Treatment Area. WESA completed the field program during August 12-17, 2009.

This report presents the results of the Phase II Environmental Site Assessment.

1.2 OBJECTIVES

The objectives for the Phase II Environmental Site Assessments of Patch Lake Workshop, Windy Camp, and Boston Soil Treatment Facility are as follows:

- Determine nature and extent of the hydrocarbon contaminated soils at the subject sites;
- Collect information necessary to establish site specific risk based remedial objectives for hydrocarbon impacted soils; and
- Collect information required to develop remedial options analysis; and to select best suitable remedial option for hydrocarbon impacted soils.

2.0 STUDY METHODOLOGY

The following tasks were completed in the performance of the Phase II ESA.

2.1.1 Health and Safety Plan

A comprehensive health and safety plan was prepared by WESA prior to implementation of the field program. This plan was reviewed by all WESA Project staff and field team prior to the commencement of the field program. The health and safety plan included information on risks specifically associated with work in the northern environment, such as black and grizzly bear dangers, cold weather issues, and chemical exposure.

2.1.2 Sampling Program

The sampling program for the subject sites consisted of the collection of soil and groundwater samples. Detailed descriptions of all samples collected at the site can be found in Appendix B – Sample Summary Sheets. A GPS unit was used to record the coordinates of the sample locations and key site features. Results of the sampling program are discussed in detail in Section 3.0 and are presented in Tables 1 to 6, immediately following the text.

A targeted approach was taken to selecting sampling locations based on the site infrastructure present on the sites, contaminants of concern, potential contaminant pathways, presence of potential receptors as well as similarities and differences to other samples collected at the Project sites.

Sample sites were excavated using hand soil auger, motorized auger and shovel. Soil samples were placed in clean, pre-labelled containers and were stored in coolers and delivered to ALS Laboratory Group in Yellowknife, Northwest Territories. Samples for chemical analysis were kept cool during shipment with ice packs except for the bulk samples. Strict chain-of-custody procedures were followed for all samples.

2.2 ASSESSMENT GUIDELINES

Due to the mineral exploration related activities and the fuel use and/or storage on the subject sites, the potential contaminants of concern (PCOCs) at the site were determined to be:

- Metals (natural background soil concentrations of some metals are known to be elevated at the subject sites);
- PHCs/TPH (petroleum hydrocarbons/total petroleum hydrocarbons); and
- BTEX (benzene, toluene, ethylbenzene and xylenes – volatile organic compounds found in some fuel products).

In order to evaluate the environmental condition of the sites with respect to these potential contaminants of concern, several environmental quality references were utilized, including:

- the *Canadian Environmental Quality Guidelines* (CEQGs) published by the Canadian Council of Ministers of the Environment (CCME, 2009) to assess results (where applicable) for soil, surface water and sediment samples analyzed for metals, BTEX, VOCs, and PAHs;

- the *Canada Wide Standard for Petroleum Hydrocarbons in Soil* (CWS) (CCME, 2008) to assess results for soil samples analyzed for PHCs; and
- the Nunavut *Environmental Guideline for Site Remediation* (NU 2002), to assess metals (not included in this assessment), PHCs, and BTEX in soil;

The Nunavut *Environmental Guideline for Contaminated Site Remediation* criteria are used for comparison and are equivalent to the CCME Canadian Soil Quality Guidelines for metals and BTEX and are equivalent to the CCME Canada Wide Standard for Petroleum Hydrocarbons.

It should be noted that some geological units in the Hope Bay area are rich in minerals. As a result, naturally occurring elevated concentrations of certain metals may be present in soil, sediment and surface water in the area. While the CCME assessment guidelines for metals have been applied to the analytical results of this ESA, it should be noted that these generic guidelines do not take into account such naturally occurring elevated concentrations of metals. Results for background samples collected during similar investigations in the area will be evaluated to determine whether a regional background level for some inorganic substances can be established for the region.

A more detailed discussion of the pathway specific assessment guidelines can be found in Appendix A of the report. Exposure pathways that are applicable to the subject site were identified and the corresponding CCME criteria were used to evaluate the analytical results for the sampling program. A complete table of soil sampling results, including the identification of the criteria applied for the subject sites, can be found in Table 1 to 6 following the text.

2.3 SITES OVERVIEW

The Hope Bay project is located in the West Kitikmeot region of Nunavut approximately 135 km southwest of Cambridge Bay and 50 km east of Umingmaktok. It is centered at approximately 68º 09' N and 106º 40' W. There are facilities at several locations that extend from the head of Roberts Bay (an extension of Melville Sound) in the north to the Boston site located approximately 60 km to the south (SRK, 2009a).

The Patch Lake facilities are located near the north end of Patch Lake (see Figure 1, Photos 1 & 2). It is located on a bedrock ridge approximately 60 m west of the lake and approximately 10 to 14m above the high water level in the lake. The facilities have included a drill maintenance workshop (also referred to as the Major Drilling shop complex), lay down areas, an incinerator, and fuel storage facilities (six above ground storage tanks). The drill maintenance workshop has been decommissioned and materials removed. The lay down areas fuel storage facilities will continue to be utilized for exploration activities in the Hope Bay Project Belt.

Windy Camp is located approximately 2 km southwest of the Patch Lake facilities (see Figure 2, Photos 11 and 12). It included tents/tent frames for temporary residences, office, dining room, kitchen, and storage areas for supplies. A short distance to the southeast is a lay down area for old barrels, scrap metal and equipment, a helicopter pad and fuel storage area. Diamond drill core is stacked at various locations surrounding the camp.

The facilities are accessible from other Hope Bay facilities by winter roads. In summer, the facilities are accessible by foot or helicopter. Diesel powered generating stations are used to provide electricity. Water is drawn from Patch Lake and Windy Lake. Both facilities store and use petroleum hydrocarbons principally diesel fuel and Jet B.

The Boston Soil Treatment Facility (photo 20 and 21) is located at Boston Camp Area which is approximately 65 km south of the Patch Lake and Windy Camp facilities.

2.3.1 Climate

The Hope Bay Belt has a low arctic eco-climate with a mean annual temperature of –12.1 °C. The average monthly air temperature is above 0 °C between June and September with the peak in July, and below freezing between October and May with the coldest temperatures usually occurring in February. The mean daily temperatures range from -50 to +11°C during winter (October to May) and from -14 to +30 °C in summer (June to September).

Mean annual precipitation ranges from 94 to 207 mm with 41% occurring as rain between May and October and 59% as snow through the remainder of the year.

Annual lake evaporation (typically occurring between June and September) is estimated to be 220 mm.

In the lakes located in the Project area concentrations of total suspended particulate (TSP) matter were consistently low, ranging from 3.9 to 5.5 $\mu g/m^3$, which is less than 5% of the federal objective (120 $\mu g/m^3$) for TSP. Concentrations of sulphur dioxide, oxides of nitrogen and fine particles are also expected to be low in the Project area.

2.3.2 Topography and Hydrology

The topography within the Project Area ranges from sea level at Roberts Bay to 158 m above sea level (asl) at the summit of Doris mesa, 3 km inland. The ridge separating Doris and Tail lake drainages rises to 70 m asl.

The Hope Bay Project area drains north into the Arctic Ocean. Windy Camp and Patch Lake drain into Roberts Bay and Boston drains into Hope Bay. Peak flows typically occur in June during snowmelt. A second smaller peak may occur from rainfall in late August or early September. The streams in the study area are usually frozen with negligible flow from November until May.

None of the fish species that occur in the Hope Bay Project area are designated as endangered or threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

2.3.3 Geology and Hydrogeology

The Hope Bay Belt occurs in the Slave Structural Province, a geological sub-province of the Canadian Shield. The region is underlain by the late Archean Hope Bay Greenstone Belt. This geological formation ranges from 7 to 20 km wide and is more than 80 km long. It is oriented in a north-south direction. It is mainly comprised of mafic volcanic and sedimentary rocks that are bound by Archean granite intrusives and gneisses. Archean volcanic greenstone hosts many of Canada's precious and base metal mines (*e.g.*, Yellowknife, Timmins, Rouyn-Noranda).

Most of the soils are of marine origin and include clay, silt and some sand. Surface materials include frost-churned mineral and organic soils mantled by a thin cover of tundra vegetation. Small, frost-heaved clay-silt polygons are common. Linear frost cracks occur in raised marine spit deposits. Ice wedge polygons are common. Pleistocene deposits, including till, are buried beneath marine sediments deposited during the post-glacial marine emergence.

Continuous permafrost extends to depths of more than 500 m. The permafrost underlying the area is generally impervious to groundwater movements. Groundwater movement will only occur in the shallow active layer to a depth of between 1.5 to 2.6 m during its seasonal thaw period. This was confirmed by water levels measured in August 2009.

2.3.4 Wildlife

The Hope Bay Project area provides habitat for a variety of mammals including: shrews, voles and lemmings, hares, ground squirrels, weasels, wolves and foxes, grizzly bears, caribou, and muskox. Many are year-round residents, while others such as caribou and musk-ox, are nomadic or migratory. Some large predators/scavengers such as grizzly bear, wolverine and wolf have large ranges that can extend across or beyond the Project area. The small mammal species present, including ground squirrels and Arctic hare, spend their entire life in a small area.

Vole and lemming populations are cyclic affecting the abundance and productivity of both bird and mammal predators. Weasel populations will cycle in synchrony with vole and lemming populations.

The Hope Bay Project area is on the fringes of areas used by the Dolphin-Union, Ahiak, and the Bathurst herds of caribou. The Dolphin-Union herd is of special interest from a resource management and conservation perspective.

The area provides breeding habitat for a wide range of resident and migratory birds including songbirds, upland birds, shorebirds, waterfowl, seabirds and raptors. The raptors in the area include peregrine falcon, gyrfalcon and golden eagle. Some birds such as peregrine falcon have been the focus of special conservation and management efforts in Canada since the 1970s.

There are no protected areas in, or adjacent to the Project area. The closest designated land use restriction is the Queen Maud Gulf Bird Sanctuary approximately 40 km to the east.

2.3.5 Vegetation

Vegetation is characteristic of sub-arctic tundra vegetation. Three ecosystem units dominate the area: the ocean shoreline association; lowland ecosystems; and the rock outcrop and upland ecosystems. Several plant communities make up each of these ecosystems. Plant species identified include 19 shrubs, 92 herbs, 18 grasses, 32 sedges and rushes, 21 mosses, and 8 species and/or genera of lichen. Inuit traditionally use many local plant species and understand the relationship between plants and caribou habitat requirements including the early showing of plants in snow free areas and the importance of such areas to caribou calving locations in the region.

None of the local plants identified during the course of baseline studies are designated as endangered or threatened by COSEWIC.

2.3.6 Land and Water Use

The Hope Bay Project is situated almost entirely on Inuit owned land administered by the KIA with minerals development authority vested within Nunavut Tunngavik Inc. (NTI). Mineral rights are also held by the Crown on select areas of the Hope Bay Belt, which include Boston, part of Windy Camp, the Madrid exploration area, and the Patch Lake drill shop.

The current land use is classified as industrial. The pre-development land use as well as post closure land use can be classified as wildlife habitat with occasional use by Inuit people for subsistence hunting and fishing.

3.0 OBSERVATIONS & RESULTS

The WESA team carried out the Phase II ESA for hydrocarbon contamination at the Patch Lake facility, Windy Camp and Boston Soil Treatment Facilities from August 12-17, 2009. The field team consisted of Andrea Jenney (WESA), Wayne Ingham (WESA), and Arlene Laudrum (SRK). The field team was assisted by Aaron Haluska (HBML), Darcy Kanagak (HBML), and Francis Eningak (Nuna Logistics). Field activities included the identification and quantification of potentially hydrocarbon environmentally impacted areas, and sampling of the potentially contaminated environmental media including soil and groundwater. Refer to Appendix C for photos of site infrastructure and sampling locations, which are referenced throughout the text.

3.1 PATCH LAKE FACILITY

3.1.1 Soil sampling

Following the site reconnaissance, the primary drainage courses from the site were inspected and assessed for potential impact from contaminant sources originating from the site activities. The soils primarily consisted clay, silt and some sand with coarse grained soils at the surface (within 30 cm below ground surface) underlain fine grained soils. Refer to Appendix B – Sample Summary Sheets.

Surface, shallow depth and depth (refusal due to frozen ground or rock) soil samples were collected in all accessible areas of the upper site associated with the former workshop north laydown yard, in the drainage courses and around the current location of the tankfarm.

Surface, shallow depth and depth soil samples in the former fuel storage area south of the current incinerator location and around the southern lay down yard of waste rock covering the second former fuel tankfarm area. Surface staining was evident and a hydrocarbon odour noted at some of the sample sites. Bulk samples of approximately 5 kilogram were collected from two locations within the upper site worked areas for future assessment of treatment potential and requirements.

Soil samples were also collected at shallow depth and at depth (overburden/refusal interface) in the drainage courses of the site. Surface staining was not evident at these locations and the sampling was focused on capturing any potential subsurface migration of contaminants.

Soil samples were collected for petroleum hydrocarbon analyses and a select number of samples were also selected for BTEX, PAH and metal analyses.

A GPS unit was used in conjunction with high resolution aerial photos to record the coordinates of the sample locations and key site features. Coordinates of sampling locations are presented on the Sample Summary Sheets found in Appendix B. The locations of soil samples and site infrastructure are presented Figure 3.

Soil samples were placed in clean, pre-labelled containers, stored in coolers and shipped to ALS Laboratory Group in Yellowknife, NWT. Samples were kept cool during shipment with ice packs, and strict chain-of-custody protocols were followed. The Yellowknife lab transferred the samples to their Edmonton laboratory for analysis.

Results of the sampling program are discussed in detail below and are presented in Tables 1 through 6 following the text; exceedances of generic CCME criteria are highlighted on Figure 3.

Soil samples were collected at surface, shallow depth and depth and five groundwater monitors were installed to assess the areas of concern at the Patch Lake Facility. Analytical results were compared to the Canadian Council of Ministers of the Environment (CCME) Canada Wide Standard for Petroleum Hydrocarbons (PHC) for Residential Land Use. Samples exceeding the above criteria were noted and the following areas of concern were identified. Select samples also analysed for metals.

Impacted Soil at Depth:

Area 1 - Former Drill Shop mechanical shop footprint: A surface soil sample PLF09-SS-083 (photo 3) was collected in a stained area with a strong PHC odour. This sample was analyzed for metals, F1-F4 PHCs, PAHs, and TCE. Metal concentrations in this sample exceeded Canadian Soil Quality Guidelines for Chromium, Copper and Zinc. The concentrations of F2 and F4 PHCs in the sample exceeded the Canada-wide Standards (CWS) for eco soil contact and F3 PHCs exceeded the CWS for direct soil contact. The PAHs and TCE concentrations were below the applicable criteria.

Impacted soil in this area was encountered at depths up to 1.0 metres below ground surface (mbgs) at which depth permafrost was encountered. A depth sample (PLF09-SS-062) at this location collected at a depth of 0.9-1.0 metres had measurable concentrations of F2-F4 PHCs.

The stained soil was observed throughout the drill shop foot print and estimated to be approximately 600 m^3.

<u>Shallow Impacted Soil:</u>

Area 2 - North Laydown Area: Located north of the former workshop foundation (photos 4, 5 and 6), this area exhibited surface staining that exceeds the criteria for PHCs. A total of eight surface soil samples (PLFSS-001, 03, 53, 77, 78, 79, 80, 81, 82, and 83) exceeded the Canada wide Standards for PHCs. Two of the soil samples (PLF09-SS-077 and 083) have also exceeded CSQGs for metals. Three of these samples PLF09-SS-077, 79, and 83 were analyzed for PAHs and the concentrations were below applicable criteria. Soil sample PLF09-SS-083 was analyzed for TCE and the concentration was below detection limits.

The PHC impacts are generally limited to the upper 0.3 mbgs except at the former workshop foot print as discussed above in Area 1. The total quantity of the contaminated soil estimated to be approximately 2500 m^3.

Area 3 - Incinerator Area: A surface soil sample PLF09-SS-084 (photo 7) was collected in a stained area suspected of PHC contamination. This sample was analyzed for metals and F1-F4 PHCs. Metal concentrations in this sample exceeded Canadian Soil Quality Guidelines for Chromium and Nickel. The concentrations of F2 and F3 PHCs in the sample exceeded the Canada-wide Standards (CWS) for direct soil contact and F4 PHCs exceeded the CWS for eco soil contact. A surface sample PLF09-SS-004 collected 10m southwest of PLF09-SS-084 had F3 PHC concentrations slightly exceeding the criterion for CWS eco soil contact.

The PHC impacts are generally limited to the upper 0.3 mbgs and the total quantity of the contaminated soil estimated to be approximately 150 m^3.

Area 4 - Former tank farm site: A surface soil sample PLF09-SS-085 (photo 8) was collected in a stained area located south of the incinerator and in the vicinity of the historical tank farm. This sample was analyzed for metals and F1-F4 PHCs. Metal concentrations in this sample exceeded Canadian Soil Quality Guidelines for Zinc. The concentrations of F3 and F4 PHCs in the sample exceeded the Canada-wide Standards (CWS) for direct soil contact.

A surface soil sample (PLF09-SS-085) collected about 25m south of the Area 4 noted a slight exceedance for F3 PHCs for Canada-wide Standards (CWS) for eco soil contact.

The PHC impacts are generally limited to the upper 0.3 mbgs and the total quantity of the contaminated soil estimated to be approximately 150 m^3.

Based on the results, the contamination at depth likely consists of diesel and some oil and grease. Shallow impacted soils are contaminated primarily with diesel with some areas of oil and grease.

Groundwater Sampling

Five groundwater monitors (PMW-1 through to PMW-5) were installed to frozen ground or bedrock and screened across the lower portion of the overburden in contact with the frozen ground or bedrock. PMW-1 (photo 9) was installed in a drainage course down gradient of Areas 3 and 4. PMW-2 (photo 10) was installed close to the Patch Lake shore down gradient of Areas 1 and 2. PMW-3 is located north of the Area 2. PMW-4 and PMW-5 are located to the south of the current fuel tankfarm and former fuel storage area respectively. These monitors are expected to intercept any subsurface migration of contaminants and provide an indication if contaminants originating from the facility are migrating from the site to the surrounding receiving water bodies.

Groundwater samples were collected from each of these monitors on the last day of the field program. Groundwater samples were submitted for petroleum hydrocarbon analysis (F2 – F4) for all monitor locations and additional sample bottles were collected from one of the locations for BTEX analysis. Groundwater samples were placed in clean, pre-labelled containers, stored in coolers and shipped to ALS Laboratory Group in Yellowknife, NWT. Samples were kept cool during shipment with ice packs, and strict chain-of-custody protocols were followed. PMW-2 and PMW-5 were re-sampled on August 24, 2009 by Darcy Kanagak due to bottle breakage during the transportation of samples between the ALS Yellowknife and Edmonton laboratories.

Locations of the groundwater monitoring wells are identified in Figure 3 and the laboratory analytical results are presented in Table 6.

None of the groundwater monitors had any free product or sheen on the groundwater and F2-F4 PHC concentrations in all groundwater samples were below detection limits.

3.2 WINDY LAKE CAMP

The focus of the field investigation was the former fuel tank farm; former soil treatment facility located between Windy Lake and the tankfarm; and an area in the vicinity of the workshop where significant spills and contaminant releases had previously been reported associated with these facilities. Small areas of surface staining were evident at some of the fuel tanks behind the accommodation tents and cabins.

Surface staining and visible sheen were observed in the vicinity of the former fuel tank farm and the workshop. The origin of the visible sheen may be related to hydrocarbon contamination, natural organics and/or iron leachate from rock and drill core present on the site. A number of areas have been covered with coconut husk mat erosion protection. These areas include the former soil treatment facility, an area between the camp structures and the lake and in some cases beneath the buildings. Similar coverings were noted to the south of the tank farm covering the footprint of an area of surface disturbance and apparent permafrost degradation potentially due to the presence of a former building.

3.2.1 Soil Sampling

Soil samples were collected at surface, shallow depth and depth to assess the areas of concern at the Windy Lake Camp. Analytical results were compared to the CCME Canada Wide Standard for Petroleum Hydrocarbons for Residential and Parkland Land Use. Samples exceeding the applicable criteria were noted and the following areas of concern were identified based on the results in Tables 1 to 6 and presented in attached Figure 4.

<u>Impacted Soil Areas:</u>

Areas 1 & 2 - Former Tankfarm and Land Treatment Area: Soil samples were collected from down gradient of the tankfarm, down gradient of the former soil treatment facility and also from within the former treatment facility remediated area. This area had recently been regraded and partially covered with coconut husk mats to mitigate erosion.

A shallow depth soil sample WLF09-SS-026 (photo 13) was collected down gradient of the tankfarm area to the southwest at a depth 0.20-0.30 mbgs. Anoxic conditions with black staining were observed at the bottom of the test pit. The soil sample and analyzed for metals and F1-F4 PHCs. The concentrations of F2 PHCs in the sample slightly exceeded the CWS for eco soil contact. The metal concentrations in this sample were below the Canadian Soil Quality Guidelines.

Two soil samples collected at the tankfarm area and further down gradient to the west in areas where surface staining and a visible sheen was observed. Soil sample WLF09-SS-024 (photo 14) collected near the tank farm area exhibited F2 PHCs concentrations exceeding CWS for eco soil contact but BTEX concentrations below laboratory detection limits. The metal concentrations in the same sample were below the Canadian Soil Quality Guidelines. Soil WLF09-SS-020/021 (photo 15) which was collected further down gradient of sample WLF09-SS-024 also exceeded F2 PHC concentrations for CWS eco soil contact.

The PHC impacted soil in these two areas was encountered is assumed to extend to a depth of 1.0 mbgs and the total quantity of the contaminated soil estimated to be approximately 1200 m^3.

Area 3 – Down gradient of Helipad: A shallow depth soil sample WLF09-SS-033 (photo 16) was collected down gradient of the Helipad a depth 0.25-0.30 mbgs. The soil sample and analyzed for F1-F4 PHCs. The F2 PHCs concentrations in the sample have exceeded the CWS for eco soil contact. A surface sample WLF09-SS-087 collected to the south of WLF09-SS-033 has slightly exceeded F3 PHCs concentrations for CWS for eco soil contact.

Impacted soil in this area is assumed to extend to 1.0 mbgs and the total PHC impacted soil is estimated to be approximately 300 m^3.

Area 4 - Workshop and Generator Building Area: A shallow depth soil sample WLF09-SS-029 (photo 17) was collected east of the workshop and generator building area at a depth 0.15-0.25 mbgs. The soil sample and analyzed for F1-F4 PHCs and PAHs. The concentrations of F2 PHCs in the sample exceeded the CWS for eco soil contact but the PAH concentrations were below the applicable criteria.

Impacted soil in this area is assumed to extend to 1.0 mbgs and the total PHC impacted soil is estimated to be approximately 300 m^3.

Area 5 - Camp Tent Frame Area: Fuel impacted soil is suspected at the camp tent frame area resulting from potential leaks or spills from the existing and historical heating tanks for tent frames and the kitchen facility.

Based on the results, the contamination in the former tank farm area, workshop and generator building area and downgradient of helipad area consists mainly of diesel range hydrocarbons. Potentially impacted soils in the Camp Tent Frame Area are expected to consist primarily of heating oil as there are supply tanks for the camps heating systems.

3.2.2 Groundwater Sampling

Groundwater monitors were installed along drainage pathways between potential contaminant sources and Windy Lake. Groundwater monitor WMW-1 (photo 18) was installed between the former soil treatment facility and Windy Lake shoreline. Groundwater monitor WMW-3 was installed in the vegetated area down gradient of the helicopter support building adjacent to the helipad nearest the lake. Groundwater monitor WMW-2 (photo 19) was installed beside the core splitting building, down gradient of the fuel spill location to the rear of the workshop building. Monitors WMW-1 and WMW-3 (photo 20) were installed to frozen ground. Monitor WMW-2 was installed into the water table underlain by a heavy clay layer.

Groundwater samples were collected from each of these monitors and were submitted for petroleum hydrocarbon analysis (F2 – F4) at WMW-1 and WMW-2 and F1-F4 PHCs and BTEX analysis at WMW-3. Groundwater samples were placed in clean, pre-labelled containers, stored in coolers and shipped to ALS Laboratory Group in Yellowknife, NWT. Samples were kept cool during shipment with ice packs, and strict chain-of-custody protocols were followed.

Locations of the groundwater monitoring wells are identified in Figure 2 and the laboratory analytical results are presented in Table 6.

None of the groundwater monitors had any free product or sheen on the groundwater and all groundwater samples were below detection limits for the parameters analyzed.

3.3 Boston Facility

The Soil Treatment Facility (photo 21) located at the Boston Facility was sampled. Drums with unknown contents were being stored on the surface of the facility and as a result, restricted access to some areas. The drums were located primarily on the rear portion of the facility. A sufficient number of accessible locations were selected to reasonably characterize the facility. A sample location near each of the corners of the facility was identified and three additional locations toward the middle of the facility were identified, two of these being between the drum stored on the surface of the soil treatment facility.

A total of 11 soil samples (BLF09SS-095 to 105) were collected from the Boston Soil Treatment Facility. The sample locations were excavated by hand shovel. The depth of contaminated soil located in the facility was determined. Towards the rear of the facility the liner was encountered at a depth of approximately 10-15 cm and a soil sample was collected from this entire profile. Toward the front of the facility test pits were excavated to 70 cm and the liner was not encountered. Discrete samples were collected from the top 20 cm and also from the bottom 30 cm of the test pit. Based on the site topography it is estimated that the liner is located at a maximum depth of 1 m below surface along the front portion of the facility.

All the soil samples have exhibited F2 PHC concentrations above the CWS eco soil contact with some exceeding the direct soil contact standard. Seven (7) of the eleven (11) soil samples also had F3 PHC concentrations above the CWS for eco soil contact. The analytical results indicate that PHC contamination is primarily from diesel fuel.

Detailed analytical results are presented in Table 2 at the end of the text.

3.4 Quality Assurance/Quality Control

The collection of duplicate samples was carried out at selected sample locations to provide a measure of the precision/repeatability of the sampling procedure and analytical technique, evaluate the heterogeneity of the sample, and to determine whether the data is representative of conditions at the sampling locations. The number of duplicates collected was approximately 10% of the overall number of samples collected during the 2009 Field Program.

A review of analytical results was carried out and the results were found to be generally consistent and representative of the soil conditions in the specified locations. A measure of consistency of the results was derived by calculating the relative percentage difference (RPD) for the duplicate samples. If the contaminant concentrations are greater than 5 times the RDL, an RPD of 50% or less is generally considered acceptable (See Table 7).

Duplicates of eight (8) soil samples were collected and analyzed for contaminants of concern as part of the QA/QC program implemented during the 2009 Field Program. The degree of variability in the analysis was generally found to be low and the overall data set was found to be representative of the conditions of the sampling locations.

Only one sample duplicate pair (WLF09-SS-090/091), exceeded the acceptable RPD value (F3 fraction). This duplicate sample pair was further investigated with respect to the agreement with applicable criteria (i.e above or below the criterion), nature of sample (heterogeneity), and sampling procedures. The concentrations of F3 PHCs in the sample pair were below the applicable criterion.

The correlation between values of analytes in the duplicate pairs is considered good in most cases, which suggests that the variability in the one instance is a function of the lab method and not of how the duplicate was collected in the field.

4.0 RECOMMENDATIONS

Recommendations for remediation to address of the areas of environmental concerns are summarized below.

4.1 Patch Lake Facility:

The estimated volume of contaminated soil to be treated based on the generic CCME criteria for Residential and Parkland land use is presented in the following table.

Table A: Contaminated Soil Volume Estimate – Patch Lake Facility:

Area	Area of Impact	Volume of soil to be treated
1	Drill Shop Area	600 m^3
2	North Laydown Area	2500 m^3
3	Incinerator Area	150 m^3
4	Former Tank Farm Site	150 m^3
	Total In-situ Volume Estimate	**3400 m^3**

The investigation of one of the former tankfarm areas at the southwest side of the site was limited due to the layer of waste rock that has been placed on top of this area. Groundwater monitoring wells at the toe of this area were installed to detect the migration of hydrocarbon contamination from a buried source. Areas of this waste rock pad may be removed during final site decommissioning and reclamation. The ongoing operation and cycling of soil through the treatment facility would allow for the treatment of additional soil in the event that hydrocarbon impacted soil is encountered.

4.2 WINDY LAKE CAMP

The estimated volume of contaminated soil to be treated based on the generic CCME criteria for Residential and Parkland land use is presented in the following table.

Table B: Contaminated Soil Volume Estimate – Windy Lake Camp:

Area	Area of Impact	Volume of Soil to be Treated
1 & 2	Tank Farm Area & Downgradient[1]	1200 m^3
3	Downgradient of Helipad Area[1]	300 m^3
4	Workshop & Generator Building Area[1]	250 m^3
5	Camp Tent Frames Area[2]	250m^3
	Total In-situ Volume Estimate	**2000 m^3**

1 – Assumes average depth of soil treatment of 1.0 m
2 – Assumes average depth of soil treatment of 0.5 m

Each supply tank located in Area 5 – Camp Tent Frame Area is assumed to have a volume of impacted soil due to spills during filling of tanks and due to leaks during the site operation. Delineation of these impacted areas would be aided by the presence of heavy equipment on site, ideally when remediation activities have commenced.

4.3 Boston Soil Treatment Facility

The analytical results indicate that PHC contamination is primarily from diesel fuel. The currently identified technique of remediation by landfarming and bioremediation should be continued or initiated.

5.0 CONCLUSIONS

At Patch Lake Facility, a total of fifty six (56) surface and shallow depth soil samples were collected and selected samples were analyzed for metals, F1-F4 PHCs, BTEX, PAHs, and TCE. The primary contaminants of concern at the Patch Lake Facility are F2-F4 PHCs that are associated with fuel storage, workshop and lay down areas. Fifteen (15) soil samples exhibited PHC concentrations above the Canada-wide Standards for Residential and Parkland land use. Four (4) samples exceeded the Canadian Soil Quality Guidelines (R/P land use) for metals.

Five (5) groundwater samples were collected with select samples undergoing analysis for F1-F4 PHCs and BTEX. None of the samples exceeded the applicable criteria. The estimated volume of contaminated soil to be treated is 3500 m^3.

At Windy Lake Camp, a total of thirty eight (38) surface and shallow depth soil samples were collected and selected samples were analyzed for metals, F1-F4 PHCs, BTEX, PAHs, and TCE. The primary contaminants of concern at the Windy Lake Camp Facility are F2 PHCs that are associated with fuel storage and the lay down areas. Seven (7) soil samples exhibited PHC concentrations above the Canada-wide Standards for Residential and Parkland land use.

Three (3) groundwater samples were collected with select samples undergoing analysis for F1-F4 PHCs and BTEX. None of the samples exceeded the applicable criteria. The estimated volume of contaminated soil to be treated is 2000 m^3.

At Boston Soil Treatment Facility, a total of eleven (11) surface and shallow depth soil samples were collected and selected samples were analyzed for F2-F4 PHCs. The primary contaminants of concern at the Boston Soil Treatment Facility are F2 and F3 PHCs. All eleven (11) soil samples exhibited PHC concentrations above the Canada-wide Standards for Residential and Parkland land use.

5.1 Closure

The above-captioned Phase II ESA for hydrocarbon contamination was performed, whenever possible, in accordance with the substance and intent of the Phase II ESA guideline documents produced by the Canadian Standards Association (CSAZ768-01, CSAZ769-00). Where the approach deviated from the CSA standard, it was due to a limited scope to address hydrocarbon contamination, which was at the request of the client. Due to the remote location of the site, an extensive intrusive investigation (i.e. one involving earth moving equipment to dig test pits or drilling rigs to drill boreholes or wells) could not be conducted. Subsurface investigation was limited to work that could be accomplished manually and with hand powered tools. Some areas of the sites were under the waste rock which limited the ability of the field team to investigate underlying areas.

The conclusions presented in the above captioned report represent our professional opinion, in light of the terms of reference, scope of work, and the limiting conditions noted herein. This report describes the site conditions and observations made by the WESA team at the time of the site investigation and it has been prepared solely for the use of SRK Consulting (Canada) Inc. and their client Hope Bay Mining Limited. No other party may use or rely upon the above-captioned report or portion thereof without the express written consent of WESA. WESA will consent to any reasonable request by SRK and HBML to approve the use of this report by other parties as "Approved Users".

Respectfully Submitted,

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Project Manager, Senior Consultant

Sam Voore, M.Eng., P. Eng.
Senior Environmental Engineer

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Tables

Table 1: Soil Analytical Results - Metals

CSQG R/P = Canadian Soil Quality Guidelines for Coarse GrainedSurficial Soil in a Residential/Parkland Setting (CCME, 2007)
CSQG I/C = Canadian Soil Quality Guidelines for Coarse Grained Surficial Soil in an Industrial/Commercial (CCME, 2007)

Exceeds CSQG R/P
Exceeds I/C

	Parameter	Mercury	Silver	Arsenic	Barium	Beryllium	Cadmium	Cobalt	Chromium	Copper	Molybdenum	Nickel	Lead	Antimony	Selenium	Tin	Thallium	Uranium	Vanadium	Zinc
Criteria	CSQG R/P	6.6	20	12	500	4	10	50	64	63	10	50	140	20	1	50	1	23	130	200
	CSQG I/C	24	40	12	2,000	8	22	300	87	91	40	50	260	40	2.9	300	1	33	130	360
Sample	RDL	0.05	1.0	0.2	5	1.0	0.5	1	0.5	2	1.0	2	5	0.2	0.2	5	1.0	2.0	1	10
	Units	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
PLF09-SS-008	13-Aug-09	<0.05	<1	2.10	27.4	<1	<0.5	6.1	22.2	19.4	<1	14.3	<5	<0.2	<0.2	<5	<1	<2	26.5	23
WLF09-SS-026	14-Aug-09	<0.05	<1	1.63	27.4	<1	<0.5	5.4	21.6	23.9	<1	14.6	<5	<0.2	<0.2	<5	<1	<2	24.6	28
WLF09-SS-027	14-Aug-09	<0.05	<1	4.40	57.5	<1	<0.5	6.8	34.8	26.2	<1	18.7	<5	<0.2	0.5	<5	<1	<2	37.5	38
WLF09-SS-034	14-Aug-09	<0.05	<1	1.32	15.9	<1	<0.5	4.1	15.3	25.2	<1	11.2	<5	<0.2	<0.2	<5	<1	<2	19.1	20
PLF09-SS-048	15-Aug-09	<0.05	<1	1.97	96.1	<1	<0.5	11.3	49.2	24.7	<1	30.7	6.0	<0.2	0.3	<5	<1	<2	48.4	58
PLF09-SS-049	15-Aug-09	<0.05	<1	2.89	112.0	<1	<0.5	14.2	56.3	32.2	<1	36.0	8.1	<0.2	0.3	<5	<1	2.1	58.4	65
PLF09-SS-077	16-Aug-09	<0.05	<1	2.60	44.5	<1	<0.5	7.2	26.6	41.7	1.3	18.2	112.0	0.4	<0.2	<5	<1	<2	28.3	344
PLF09-SS-079	16-Aug-09	<0.05	<1	2.10	54.4	<1	<0.5	6.5	27.1	18.2	<1	15.5	33.0	0.4	<0.2	<5	<1	<2	28.6	51
PLF09-SS-080	16-Aug-09	0.057	<1	1.21	18.9	<1	<0.5	3.3	13.2	12.1	<1	7.6	<5	<0.2	<0.2	<5	<1	<2	18.2	59
PLF09-SS-081	16-Aug-09	<0.05	<1	1.21	15.7	<1	<0.5	3.7	15.7	8.5	<1	9.1	<5	<0.2	<0.2	<5	<1	<2	20.8	46
PLF09-SS-083	16-Aug-09	<0.05	1.2	5.06	182.0	<1	1.9	11.3	71.3	104.0	6.3	41.8	86.3	3.5	<0.2	<5	<1	<2	34.2	270
PLF09-SS-084	16-Aug-09	<0.05	<1	1.91	32.3	<1	<0.5	6.5	71.7	19.4	1.6	131.0	5.2	1.2	<0.2	<5	<1	<2	25.1	53
PLF09-SS-085	16-Aug-09	<0.05	<1	3.35	75.8	<1	<0.5	8.8	37.7	23.2	<1	24.0	11.7	0.8	0.2	<5	<1	<2	35.7	206
WLF09-SS-087	16-Aug-09	<0.05	<1	2.33	22.0	<1	<0.5	6.1	20.4	15.2	<1	13.6	<5	<0.2	<0.2	<5	<1	<2	26.0	27
WLF09-SS-090	16-Aug-09	<0.05	<1	1.69	21.6	<1	<0.5	4.9	21.0	12.8	<1	11.3	<5	<0.2	<0.2	<5	<1	<2	24.2	26

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Table 2: Soil Analytical Results - PHCs

CWS ES = Canada Wide Standards - Eco Soil Contact (R/P) (CCME, 2008)
CWS ES = Canada Wide Standards - Eco Soil Contact (I/C) (CCME, 2008)
CWS AL* = Canada Wide Standards - Protection of Aquatic Life (CCME, 2008)
CWS DC = Canada Wide Standards - Direct Contact (R/P) (CCME, 2008)
* Exceedances of CWS AL guidelines only relevant at certain locations (within 10 m of a water body)

Exceeds CWS ES (R/P)
Exceeds CWS ES (I/C)
Exceeds CWS AL (& ES)
Exceeds CWS DC (& ES)

	Parameter	F1	F1 - BTEX	F2	F3	F4
Criteria	CWS ES (R/P)	---	210	150	300	2,800
	CWS ES (I/C)	---	320	260	1,700	3,300
	CWS AL	---	970	380	---	---
	CWS DC	---	12,000	6,800	15,000	21,000
Sample	RDL	10	10	20	20	20
	Units	µg/g	µg/g	µg/g	µg/g	µg/g
PLF09-SS-001	13-Aug-09	--	--	361	12,700	1,060
PLF09-SS-002	13-Aug-09	--	--	<20	276	303
PLF09-SS-003	13-Aug-09	--	--	735	387	47
PLF09-SS-004	13-Aug-09	--	--	<20	339	282
PLF09-SS-005	13-Aug-09	--	--	<20	43	37
PLF09-SS-006	13-Aug-09	--	--	<20	<20	<20
PLF09-SS-007	13-Aug-09	--	--	<20	34	24
PLF09-SS-008	13-Aug-09	--	--	<20	<20	<20
PLF09-SS-009	13-Aug-09	--	--	<20	<20	24
PLF09-SS-010	13-Aug-09	--	--	<20	24	27
PLF09-SS-011	13-Aug-09	--	--	<20	21	23
PLF09-SS-012	13-Aug-09	--	--	<20	26	<20
WLF09-SS-013	14-Aug-09	--	--	<20	<20	<20
WLF09-SS-014	14-Aug-09	--	--	<20	<20	<20
WLF09-SS-015	14-Aug-09	--	--	<20	23	20
WLF09-SS-016	14-Aug-09	--	--	<20	<20	<20
WLF09-SS-017	14-Aug-09	--	--	<20	<20	<20
WLF09-SS-018	14-Aug-09	--	--	<20	<20	<20
WLF09-SS-019	14-Aug-09	--	--	<20	38	35
WLF09-SS-020	14-Aug-09	--	--	327	321	30
WLF09-SS-021	14-Aug-09	--	--	277	279	28
WLF09-SS-022	14-Aug-09	--	--	<20	62	34
WLF09-SS-023	14-Aug-09	--	--	<20	105	38
WLF09-SS-024	14-Aug-09	31	31	1,060	275	<20
WLF09-SS-025	14-Aug-09	--	--	103	39	<20
WLF09-SS-026	14-Aug-09	--	--	292	206	23
WLF09-SS-027	14-Aug-09	--	--	<20	64	48
WLF09-SS-028	14-Aug-09	--	--	<20	<20	<20
WLF09-SS-029	14-Aug-09	--	--	1,280	589	<20
WLF09-SS-030	14-Aug-09	<10	<10	21	<20	<20
WLF09-SS-031	14-Aug-09	<10	<10	21	23	<20
WLF09-SS-032	14-Aug-09	--	--	<20	<20	<20
WLF09-SS-033	14-Aug-09	--	--	1,970	129	<20
WLF09-SS-034	14-Aug-09	--	--	<20	51	<20
WLF09-SS-035	14-Aug-09	--	--	<20	29	<20
WLF09-SS-036	14-Aug-09	--	--	<20	<20	<20
WLF09-SS-037	14-Aug-09	--	--	<20	<20	<20
PLF09-SS-038	15-Aug-09	--	--	<20	135	76
PLF09-SS-039	15-Aug-09	--	--	<20	<20	<20
PLF09-SS-040	15-Aug-09	--	--	<20	<20	<20
PLF09-SS-041	15-Aug-09	--	--	<20	<20	<20
PLF09-SS-042	15-Aug-09	--	--	<20	49	23
PLF09-SS-043	15-Aug-09	--	--	<20	27	<20
PLF09-SS-044	15-Aug-09	--	--	<20	30	24
PLF09-SS-045	15-Aug-09	--	--	<20	20	<20
PLF09-SS-046	15-Aug-09	--	--	<20	278	144
PLF09-SS-047	15-Aug-09	<10	<10	<20	259	153
PLF09-SS-048	15-Aug-09	--	--	<20	102	49
PLF09-SS-049	15-Aug-09	<10	<10	<20	76	48
PLF09-SS-050	15-Aug-09	--	--	<20	<20	<20
PLF09-SS-051	15-Aug-09	--	--	<20	23	<20
PLF09-SS-052	15-Aug-09	--	--	<20	<20	<20

Table 2: Soil Analytical Results - PHCs

CWS ES = Canada Wide Standards - Eco Soil Contact (R/P) (CCME, 2008)
CWS ES = Canada Wide Standards - Eco Soil Contact (I/C) (CCME, 2008)
CWS AL* = Canada Wide Standards - Protection of Aquatic Life (CCME, 2008)
CWS DC = Canada Wide Standards - Direct Contact (R/P) (CCME, 2008)
* Exceedances of CWS AL guidelines only relevant at certain locations (within 10 m of a water body)

Exceeds CWS ES (R/P)
Exceeds CWS ES (I/C)
Exceeds CWS AL (& ES)
Exceeds CWS DC (& ES)

	Parameter	F1	F1 - BTEX	F2	F3	F4
Criteria	CWS ES (R/P)	---	210	150	300	2,800
	CWS ES (I/C)	---	320	260	1,700	3,300
	CWS AL	---	970	380	---	---
	CWS DC	---	12,000	6,800	15,000	21,000
Sample	RDL	10	10	20	20	20
	Units	µg/g	µg/g	µg/g	µg/g	µg/g
PLF09-SS-053	15-Aug-09	--	--	92	1,260	232
PLF09-SS-054	15-Aug-09	--	--	<20	34	29
PLF09-SS-055	15-Aug-09	<10	<10	<20	<20	<20
PLF09-SS-056	15-Aug-09	--	--	<20	<20	<20
PLF09-SS-057	15-Aug-09	--	--	<20	47	29
PLF09-SS-058	15-Aug-09	--	--	<20	<20	<20
PLF09-SS-059	15-Aug-09	--	--	<20	<20	<20
PLF09-SS-060	15-Aug-09	--	--	<20	<20	<20
PLF09-SS-061	15-Aug-09	--	--	<20	<20	<20
PLF09-SS-062	15-Aug-09	<10	<10	28	956	182
PLF09-SS-063	15-Aug-09	--	--	<20	21	<20
PLF09-SS-064	15-Aug-09	--	--	80	44	<20
PLF09-SS-065	15-Aug-09	--	--	<20	67	31
PLF09-SS-066	15-Aug-09	--	--	<20	<20	<20
PLF09-SS-067	15-Aug-09	--	--	<20	76	24
PLF09-SS-068	15-Aug-09	--	--	<20	59	25
PLF09-SS-069	15-Aug-09	--	--	<20	20	<20
PLF09-SS-070	15-Aug-09	--	--	<20	42	23
PLF09-SS-071	15-Aug-09	--	--	<20	30	<20
WLF09-SS-072	15-Aug-09	--	--	<20	<20	<20
WLF09-SS-073	15-Aug-09	<10	<10	<20	<20	<20
WLF09-SS-074	15-Aug-09	--	--	<20	<20	<20
WLF09-SS-075	15-Aug-09	--	--	<20	24	<20
WLF09-SS-076	15-Aug-09	--	--	<20	<20	<20
PLF09-SS-077	16-Aug-09	--	--	3,720	60,200	20,800
PLF09-SS-078	16-Aug-09	--	--	28	759	206
PLF09-SS-079	16-Aug-09	--	--	27,100	7,950	239
PLF09-SS-080	16-Aug-09	--	--	71	53,300	6,400
PLF09-SS-081	16-Aug-09	--	--	65	63,500	7,620
PLF09-SS-082	16-Aug-09	--	--	51	74,900	6,300
PLF09-SS-083	16-Aug-09	--	--	790	36,400	8,110
PLF09-SS-084	16-Aug-09	--	--	13,200	26,500	4,700
PLF09-SS-085	16-Aug-09	--	--	94	258,000	29,900
PLF09-SS-086	16-Aug-09	--	--	68	508	103
WLF09-SS-087	16-Aug-09	--	--	52	360	71
WLF09-SS-088	16-Aug-09	--	--	<20	139	29
WLF09-SS-089	16-Aug-09	--	--	<20	<20	<20
WLF09-SS-090	16-Aug-09	--	--	<20	44	<20
WLF09-SS-091	16-Aug-09	--	--	<20	85	31
WLF09-SS-092	16-Aug-09	--	--	<20	86	21
WLF09-SS-093	16-Aug-09	<10	<10	<20	23	<20
WLF09-SS-094	16-Aug-09	<10	<10	86	<20	<20
BLF09-SS-095	16-Aug-09	--	--	2,010	923	<20
BLF09-SS-096	16-Aug-09	--	--	3,790	1,400	65
BLF09-SS-097	16-Aug-09	--	--	1,370	882	<20
BLF09-SS-098	16-Aug-09	--	--	13,200	2,350	<20
BLF09-SS-099	16-Aug-09	--	--	1,590	1,040	<20
BLF09-SS-100	16-Aug-09	--	--	7,240	3,770	24
BLF09-SS-101	16-Aug-09	--	--	5,400	2,560	<20
BLF09-SS-102	16-Aug-09	--	--	9,940	1,850	<20
BLF09-SS-103	16-Aug-09	--	--	7,710	1,830	<20
BLF09-SS-104	16-Aug-09	--	--	8,550	4,900	474

Table 2: Soil Analytical Results - PHCs

CWS ES = Canada Wide Standards - Eco Soil Contact (R/P) (CCME, 2008)
CWS ES = Canada Wide Standards - Eco Soil Contact (I/C) (CCME, 2008)
CWS AL* = Canada Wide Standards - Protection of Aquatic Life (CCME, 2008)
CWS DC = Canada Wide Standards - Direct Contact (R/P) (CCME, 2008)
***** Exceedances of CWS AL guidelines only relevant at certain locations (within 10 m of a water body)

Legend
Exceeds CWS ES (R/P)
Exceeds CWS ES (I/C)
Exceeds CWS AL (& ES)
Exceeds CWS DC (& ES)

	Parameter	F1	F1 - BTEX	F2	F3	F4
Criteria	CWS ES (R/P)	---	210	150	300	2,800
	CWS ES (I/C)	---	320	260	1,700	3,300
	CWS AL	---	970	380	---	---
	CWS DC	---	12,000	6,800	15,000	21,000
Sample	RDL	10	10	20	20	20
	Units	µg/g	µg/g	µg/g	µg/g	µg/g
BLF09-SS-105	16-Aug-09	--	--	2,940	1,780	<20

Table 3: Soil Analytical Results - BTEX

NU = Contaminated Site Remediation Guideline R/P (GN,2002)
CSQG SC = Canadian Soil Quality Guideline - Soil Contact R/P (CCME, 2008)
CSQG SI = Canadian Soil Quality Guideline - Soil Ingestion R/P (CCME, 2008)

Legend
Exceeds NU
Exceeds CSQG (SC)
Exceeds CSQG (SI & SC)
RDL > NWT

	Parameter	Benzene	Toluene	Ethylbenzene	o-Xylene	p+m-Xylene	Xylene
Criteria	NU	0.5	0.8	1.2	---	---	1
	CSQG SC	31	75	55	---	---	95
	CSQG SI	11	22,000	10,000	---	---	150,000
Sample	RDL	0.005	0.05	0.015	0.05	0.05	0.1
	Units	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
WLF09-SS-024	14-Aug-09	<0.0050	<0.050	<0.015	<0.050	<0.050	<0.10
WLF09-SS-030	14-Aug-09	<0.0050	<0.050	<0.015	<0.050	<0.050	<0.10
WLF09-SS-031	14-Aug-09	<0.0050	<0.050	<0.015	<0.050	<0.050	<0.10
PLF09-SS-047	15-Aug-09	<0.0050	<0.050	<0.015	<0.050	<0.050	<0.10
PLF09-SS-049	15-Aug-09	<0.0050	<0.050	<0.015	<0.050	<0.050	<0.10
PLF09-SS-055	15-Aug-09	<0.0050	<0.050	<0.015	<0.050	<0.050	<0.10
PLF09-SS-062	15-Aug-09	<0.0050	<0.050	<0.015	<0.050	<0.050	<0.10
WLF09-SS-073	15-Aug-09	0.0072	<0.050	<0.015	<0.050	<0.050	<0.10
WLF09-SS-093	16-Aug-09	<0.0050	<0.050	<0.015	<0.050	<0.050	<0.10
WLF09-SS-094	16-Aug-09	<0.0050	<0.050	<0.015	<0.050	<0.050	<0.10

Table 4: Soil Analytical Results - PAHs

CSQG = Canadian Soil Quality Guidelines for Coarse Surficial Soil in a Residential/Parkland Setting (CCME, 2007) | Exceeds CSQG

	Parameter	Naphthalene	Quinoline	Phenanthrene	Pyrene	Benzo(a)anthracene	Benzo(b&j)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Dibenzo(a,h)anthracene
Criteria	CSQG	0.6	--	5	10	1	1	1	0.7	1	1
Sample	RDL	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Units	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
WLF09-SS-032	14-Aug-09	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
WLF09-SS-033	14-Aug-09	<0.010	<0.010	0.032	0.021	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
PLF09-SS-077	16-Aug-09	<0.20	<0.20	<0.20	0.29	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
PLF09-SS-079	16-Aug-09	<0.050	<0.050	1.66	0.066	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
PLF09-SS-083	16-Aug-09	0.029	<0.010	<0.010	0.204	<0.010	<0.010	<0.010	0.072	0.098	<0.010

Table 4: Soil Analytical Results - TCE

CSQG = Canadian Soil Quality Guidelines for Coarse Surficial Soil in a Residential/Parkland Setting (CCME, 2007)

[purple box] Exceeds CSQG

	Parameter	Trichloroethene
Criteria	CSQG	0.01
	RDL	Variable
Sample	Units	µg/g
WLF09-SS-032	14-Aug-09	<0.010
PLF09-SS-056	14-Aug-09	<0.010
PLF09-SS-062	16-Aug-09	<0.010
PLF09-SS-083	16-Aug-09	<0.010
PLF09-SS-092	16-Aug-09	<0.010

Table 7: Quality Assurance/Quality Control

Analyte	Units	MDL	Sample Pair	Date	Regular Sample	Sample Duplicate	RPD (%)
F2	ug/g	20	PLF09-SS-010/011	13-Aug-09	<20	<20	0%
F3	ug/g	20	PLF09-SS-010/011	13-Aug-09	24	21	13%
F4	ug/g	20	PLF09-SS-010/011	13-Aug-09	27	23	16%
F2	ug/g	20	WLF09-SS-020/021	14-Aug-09	327	277	17%
F3	ug/g	20	WLF09-SS-020/021	14-Aug-09	321	279	14%
F4	ug/g	20	WLF09-SS-020/021	14-Aug-09	30	28	7%
Benzene	ug/g	0.005	WLF09-SS-030/031	14-Aug-09	<0.0050	<0.0050	21%
Ethylbenzene	ug/g	0.015	WLF09-SS-030/031	14-Aug-09	<0.015	<0.015	21%
F1	ug/g	10	WLF09-SS-030/031	14-Aug-09	<10	<10	32%
F1 (C6-C10) - Less BTEX	ug/g	10	WLF09-SS-030/031	14-Aug-09	<10	<10	18%
F2	ug/g	20	WLF09-SS-030/031	14-Aug-09	21	21	0%
F3	ug/g	20	WLF09-SS-030/031	14-Aug-09	<20	23	14%
F4	ug/g	20	WLF09-SS-030/031	14-Aug-09	<20	<20	0%
o-Xylene	ug/g	0.05	WLF09-SS-030/031	14-Aug-09	<0.050	<0.050	0%
p+m-Xylene	ug/g	0.05	WLF09-SS-030/031	14-Aug-09	<0.050	<0.050	0%
Toluene	ug/g	0.05	WLF09-SS-030/031	14-Aug-09	<0.050	<0.050	0%
F2	ug/g	20	PLF09-SS-040/041	15-Aug-09	<20	<20	0%
F3	ug/g	20	PLF09-SS-040/041	15-Aug-09	<20	<20	0%
F4	ug/g	20	PLF09-SS-040/041	15-Aug-09	<20	<20	0%
F2	ug/g	20	PLF09-SS-050/051	15-Aug-09	<20	<20	0%
F3	ug/g	20	PLF09-SS-050/051	15-Aug-09	<20	23	14%
F4	ug/g	20	PLF09-SS-050/051	15-Aug-09	<20	<20	0%
F2	ug/g	20	PLF09-SS-060/061	15-Aug-09	<20	<20	0%
F3	ug/g	20	PLF09-SS-060/061	15-Aug-09	<20	<20	0%
F4	ug/g	20	PLF09-SS-060/061	15-Aug-09	<20	<20	0%
F2	ug/g	20	PLF09-SS-070/071	15-Aug-09	<20	<20	0%
F3	ug/g	20	PLF09-SS-070/071	15-Aug-09	42	30	33%
F4	ug/g	20	PLF09-SS-070/071	15-Aug-09	23	<20	14%
F2	ug/g	20	WLF09-SS-090/091	16-Aug-09	<20	<20	0%
F3	ug/g	20	WLF09-SS-090/091	16-Aug-09	44	85	64%
F4	ug/g	20	WLF09-SS-090/091	16-Aug-09	<20	31	43%

(shaded) RPDs are greater than 50%

Figures

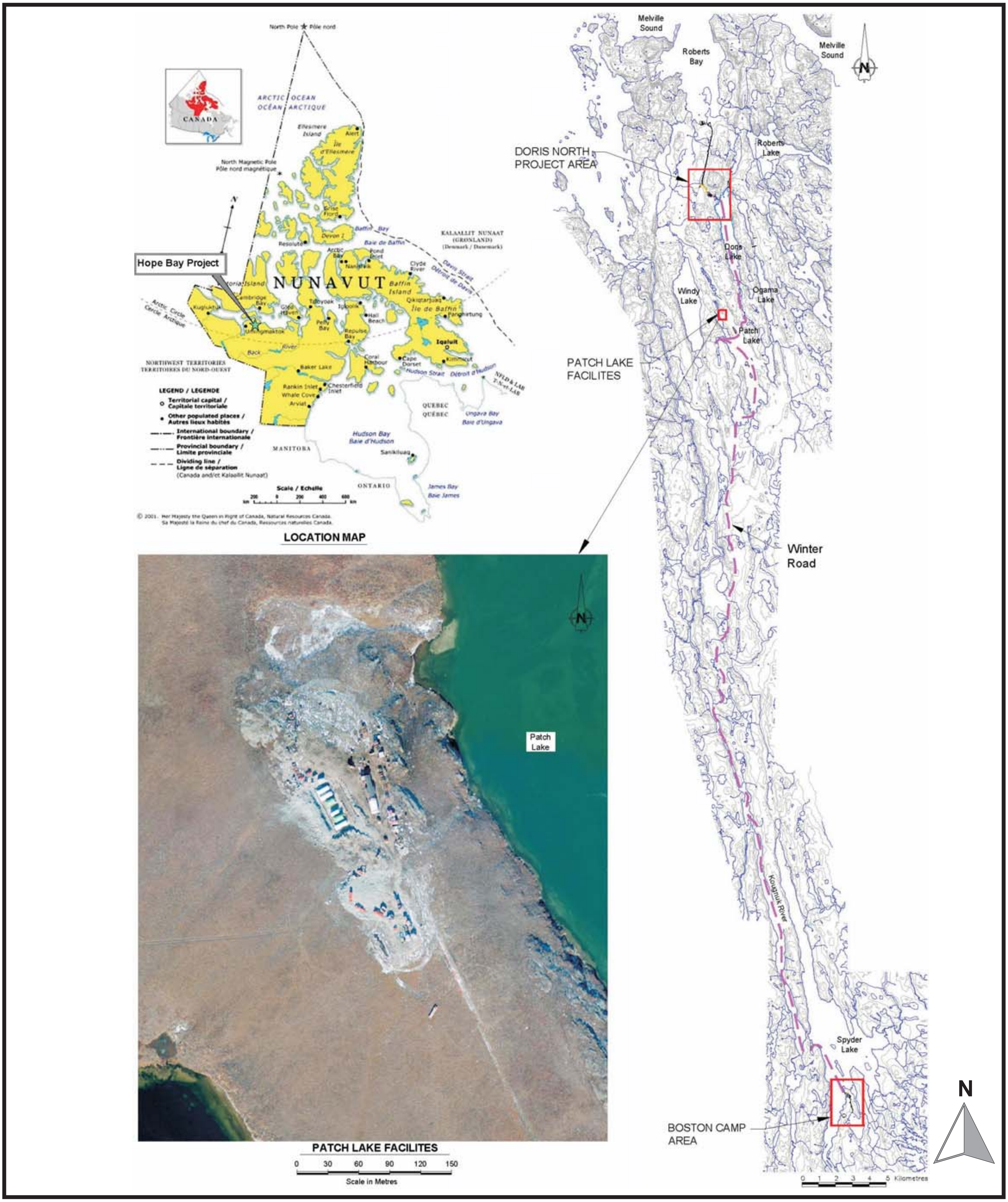


FIGURE 1:

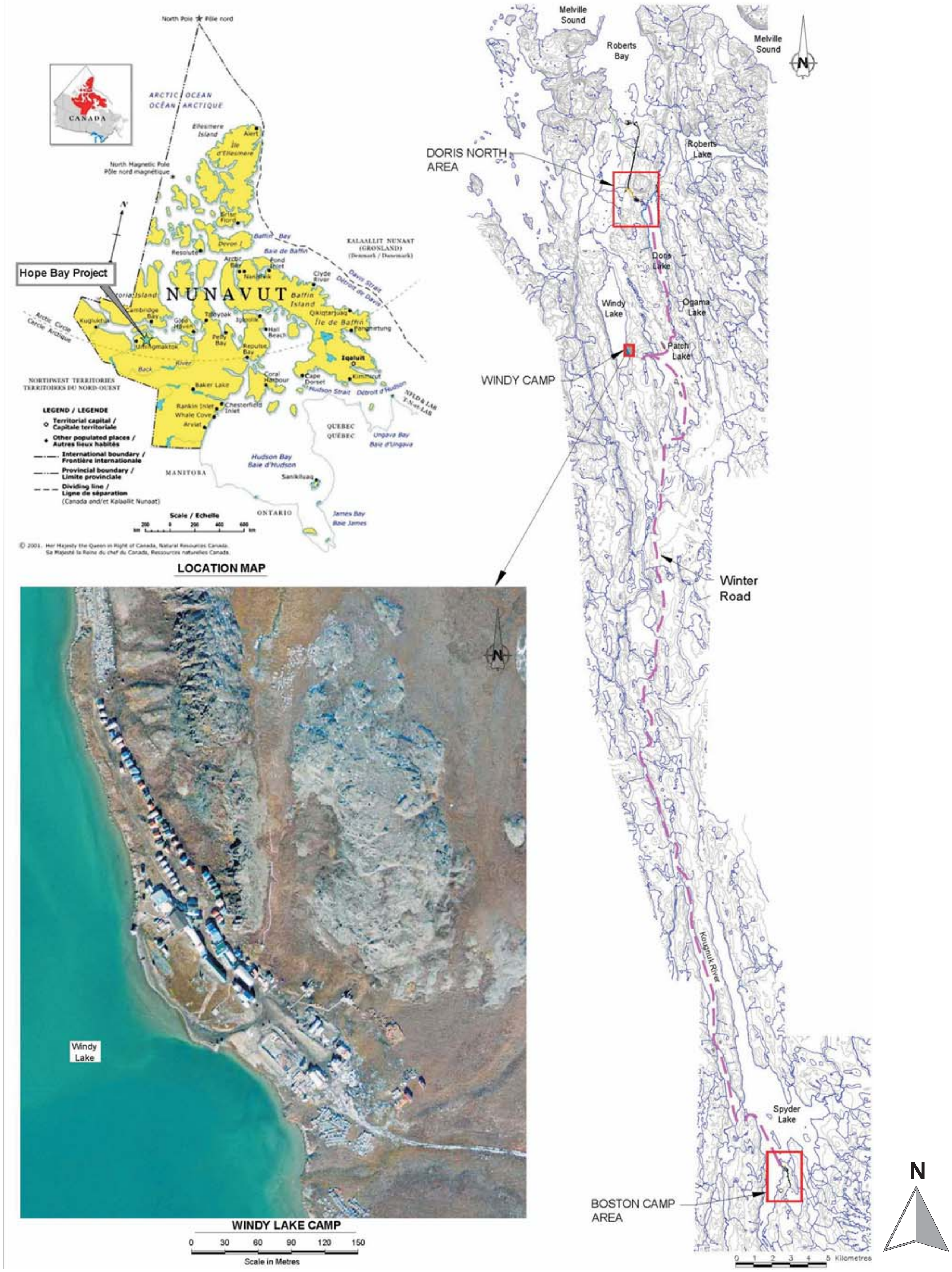
PATCH LAKE FACILITIES AND SITE LOCATION MAP

HOPE BAY PROJECT

MAP REFERENCE: SRK CONSULTING CANADA - MAY 2009

YB7997-PL-SLM

WESA
A Better Environment For Business



MAP REFERENCE: SRK CONSULTING CANADA - MAY 2009

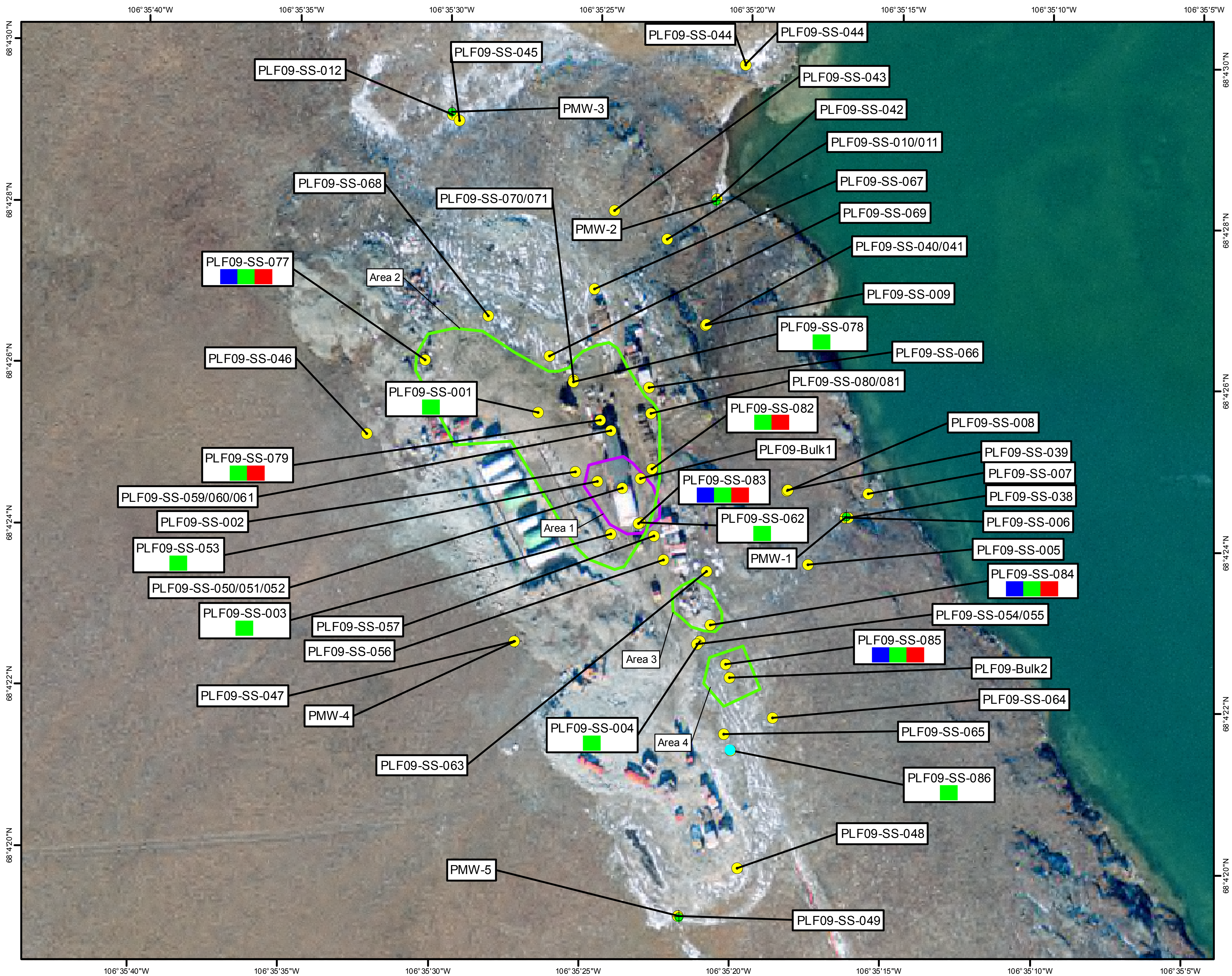
FIGURE 2:

WINDY CAMP FACILITIES AND SITE LOCATION MAP

HOPE BAY PROJECT

YB7997-WC-SLM

WESA
A Better Environment For Business



LEGEND

- Monitoring Wells
- Sample Locations
- Estimated Area of Shallow Impacted Soil
- Estimated Area of Impacted Soil at Depth

Exceedance Legend

- CSQG_Met
- PHC_Eco
- PHC_DC
- PHC_GW

REFERENCE

Note:
Coordinate System : UTM NAD83 Zone 13 North

0 10 20 40 60 80 Meters

PROJECT

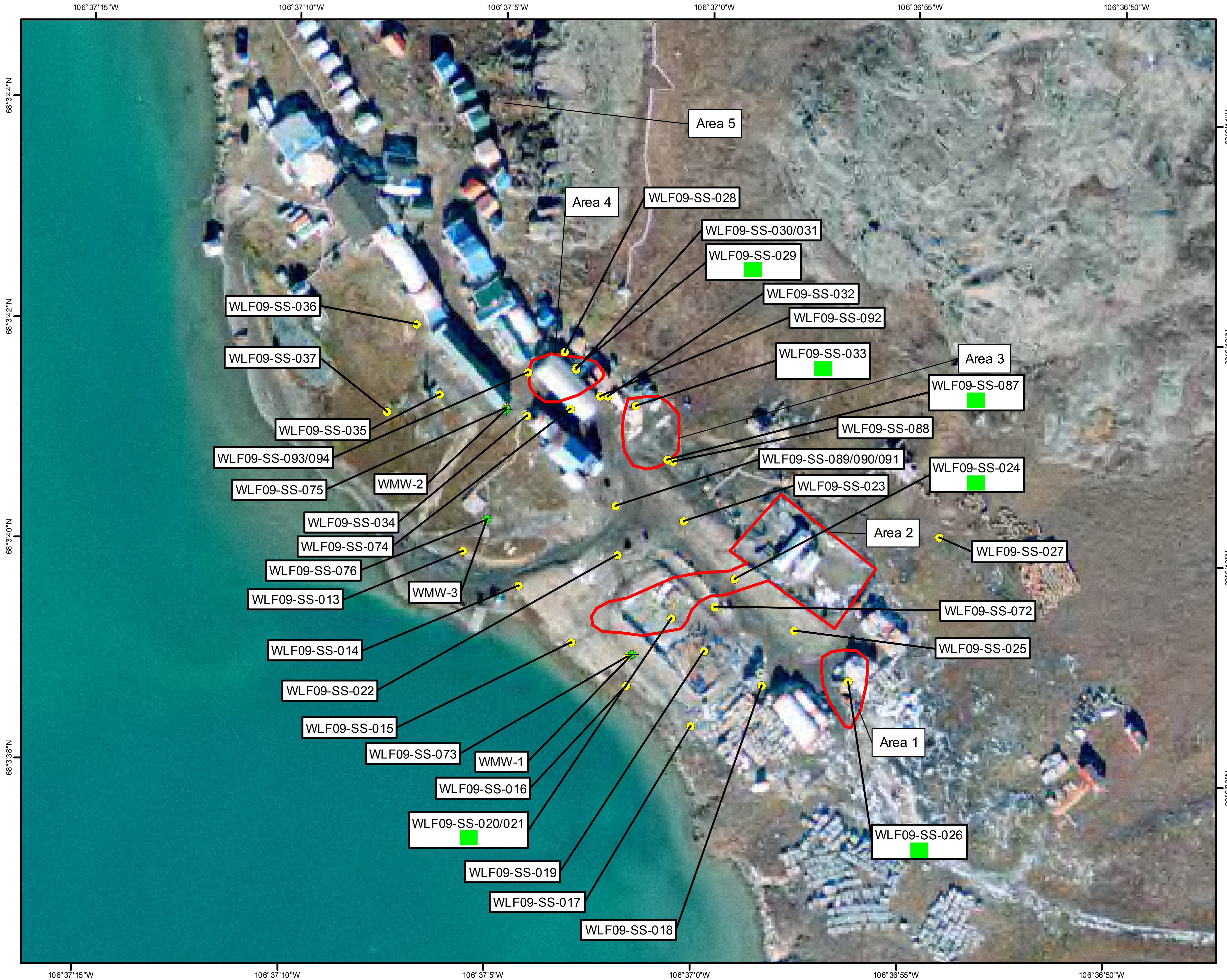
Hope Bay Mining Ltd. - Hydrocarbon Assesment

TITLE

Patch Lake Facility - Sample Locations

WESA
A Better Environment For Business

PROJECT No. Y-B7997			SCALE AS SHOWN	REV.0
DESIGN	YL	09/10/2009	FIGURE 3	
GIS	YL	19/10/2009		
CHECK	SV	19/10/2009		
REVIEW	SV	19/10/2009		



LEGEND

- Monitoring Wells
- Sample Locations
- Estimated Areas of Impacted Soil

Exceedance Legend

- CSQG_Met
- PHC_Eco
- PHC_DC
- PHC_GW

REFERENCE

Note:
Coordinate System : UTM NAD83 Zone 13 North

25 12.5 0 25 Meters

PROJECT

Hope Bay Mining Ltd. - Hydrocarbon Assesment

TITLE

Windy Lake Camp - Sample Locations

WESA

PROJECT No. Y-B7997			SCALE AS SHOWN	REV.0
DESIGN	YL	09/10/2009		
GIS	YL	19/10/2009		
CHECK	SV	19/10/2009		
REVIEW	SV	19/10/2009		

FIGURE 4

Appendix A:

CCME Assessment Guidelines

Soil Criteria - Exposure Pathways and Receptor Considerations

The current land use at Patch Lake Workshop and Windy Camp is classified as industrial. However, the pre-development land use as well as post closure land use can be classified as wildlife habitat with occasional use by Inuit people for subsistence hunting and fishing.

The following exposure pathways and key receptors are considered in the development of generic soil quality levels for residential/parkland land use in both the CCME *Canada Wide Standards for Petroleum Hydrocarbons in Soil* (CWS) as well as the CCME *Canadian Soil Quality Guidelines* (CSQG):

- *Eco soil contact*: this pathway includes nutrient cycling and considers invertebrates and plants as receptors;
- *Direct contact (soil ingestion + dermal contact)*: this pathway considers both wildlife and humans as receptors;
- *Protection of groundwater and surface water*: this pathway considers drinking water wells and fish bearing water bodies within 10 m of a PHC or BTEX contaminant source; if the drinking water well or surface water body is beyond 10 m from the PHC or BTEX contaminant source, site-specific soil parameters can be used to calculate a more site-specific clean up guideline;
- *Vapour inhalation*: this pathway considers children in an indoor exposure environment as receptors; and
- *Produce, meat and milk produced on site*: this pathway considers children as receptors and only via the consumption of produce in the case of residential/parkland land use.

The exposure pathways noted above are based on a generic model of residential/parkland land use in Canada. This model is not necessarily reflective of land use, pathways and receptors on remote sites and as a result, WESA followed a site-specific approach, where applicable, to better represent the potential risks associated with contamination found on the site. A contaminant-specific discussion of soil guidelines follows.

Soil Criteria - Petroleum Hydrocarbons (PHCs)

Potential PHC soil contamination at the site was evaluated based on the CCME *Canada Wide Standards for Petroleum Hydrocarbons in Soil* (CCME, 2008). These standards evaluate PHC contamination based on the risk of mobility of fraction F1, F2, F3 and F4 hydrocarbons, which are progressively heavier and less mobile from F1 to F4. Guidelines for several potential exposure pathways exist in the CWS for PHCs. These guidelines are specific to soil conditions on site, and in this case the more conservative coarse-grained surface soil guidelines are used, based on visual observations of the characteristics of the soil cover at the site.

Of the five exposure pathways mentioned above, vapour inhalation and consumption of produce are not relevant as there are no structures designed for continued occupancy at the site, nor are agricultural food products or significant amounts of edible plants (blueberries, cranberries, etc.) being cultivated there. The nearest surface water body to the sites that are potentially fish-bearing are Patch Lake and Windy Lake, which are not located within 10 m of the nearest significant contaminated area. As no areas of potentially PHC-impacted soil were identified within 10 m of the Patch Lake and Windy Lake, the CCME guidelines for the protection of aquatic life pathway is not considered to be applicable for the subject sites.

There are moderate amounts of vegetation and plant life at the site; therefore, the eco soil contact pathway, which includes nutrient cycling and considers invertebrates and plants as receptors, is considered applicable for the site. Wildlife is known to frequent the area in which the site is located, and the potential exists for humans to visit the site. As a result, the coarse-grained direct contact (soil ingestion/contact) guidelines for PHCs were determined to be applicable for the site under the residential/parkland land use designation, as they are protective of wildlife and human receptors. Site specific soil conditions are assessed to determine whether the fine-grained or coarse-grained soil criteria are applicable. The possibility, although remote, exists for human harvesting of berries or medicinal plants at the site; however, no applicable criteria exist for this pathway under the CWS.

Soil Criteria - Benzene, Toluene, Ethylbenzene and Xylenes (BTEX)

Potential BTEX soil contamination at the site was evaluated based on the CCME *Canadian Soil Quality Guidelines* (CCME, 2007; BTEX criteria updated 2004). In contrast with earlier versions of this document, the 2004 BTEX updates included a revised approach to dealing with BTEX at contaminated sites, based on several possible exposure routes for human and environmental receptors. This has resulted in several different guidelines and check values for each of the BTEX contaminants, depending on soil texture, depth of contamination, receptors and pathways.

Based on potential exposure pathways similar to those mentioned in the previous section, the guidelines and check values for BTEX in a residential/parkland land use are grouped into two categories, Human Health and Environmental Health, and are listed below:

<u>Human Health Guidelines/Check Values:</u>

- Soil ingestion
- Soil dermal contact
- Inhalation of indoor air (basement)
- Inhalation of indoor air (slab on grade)
- Groundwater (drinking water)

<u>Environmental Health Guidelines/Check Values:</u>

- Soil contact
- Groundwater (protection of aquatic life)

Of the exposure pathways mentioned above, the vapour inhalation pathway is considered not applicable because there are no structures designed for continued occupancy at the site. The groundwater (drinking water) exposure pathway is not considered applicable for this site because groundwater is not a direct source of drinking water for human visitors to the site. The groundwater (aquatic life) exposure pathway is not considered applicable for this site because no areas of potentially BTEX-impacted soil were identified within 10 m of the Patch Lake and Windy Lake.

As wildlife frequents the area in which the site is located, the environmental guideline for soil contact is considered applicable for the site. With respect to potential human receptors, the soil ingestion pathway was determined to be more applicable to the site conditions than the soil dermal contact pathway, because the CCME BTEX guidelines are more stringent for the ingestion pathway than for the dermal contact pathway in a residential/parkland land use setting with coarse-grained surface soils.

<u>Soil Criteria – Metals</u>

Potential metal soil contamination at the site was evaluated based on the CCME *Canadian Environmental Quality Guidelines* (CEQGs) (CCME, 2007) residential/parkland land use designation. *Canadian Soil Quality Guidelines* (CSQGs) for certain metals in a residential/parkland setting have been developed in accordance with the CCME soil protocol (CCME, 1996). Where data are sufficient, CSQGs for human health (SQG_{HH}) and environmental health (SQG_{E}) have been calculated. The soil quality guidelines for these metals are the lower of the SQG_{HH} and the SQG_{E} and represent fully integrated *de novo* guidelines (CCME, 2007).

In the case of metals for which CSQGs have not yet been developed, the CCME *Interim Remediation Criteria* for residential/parkland land use are applicable. These interim criteria (CCME, 1991) are considered generally protective of human and environmental health.

Appendix B:

Sample Summary Sheets

YB7997 sampling Summary

Site ID/Name: Patch Lake Facility
Date: 13-Aug-09

Area of Site:	Patch Stagin Area North			
Topography/Drainage:	Slopes downgradient to Patch Lake			
Surface Water Receptors:	tank farm upgradient			
Features/Observations:				
Sample #	PLF09-SS-001	PLF09-SS-002	PLF09-SS-003	PLF09-SS-004
Sample Matrix	Soil	Soil	Soil	Soil
Sample Type	Regular	Regular	Regular	Regular
Sample Description	light brown medium sand with cobbles and gravel, BR @ 0.2m	light brown medium sand 0-0.1, 0.1-0.2m bsi, dense clay, dk brown 0.2-0.3 coarse grain sand	Dark brown clay, moist dense 0-0.15, light brown dry clay 0.15-0.25	dark brown moist silt with some clay above the bedrock
Within 10 m of SW Body?	No	No	No	No
Sample Depth (mbgs)	0.1-0.15m	0.1-0.2m	0.1-0.2m	0.1-0.15m
Field Screening	0-10 ppm VOCs	270 ppm VOCs	55-60 ppm VOCs	15-20 ppm VOCs
Nearby Area of Interest (APEC(s)/ Site Features)		tank farm	tank farm	incinerator?
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	slight HC odour, staining	staining, slight odour	stain, odour	stain strong, no odour
Approximate Volume of Impacted Soil/Amount of Material (X m x Y m x Z m)	N/A stain from 0.1-0.2m			

SS = Soil
SW = Surface Water
SD = Sediment
GW = Groundwater
WR = Waste Rock

OR = Ore
TA = Tailings
PS = Paint
BM = Building Material
DC = Drum Contents

DI = DI Water
TB = Trip Blank
FB = Field Blank
REG = Regular
DUP = Duplicate

YB8046 Sampling Summary

Site ID/Name: Patch Lake Facility
Date: 13-Aug-09

Area of Site:	Patch- Drainage path to lake			
Topography/Drainage:	downgradient pathway			
Surface Water Receptors:	Patch Lake			
Features/Observations:	Main drainage channel	Flag 2	Flag 3	Flag 4
Sample #	PFL09-SS-005	PFL09-SS-006	PFL09-SS-007	PFL09-SS-008
Sample Matrix	Soil	Ore	Soil	Soil
Sample Type	Regular	Regular	Regular	Regular
Sample Description	depth silty clay, saturated, light brown	depth silty clay with sand, saturated, light brown, GW @ 0.4m	depth silty clay with some clay and sand, saturated, light brown, GW @ 0.02m	depth sand with some silt, GW @ 0.6m
Within 10 m of SW Body?	No	No	Yes	No
Sample Depth (mbgs)	0.7-0.8	0.9-1.0	0.4-0.5	0.8-0.9
Field Screening	15-20 ppm VOCs	15-20 ppm VOCs	10-15 ppm VOCs	10-15 ppm VOCs
Nearby Area of Interest (APEC(s)/ Site Features)				
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	slight odour	no sheen on water	no sheen on water	no sheen on water, no odour

SS = Soil
SW = Surface Water
SD = Sediment
GW = Groundwater
WR = Waste Rock

OR = Ore
TA = Tailings
PS = Paint
BM = Building Material
DC = Drum Contents

DI = DI Water
TB = Trip Blank
FB = Field Blank
REG = Regular
DUP = Duplicate

YB8046 Sampling Summary

Site ID/Name: Patch Lake
Date: 13-Aug-09

Area of Site:	NE Drainage Channel			
Topography/Drainage:				
Surface Water Receptors:				
Features/Observations:	Flag 5			
Sample #	PFL09-SS-009	PFL09-SS-010	PFL09-SS-011	PFL09-SS-012
Sample Matrix	Soil	Soil	Soil	Soil
Sample Type	Regular	Regular	Duplicate	Regular
Sample Description	0.7-0.8 saturated sand with some clay, 0-0.15: organic , 0.15-0.17: Sandy, GW @ 0.6m	0-0.1, organics with some clay , 0.1-0.5, silty sand, light brown, wet, GW @ 0.4m	dark brown sand with some gravel	Rock sample from trench
Within 10 m of SW Body?	Yes	No	No	No
Sample Depth (mbgs)	0.7-0.8	0.7-0.8	0.7-0.8	0.5-0.6
Field Screening	5-15 ppm VOCs	5-15 ppm VOCs	0-15 ppm VOCs	0-15ppm VOCs
Nearby Area of Interest (APEC(s)/ Site Features)	fuel storrage upgradient	fuel storrage upgradient	fuel storrage upgradient	drill material storrage upgradient
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	none	no odour or sheen	no odour or sheen	none

SS = Soil
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PS = Paint
BM = Building Material
DC = Drum Contents

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DUP = Duplicate

YB8046 Sampling Summary

Site ID/Name: Windy Lake Facility
Date: 14-Aug-09

Area of Site:	Storeline Investigation			
Topography/Drainage:	to Windy Lake			
Surface Water Receptors:	Fule spill site upgradient			
Features/Observations:				
Sample #	WFL09-SS-013	WFL09-SS-014	WFL09-SS-015	WFL09-SS-016
Sample Matrix	Soil	Soil	Soil	Soil
Sample Type	Regular	Regular	Regular	Regular
Sample Description	coarse grained dark brown saturated sand , GW @ 0.25m	coarse grained wet, light brown sand with some clay 0-0.15 seepage @ top of clay, clay dense wet , grey 0.15-0.8	Coots 0-0.1 with sand wet, clay wet grey 0.1-0.3 Gwscep @0.05-0.1m	silty sand 0-0.5m GW@ 0.4m roots from 0-0.25
Within 10 m of SW Body?	Yes	Yes	Yes	Yes
Sample Depth (mbgs)	0.25-0.3	0.15-0.2	0.1-0.2	0.3-0.4
Field Screening	0ppm VOCs	0-0.5 ppm VOCs	0-10ppm VOCs	0-15 ppm VOCs
Nearby Area of Interest (APEC(s)/ Site Features)	fuel spill			

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YB8046 Sampling Summary

Site ID/Name: Windy Lake Facility
Date: 14-Aug-09

Area of Site:	WLF- Shoreline			
Topography/Drainage:				
Surface Water Receptors:				
Features/Observations:	Row 1	Row2	Row 2	Row 2
Sample #	WFL09-SS-017	WFL09-SS-018	WFL09-SS-019	WFL09-SS-020
Sample Matrix	Soil	Soil	Soil	Soil
Sample Type	Regular	Regular	Regular	Regular
Sample Description	0-0.1, roots with organic material, Light brown, silty sand wet, 0.1-0.4 -no major seepage, slight at 0.05	0-0.07, silty sand. 0.07-0.12, reddish fine sand with some silt, 0.12-0.35, silty sand , grey, trace clay, moist, origin red layer	0-0.4, silt light brown, GW @ 0.3	0-0.1 sandy fine, 0.1-clay lenses, 0.3in silty sand layer, 0.3-0.35 clay, grey , moist, slow seepage
Within 10 m of SW Body?	Yes	No	No	No
Sample Depth (mbgs)	0.3-0.4	0.35-0.4	0.3-0.4	0.25-0.3
Field Screening	0-10 ppm VOCs	15ppm VOCs	10 ppm VOCs	see 021 ppm VOCs
Nearby Area of Interest (APEC(s)/ Site Features)		tank berm with fuel spill		
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation		None		None
Approximate Volume of Impacted Soil/Amount of Material (X m x Y m x Z m)	coarse rock from 0.4-0.5m			

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YB8046 Sampling Summary

Site ID/Name: Windy Lake
Date: 14-Aug-09

Area of Site:	Shoreline Area			
Topography/Drainage:				
Surface Water Receptors:	Windy Lake			
Features/Observations:	Row 2	Row 2	Row 3	
Sample #	WFL09-SS-021	WFL09-SS-022	WFL09-SS-023	WFL09-SS-024
Sample Matrix	Soil	Soil	Soil	Soil
Sample Type	Duplicate	Regular	Duplicate	Regular
Sample Description	See 020	0-0.05, Light brown fine sand, 0.05-0.2, anoxic black silty sand, 0.2-0.45, light damp brown fine silty sand	0-0.4 sand gravel, 0.4-0.42 black clay silt, anoxic , GW @ 0.3	0-0.3 sand gravel with cobbles, 0.3-0.35 brown silty sand, moist, no GW
Within 10 m of SW Body?	No	No	No	No
Sample Depth (mbgs)		0.4-0.45	0.3-0.4	0.25-0.35
Field Screening	0-10ppm VOCs	No GW 0-5 ppm VOCs	0.3-0.4 ppm VOCs	15 ppm VOCs
Nearby Area of Interest (APEC(s)/ Site Features)				
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	None, slight odour in - auger to 0.5	None	None	HC odour, anoxic

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YB8046 Sampling Summary

Site ID/Name: Windy Lake
Date: 14-Aug-09

Area of Site:	Bermed Area			
Topography/Drainage:	< 3%			
Surface Water Receptors:	Strike Lake			
Features/Observations:				
Sample #	WFL09-SS-025	WFL09-SS-026	WFL09-SS-027	
Sample Matrix	Soil	Soil	Soil	
Sample Type	Regular	Regular	Regular	
Sample Description	0-0.1: grey brown coarse sand, 0.1-0.25: coarse sand, 0.25-0.45 fine grey silty sand, GW @ 0.45	0-0.05 graded sand moist, 0.05-0.1, dark black sand, 0.1-0.25coarse grey sand with organics	00.1 organics dark rown,0.1-0.3 light brown mois dense clay	
Within 10 m of SW Body?	No	No	No	
Sample Depth (mbgs)	0.45--.5	0.2-0.3	0.2-0.3	
Soil Field Screening	0-10 ppm VOCs	10 ppm VOCs	0-10 ppm VOCs	
Nearby Area of Interest (APEC(s)/ Site Features)		0.25-.3	another burn pit- bigger than 024 pit	
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	HC odour, some anoxic	HC oour @ upper ara,anoxic @ ottom, black stains	No	

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YB8046 Sampling Summary

Site ID/Name: Windy Lake
Date: 14-Aug-09, 2pm

Area of Site:	Workshop north			
Topography/Drainage:				
Surface Water Receptors:	None			
Features/Observations:				
Sample #	WFL09-SS-028	WFL09-SS-029	WFL09-SS-030	WFL09-SS-031
Sample Matrix	Soil	Soil	Soil	Soil
Sample Type	Regular	Regular	Regular	Duplicate
Sample Description	0-0.2 dark brown sand silt, 0.2-0.35 light brown wet medium sand layer	0-0.15 med silty sand with gravel, 0.15-0.3, oily sheen, odour	0.3-0.75 coarse sand with gravel and PHC odour some small cobbles, wet	see 030
Within 10 m of SW Body?	No	No	No	No
Sample Depth (mbgs)	0.3-0.35	0.15-25	0.6-0.7	0.05-0.15m
Field Screening	0-15 ppm VOCs	30 ppm VOCs	0-10ppm VOCs	0-10ppm VOCs
Nearby Area of Interest (APEC(s)/ Site Features)		0.3-0.75 coarse grain sand with gravel and HCs	GW @ 0.35m	GW @ 0.35m
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	none (no odour)	strong HC odour	odour PHCs	odour PHCs

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YB8046 Sampling Summary

Site ID/Name: Windy Lake
Date: 14-Aug-09

Area of Site:	Workshop North HC investigation			
Topography/Drainage:	SW to Windy toward SW corner of buildings			
Surface Water Receptors:				
Features/Observations:		south of main building	southwest corner of the operations building	southwest of the geology coreshak building
Sample #	WFL09-SS-032	WFL09-SS-033	WFL09-SS-034	WFL09-SS-035
Sample Matrix	Soil	Soil	Soil	Soil
Sample Type	Regular	Regular	Regular	Regular
Sample Description	0-0.30 coarse grained sand with gravel, light brown , moist	0-0.35, silty clay, dense dry dark brown , 0.15-0.3 same but lighter	0-0.5 organics at surface, 0.1-0.5 coarse saturated sand	0-0.15 dark brown silt with the some sand, moss, 0.15-0.3 light brown wet silty sand
Within 10 m of SW Body?	No	No	Yes	Yes
Sample Depth (mbgs)	0.3-0.35	0.25-0.3	0.4-0.5	0.25-0.3
Field Screening	20 ppm VOCs	190 ppm VOCs	0-10 ppm VOCs	0-10 ppm VOCs
Nearby Area of Interest (APEC(s)/ Site Features)				
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	no odour, no stains	PHC odour	no odour	no odour

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YB8046 Sampling Summary

Site ID/Name: Windy Lake
Date: 14-Aug-09

Area of Site:	Geology driling buildingdraining SW in channel to Windy lake			
Topography/Drainage:	Windy lake			
Surface Water Receptors:	SW of drillers dry			
Features/Observations:				
Sample #	WFL09-SS-036	WFL09-SS-037		
Soil Field Screening	Soil	Soil		
Sample Type	Regular	Regular		
Sample Description	0-0.1 Fine silty sand , dark brown, 0.15-0.5 light brown silt and	0-0.15 dark brown organic , 0.15-0.5 saturated fine sand,		
Within 10 m of SW Body?	No	No		
Sample Depth (mbgs)	0.4-0.5	0.4-0.5		
Field Screening	0-5 ppm VOCs	0-5 ppm VOCs		
Nearby Area of Interest (APEC(s)/ Site Features)	fuel storrage gradient			
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	sulfur anoxic odour			

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YB8046 Sampling Summary

Site ID/Name: Patch (Hope Bay)
Date: 15-Aug-09

Area of Site:	East drainage drainage from incinerator			
Topography/Drainage:	drainage to water apply uptake			
Surface Water Receptors:	Patch Lake			
Features/Observations:	Previous test pit flooded auger hole flooded			
Sample #	PFL09-SS-038	PFL09-SS-039	PFL09-SS-040	PFL09-SS-041
Sample Matrix	Soil	Soil	Soil	Soil
Sample Type	Regular	Regular	Regular	Duplicate
Sample Description	sample at bottom of the hole fine grey silty sand	brown silty sand drain above MW1	light brown sand, drainage course above MW2	light brown sand
Within 10 m of SW Body?	No	No	No	No
Sample Depth (mbgs)	0.55	0.87	0.75	0.75
Field Screening	0.1 ppm VOCs	1.9 ppm VOCs	0.1 ppm VOCs	0.2 ppm VOCs
Nearby Area of Interest (APEC(s)/ Site Features)	incinerator and hele pad drainage course, refusal on rock (BR?) stick up 0.5m	hele pad drainage course, refusal on frozen ground?	empty down beside rock outcrop, refusal on frozen ground?	empty down beside rock outcrop
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	None waste incinerator	None waste incinerator	None	None

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YB8046 Sampling Summary

Site ID/Name: Patch
Date: 15-Aug-09

Area of Site:	Lake edge drainage			
Topography/Drainage:	drainage from NE of site			
Surface Water Receptors:	Patch Lake			
Features/Observations:	6x6 beams close by and down gradient			
Sample #	PFL09-SS-042	PFL09-SS-043	PFL09-SS-044	PFL09-SS-045
Sample Matrix	Sediment	Sediment	Sediment	Sediment
Sample Type	Regular	Regular	Regular	Duplicate
Sample Description	Fine grain silty sand	drainage course above MW2	Drainage from N of site where it meets Patch Lake	Drainage from the West end of the site in depression beyond core boxes; at depth for sample ss-012; MW-3
Within 10 m of SW Body?	Yes	No	Yes	No
Sample Depth (mbgs)	0.67	0.51	0.48	0.69
Field Screening				
Nearby Area of Interest (APEC(s)/ Site Features)	wooden beams, Well MW 2 stick up 0.68, frozen ground refusal, screen last 0.5	core stacks upgradient, Add 0.1m to GIS, frozen ground	core stacks visible above rocky outcrop at the north of the site, Add 0.1 m to GIS, impermeable clay layer not permafrost, ~8m from lake shore	core boxes, Well MW 3, add to GIS, stick up 0.5m, screen last 0.5m
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	None	None	Mossy with caribou tracks	None

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YB7997 sampling Summary

Site ID/Name: Patch
Date: 15-Aug-09

Area of Site:	W of tank Pad and cores/toe of slope			
Topography/Drainage:	small draininage to lake			
Surface Water Receptors:	Organics lake?			
Features/Observations:	well loacted further west			
Sample #	SS-046	SS-047	SS-048	SS-049
Sample Matrix	sediment	sediment	sediment	sediment
Sample Type	Regular	Regular	Regular	Regular
Sample Description	dark brown organis		grey silty sand under dark brown cover	grey silty sand with dark brown cover
Within 10 m of SW Body?	No	No	No	
Sample Depth (mbgs)	0.46	0.59		0.66
Field Screening				
Nearby Area of Interest (APEC(s)/ Site Features)	tankfarm and laydown area, frozen ground	in drainiage course from tank farm discharge pipe, WM 4, stick up 0.31m, screen last 0.4m, frozen ground	S of old tank farm, frozen ground	old tank farm and cutting depossit, frozen ground, MW 5, screen bottom 0.5m, stick up 0.46m
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	No	yes veg stressed in channel	possible slight sheen	slightly sheen

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PS = Paint
BM = Building Material
DC = Drum Contents

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REG = Regular
DUP = Duplicate

YB7997 sampling Summary

Site ID/Name: Patch Lake
Date: 15-Aug-09

Area of Site:	E of Tank Farm			
Topography/Drainage:				
Surface Water Receptors:				
Features/Observations:	N of Wood platform			E of tank farm
Sample #	SS-050	SS-051	SS-052	SS-053
Sample Matrix			Soil	Soil
Sample Type	Regular	Duplicate	Regular	Regular
Sample Description	light brown dry silt sand	light brown dry silt sand	saturated lt brown silty sand	dk brown silty sand trace organics (wood)
Within 10 m of SW Body?	No	No	No	No
Sample Depth (mbgs)	0.3-0.4	0.3-0.4	0.8-0.9	0.1-0.15
Field Screening	-	-	-	-
Nearby Area of Interest (APEC(s)/ Site Features)				
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	HC odour	HC odour	no odour	no odour

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YB7997 sampling Summary

Site ID/Name: Patch Lake
Date: 15-Aug-09

Area of Site:	Tank farm area			
Topography/Drainage:				
Surface Water Receptors:	tank farm upgradient			
Features/Observations:	SW of incinerator just off pad		not including ballister	S of drill Shack
Sample #	PLF09-SS-054	PLF09-SS-055	PLF09-SS-056	PLF09-SS-057
Sample Matrix	Soil	Soil	Soil	Soil
Sample Type	Regular	Regular	Regular	Regular
Sample Description	fine to med. Trace silty clay leanses, trace orig. W debris	sand saturated, lt brown, BR @ 0.9 (depth)	lt coloureds sand, dry, some gravel @ bottom to refusal (bldrs or clay)	silty sand, srk brown, dry, trace gravel @ bldrs?
Within 10 m of SW Body?	No	-	-	-
Sample Depth (mbgs)	0.25-0.35	0.8-0.9	0.15-0.40	0.25-0.40
Field Screening	-	-	-	-
Nearby Area of Interest (APEC(s)/ Site Features)	same as SS-004 location			
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	no odour	no odour	no odour	no odour

SS = Soil	OR = Ore	DI = DI Water
SW = Surface Water	TA = Tailings	TB = Trip Blank
SD = Sediment	PS = Paint	FB = Field Blank
GW = Groundwater	BM = Building Material	REG = Regular
WR = Waste Rock	DC = Drum Contents	DUP = Duplicate

YB7997 sampling Summary

Site ID/Name: Patch Lake
Date: 15-Aug-09

Area of Site:	Tank farm area			
Topography/Drainage:				
Surface Water Receptors:	tank farm upgradient			
Features/Observations:	NW of drill shack	NE of Gen shack shallow depth	depth	
Sample #	PLF09-SS-058	PLF09-SS-059	PLF09-SS-060	PLF09-SS-061
Sample Matrix	Soil	Soil	Soil	Soil
Sample Type	Regular	Regular	Regular	Regular
Sample Description	H. Brown sand, dry stuck auger in silty clay layer	slayey sandy silt 30-80cmbs, 0-30- dry sand	basal till wet cold, -silten clay mixure	basal till wet cold, -silten clay mixure
Within 10 m of SW Body?	No	No	No	-
Sample Depth (mbgs)	0.8-1.0(?)	0.7-0.8	0.8-0.9	
Field Screening	>0.5mbgs (-)	-	-	-
Nearby Area of Interest (APEC(s)/ Site Features)				
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	no odour	no odour	no odour	no odour

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YB7997 sampling Summary

Site ID/Name: Patch Lake
Date: 15-Aug-09

Area of Site:	patch lake			
Topography/Drainage:				
Surface Water Receptors:				
Features/Observations:	SE of drill shop foundation	NE of incinerator	S of incinerator	W of road
Sample #	PLF09-SS-062	PLF09-SS-063	PLF09-SS-064	PLF09-SS-065
Sample Matrix	Soil	Soil	Soil	Soil
Sample Type	Regular	Regular	Regular	Regular
Sample Description Top 0-0.3 sand and fill	Silty sandy clay, dk crown w/ gravel basal fill	0-0.5 dark vrown dilty sand with gravel, 0.6- wet sand gravel silt with trace clay	depth clayey sandy silt sat. cold grey	- wet grey, -clayey sandy silt,, - saturated GW @ 0.25
Within 10 m of SW Body?	No	No	No	No
Sample Depth (mbgs)	0.9-1.0	0.4-0.6	0.4-0.6	0.45-0.5
Field Screening	-	-	-	-
Nearby Area of Interest (APEC(s)/ Site Features)				
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	some odour	no odour	no odour	no odour

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YB7997 sampling Summary

Site ID/Name: Patch Lake
Date: 15-Aug-09

Area of Site:	N laydown yard			
Topography/Drainage:				
Surface Water Receptors:				
Features/Observations:	NE corner of laydown yard	S of corebboxes	W of coreboxes	S of corebboxes
Sample #	PLF09-SS-066	PLF09-SS-067	PLF09-SS-068	PLF09-SS-069
Sample Matrix	Soil	Soil	Soil	Soil
Sample Type	Regular	Regular	Regular	Regular
Sample Description	0.5- silty sand damp, grey cold, 0-0.5 tine gr- br sand	0- dine sandy silt saturated grey	0__ clay silt, - black bande of vorved cay	- med grey to drk grey silt and clay with trace gravel, no odour, - permafrost @ last 5cm
Within 10 m of SW Body?	-	No	No	No
Sample Depth (mbgs)	0.8-0.9	0.6-07	0.6-0.7	0.85-1.05
Field Screening	-	-	-	-
Nearby Area of Interest (APEC(s)/ Site Features)				
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	no odour	no odour	light colour in dark clay	

SS = Soil	OR = Ore	DI = DI Water
SW = Surface Water	TA = Tailings	TB = Trip Blank
SD = Sediment	PS = Paint	FB = Field Blank
GW = Groundwater	BM = Building Material	REG = Regular
WR = Waste Rock	DC = Drum Contents	DUP = Duplicate

YB7997 sampling Summary

Site ID/Name: Patch Lake
Date: 15-Aug-09

Area of Site:	patch lake			
Topography/Drainage:				
Surface Water Receptors:				
Features/Observations:				
Sample #	PLF09-SS-070	PLF09-SS-071		
Sample Matrix	Soil	Soil		
Sample Type	Regular	Duplicate		
Sample Description	Silt & clay med brown with grey bands, permafrost @ last 10 cm	Silt & clay med brown with grey bands, permafrost @ last 10 cm		
Within 10 m of SW Body?	-	-		
Sample Depth (mbgs)	0.75-0.9			
Field Screening	-	-		
Nearby Area of Interest (APEC(s)/ Site Features)				
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	no odour	no odour		

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YB7997 sampling Summary

Site ID/Name: Patch Lake

Date: 15-Aug-09

Area of Site:	s of berm			
Topography/Drainage:	toward windy lake			
Surface Water Receptors:				
Features/Observations:		WMW1	S side of shop	btwn MW2 Splinters of shale and organics
Sample #	WLF09-SS-072	WLF09-SS-073	WLF09-SS-074	WLF09-SS-075
Sample Matrix	Soil	Soil	Soil	Soil
Sample Type	Regular	Regular	Regular	Regular
Sample Description	sandy silt, saturated @ 1.2 metres grey	0-0.25 sand, 0.25- silty, 0.9 clay grey sat, refusal @ permafrost	Coarse sand and gravel find sand @ tow 0-0.15	-silty sand lt brown 0-0.15, -grey sandy silt w clay wet, 0.15-0.9 refusal @ permafrost
Within 10 m of SW Body?	No	Yes	No	-
Sample Depth (mbgs)	1.1-1.2	0.9-0.9	.45-0.6	0.8-0.9
Field Screening	-	-	-	-
Nearby Area of Interest (APEC(s)/ Site Features)				
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	no odour	no odour	no odour	
MW construction details		stick up- 0.58, screen - 0.2-0.9		screen from 0.9-0.2 mbgs, stick up 0.7m

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YB7997 sampling Summary

Site ID/Name: Windy Lake
Date: 15-Aug-09

Area of Site:	SW of shoreline helipad			
Topography/Drainage:				
Surface Water Receptors:				
Features/Observations:	MW3			
Sample #	WLF09-SS-076			
Sample Matrix	Soil			
Sample Type	Regular			
Sample Description	0-0.2 coco mat roots coarse sand with fines, 0.2-0.6 silty clat dense			
Within 10 m of SW Body?	No			
Sample Depth (mbgs)	0.5-0.6			
Field Screening	-			
Nearby Area of Interest (APEC(s)/ Site Features)				
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation				
MW Construction Details	-screen 0.1-10.6 mbgs, stuck up 0.71m			

SS = Soil	OR = Ore	DI = DI Water
SW = Surface Water	TA = Tailings	TB = Trip Blank
SD = Sediment	PS = Paint	FB = Field Blank
GW = Groundwater	BM = Building Material	REG = Regular
WR = Waste Rock	DC = Drum Contents	DUP = Duplicate

YB7997 sampling Summary

Site ID/Name: Patch
Date: 16-Aug-09

Area of Site:	patch GW sampling			
Topography/Drainage:				
Surface Water Receptors:				
Features/Observations:	PMW-5	laydown area		
Sample #	PLF09-GW-110	PLF09-SS-077	PLF09-SS-078	PLF09-SS-079
Sample Matrix	-	Soil	Soil	Soil
Sample Type		Regular	Regular	Regular
Sample Description		drk brown samd moist with some roots & stell	lt brown slity sand dry; surface of SS-070/71 location	drk brown silty snd dry, stained
Within 10 m of SW Body?		No	No	No
Sample Depth (mbgs)		0.-0.1	0-0.1	0-0.2
water Field Screening	7.2 pH 8.6 °C			
Nearby Area of Interest (APEC(s)/ Site Features)				
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation		stained, oily odour	some staining, faint	stained, oily odour
Approximate Volume of Impacted Soil/Amount of Material (X m x Y m x Z m)		4x5 m		1.5x1.5

SS = Soil
SW = Surface Water
SD = Sediment
GW = Groundwater
WR = Waste Rock

OR = Ore
TA = Tailings
PS = Paint
BM = Building Material
DC = Drum Contents

DI = DI Water
TB = Trip Blank
FB = Field Blank
REG = Regular
DUP = Duplicate

YB7997 sampling Summary

Site ID/Name: Patch Lake
Date: 16-Aug-09

Area of Site:				
Topography/Drainage:				
Surface Water Receptors:				
Features/Observations:	laydown area near helipad		N of Prill shack	NE corner of platform
Sample #	PLF09-SS-080	PLF09-SS-081	PLF09-SS-082	PLF09-SS-083
Sample Matrix	Soil	Soil	Soil	Soil
Sample Type	Regular	Regular	Regular	Regular
Sample Description	silty sand with some roots, drk oil	silty sand with some roots, drk oil	silty sand moist, oiily drk brown, - roots and some debris	silty sand, oily
Within 10 m of SW Body?	No		No	
Sample Depth (mbgs)	0.-0.1	0.-0.1	0-0.1	
water Field Screening				
Nearby Area of Interest (APEC(s)/ Site Features)				*depth 062*
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	dk brown staining oil odour dead vegetation	dk brown staining oil odour dead vegetation	drk brown stain, strong odour	stains, odour
Approximate Volume of Impacted Soil/Amount of Material (X m x Y m x Z m)	1.5x1.5 m	1.5x1.5 m	1.5x1.5 m	under entire platform

SS = Soil	OR = Ore	DI = DI Water
SW = Surface Water	TA = Tailings	TB = Trip Blank
SD = Sediment	PS = Paint	FB = Field Blank
GW = Groundwater	BM = Building Material	REG = Regular
WR = Waste Rock	DC = Drum Contents	DUP = Duplicate

YB7997 sampling Summary

Site ID/Name: Windy Lake
Date: 16-Aug-09

Area of Site:	windy lake- surface stains			
Topography/Drainage:	slope to windy			
Surface Water Receptors:				
Features/Observations:		W od helpipad	SW of front of porch of ops	
Sample #	WLF09-SS-087	WLF09-SS-088	WLF09-SS-089	WLF09-SS-090/91
Sample Matrix			Soil	
Sample Type			Regular	Regular/duplicate
Sample Description	0-.25, fine sandy silt saturated, GW @ 0.1 mbgs	Depth: 25-35cm, -clay/fine sand & gravel, lt grey, -saturated	*Depth*, lt. grey silt moist	Shallow depth, dk grey sandy silt
Within 10 m of SW Body?	No	No	No	No
Sample Depth (mbgs)	0.-0.1	0.25-0.35	0.35-0.45	0.1-0.15
water Field Screening				
Nearby Area of Interest (APEC(s)/ Site Features)				
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation	Light odour, sheen on adj water		Sheen on SW adj. to hole	Sheen on SW adj. to hole

SS = Soil
SW = Surface Water
SD = Sediment
GW = Groundwater
WR = Waste Rock

OR = Ore
TA = Tailings
PS = Paint
BM = Building Material
DC = Drum Contents

DI = DI Water
TB = Trip Blank
FB = Field Blank
REG = Regular
DUP = Duplicate

YB7997 sampling Summary

Site ID/Name: Windy Lake
Date: 16-Aug-09

Area of Site:	Windy Lake			
Topography/Drainage:				
Surface Water Receptors:				
Features/Observations:	Maint. Shop S side	N- side of Maintenance		
Sample #	WLF09-SS-092	WLF09-SS-093	WLF09-SS-094	
Sample Matrix	Soil	Soil		
Sample Type	Regular	Regular		
Sample Description	0-0.15- sand w silt, lt brown, 0.15-0.2- sandy silt, grey, dense	moist w some grevel, shallow	Depth, - coarse grained sand with gravel satutated from 0.5m down	
Within 10 m of SW Body?	No			
Sample Depth (mbgs)	0-20	0-0.1	0.6-0.7	
water Field Screening				
Nearby Area of Interest (APEC(s)/ Site Features)	Minat shop fuel spill upgrade			
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation		no odour	strong odour	

SS = Soil
SW = Surface Water
SD = Sediment
GW = Groundwater
WR = Waste Rock

OR = Ore
TA = Tailings
PS = Paint
BM = Building Material
DC = Drum Contents

DI = DI Water
TB = Trip Blank
FB = Field Blank
REG = Regular
DUP = Duplicate

YB7997 sampling Summary

Site ID/Name: Patch
Date: 16-Aug-09

Area of Site:	patch lake facilty- GW sampling			
Topography/Drainage:				
Surface Water Receptors:				
Features/Observations:	PMW-1	PMW-2	PMW-3	PMW-4
Sample #	PLF09-GW-106	PLF09-GW-107	PLF09-GW-108	PLF09-GW-109
Sample Matrix				
Sample Type				
Sample Description				
Within 10 m of SW Body?				
Sample Depth (mbgs)	0-20	0-0.1	0.6-0.7	
water Field Screening	6.7 pH °C	6.9 pH 8.5 °C	6.9 pH 8.8 °C	7.3 pH 6.5 °C
Nearby Area of Interest (APEC(s)/ Site Features)				
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation				

SS = Soil	OR = Ore	DI = DI Water
SW = Surface Water	TA = Tailings	TB = Trip Blank
SD = Sediment	PS = Paint	FB = Field Blank
GW = Groundwater	BM = Building Material	REG = Regular
WR = Waste Rock	DC = Drum Contents	DUP = Duplicate

YB7997 sampling Summary

Site ID/Name: Windy Lake
Date: 16-Aug-09

Area of Site:	Windy lake GW sampling			
Topography/Drainage:				
Surface Water Receptors:				
Features/Observations:	WMW-1	WMW-2	WMW-3	
Sample #	WLF09-GW-111	WLF09-GW-112	WLF09-GW-113	
Sample Matrix				
Sample Type				
Sample Description				
Within 10 m of SW Body?				
Sample Depth (mbgs)	0-20	0-0.1	0.6-0.7	
water Field Screening	7.0 pH 16.0 °C	7.4 pH 16.4 °C	6.8 pH 16.4 °C	
Nearby Area of Interest (APEC(s)/ Site Features)				
Staining/Odour/ Discolouration/Sheen/ Stressed Vegetation				

SS = Soil
SW = Surface Water
SD = Sediment
GW = Groundwater
WR = Waste Rock

OR = Ore
TA = Tailings
PS = Paint
BM = Building Material
DC = Drum Contents

DI = DI Water
TB = Trip Blank
FB = Field Blank
REG = Regular
DUP = Duplicate

Appendix C:

Site Photos

Patch Lake Facility Photographs

August 12-17, 2009

Photo 1: Areal view of Patch Lake Facility facing west.

Photo 2: Areal view of Patch Lake Facility facing west with the south end of the facility in the foreground and the north end in the background.

Photo 3: Southeast corner of the former mechanical shop foot print. Sample PLF09-SS-083 in the foreground. Significant PHC staining found throughout the foot print.

Photo 4: Sample PLF09-SS-001. Looking southwest at the tank farm

Photo 5: Sample PLF09-SS-077. There was a stain with oily odour present in the area.

Photo 6: Sample PLF09-SS-082. Looking west with dark brown staining (1.5m X 1.5m) where the sample was collected in the foreground. Strong odour present.

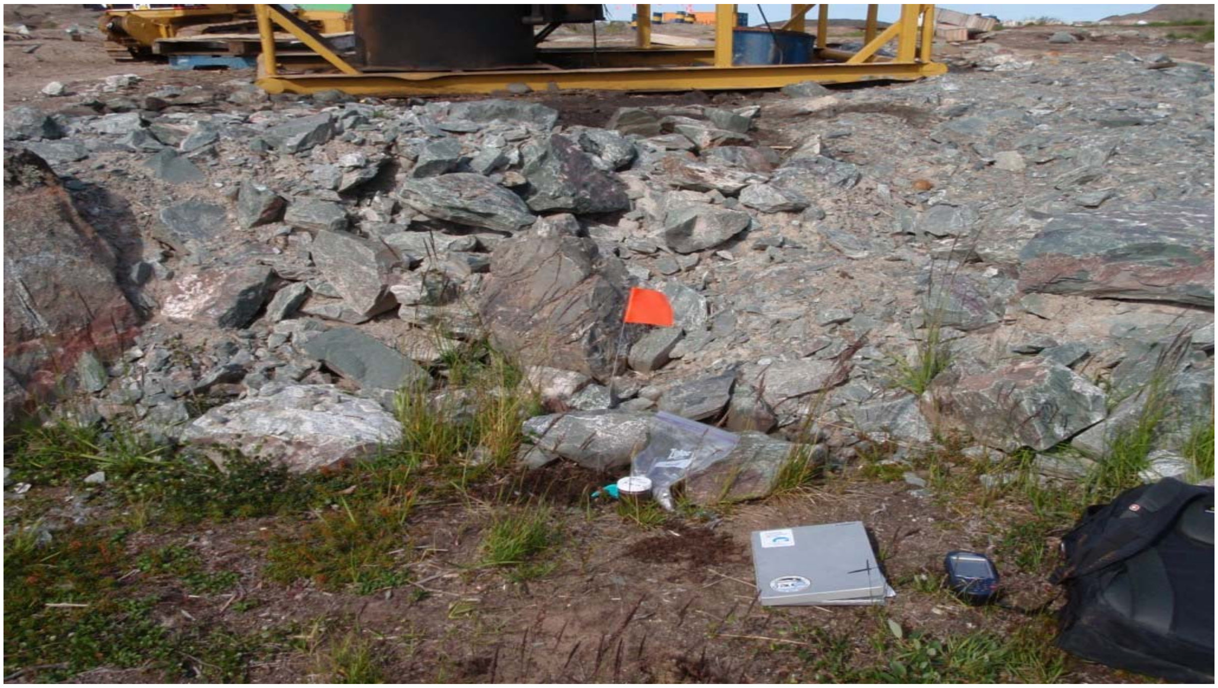


Photo 7: Sample PLF09-SS-084 collected south of the incinerator. There was hydrocarbon staining with sparse vegetation in the area.

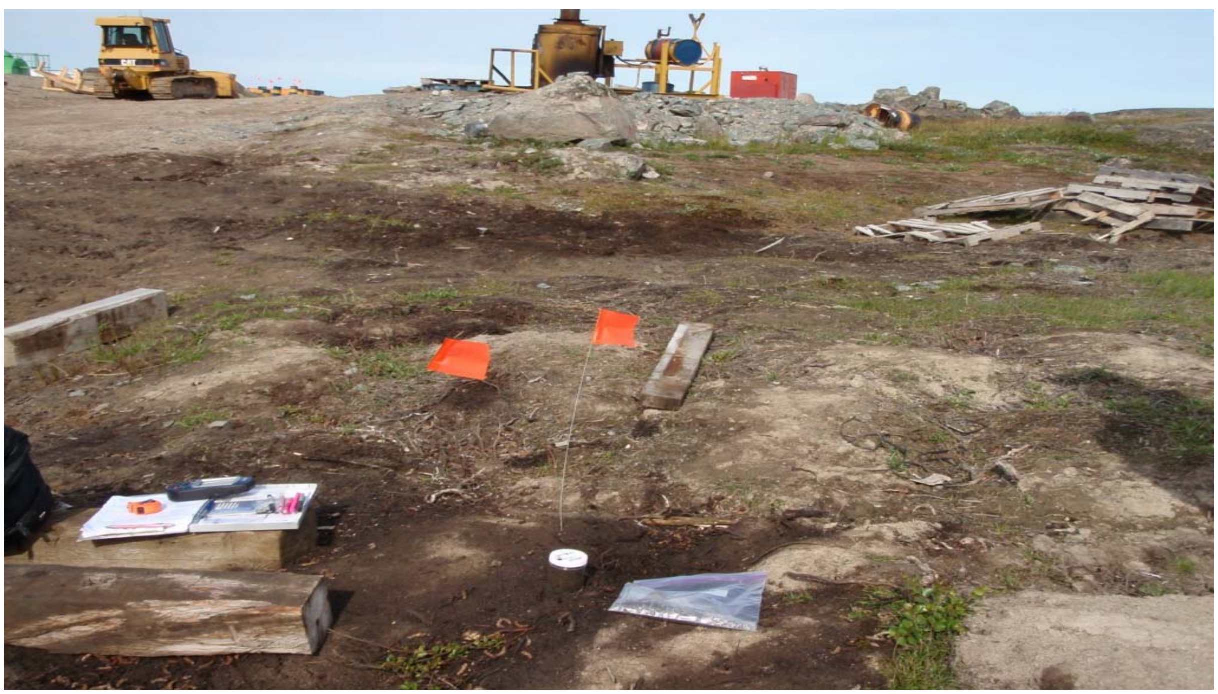


Photo 8: Sample PLF09-SS-085 collected in Area 4. There was a 2.5m by 2.5m stain observed in the area.

Photo 9: PMW -1 and Sample PLF 9-SS-038. PMW-2 installed in a drainage course downgradient of Areas 3 & 4.

Photo 10: PMW -2 and Sample PLF 9-SS-042. PMW-2 installed in a drainage course downgradient of Areas 1 & 2.

Windy Lake Camp Photographs

August 12-17, 2009

Photo 11: Areal view of the Windy Lake Camp facing south looking at the north of the camp in the foreground and the south of the camp in the background.

Photo 12: Areal view of the Windy Lake Camp facing north looking at the south of the camp in the foreground and the north of the camp in the background.

Photo 13: Sample WLF09-SS-026 at Area 1 Southwest of Former Tank Farm. There was hydrocarbon odour with anoxic conditions at the bottom of the test pit. Black stains visible around the area.

Photo 14: Sample WLF09-SS-024. West of the Former Tank Farm immediately down gradient.

Photo 15: Sample WLF09-SS-20/21. No Staining, odour or sheen was observed in the area.

Photo 16: Sample WLF09-SS-033 collected in Area 3.

Photo 17: Samples WLF09-SS-29/30/31. Strong hydrocarbon odour observed in the area.

Photo 18: Groundwater Monitor WMW-1.

Photo 19: Groundwater Monitor WMW-2 and Sample WLF09-SS-075.

Photo 20: Groundwater Monitor WMW-3.

Boston Soil Treatment Facility Photographs

August 12-17, 2009

Photo 21: Boston Lake Facility – Aerial View

Photo 22: Boston Soil Treatment Facility.

Appendix D:

Analytical Laboratory Reports

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

Certificate of Analysis

WESA
ATTN: WAYNE INGHAM
3108 CARP ROAD, BOX 430
CARP (OTTAWA) ON K0A 1L0

Report Date: 26-AUG-09 10:02 (MT)
Version: FINAL

Lab Work Order #: L806542 **Date Received:** 17-AUG-09

Project P.O. #: HOPE BAY
Job Reference:
Legal Site Desc:
CofC Numbers:

Other Information:

Comments:

ALS LABORATORY GROUP ANALYTICAL REPORT

Grouping	Analyte	L806542-1	L806542-2	L806542-3	L806542-4	L806542-5
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	13-AUG-09	13-AUG-09	13-AUG-09	13-AUG-09	13-AUG-09
	Sampled Time					
	Client ID	PLF09-SS-001	PLF09-SS-002	PLF09-SS-003	PLF09-SS-004	PLF09-SS-005
SOIL						
Physical Tests	% Moisture (%)	6.69	38.9	9.75	52.8	28.5
Metals	Antimony (Sb) (mg/kg)					
	Arsenic (As) (mg/kg)					
	Barium (Ba) (mg/kg)					
	Beryllium (Be) (mg/kg)					
	Cadmium (Cd) (mg/kg)					
	Chromium (Cr) (mg/kg)					
	Cobalt (Co) (mg/kg)					
	Copper (Cu) (mg/kg)					
	Lead (Pb) (mg/kg)					
	Mercury (Hg) (mg/kg)					
	Molybdenum (Mo) (mg/kg)					
	Nickel (Ni) (mg/kg)					
	Selenium (Se) (mg/kg)					
	Silver (Ag) (mg/kg)					
	Thallium (Tl) (mg/kg)					
	Tin (Sn) (mg/kg)					
	Uranium (U) (mg/kg)					
	Vanadium (V) (mg/kg)					
	Zinc (Zn) (mg/kg)					
Volatile Organic Compounds	Benzene (mg/kg)					
	Ethylbenzene (mg/kg)					
	Toluene (mg/kg)					
	Trichloroethene (mg/kg)					
	o-Xylene (mg/kg)					
	m+p-Xylene (mg/kg)					
	Xylenes (mg/kg)					
	Surrogate: 4-Bromofluorobenzene (%)					
	Surrogate: 1,2-Dichloroethane d4 (%)					
	Surrogate: Toluene d8 (%)					
Hydrocarbons	F1 (C6-C10) (mg/kg)					
	F1-BTEX (mg/kg)					
	F2 (C10-C16) (mg/kg)	361	<20	735	<20	<20
	F2-Naphth (mg/kg)					
	F3 (C16-C34) (mg/kg)	12700	276	387	339	43
	F3-PAH (mg/kg)					
	F4 (C34-C50) (mg/kg)	1060	303	47	282	37
	F4G-SG (GHH-Silica) (mg/kg)	12700	1780		1460	
	Total Hydrocarbons (C6-C50) (mg/kg)					
	Chrom. to baseline at nC50	NO	NO	YES	NO	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	116	80	137 *	87	111

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-6	L806542-7	L806542-8	L806542-9	L806542-10
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	13-AUG-09	13-AUG-09	13-AUG-09	13-AUG-09	13-AUG-09
	Sampled Time					
	Client ID	PLF09-SS-006	PLF09-SS-007	PLF09-SS-008	PLF09-SS-009	PLF09-SS-010
Grouping	**Analyte**					
SOIL						
Physical Tests	% Moisture (%)	18.4	22.5	12.8	15.4	28.5
Metals	Antimony (Sb) (mg/kg)			<0.20		
	Arsenic (As) (mg/kg)			2.10		
	Barium (Ba) (mg/kg)			27.4		
	Beryllium (Be) (mg/kg)			<1.0		
	Cadmium (Cd) (mg/kg)			<0.50		
	Chromium (Cr) (mg/kg)			22.2		
	Cobalt (Co) (mg/kg)			6.1		
	Copper (Cu) (mg/kg)			19.4		
	Lead (Pb) (mg/kg)			<5.0		
	Mercury (Hg) (mg/kg)			<0.050		
	Molybdenum (Mo) (mg/kg)			<1.0		
	Nickel (Ni) (mg/kg)			14.3		
	Selenium (Se) (mg/kg)			<0.20		
	Silver (Ag) (mg/kg)			<1.0		
	Thallium (Tl) (mg/kg)			<1.0		
	Tin (Sn) (mg/kg)			<5.0		
	Uranium (U) (mg/kg)			<2.0		
	Vanadium (V) (mg/kg)			26.5		
	Zinc (Zn) (mg/kg)			23		
Volatile Organic Compounds	Benzene (mg/kg)					
	Ethylbenzene (mg/kg)					
	Toluene (mg/kg)					
	Trichloroethene (mg/kg)					
	o-Xylene (mg/kg)					
	m+p-Xylene (mg/kg)					
	Xylenes (mg/kg)					
	Surrogate: 4-Bromofluorobenzene (%)					
	Surrogate: 1,2-Dichloroethane d4 (%)					
	Surrogate: Toluene d8 (%)					
Hydrocarbons	F1 (C6-C10) (mg/kg)					
	F1-BTEX (mg/kg)					
	F2 (C10-C16) (mg/kg)	<20	<20	<20	<20	<20
	F2-Naphth (mg/kg)					
	F3 (C16-C34) (mg/kg)	<20	34	<20	<20	24
	F3-PAH (mg/kg)					
	F4 (C34-C50) (mg/kg)	<20	24	<20	24	27
	F4G-SG (GHH-Silica) (mg/kg)					
	Total Hydrocarbons (C6-C50) (mg/kg)					
	Chrom. to baseline at nC50	YES	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	102	103	98	88	91

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-11	L806542-12	L806542-13	L806542-14	L806542-15
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	13-AUG-09	13-AUG-09	14-AUG-09	14-AUG-09	14-AUG-09
	Sampled Time					
	Client ID	PLF09-SS-011	PLF09-SS-012	WLF09-SS-013	WLF09-SS-014	WLF09-SS-015
Grouping	**Analyte**					
SOIL						
Physical Tests	% Moisture (%)	35.2	38.6	25.2	19.8	20.1
Metals	Antimony (Sb) (mg/kg)					
	Arsenic (As) (mg/kg)					
	Barium (Ba) (mg/kg)					
	Beryllium (Be) (mg/kg)					
	Cadmium (Cd) (mg/kg)					
	Chromium (Cr) (mg/kg)					
	Cobalt (Co) (mg/kg)					
	Copper (Cu) (mg/kg)					
	Lead (Pb) (mg/kg)					
	Mercury (Hg) (mg/kg)					
	Molybdenum (Mo) (mg/kg)					
	Nickel (Ni) (mg/kg)					
	Selenium (Se) (mg/kg)					
	Silver (Ag) (mg/kg)					
	Thallium (Tl) (mg/kg)					
	Tin (Sn) (mg/kg)					
	Uranium (U) (mg/kg)					
	Vanadium (V) (mg/kg)					
	Zinc (Zn) (mg/kg)					
Volatile Organic Compounds	Benzene (mg/kg)					
	Ethylbenzene (mg/kg)					
	Toluene (mg/kg)					
	Trichloroethene (mg/kg)					
	o-Xylene (mg/kg)					
	m+p-Xylene (mg/kg)					
	Xylenes (mg/kg)					
	Surrogate: 4-Bromofluorobenzene (%)					
	Surrogate: 1,2-Dichloroethane d4 (%)					
	Surrogate: Toluene d8 (%)					
Hydrocarbons	F1 (C6-C10) (mg/kg)					
	F1-BTEX (mg/kg)					
	F2 (C10-C16) (mg/kg)	<20	<20	<20	<20	<20
	F2-Naphth (mg/kg)					
	F3 (C16-C34) (mg/kg)	21	26	<20	<20	23
	F3-PAH (mg/kg)					
	F4 (C34-C50) (mg/kg)	23	<20	<20	<20	20
	F4G-SG (GHH-Silica) (mg/kg)					
	Total Hydrocarbons (C6-C50) (mg/kg)					
	Chrom. to baseline at nC50	YES	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	84	100	85	82	91

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-16	L806542-17	L806542-18	L806542-19	L806542-20
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	14-AUG-09	14-AUG-09	14-AUG-09	14-AUG-09	14-AUG-09
	Sampled Time					
	Client ID	WLF09-SS-016	WLF09-SS-017	WLF09-SS-018	WLF09-SS-019	WLF09-SS-020
Grouping	**Analyte**					
SOIL						
Physical Tests	% Moisture (%)	21.4	18.2	13.4	18.9	19.3
Metals	Antimony (Sb) (mg/kg)					
	Arsenic (As) (mg/kg)					
	Barium (Ba) (mg/kg)					
	Beryllium (Be) (mg/kg)					
	Cadmium (Cd) (mg/kg)					
	Chromium (Cr) (mg/kg)					
	Cobalt (Co) (mg/kg)					
	Copper (Cu) (mg/kg)					
	Lead (Pb) (mg/kg)					
	Mercury (Hg) (mg/kg)					
	Molybdenum (Mo) (mg/kg)					
	Nickel (Ni) (mg/kg)					
	Selenium (Se) (mg/kg)					
	Silver (Ag) (mg/kg)					
	Thallium (Tl) (mg/kg)					
	Tin (Sn) (mg/kg)					
	Uranium (U) (mg/kg)					
	Vanadium (V) (mg/kg)					
	Zinc (Zn) (mg/kg)					
Volatile Organic Compounds	Benzene (mg/kg)					
	Ethylbenzene (mg/kg)					
	Toluene (mg/kg)					
	Trichloroethene (mg/kg)					
	o-Xylene (mg/kg)					
	m+p-Xylene (mg/kg)					
	Xylenes (mg/kg)					
	Surrogate: 4-Bromofluorobenzene (%)					
	Surrogate: 1,2-Dichloroethane d4 (%)					
	Surrogate: Toluene d8 (%)					
Hydrocarbons	F1 (C6-C10) (mg/kg)					
	F1-BTEX (mg/kg)					
	F2 (C10-C16) (mg/kg)	<20	<20	<20	<20	327
	F2-Naphth (mg/kg)					
	F3 (C16-C34) (mg/kg)	<20	<20	<20	38	321
	F3-PAH (mg/kg)					
	F4 (C34-C50) (mg/kg)	<20	<20	<20	35	30
	F4G-SG (GHH-Silica) (mg/kg)					
	Total Hydrocarbons (C6-C50) (mg/kg)					
	Chrom. to baseline at nC50	YES	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	101	90	82	88	102

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-21	L806542-22	L806542-23	L806542-24	L806542-25
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	14-AUG-09	14-AUG-09	14-AUG-09	14-AUG-09	14-AUG-09
	Sampled Time					
	Client ID	WLF09-SS-021	WLF09-SS-022	WLF09-SS-023	WLF09-SS-024	WLF09-SS-025
Grouping	**Analyte**					
SOIL						
Physical Tests	% Moisture (%)	20.8	17.2	11.8	12.0	13.9
Metals	Antimony (Sb) (mg/kg)					
	Arsenic (As) (mg/kg)					
	Barium (Ba) (mg/kg)					
	Beryllium (Be) (mg/kg)					
	Cadmium (Cd) (mg/kg)					
	Chromium (Cr) (mg/kg)					
	Cobalt (Co) (mg/kg)					
	Copper (Cu) (mg/kg)					
	Lead (Pb) (mg/kg)					
	Mercury (Hg) (mg/kg)					
	Molybdenum (Mo) (mg/kg)					
	Nickel (Ni) (mg/kg)					
	Selenium (Se) (mg/kg)					
	Silver (Ag) (mg/kg)					
	Thallium (Tl) (mg/kg)					
	Tin (Sn) (mg/kg)					
	Uranium (U) (mg/kg)					
	Vanadium (V) (mg/kg)					
	Zinc (Zn) (mg/kg)					
Volatile Organic Compounds	Benzene (mg/kg)				<0.0050	
	Ethylbenzene (mg/kg)				<0.015	
	Toluene (mg/kg)				<0.050	
	Trichloroethene (mg/kg)					
	o-Xylene (mg/kg)				<0.050	
	m+p-Xylene (mg/kg)				<0.050	
	Xylenes (mg/kg)				<0.10	
	Surrogate: 4-Bromofluorobenzene (%)					
	Surrogate: 1,2-Dichloroethane d4 (%)					
	Surrogate: Toluene d8 (%)					
Hydrocarbons	F1 (C6-C10) (mg/kg)				31	
	F1-BTEX (mg/kg)				31	
	F2 (C10-C16) (mg/kg)	277	<20	<20	1060	103
	F2-Naphth (mg/kg)					
	F3 (C16-C34) (mg/kg)	279	62	105	275	39
	F3-PAH (mg/kg)					
	F4 (C34-C50) (mg/kg)	28	34	38	<20	<20
	F4G-SG (GHH-Silica) (mg/kg)					
	Total Hydrocarbons (C6-C50) (mg/kg)				1370	
	Chrom. to baseline at nC50	YES	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	96	83	80	138 *	119

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

Grouping	Analyte	L806542-26	L806542-27	L806542-28	L806542-29	L806542-30
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	14-AUG-09	14-AUG-09	14-AUG-09	14-AUG-09	14-AUG-09
	Sampled Time					
	Client ID	WLF09-SS-026	WLF09-SS-027	WLF09-SS-028	WLF09-SS-029	WLF09-SS-030
SOIL						
Physical Tests	% Moisture (%)	19.2	19.6	18.6	17.2	12.5
Metals	Antimony (Sb) (mg/kg)	<0.20	<0.20			
	Arsenic (As) (mg/kg)	1.63	4.40			
	Barium (Ba) (mg/kg)	27.4	57.5			
	Beryllium (Be) (mg/kg)	<1.0	<1.0			
	Cadmium (Cd) (mg/kg)	<0.50	<0.50			
	Chromium (Cr) (mg/kg)	21.6	34.8			
	Cobalt (Co) (mg/kg)	5.4	6.8			
	Copper (Cu) (mg/kg)	23.9	26.2			
	Lead (Pb) (mg/kg)	<5.0	<5.0			
	Mercury (Hg) (mg/kg)	<0.050	<0.050			
	Molybdenum (Mo) (mg/kg)	<1.0	<1.0			
	Nickel (Ni) (mg/kg)	14.6	18.7			
	Selenium (Se) (mg/kg)	<0.20	0.45			
	Silver (Ag) (mg/kg)	<1.0	<1.0			
	Thallium (Tl) (mg/kg)	<1.0	<1.0			
	Tin (Sn) (mg/kg)	<5.0	<5.0			
	Uranium (U) (mg/kg)	<2.0	<2.0			
	Vanadium (V) (mg/kg)	24.6	37.5			
	Zinc (Zn) (mg/kg)	28	38			
Volatile Organic Compounds	Benzene (mg/kg)					<0.0050
	Ethylbenzene (mg/kg)					<0.015
	Toluene (mg/kg)					<0.050
	Trichloroethene (mg/kg)					
	o-Xylene (mg/kg)					<0.050
	m+p-Xylene (mg/kg)					<0.050
	Xylenes (mg/kg)					<0.10
	Surrogate: 4-Bromofluorobenzene (%)					
	Surrogate: 1,2-Dichloroethane d4 (%)					
	Surrogate: Toluene d8 (%)					
Hydrocarbons	F1 (C6-C10) (mg/kg)					<10
	F1-BTEX (mg/kg)					<10
	F2 (C10-C16) (mg/kg)	292	<20	<20	1280	21
	F2-Naphth (mg/kg)					
	F3 (C16-C34) (mg/kg)	206	64	<20	589	<20
	F3-PAH (mg/kg)					
	F4 (C34-C50) (mg/kg)	23	48	<20	<20	<20
	F4G-SG (GHH-Silica) (mg/kg)					
	Total Hydrocarbons (C6-C50) (mg/kg)					21
	Chrom. to baseline at nC50	YES	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	125	97	111	253 *	108

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-31	L806542-32	L806542-33	L806542-34	L806542-35
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	14-AUG-09	14-AUG-09	14-AUG-09	14-AUG-09	14-AUG-09
	Sampled Time					
	Client ID	WLF09-SS-031	WLF09-SS-032	WLF09-SS-033	WLF09-SS-034	WLF09-SS-035
Grouping	**Analyte**					
SOIL						
Physical Tests	% Moisture (%)	11.1	6.78	10.7	24.5	19.5
Metals	Antimony (Sb) (mg/kg)				<0.20	
	Arsenic (As) (mg/kg)				1.32	
	Barium (Ba) (mg/kg)				15.9	
	Beryllium (Be) (mg/kg)				<1.0	
	Cadmium (Cd) (mg/kg)				<0.50	
	Chromium (Cr) (mg/kg)				15.3	
	Cobalt (Co) (mg/kg)				4.1	
	Copper (Cu) (mg/kg)				25.2	
	Lead (Pb) (mg/kg)				<5.0	
	Mercury (Hg) (mg/kg)				<0.050	
	Molybdenum (Mo) (mg/kg)				<1.0	
	Nickel (Ni) (mg/kg)				11.2	
	Selenium (Se) (mg/kg)				<0.20	
	Silver (Ag) (mg/kg)				<1.0	
	Thallium (Tl) (mg/kg)				<1.0	
	Tin (Sn) (mg/kg)				<5.0	
	Uranium (U) (mg/kg)				<2.0	
	Vanadium (V) (mg/kg)				19.1	
	Zinc (Zn) (mg/kg)				20	
Volatile Organic Compounds	Benzene (mg/kg)	<0.0050				
	Ethylbenzene (mg/kg)	<0.015				
	Toluene (mg/kg)	<0.050				
	Trichloroethene (mg/kg)		<0.010			
	o-Xylene (mg/kg)	<0.050				
	m+p-Xylene (mg/kg)	<0.050				
	Xylenes (mg/kg)	<0.10				
	Surrogate: 4-Bromofluorobenzene (%)		96			
	Surrogate: 1,2-Dichloroethane d4 (%)		106			
	Surrogate: Toluene d8 (%)		96			
Hydrocarbons	F1 (C6-C10) (mg/kg)	<10				
	F1-BTEX (mg/kg)	<10				
	F2 (C10-C16) (mg/kg)	21	<20	1970	<20	<20
	F2-Naphth (mg/kg)		<20	1970		
	F3 (C16-C34) (mg/kg)	23	<20	129	51	29
	F3-PAH (mg/kg)		<20	129		
	F4 (C34-C50) (mg/kg)	<20	<20	<20	<20	<20
	F4G-SG (GHH-Silica) (mg/kg)					
	Total Hydrocarbons (C6-C50) (mg/kg)	44				
	Chrom. to baseline at nC50	YES	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	102	90	221 *	87	96

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-36	L806542-37	L806542-38	L806542-39	L806542-40
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	14-AUG-09	14-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09
	Sampled Time					
	Client ID	WLF09-SS-036	WLF09-SS-037	PLF09-SS-038	PLF09-SS-039	PLF09-SS-040
Grouping	**Analyte**					
SOIL						
Physical Tests	% Moisture (%)	20.2	21.9	26.3	11.7	15.6
Metals	Antimony (Sb) (mg/kg)					
	Arsenic (As) (mg/kg)					
	Barium (Ba) (mg/kg)					
	Beryllium (Be) (mg/kg)					
	Cadmium (Cd) (mg/kg)					
	Chromium (Cr) (mg/kg)					
	Cobalt (Co) (mg/kg)					
	Copper (Cu) (mg/kg)					
	Lead (Pb) (mg/kg)					
	Mercury (Hg) (mg/kg)					
	Molybdenum (Mo) (mg/kg)					
	Nickel (Ni) (mg/kg)					
	Selenium (Se) (mg/kg)					
	Silver (Ag) (mg/kg)					
	Thallium (Tl) (mg/kg)					
	Tin (Sn) (mg/kg)					
	Uranium (U) (mg/kg)					
	Vanadium (V) (mg/kg)					
	Zinc (Zn) (mg/kg)					
Volatile Organic Compounds	Benzene (mg/kg)					
	Ethylbenzene (mg/kg)					
	Toluene (mg/kg)					
	Trichloroethene (mg/kg)					
	o-Xylene (mg/kg)					
	m+p-Xylene (mg/kg)					
	Xylenes (mg/kg)					
	Surrogate: 4-Bromofluorobenzene (%)					
	Surrogate: 1,2-Dichloroethane d4 (%)					
	Surrogate: Toluene d8 (%)					
Hydrocarbons	F1 (C6-C10) (mg/kg)					
	F1-BTEX (mg/kg)					
	F2 (C10-C16) (mg/kg)	<20	<20	<20	<20	<20
	F2-Naphth (mg/kg)					
	F3 (C16-C34) (mg/kg)	<20	<20	135	<20	<20
	F3-PAH (mg/kg)					
	F4 (C34-C50) (mg/kg)	<20	<20	76	<20	<20
	F4G-SG (GHH-Silica) (mg/kg)					
	Total Hydrocarbons (C6-C50) (mg/kg)					
	Chrom. to baseline at nC50	YES	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	94	97	97	88	93

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-41	L806542-42	L806542-43	L806542-44	L806542-45
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09
	Sampled Time					
	Client ID	PLF09-SS-041	PLF09-SS-042	PLF09-SS-043	PLF09-SS-044	PLF09-SS-045
Grouping	**Analyte**					
SOIL						
Physical Tests	% Moisture (%)	14.0	28.3	13.0	19.5	31.8
Metals	Antimony (Sb) (mg/kg)					
	Arsenic (As) (mg/kg)					
	Barium (Ba) (mg/kg)					
	Beryllium (Be) (mg/kg)					
	Cadmium (Cd) (mg/kg)					
	Chromium (Cr) (mg/kg)					
	Cobalt (Co) (mg/kg)					
	Copper (Cu) (mg/kg)					
	Lead (Pb) (mg/kg)					
	Mercury (Hg) (mg/kg)					
	Molybdenum (Mo) (mg/kg)					
	Nickel (Ni) (mg/kg)					
	Selenium (Se) (mg/kg)					
	Silver (Ag) (mg/kg)					
	Thallium (Tl) (mg/kg)					
	Tin (Sn) (mg/kg)					
	Uranium (U) (mg/kg)					
	Vanadium (V) (mg/kg)					
	Zinc (Zn) (mg/kg)					
Volatile Organic Compounds	Benzene (mg/kg)					
	Ethylbenzene (mg/kg)					
	Toluene (mg/kg)					
	Trichloroethene (mg/kg)					
	o-Xylene (mg/kg)					
	m+p-Xylene (mg/kg)					
	Xylenes (mg/kg)					
	Surrogate: 4-Bromofluorobenzene (%)					
	Surrogate: 1,2-Dichloroethane d4 (%)					
	Surrogate: Toluene d8 (%)					
Hydrocarbons	F1 (C6-C10) (mg/kg)					
	F1-BTEX (mg/kg)					
	F2 (C10-C16) (mg/kg)	<20	<20	<20	<20	<20
	F2-Naphth (mg/kg)					
	F3 (C16-C34) (mg/kg)	<20	49	27	30	20
	F3-PAH (mg/kg)					
	F4 (C34-C50) (mg/kg)	<20	23	<20	24	<20
	F4G-SG (GHH-Silica) (mg/kg)					
	Total Hydrocarbons (C6-C50) (mg/kg)					
	Chrom. to baseline at nC50	YES	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	85	104	78	103	91

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L806542-46 SOIL 15-AUG-09 PLF09-SS-046	L806542-47 SOIL 15-AUG-09 PLF09-SS-047	L806542-48 SOIL 15-AUG-09 PLF09-SS-048	L806542-49 SOIL 15-AUG-09 PLF09-SS-049	L806542-50 SOIL 15-AUG-09 PLF09-SS-050
Grouping	**Analyte**					
SOIL						
Physical Tests	% Moisture (%)	50.1	55.5	27.7	43.0	7.96
Metals	Antimony (Sb) (mg/kg)			<0.20	<0.20	
	Arsenic (As) (mg/kg)			1.97	2.89	
	Barium (Ba) (mg/kg)			96.1	112	
	Beryllium (Be) (mg/kg)			<1.0	<1.0	
	Cadmium (Cd) (mg/kg)			<0.50	<0.50	
	Chromium (Cr) (mg/kg)			49.2	56.3	
	Cobalt (Co) (mg/kg)			11.3	14.2	
	Copper (Cu) (mg/kg)			24.7	32.2	
	Lead (Pb) (mg/kg)			6.0	8.1	
	Mercury (Hg) (mg/kg)			<0.050	<0.050	
	Molybdenum (Mo) (mg/kg)			<1.0	<1.0	
	Nickel (Ni) (mg/kg)			30.7	36.0	
	Selenium (Se) (mg/kg)			0.26	0.26	
	Silver (Ag) (mg/kg)			<1.0	<1.0	
	Thallium (Tl) (mg/kg)			<1.0	<1.0	
	Tin (Sn) (mg/kg)			<5.0	<5.0	
	Uranium (U) (mg/kg)			<2.0	2.1	
	Vanadium (V) (mg/kg)			48.4	58.4	
	Zinc (Zn) (mg/kg)			58	65	
Volatile Organic Compounds	Benzene (mg/kg)		<0.0050		<0.0050	
	Ethylbenzene (mg/kg)		<0.015		<0.015	
	Toluene (mg/kg)		<0.050		<0.050	
	Trichloroethene (mg/kg)					
	o-Xylene (mg/kg)		<0.050		<0.050	
	m+p-Xylene (mg/kg)		<0.050		<0.050	
	Xylenes (mg/kg)		<0.10		<0.10	
	Surrogate: 4-Bromofluorobenzene (%)					
	Surrogate: 1,2-Dichloroethane d4 (%)					
	Surrogate: Toluene d8 (%)					
Hydrocarbons	F1 (C6-C10) (mg/kg)		<10		<10	
	F1-BTEX (mg/kg)		<10		<10	
	F2 (C10-C16) (mg/kg)	<20	<20	<20	<20	<20
	F2-Naphth (mg/kg)					
	F3 (C16-C34) (mg/kg)	278	259	102	76	<20
	F3-PAH (mg/kg)					
	F4 (C34-C50) (mg/kg)	144	153	49	48	<20
	F4G-SG (GHH-Silica) (mg/kg)					
	Total Hydrocarbons (C6-C50) (mg/kg)		412		124	
	Chrom. to baseline at nC50	YES	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	99	89	112	91	101

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-51	L806542-52	L806542-53	L806542-54	L806542-55
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09
	Sampled Time					
	Client ID	PLF09-SS-051	PLF09-SS-052	PLF09-SS-053	PLF09-SS-054	PLF09-SS-055
Grouping	**Analyte**					
SOIL						
Physical Tests	% Moisture (%)	8.68	16.3	14.8	13.7	17.6
Metals	Antimony (Sb) (mg/kg)					
	Arsenic (As) (mg/kg)					
	Barium (Ba) (mg/kg)					
	Beryllium (Be) (mg/kg)					
	Cadmium (Cd) (mg/kg)					
	Chromium (Cr) (mg/kg)					
	Cobalt (Co) (mg/kg)					
	Copper (Cu) (mg/kg)					
	Lead (Pb) (mg/kg)					
	Mercury (Hg) (mg/kg)					
	Molybdenum (Mo) (mg/kg)					
	Nickel (Ni) (mg/kg)					
	Selenium (Se) (mg/kg)					
	Silver (Ag) (mg/kg)					
	Thallium (Tl) (mg/kg)					
	Tin (Sn) (mg/kg)					
	Uranium (U) (mg/kg)					
	Vanadium (V) (mg/kg)					
	Zinc (Zn) (mg/kg)					
Volatile Organic Compounds	Benzene (mg/kg)					<0.0050
	Ethylbenzene (mg/kg)					<0.015
	Toluene (mg/kg)					<0.050
	Trichloroethene (mg/kg)					
	o-Xylene (mg/kg)					<0.050
	m+p-Xylene (mg/kg)					<0.050
	Xylenes (mg/kg)					<0.10
	Surrogate: 4-Bromofluorobenzene (%)					
	Surrogate: 1,2-Dichloroethane d4 (%)					
	Surrogate: Toluene d8 (%)					
Hydrocarbons	F1 (C6-C10) (mg/kg)					<10
	F1-BTEX (mg/kg)					<10
	F2 (C10-C16) (mg/kg)	<20	<20	92	<20	<20
	F2-Naphth (mg/kg)					
	F3 (C16-C34) (mg/kg)	23	<20	1260	34	<20
	F3-PAH (mg/kg)					
	F4 (C34-C50) (mg/kg)	<20	<20	232	29	<20
	F4G-SG (GHH-Silica) (mg/kg)					
	Total Hydrocarbons (C6-C50) (mg/kg)					<20
	Chrom. to baseline at nC50	YES	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	96	88	100	93	86

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

Grouping	Analyte	L806542-56	L806542-57	L806542-58	L806542-59	L806542-60
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09
	Sampled Time					
	Client ID	PLF09-SS-056	PLF09-SS-057	PLF09-SS-058	PLF09-SS-059	PLF09-SS-060
SOIL						
Physical Tests	% Moisture (%)	8.11	12.0	6.94	13.1	14.6
Metals	Antimony (Sb) (mg/kg)					
	Arsenic (As) (mg/kg)					
	Barium (Ba) (mg/kg)					
	Beryllium (Be) (mg/kg)					
	Cadmium (Cd) (mg/kg)					
	Chromium (Cr) (mg/kg)					
	Cobalt (Co) (mg/kg)					
	Copper (Cu) (mg/kg)					
	Lead (Pb) (mg/kg)					
	Mercury (Hg) (mg/kg)					
	Molybdenum (Mo) (mg/kg)					
	Nickel (Ni) (mg/kg)					
	Selenium (Se) (mg/kg)					
	Silver (Ag) (mg/kg)					
	Thallium (Tl) (mg/kg)					
	Tin (Sn) (mg/kg)					
	Uranium (U) (mg/kg)					
	Vanadium (V) (mg/kg)					
	Zinc (Zn) (mg/kg)					
Volatile Organic Compounds	Benzene (mg/kg)					
	Ethylbenzene (mg/kg)					
	Toluene (mg/kg)					
	Trichloroethene (mg/kg)	<0.010				
	o-Xylene (mg/kg)					
	m+p-Xylene (mg/kg)					
	Xylenes (mg/kg)					
	Surrogate: 4-Bromofluorobenzene (%)	95				
	Surrogate: 1,2-Dichloroethane d4 (%)	107				
	Surrogate: Toluene d8 (%)	96				
Hydrocarbons	F1 (C6-C10) (mg/kg)					
	F1-BTEX (mg/kg)					
	F2 (C10-C16) (mg/kg)	<20	<20	<20	<20	<20
	F2-Naphth (mg/kg)					
	F3 (C16-C34) (mg/kg)	<20	47	<20	<20	<20
	F3-PAH (mg/kg)					
	F4 (C34-C50) (mg/kg)	<20	29	<20	<20	<20
	F4G-SG (GHH-Silica) (mg/kg)					
	Total Hydrocarbons (C6-C50) (mg/kg)					
	Chrom. to baseline at nC50	YES	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	95	109	99	88	88

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L806542-61 SOIL 15-AUG-09 PLF09-SS-061	L806542-62 SOIL 15-AUG-09 PLF09-SS-062	L806542-63 SOIL 15-AUG-09 PLF09-SS-063	L806542-64 SOIL 15-AUG-09 PLF09-SS-064	L806542-65 SOIL 15-AUG-09 PLF09-SS-065
Grouping	**Analyte**					
SOIL						
Physical Tests	% Moisture (%)	13.6	15.2	14.1	35.8	25.7
Metals	Antimony (Sb) (mg/kg)					
	Arsenic (As) (mg/kg)					
	Barium (Ba) (mg/kg)					
	Beryllium (Be) (mg/kg)					
	Cadmium (Cd) (mg/kg)					
	Chromium (Cr) (mg/kg)					
	Cobalt (Co) (mg/kg)					
	Copper (Cu) (mg/kg)					
	Lead (Pb) (mg/kg)					
	Mercury (Hg) (mg/kg)					
	Molybdenum (Mo) (mg/kg)					
	Nickel (Ni) (mg/kg)					
	Selenium (Se) (mg/kg)					
	Silver (Ag) (mg/kg)					
	Thallium (Tl) (mg/kg)					
	Tin (Sn) (mg/kg)					
	Uranium (U) (mg/kg)					
	Vanadium (V) (mg/kg)					
	Zinc (Zn) (mg/kg)					
Volatile Organic Compounds	Benzene (mg/kg)		<0.0050			
	Ethylbenzene (mg/kg)		<0.015			
	Toluene (mg/kg)		<0.050			
	Trichloroethene (mg/kg)		<0.010			
	o-Xylene (mg/kg)		<0.050			
	m+p-Xylene (mg/kg)		<0.050			
	Xylenes (mg/kg)		<0.10			
	Surrogate: 4-Bromofluorobenzene (%)		95			
	Surrogate: 1,2-Dichloroethane d4 (%)		107			
	Surrogate: Toluene d8 (%)		96			
Hydrocarbons	F1 (C6-C10) (mg/kg)		<10			
	F1-BTEX (mg/kg)		<10			
	F2 (C10-C16) (mg/kg)	<20	28	<20	80	<20
	F2-Naphth (mg/kg)					
	F3 (C16-C34) (mg/kg)	<20	956	21	44	67
	F3-PAH (mg/kg)					
	F4 (C34-C50) (mg/kg)	<20	182	<20	<20	31
	F4G-SG (GHH-Silica) (mg/kg)					
	Total Hydrocarbons (C6-C50) (mg/kg)		1170			
	Chrom. to baseline at nC50	YES	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	93	102	93	128	93

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

Grouping	Analyte	L806542-66	L806542-67	L806542-68	L806542-69	L806542-70
	Sample ID	L806542-66	L806542-67	L806542-68	L806542-69	L806542-70
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09
	Sampled Time					
	Client ID	PLF09-SS-066	PLF09-SS-067	PLF09-SS-068	PLF09-SS-069	PLF09-SS-070
SOIL						
Physical Tests	% Moisture (%)	15.0	14.6	26.5	28.9	24.3
Metals	Antimony (Sb) (mg/kg)					
	Arsenic (As) (mg/kg)					
	Barium (Ba) (mg/kg)					
	Beryllium (Be) (mg/kg)					
	Cadmium (Cd) (mg/kg)					
	Chromium (Cr) (mg/kg)					
	Cobalt (Co) (mg/kg)					
	Copper (Cu) (mg/kg)					
	Lead (Pb) (mg/kg)					
	Mercury (Hg) (mg/kg)					
	Molybdenum (Mo) (mg/kg)					
	Nickel (Ni) (mg/kg)					
	Selenium (Se) (mg/kg)					
	Silver (Ag) (mg/kg)					
	Thallium (Tl) (mg/kg)					
	Tin (Sn) (mg/kg)					
	Uranium (U) (mg/kg)					
	Vanadium (V) (mg/kg)					
	Zinc (Zn) (mg/kg)					
Volatile Organic Compounds	Benzene (mg/kg)					
	Ethylbenzene (mg/kg)					
	Toluene (mg/kg)					
	Trichloroethene (mg/kg)					
	o-Xylene (mg/kg)					
	m+p-Xylene (mg/kg)					
	Xylenes (mg/kg)					
	Surrogate: 4-Bromofluorobenzene (%)					
	Surrogate: 1,2-Dichloroethane d4 (%)					
	Surrogate: Toluene d8 (%)					
Hydrocarbons	F1 (C6-C10) (mg/kg)					
	F1-BTEX (mg/kg)					
	F2 (C10-C16) (mg/kg)	<20	<20	<20	<20	<20
	F2-Naphth (mg/kg)					
	F3 (C16-C34) (mg/kg)	<20	76	59	20	42
	F3-PAH (mg/kg)					
	F4 (C34-C50) (mg/kg)	<20	24	25	<20	23
	F4G-SG (GHH-Silica) (mg/kg)					
	Total Hydrocarbons (C6-C50) (mg/kg)					
	Chrom. to baseline at nC50	YES	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	89	97	106	92	89

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L806542-71 SOIL 15-AUG-09 PLF09-SS-071	L806542-72 SOIL 15-AUG-09 WLF09-SS-072	L806542-73 SOIL 15-AUG-09 WLF09-SS-073	L806542-74 SOIL 15-AUG-09 WLF09-SS-074	L806542-75 SOIL 15-AUG-09 WLF09-SS-075
Grouping	**Analyte**					
SOIL						
Physical Tests	% Moisture (%)	23.1	12.9	19.6	11.6	27.4
Metals	Antimony (Sb) (mg/kg)					
	Arsenic (As) (mg/kg)					
	Barium (Ba) (mg/kg)					
	Beryllium (Be) (mg/kg)					
	Cadmium (Cd) (mg/kg)					
	Chromium (Cr) (mg/kg)					
	Cobalt (Co) (mg/kg)					
	Copper (Cu) (mg/kg)					
	Lead (Pb) (mg/kg)					
	Mercury (Hg) (mg/kg)					
	Molybdenum (Mo) (mg/kg)					
	Nickel (Ni) (mg/kg)					
	Selenium (Se) (mg/kg)					
	Silver (Ag) (mg/kg)					
	Thallium (Tl) (mg/kg)					
	Tin (Sn) (mg/kg)					
	Uranium (U) (mg/kg)					
	Vanadium (V) (mg/kg)					
	Zinc (Zn) (mg/kg)					
Volatile Organic Compounds	Benzene (mg/kg)			0.0072		
	Ethylbenzene (mg/kg)			<0.015		
	Toluene (mg/kg)			<0.050		
	Trichloroethene (mg/kg)					
	o-Xylene (mg/kg)			<0.050		
	m+p-Xylene (mg/kg)			<0.050		
	Xylenes (mg/kg)			<0.10		
	Surrogate: 4-Bromofluorobenzene (%)					
	Surrogate: 1,2-Dichloroethane d4 (%)					
	Surrogate: Toluene d8 (%)					
Hydrocarbons	F1 (C6-C10) (mg/kg)			<10		
	F1-BTEX (mg/kg)			<10		
	F2 (C10-C16) (mg/kg)	<20	<20	<20	<20	<20
	F2-Naphth (mg/kg)					
	F3 (C16-C34) (mg/kg)	30	<20	<20	<20	24
	F3-PAH (mg/kg)					
	F4 (C34-C50) (mg/kg)	<20	<20	<20	<20	<20
	F4G-SG (GHH-Silica) (mg/kg)					
	Total Hydrocarbons (C6-C50) (mg/kg)			<20		
	Chrom. to baseline at nC50	YES	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	89	100	102	91	95

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-76	L806542-77	L806542-78	L806542-79	L806542-80
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	15-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09
	Sampled Time					
	Client ID	WLF09-SS-076	PLF09-SS-077	PLF09-SS-078	PLF09-SS-079	PLF09-SS-080
Grouping	**Analyte**					
SOIL						
Physical Tests	% Moisture (%)	17.7	15.7	9.67	14.8	29.6
Metals	Antimony (Sb) (mg/kg)		0.41		0.37	<0.20
	Arsenic (As) (mg/kg)		2.60		2.10	1.21
	Barium (Ba) (mg/kg)		44.5		54.4	18.9
	Beryllium (Be) (mg/kg)		<1.0		<1.0	<1.0
	Cadmium (Cd) (mg/kg)		<0.50		<0.50	<0.50
	Chromium (Cr) (mg/kg)		26.6		27.1	13.2
	Cobalt (Co) (mg/kg)		7.2		6.5	3.3
	Copper (Cu) (mg/kg)		41.7		18.2	12.1
	Lead (Pb) (mg/kg)		112		33.0	<5.0
	Mercury (Hg) (mg/kg)		<0.050		<0.050	0.057
	Molybdenum (Mo) (mg/kg)		1.3		<1.0	<1.0
	Nickel (Ni) (mg/kg)		18.2		15.5	7.6
	Selenium (Se) (mg/kg)		<0.20		<0.20	<0.20
	Silver (Ag) (mg/kg)		<1.0		<1.0	<1.0
	Thallium (Tl) (mg/kg)		<1.0		<1.0	<1.0
	Tin (Sn) (mg/kg)		<5.0		<5.0	<5.0
	Uranium (U) (mg/kg)		<2.0		<2.0	<2.0
	Vanadium (V) (mg/kg)		28.3		28.6	18.2
	Zinc (Zn) (mg/kg)		344		51	59
Volatile Organic Compounds	Benzene (mg/kg)					
	Ethylbenzene (mg/kg)					
	Toluene (mg/kg)					
	Trichloroethene (mg/kg)					
	o-Xylene (mg/kg)					
	m+p-Xylene (mg/kg)					
	Xylenes (mg/kg)					
	Surrogate: 4-Bromofluorobenzene (%)					
	Surrogate: 1,2-Dichloroethane d4 (%)					
	Surrogate: Toluene d8 (%)					
Hydrocarbons	F1 (C6-C10) (mg/kg)					
	F1-BTEX (mg/kg)					
	F2 (C10-C16) (mg/kg)	<20	3720	28	27100	71
	F2-Naphth (mg/kg)		3720		27100	
	F3 (C16-C34) (mg/kg)	<20	60200	759	7950	53300
	F3-PAH (mg/kg)		60200		7950	
	F4 (C34-C50) (mg/kg)	<20	20800	206	239	6400
	F4G-SG (GHH-Silica) (mg/kg)		83200			61100
	Total Hydrocarbons (C6-C50) (mg/kg)					
	Chrom. to baseline at nC50	YES	NO	YES	YES	NO
	Surrogate: 2-Bromobenzotrifluoride (%)	112	0 *	105		88

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-81	L806542-82	L806542-83	L806542-84	L806542-85
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09
	Sampled Time					
	Client ID	PLF09-SS-081	PLF09-SS-082	PLF09-SS-083	PLF09-SS-084	PLF09-SS-085
Grouping	**Analyte**					
SOIL						
Physical Tests	% Moisture (%)	41.9	22.9	23.6	35.4	27.9
Metals	Antimony (Sb) (mg/kg)	<0.20		3.47	1.16	0.84
	Arsenic (As) (mg/kg)	1.21		5.06	1.91	3.35
	Barium (Ba) (mg/kg)	15.7		182	32.3	75.8
	Beryllium (Be) (mg/kg)	<1.0		<1.0	<1.0	<1.0
	Cadmium (Cd) (mg/kg)	<0.50		1.85	<0.50	<0.50
	Chromium (Cr) (mg/kg)	15.7		71.3	71.7	37.7
	Cobalt (Co) (mg/kg)	3.7		11.3	6.5	8.8
	Copper (Cu) (mg/kg)	8.5		104	19.4	23.2
	Lead (Pb) (mg/kg)	<5.0		86.3	5.2	11.7
	Mercury (Hg) (mg/kg)	<0.050		<0.050	<0.050	<0.050
	Molybdenum (Mo) (mg/kg)	<1.0		6.3	1.6	<1.0
	Nickel (Ni) (mg/kg)	9.1		41.8	131	24.0
	Selenium (Se) (mg/kg)	<0.20		<0.20	<0.20	0.24
	Silver (Ag) (mg/kg)	<1.0		1.2	<1.0	<1.0
	Thallium (Tl) (mg/kg)	<1.0		<1.0	<1.0	<1.0
	Tin (Sn) (mg/kg)	<5.0		<5.0	<5.0	<5.0
	Uranium (U) (mg/kg)	<2.0		<2.0	<2.0	<2.0
	Vanadium (V) (mg/kg)	20.8		34.2	25.1	35.7
	Zinc (Zn) (mg/kg)	46		270	53	206
Volatile Organic Compounds	Benzene (mg/kg)					
	Ethylbenzene (mg/kg)					
	Toluene (mg/kg)					
	Trichloroethene (mg/kg)			<0.010		
	o-Xylene (mg/kg)					
	m+p-Xylene (mg/kg)					
	Xylenes (mg/kg)					
	Surrogate: 4-Bromofluorobenzene (%)			94		
	Surrogate: 1,2-Dichloroethane d4 (%)			108		
	Surrogate: Toluene d8 (%)			96		
Hydrocarbons	F1 (C6-C10) (mg/kg)					
	F1-BTEX (mg/kg)					
	F2 (C10-C16) (mg/kg)	65	51	790	13200	94
	F2-Naphth (mg/kg)			790		
	F3 (C16-C34) (mg/kg)	63500	74900	36400	26500	258000
	F3-PAH (mg/kg)			36400		
	F4 (C34-C50) (mg/kg)	7620	6300	8110	4700	29900
	F4G-SG (GHH-Silica) (mg/kg)	65800	48000	39200	28600	303000
	Total Hydrocarbons (C6-C50) (mg/kg)					
	Chrom. to baseline at nC50	NO	NO	NO	NO	NO
	Surrogate: 2-Bromobenzotrifluoride (%)	107	105	97	381 *	0 *

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L806542-86 SOIL 16-AUG-09 PLF09-SS-086	L806542-87 SOIL 16-AUG-09 WLF09-SS-087	L806542-88 SOIL 16-AUG-09 WLF09-SS-088	L806542-89 SOIL 16-AUG-09 WLF09-SS-089	L806542-90 SOIL 16-AUG-09 WLF09-SS-090
Grouping	**Analyte**					
SOIL						
Physical Tests	% Moisture (%)	25.0	17.7	9.81	17.5	16.0
Metals	Antimony (Sb) (mg/kg)		<0.20			<0.20
	Arsenic (As) (mg/kg)		2.33			1.69
	Barium (Ba) (mg/kg)		22.0			21.6
	Beryllium (Be) (mg/kg)		<1.0			<1.0
	Cadmium (Cd) (mg/kg)		<0.50			<0.50
	Chromium (Cr) (mg/kg)		20.4			21.0
	Cobalt (Co) (mg/kg)		6.1			4.9
	Copper (Cu) (mg/kg)		15.2			12.8
	Lead (Pb) (mg/kg)		<5.0			<5.0
	Mercury (Hg) (mg/kg)		<0.050			<0.050
	Molybdenum (Mo) (mg/kg)		<1.0			<1.0
	Nickel (Ni) (mg/kg)		13.6			11.3
	Selenium (Se) (mg/kg)		<0.20			<0.20
	Silver (Ag) (mg/kg)		<1.0			<1.0
	Thallium (Tl) (mg/kg)		<1.0			<1.0
	Tin (Sn) (mg/kg)		<5.0			<5.0
	Uranium (U) (mg/kg)		<2.0			<2.0
	Vanadium (V) (mg/kg)		26.0			24.2
	Zinc (Zn) (mg/kg)		27			26
Volatile Organic Compounds	Benzene (mg/kg)					
	Ethylbenzene (mg/kg)					
	Toluene (mg/kg)					
	Trichloroethene (mg/kg)					
	o-Xylene (mg/kg)					
	m+p-Xylene (mg/kg)					
	Xylenes (mg/kg)					
	Surrogate: 4-Bromofluorobenzene (%)					
	Surrogate: 1,2-Dichloroethane d4 (%)					
	Surrogate: Toluene d8 (%)					
Hydrocarbons	F1 (C6-C10) (mg/kg)					
	F1-BTEX (mg/kg)					
	F2 (C10-C16) (mg/kg)	68	52	<20	<20	<20
	F2-Naphth (mg/kg)					
	F3 (C16-C34) (mg/kg)	508	360	139	<20	44
	F3-PAH (mg/kg)					
	F4 (C34-C50) (mg/kg)	103	71	29	<20	<20
	F4G-SG (GHH-Silica) (mg/kg)					
	Total Hydrocarbons (C6-C50) (mg/kg)					
	Chrom. to baseline at nC50	YES	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	92	82	86	94	89

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

Grouping	Analyte	L806542-91	L806542-92	L806542-93	L806542-94	L806542-95
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09
	Sampled Time					
	Client ID	WLF09-SS-091	WLF09-SS-092	WLF09-SS-093	WLF09-SS-094	BLF09-SS-095
SOIL						
Physical Tests	% Moisture (%)	16.7	12.3	13.4	10.5	18.1
Metals	Antimony (Sb) (mg/kg)					
	Arsenic (As) (mg/kg)					
	Barium (Ba) (mg/kg)					
	Beryllium (Be) (mg/kg)					
	Cadmium (Cd) (mg/kg)					
	Chromium (Cr) (mg/kg)					
	Cobalt (Co) (mg/kg)					
	Copper (Cu) (mg/kg)					
	Lead (Pb) (mg/kg)					
	Mercury (Hg) (mg/kg)					
	Molybdenum (Mo) (mg/kg)					
	Nickel (Ni) (mg/kg)					
	Selenium (Se) (mg/kg)					
	Silver (Ag) (mg/kg)					
	Thallium (Tl) (mg/kg)					
	Tin (Sn) (mg/kg)					
	Uranium (U) (mg/kg)					
	Vanadium (V) (mg/kg)					
	Zinc (Zn) (mg/kg)					
Volatile Organic Compounds	Benzene (mg/kg)			<0.0050	<0.0050	
	Ethylbenzene (mg/kg)			<0.015	<0.015	
	Toluene (mg/kg)			<0.050	<0.050	
	Trichloroethene (mg/kg)		<0.010			
	o-Xylene (mg/kg)			<0.050	<0.050	
	m+p-Xylene (mg/kg)			<0.050	<0.050	
	Xylenes (mg/kg)			<0.10	<0.10	
	Surrogate: 4-Bromofluorobenzene (%)		102			
	Surrogate: 1,2-Dichloroethane d4 (%)		109			
	Surrogate: Toluene d8 (%)		96			
Hydrocarbons	F1 (C6-C10) (mg/kg)			<10	<10	
	F1-BTEX (mg/kg)			<10	<10	
	F2 (C10-C16) (mg/kg)	<20	<20	<20	86	2010
	F2-Naphth (mg/kg)					
	F3 (C16-C34) (mg/kg)	85	86	23	<20	923
	F3-PAH (mg/kg)					
	F4 (C34-C50) (mg/kg)	31	21	<20	<20	<20
	F4G-SG (GHH-Silica) (mg/kg)					
	Total Hydrocarbons (C6-C50) (mg/kg)			23	86	
	Chrom. to baseline at nC50	YES	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	90	78 *	85	99	166 *

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-96	L806542-97	L806542-98	L806542-99	L806542-100
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09
	Sampled Time					
	Client ID	BLF09-SS-096	BLF09-SS-097	BLF09-SS-098	BLF09-SS-099	BLF09-SS-100
Grouping	**Analyte**					
SOIL						
Physical Tests	% Moisture (%)	12.3	11.7	13.6	13.3	13.9
Metals	Antimony (Sb) (mg/kg)					
	Arsenic (As) (mg/kg)					
	Barium (Ba) (mg/kg)					
	Beryllium (Be) (mg/kg)					
	Cadmium (Cd) (mg/kg)					
	Chromium (Cr) (mg/kg)					
	Cobalt (Co) (mg/kg)					
	Copper (Cu) (mg/kg)					
	Lead (Pb) (mg/kg)					
	Mercury (Hg) (mg/kg)					
	Molybdenum (Mo) (mg/kg)					
	Nickel (Ni) (mg/kg)					
	Selenium (Se) (mg/kg)					
	Silver (Ag) (mg/kg)					
	Thallium (Tl) (mg/kg)					
	Tin (Sn) (mg/kg)					
	Uranium (U) (mg/kg)					
	Vanadium (V) (mg/kg)					
	Zinc (Zn) (mg/kg)					
Volatile Organic Compounds	Benzene (mg/kg)					
	Ethylbenzene (mg/kg)					
	Toluene (mg/kg)					
	Trichloroethene (mg/kg)					
	o-Xylene (mg/kg)					
	m+p-Xylene (mg/kg)					
	Xylenes (mg/kg)					
	Surrogate: 4-Bromofluorobenzene (%)					
	Surrogate: 1,2-Dichloroethane d4 (%)					
	Surrogate: Toluene d8 (%)					
Hydrocarbons	F1 (C6-C10) (mg/kg)					
	F1-BTEX (mg/kg)					
	F2 (C10-C16) (mg/kg)	3790	1370	13200	1590	7240
	F2-Naphth (mg/kg)					
	F3 (C16-C34) (mg/kg)	1400	882	2350	1040	3770
	F3-PAH (mg/kg)					
	F4 (C34-C50) (mg/kg)	65	<20	<20	<20	24
	F4G-SG (GHH-Silica) (mg/kg)					
	Total Hydrocarbons (C6-C50) (mg/kg)					
	Chrom. to baseline at nC50	YES	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	313 *	115	832 *	102	16 *

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-101	L806542-102	L806542-103	L806542-104	L806542-105
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09
	Sampled Time					
	Client ID	BLF09-SS-101	BLF09-SS-102	BLF09-SS-103	BLF09-SS-104	BLF09-SS-105
Grouping	**Analyte**					
SOIL						
Physical Tests	% Moisture (%)	15.4	16.5	15.8	13.4	17.7
Metals	Antimony (Sb) (mg/kg)					
	Arsenic (As) (mg/kg)					
	Barium (Ba) (mg/kg)					
	Beryllium (Be) (mg/kg)					
	Cadmium (Cd) (mg/kg)					
	Chromium (Cr) (mg/kg)					
	Cobalt (Co) (mg/kg)					
	Copper (Cu) (mg/kg)					
	Lead (Pb) (mg/kg)					
	Mercury (Hg) (mg/kg)					
	Molybdenum (Mo) (mg/kg)					
	Nickel (Ni) (mg/kg)					
	Selenium (Se) (mg/kg)					
	Silver (Ag) (mg/kg)					
	Thallium (Tl) (mg/kg)					
	Tin (Sn) (mg/kg)					
	Uranium (U) (mg/kg)					
	Vanadium (V) (mg/kg)					
	Zinc (Zn) (mg/kg)					
Volatile Organic Compounds	Benzene (mg/kg)					
	Ethylbenzene (mg/kg)					
	Toluene (mg/kg)					
	Trichloroethene (mg/kg)					
	o-Xylene (mg/kg)					
	m+p-Xylene (mg/kg)					
	Xylenes (mg/kg)					
	Surrogate: 4-Bromofluorobenzene (%)					
	Surrogate: 1,2-Dichloroethane d4 (%)					
	Surrogate: Toluene d8 (%)					
Hydrocarbons	F1 (C6-C10) (mg/kg)					
	F1-BTEX (mg/kg)					
	F2 (C10-C16) (mg/kg)	5400	9940	7710	8550	2940
	F2-Naphth (mg/kg)					
	F3 (C16-C34) (mg/kg)	2560	1850	1830	4900	1780
	F3-PAH (mg/kg)					
	F4 (C34-C50) (mg/kg)	<20	<20	<20	474	<20
	F4G-SG (GHH-Silica) (mg/kg)				1400	
	Total Hydrocarbons (C6-C50) (mg/kg)					
	Chrom. to baseline at nC50	YES	YES	YES	NO	YES
	Surrogate: 2-Bromobenzotrifluoride (%)	15 *	862 *	102	32 *	2 *

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-1	L806542-2	L806542-3	L806542-4	L806542-5
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	13-AUG-09	13-AUG-09	13-AUG-09	13-AUG-09	13-AUG-09
	Sampled Time					
	Client ID	PLF09-SS-001	PLF09-SS-002	PLF09-SS-003	PLF09-SS-004	PLF09-SS-005
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Dibenzo(a,h)anthracene (mg/kg)					
	Indeno(1,2,3-cd)pyrene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Quinoline (mg/kg)					
	Surrogate: 2-Fluorobiphenyl (%)					
	Surrogate: Nitrobenzene d5 (%)					
	Surrogate: p-Terphenyl d14 (%)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-6	L806542-7	L806542-8	L806542-9	L806542-10
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	13-AUG-09	13-AUG-09	13-AUG-09	13-AUG-09	13-AUG-09
	Sampled Time					
	Client ID	PLF09-SS-006	PLF09-SS-007	PLF09-SS-008	PLF09-SS-009	PLF09-SS-010
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Dibenzo(a,h)anthracene (mg/kg)					
	Indeno(1,2,3-cd)pyrene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Quinoline (mg/kg)					
	Surrogate: 2-Fluorobiphenyl (%)					
	Surrogate: Nitrobenzene d5 (%)					
	Surrogate: p-Terphenyl d14 (%)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-11	L806542-12	L806542-13	L806542-14	L806542-15
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	13-AUG-09	13-AUG-09	14-AUG-09	14-AUG-09	14-AUG-09
	Sampled Time					
	Client ID	PLF09-SS-011	PLF09-SS-012	WLF09-SS-013	WLF09-SS-014	WLF09-SS-015
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Dibenzo(a,h)anthracene (mg/kg)					
	Indeno(1,2,3-cd)pyrene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Quinoline (mg/kg)					
	Surrogate: 2-Fluorobiphenyl (%)					
	Surrogate: Nitrobenzene d5 (%)					
	Surrogate: p-Terphenyl d14 (%)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-16	L806542-17	L806542-18	L806542-19	L806542-20
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	14-AUG-09	14-AUG-09	14-AUG-09	14-AUG-09	14-AUG-09
	Sampled Time					
	Client ID	WLF09-SS-016	WLF09-SS-017	WLF09-SS-018	WLF09-SS-019	WLF09-SS-020
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Dibenzo(a,h)anthracene (mg/kg)					
	Indeno(1,2,3-cd)pyrene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Quinoline (mg/kg)					
	Surrogate: 2-Fluorobiphenyl (%)					
	Surrogate: Nitrobenzene d5 (%)					
	Surrogate: p-Terphenyl d14 (%)					

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-21	L806542-22	L806542-23	L806542-24	L806542-25
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	14-AUG-09	14-AUG-09	14-AUG-09	14-AUG-09	14-AUG-09
	Sampled Time					
	Client ID	WLF09-SS-021	WLF09-SS-022	WLF09-SS-023	WLF09-SS-024	WLF09-SS-025
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Dibenzo(a,h)anthracene (mg/kg)					
	Indeno(1,2,3-cd)pyrene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Quinoline (mg/kg)					
	Surrogate: 2-Fluorobiphenyl (%)					
	Surrogate: Nitrobenzene d5 (%)					
	Surrogate: p-Terphenyl d14 (%)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-26	L806542-27	L806542-28	L806542-29	L806542-30
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	14-AUG-09	14-AUG-09	14-AUG-09	14-AUG-09	14-AUG-09
	Sampled Time					
	Client ID	WLF09-SS-026	WLF09-SS-027	WLF09-SS-028	WLF09-SS-029	WLF09-SS-030
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Dibenzo(a,h)anthracene (mg/kg)					
	Indeno(1,2,3-cd)pyrene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Quinoline (mg/kg)					
	Surrogate: 2-Fluorobiphenyl (%)					
	Surrogate: Nitrobenzene d5 (%)					
	Surrogate: p-Terphenyl d14 (%)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L806542-31 SOIL 14-AUG-09 WLF09-SS-031	L806542-32 SOIL 14-AUG-09 WLF09-SS-032	L806542-33 SOIL 14-AUG-09 WLF09-SS-033	L806542-34 SOIL 14-AUG-09 WLF09-SS-034	L806542-35 SOIL 14-AUG-09 WLF09-SS-035
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)		<0.010	<0.010		
	Benzo(a)pyrene (mg/kg)		<0.010	<0.010		
	Benzo(b&j)fluoranthene (mg/kg)		<0.010	<0.010		
	Benzo(k)fluoranthene (mg/kg)		<0.010	<0.010		
	Dibenzo(a,h)anthracene (mg/kg)		<0.010	<0.010		
	Indeno(1,2,3-cd)pyrene (mg/kg)		<0.010	<0.010		
	Naphthalene (mg/kg)		<0.010	<0.010		
	Phenanthrene (mg/kg)		<0.010	0.032		
	Pyrene (mg/kg)		0.011	0.021		
	Quinoline (mg/kg)		<0.010	<0.010		
	Surrogate: 2-Fluorobiphenyl (%)		61	84		
	Surrogate: Nitrobenzene d5 (%)		63	48		
	Surrogate: p-Terphenyl d14 (%)		75	80		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

		L806542-36	L806542-37	L806542-38	L806542-39	L806542-40
	Sample ID	L806542-36	L806542-37	L806542-38	L806542-39	L806542-40
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	14-AUG-09	14-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09
	Sampled Time					
	Client ID	WLF09-SS-036	WLF09-SS-037	PLF09-SS-038	PLF09-SS-039	PLF09-SS-040
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Dibenzo(a,h)anthracene (mg/kg)					
	Indeno(1,2,3-cd)pyrene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Quinoline (mg/kg)					
	Surrogate: 2-Fluorobiphenyl (%)					
	Surrogate: Nitrobenzene d5 (%)					
	Surrogate: p-Terphenyl d14 (%)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-41	L806542-42	L806542-43	L806542-44	L806542-45
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09
	Sampled Time					
	Client ID	PLF09-SS-041	PLF09-SS-042	PLF09-SS-043	PLF09-SS-044	PLF09-SS-045
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Dibenzo(a,h)anthracene (mg/kg)					
	Indeno(1,2,3-cd)pyrene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Quinoline (mg/kg)					
	Surrogate: 2-Fluorobiphenyl (%)					
	Surrogate: Nitrobenzene d5 (%)					
	Surrogate: p-Terphenyl d14 (%)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L806542-46 SOIL 15-AUG-09 PLF09-SS-046	L806542-47 SOIL 15-AUG-09 PLF09-SS-047	L806542-48 SOIL 15-AUG-09 PLF09-SS-048	L806542-49 SOIL 15-AUG-09 PLF09-SS-049	L806542-50 SOIL 15-AUG-09 PLF09-SS-050
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Dibenzo(a,h)anthracene (mg/kg)					
	Indeno(1,2,3-cd)pyrene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Quinoline (mg/kg)					
	Surrogate: 2-Fluorobiphenyl (%)					
	Surrogate: Nitrobenzene d5 (%)					
	Surrogate: p-Terphenyl d14 (%)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-51	L806542-52	L806542-53	L806542-54	L806542-55
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09
	Sampled Time					
	Client ID	PLF09-SS-051	PLF09-SS-052	PLF09-SS-053	PLF09-SS-054	PLF09-SS-055
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Dibenzo(a,h)anthracene (mg/kg)					
	Indeno(1,2,3-cd)pyrene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Quinoline (mg/kg)					
	Surrogate: 2-Fluorobiphenyl (%)					
	Surrogate: Nitrobenzene d5 (%)					
	Surrogate: p-Terphenyl d14 (%)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L806542-56 SOIL 15-AUG-09 PLF09-SS-056	L806542-57 SOIL 15-AUG-09 PLF09-SS-057	L806542-58 SOIL 15-AUG-09 PLF09-SS-058	L806542-59 SOIL 15-AUG-09 PLF09-SS-059	L806542-60 SOIL 15-AUG-09 PLF09-SS-060
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Dibenzo(a,h)anthracene (mg/kg)					
	Indeno(1,2,3-cd)pyrene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Quinoline (mg/kg)					
	Surrogate: 2-Fluorobiphenyl (%)					
	Surrogate: Nitrobenzene d5 (%)					
	Surrogate: p-Terphenyl d14 (%)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L806542-61 SOIL 15-AUG-09 PLF09-SS-061	L806542-62 SOIL 15-AUG-09 PLF09-SS-062	L806542-63 SOIL 15-AUG-09 PLF09-SS-063	L806542-64 SOIL 15-AUG-09 PLF09-SS-064	L806542-65 SOIL 15-AUG-09 PLF09-SS-065
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Dibenzo(a,h)anthracene (mg/kg)					
	Indeno(1,2,3-cd)pyrene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Quinoline (mg/kg)					
	Surrogate: 2-Fluorobiphenyl (%)					
	Surrogate: Nitrobenzene d5 (%)					
	Surrogate: p-Terphenyl d14 (%)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-66	L806542-67	L806542-68	L806542-69	L806542-70
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09	15-AUG-09
	Sampled Time					
	Client ID	PLF09-SS-066	PLF09-SS-067	PLF09-SS-068	PLF09-SS-069	PLF09-SS-070
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Dibenzo(a,h)anthracene (mg/kg)					
	Indeno(1,2,3-cd)pyrene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Quinoline (mg/kg)					
	Surrogate: 2-Fluorobiphenyl (%)					
	Surrogate: Nitrobenzene d5 (%)					
	Surrogate: p-Terphenyl d14 (%)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L806542-71 SOIL 15-AUG-09 PLF09-SS-071	L806542-72 SOIL 15-AUG-09 WLF09-SS-072	L806542-73 SOIL 15-AUG-09 WLF09-SS-073	L806542-74 SOIL 15-AUG-09 WLF09-SS-074	L806542-75 SOIL 15-AUG-09 WLF09-SS-075
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Dibenzo(a,h)anthracene (mg/kg)					
	Indeno(1,2,3-cd)pyrene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Quinoline (mg/kg)					
	Surrogate: 2-Fluorobiphenyl (%)					
	Surrogate: Nitrobenzene d5 (%)					
	Surrogate: p-Terphenyl d14 (%)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L806542-76 SOIL 15-AUG-09 WLF09-SS-076	L806542-77 SOIL 16-AUG-09 PLF09-SS-077	L806542-78 SOIL 16-AUG-09 PLF09-SS-078	L806542-79 SOIL 16-AUG-09 PLF09-SS-079	L806542-80 SOIL 16-AUG-09 PLF09-SS-080
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)		<0.20		<0.010	
	Benzo(a)pyrene (mg/kg)		<0.20		<0.010	
	Benzo(b&j)fluoranthene (mg/kg)		<0.20		<0.010	
	Benzo(k)fluoranthene (mg/kg)		<0.20		<0.010	
	Dibenzo(a,h)anthracene (mg/kg)		<0.20		<0.010	
	Indeno(1,2,3-cd)pyrene (mg/kg)		<0.20		<0.010	
	Naphthalene (mg/kg)		<0.20		<0.050	
	Phenanthrene (mg/kg)		<0.20		1.66	
	Pyrene (mg/kg)		0.29		0.066	
	Quinoline (mg/kg)		<0.20		<0.050	
	Surrogate: 2-Fluorobiphenyl (%)		85		0 *	
	Surrogate: Nitrobenzene d5 (%)		71		0 *	
	Surrogate: p-Terphenyl d14 (%)		75		90	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-81	L806542-82	L806542-83	L806542-84	L806542-85
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09
	Sampled Time					
	Client ID	PLF09-SS-081	PLF09-SS-082	PLF09-SS-083	PLF09-SS-084	PLF09-SS-085
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)			<0.010		
	Benzo(a)pyrene (mg/kg)			0.072		
	Benzo(b&j)fluoranthene (mg/kg)			<0.010		
	Benzo(k)fluoranthene (mg/kg)			<0.010		
	Dibenzo(a,h)anthracene (mg/kg)			<0.010		
	Indeno(1,2,3-cd)pyrene (mg/kg)			0.098		
	Naphthalene (mg/kg)			0.029		
	Phenanthrene (mg/kg)			<0.010		
	Pyrene (mg/kg)			0.204		
	Quinoline (mg/kg)			<0.010		
	Surrogate: 2-Fluorobiphenyl (%)			56		
	Surrogate: Nitrobenzene d5 (%)			44		
	Surrogate: p-Terphenyl d14 (%)			88		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-86	L806542-87	L806542-88	L806542-89	L806542-90
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09
	Sampled Time					
	Client ID	PLF09-SS-086	WLF09-SS-087	WLF09-SS-088	WLF09-SS-089	WLF09-SS-090
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Dibenzo(a,h)anthracene (mg/kg)					
	Indeno(1,2,3-cd)pyrene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Quinoline (mg/kg)					
	Surrogate: 2-Fluorobiphenyl (%)					
	Surrogate: Nitrobenzene d5 (%)					
	Surrogate: p-Terphenyl d14 (%)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-91	L806542-92	L806542-93	L806542-94	L806542-95
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09
	Sampled Time					
	Client ID	WLF09-SS-091	WLF09-SS-092	WLF09-SS-093	WLF09-SS-094	BLF09-SS-095
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Dibenzo(a,h)anthracene (mg/kg)					
	Indeno(1,2,3-cd)pyrene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Quinoline (mg/kg)					
	Surrogate: 2-Fluorobiphenyl (%)					
	Surrogate: Nitrobenzene d5 (%)					
	Surrogate: p-Terphenyl d14 (%)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L806542-96 SOIL 16-AUG-09 BLF09-SS-096	L806542-97 SOIL 16-AUG-09 BLF09-SS-097	L806542-98 SOIL 16-AUG-09 BLF09-SS-098	L806542-99 SOIL 16-AUG-09 BLF09-SS-099	L806542-100 SOIL 16-AUG-09 BLF09-SS-100
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Dibenzo(a,h)anthracene (mg/kg)					
	Indeno(1,2,3-cd)pyrene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Quinoline (mg/kg)					
	Surrogate: 2-Fluorobiphenyl (%)					
	Surrogate: Nitrobenzene d5 (%)					
	Surrogate: p-Terphenyl d14 (%)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-101	L806542-102	L806542-103	L806542-104	L806542-105
	Description	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampled Date	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09
	Sampled Time					
	Client ID	BLF09-SS-101	BLF09-SS-102	BLF09-SS-103	BLF09-SS-104	BLF09-SS-105
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b&j)fluoranthene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Dibenzo(a,h)anthracene (mg/kg)					
	Indeno(1,2,3-cd)pyrene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Quinoline (mg/kg)					
	Surrogate: 2-Fluorobiphenyl (%)					
	Surrogate: Nitrobenzene d5 (%)					
	Surrogate: p-Terphenyl d14 (%)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

Grouping	Analyte	L806542-106	L806542-108	L806542-110	L806542-111	L806542-112
	Description	GROUND WATE	GROUND WATE	GROUND WATE	GROUND WATE	GROUND WATE
	Sampled Date	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09	16-AUG-09
	Sampled Time					
	Client ID	PLF09-GW-106	PLF09-GW-108	PLF09-GW-110	WLF09-GW-111	WLF09-GW-112
WATER						
Volatile Organic Compounds	Benzene (mg/L)			<0.00050		
	EthylBenzene (mg/L)			<0.00050		
	Toluene (mg/L)			<0.00050		
	Xylenes (mg/L)			<0.00050		
	F1(C6-C10) (mg/L)			<0.10		
	F1-BTEX (mg/L)			<0.10		
Hydrocarbons	F2 (>C10-C16) (mg/L)	<0.25	<0.25	<0.25	<0.25	<0.25
	F3 (C16-C34) (mg/L)	<0.25	<0.25	<0.25	<0.25	<0.25
	F4 (C34-C50) (mg/L)	<0.25	<0.25	<0.25	<0.25	<0.25

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L806542-113				
	Description	GROUND WATE				
	Sampled Date	16-AUG-09				
	Sampled Time					
	Client ID	WLF09-GW-113				
Grouping	**Analyte**					
WATER						
Volatile Organic Compounds	Benzene (mg/L)	<0.00050				
	EthylBenzene (mg/L)	<0.00050				
	Toluene (mg/L)	<0.00050				
	Xylenes (mg/L)	<0.00050				
	F1(C6-C10) (mg/L)	<0.10				
	F1-BTEX (mg/L)	<0.10				
Hydrocarbons	F2 (>C10-C16) (mg/L)	<0.25				
	F3 (C16-C34) (mg/L)	<0.25				
	F4 (C34-C50) (mg/L)	<0.25				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Additional Comments for Sample Listed:

Samplenum	Matrix	Report Remarks	Sample Comments
L806542-79	Soil	Note: PAH detection limit raised for some compounds due to matrix interference.	
L806542-77	Soil	Note: PAH detection limit raised due to matrix interference.	

Qualifiers for Individual Parameters Listed:

Qualifier	Description
SOL:MI	Surrogate recovery outside acceptable limits due to matrix interference
SDO:RNA	Surrogate diluted out:% recovery not available

Samples with Qualifiers for Individual Parameters as listed above:

Sample Number	Client Sample ID	Parameters	Qualifier
L806542-100	BLF09-SS-100	2-Bromobenzotrifluoride	SDO:RNA
L806542-101	BLF09-SS-101	2-Bromobenzotrifluoride	SDO:RNA
L806542-102	BLF09-SS-102	2-Bromobenzotrifluoride	SOL:MI
L806542-104	BLF09-SS-104	2-Bromobenzotrifluoride	SDO:RNA
L806542-105	BLF09-SS-105	2-Bromobenzotrifluoride	SDO:RNA
L806542-24	WLF09-SS-024	2-Bromobenzotrifluoride	SOL:MI
L806542-29	WLF09-SS-029	2-Bromobenzotrifluoride	SOL:MI
L806542-3	PLF09-SS-003	2-Bromobenzotrifluoride	SOL:MI
L806542-33	WLF09-SS-033	2-Bromobenzotrifluoride	SOL:MI
L806542-77	PLF09-SS-077	2-Bromobenzotrifluoride	SDO:RNA
L806542-79	PLF09-SS-079	2-Fluorobiphenyl Nitrobenzene d5	SOL:MI
L806542-84	PLF09-SS-084	2-Bromobenzotrifluoride	SOL:MI
L806542-85	PLF09-SS-085	2-Bromobenzotrifluoride	SDO:RNA
L806542-92	WLF09-SS-092	2-Bromobenzotrifluoride	SOL:MI
L806542-95	BLF09-SS-095	2-Bromobenzotrifluoride	SOL:MI
L806542-96	BLF09-SS-096	2-Bromobenzotrifluoride	SOL:MI
L806542-98	BLF09-SS-098	2-Bromobenzotrifluoride	SOL:MI

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
BTX,F1-ED	Water	BTEX and F1 (C6-C10)	EPA 5021/8015&8260 GC-MS & FID
BTX,F1-ED	Soil	BTEX and F1 (C6-C10)	CCME CWS-PHC Dec-2000 - Pub# 1310
ETL-TVH,TEH-CCME-ED	Soil	CCME Total Hydrocarbons	CCME CWS-PHC Dec-2000 - Pub# 1310

Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:
1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:
1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
F2,F3,F4-ED	Water	F2, F3, F4	EPA 3510/CCME PHC CWS-GC-FID
F2-4-TMB-ED	Soil	CCME Total Extractable Hydrocarbons	CCME CWS-PHC Dec-2000 - Pub# 1310
F4G-TMB-ED	Soil	CCME Gravimetric Heavy Hydrocarbons (SG)	CCME CWS-PHC Dec-2000 - Pub# 1310
HG-200.2-CVAA-ED	Soil	Mercury (Hg) in Soil	EPA 200.2 / 245.1

Test method is based on US EPA Method 200.2 "Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements", and meets all requirements of BC CSR Analytical Method 8 "Strong Acid Leachable Metals (SALM) in Soil", BC MOE, June 26, 2001. Soil is dried at <60°C and digested with nitric and hydrochloric acids, prior to analysis for mercury by cold vapour atomic absorption.

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
METAL-CCME-ED	Soil	Metals in Soil - CCME List	EPA 6020
PAH-CCME-ED	Soil	CCME PAHs	EPA 3540/8270-GC/MS
PREP-MOISTURE-ED	Soil	% Moisture	Oven dry 105C-Gravimetric
VOC-MISC-ED	Soil	Misc. Volatile Organics	EPA 5000/8260-HEADSPACE GC/MS

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.
The last two letters of the above ALS Test Code column indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
ED	ALS LABORATORY GROUP - EDMONTON, ALBERTA, CANADA		

GLOSSARY OF REPORT TERMS
Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in enviromental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.
The reported surrogate recovery value provides a measure of method efficiency.
mg/kg (units) - unit of concentration based on mass, parts per million
mg/L (units) - unit of concentration based on volume, parts per million
N/A - Result not available. Refer to qualifier code and definition for explanation

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

ALS Laboratory Group Quality Control Report

Workorder: L806542 Report Date: 26-AUG-09

Client: WESA
3108 CARP ROAD, BOX 430
CARP (OTTAWA) ON K0A 1L0
Contact: WAYNE INGHAM

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTX,F1-ED	**Water**							
Batch R916463								
WG991694-1 DUP		**L807571-1**						
Benzene		0.00085	0.00079	J	mg/L	0.00006	0.002	20-AUG-09
EthylBenzene		0.00201	0.00187	J	mg/L	0.00014	0.002	20-AUG-09
Toluene		0.00535	0.00526		mg/L	1.7	30	20-AUG-09
F1(C6-C10)		0.22	0.23	J	mg/L	0.01	0.2	20-AUG-09
Xylenes		0.0790	0.0733		mg/L	7.5	30	20-AUG-09
WG991694-4 DUP		**L806507-114**						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	20-AUG-09
EthylBenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	20-AUG-09
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	20-AUG-09
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	20-AUG-09
Xylenes		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	20-AUG-09
WG992167-2 LCS								
Benzene			116		%		70-130	20-AUG-09
EthylBenzene			100		%		70-130	20-AUG-09
Toluene			106		%		70-130	20-AUG-09
F1(C6-C10)			124		%		70-130	20-AUG-09
Xylenes			102		%		70-130	20-AUG-09
WG992167-4 LCS								
Benzene			116		%		70-130	20-AUG-09
EthylBenzene			100		%		70-130	20-AUG-09
Toluene			106		%		70-130	20-AUG-09
F1(C6-C10)			124		%		70-130	20-AUG-09
Xylenes			102		%		70-130	20-AUG-09
WG992167-1 MB								
Benzene			<0.00050		mg/L		0.0005	20-AUG-09
EthylBenzene			<0.00050		mg/L		0.0005	20-AUG-09
Toluene			<0.00050		mg/L		0.0005	20-AUG-09
F1(C6-C10)			<0.10		mg/L		0.1	20-AUG-09
Xylenes			<0.00050		mg/L		0.0005	20-AUG-09
WG992167-3 MB								
Benzene			<0.00050		mg/L		0.0005	20-AUG-09
EthylBenzene			<0.00050		mg/L		0.0005	20-AUG-09
Toluene			<0.00050		mg/L		0.0005	20-AUG-09
F1(C6-C10)			<0.10		mg/L		0.1	20-AUG-09

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTX,F1-ED	**Water**							
Batch R916463								
WG992167-3 MB								
Xylenes			<0.00050		mg/L		0.0005	20-AUG-09
WG991694-2 MS		**L806507-106**						
Benzene			126		%		50-150	20-AUG-09
EthylBenzene			100		%		50-150	20-AUG-09
Toluene			110		%		50-150	20-AUG-09
Xylenes			103		%		50-150	20-AUG-09
WG991694-3 MS		**L806507-106**						
F1(C6-C10)			97		%		50-150	20-AUG-09
F2,F3,F4-ED	**Water**							
Batch R917512								
WG992178-2 LCS								
F2 (>C10-C16)			108		%		65-135	20-AUG-09
F3 (C16-C34)			108		%		65-135	20-AUG-09
F4 (C34-C50)			108		%		65-135	20-AUG-09
WG992178-1 MB								
F2 (>C10-C16)			<0.25		mg/L		0.25	20-AUG-09
F3 (C16-C34)			<0.25		mg/L		0.25	20-AUG-09
F4 (C34-C50)			<0.25		mg/L		0.25	20-AUG-09
WG992178-3 MS		**L806507-110**						
F2 (>C10-C16)			103		%		50-150	20-AUG-09
F3 (C16-C34)			103		%		50-150	20-AUG-09
F4 (C34-C50)			103		%		50-150	20-AUG-09
WG992178-4 MS		**L807402-3**						
F2 (>C10-C16)			99		%		50-150	20-AUG-09
F3 (C16-C34)			99		%		50-150	20-AUG-09
F4 (C34-C50)			99		%		50-150	20-AUG-09
BTX,F1-ED	**Soil**							
Batch R917664								
WG991322-2 DUP		**L806507-1**						
Benzene		<0.0050	<0.0050	RPD-NA	mg/kg	N/A	50	20-AUG-09
Ethylbenzene		<0.015	<0.015	RPD-NA	mg/kg	N/A	50	20-AUG-09
m+p-Xylene		<0.050	<0.050	RPD-NA	mg/kg	N/A	39	20-AUG-09
o-Xylene		<0.050	<0.050	RPD-NA	mg/kg	N/A	39	20-AUG-09
Toluene		<0.050	<0.050	RPD-NA	mg/kg	N/A	50	20-AUG-09

ALS Laboratory Group Quality Control Report

Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTX,F1-ED		**Soil**							
Batch	**R917664**								
WG991322-2	**DUP**		**L806507-1**						
F1(C6-C10)			<10	<10	RPD-NA	mg/kg	N/A	50	20-AUG-09
Xylenes			<0.10	<0.10	RPD-NA	mg/kg	N/A	50	20-AUG-09
WG992415-2	**LCS**								
Benzene				97		%		70-130	21-AUG-09
Ethylbenzene				98		%		70-130	21-AUG-09
m+p-Xylene				97		%		70-130	21-AUG-09
o-Xylene				99		%		70-130	21-AUG-09
Toluene				99		%		70-130	21-AUG-09
F1(C6-C10)				111		%		70-130	21-AUG-09
Xylenes				98		%		70-130	21-AUG-09
WG991322-1	**MB**								
Benzene				<0.0050		mg/kg		0.005	20-AUG-09
Ethylbenzene				<0.015		mg/kg		0.015	20-AUG-09
m+p-Xylene				<0.050		mg/kg		0.05	20-AUG-09
o-Xylene				<0.050		mg/kg		0.05	20-AUG-09
Toluene				<0.050		mg/kg		0.05	20-AUG-09
F1(C6-C10)				<10		mg/kg		10	20-AUG-09
Xylenes				<0.10		mg/kg		0.1	20-AUG-09
WG992415-1	**MB**								
Benzene				<0.0050		mg/kg		0.005	21-AUG-09
Ethylbenzene				<0.015		mg/kg		0.015	21-AUG-09
m+p-Xylene				<0.050		mg/kg		0.05	21-AUG-09
o-Xylene				<0.050		mg/kg		0.05	21-AUG-09
Toluene				<0.050		mg/kg		0.05	21-AUG-09
F1(C6-C10)				<10		mg/kg		10	21-AUG-09
Xylenes				<0.10		mg/kg		0.1	21-AUG-09
WG991322-3	**MS**		**L806507-2**						
Benzene				93		%		60-141	20-AUG-09
Ethylbenzene				93		%		60-141	20-AUG-09
m+p-Xylene				92		%		29-113	20-AUG-09
o-Xylene				92		%		29-113	20-AUG-09
Toluene				91		%		60-141	20-AUG-09
Xylenes				92		%		60-141	20-AUG-09
WG991322-4	**MS**		**L806507-2**						

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTX,F1-ED	**Soil**							
Batch R917664								
WG991322-4 MS		**L806507-2**						
F1(C6-C10)			122		%		60-141	20-AUG-09
F2-4-TMB-ED	**Soil**							
Batch R918815								
WG992960-3 DUP		**L806542-51**						
F2 (C10-C16)		<20	<20	RPD-NA	mg/kg	N/A	40	21-AUG-09
F3 (C16-C34)		23	36	J	mg/kg	13	80	21-AUG-09
F4 (C34-C50)		<20	<20	RPD-NA	mg/kg	N/A	40	21-AUG-09
WG992960-2 LCS								
F2 (C10-C16)			92		%		80-120	21-AUG-09
F3 (C16-C34)			89		%		80-120	21-AUG-09
F4 (C34-C50)			107		%		80-120	21-AUG-09
WG992960-1 MB								
F2 (C10-C16)			<20		mg/kg		20	21-AUG-09
F3 (C16-C34)			<20		mg/kg		20	21-AUG-09
F4 (C34-C50)			<20		mg/kg		20	21-AUG-09
Batch R918851								
WG992275-3 DUP		**L806542-3**						
F2 (C10-C16)		735	760		mg/kg	3.4	40	23-AUG-09
F3 (C16-C34)		387	416		mg/kg	7.2	40	23-AUG-09
F4 (C34-C50)		47	56	J	mg/kg	8	80	23-AUG-09
WG992275-4 IRM		**ALS PHC1 RM**						
F2 (C10-C16)			99		%		60-140	23-AUG-09
F3 (C16-C34)			98		%		60-140	23-AUG-09
F4 (C34-C50)			93		%		60-140	23-AUG-09
WG992275-2 LCS								
F2 (C10-C16)			93		%		80-120	23-AUG-09
F3 (C16-C34)			92		%		80-120	23-AUG-09
F4 (C34-C50)			104		%		80-120	23-AUG-09
WG992275-1 MB								
F2 (C10-C16)			<20		mg/kg		20	23-AUG-09
F3 (C16-C34)			<20		mg/kg		20	23-AUG-09
F4 (C34-C50)			<20		mg/kg		20	23-AUG-09

Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2-4-TMB-ED		**Soil**							
Batch	**R918873**								
WG992111-3	**DUP**		**L806542-26**						
F2 (C10-C16)			292	356		mg/kg	20	40	20-AUG-09
F3 (C16-C34)			206	225		mg/kg	9.0	40	20-AUG-09
F4 (C34-C50)			23	<20	RPD-NA	mg/kg	N/A	40	20-AUG-09
WG992111-5	**IRM**		**ALS PHC1 RM**						
F2 (C10-C16)				105		%		60-140	20-AUG-09
F3 (C16-C34)				102		%		60-140	20-AUG-09
F4 (C34-C50)				95		%		60-140	20-AUG-09
WG992111-2	**LCS**								
F2 (C10-C16)				88		%		80-120	20-AUG-09
F3 (C16-C34)				89		%		80-120	20-AUG-09
F4 (C34-C50)				93		%		80-120	20-AUG-09
WG992111-1	**MB**								
F2 (C10-C16)				<20		mg/kg		20	20-AUG-09
F3 (C16-C34)				<20		mg/kg		20	20-AUG-09
F4 (C34-C50)				<20		mg/kg		20	20-AUG-09
Batch	**R918962**								
WG993000-4	**IRM**		**ALS PHC1 RM**						
F2 (C10-C16)				80		%		60-140	23-AUG-09
F3 (C16-C34)				84		%		60-140	23-AUG-09
F4 (C34-C50)				82		%		60-140	23-AUG-09
WG993000-2	**LCS**								
F2 (C10-C16)				92		%		80-120	23-AUG-09
F3 (C16-C34)				101		%		80-120	23-AUG-09
F4 (C34-C50)				100		%		80-120	23-AUG-09
WG993000-1	**MB**								
F2 (C10-C16)				<20		mg/kg		20	23-AUG-09
F3 (C16-C34)				<20		mg/kg		20	23-AUG-09
F4 (C34-C50)				<20		mg/kg		20	23-AUG-09
Batch	**R919005**								
WG993111-4	**IRM**		**ALS PHC1 RM**						
F2 (C10-C16)				94		%		60-140	23-AUG-09
F3 (C16-C34)				91		%		60-140	23-AUG-09
F4 (C34-C50)				88		%		60-140	23-AUG-09
WG993111-2	**LCS**								
F2 (C10-C16)				90				80-120	

ALS Laboratory Group Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2-4-TMB-ED	**Soil**							
Batch R919005								
WG993111-2 LCS								
F2 (C10-C16)			90		%		80-120	23-AUG-09
F3 (C16-C34)			92		%		80-120	23-AUG-09
F4 (C34-C50)			100		%		80-120	23-AUG-09
WG993111-1 MB								
F2 (C10-C16)			<20		mg/kg		20	23-AUG-09
F3 (C16-C34)			<20		mg/kg		20	23-AUG-09
F4 (C34-C50)			<20		mg/kg		20	23-AUG-09
Batch R921443								
WG993606-3 IRM		**ALS PHC1 RM**						
F2 (C10-C16)			109		%		60-140	21-AUG-09
F3 (C16-C34)			95		%		60-140	21-AUG-09
F4 (C34-C50)			95		%		60-140	21-AUG-09
WG993606-2 LCS								
F2 (C10-C16)			93		%		80-120	21-AUG-09
F3 (C16-C34)			91		%		80-120	21-AUG-09
F4 (C34-C50)			92		%		80-120	21-AUG-09
WG993606-1 MB								
F2 (C10-C16)			<20		mg/kg		20	21-AUG-09
F3 (C16-C34)			<20		mg/kg		20	21-AUG-09
F4 (C34-C50)			<20		mg/kg		20	21-AUG-09
Batch R921723								
WG993869-4 DUP		**L807518-1**						
F2 (C10-C16)		<20	<20	RPD-NA	mg/kg	N/A	40	24-AUG-09
F3 (C16-C34)		29	37	J	mg/kg	8	80	24-AUG-09
F4 (C34-C50)		<20	<20	RPD-NA	mg/kg	N/A	40	24-AUG-09
WG993869-5 DUP		**L806542-79**						
F2 (C10-C16)		27100	29100		mg/kg	7.1	40	24-AUG-09
F3 (C16-C34)		7950	8450		mg/kg	6.0	40	24-AUG-09
F4 (C34-C50)		239	198	J	mg/kg	41	80	24-AUG-09
WG993869-2 LCS								
F2 (C10-C16)			90		%		80-120	24-AUG-09
F3 (C16-C34)			97		%		80-120	24-AUG-09
WG993869-1 MB								
F2 (C10-C16)			<20		mg/kg		20	24-AUG-09
F3 (C16-C34)			<20				20	

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2-4-TMB-ED	**Soil**							
Batch R921723								
WG993869-1 MB								
F3 (C16-C34)			<20		mg/kg		20	24-AUG-09
F4 (C34-C50)			<20		mg/kg		20	24-AUG-09
HG-200.2-CVAA-ED	**Soil**							
Batch R917969								
WG992504-2 CRM		**TILL-1_SOIL**						
Mercury (Hg)			111		%		80-120	22-AUG-09
WG992504-3 DUP		**L806542-8**						
Mercury (Hg)		<0.050	<0.050	RPD-NA	mg/kg	N/A	20	22-AUG-09
WG992504-1 MB								
Mercury (Hg)			<0.050		mg/kg		0.05	22-AUG-09
METAL-CCME-ED	**Soil**							
Batch R914763								
WG992504-2 CRM		**TILL-1_SOIL**						
Antimony (Sb)			101		%		70-130	22-AUG-09
Arsenic (As)			102		%		70-130	22-AUG-09
Barium (Ba)			95		%		70-130	22-AUG-09
Beryllium (Be)			86		%		70-130	22-AUG-09
Chromium (Cr)			99		%		70-130	22-AUG-09
Cobalt (Co)			101		%		70-130	22-AUG-09
Copper (Cu)			101		%		70-130	22-AUG-09
Lead (Pb)			100		%		70-130	22-AUG-09
Molybdenum (Mo)			99		%		70-130	22-AUG-09
Nickel (Ni)			101		%		70-130	22-AUG-09
Vanadium (V)			97		%		70-130	22-AUG-09
Zinc (Zn)			101		%		70-130	22-AUG-09
WG992504-3 DUP		**L806542-8**						
Antimony (Sb)		<0.20	<0.20	RPD-NA	mg/kg	N/A	41	23-AUG-09
Arsenic (As)		2.10	1.71	J	mg/kg	0.39	0.8	23-AUG-09
Barium (Ba)		27.4	24.8	J	mg/kg	2.6	20	23-AUG-09
Beryllium (Be)		<1.0	<1.0	RPD-NA	mg/kg	N/A	26	23-AUG-09
Cadmium (Cd)		<0.50	<0.50	RPD-NA	mg/kg	N/A	26	23-AUG-09
Chromium (Cr)		22.2	21.4		mg/kg	3.3	15	23-AUG-09
Cobalt (Co)		6.1	5.8	J	mg/kg	0.3	4	23-AUG-09
Copper (Cu)		19.4	17.4	J	mg/kg	2.0	8	23-AUG-09

ALS Laboratory Group Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
METAL-CCME-ED	**Soil**							
Batch R914763								
WG992504-3 DUP		**L806542-8**						
Lead (Pb)		<5.0	<5.0	RPD-NA	mg/kg	N/A	27	23-AUG-09
Molybdenum (Mo)		<1.0	<1.0	RPD-NA	mg/kg	N/A	23	23-AUG-09
Nickel (Ni)		14.3	12.8	J	mg/kg	1.5	8	23-AUG-09
Selenium (Se)		<0.20	<0.20	RPD-NA	mg/kg	N/A	23	23-AUG-09
Silver (Ag)		<1.0	<1.0	RPD-NA	mg/kg	N/A	26	23-AUG-09
Thallium (Tl)		<1.0	<1.0	RPD-NA	mg/kg	N/A	26	23-AUG-09
Tin (Sn)		<5.0	<5.0	RPD-NA	mg/kg	N/A	26	23-AUG-09
Uranium (U)		<2.0	<2.0	RPD-NA	mg/kg	N/A	26	23-AUG-09
Vanadium (V)		26.5	24.3		mg/kg	8.5	14	23-AUG-09
Zinc (Zn)		23	25	J	mg/kg	2	40	23-AUG-09
WG992504-1 MB								
Antimony (Sb)			<0.20		mg/kg		1	22-AUG-09
Arsenic (As)			<0.20		mg/kg		1	22-AUG-09
Barium (Ba)			<5.0		mg/kg		25	22-AUG-09
Beryllium (Be)			<1.0		mg/kg		1	22-AUG-09
Cadmium (Cd)			<0.50		mg/kg		0.5	22-AUG-09
Chromium (Cr)			<0.50		mg/kg		2.5	22-AUG-09
Cobalt (Co)			<1.0		mg/kg		1	22-AUG-09
Copper (Cu)			<2.0		mg/kg		10	22-AUG-09
Lead (Pb)			<5.0		mg/kg		5	22-AUG-09
Molybdenum (Mo)			<1.0		mg/kg		1	22-AUG-09
Nickel (Ni)			<2.0		mg/kg		10	22-AUG-09
Selenium (Se)			<0.20		mg/kg		1	22-AUG-09
Silver (Ag)			<1.0		mg/kg		5	22-AUG-09
Thallium (Tl)			<1.0		mg/kg		1	22-AUG-09
Tin (Sn)			<5.0		mg/kg		25	22-AUG-09
Uranium (U)			<2.0		mg/kg		2	22-AUG-09
Vanadium (V)			<1.0		mg/kg		5	22-AUG-09
Zinc (Zn)			<10		mg/kg		50	22-AUG-09
PAH-CCME-ED	**Soil**							

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-CCME-ED	**Soil**							
Batch R917932								
WG991286-3 DUP		**L807356-6**						
Benzo(a)anthracene		<0.010	<0.010	RPD-NA	mg/kg	N/A	45	23-AUG-09
Benzo(a)pyrene		<0.010	<0.010	RPD-NA	mg/kg	N/A	28	23-AUG-09
Benzo(b&j)fluoranthene		0.010	0.016	J	mg/kg	0.006	0.04	23-AUG-09
Benzo(k)fluoranthene		<0.010	<0.010	RPD-NA	mg/kg	N/A	26	23-AUG-09
Dibenzo(a,h)anthracene		<0.010	<0.010	RPD-NA	mg/kg	N/A	40	23-AUG-09
Indeno(1,2,3-cd)pyrene		<0.010	<0.010	RPD-NA	mg/kg	N/A	35	23-AUG-09
Naphthalene		0.021	0.021	J	mg/kg	0.000	0.04	23-AUG-09
Phenanthrene		0.039	0.046	J	mg/kg	0.007	0.04	23-AUG-09
Pyrene		0.013	0.024	J	mg/kg	0.011	0.04	23-AUG-09
Quinoline		<0.010	<0.010	RPD-NA	mg/kg	N/A	39	23-AUG-09
WG991286-2 LCS								
Benzo(a)anthracene			75		%		60-130	22-AUG-09
Benzo(a)pyrene			75		%		40-132	22-AUG-09
Benzo(b&j)fluoranthene			76		%		70-130	22-AUG-09
Benzo(k)fluoranthene			75		%		49-134	22-AUG-09
Dibenzo(a,h)anthracene			68		%		60-130	22-AUG-09
Indeno(1,2,3-cd)pyrene			71		%		60-130	22-AUG-09
Naphthalene			64		%		36-132	22-AUG-09
Phenanthrene			67		%		46-132	22-AUG-09
Pyrene			73		%		60-130	22-AUG-09
Quinoline			66		%		44-118	22-AUG-09
WG991286-1 MB								
Benzo(a)anthracene			<0.010		mg/kg		0.01	22-AUG-09
Benzo(a)pyrene			<0.010		mg/kg		0.01	22-AUG-09
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	22-AUG-09
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	22-AUG-09
Dibenzo(a,h)anthracene			<0.010		mg/kg		0.01	22-AUG-09
Indeno(1,2,3-cd)pyrene			<0.010		mg/kg		0.01	22-AUG-09
Naphthalene			<0.010		mg/kg		0.01	22-AUG-09
Phenanthrene			<0.010		mg/kg		0.01	22-AUG-09
Pyrene			<0.010		mg/kg		0.01	22-AUG-09
Quinoline			<0.010		mg/kg		0.01	22-AUG-09
PREP-MOISTURE-ED	**Soil**							

Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PREP-MOISTURE-ED		**Soil**							
Batch	**R915663**								
WG991331-1	**DUP**		**L806507-1**						
% Moisture			14.7	13.8		%	6.3	20	20-AUG-09
Batch	**R917930**								
WG992179-1	**DUP**		**L806542-4**						
% Moisture			52.8	56.2		%	6.2	20	21-AUG-09
WG992179-2	**DUP**		**L806542-8**						
% Moisture			12.8	12.3		%	4.4	20	21-AUG-09
WG992179-3	**DUP**		**L806542-58**						
% Moisture			6.94	7.03		%	1.4	20	21-AUG-09
VOC-MISC-ED		**Soil**							
Batch	**R912658**								
WG991415-1	**MB**								
Trichloroethene				<0.010		mg/kg		0.01	20-AUG-09

Legend:

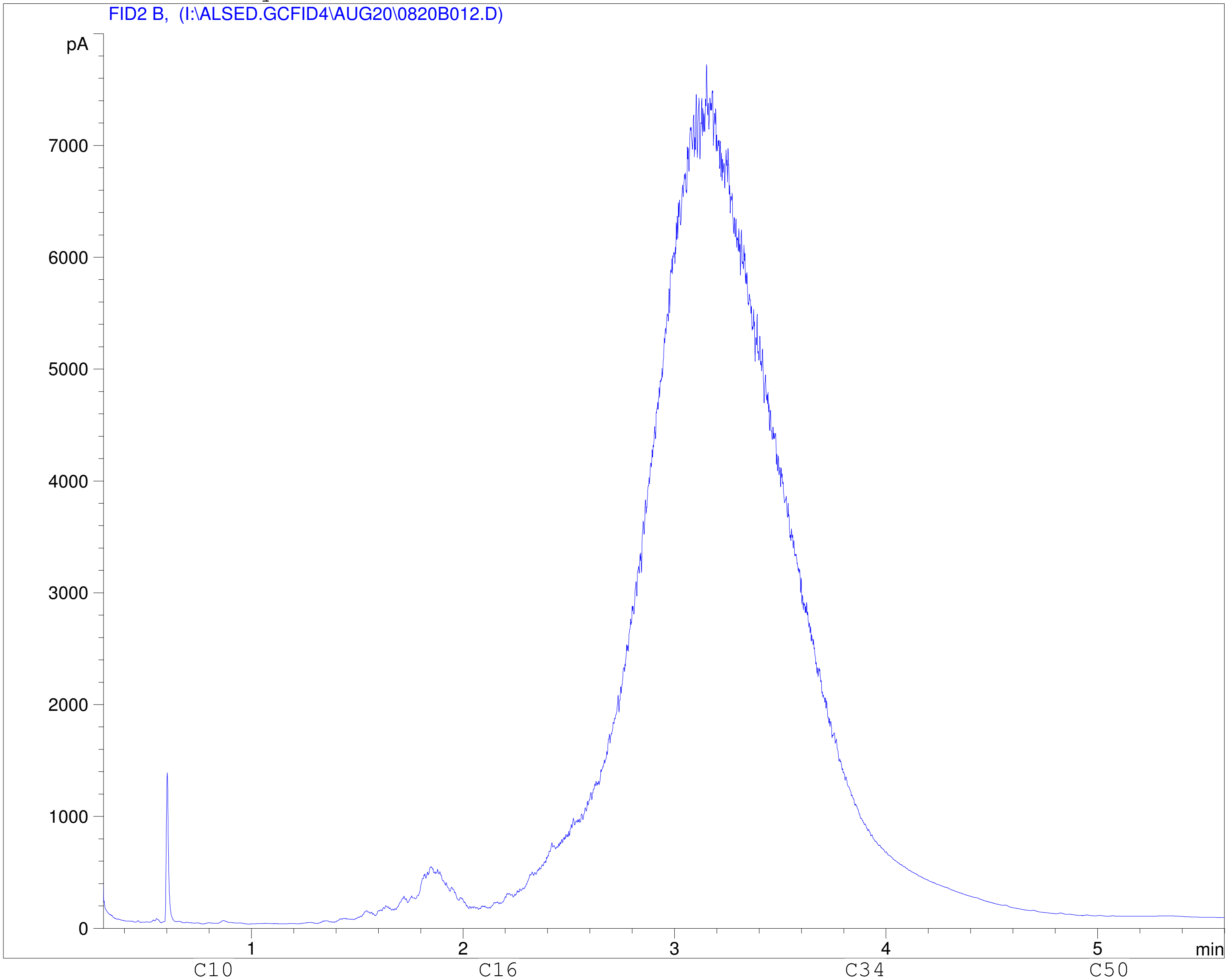
Limit	99% Confidence Interval (Laboratory Control Limits)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

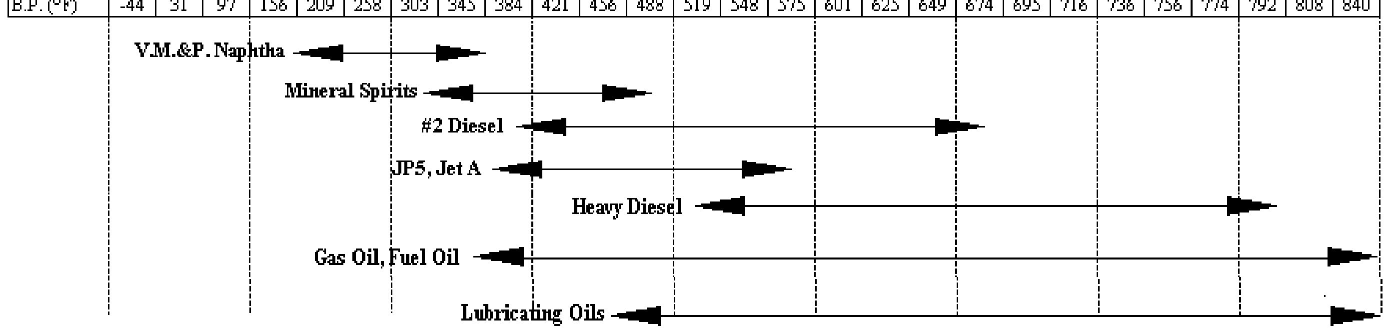
```
Client ID:              PLF09-SS-001

Sample ID:              L806542-1 30
Injection Date:         8/20/2009 8:26:34 PM
Instrument:             6890
```

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

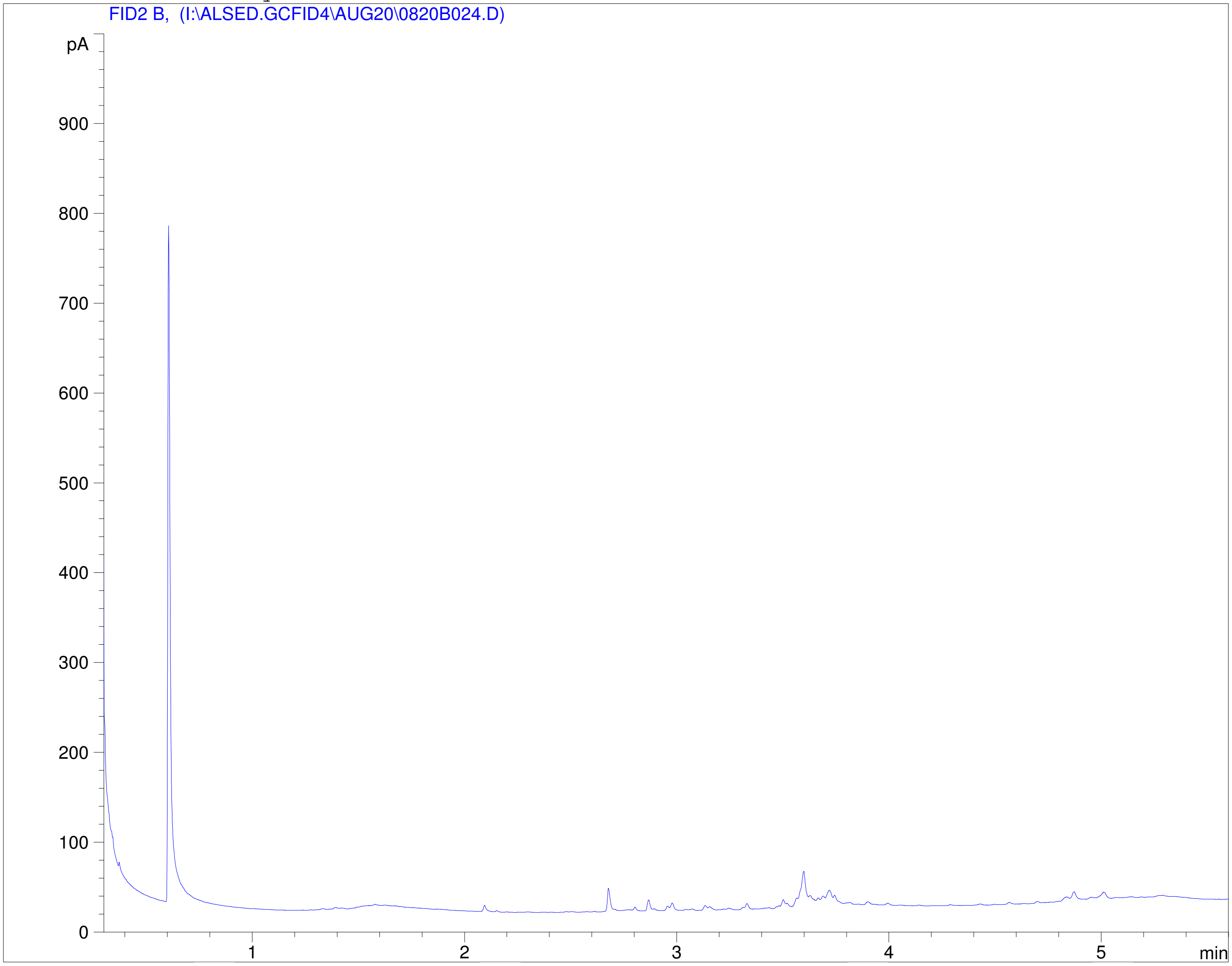


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-010

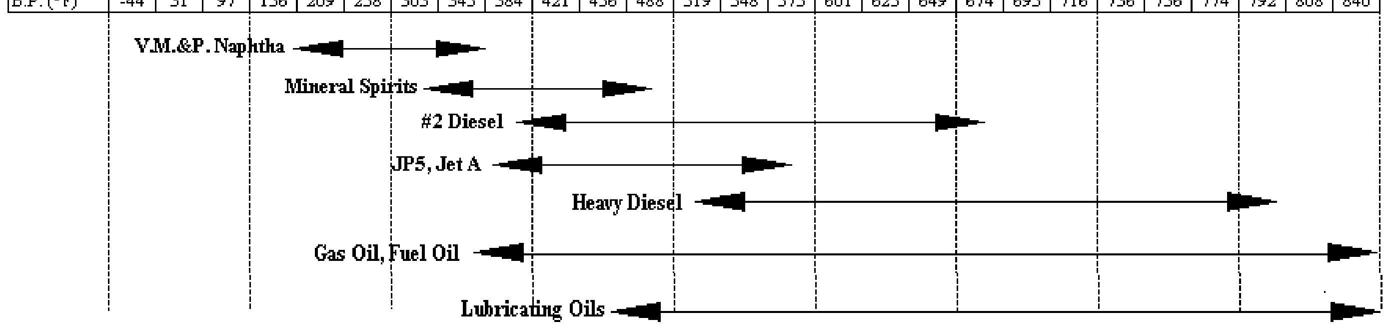
Sample ID: L806542-10 30
Injection Date: 8/21/2009 12:00:57 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

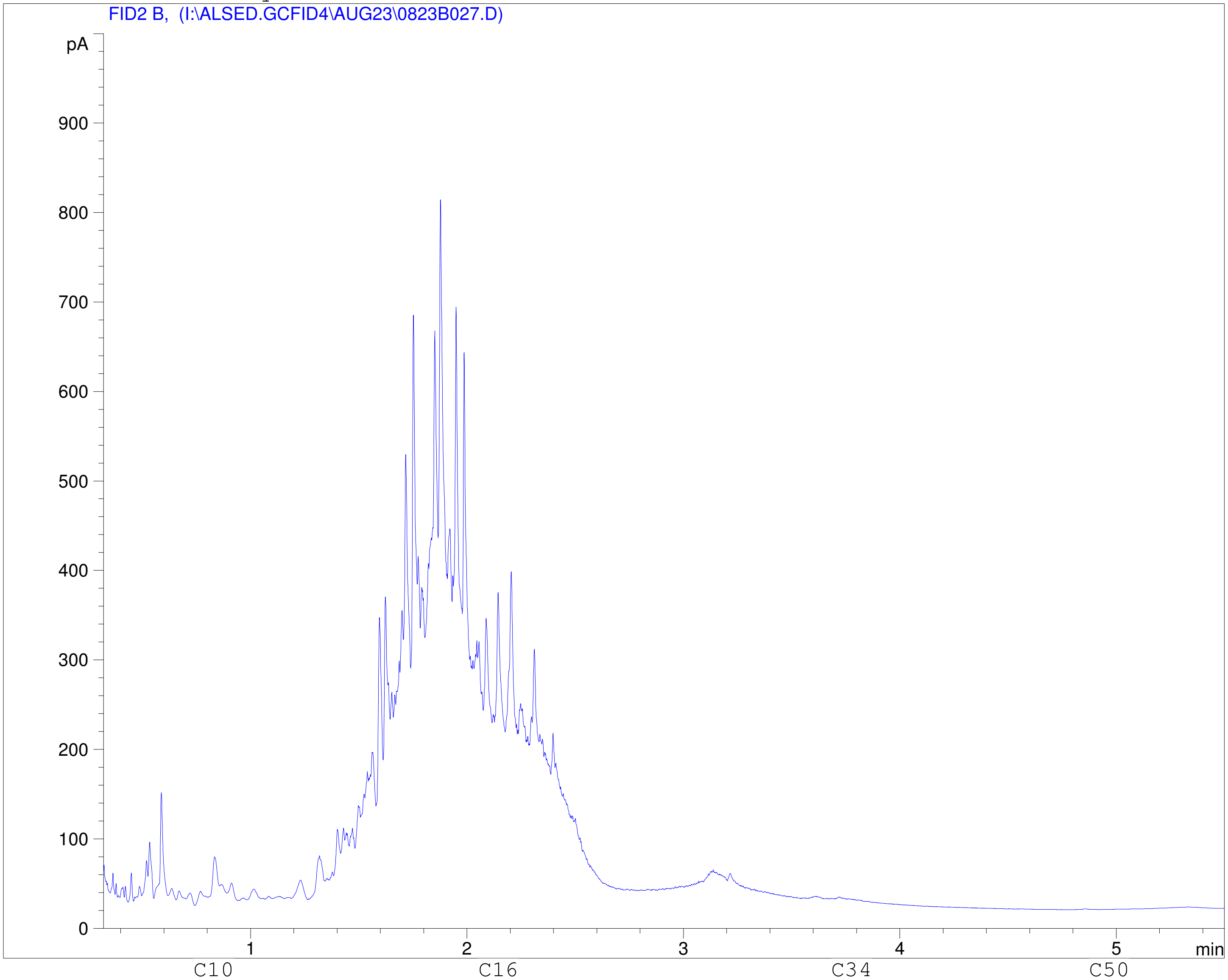


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: BLF09-SS-100

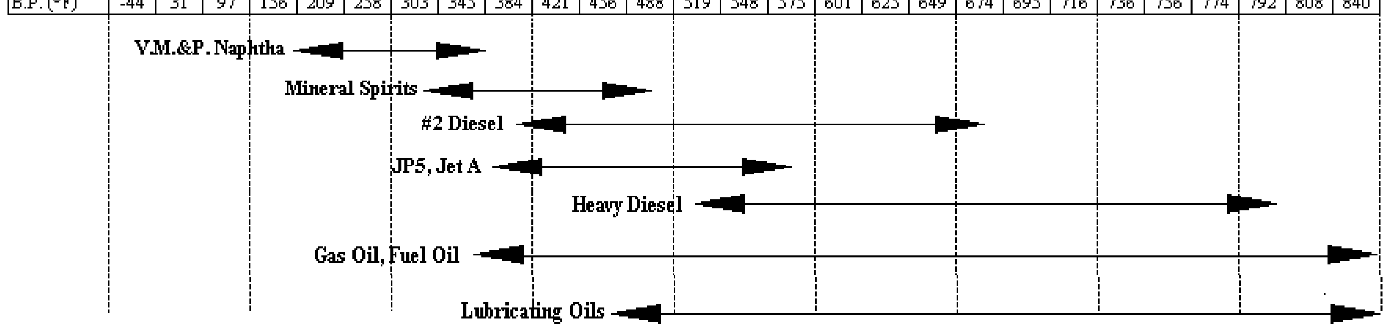
Sample ID: L806542-100 300
Injection Date: 8/24/2009 1:29:55 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

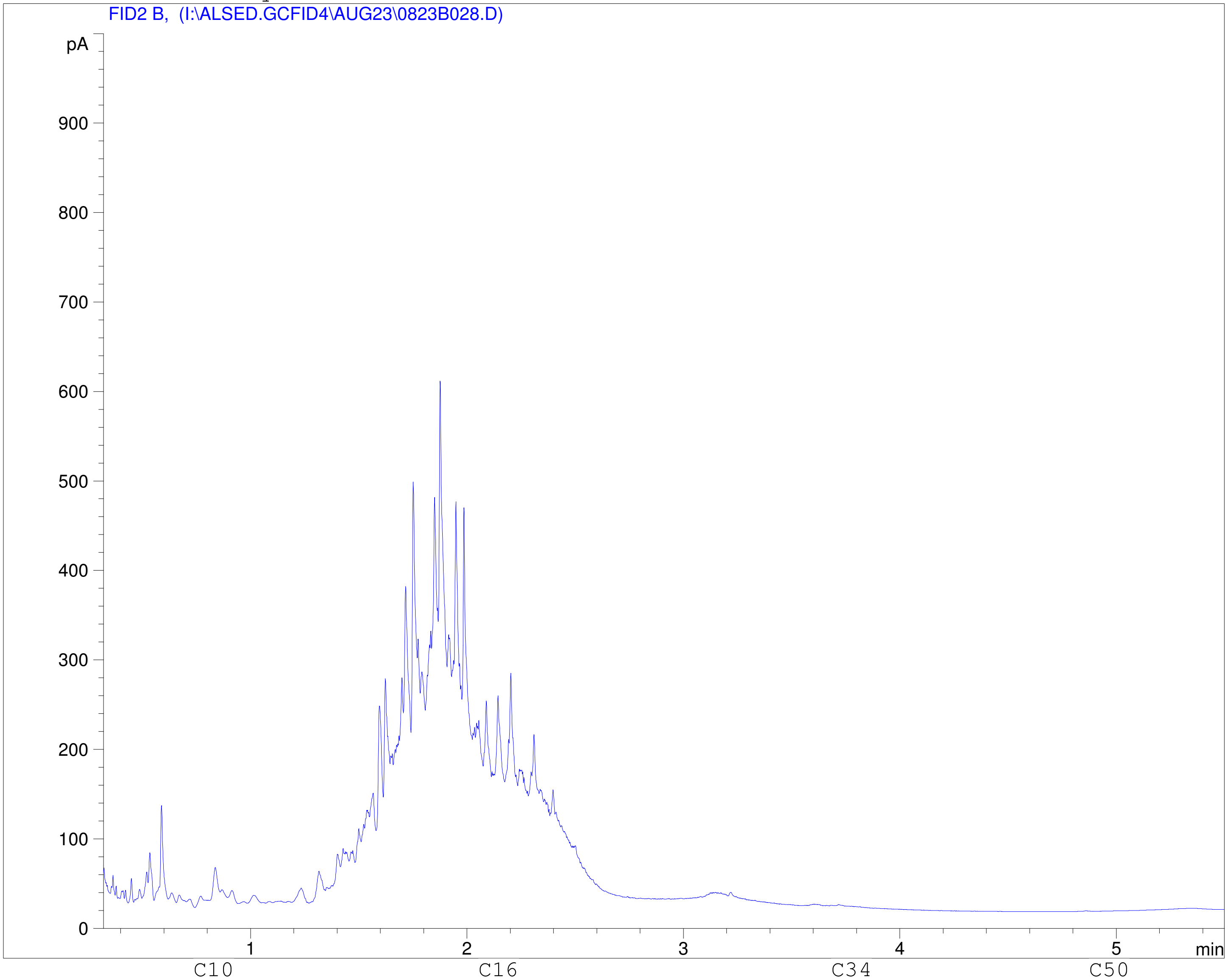


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: BLF09-SS-101

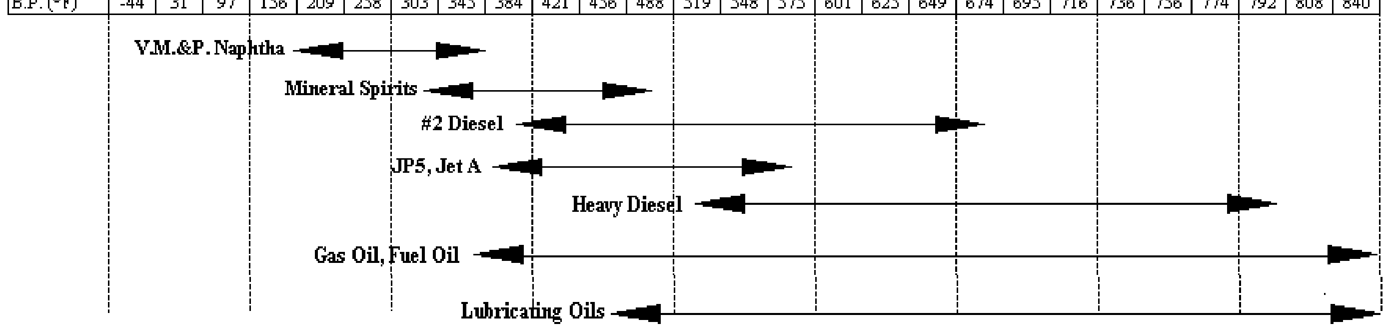
Sample ID: L806542-101 300
Injection Date: 8/24/2009 1:47:54 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

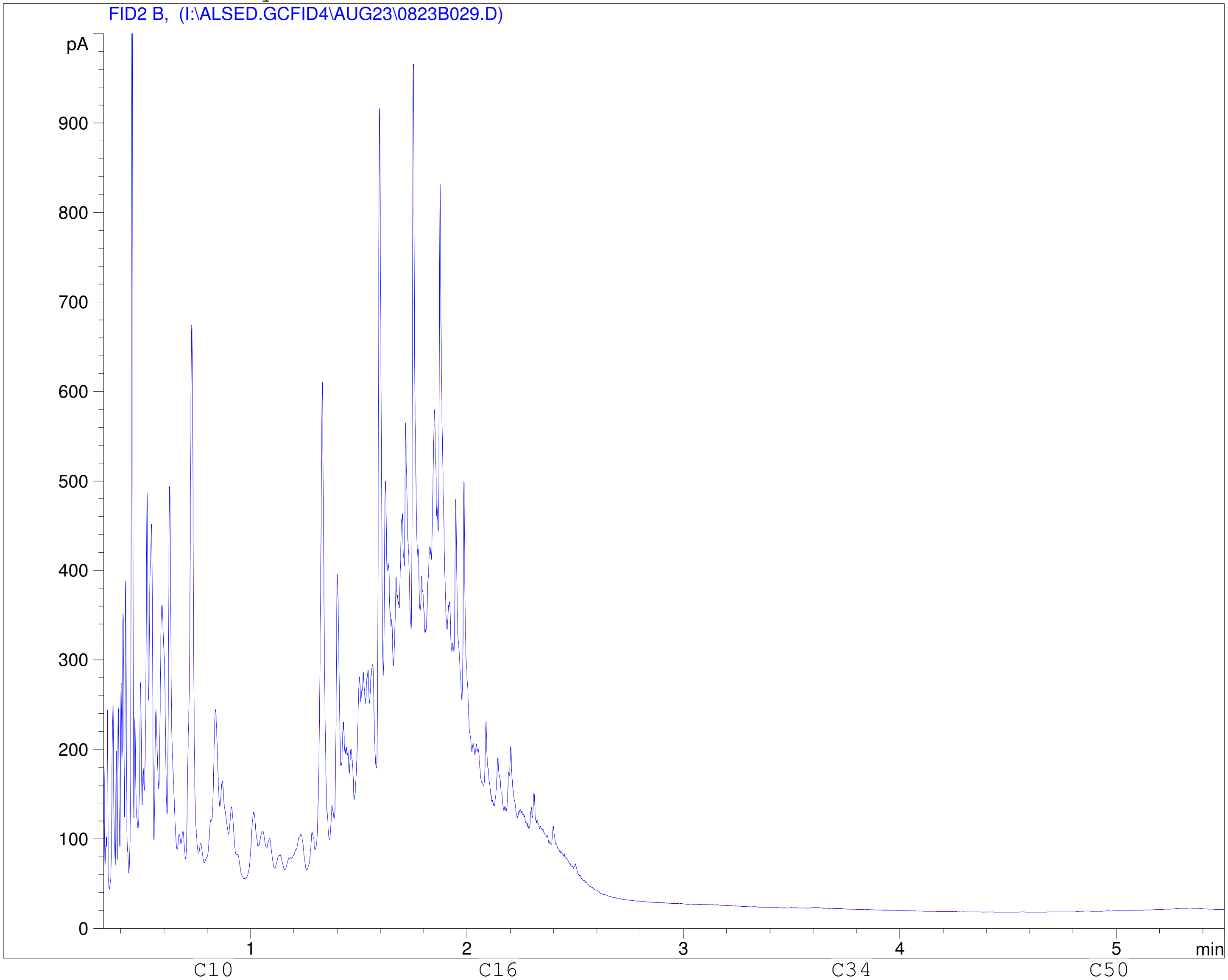


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: BLF09-SS-102

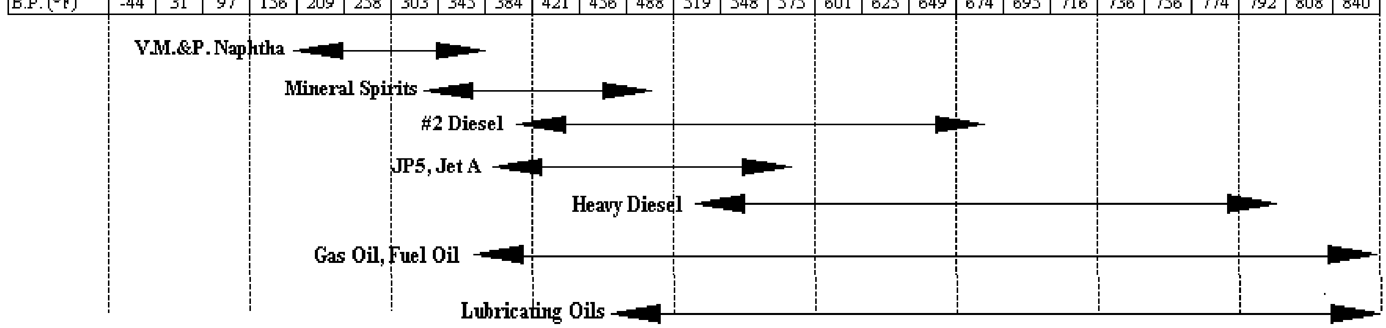
Sample ID: L806542-102 300
Injection Date: 8/24/2009 2:05:40 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

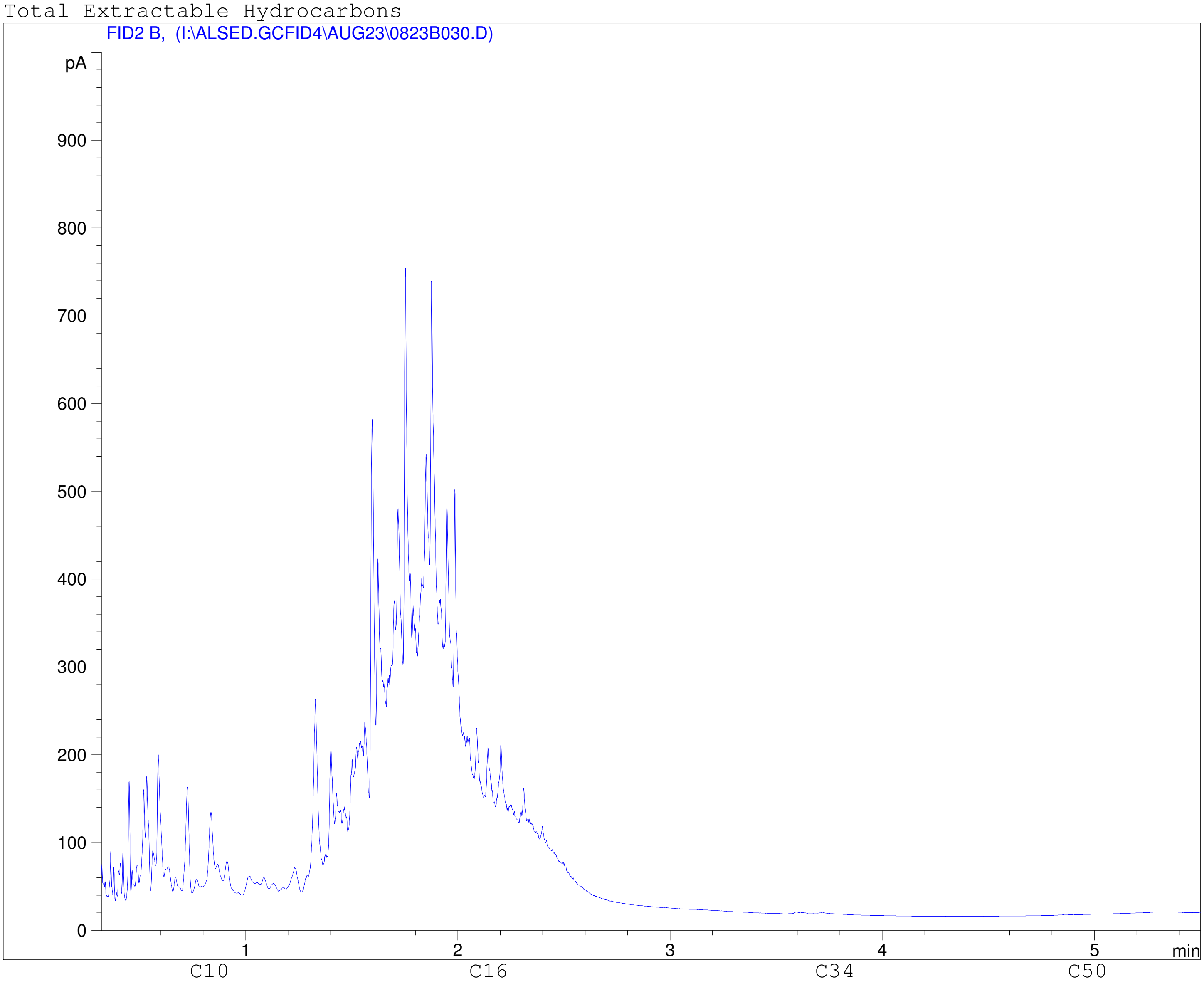


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: BLF09-SS-103

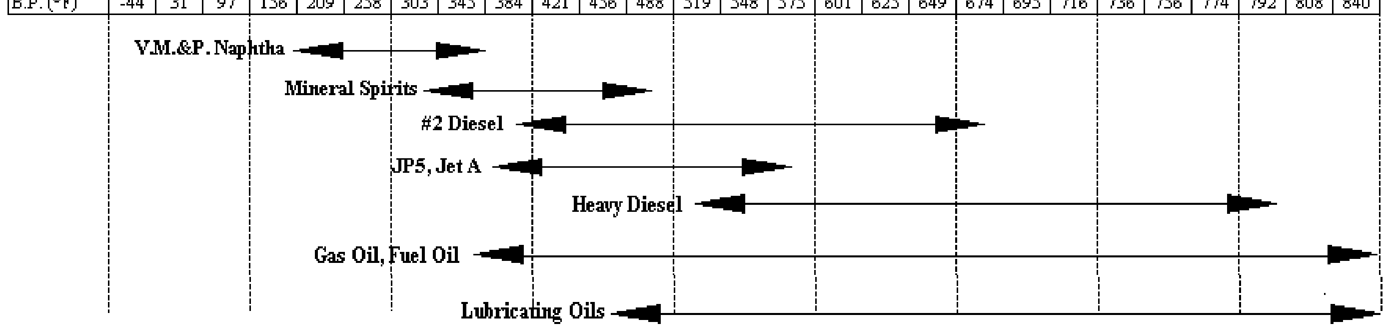
Sample ID: L806542-103 300
Injection Date: 8/24/2009 2:23:25 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

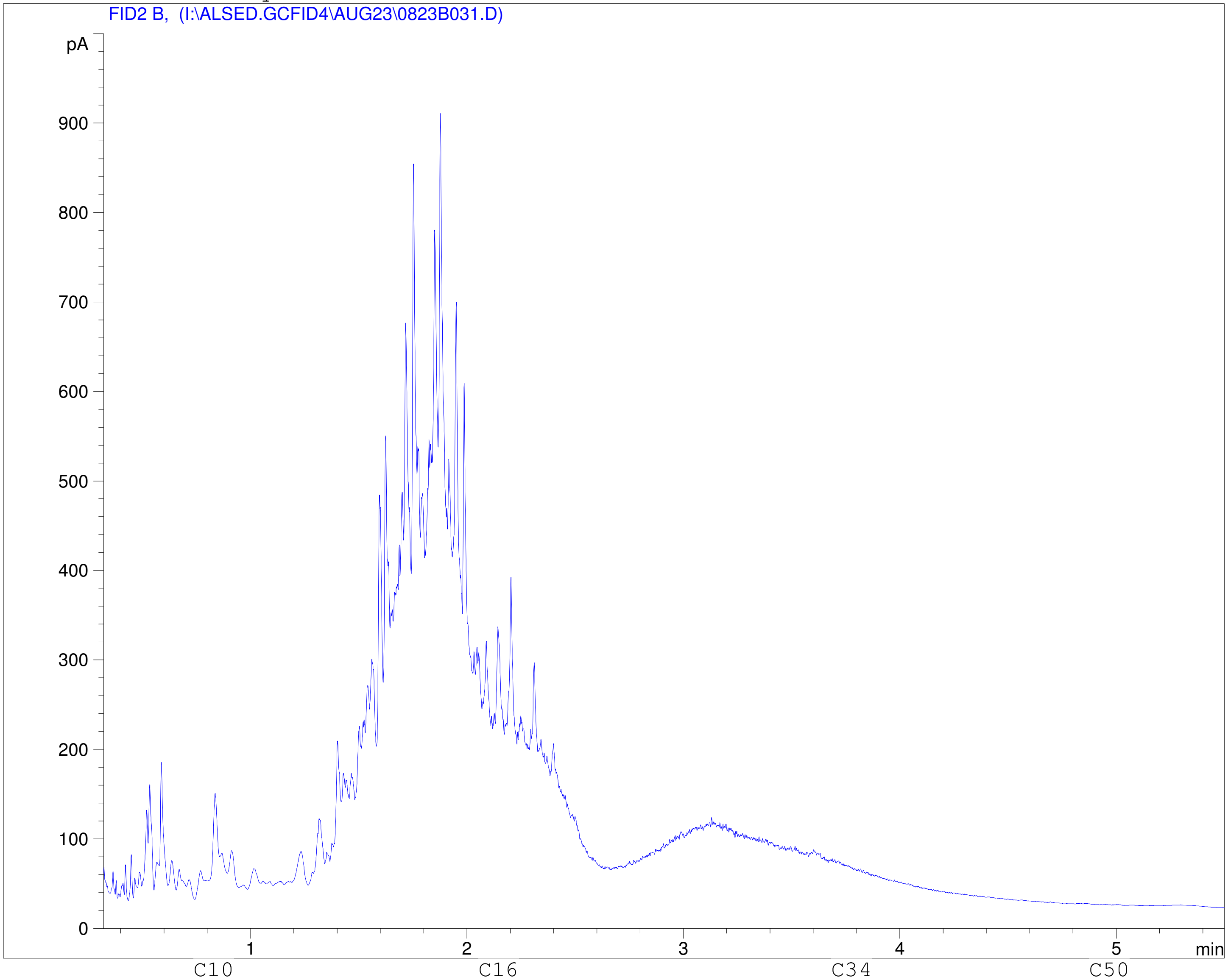


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: BLF09-SS-104

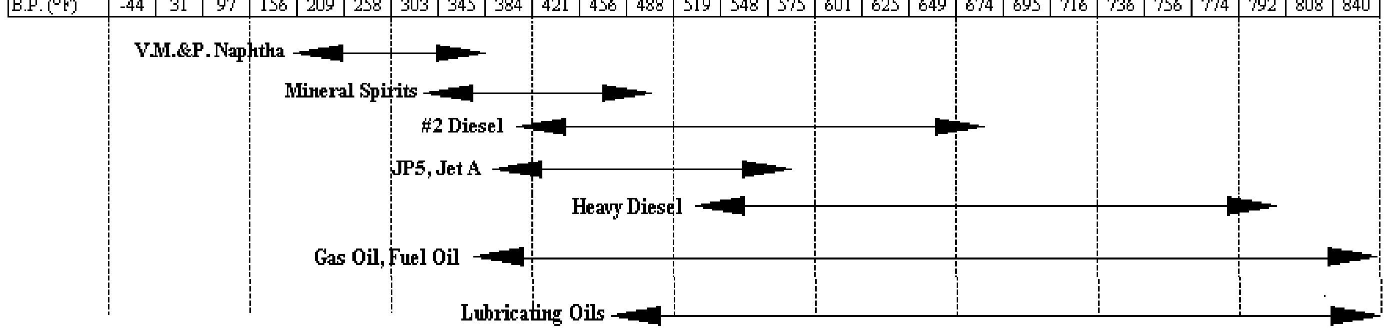
Sample ID: L806542-104 300
Injection Date: 8/24/2009 2:41:06 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

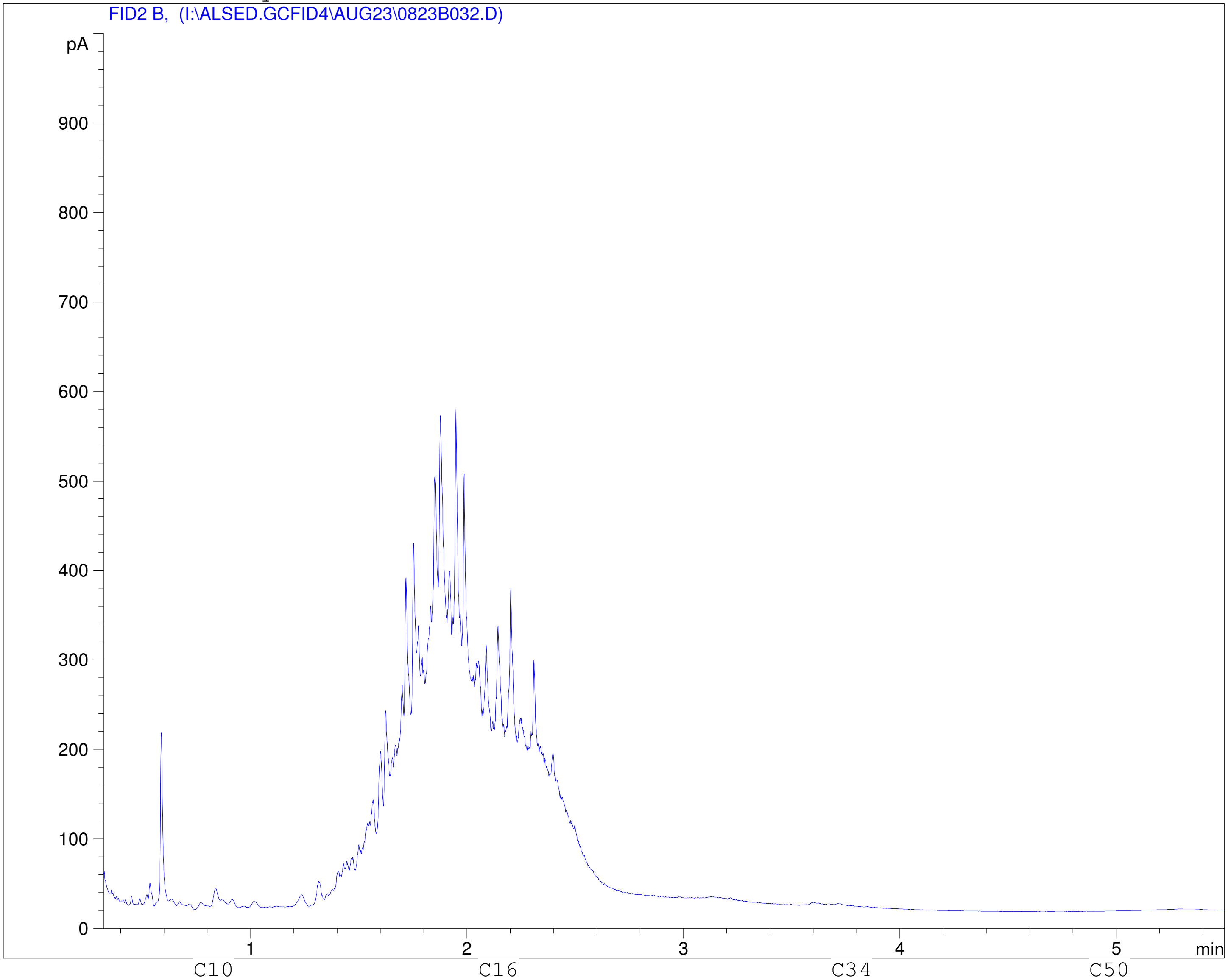


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: BLF09-SS-105

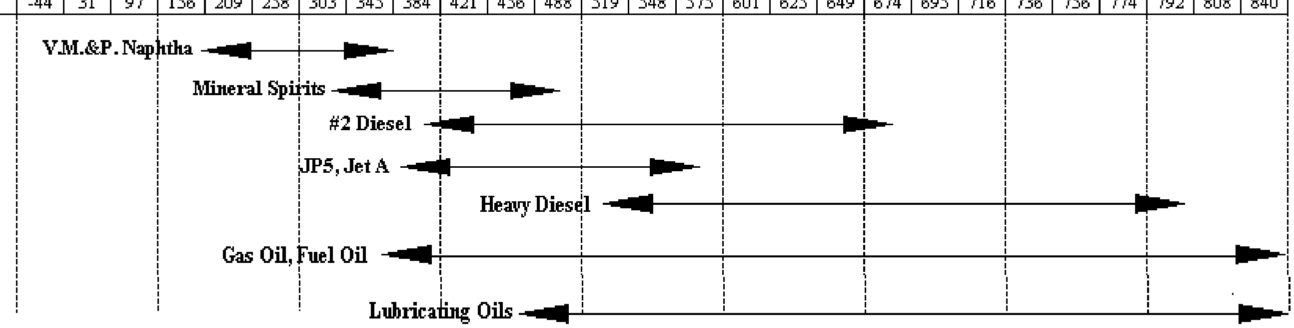
Sample ID: L806542-105 150
Injection Date: 8/24/2009 2:59:02 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

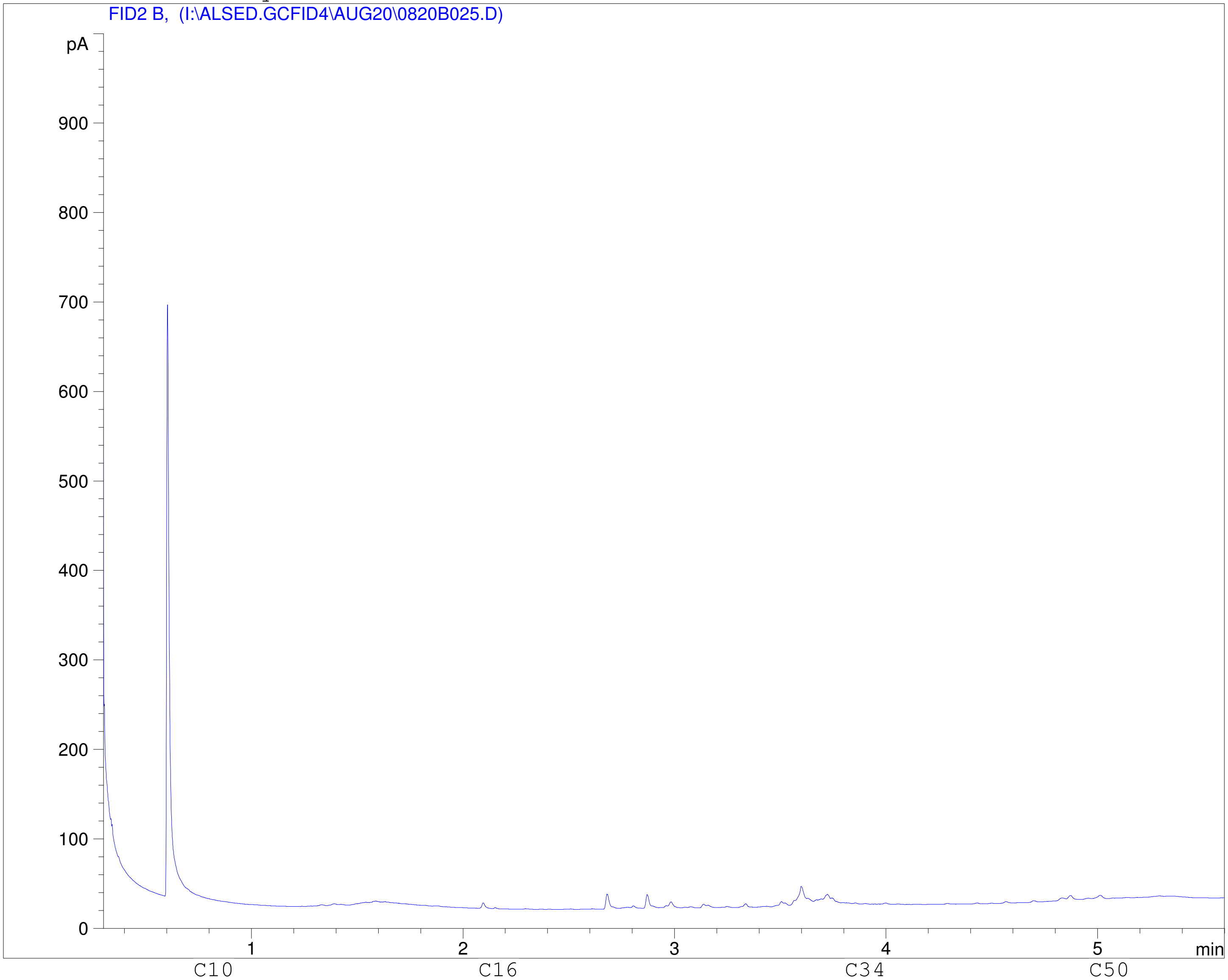


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-011

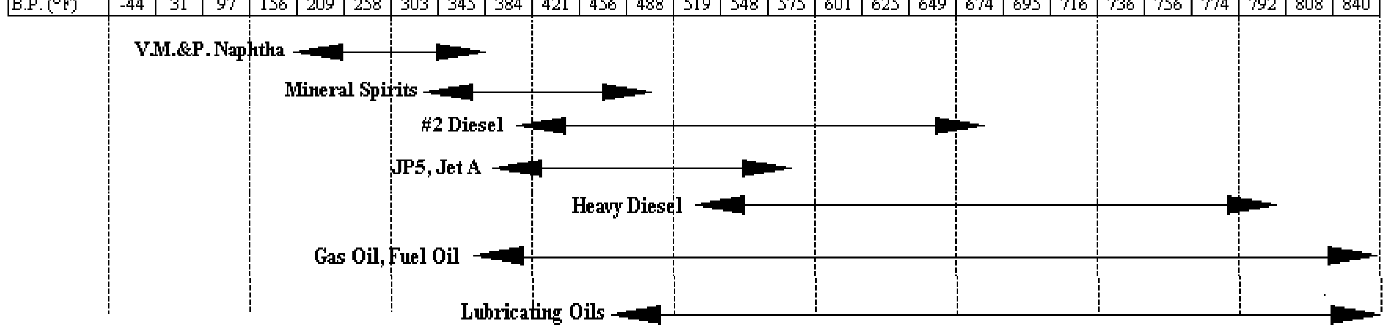
Sample ID: L806542-11 30
Injection Date: 8/21/2009 12:18:53 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

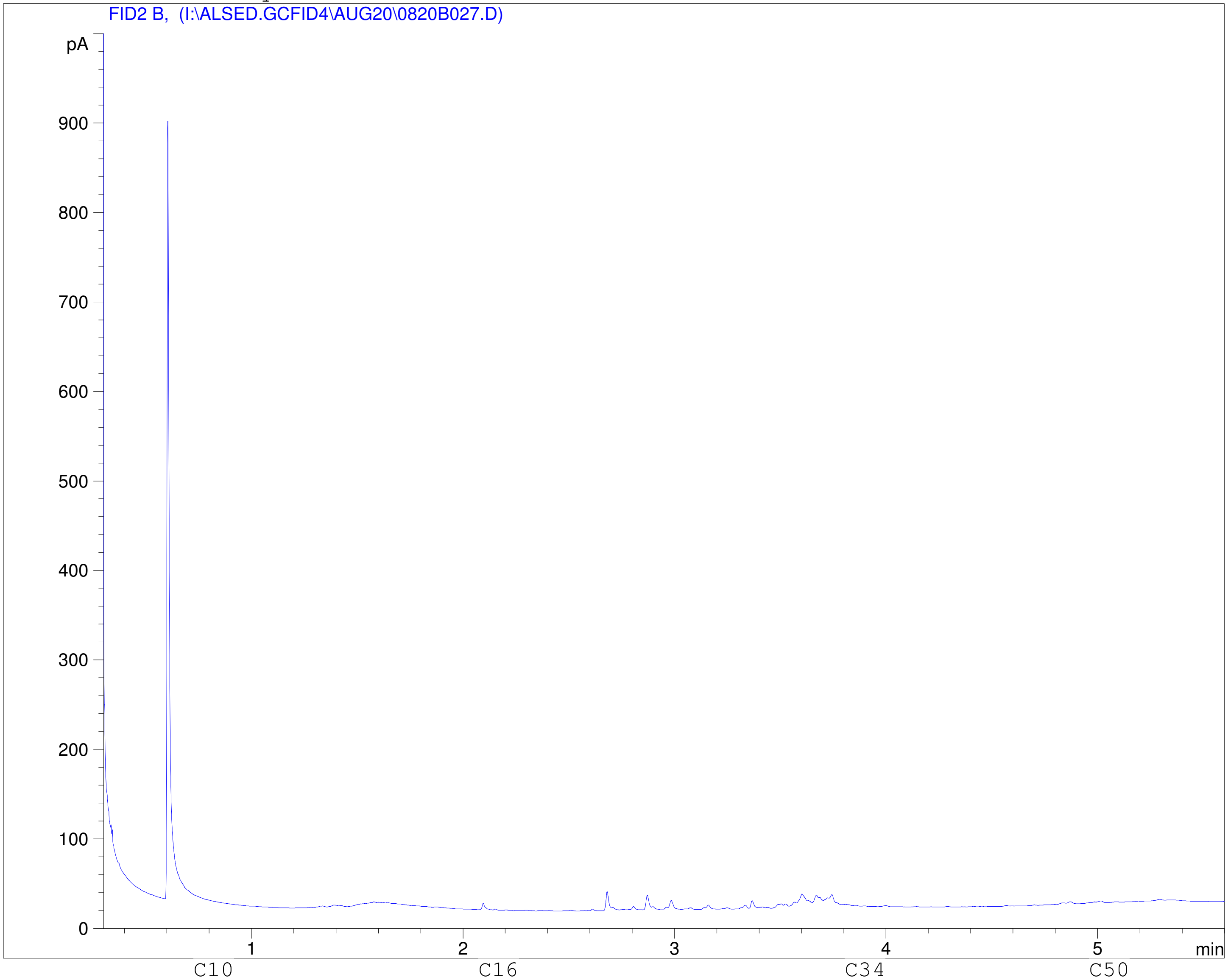


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-012

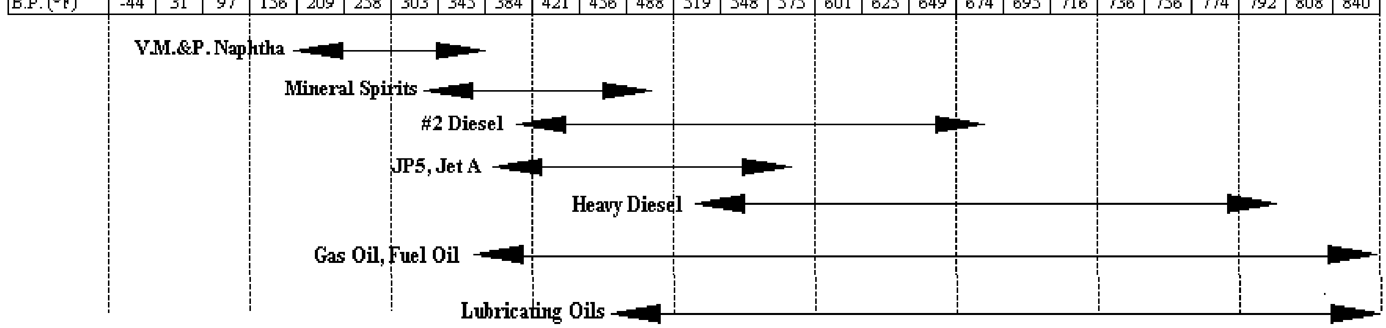
Sample ID: L806542-12 30
Injection Date: 8/21/2009 12:54:44 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

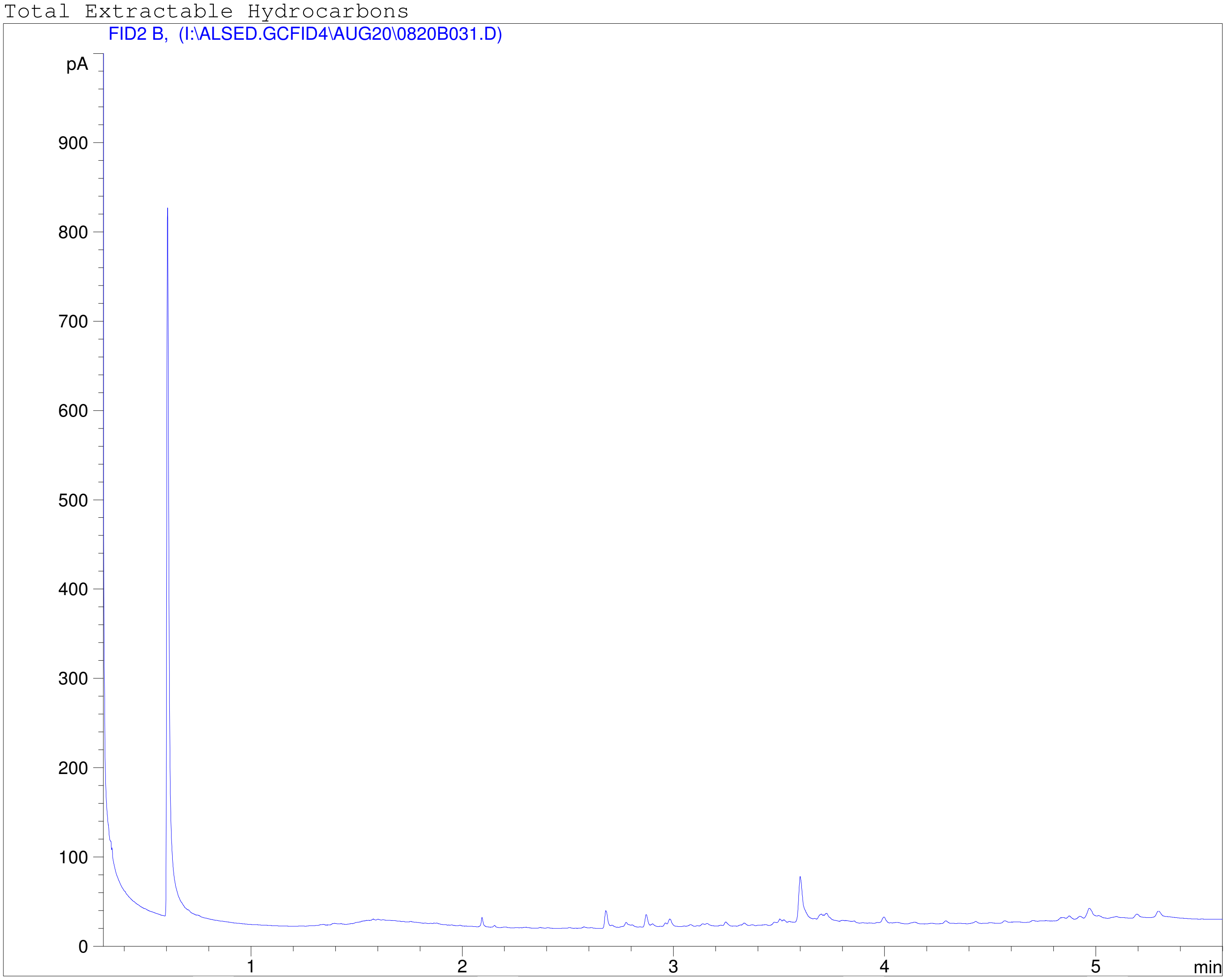


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-015

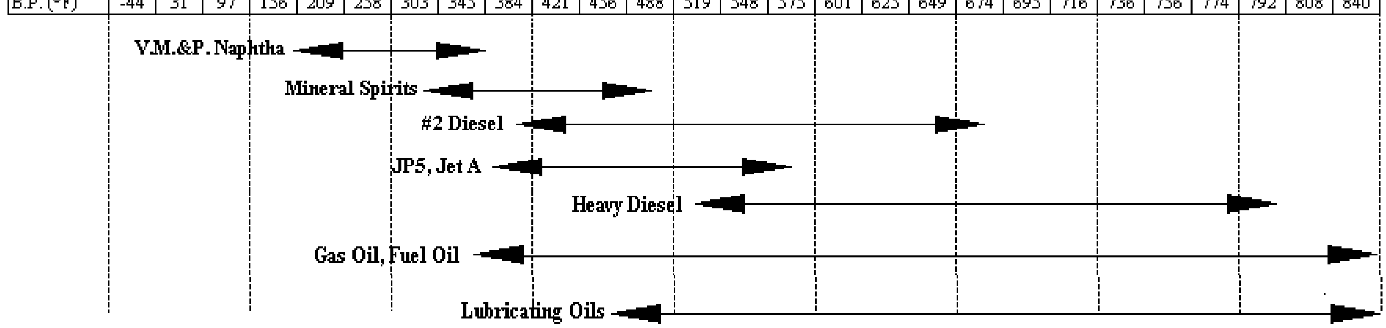
Sample ID: L806542-15 30
Injection Date: 8/21/2009 2:06:12 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

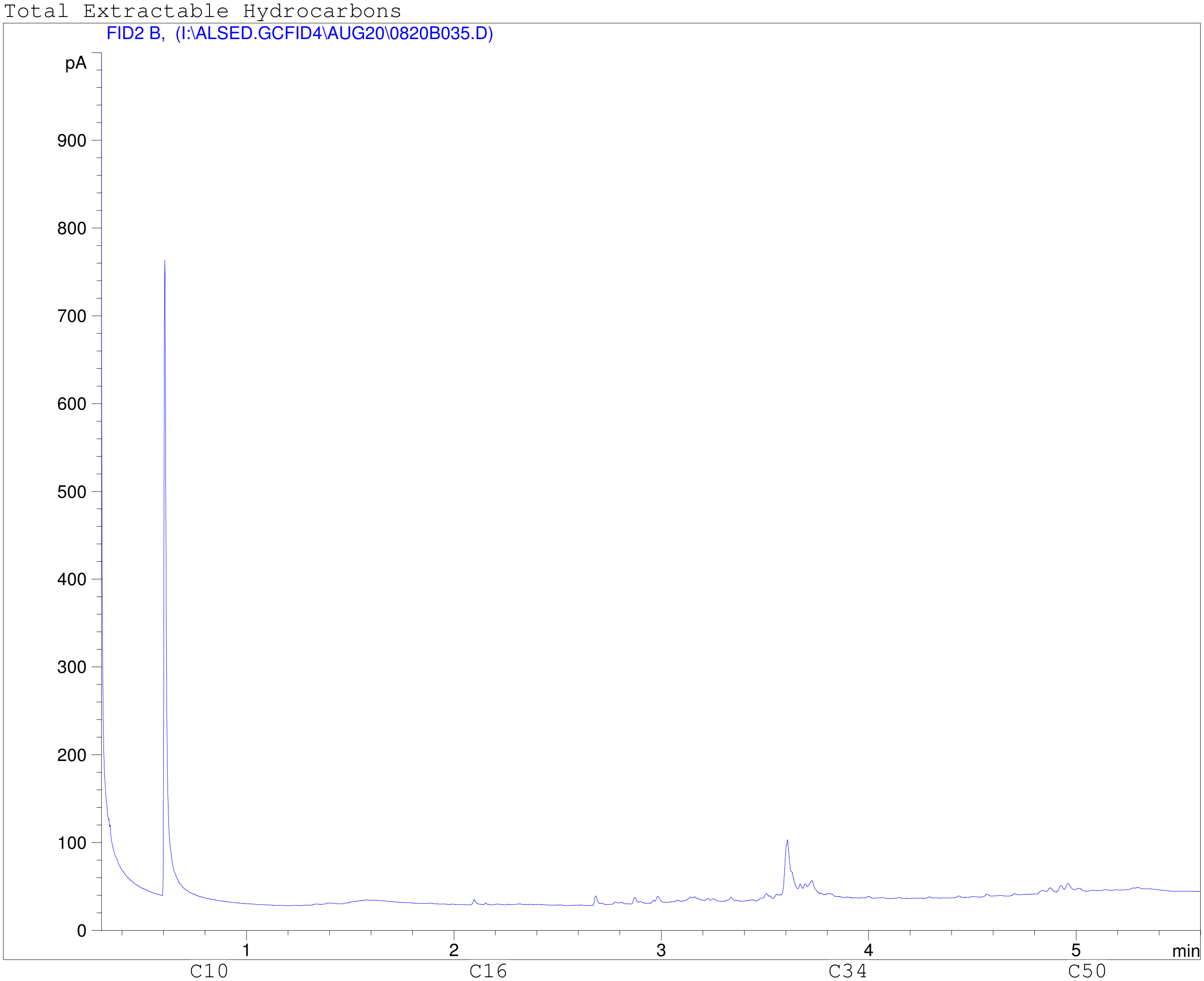


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-019

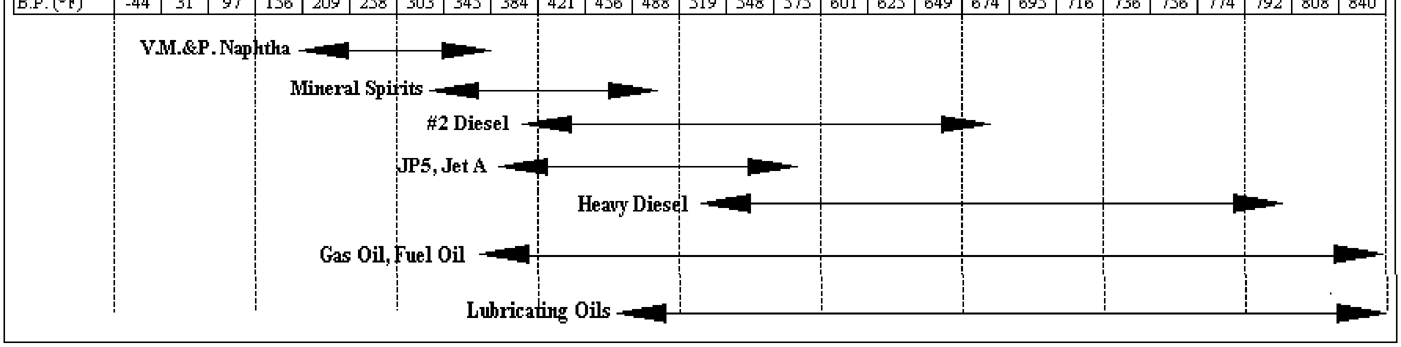
Sample ID: L806542-19 30
Injection Date: 8/21/2009 3:17:35 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

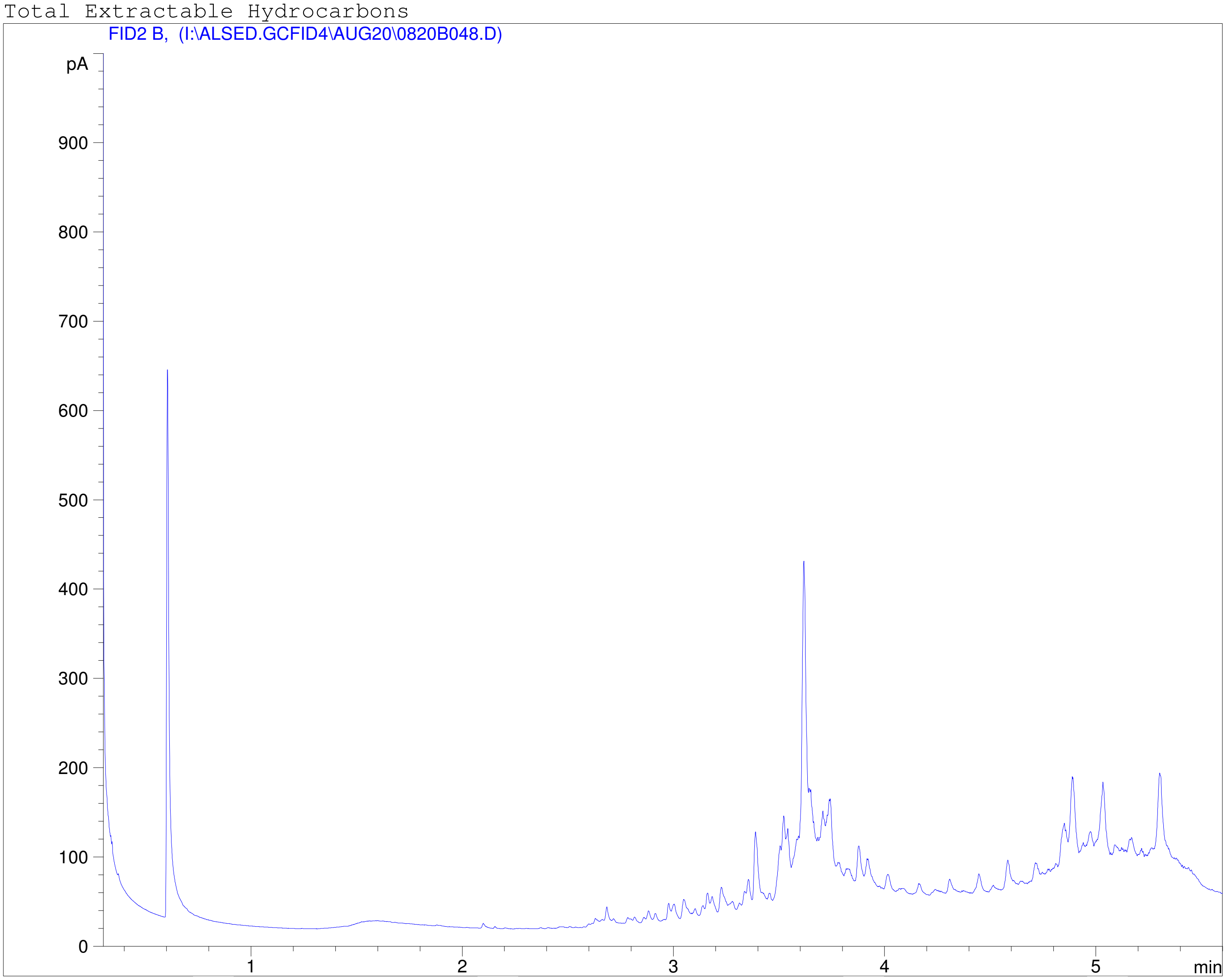


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-002

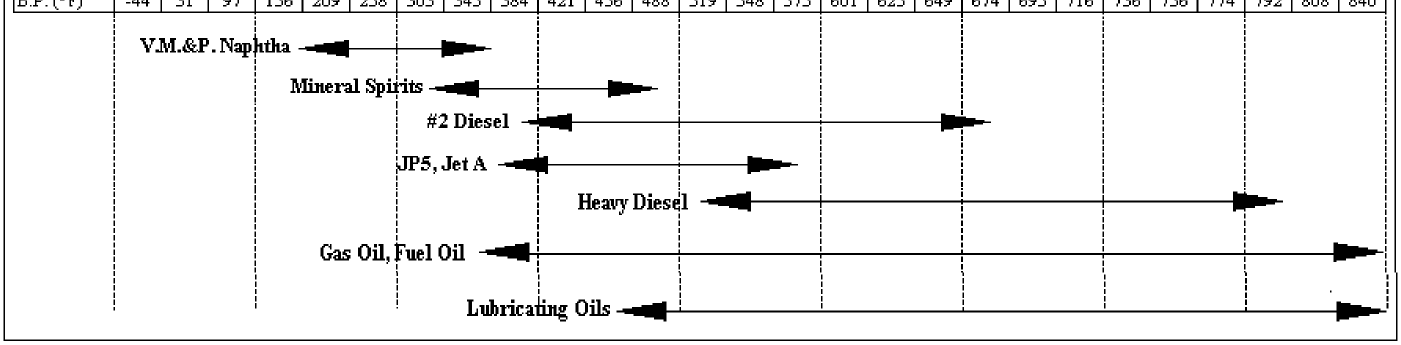
Sample ID: L806542-2 30
Injection Date: 8/21/2009 1:57:04 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

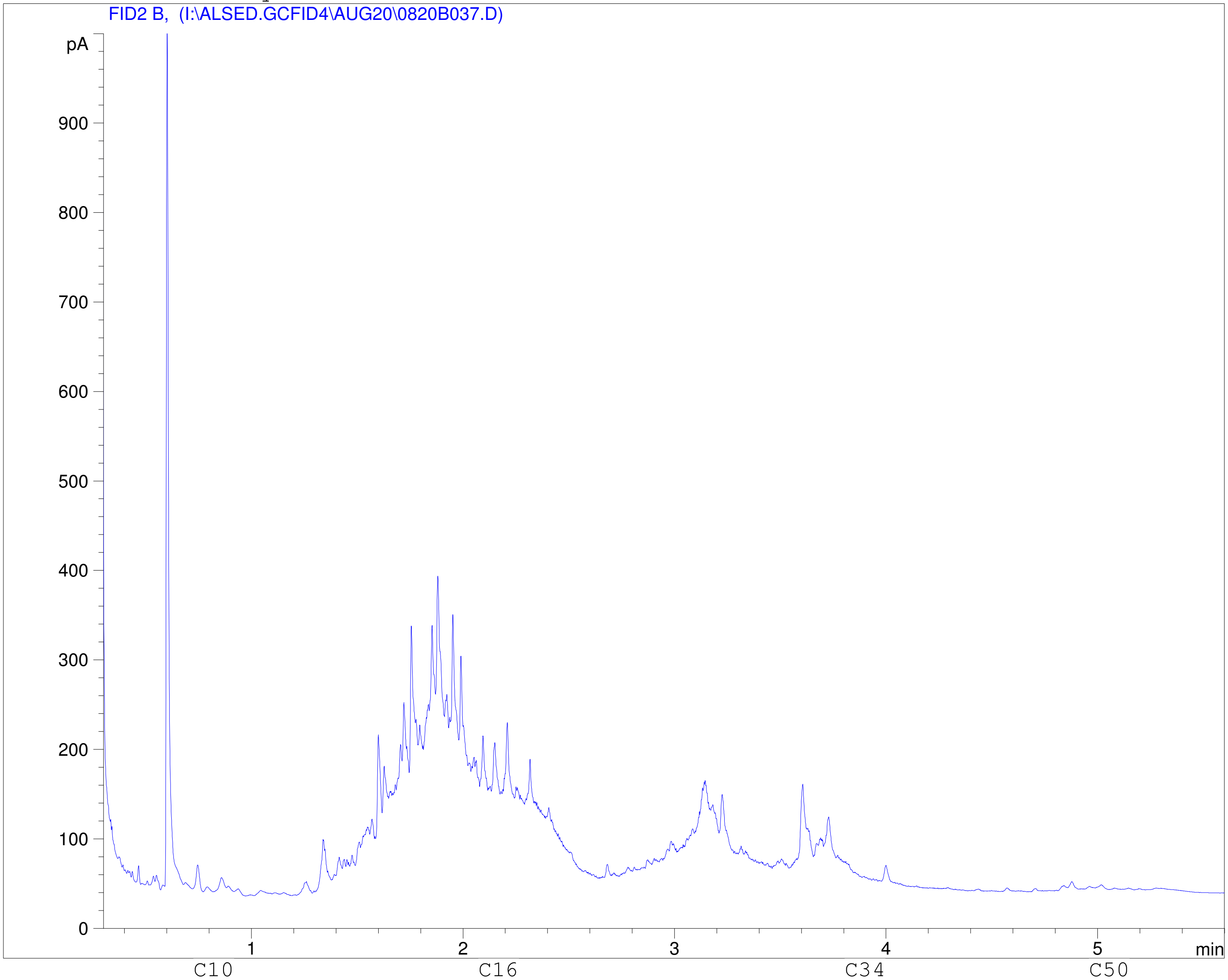


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-020

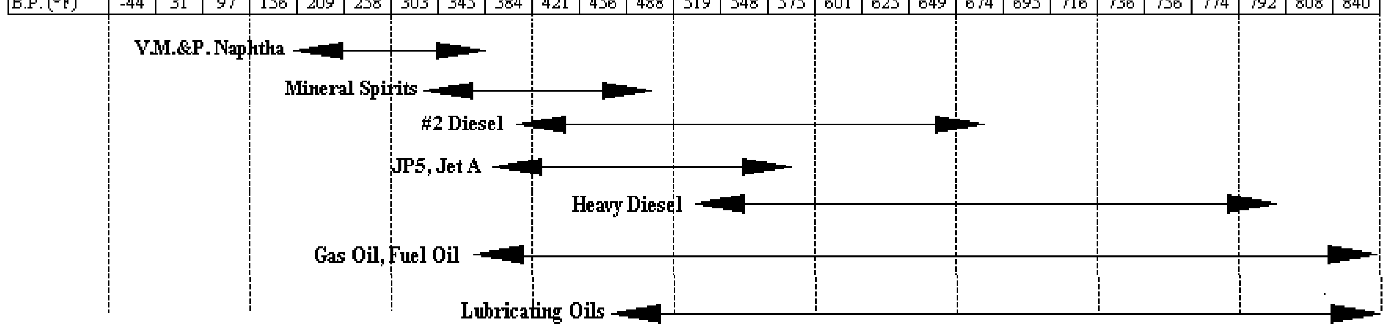
Sample ID: L806542-20 30
Injection Date: 8/21/2009 3:53:26 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

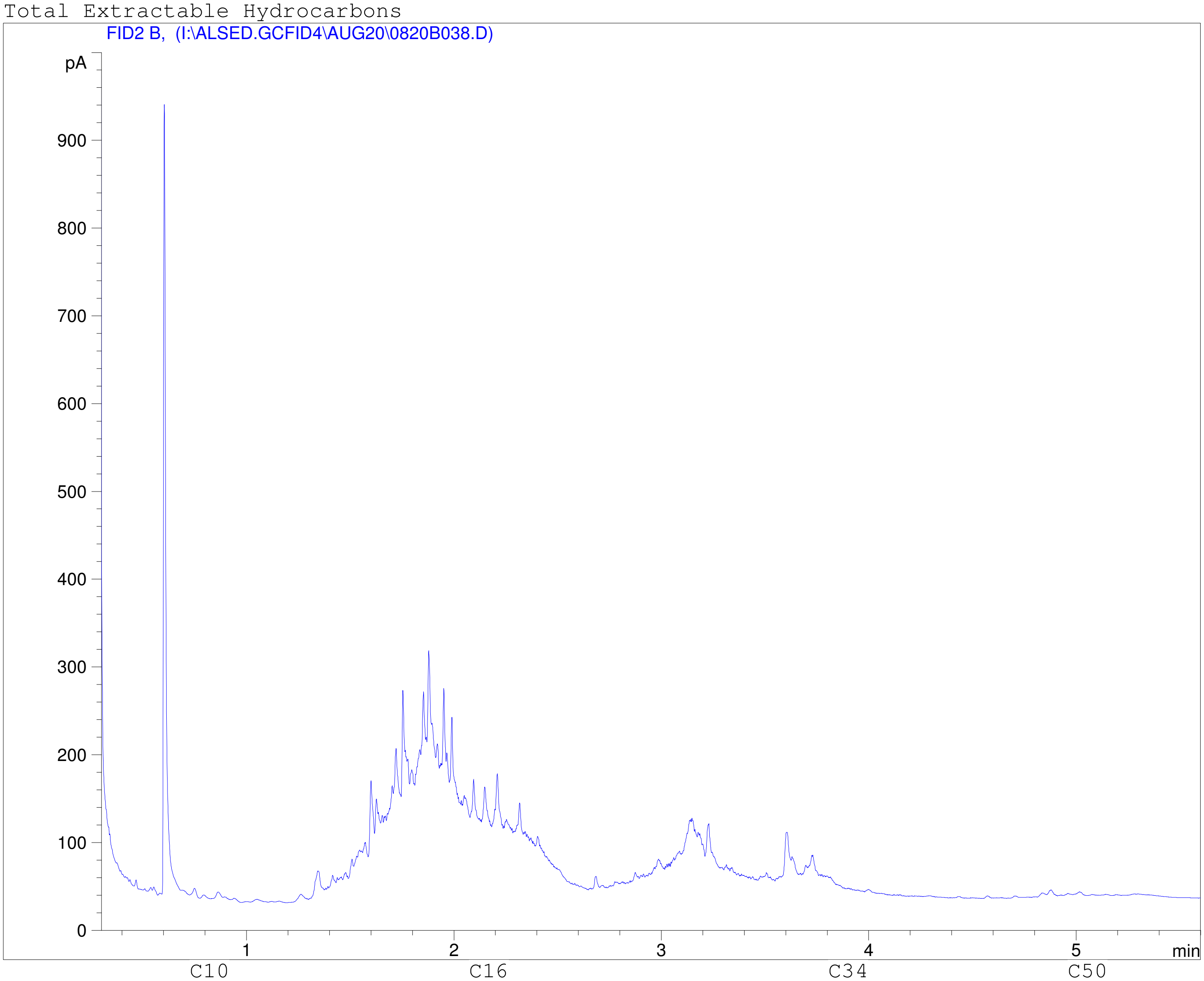


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-021

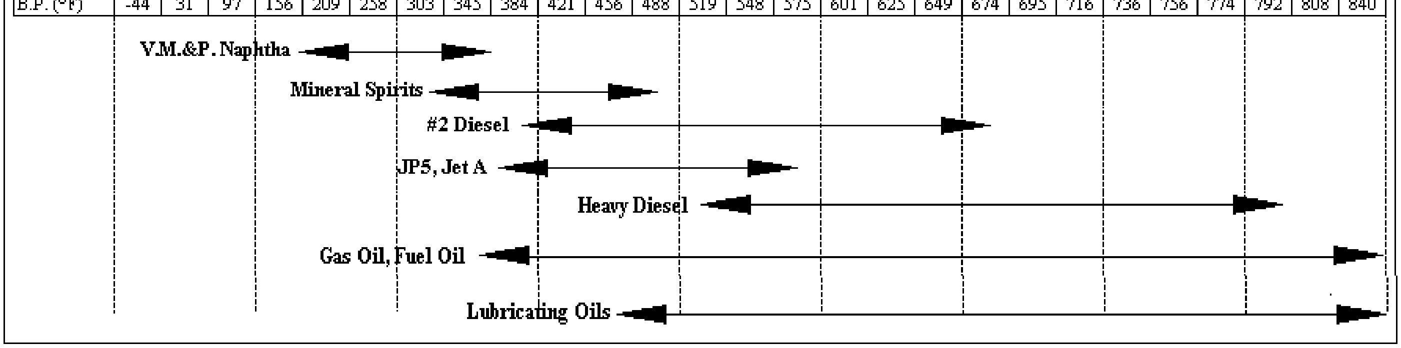
Sample ID: L806542-21 30
Injection Date: 8/21/2009 4:11:23 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

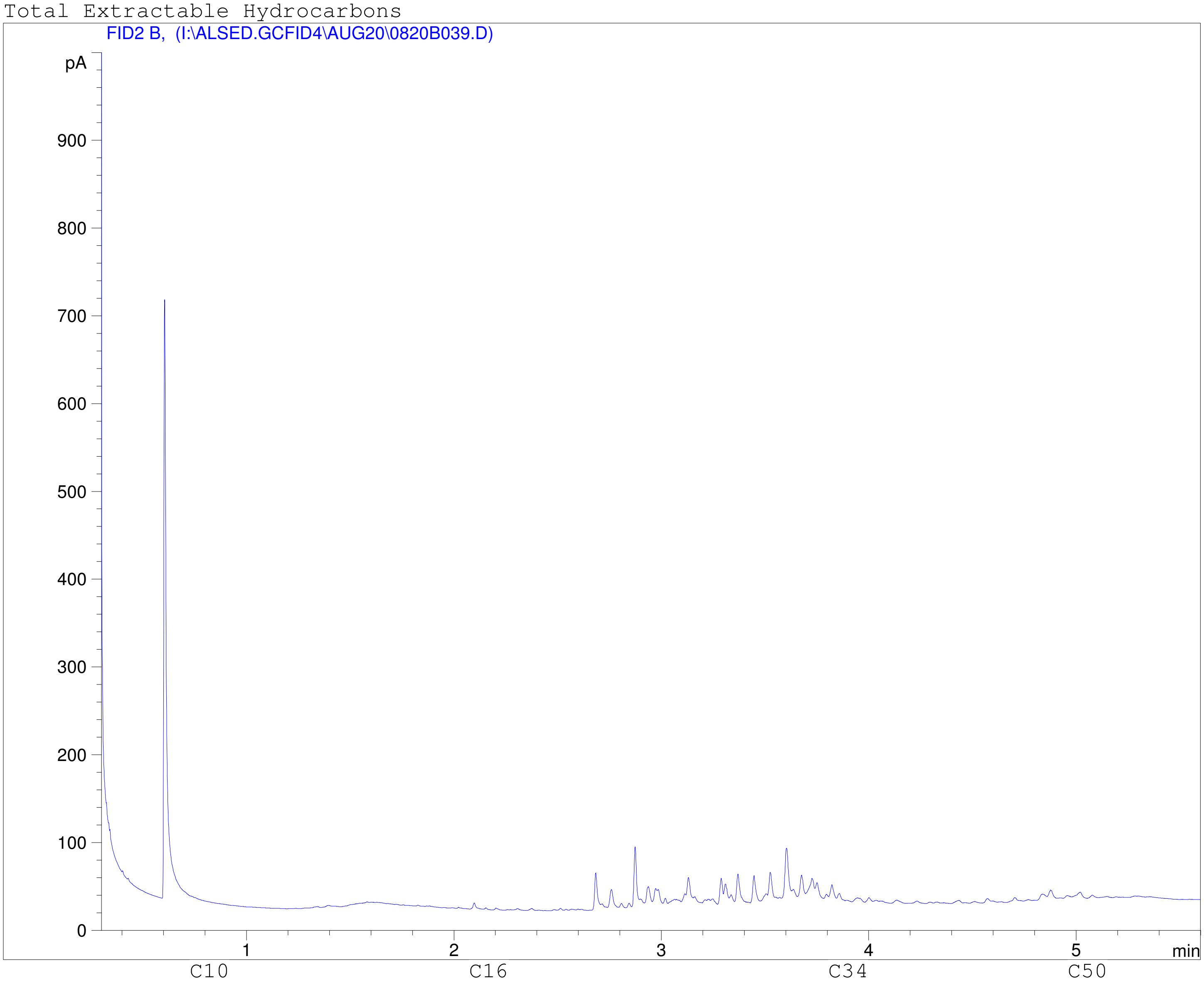


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-022

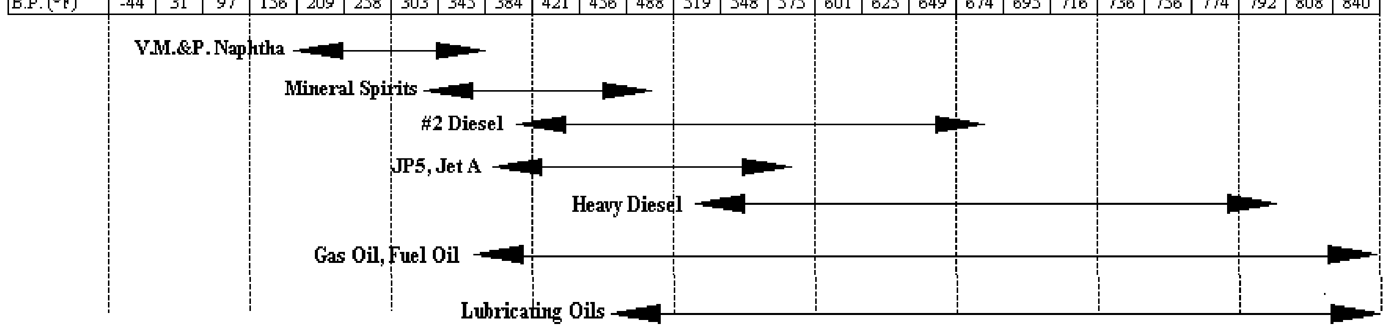
Sample ID: L806542-22 30
Injection Date: 8/21/2009 4:29:05 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

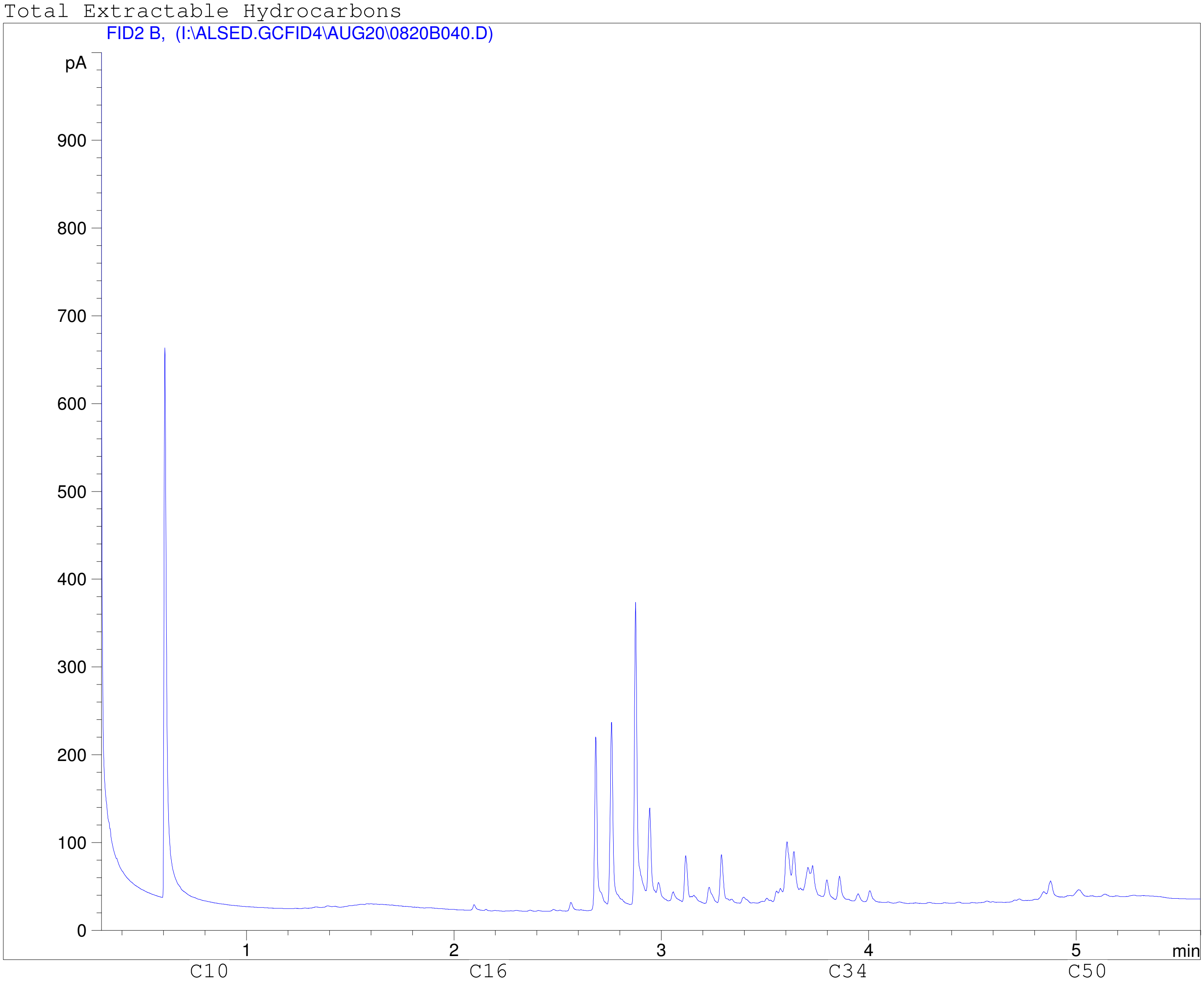


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-023

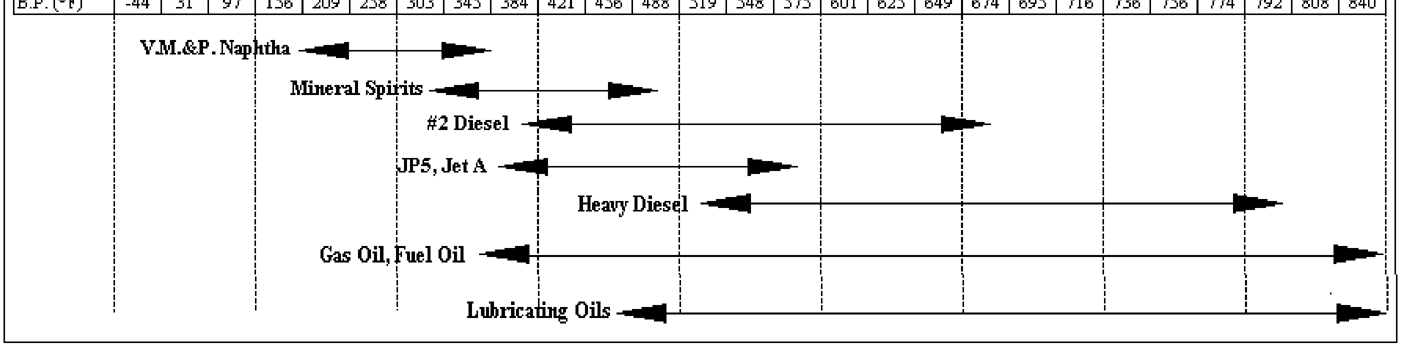
Sample ID: L806542-23 30
Injection Date: 8/21/2009 4:46:47 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

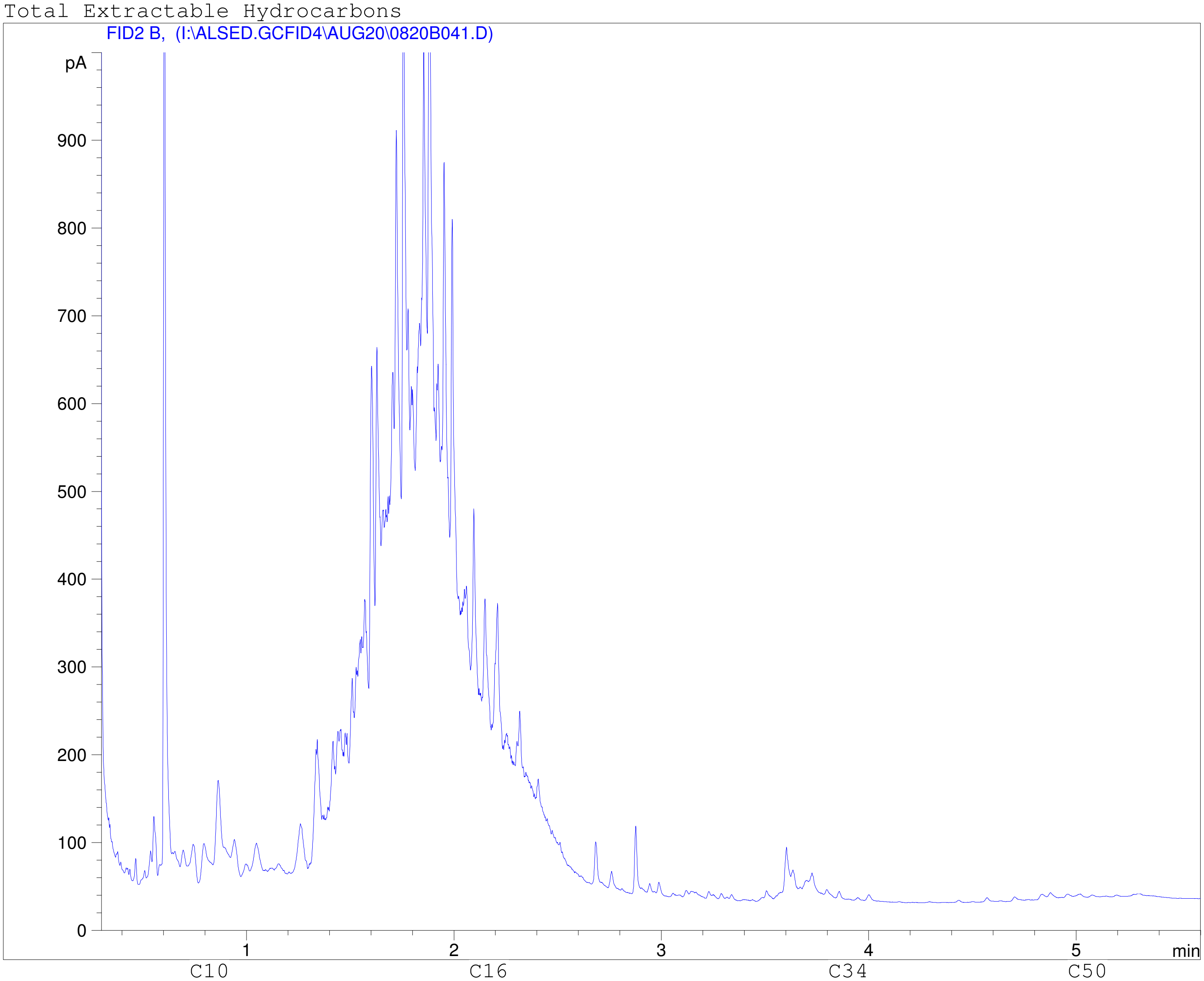


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-024

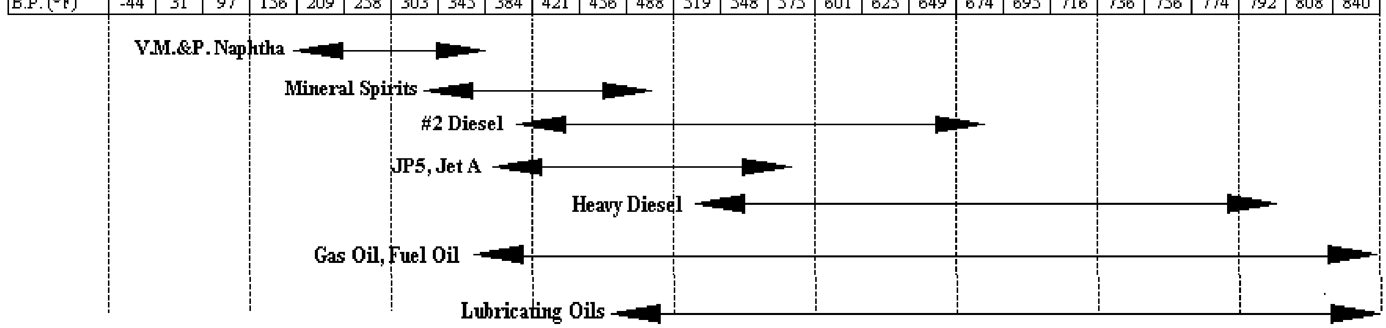
Sample ID: L806542-24 30
Injection Date: 8/21/2009 5:04:53 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

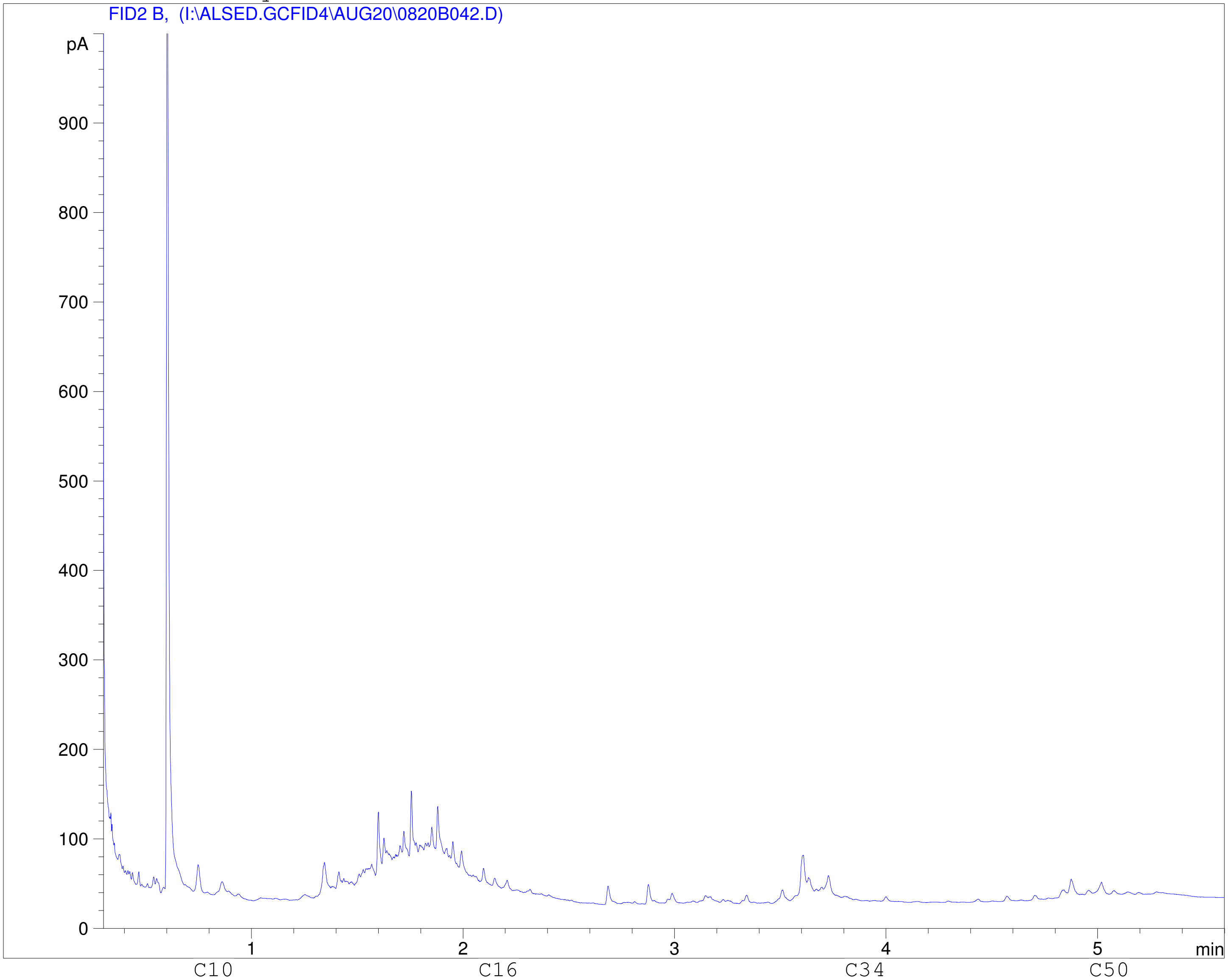


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-025

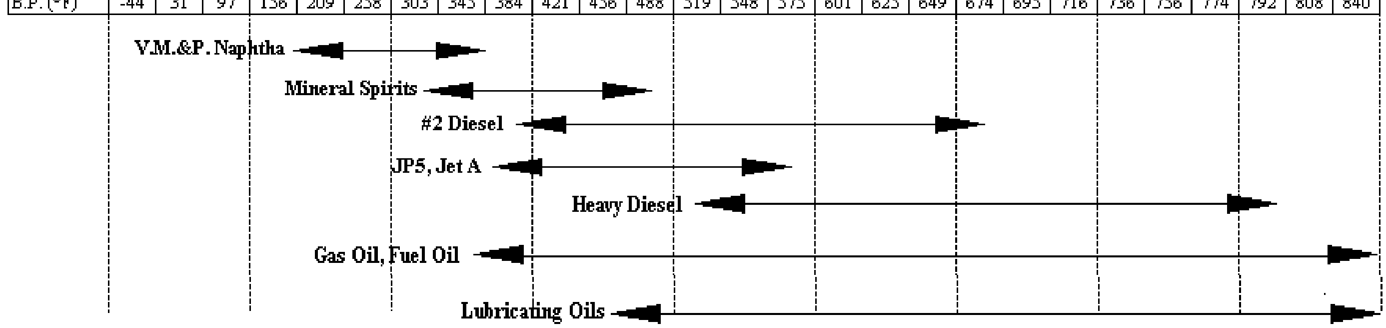
Sample ID: L806542-25 30
Injection Date: 8/21/2009 5:22:56 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

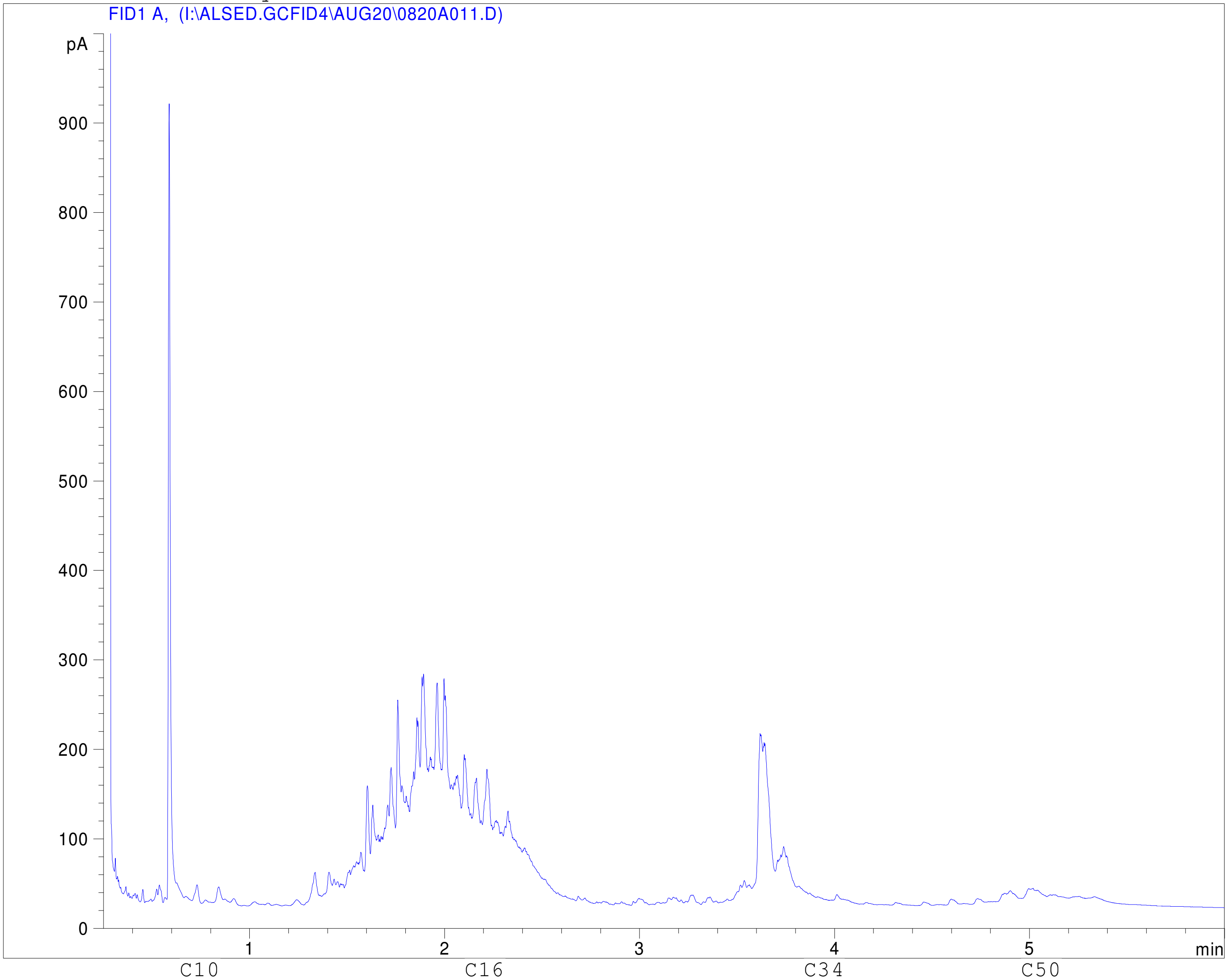


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-026

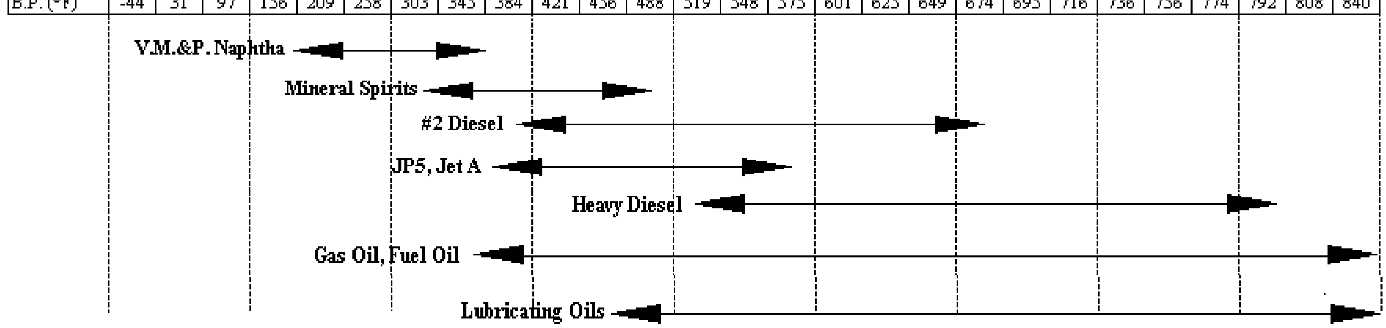
Sample ID: L806542-26 30
Injection Date: 8/20/2009 8:08:32 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

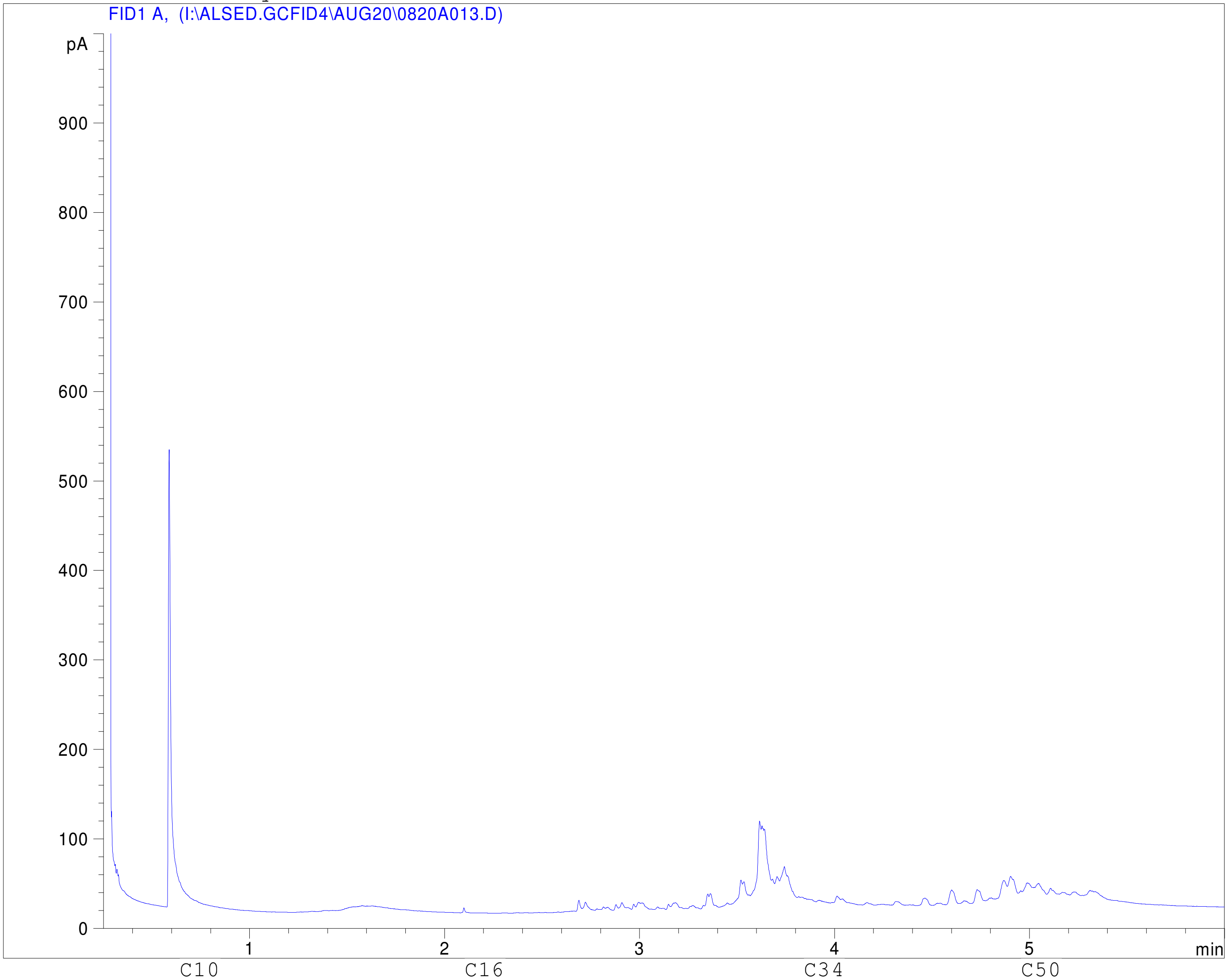


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-027

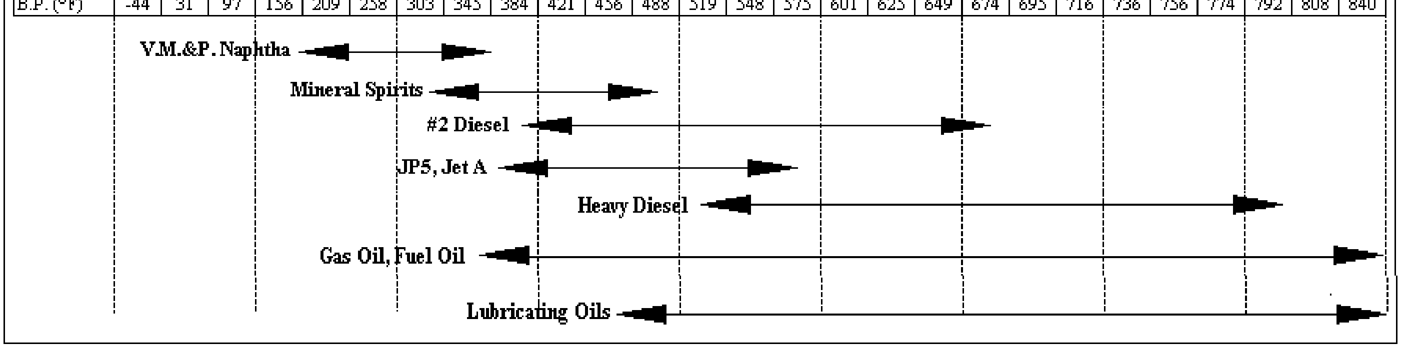
Sample ID: L806542-27 30
Injection Date: 8/20/2009 8:44:38 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

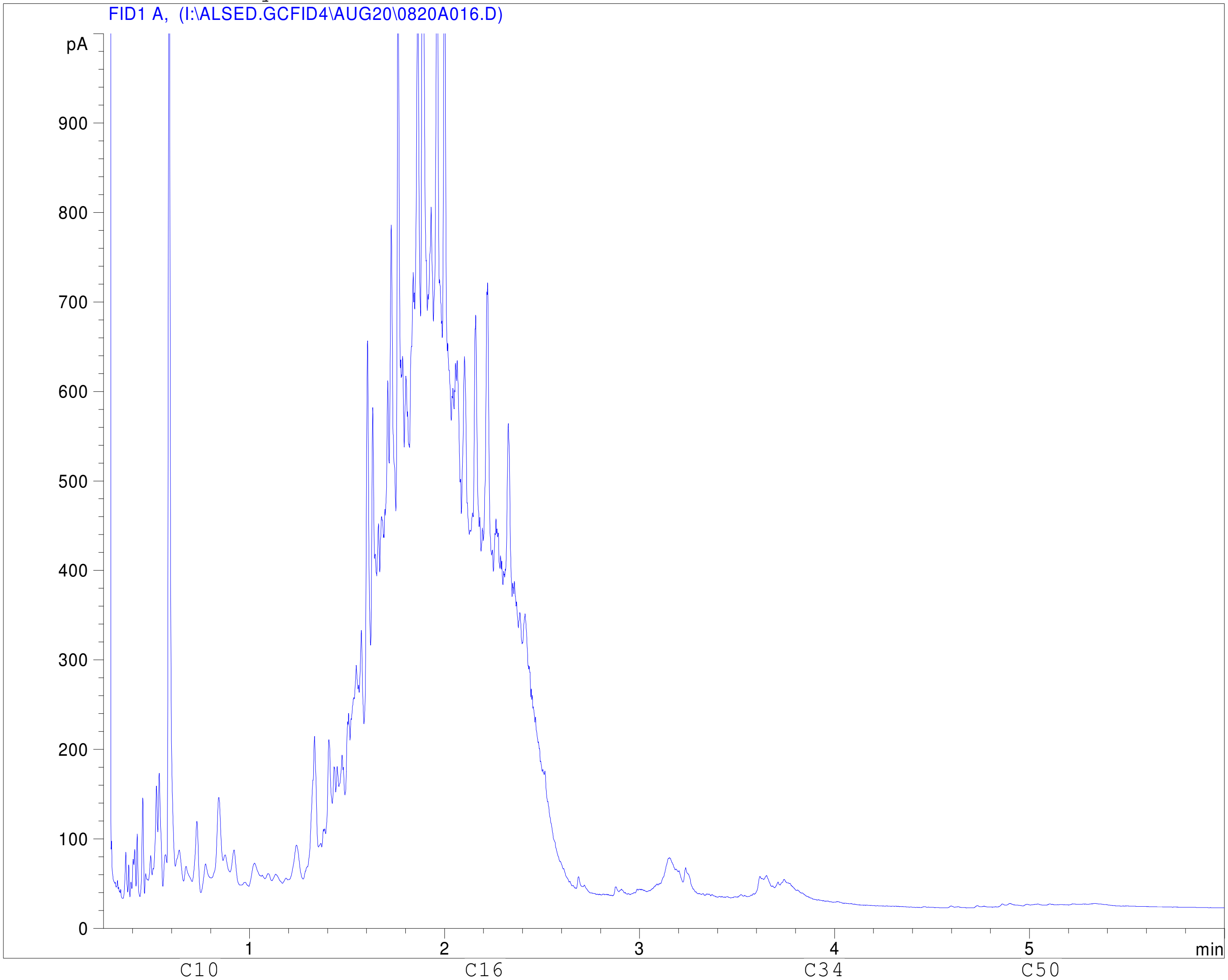


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-029

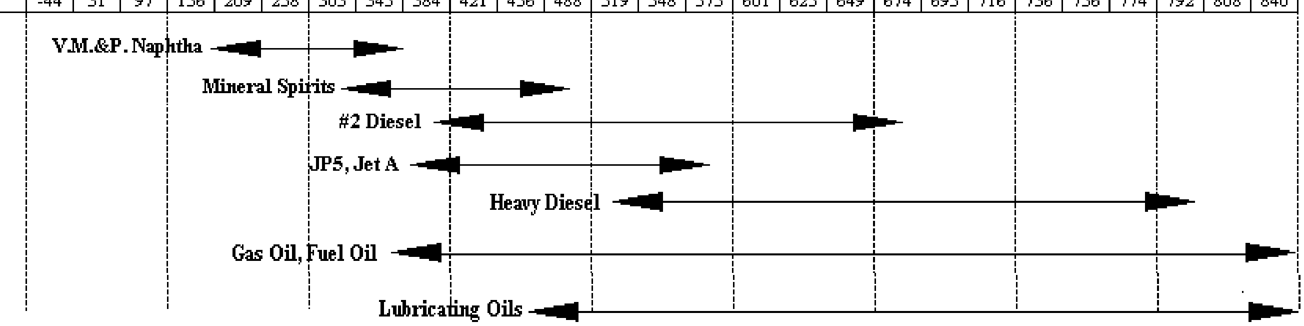
Sample ID: L806542-29 30
Injection Date: 8/20/2009 9:38:25 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

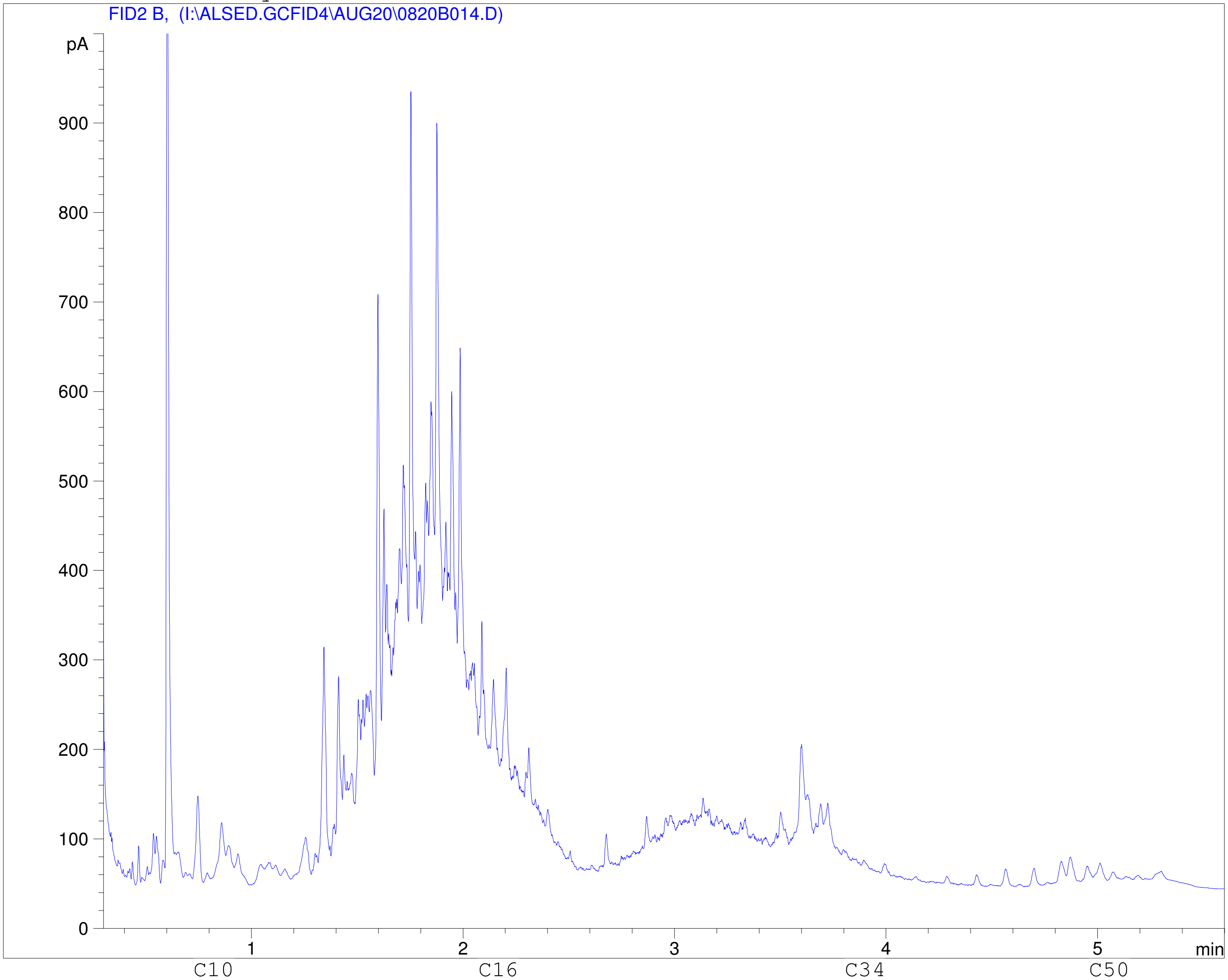


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-003

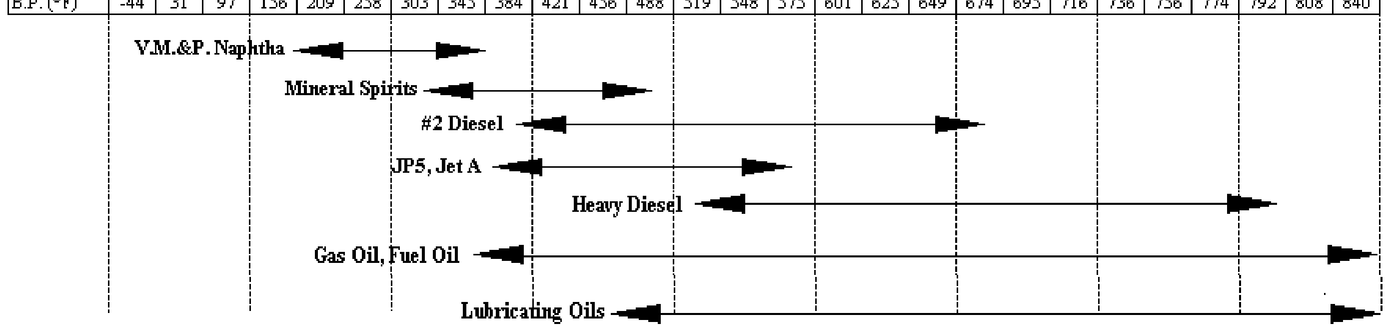
Sample ID: L806542-3 30
Injection Date: 8/20/2009 9:02:37 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

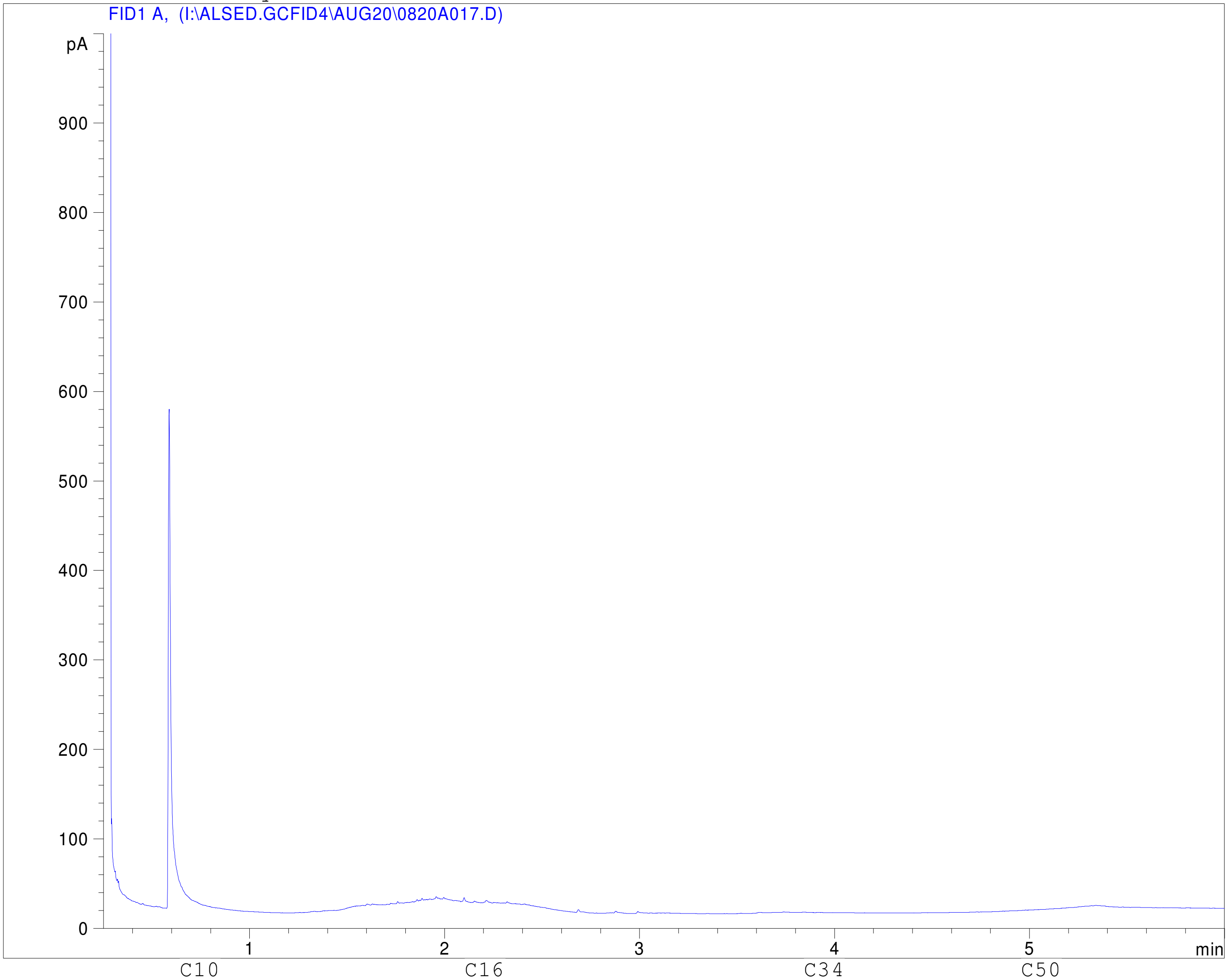


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-030

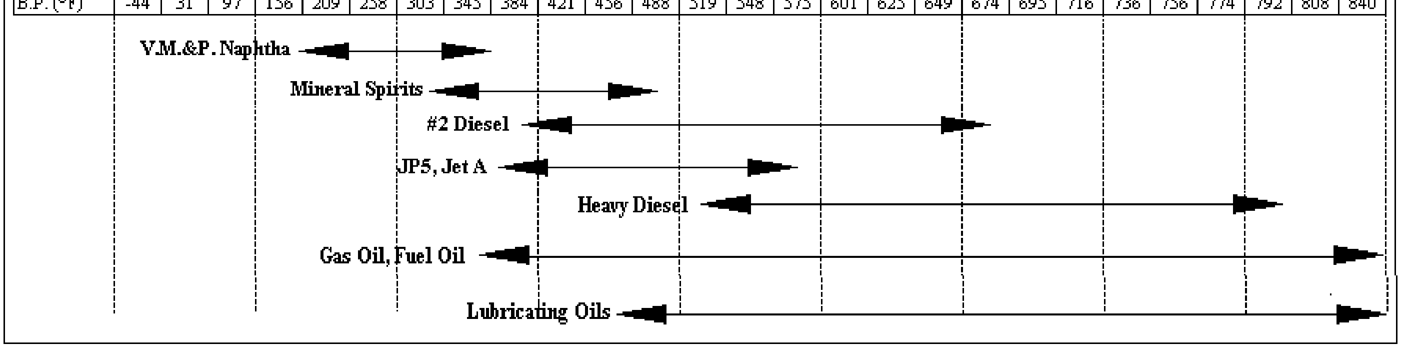
Sample ID: L806542-30 30
Injection Date: 8/20/2009 9:56:17 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

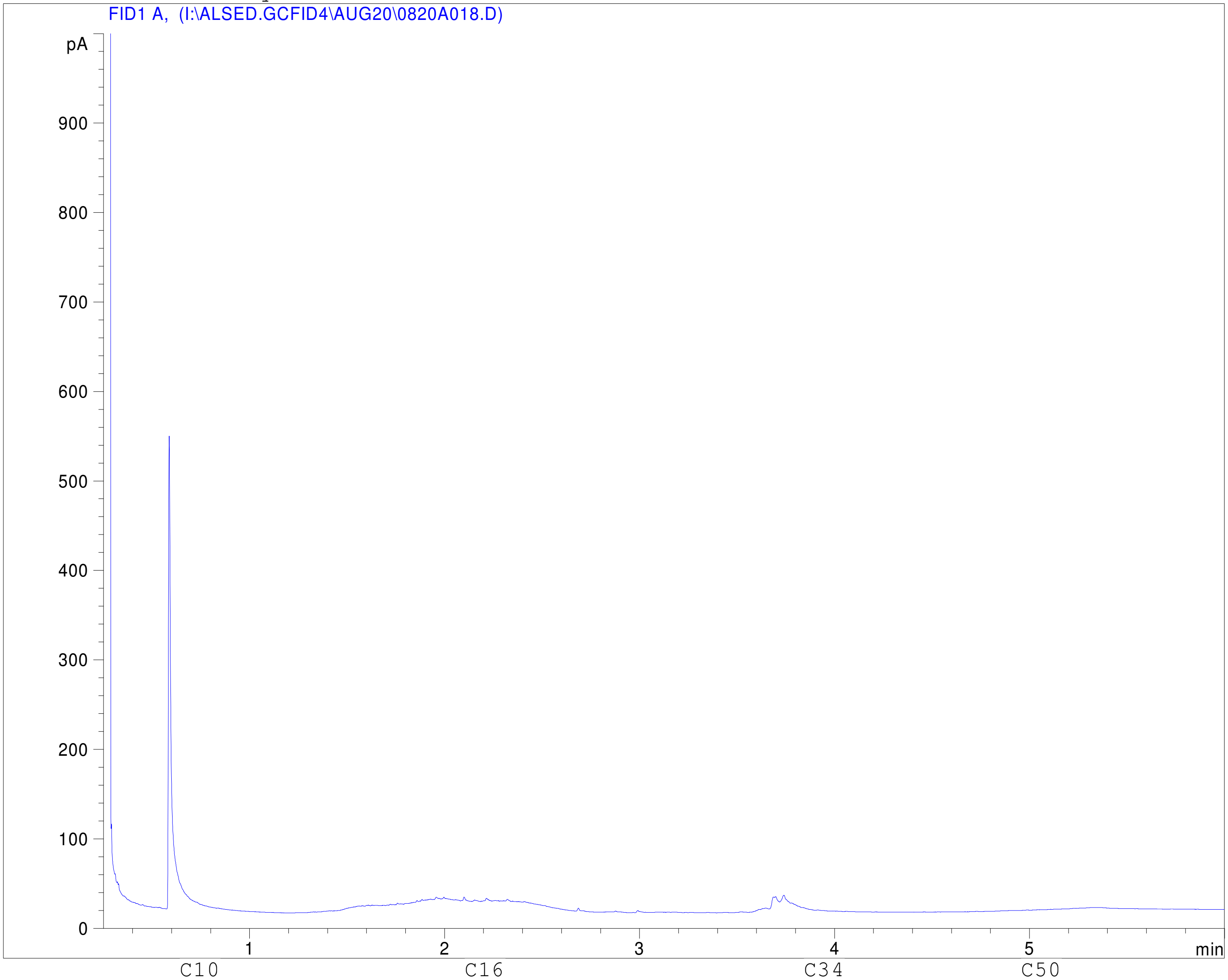


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-031

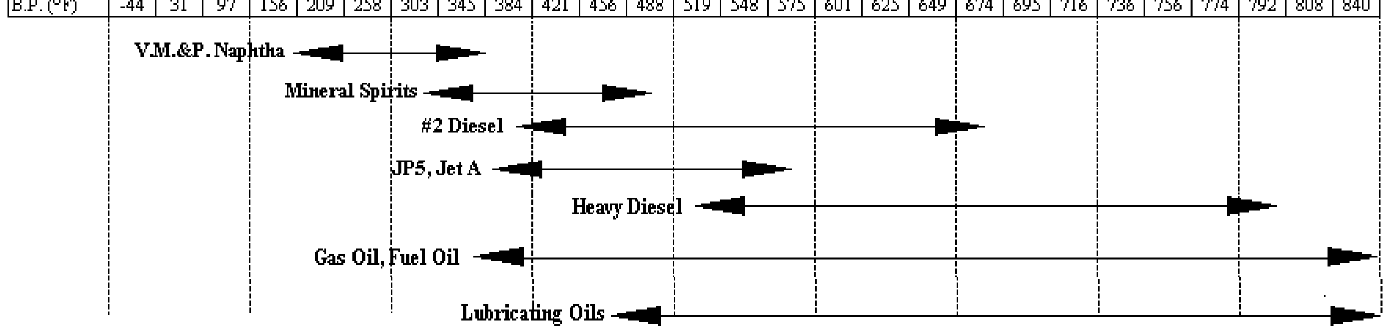
Sample ID: L806542-31 30
Injection Date: 8/20/2009 10:14:10 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

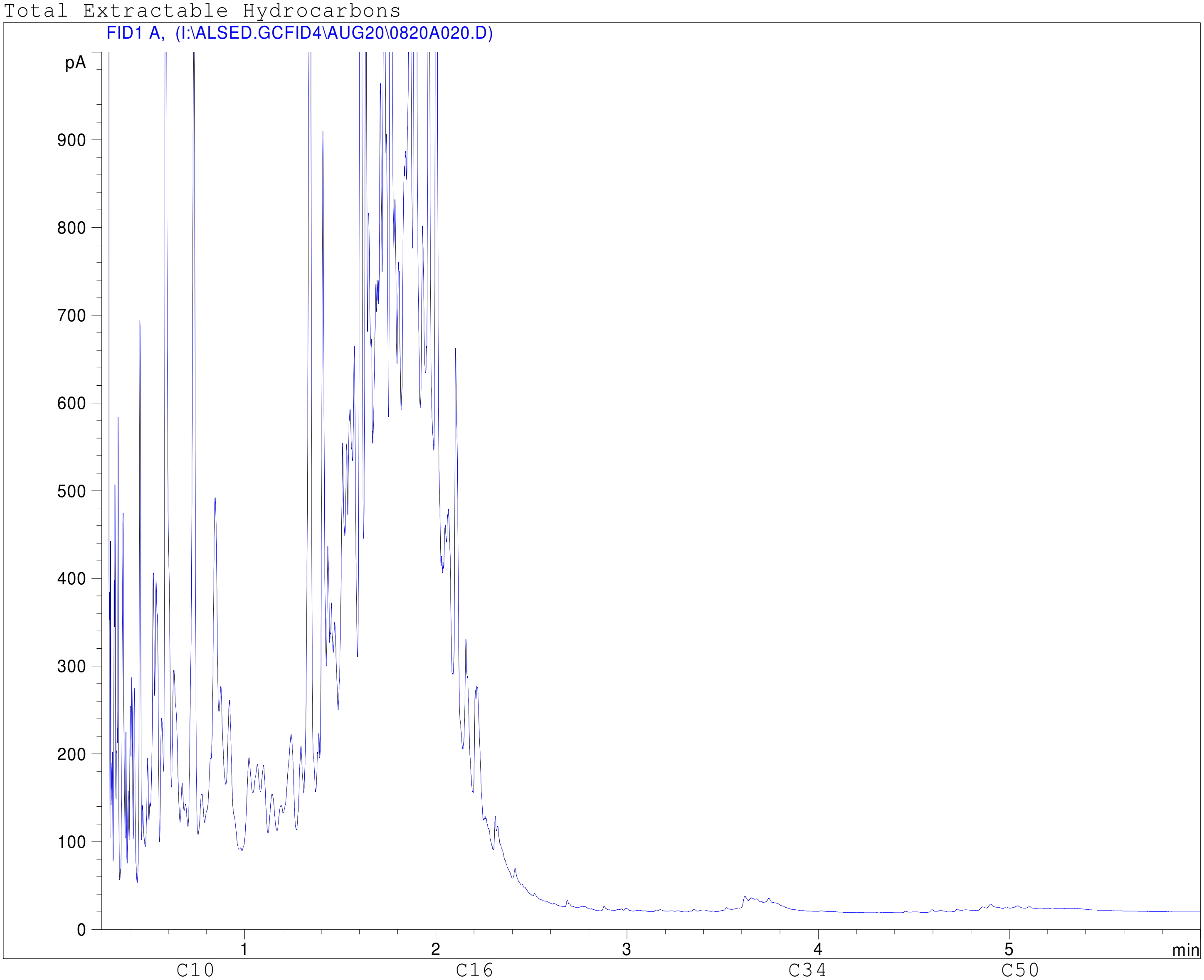


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-033

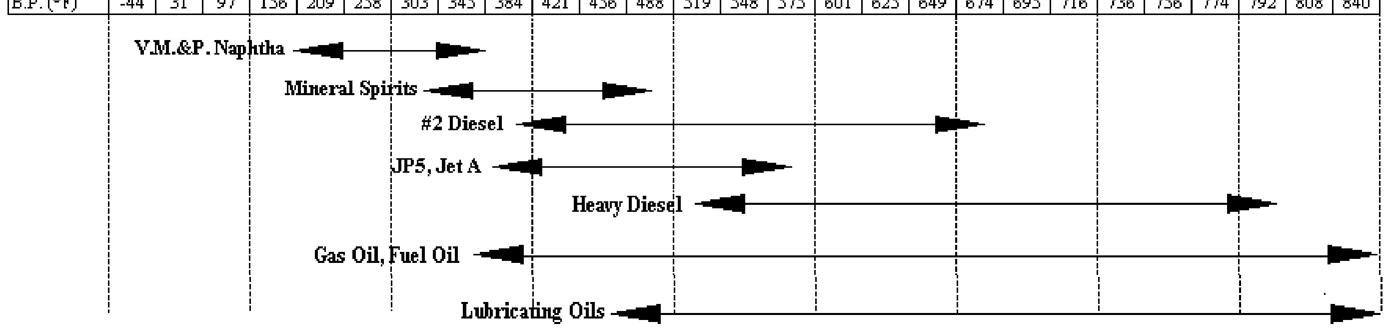
Sample ID: L806542-33 30
Injection Date: 8/20/2009 10:49:40 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

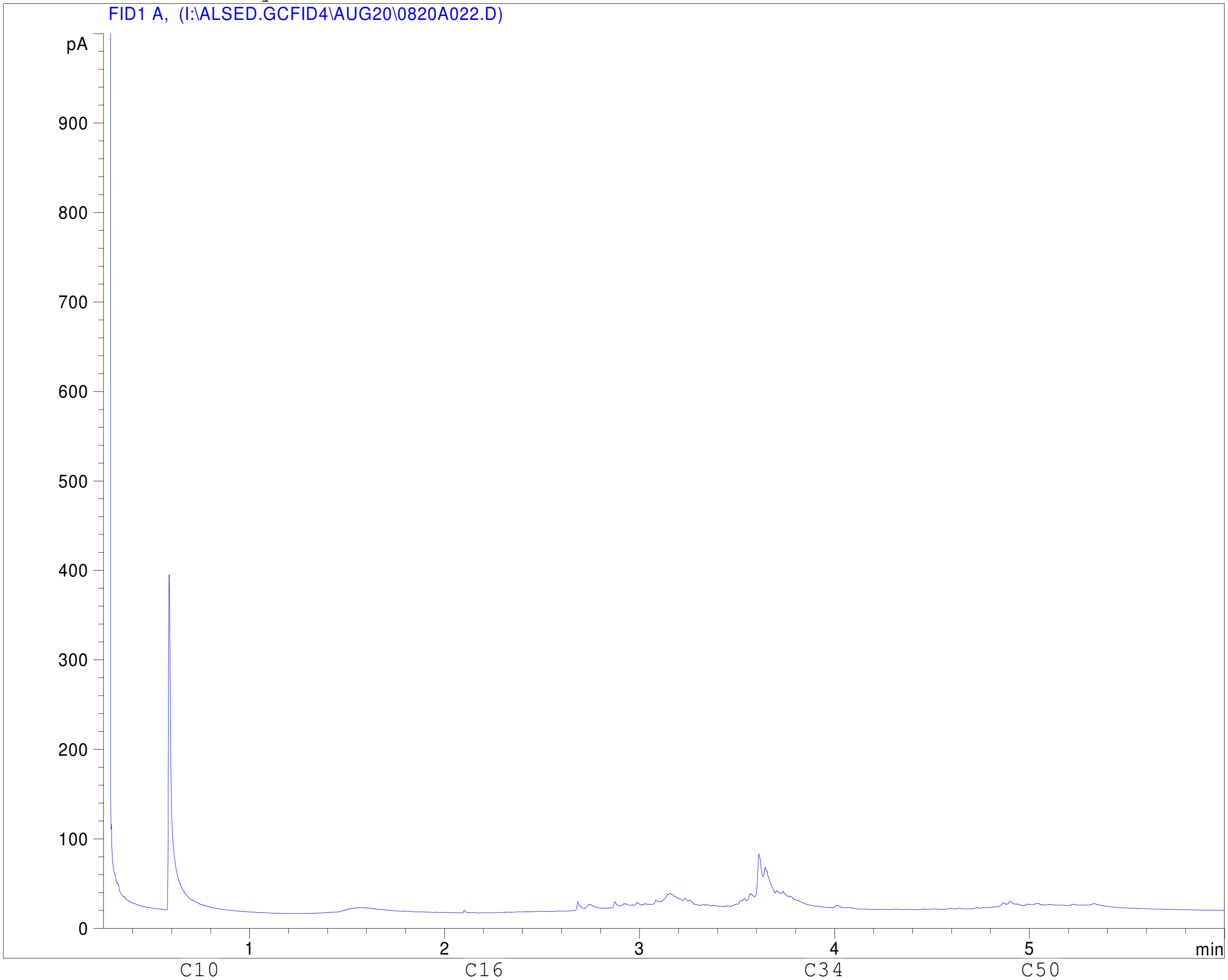


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-034

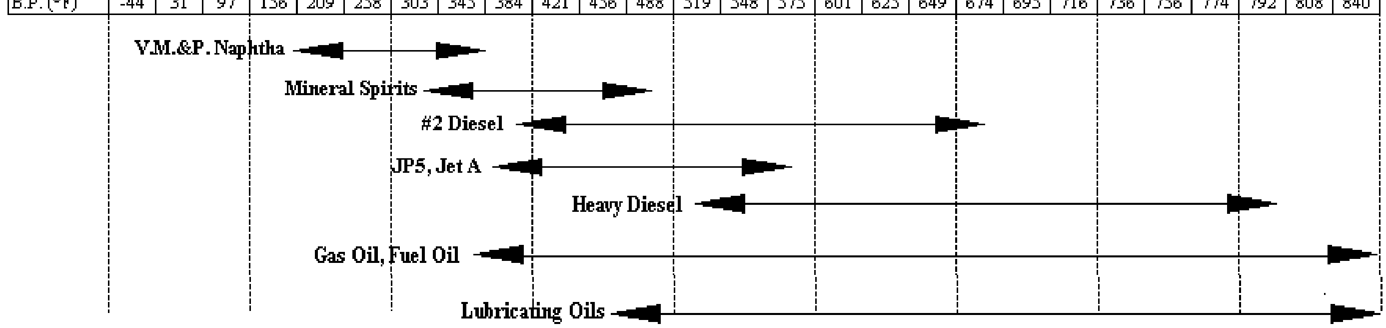
Sample ID: L806542-34 30
Injection Date: 8/20/2009 11:25:25 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

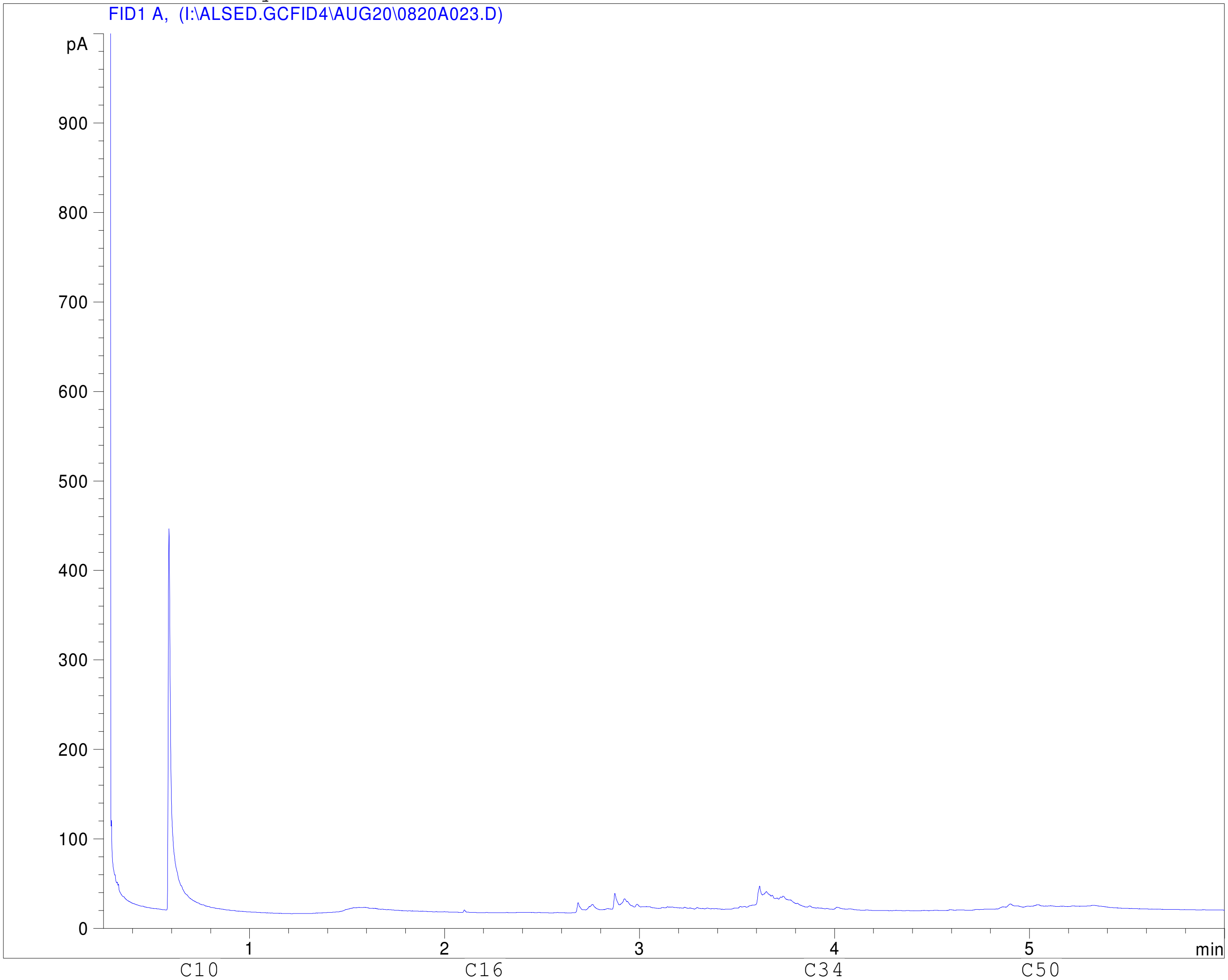


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-035

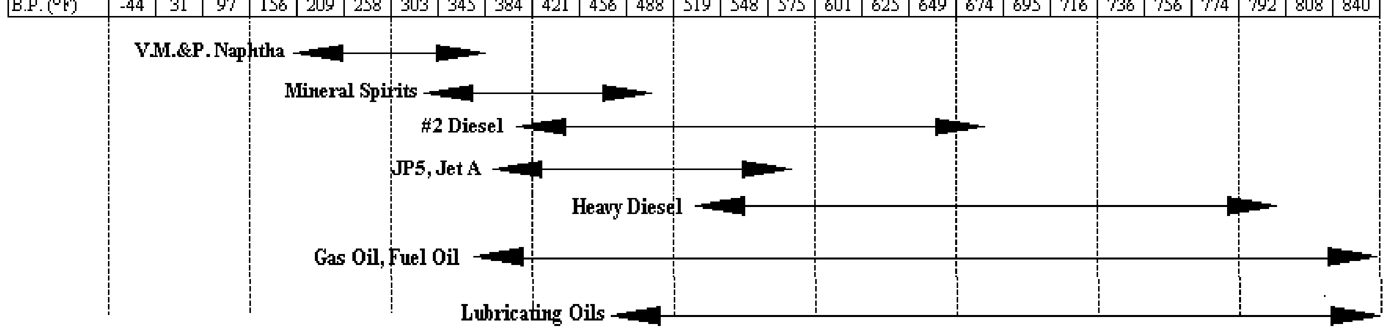
Sample ID: L806542-35 30
Injection Date: 8/20/2009 11:43:11 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

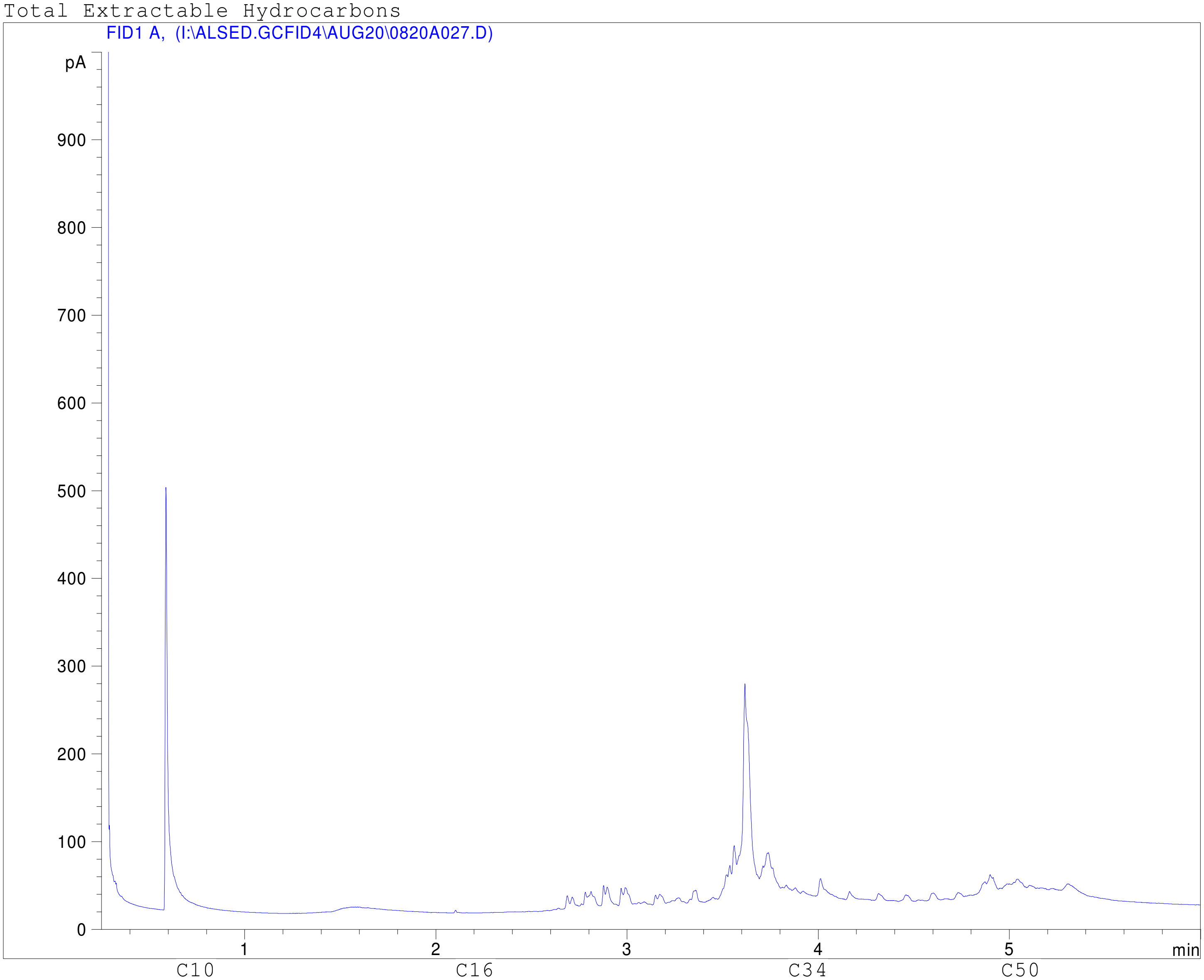


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-038

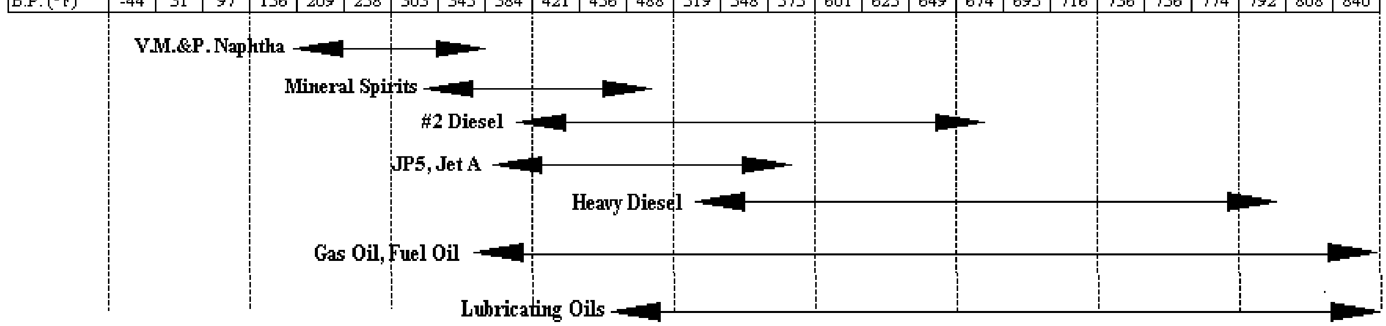
Sample ID: L806542-38 30
Injection Date: 8/21/2009 12:54:45 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840



Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

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Client ID:               PLF09-SS-039

Sample ID:               L806542-39 30
Injection Date:          8/21/2009 1:12:53 AM
Instrument:              6890
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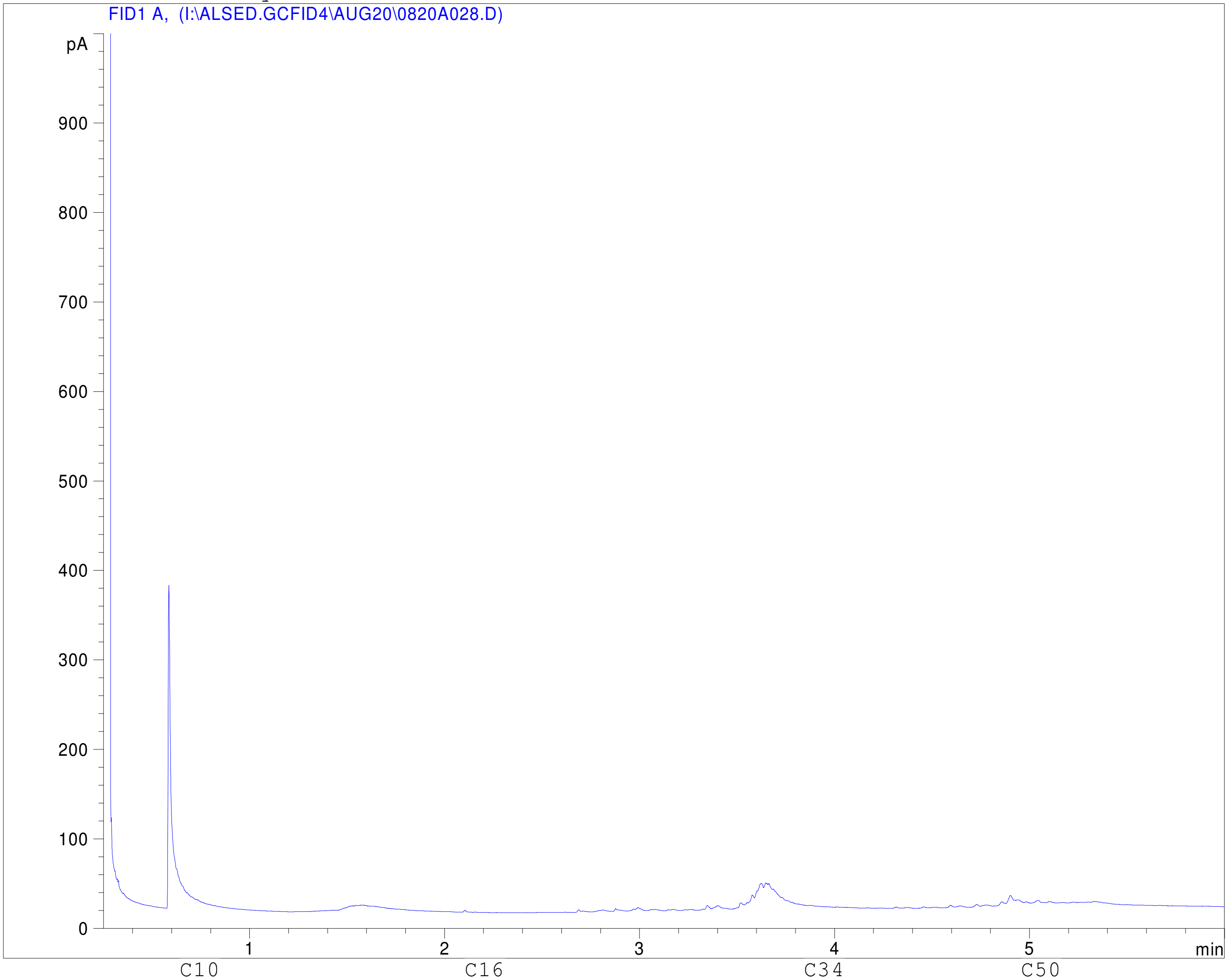
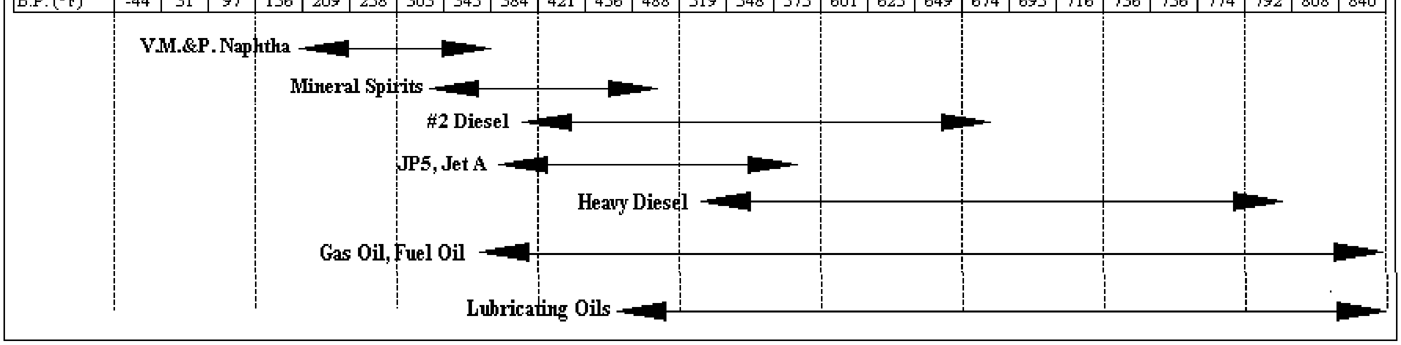
Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

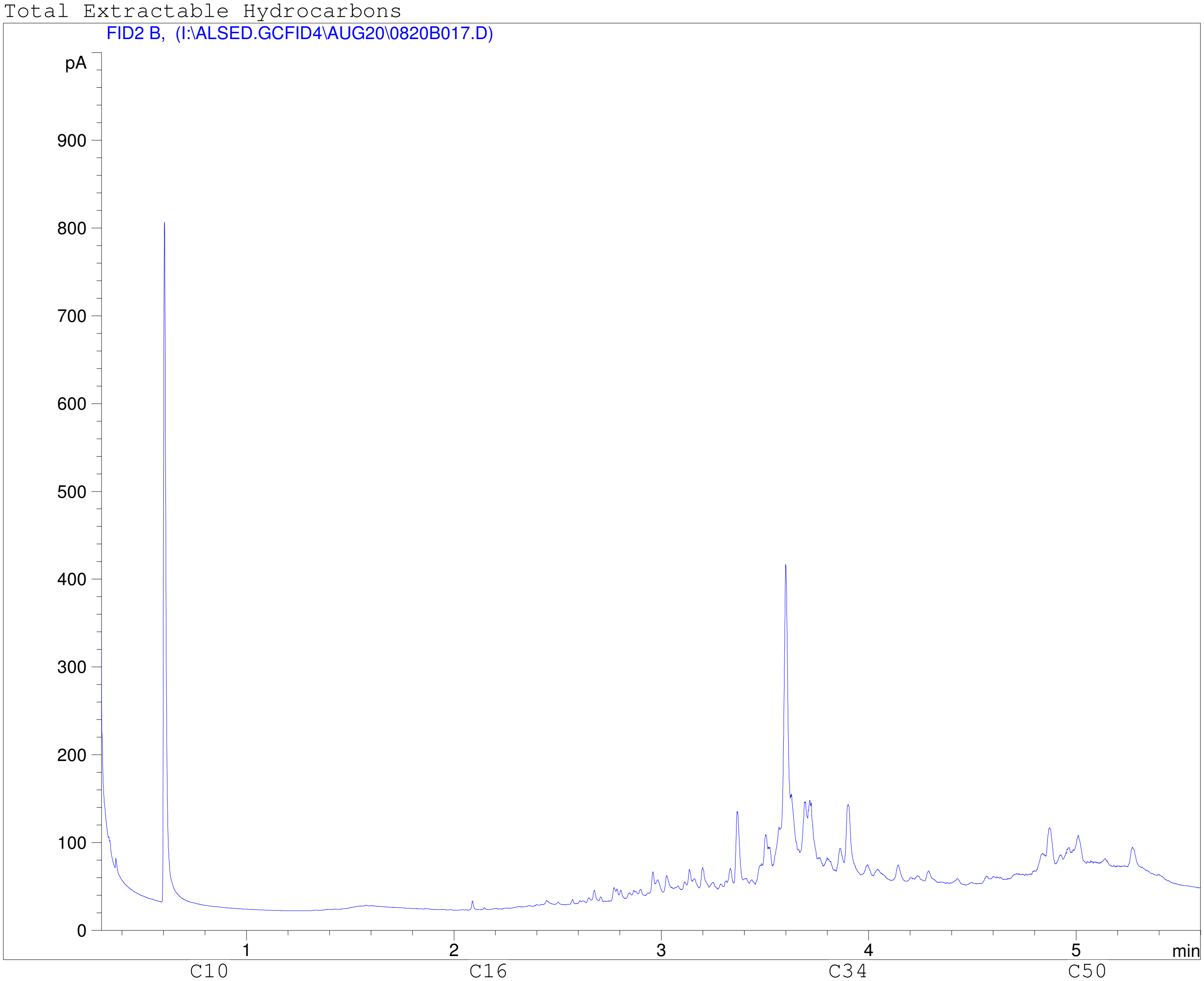


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-004

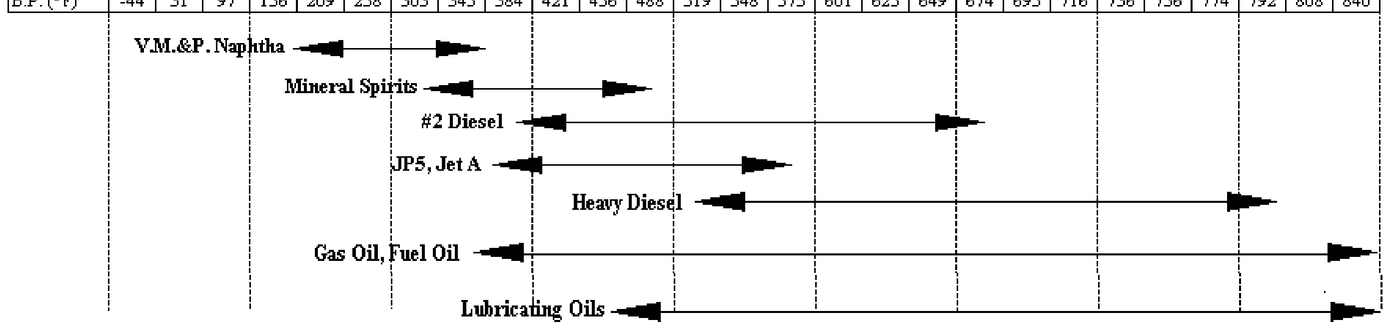
Sample ID: L806542-4 30
Injection Date: 8/20/2009 9:56:17 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

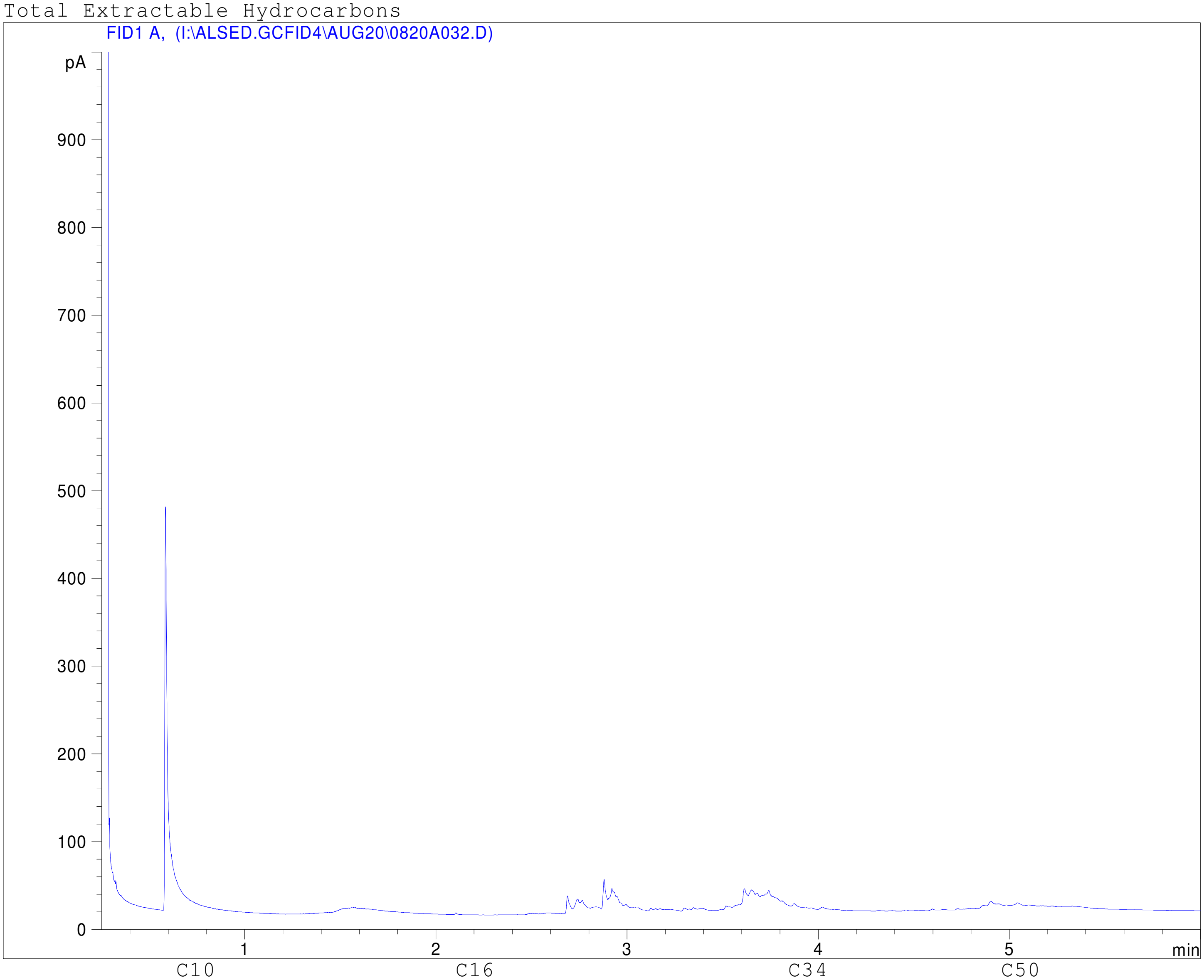
Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840



Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

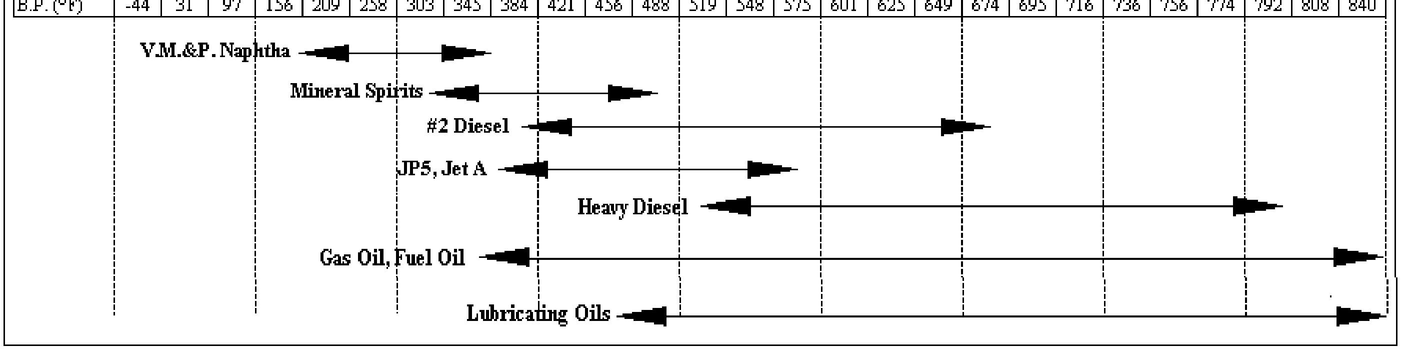
Client ID:	PLF09-SS-042
Sample ID:	L806542-42 30
Injection Date:	8/21/2009 2:24:04 AM
Instrument:	6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

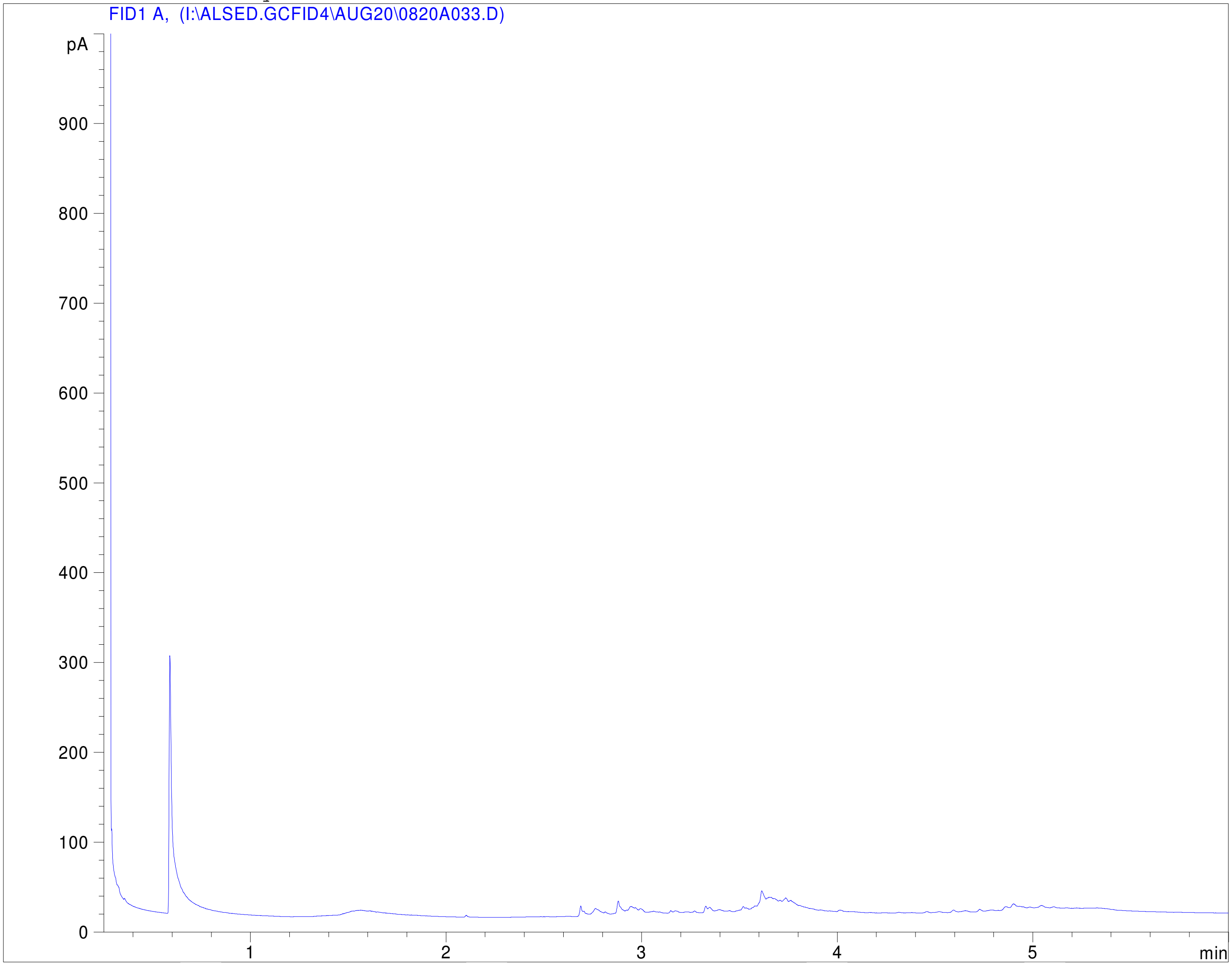


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-043

Sample ID: L806542-43 30
Injection Date: 8/21/2009 2:42:03 AM
Instrument: 6890

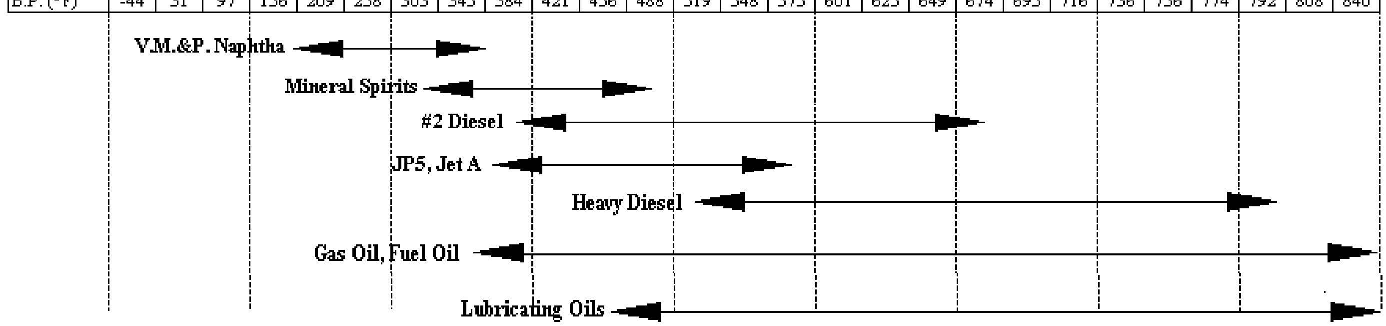
Total Extractable Hydrocarbons



C10 C16 C34 C50

Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

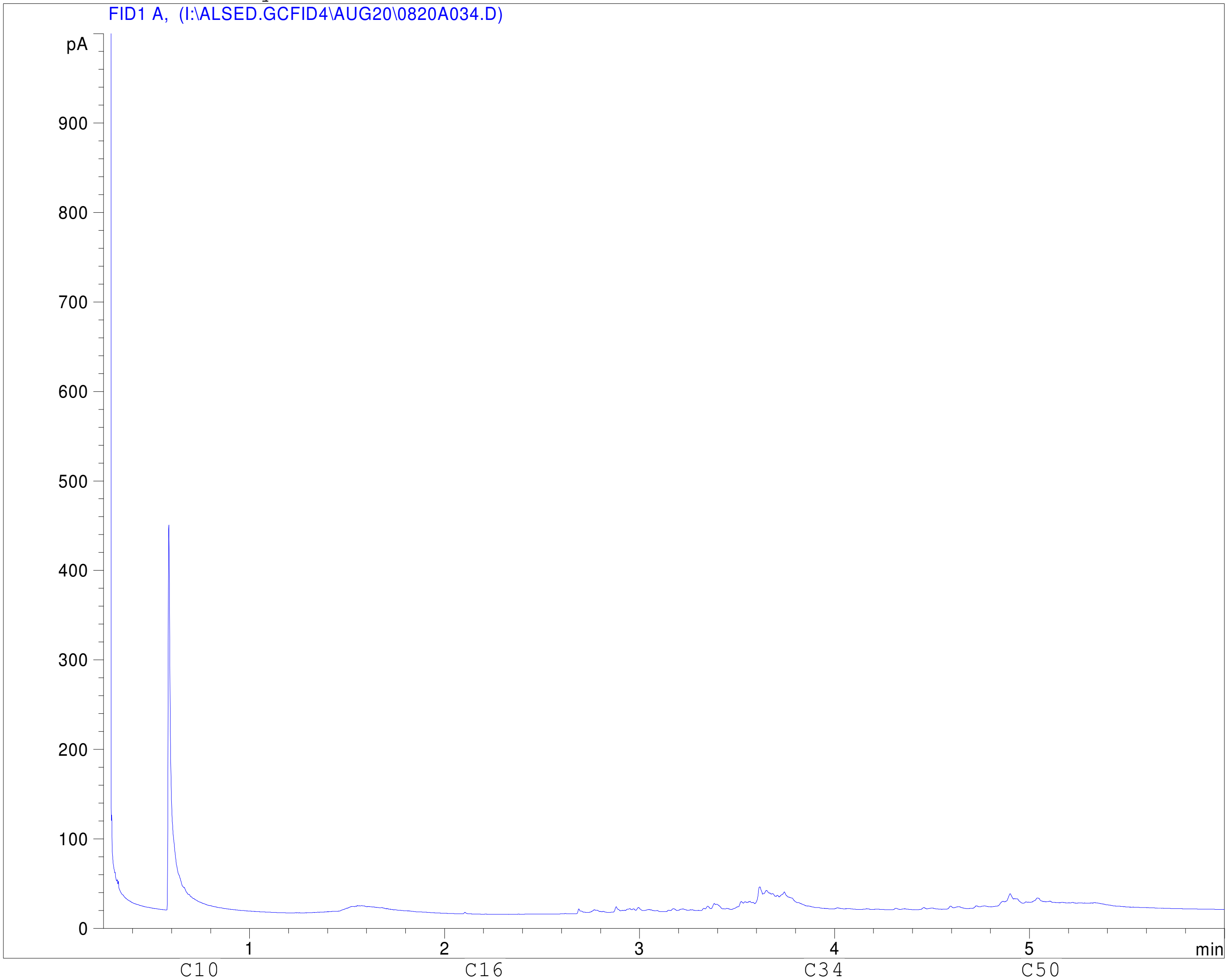


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-044

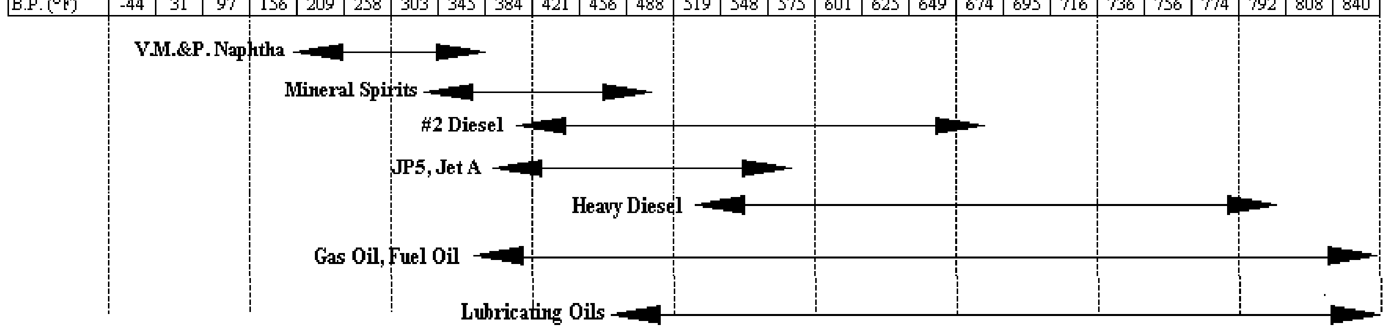
Sample ID: L806542-44 30
Injection Date: 8/21/2009 2:59:55 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

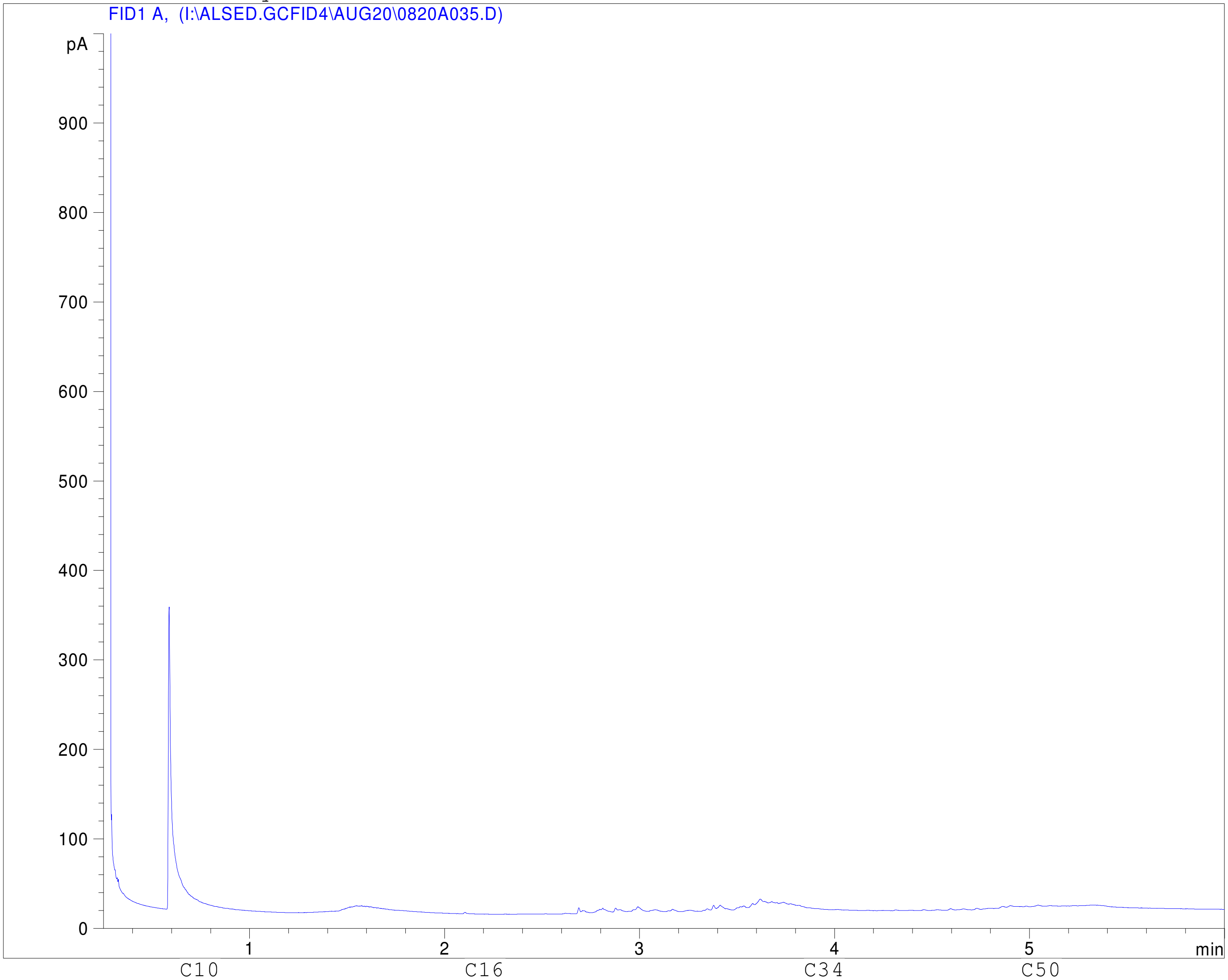


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-045

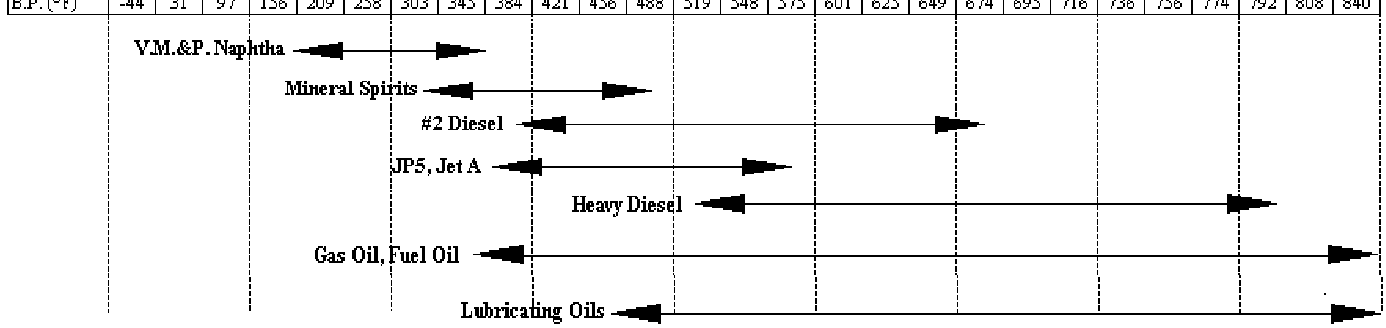
Sample ID: L806542-45 30
Injection Date: 8/21/2009 3:17:35 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

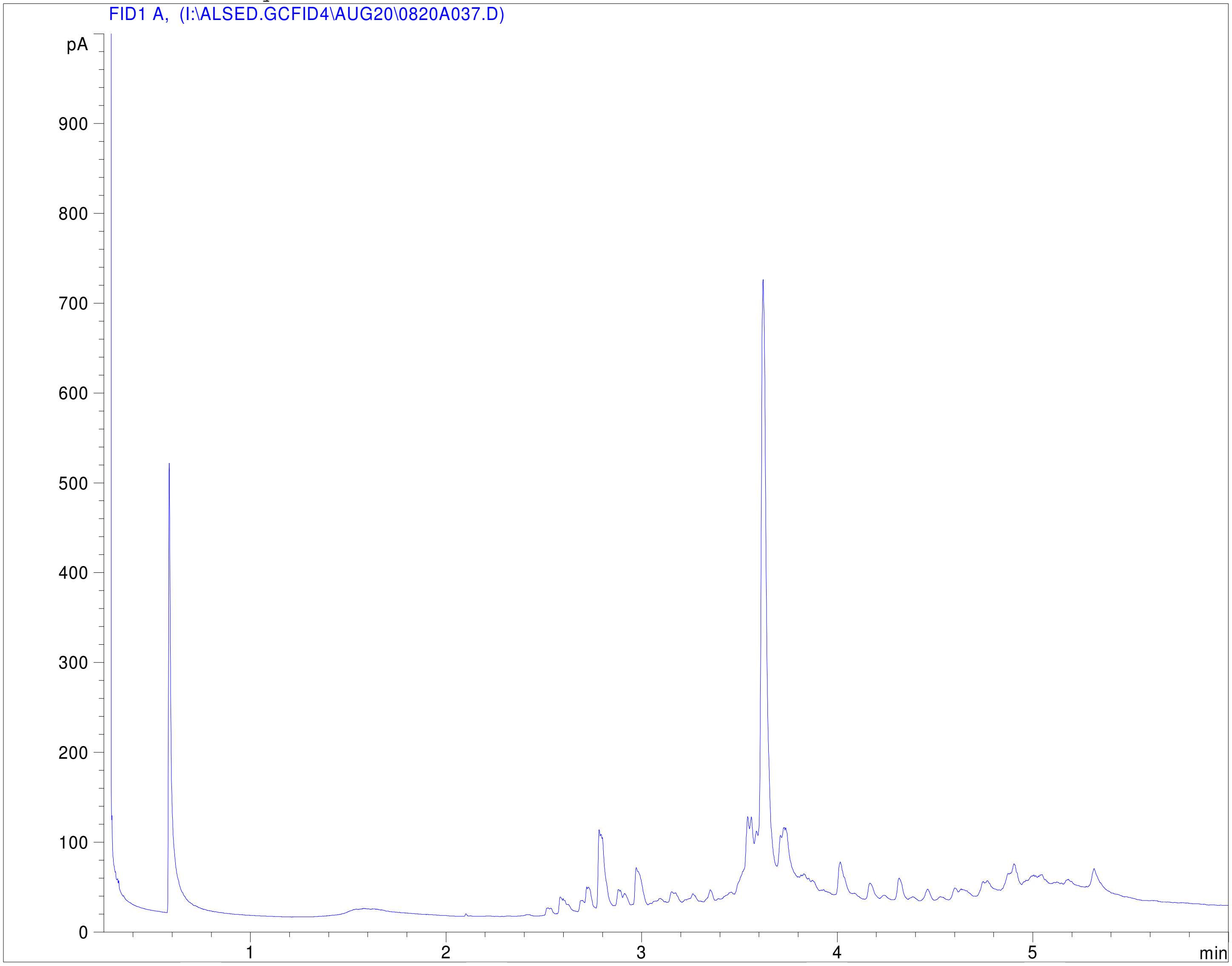


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-046

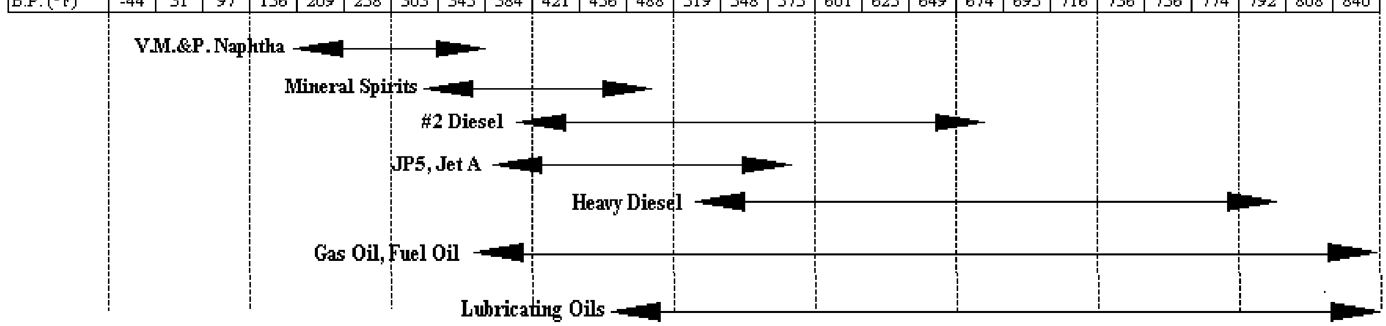
Sample ID: L806542-46 30
Injection Date: 8/21/2009 3:53:26 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840



Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

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Client ID:              PLF09-SS-047

Sample ID:              L806542-47 30
Injection Date:         8/21/2009 4:11:23 AM
Instrument:             6890
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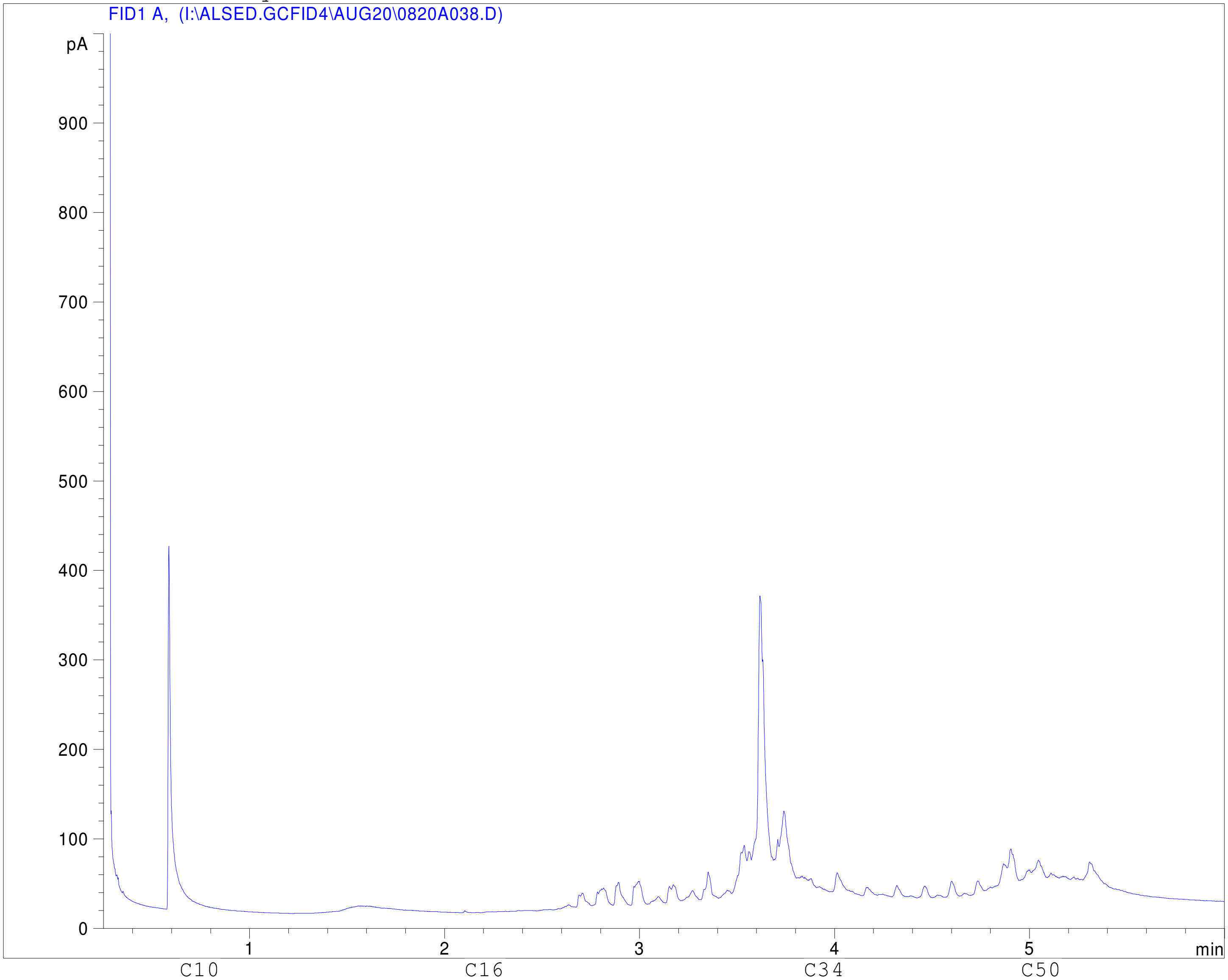
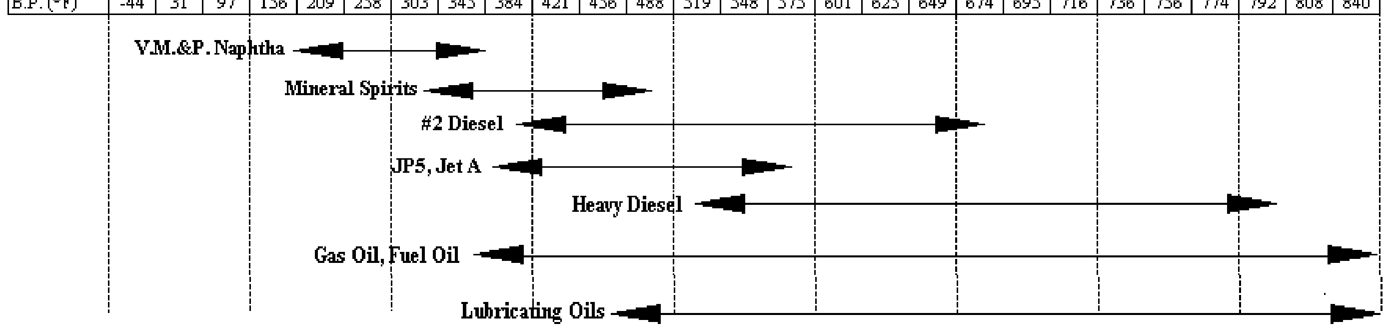
Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840



Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

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Client ID:              PLF09-SS-048

Sample ID:              L806542-48 30
Injection Date:         8/21/2009 4:29:05 AM
Instrument:             6890
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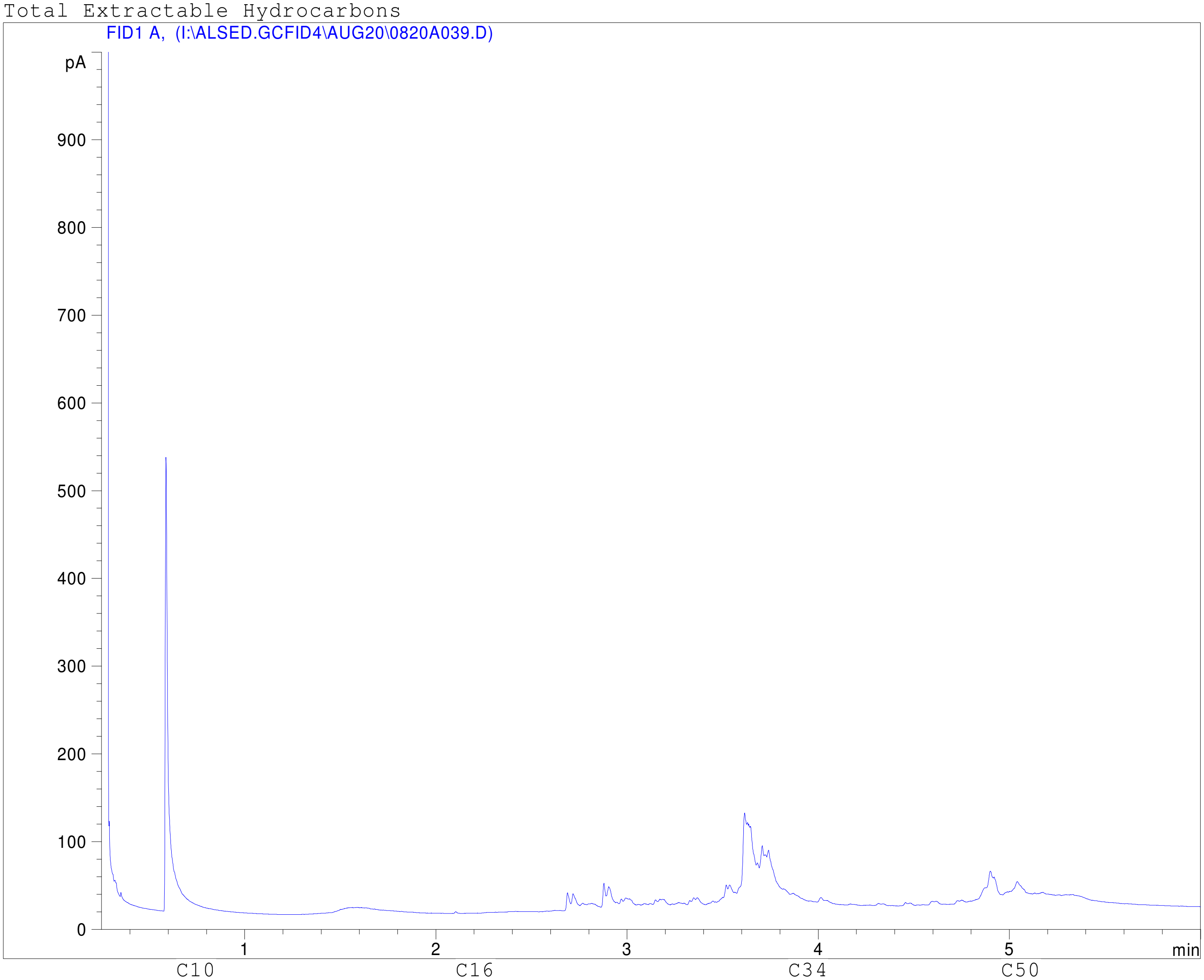
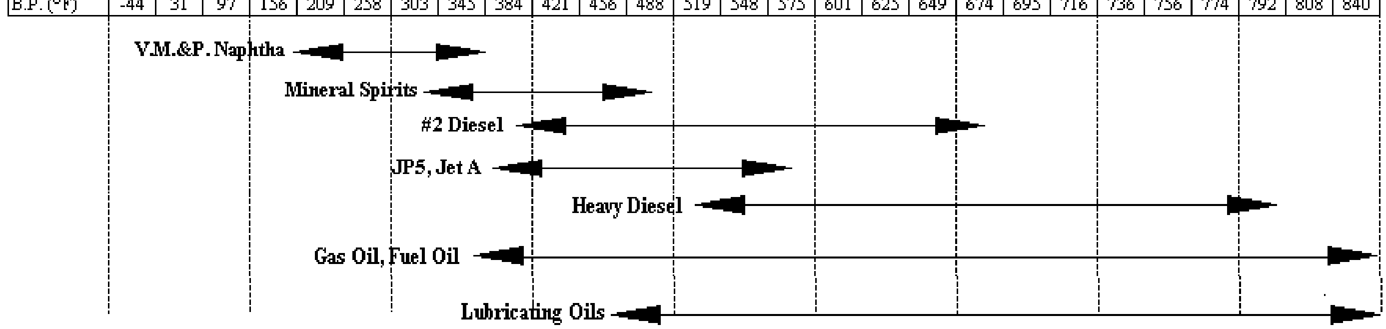
Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

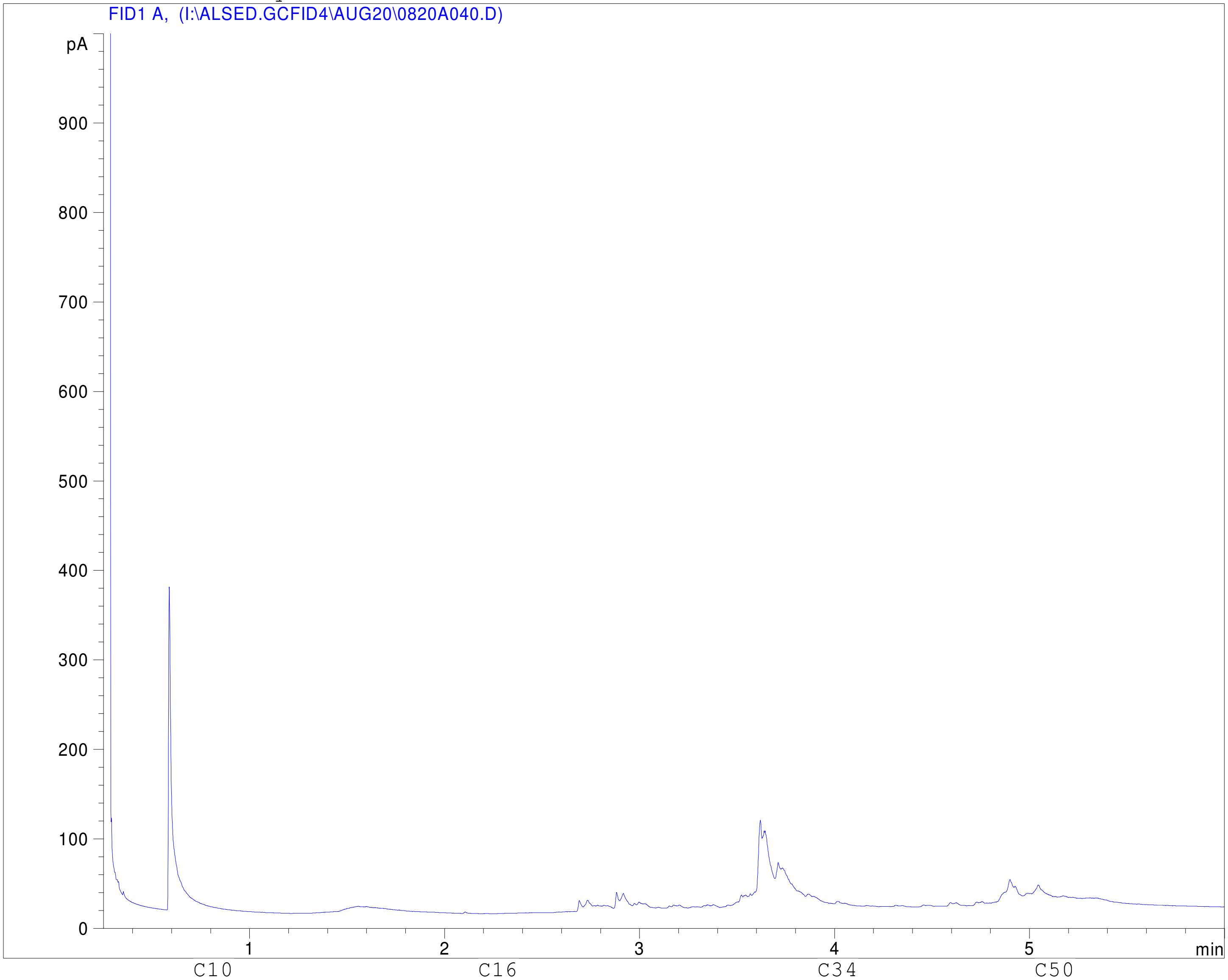


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-049

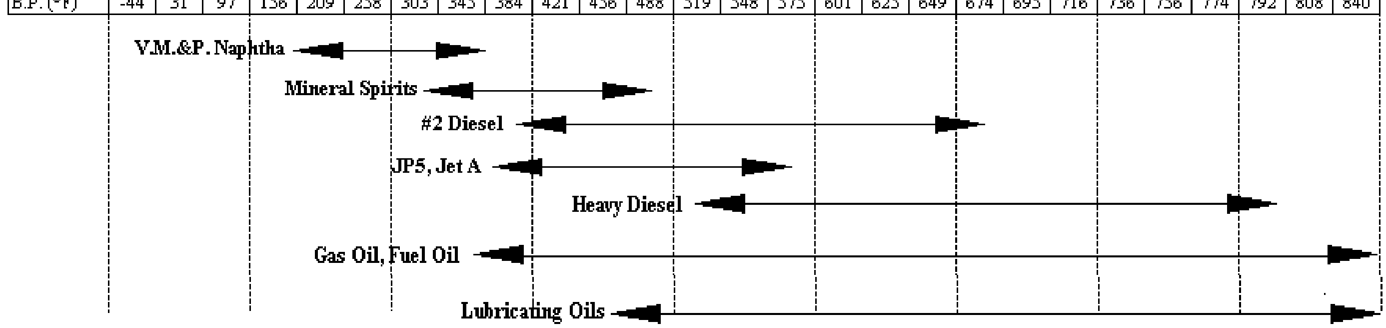
Sample ID: L806542-49 30
Injection Date: 8/21/2009 4:46:47 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

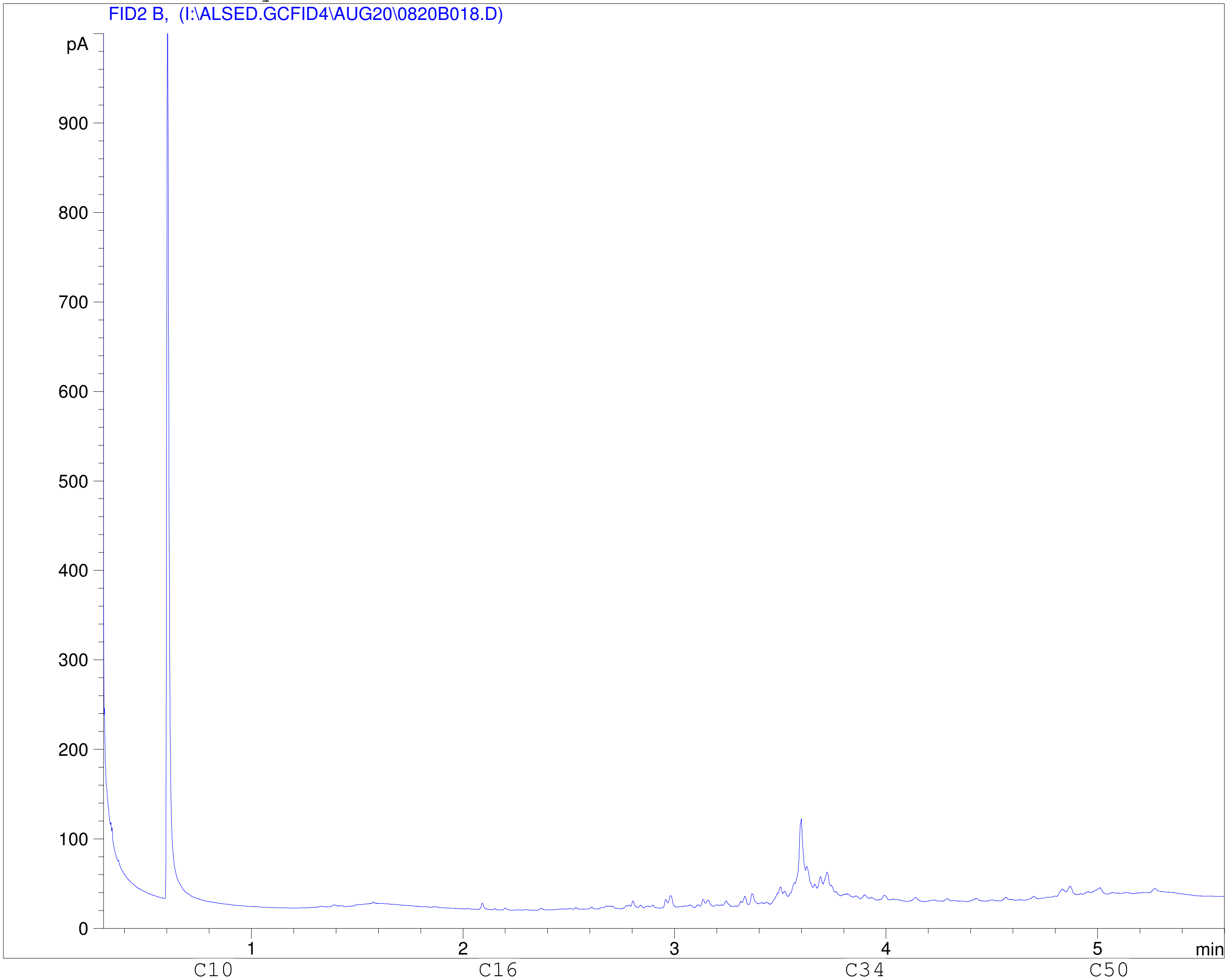


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-005

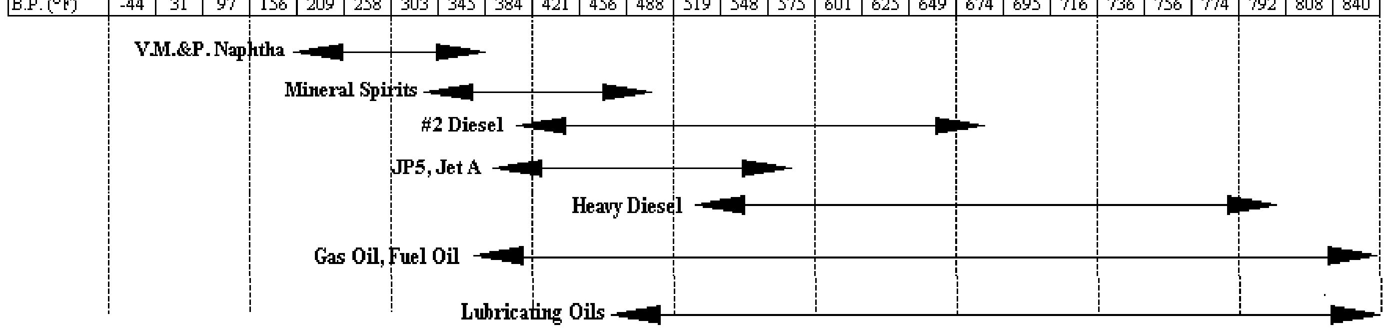
Sample ID: L806542-5 30
Injection Date: 8/20/2009 10:14:09 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

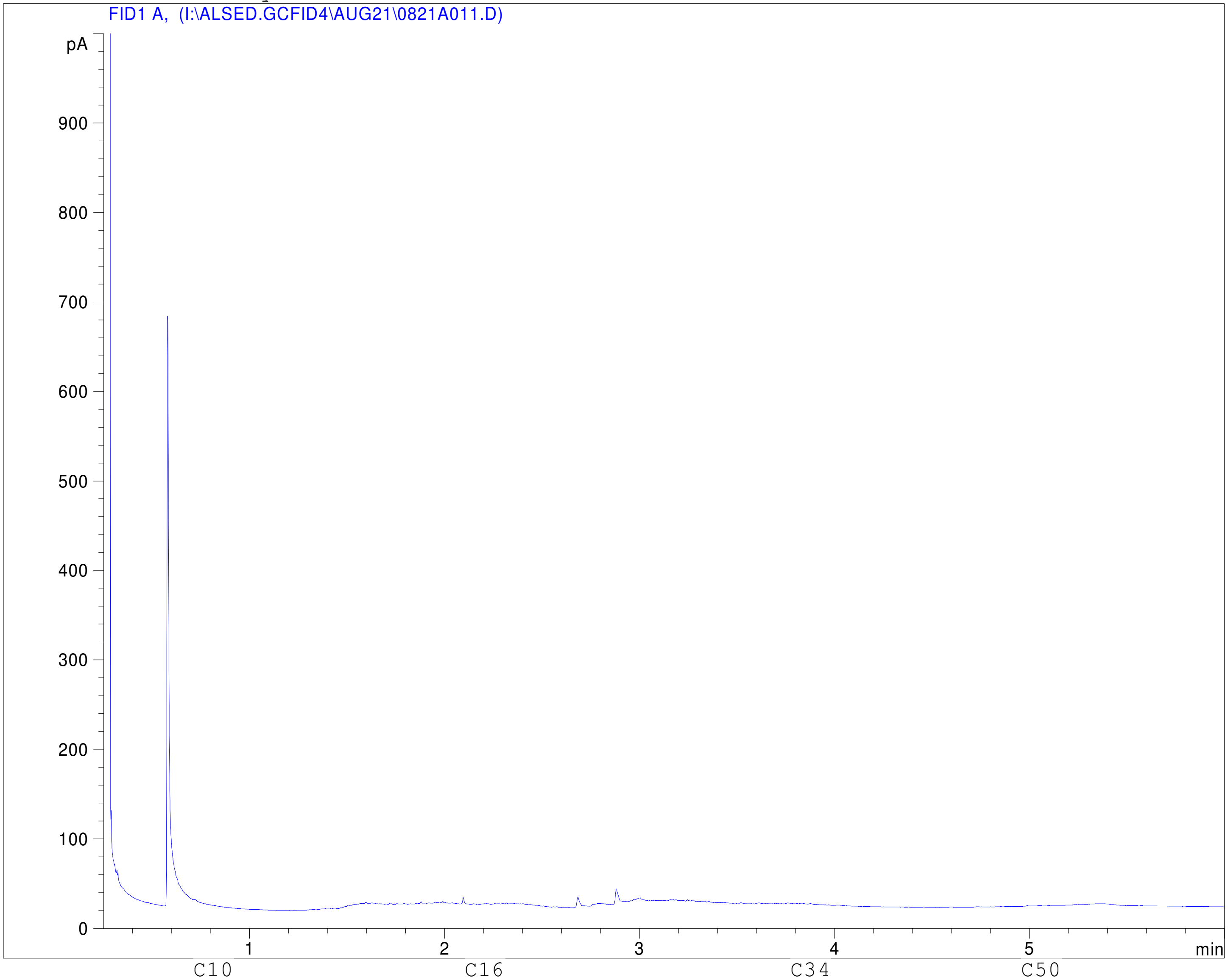


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-051

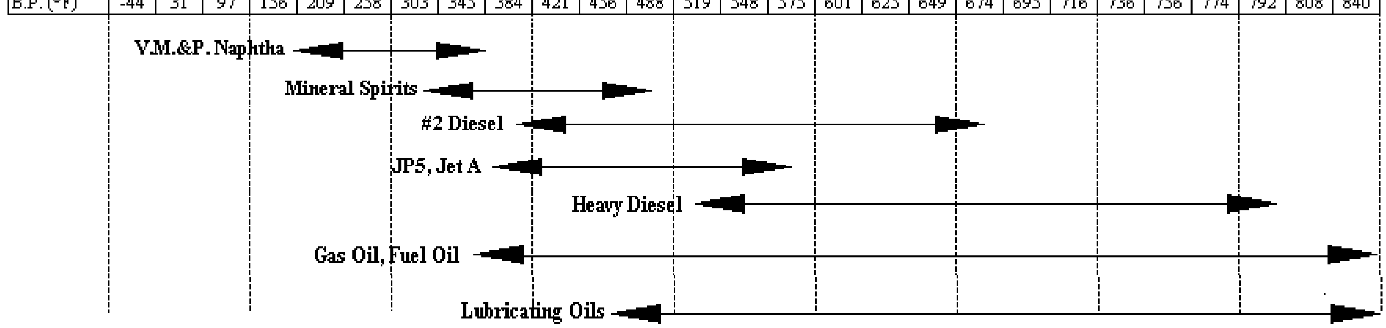
Sample ID: L806542-51 30
Injection Date: 8/21/2009 7:33:53 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

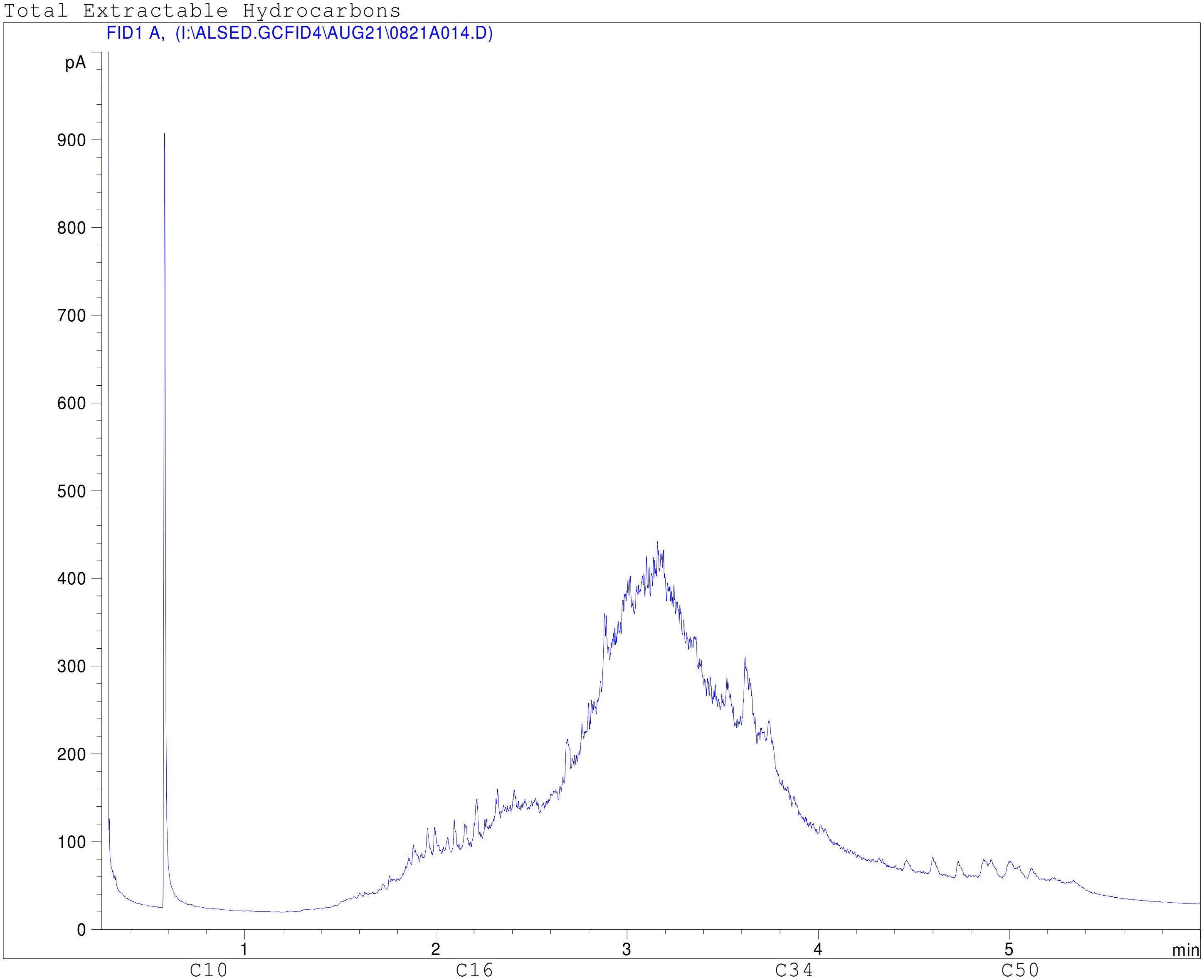


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-053

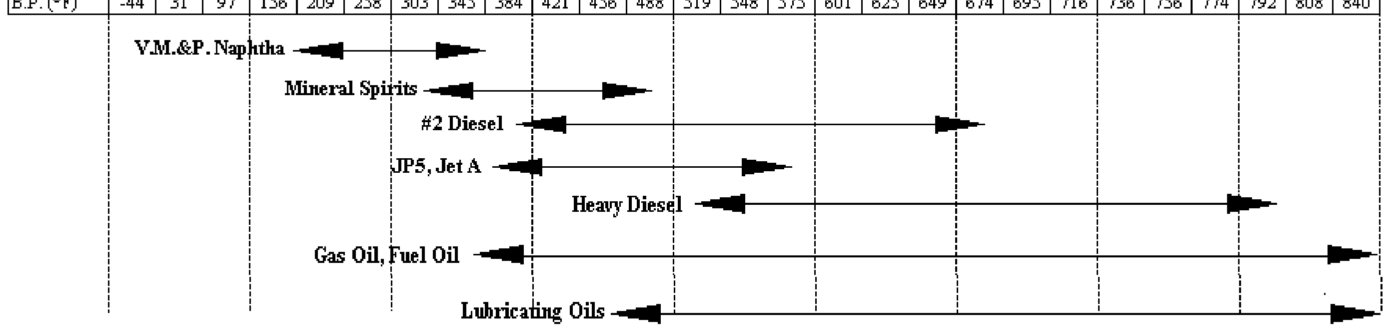
Sample ID: L806542-53 30
Injection Date: 8/21/2009 8:28:18 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

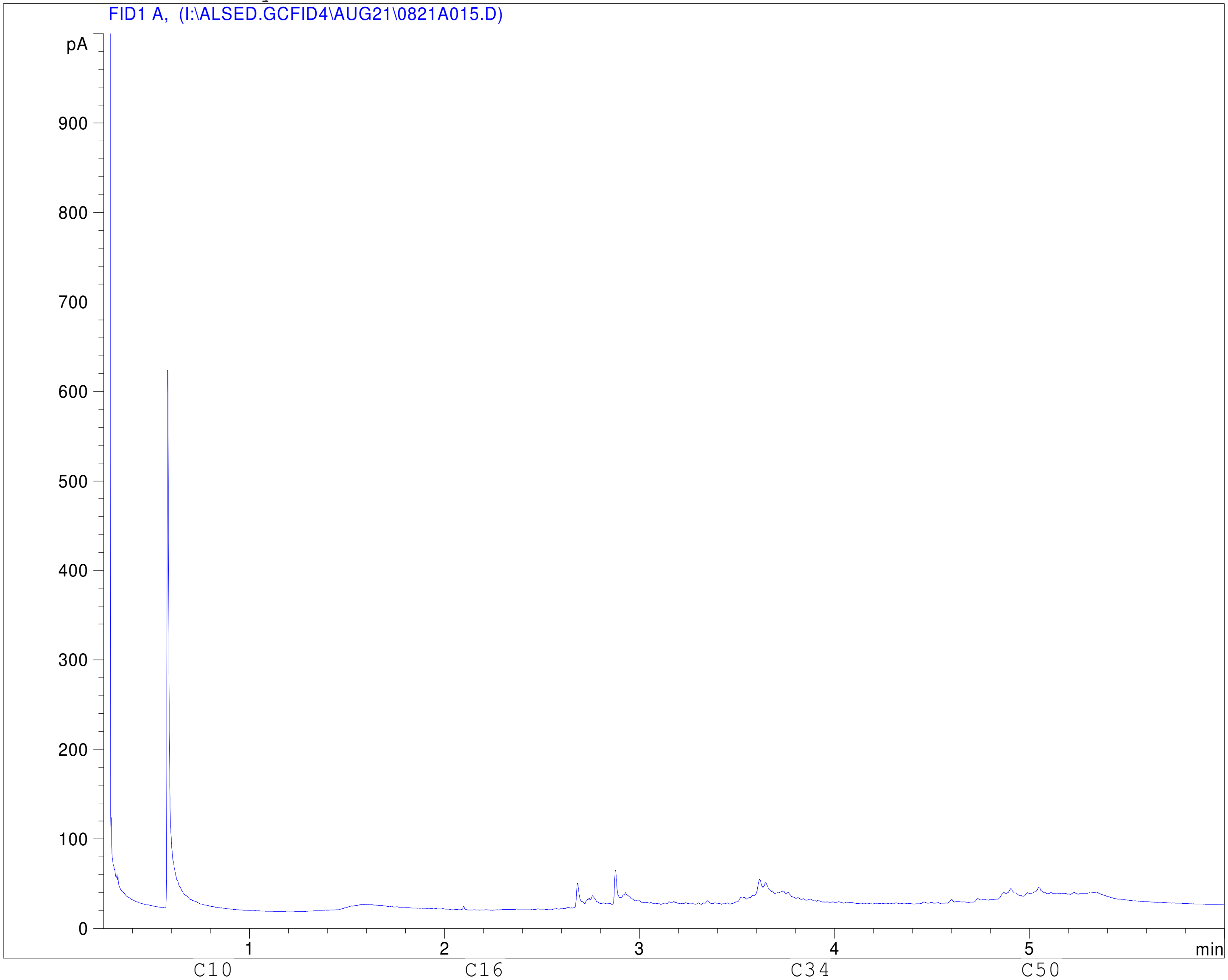


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-054

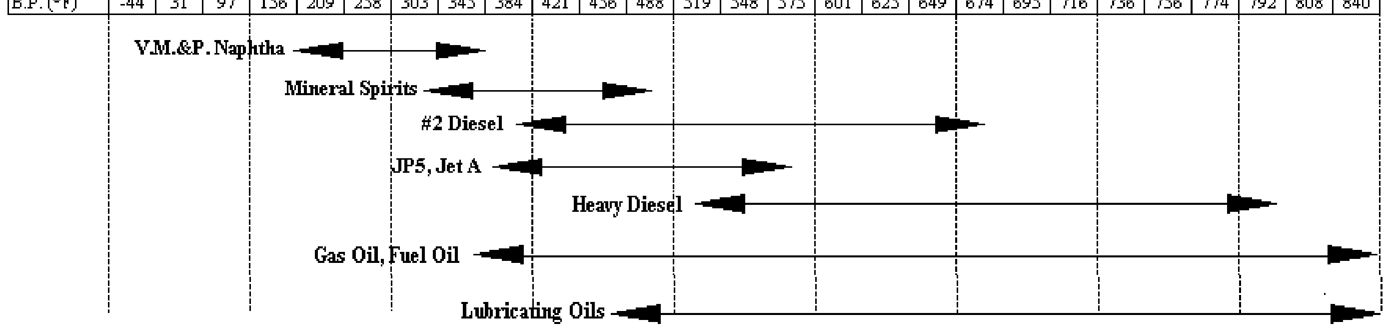
Sample ID: L806542-54 30
Injection Date: 8/21/2009 8:46:16 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

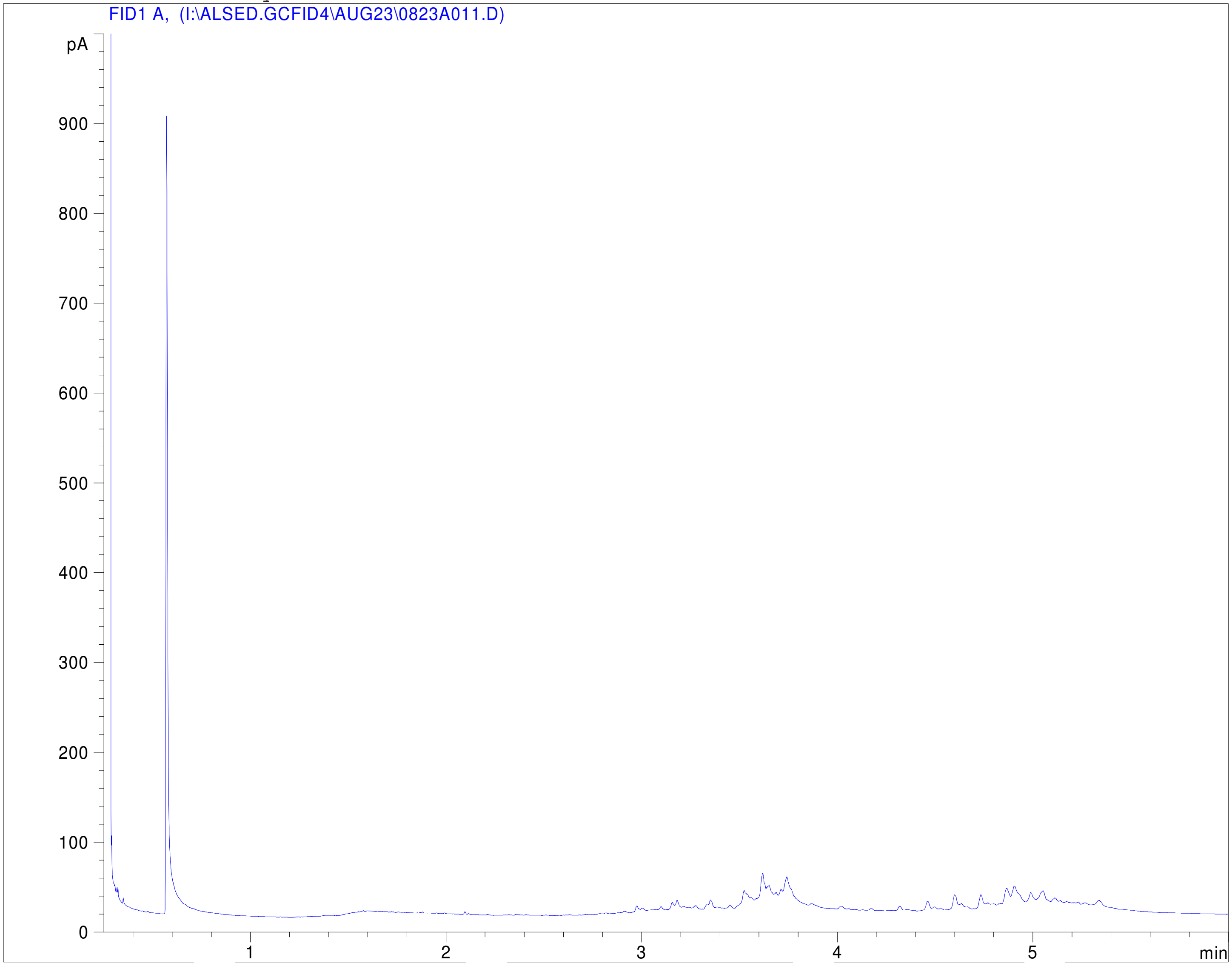


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-057

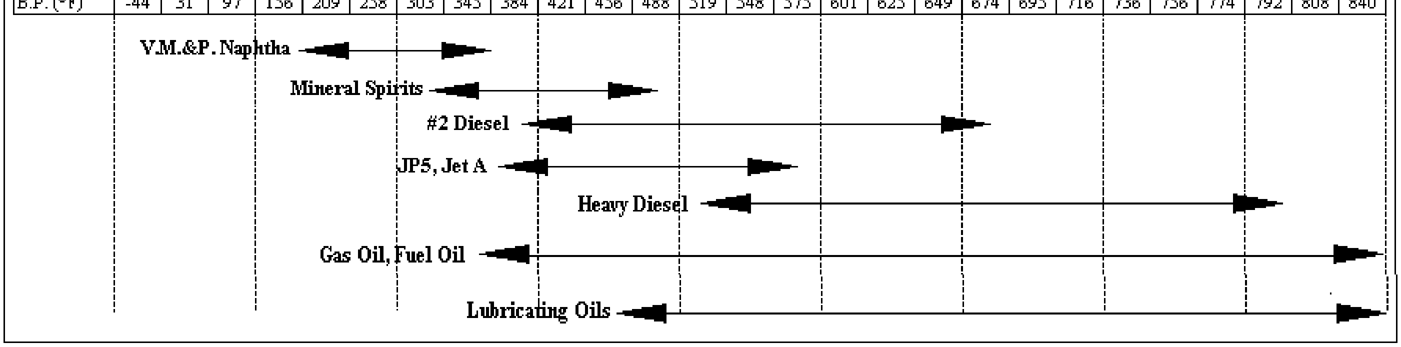
Sample ID: L806542-57 30
Injection Date: 8/23/2009 8:44:52 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

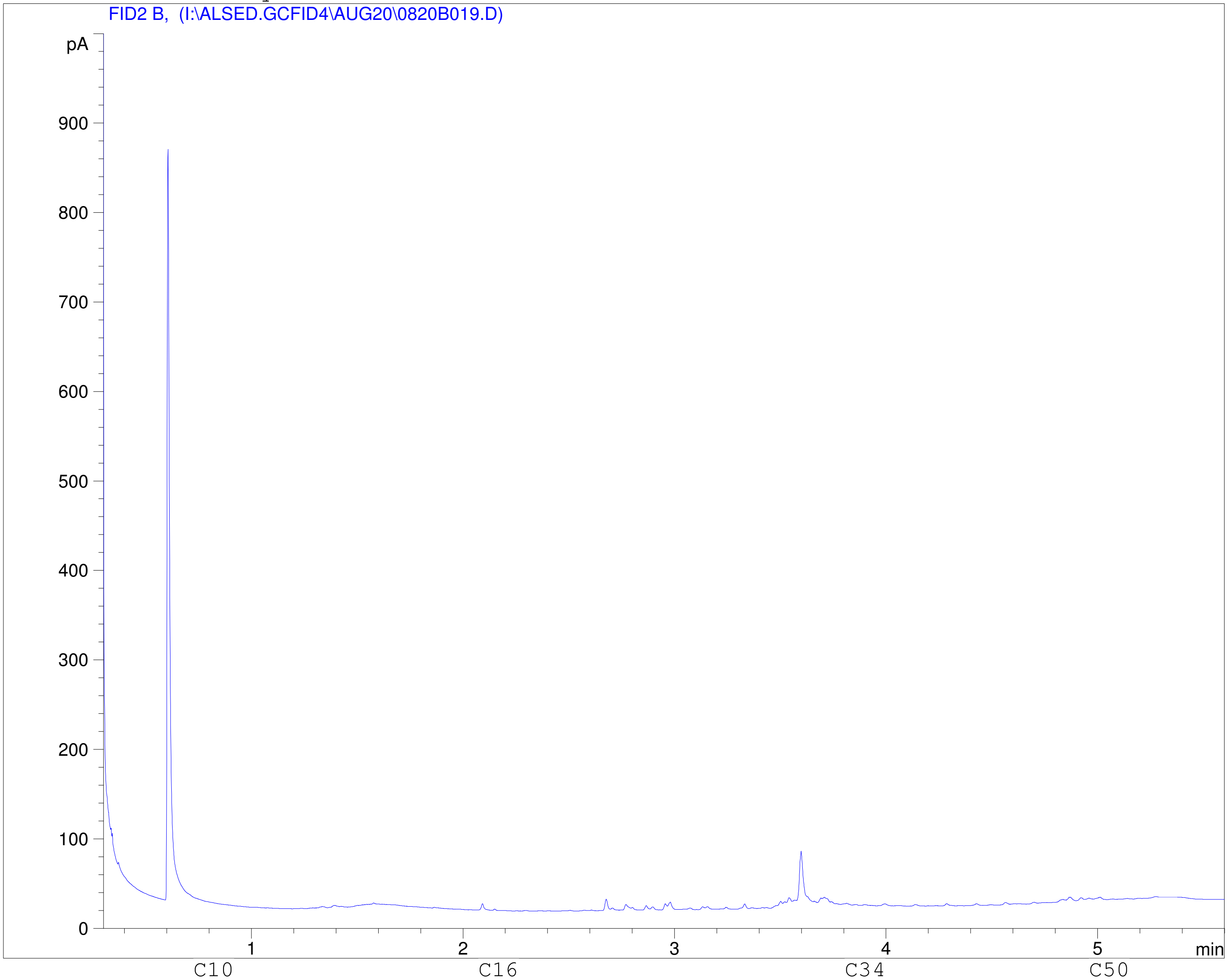


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-006

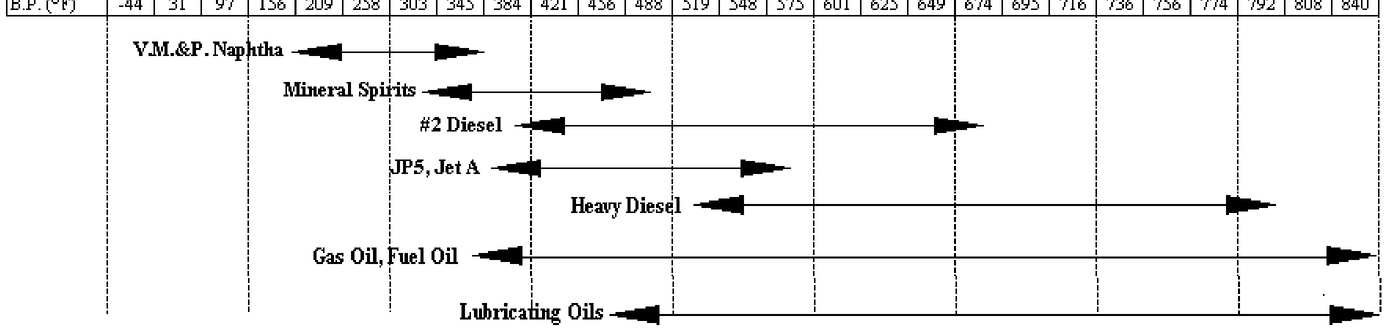
Sample ID: L806542-6 30
Injection Date: 8/20/2009 10:31:55 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

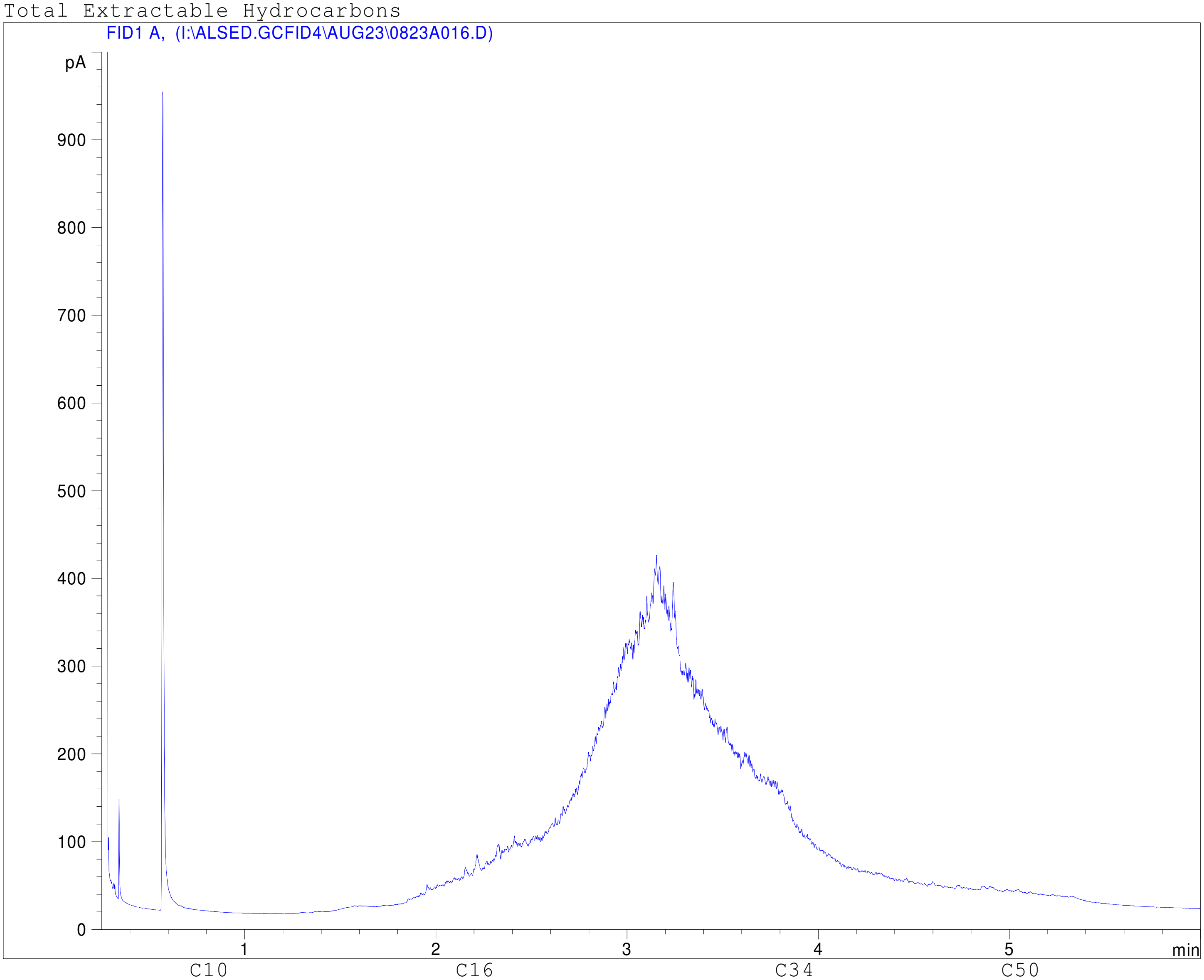


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-062

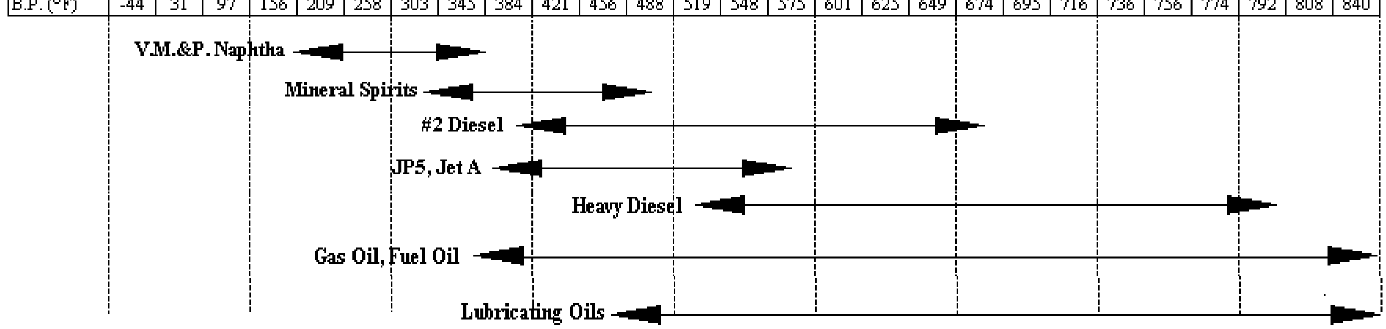
Sample ID: L806542-62 30
Injection Date: 8/23/2009 10:14:04 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

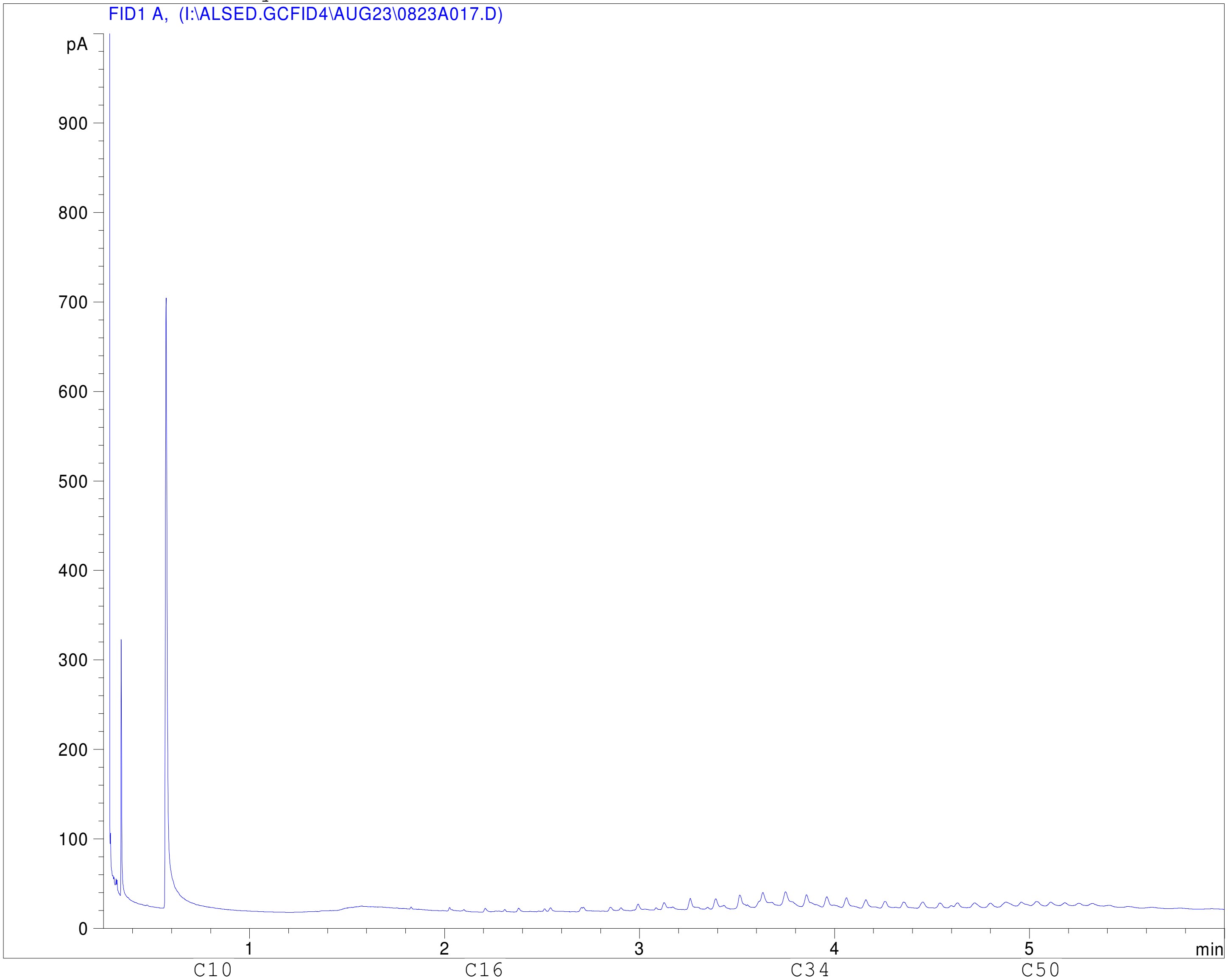


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-063

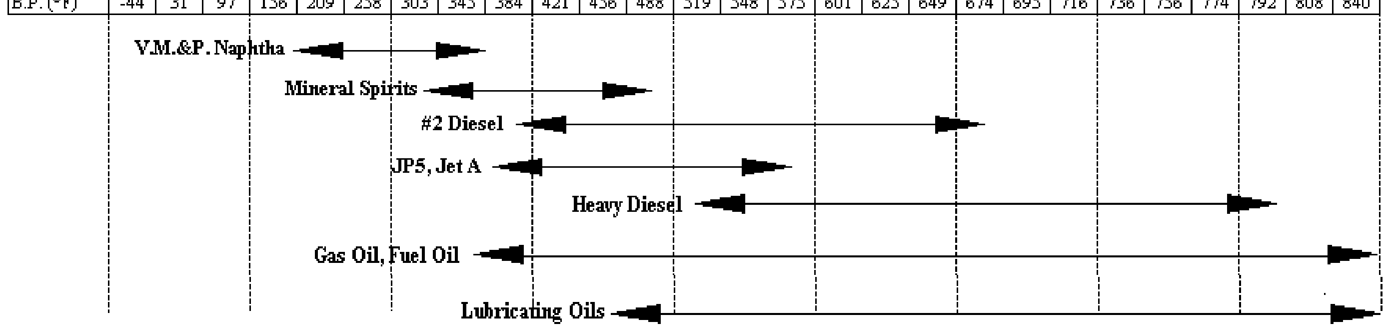
Sample ID: L806542-63 30
Injection Date: 8/23/2009 10:31:53 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

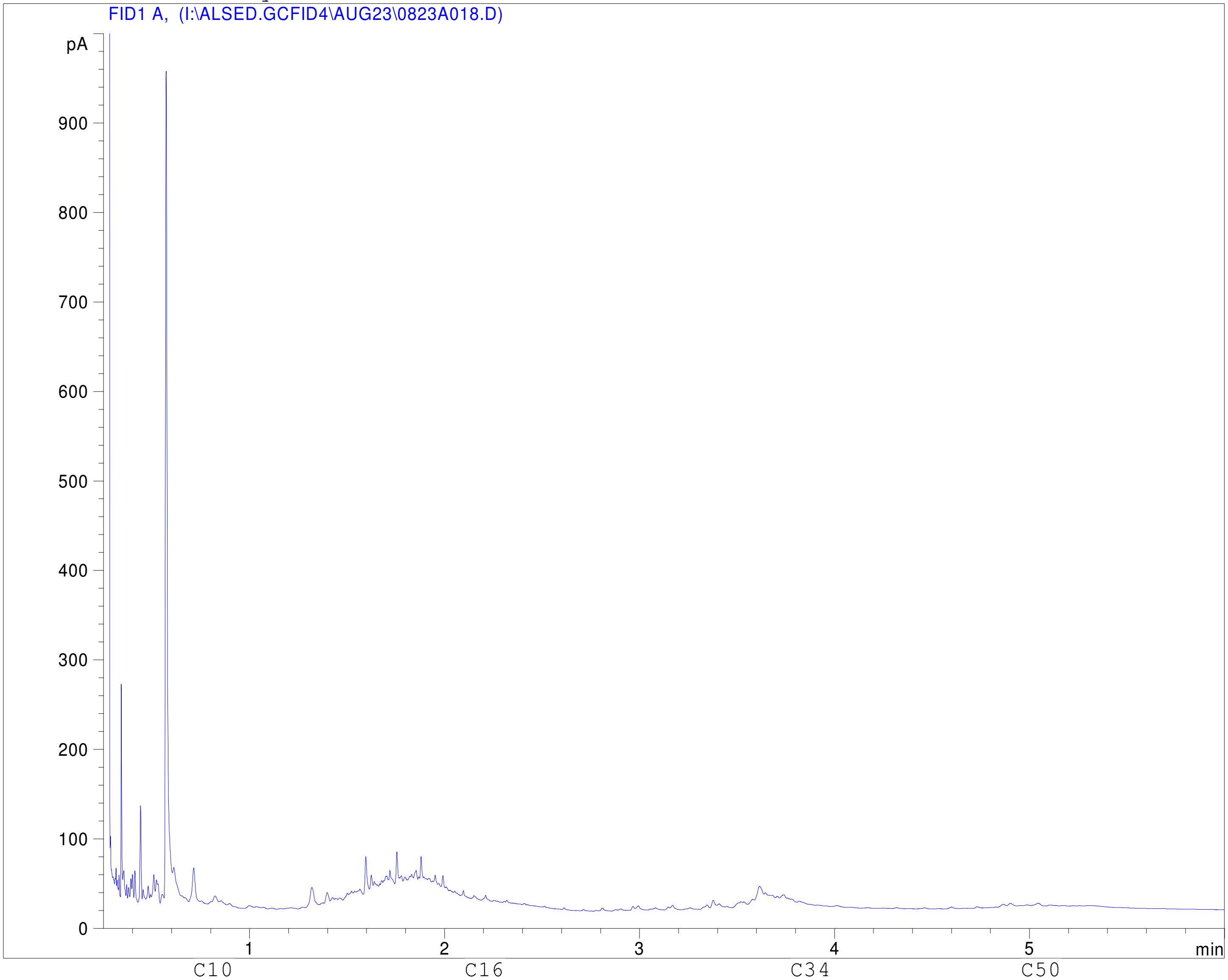


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-064

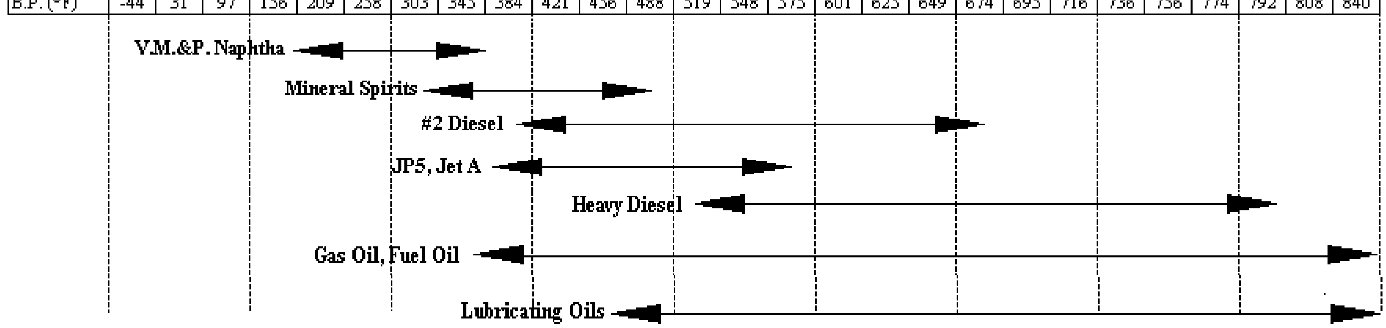
Sample ID: L806542-64 30
Injection Date: 8/23/2009 10:49:32 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

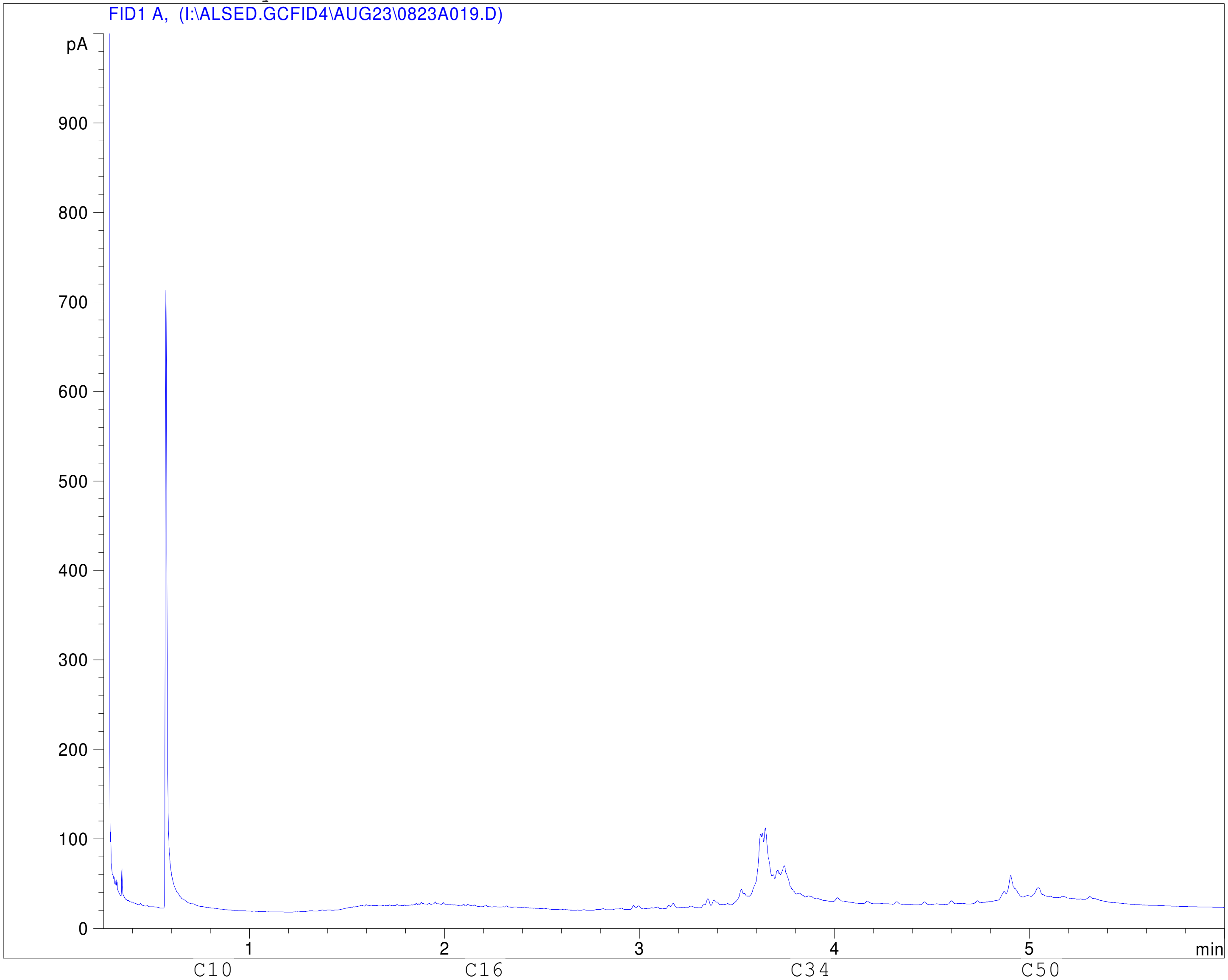


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-065

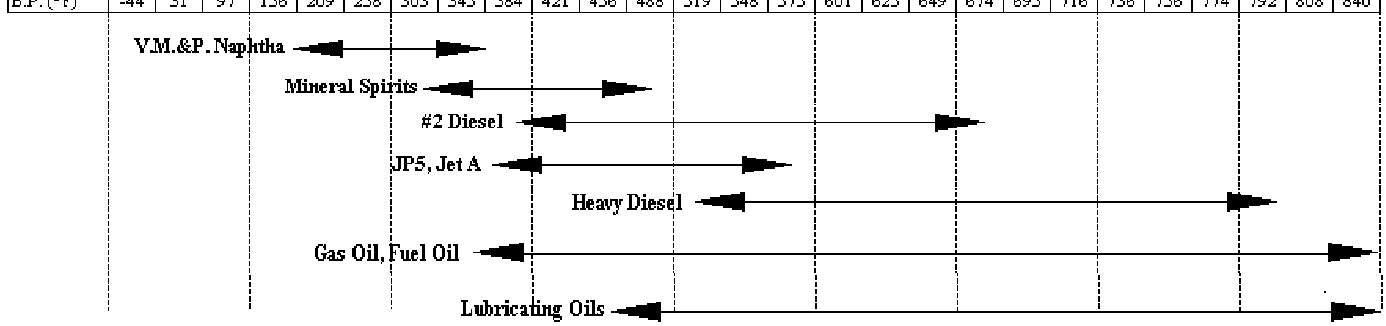
Sample ID: L806542-65 30
Injection Date: 8/23/2009 11:07:16 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

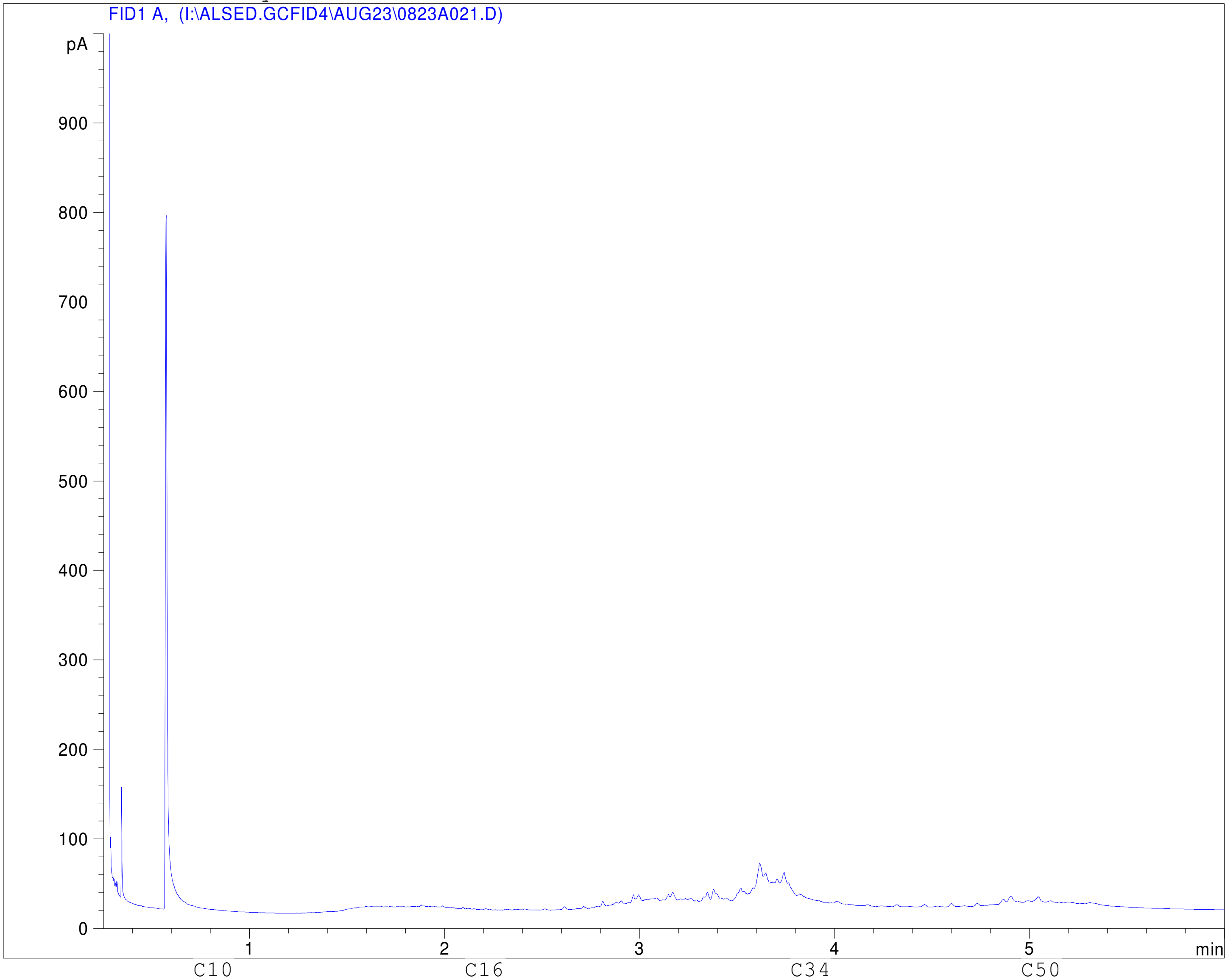


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-067

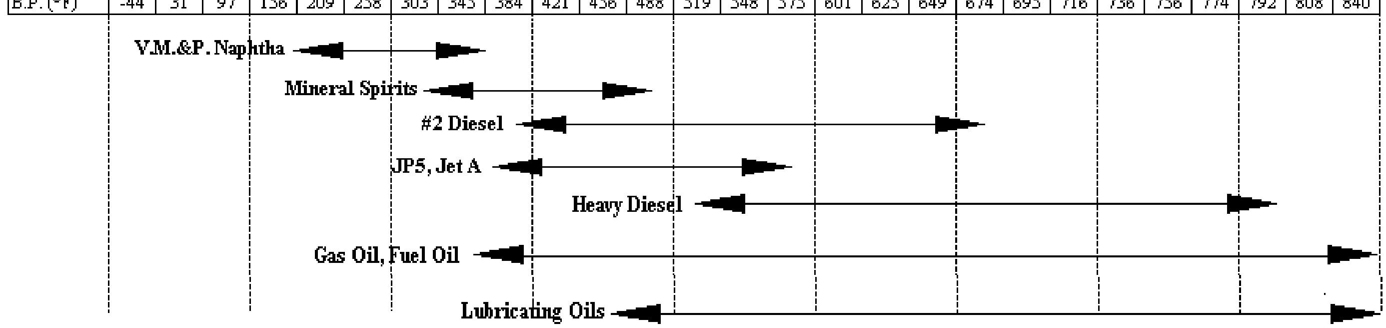
Sample ID: L806542-67 30
Injection Date: 8/23/2009 11:43:01 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

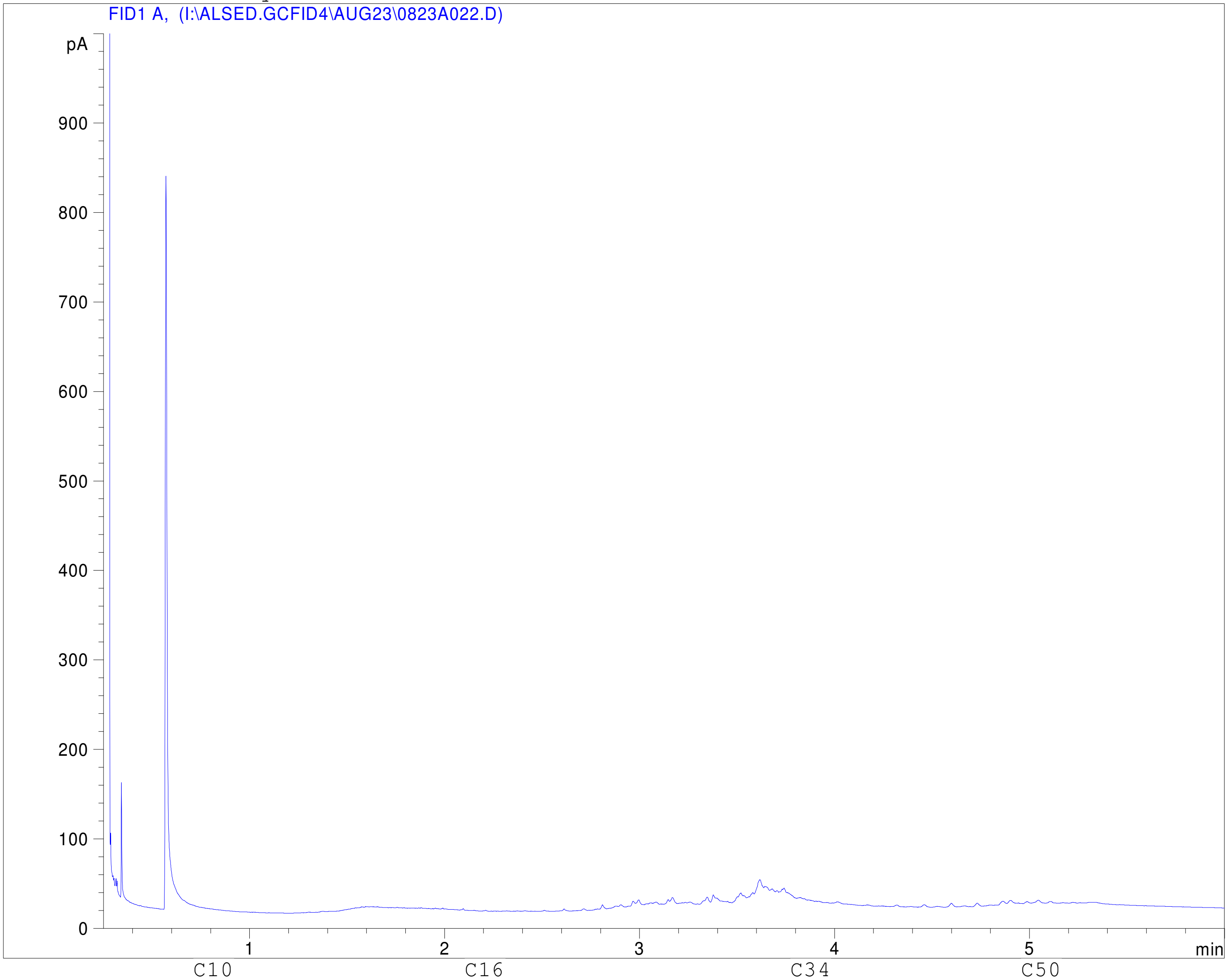


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-068

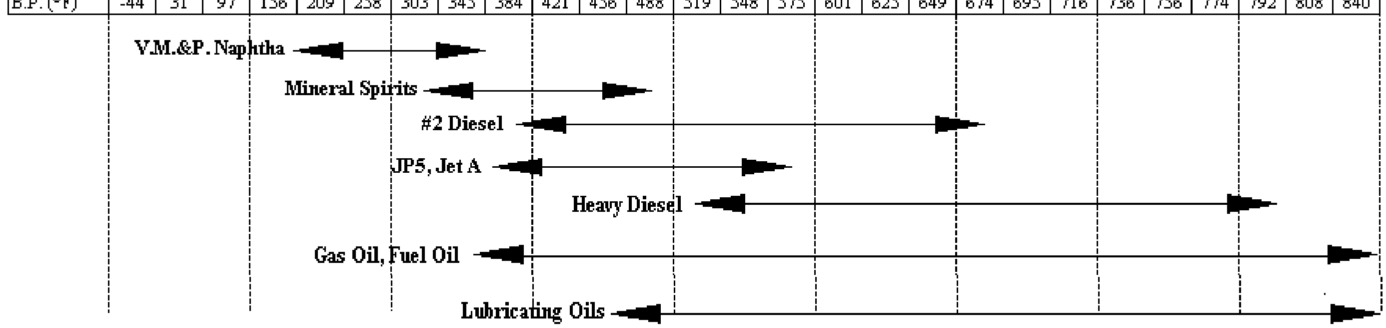
Sample ID: L806542-68 30
Injection Date: 8/24/2009 12:00:49 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

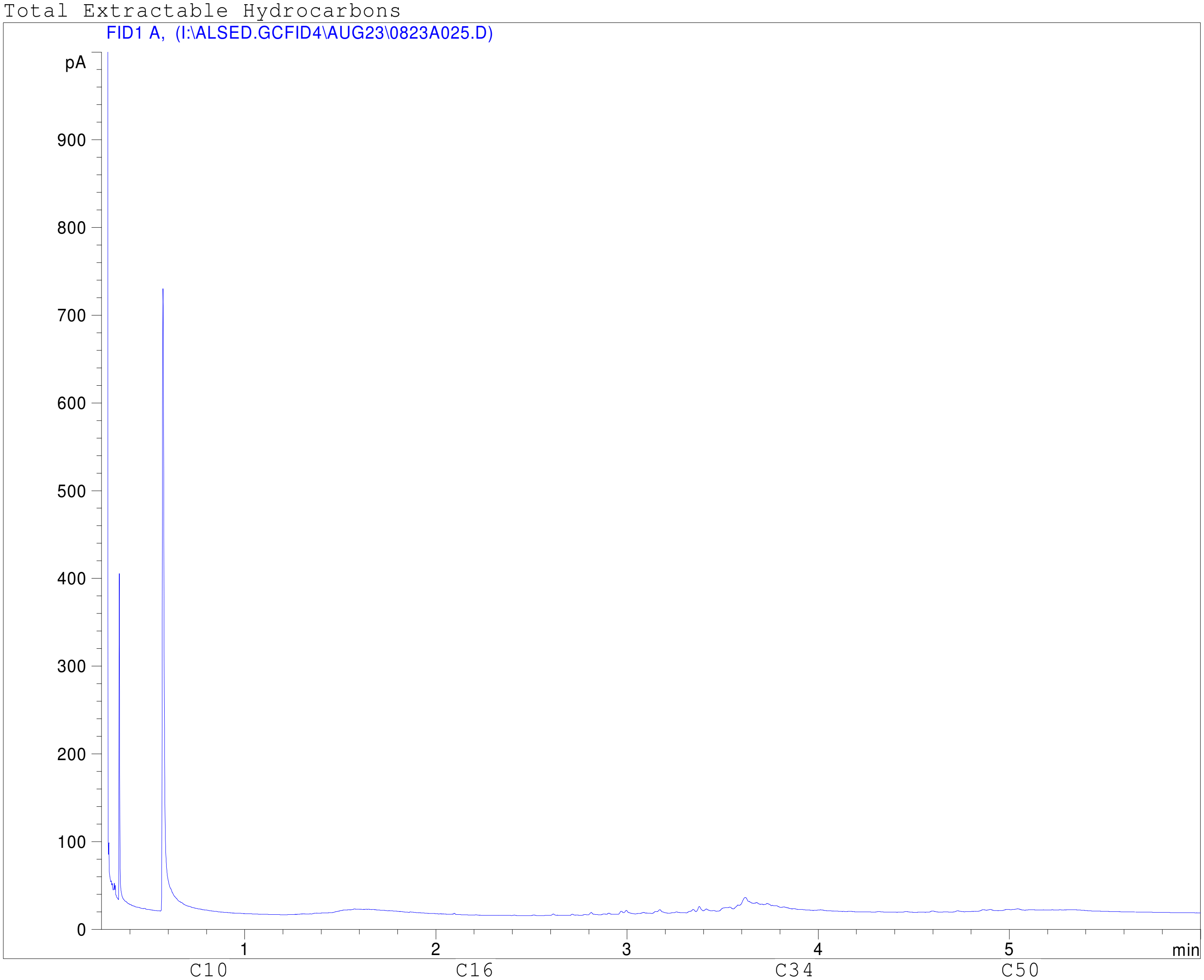


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-069

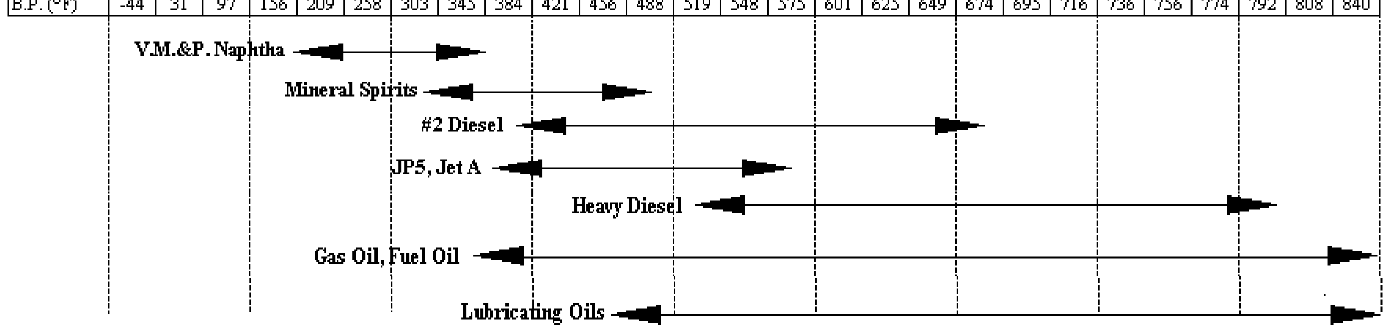
Sample ID: L806542-69 30
Injection Date: 8/24/2009 12:54:21 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

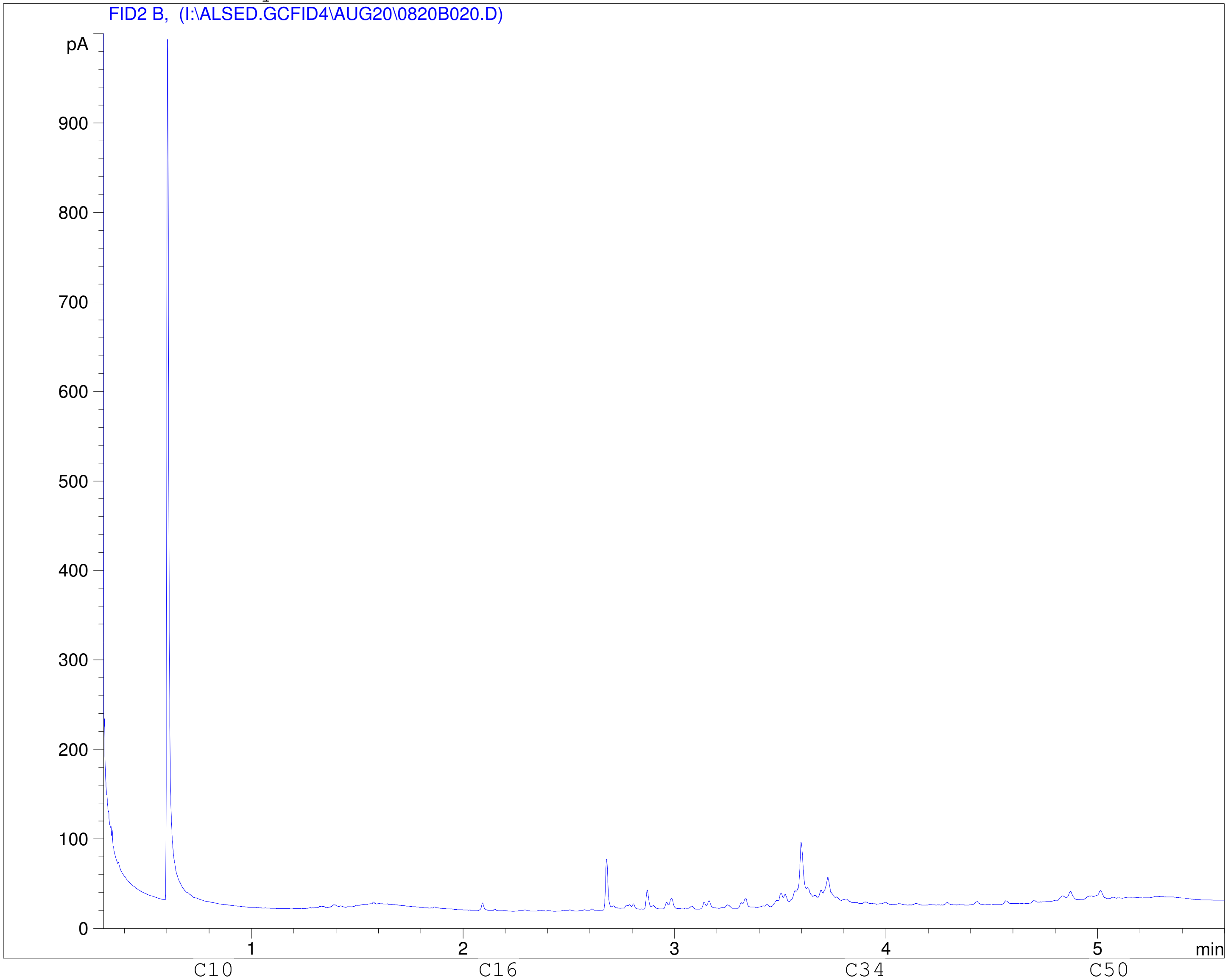


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-007

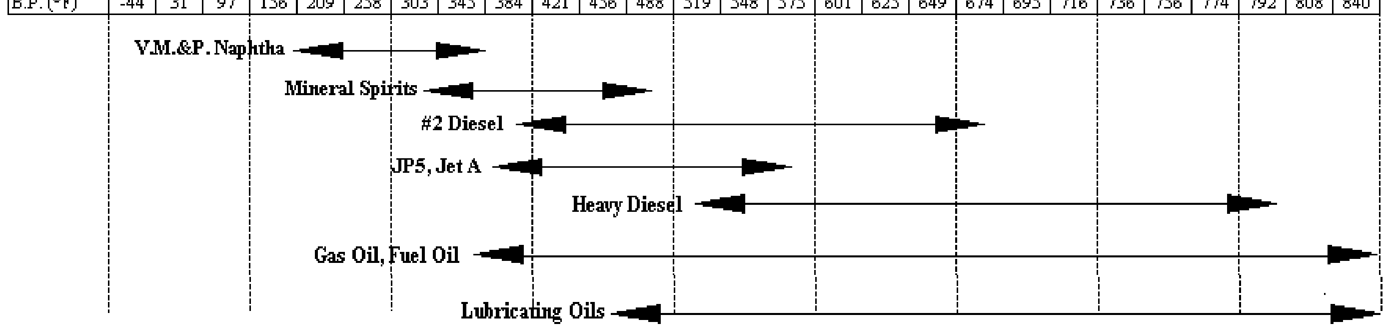
Sample ID: L806542-7 30
Injection Date: 8/20/2009 10:49:40 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

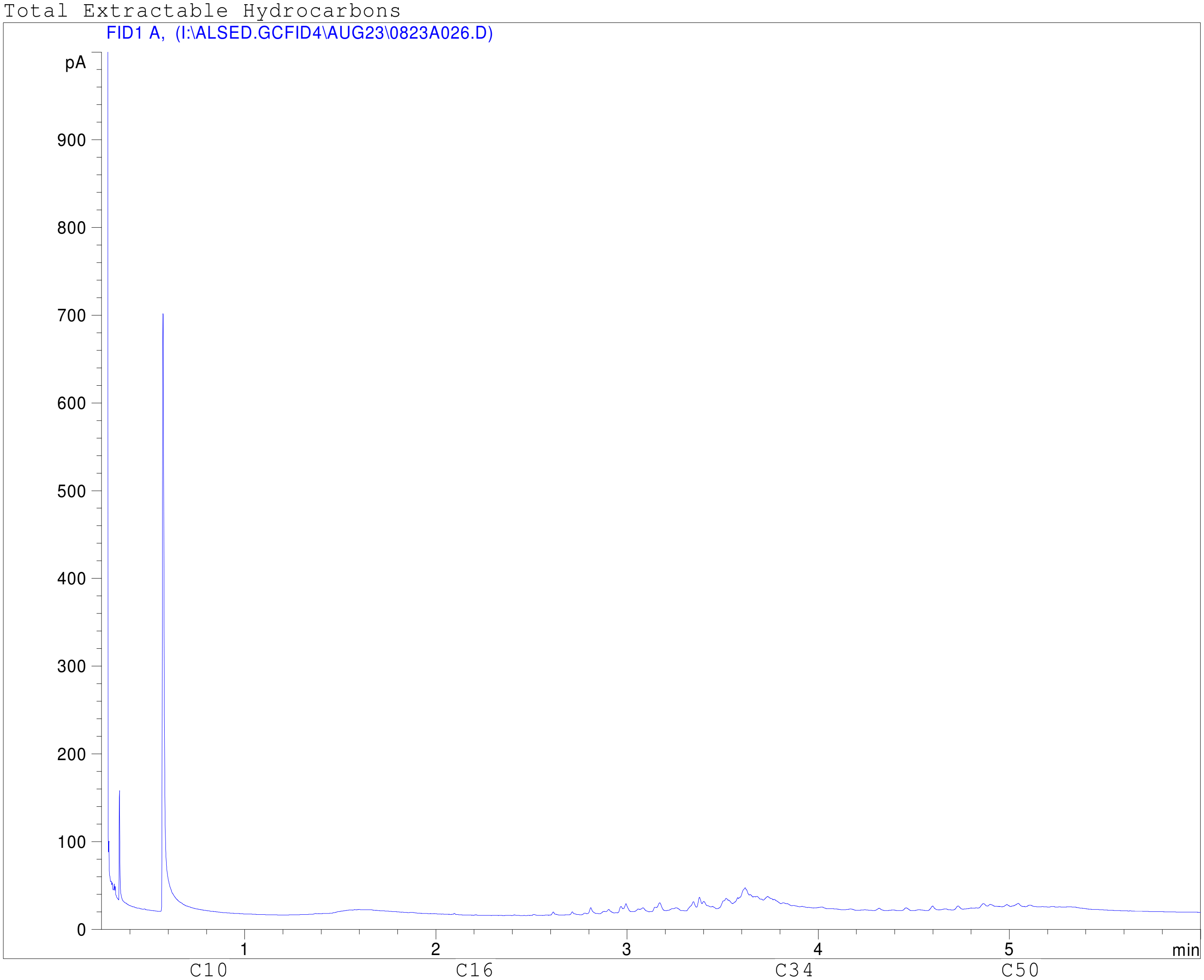


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-070

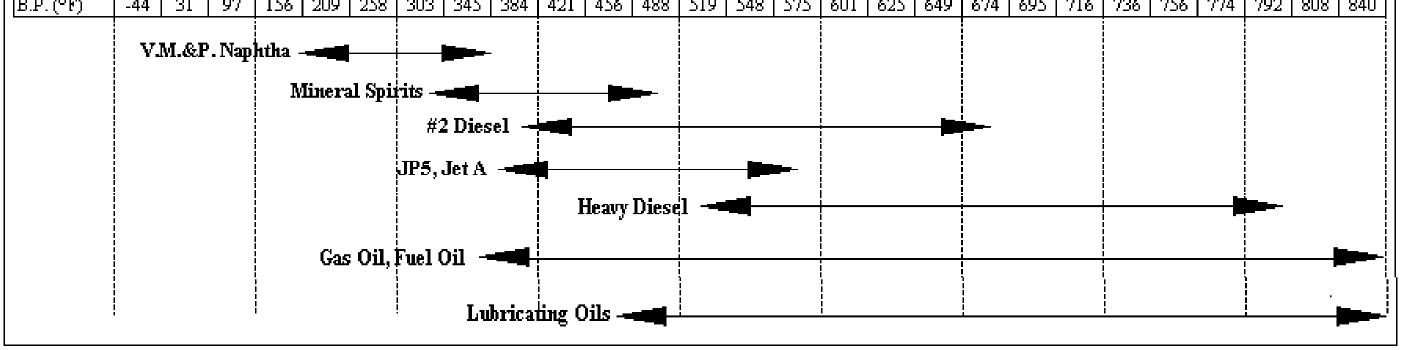
Sample ID: L806542-70 30
Injection Date: 8/24/2009 1:12:08 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

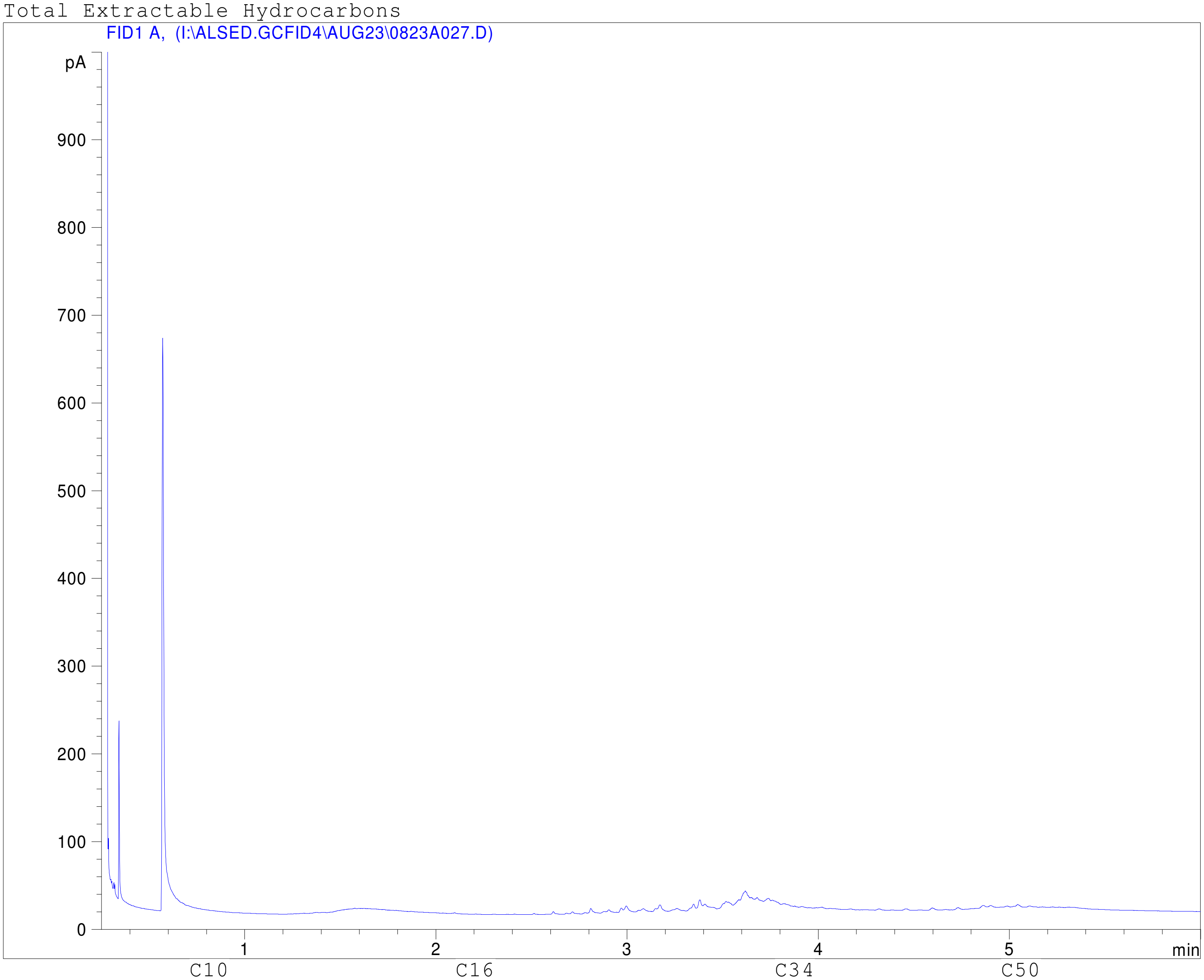


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-071

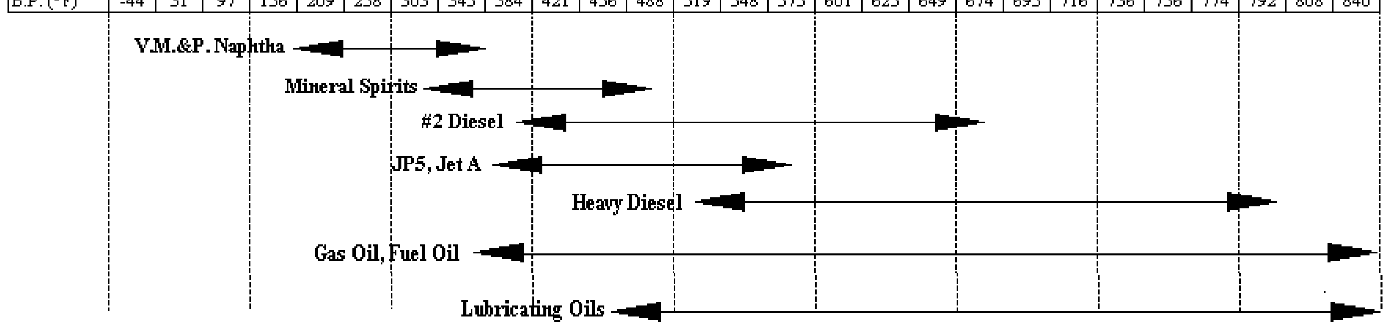
Sample ID: L806542-71 30
Injection Date: 8/24/2009 1:29:55 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

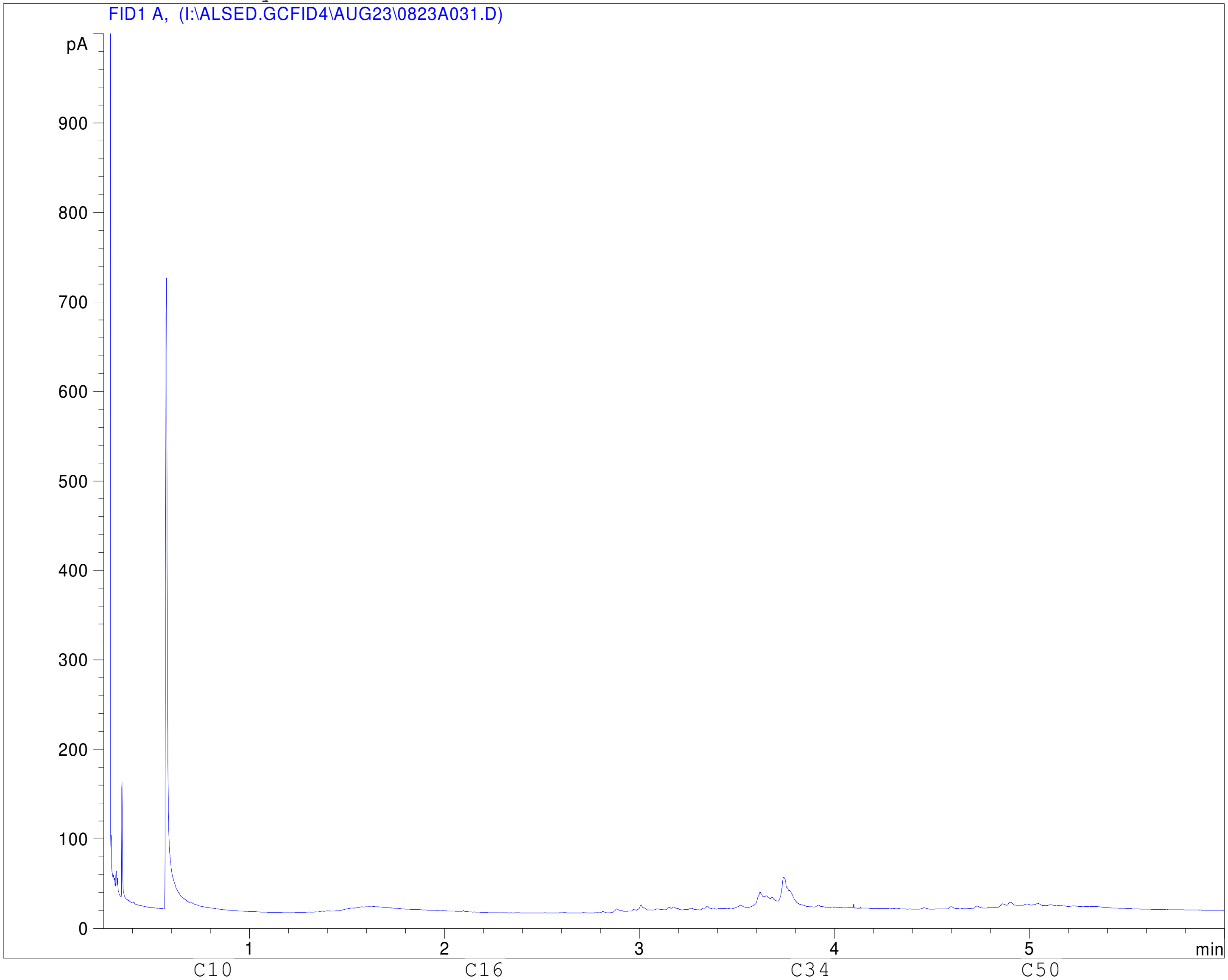


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-075

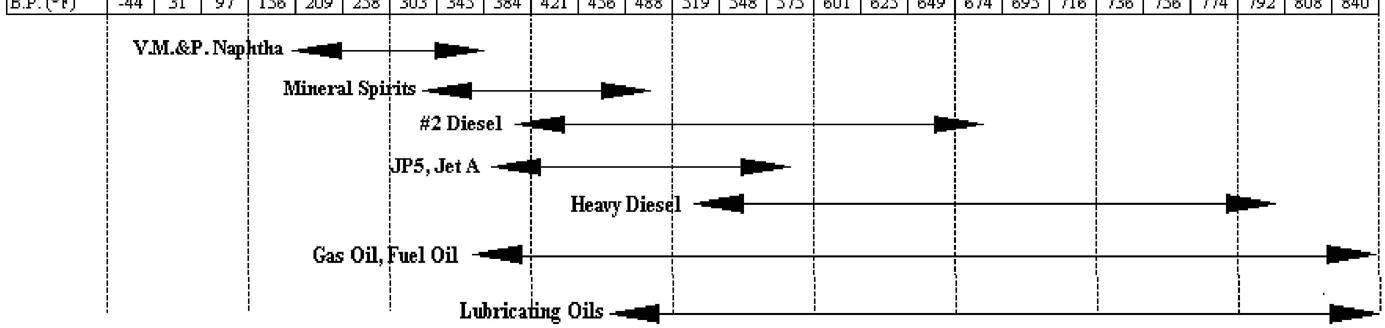
Sample ID: L806542-75 30
Injection Date: 8/24/2009 2:41:06 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

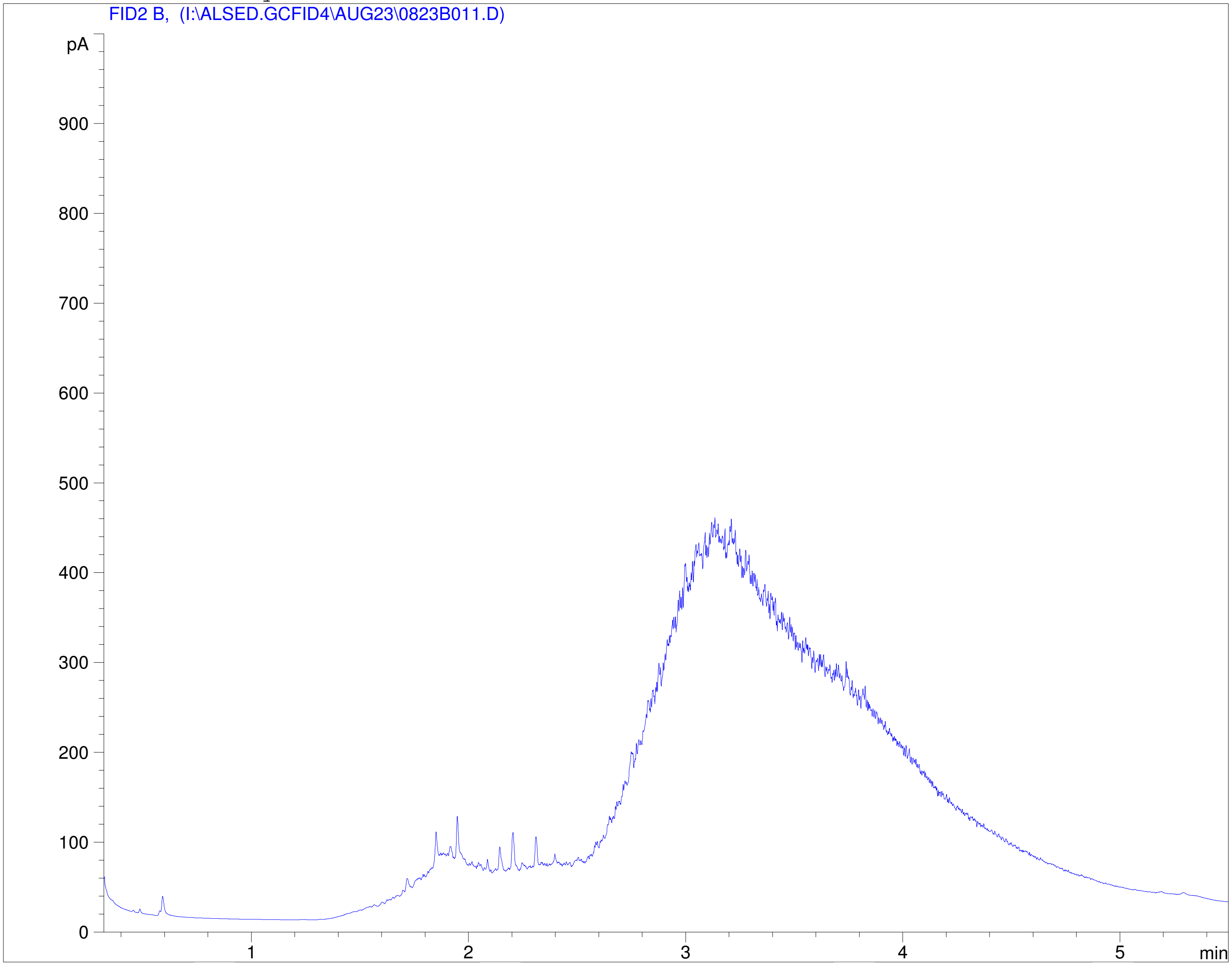


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-077

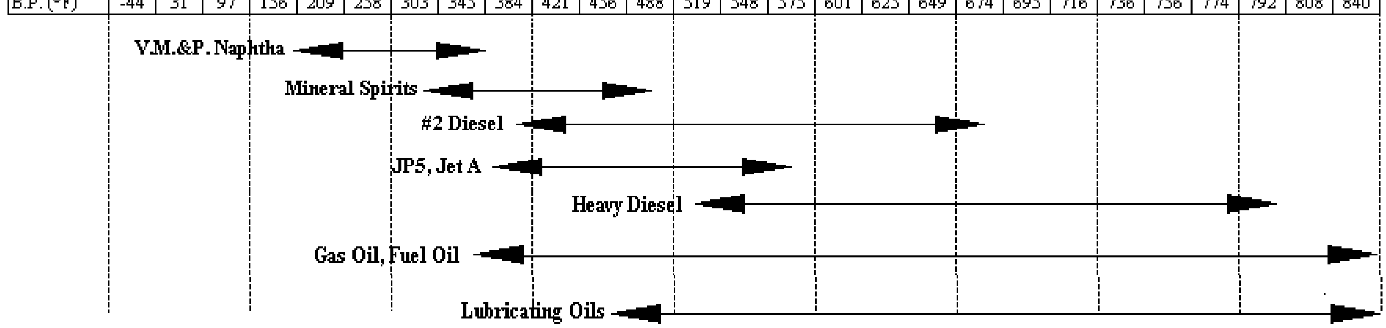
Sample ID: L806542-77 1200
Injection Date: 8/23/2009 8:44:52 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

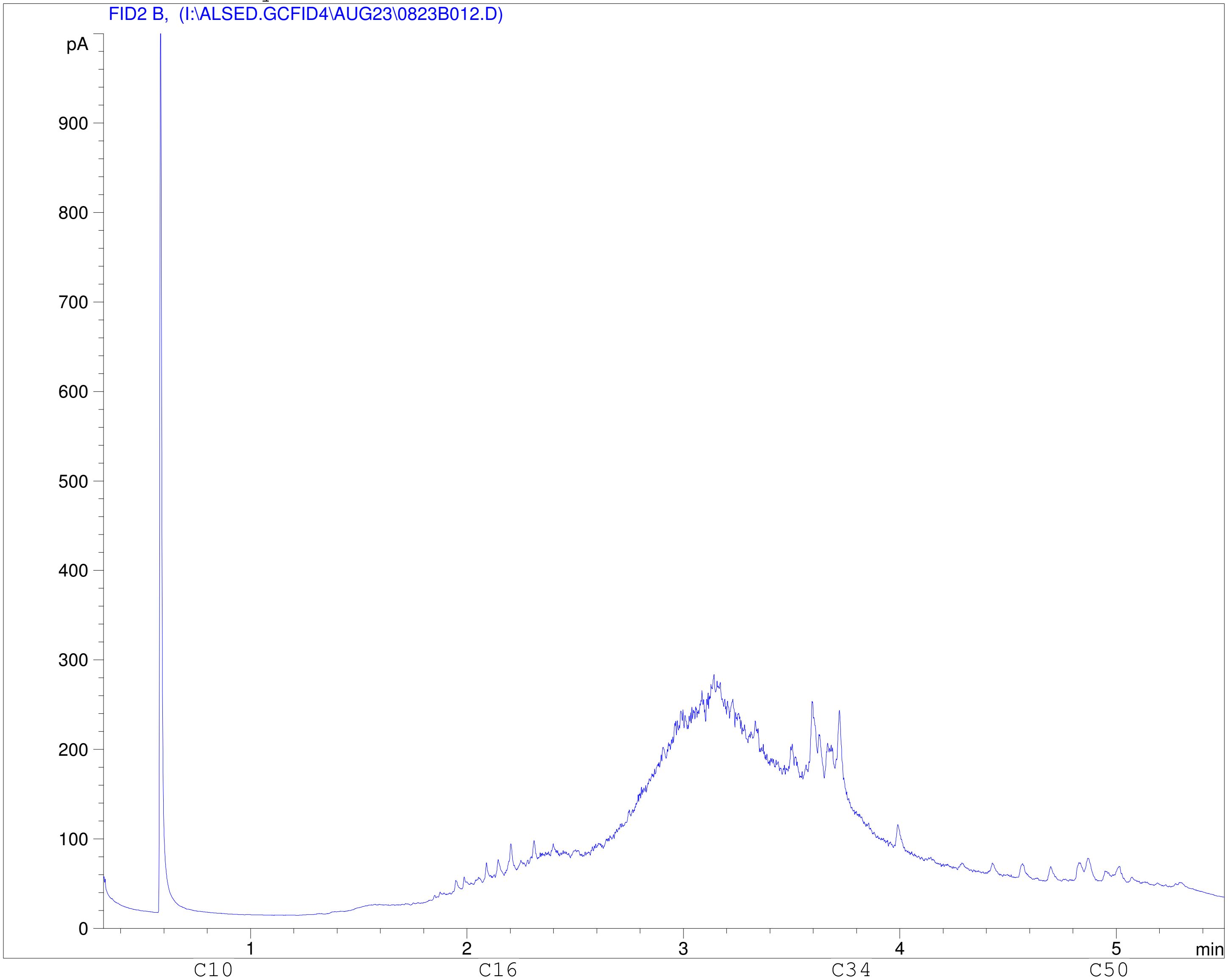


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-078

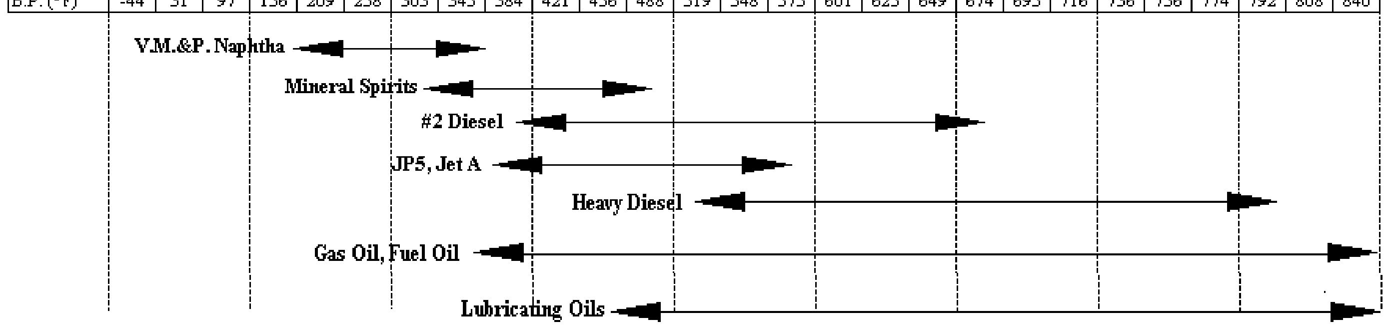
Sample ID: L806542-78 30
Injection Date: 8/23/2009 9:02:50 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

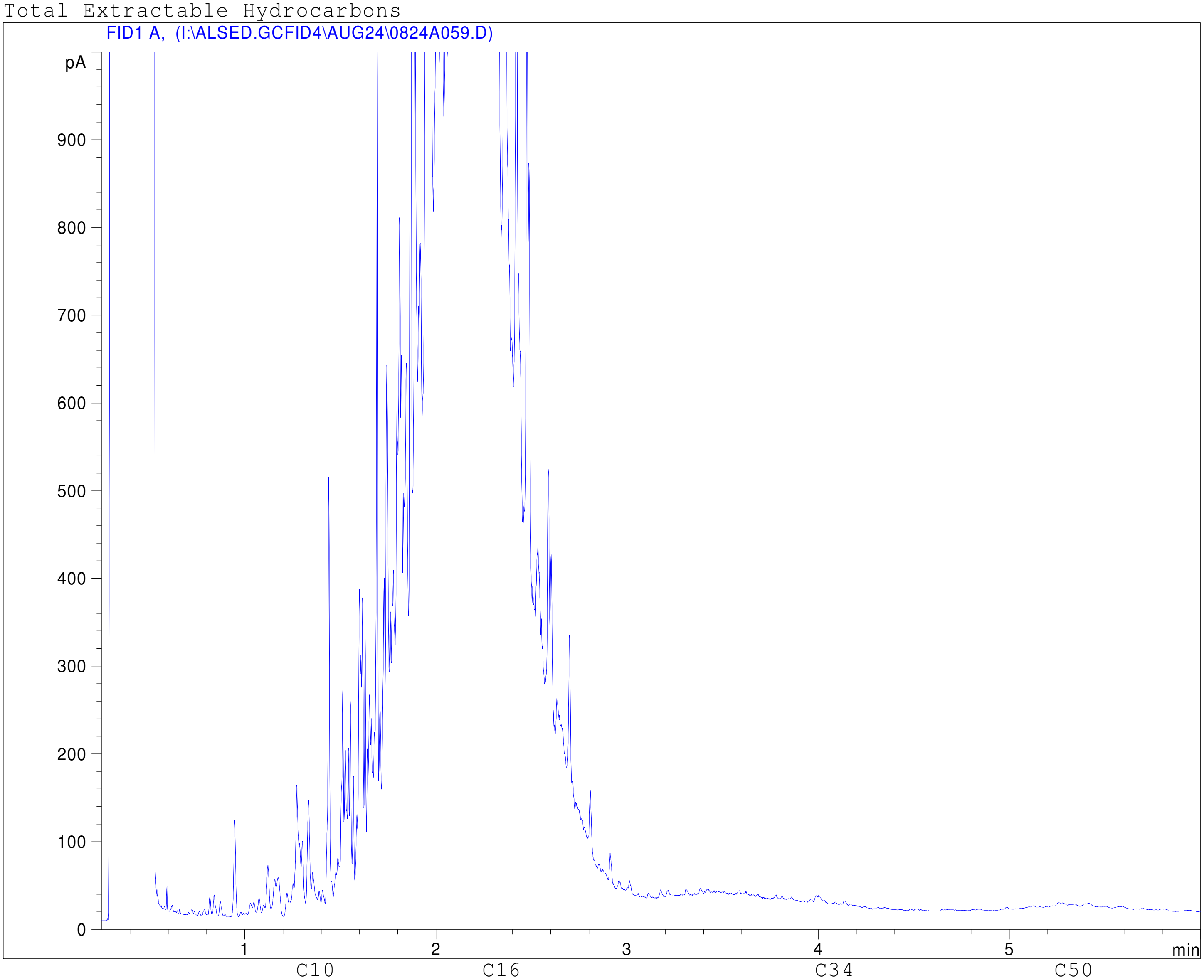


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-079

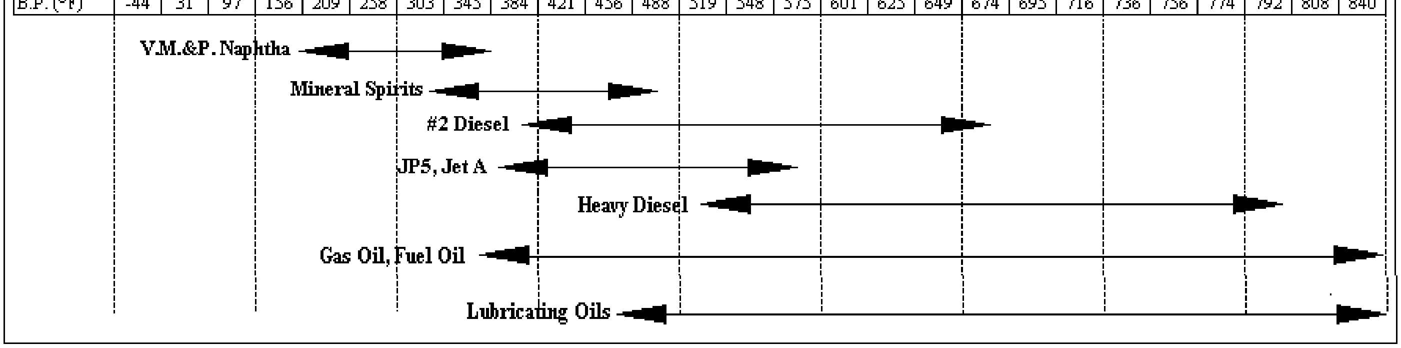
Sample ID: L806542-79 300
Injection Date: 8/25/2009 4:45:12 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

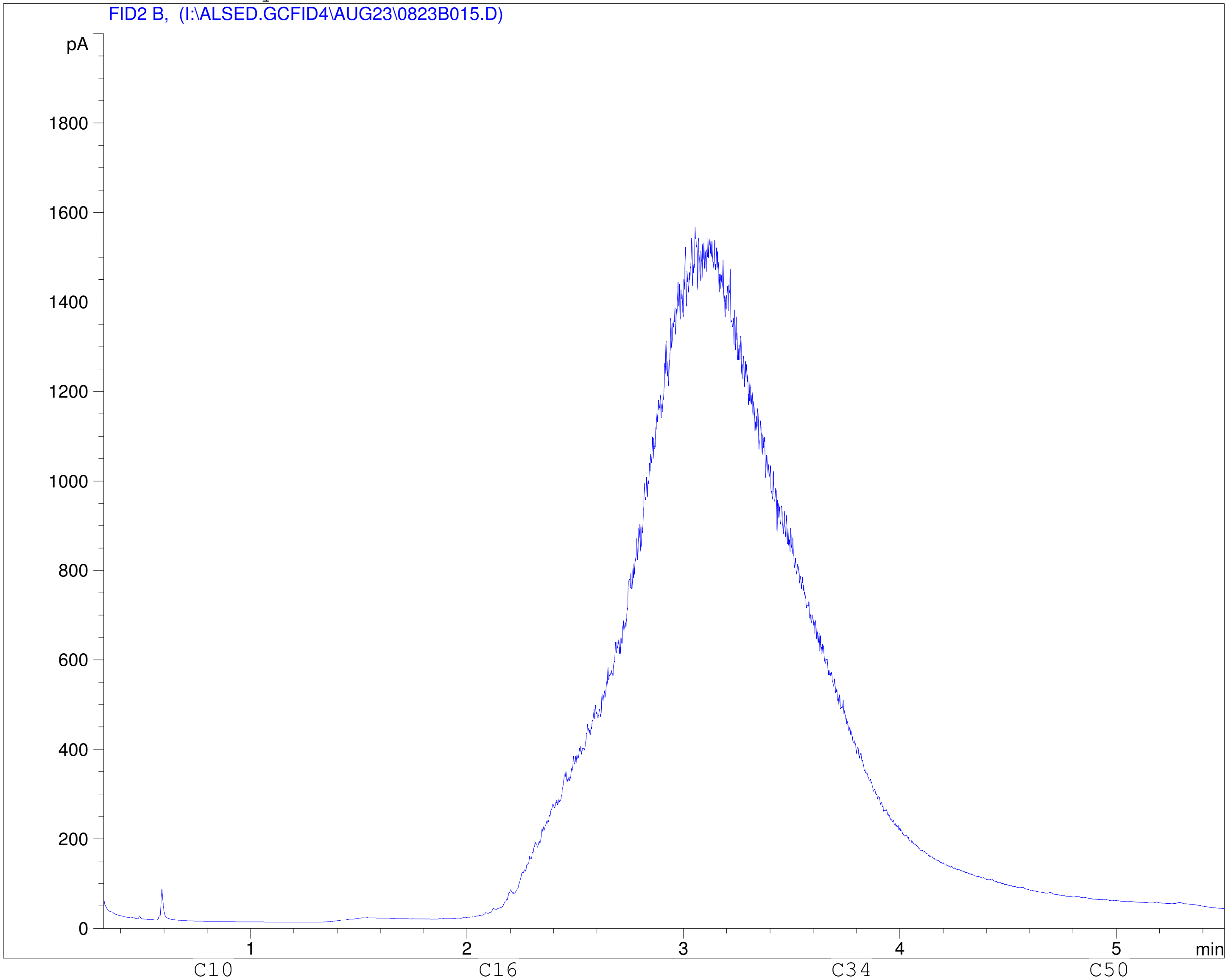


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-080

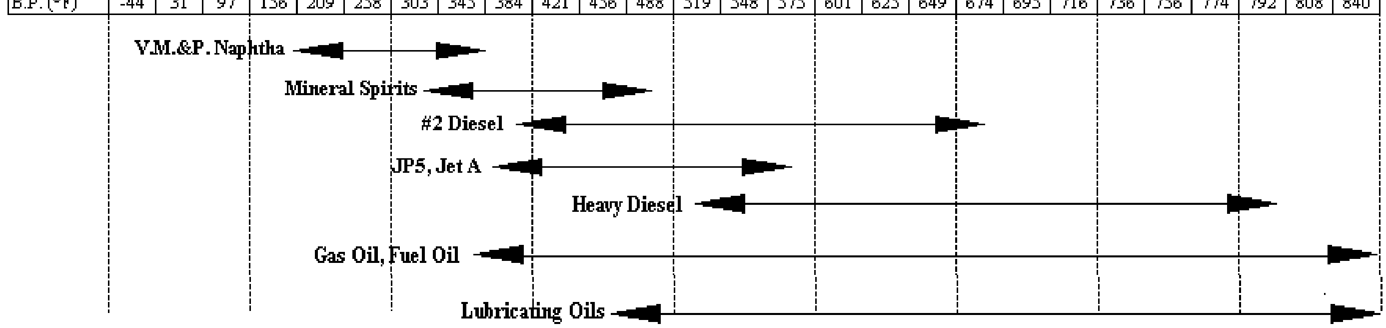
Sample ID: L806542-80 300
Injection Date: 8/23/2009 9:56:04 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

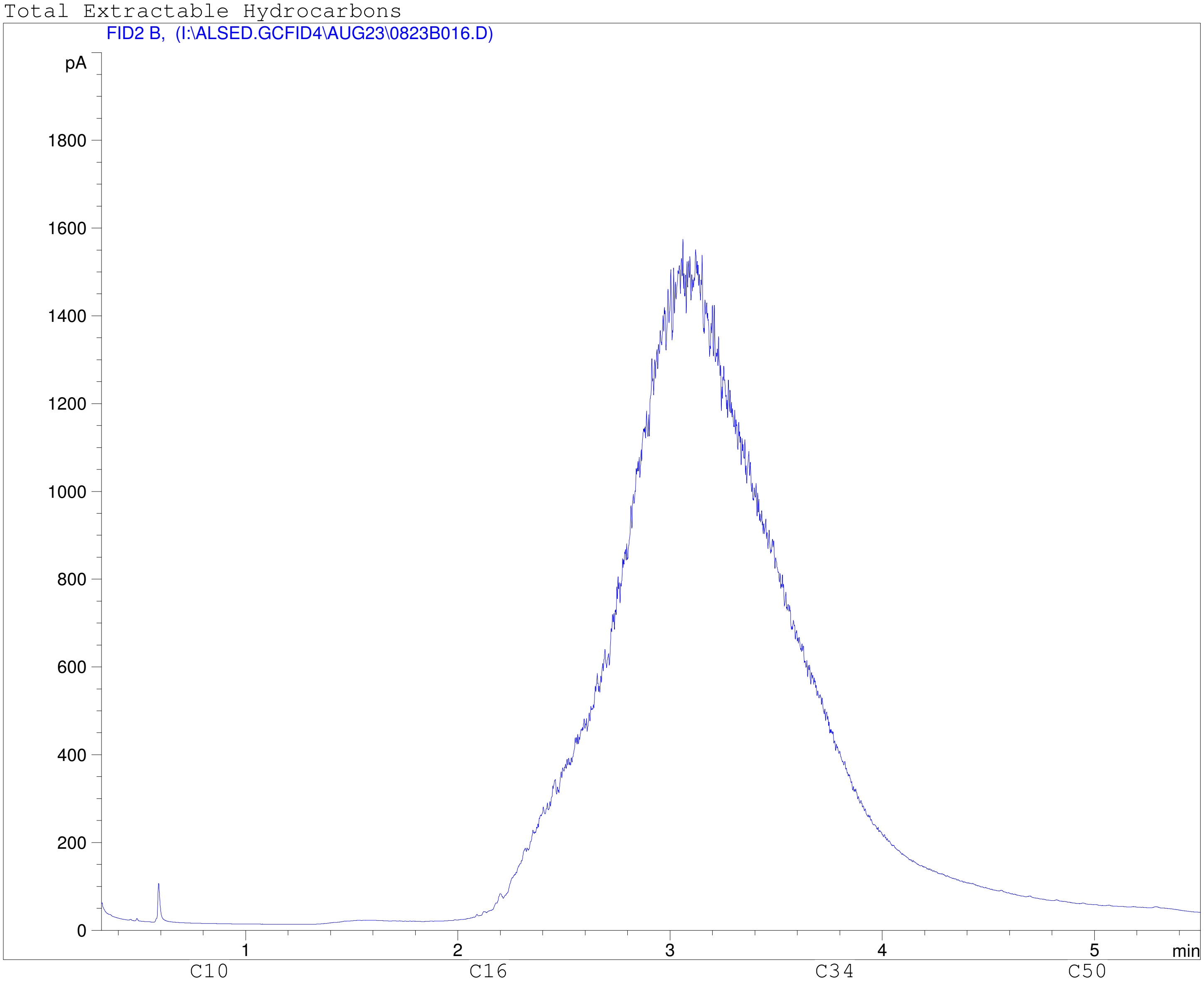


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-081

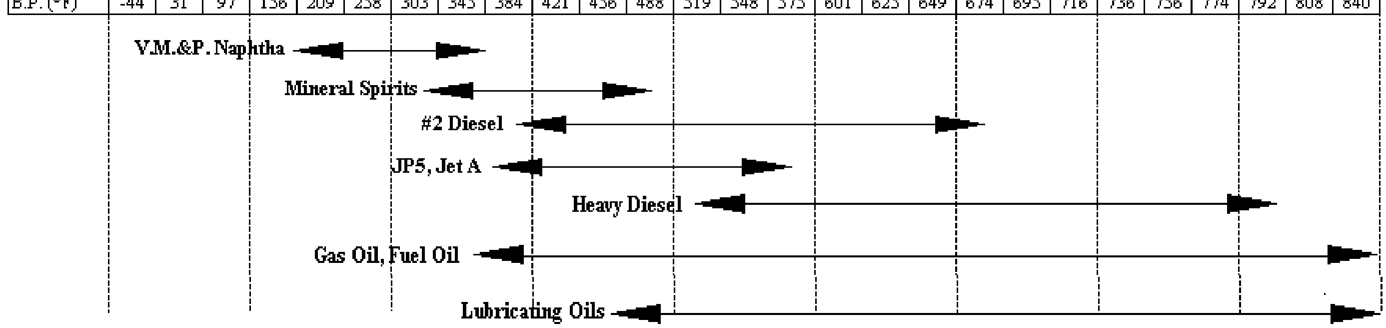
Sample ID: L806542-81 300
Injection Date: 8/23/2009 10:14:04 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

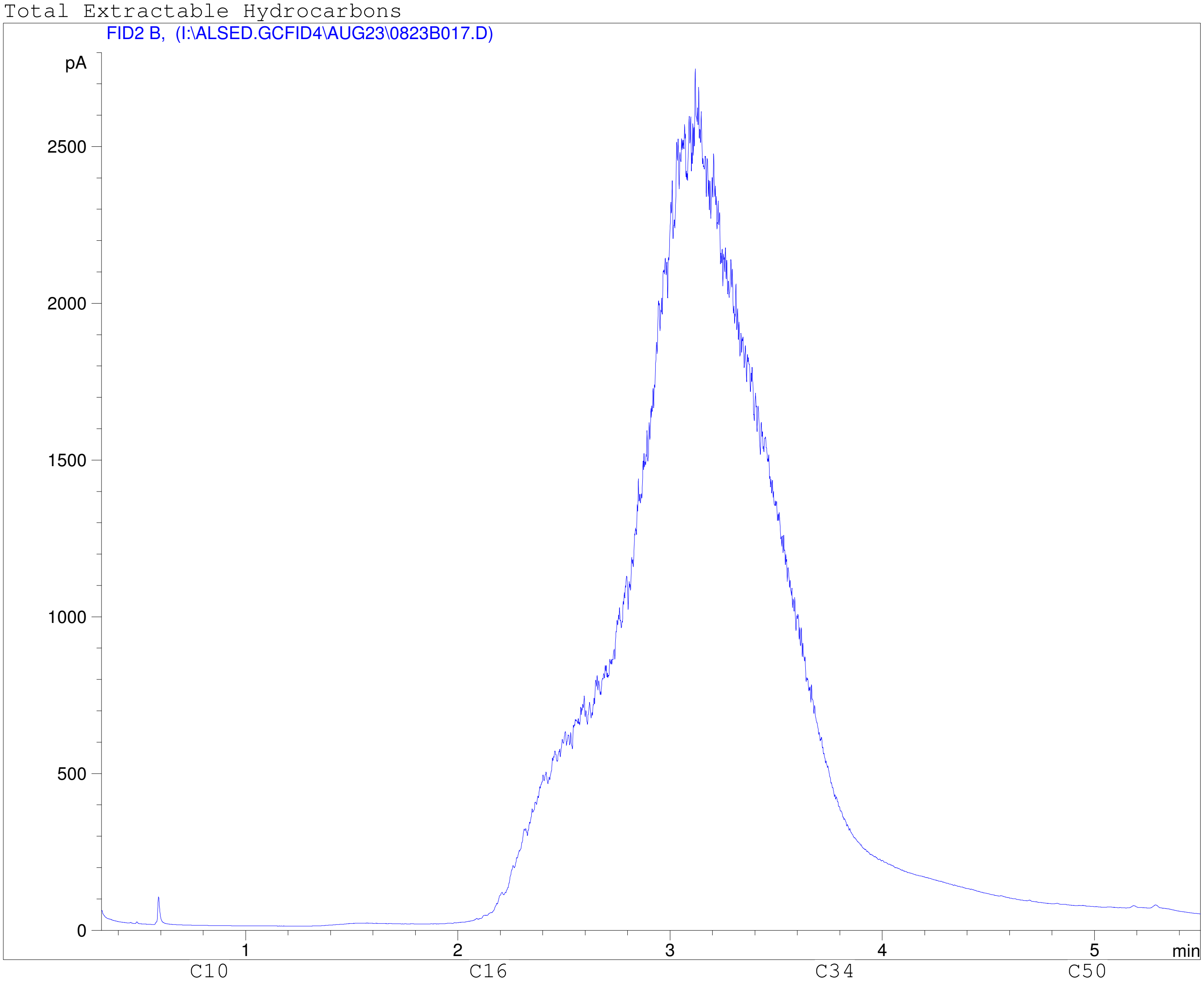


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-082

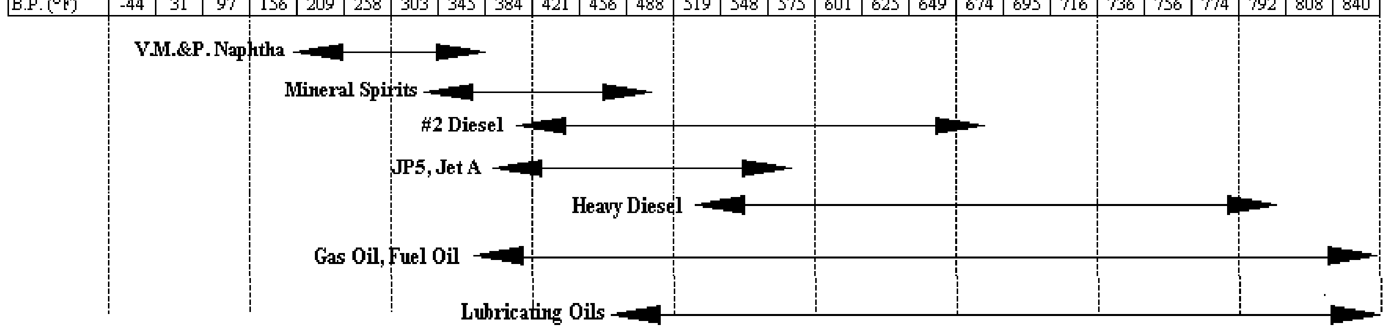
Sample ID: L806542-82 300
Injection Date: 8/23/2009 10:31:53 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

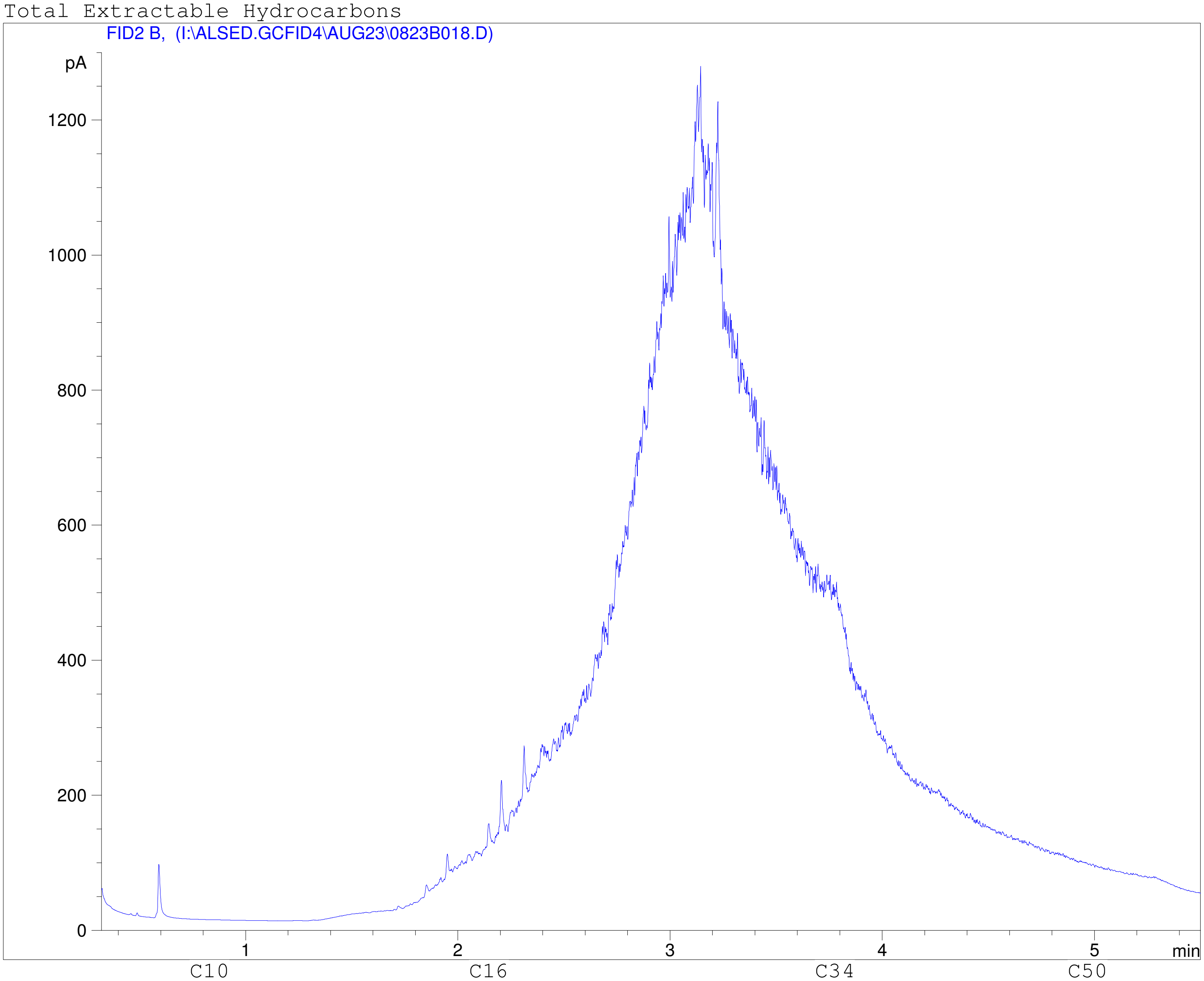


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-083

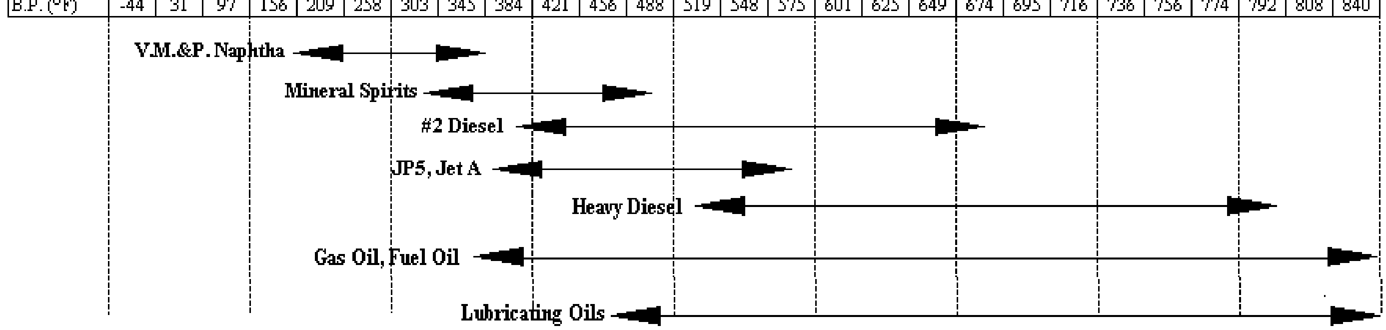
Sample ID: L806542-83 300
Injection Date: 8/23/2009 10:49:32 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840



Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

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Client ID:            PLF09-SS-084

Sample ID:            L806542-84 300
Injection Date:       8/23/2009 11:07:16 PM
Instrument:           6890
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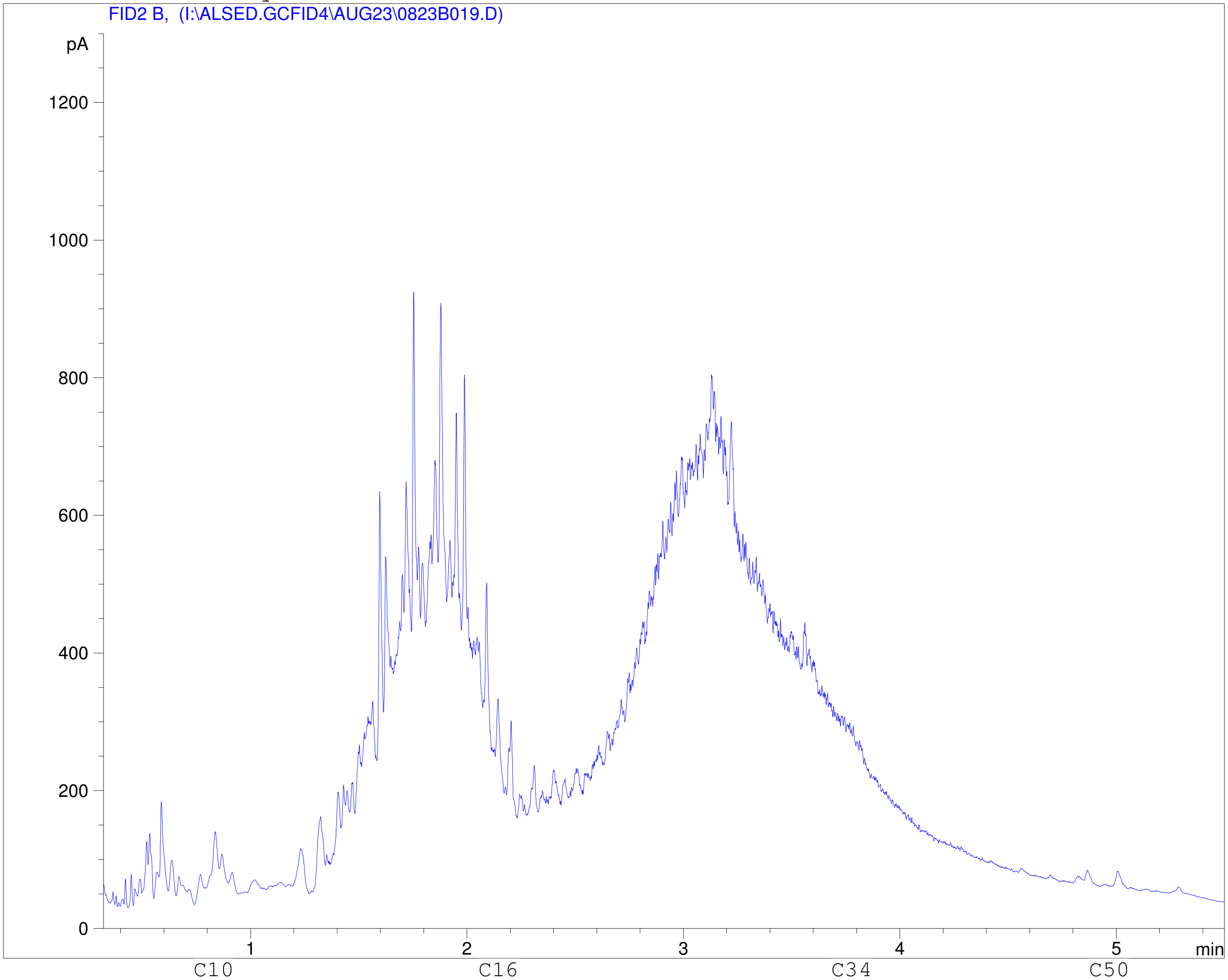
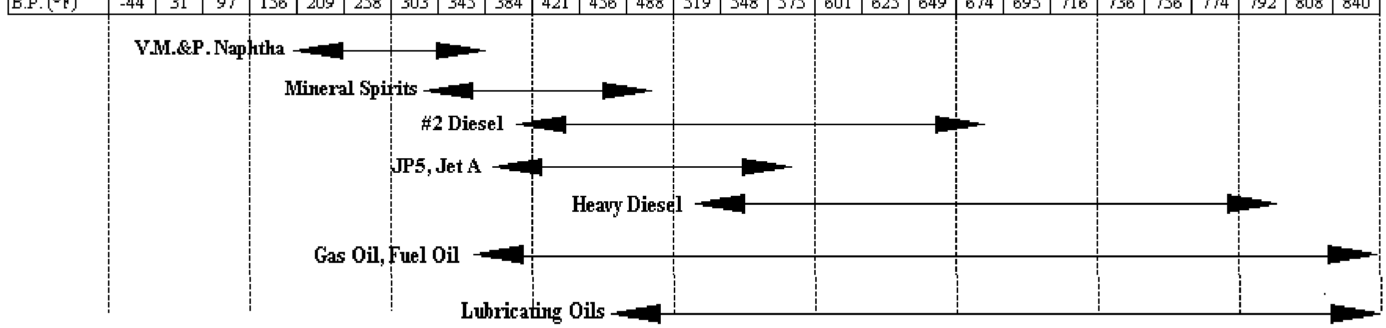
Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

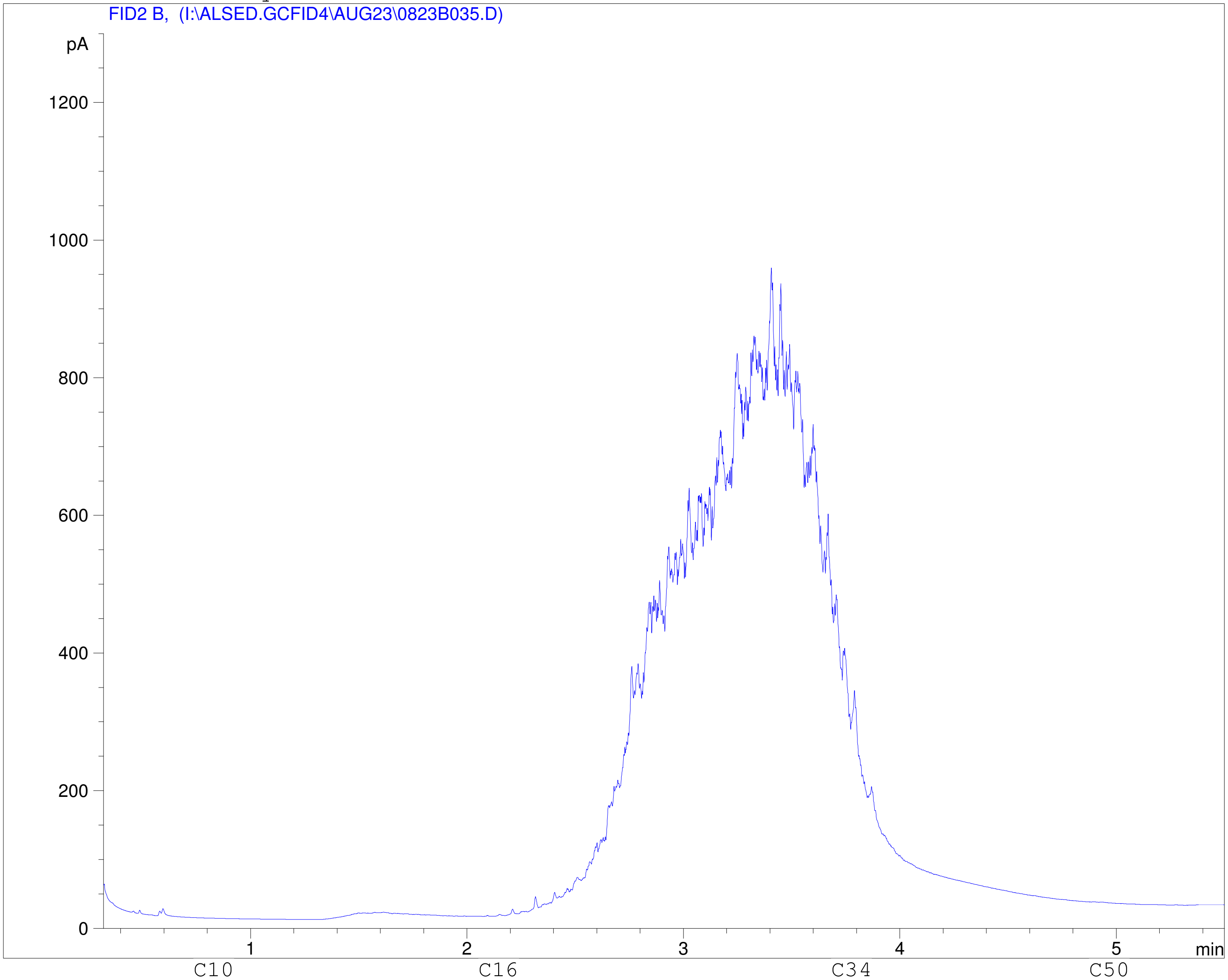


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-085

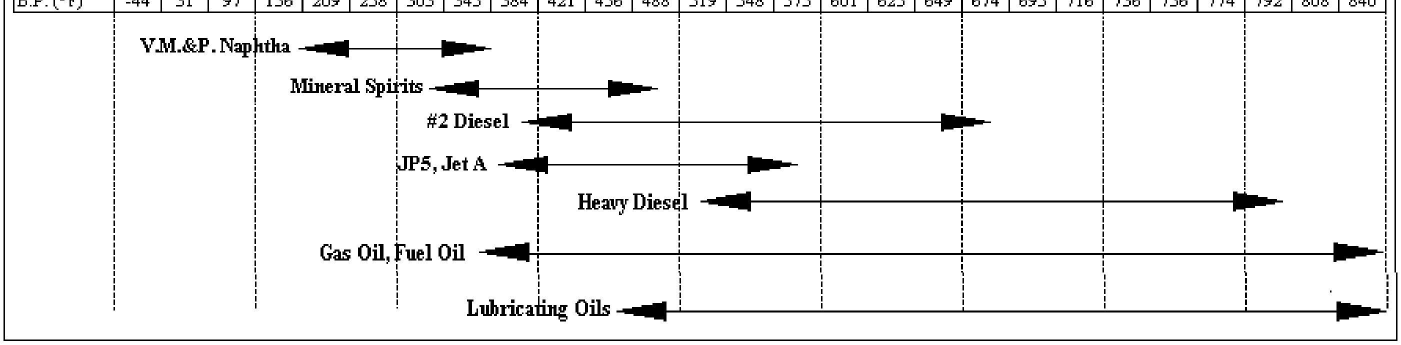
Sample ID: L806542-85 3000
Injection Date: 8/24/2009 12:37:24 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

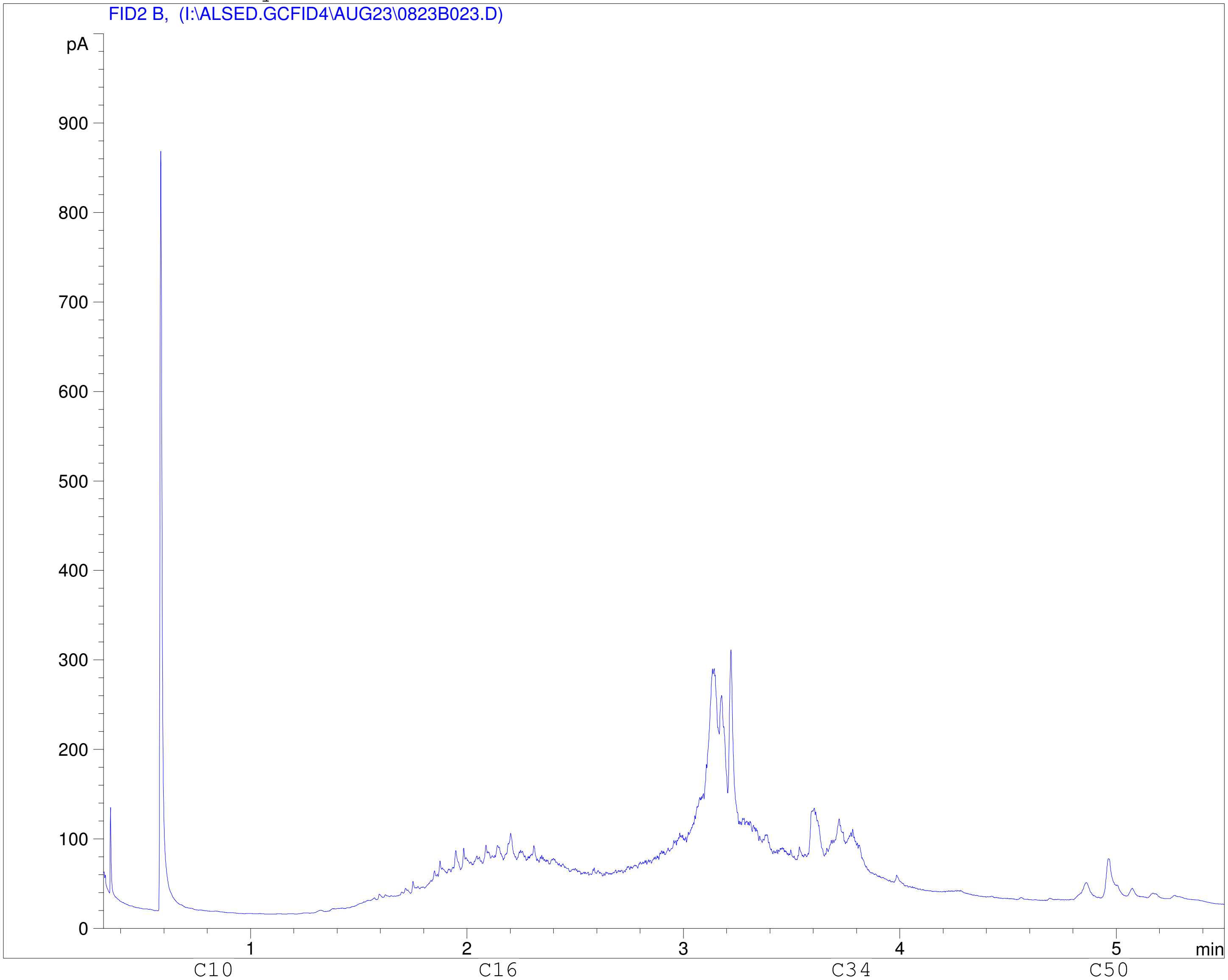


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-086

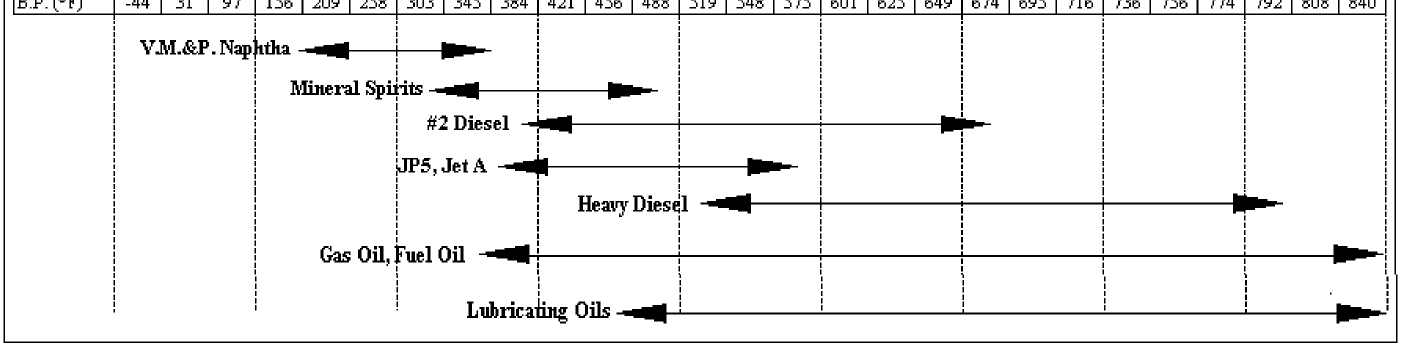
Sample ID: L806542-86 30
Injection Date: 8/24/2009 12:18:36 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

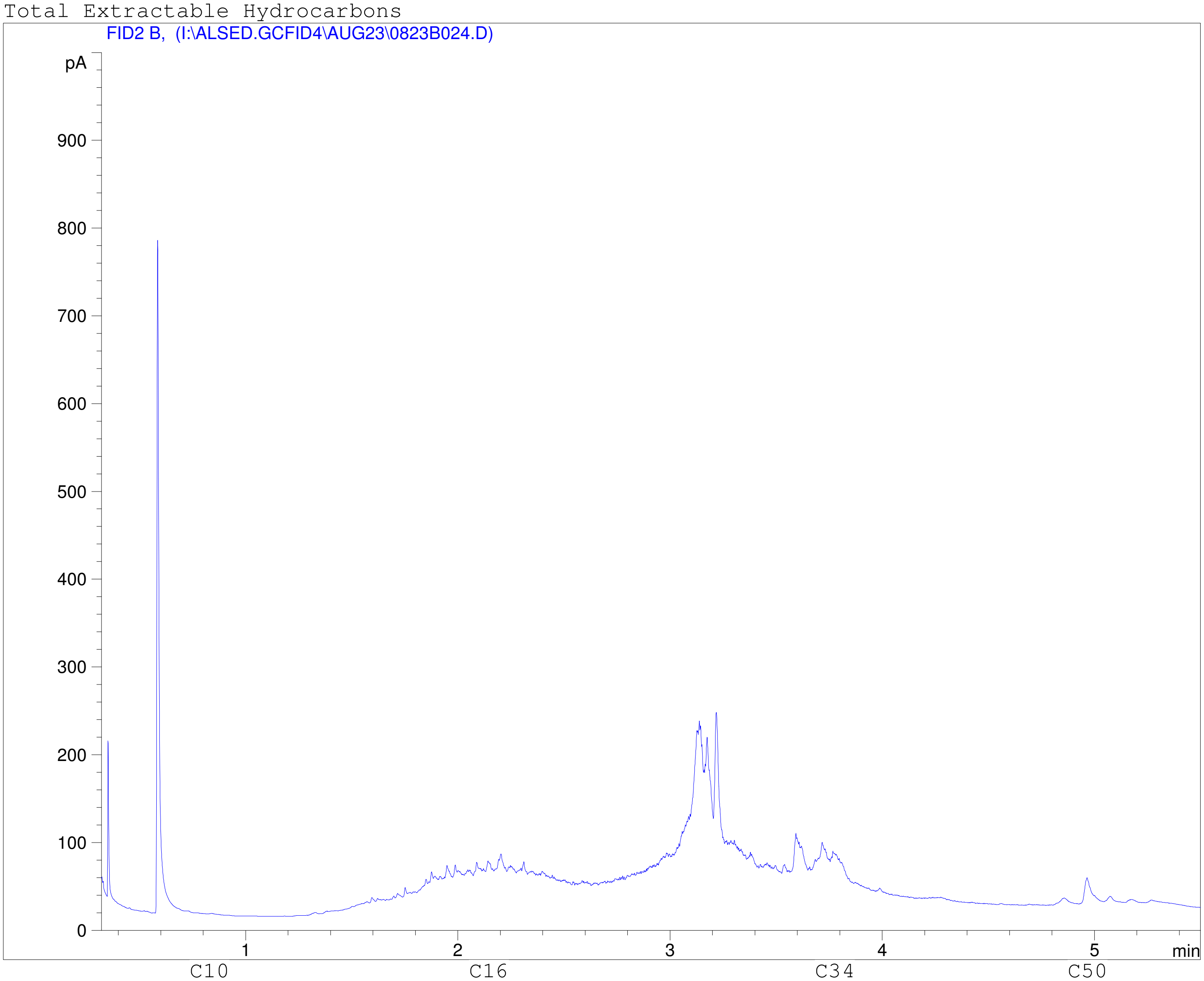


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-087

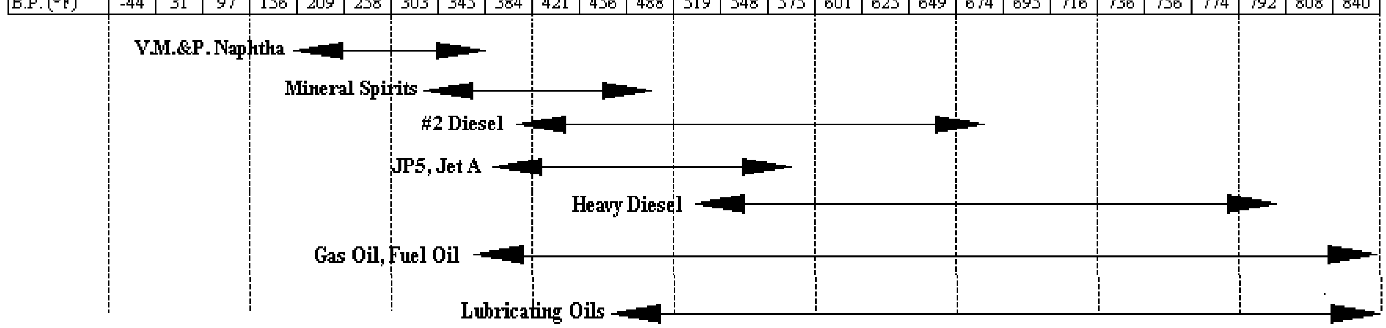
Sample ID: L806542-87 30
Injection Date: 8/24/2009 12:36:33 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

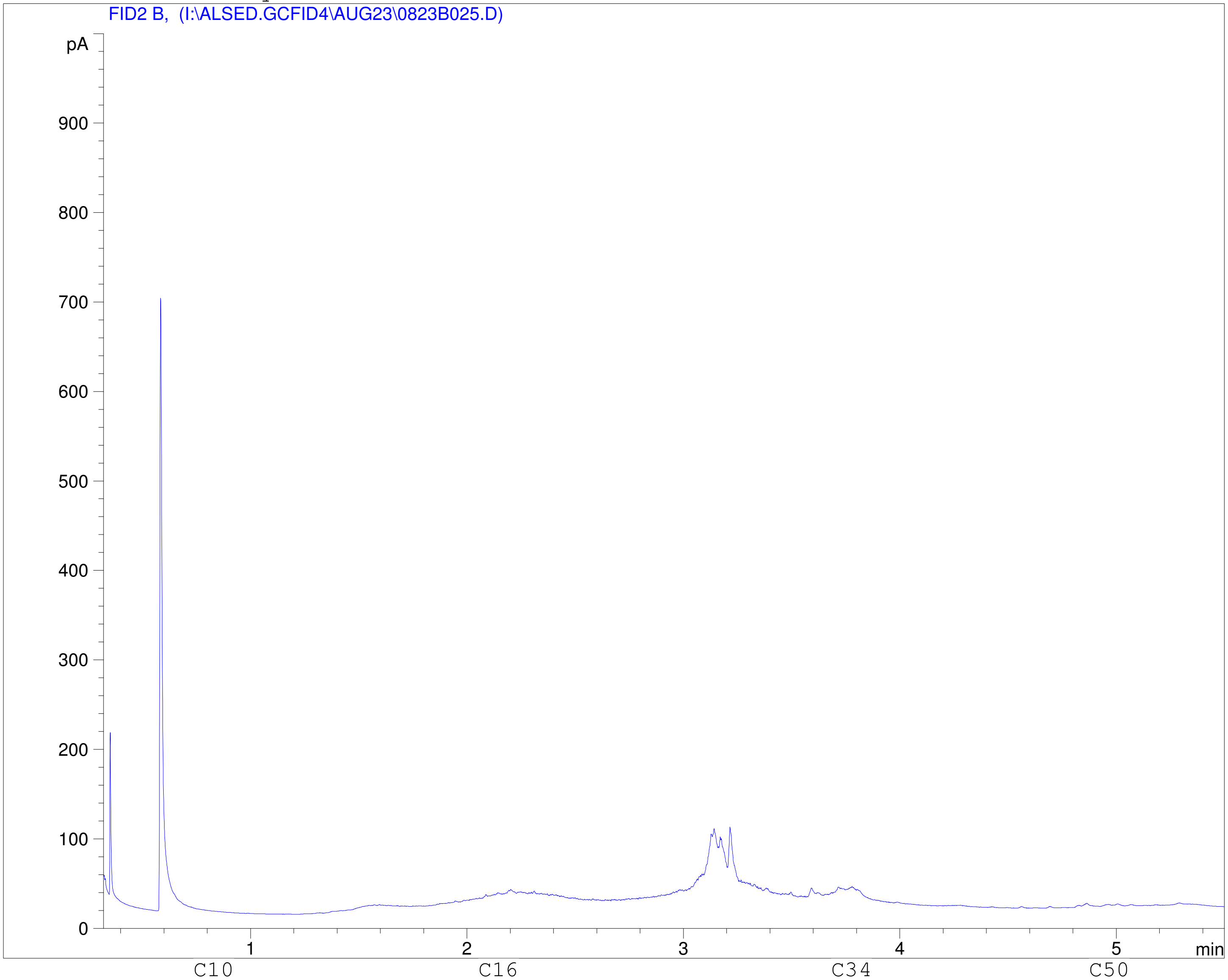


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-088

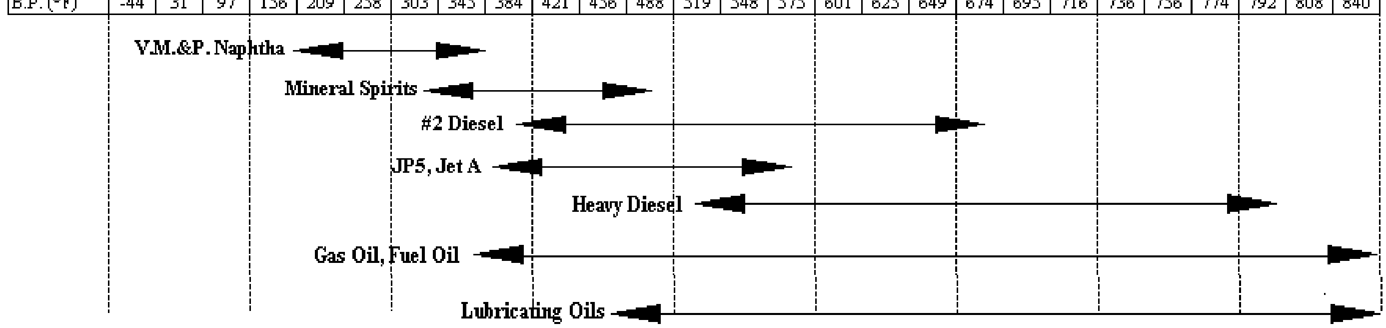
Sample ID: L806542-88 30
Injection Date: 8/24/2009 12:54:21 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

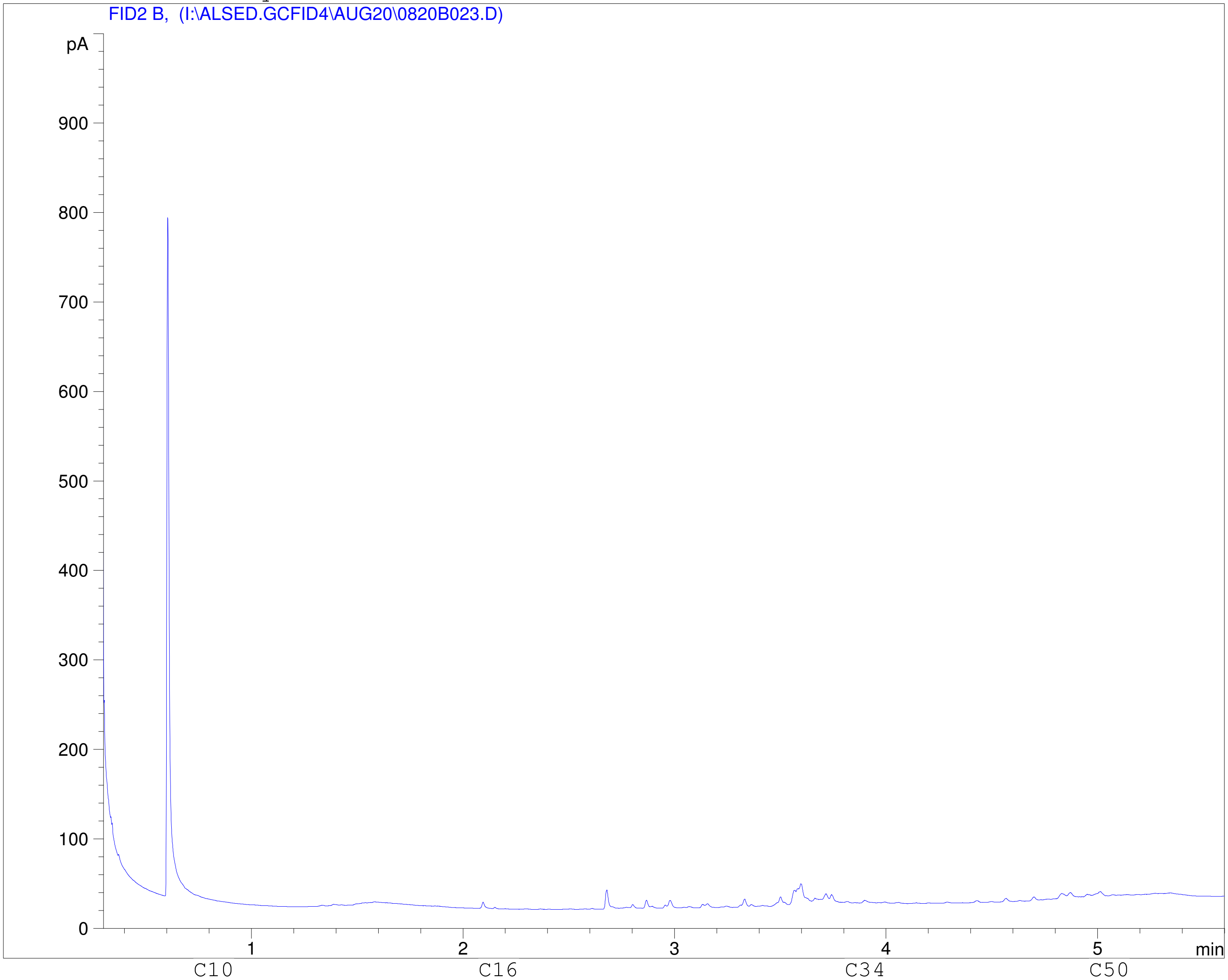


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: PLF09-SS-009

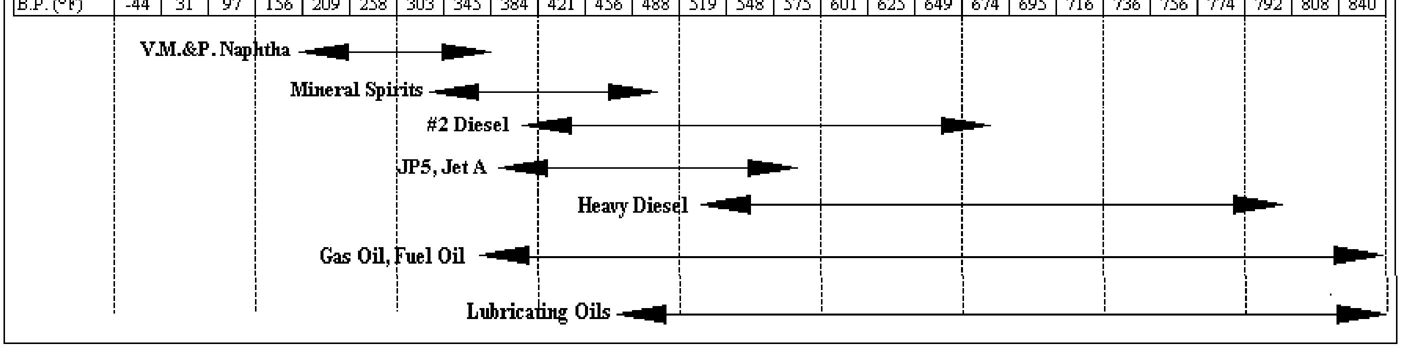
Sample ID: L806542-9 30
Injection Date: 8/20/2009 11:43:11 PM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

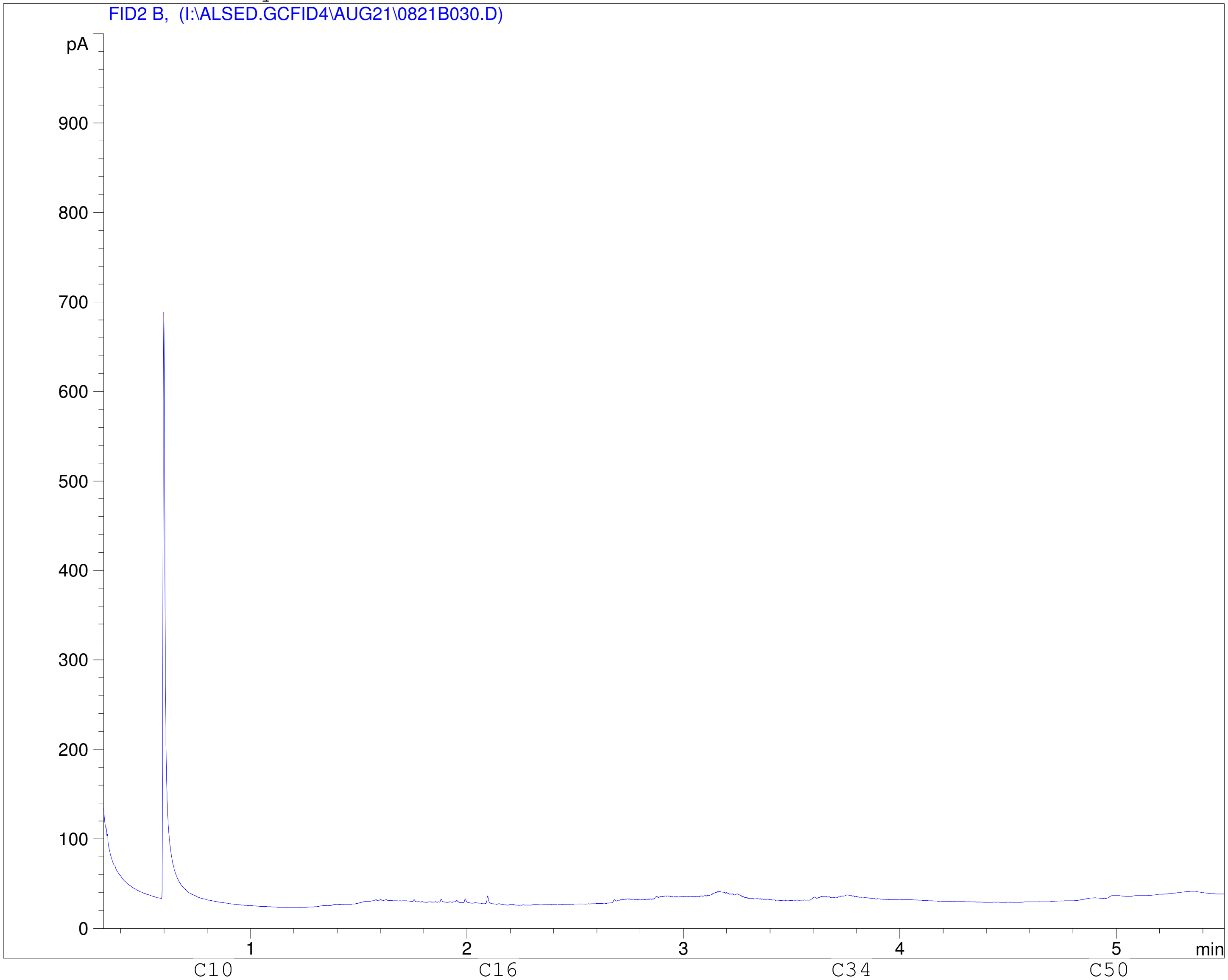


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-090

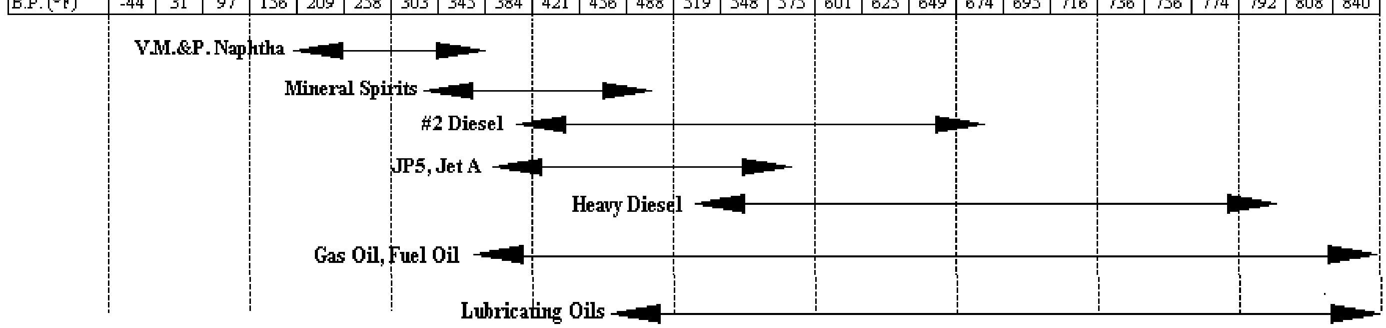
Sample ID: L806542-90 30
Injection Date: 8/22/2009 1:16:27 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

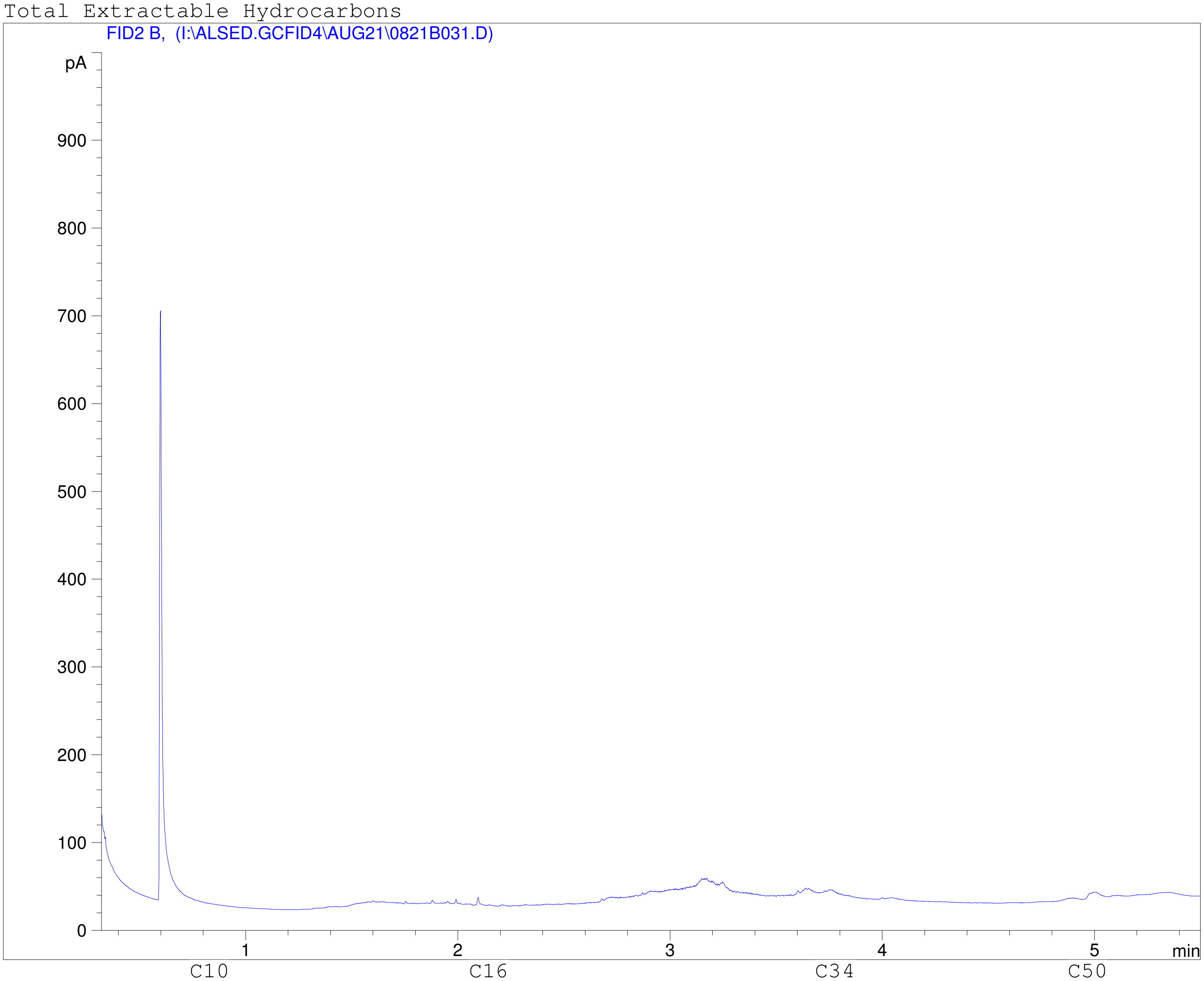


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-091

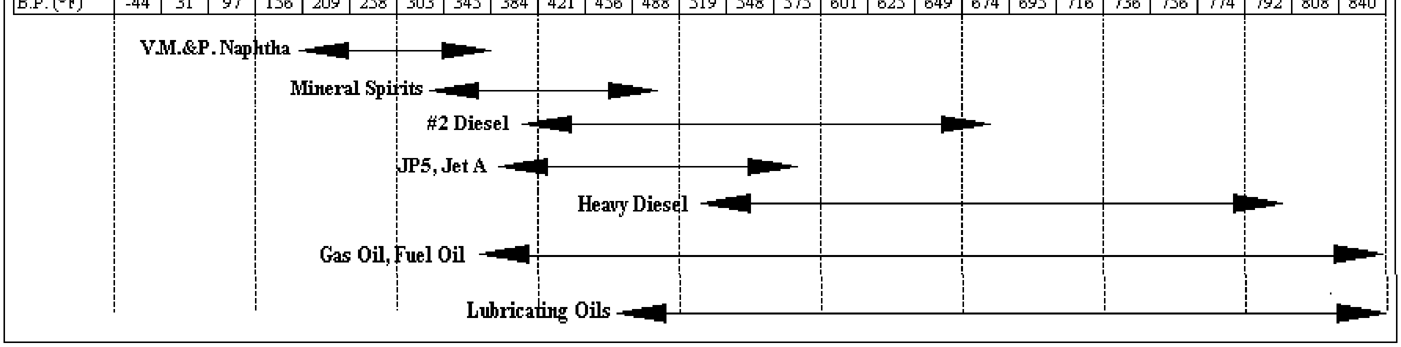
Sample ID: L806542-91 30
Injection Date: 8/22/2009 1:34:32 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

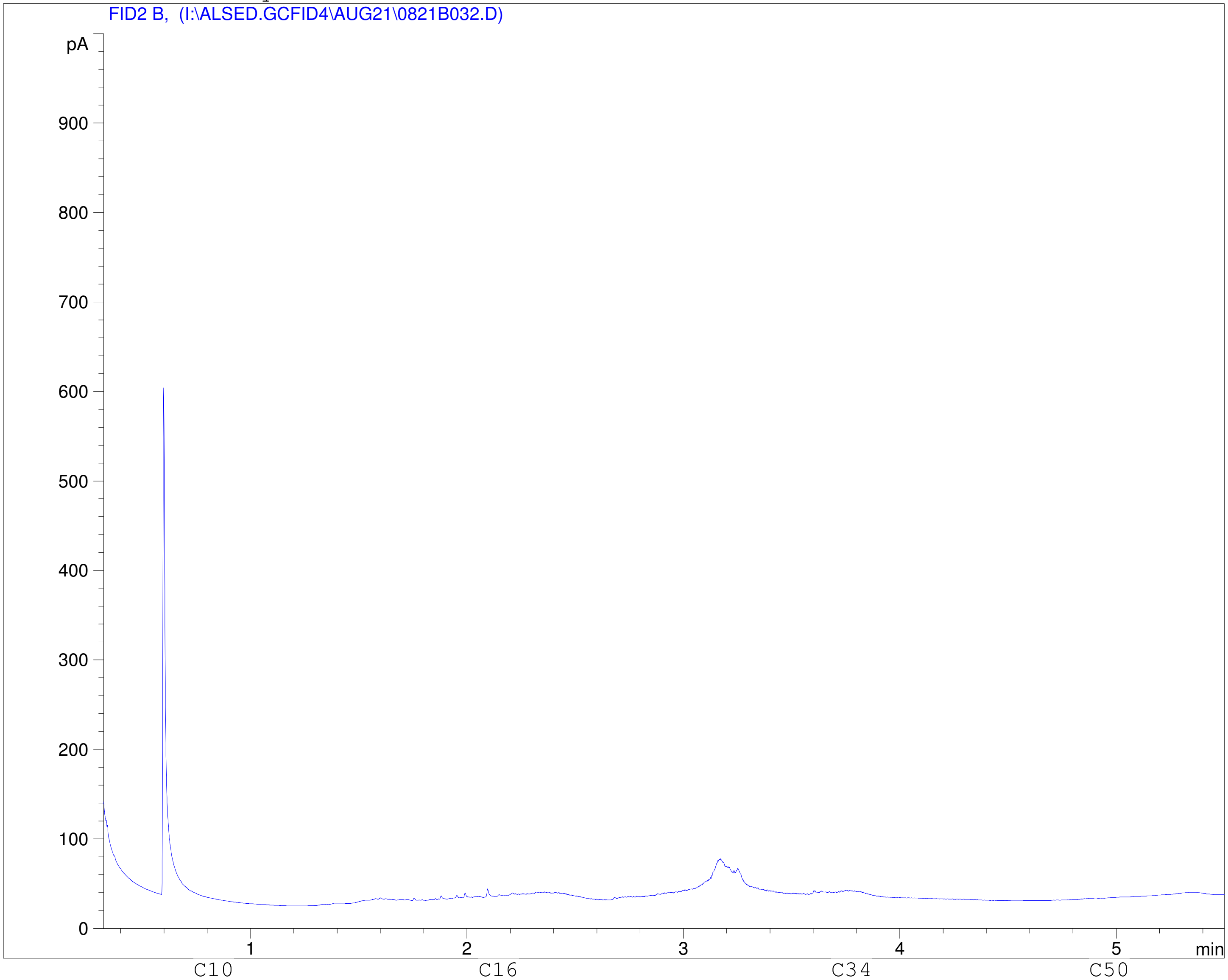


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-092

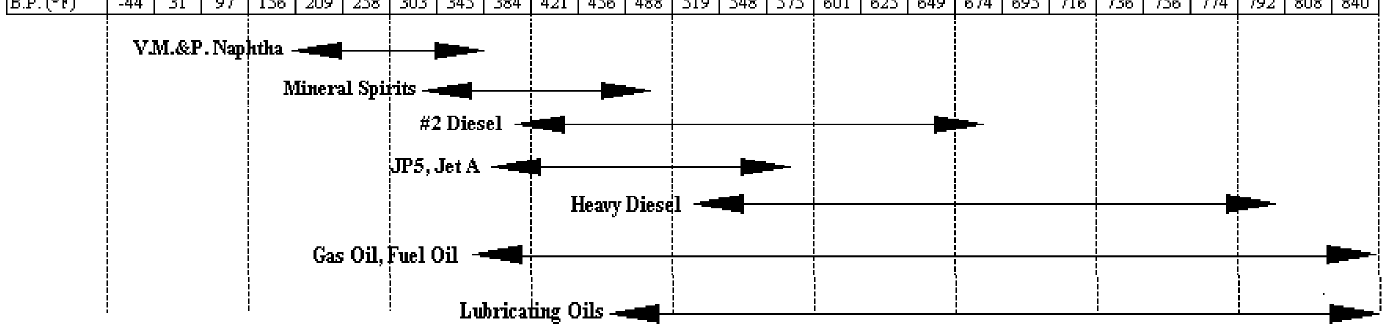
Sample ID: L806542-92 30
Injection Date: 8/22/2009 1:52:18 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

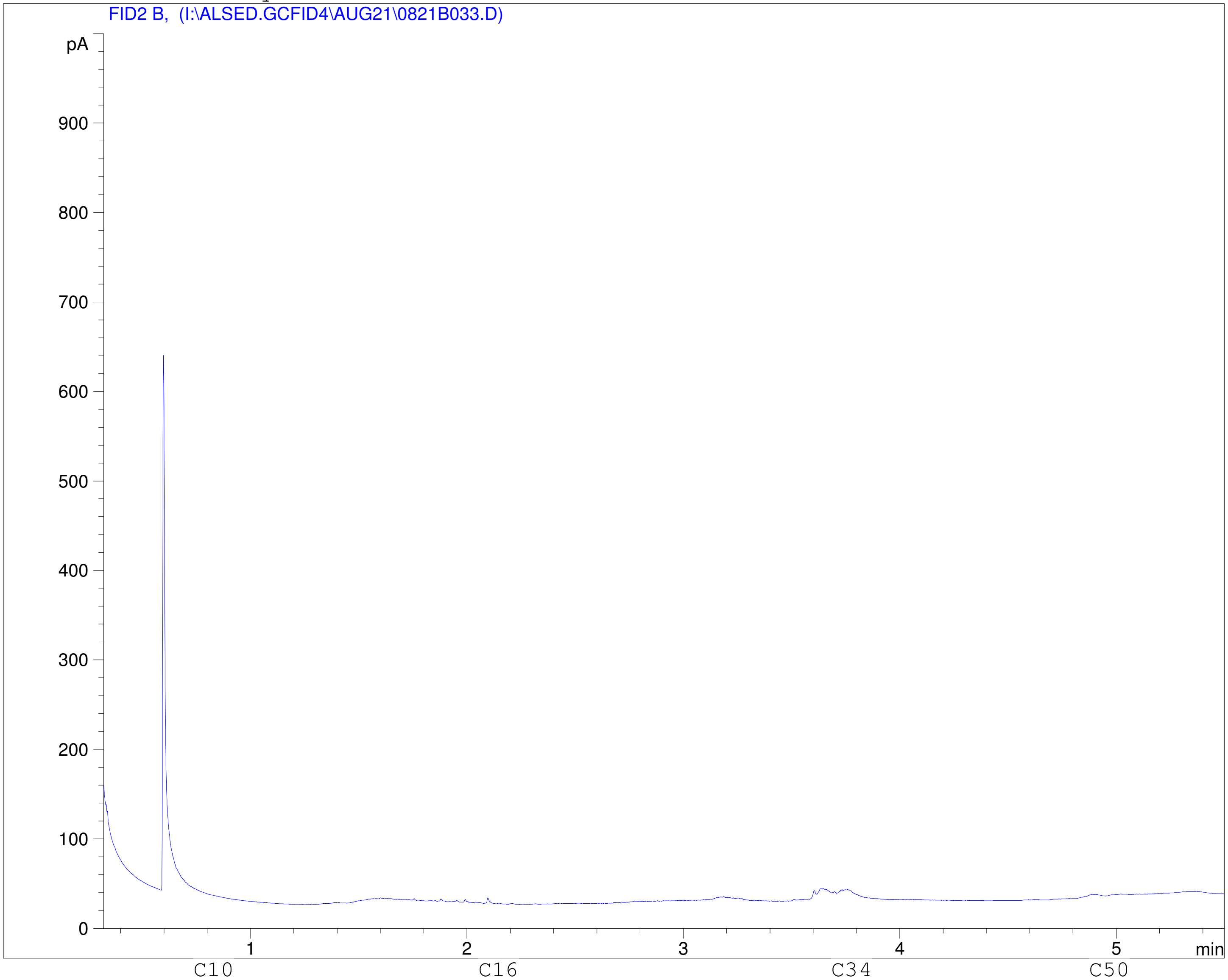


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-093

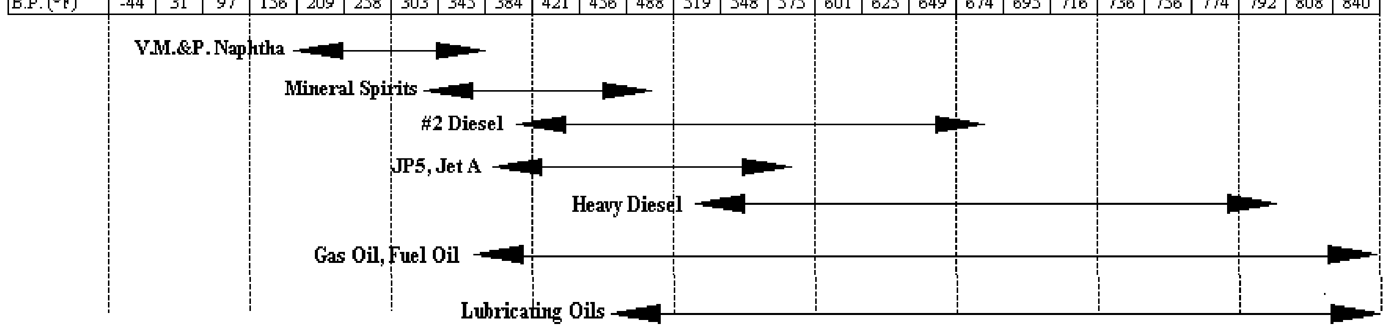
Sample ID: L806542-93 30
Injection Date: 8/22/2009 2:10:18 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

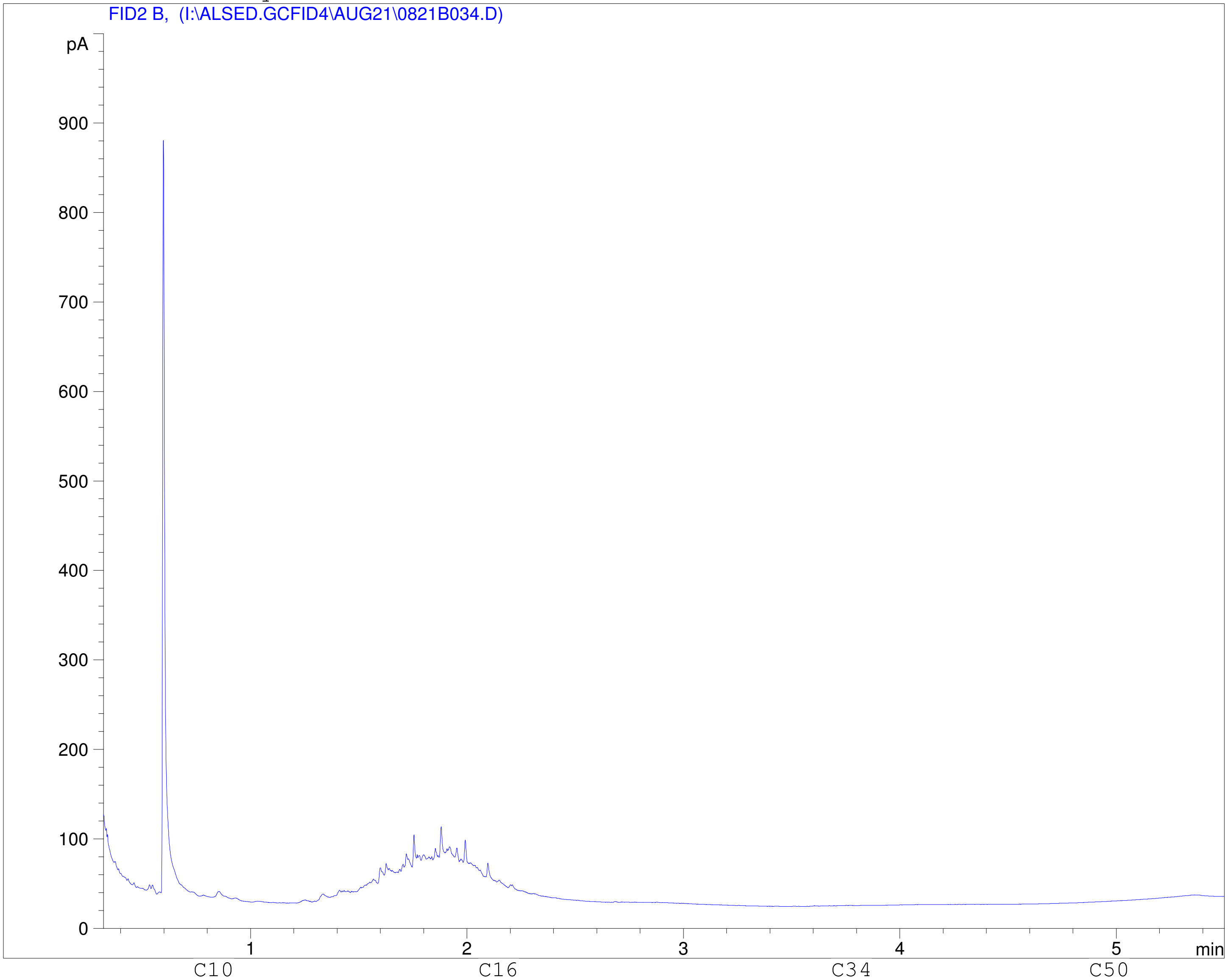


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: WLF09-SS-094

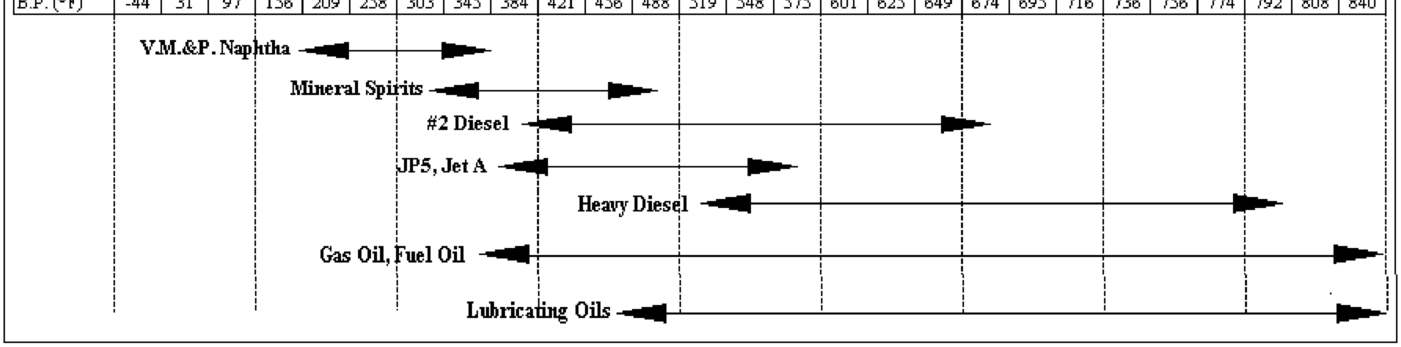
Sample ID: L806542-94 30
Injection Date: 8/22/2009 2:28:14 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

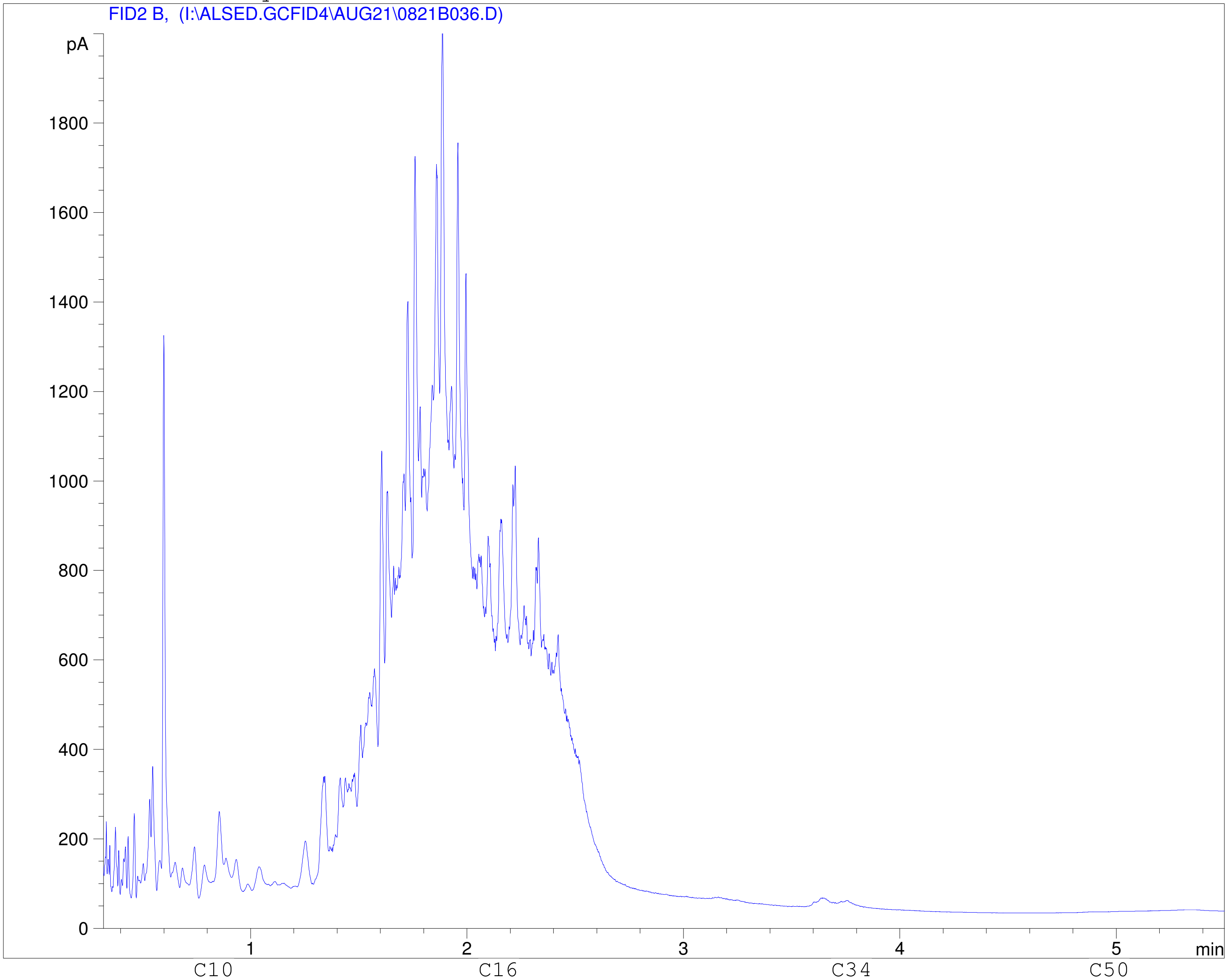


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: BLF09-SS-095

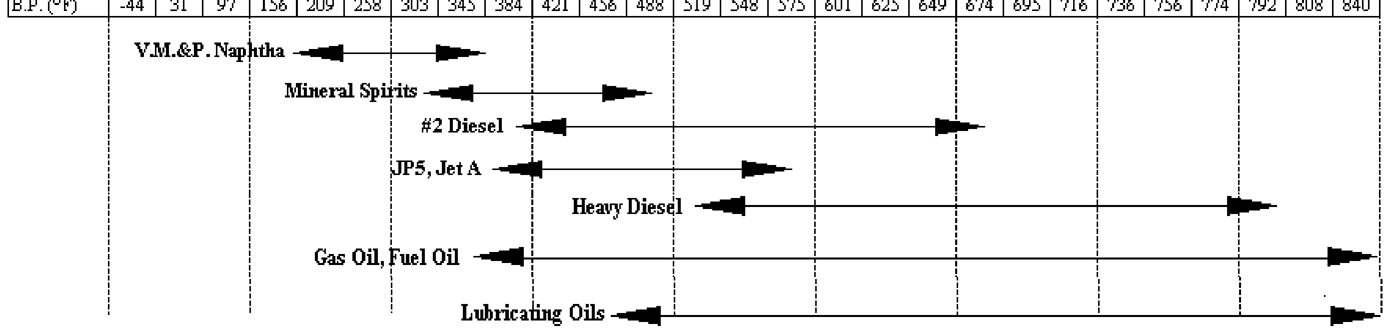
Sample ID: L806542-95 30
Injection Date: 8/22/2009 3:03:49 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

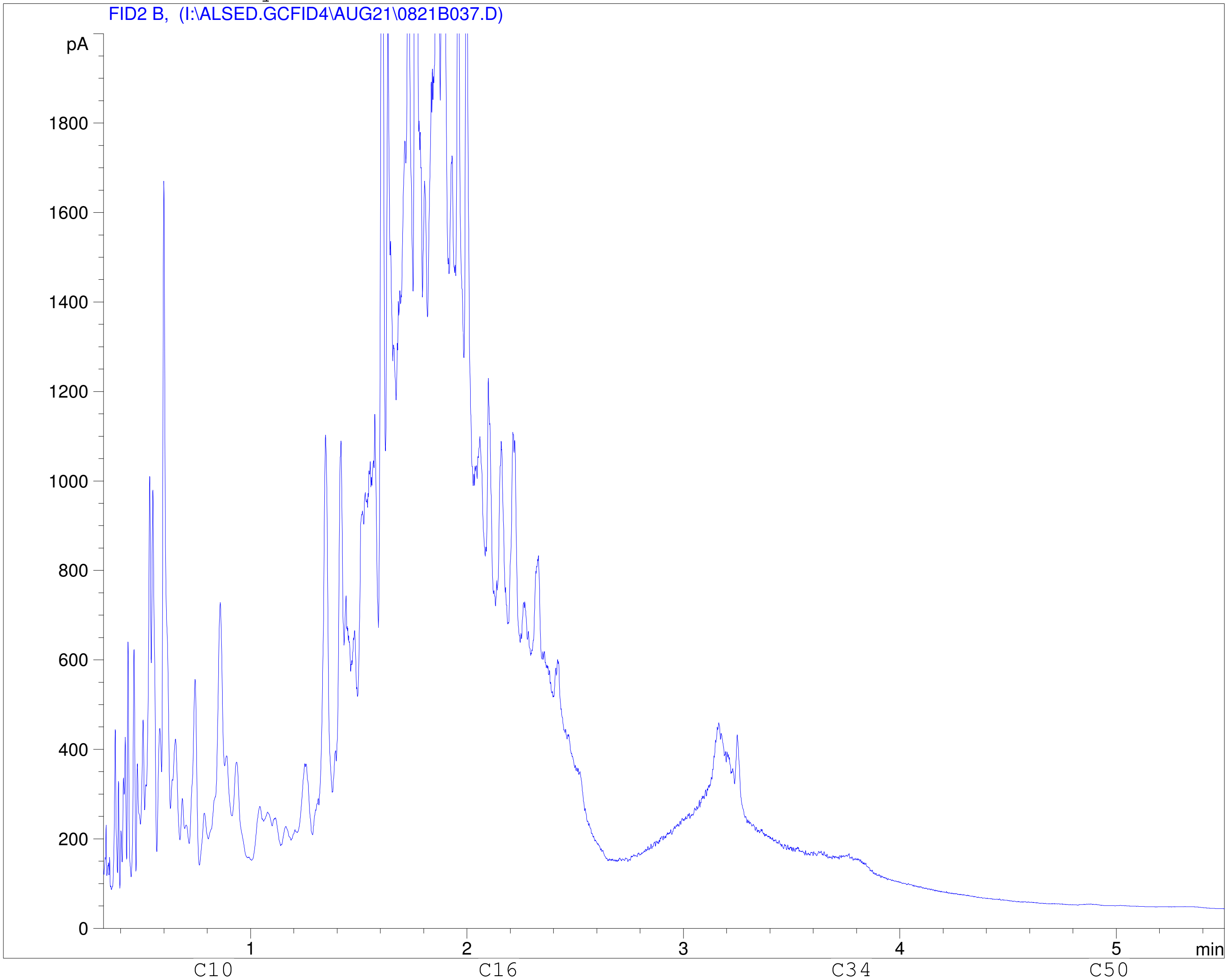


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: BLF09-SS-096

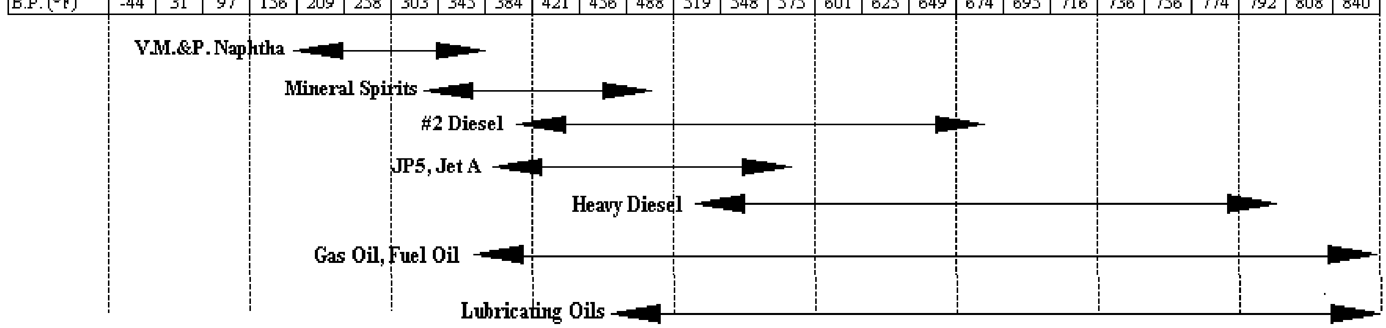
Sample ID: L806542-96 30
Injection Date: 8/22/2009 3:22:00 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

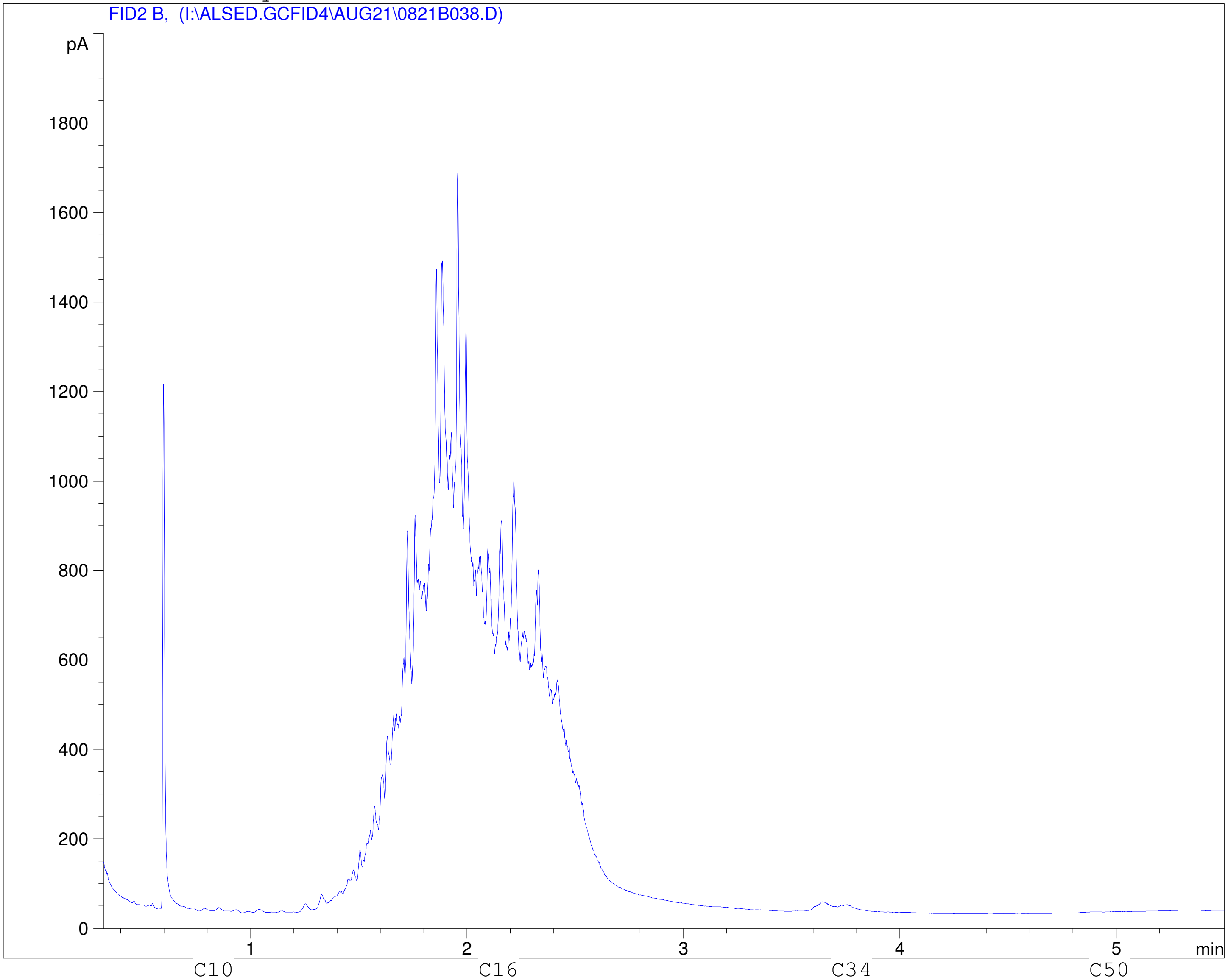


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: BLF09-SS-097

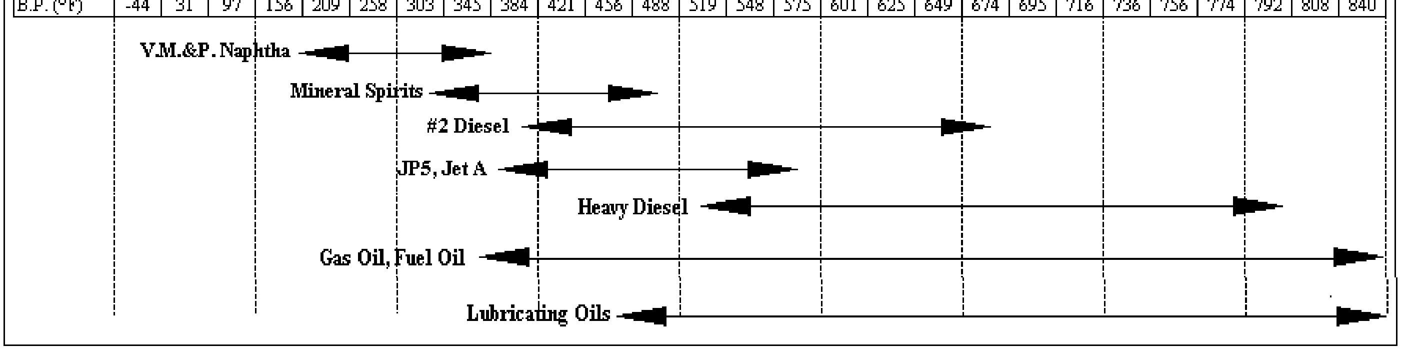
Sample ID: L806542-97 30
Injection Date: 8/22/2009 3:39:49 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

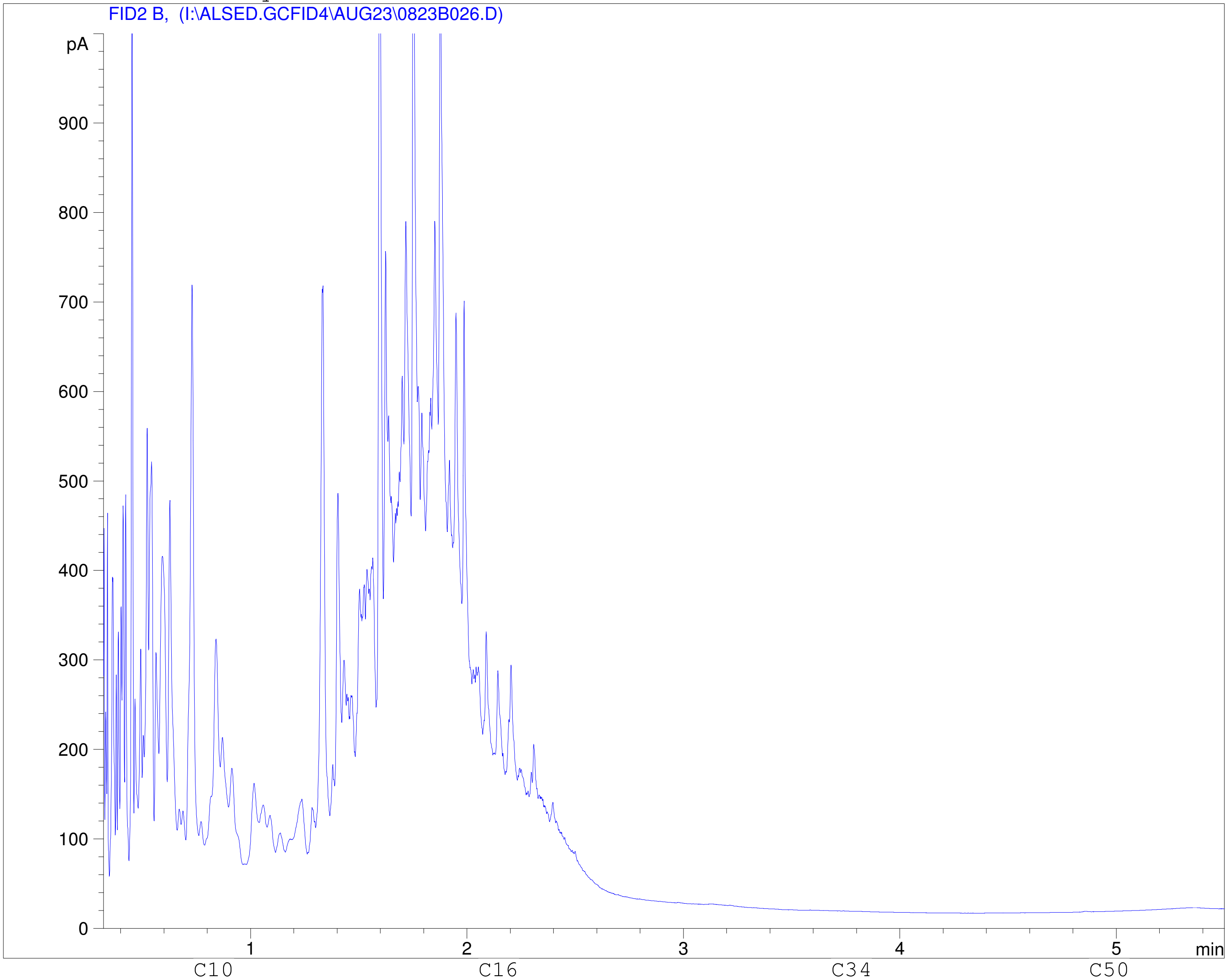


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: BLF09-SS-098

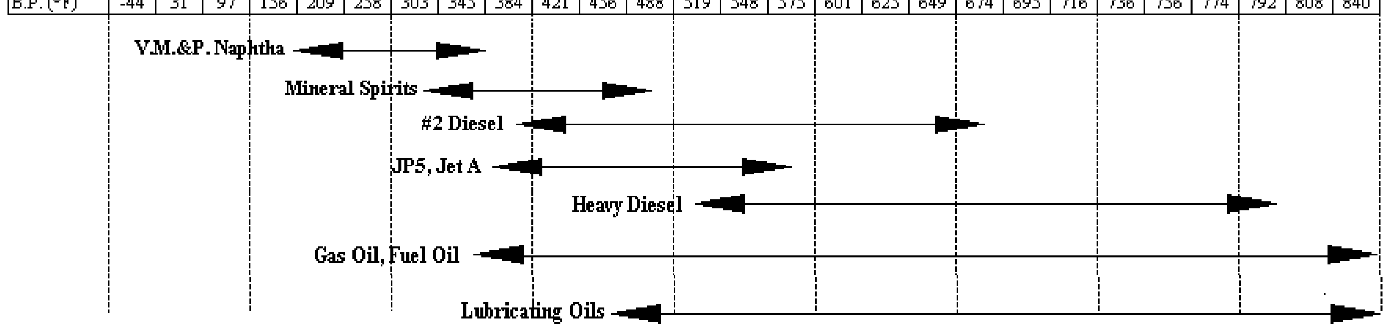
Sample ID: L806542-98 300
Injection Date: 8/24/2009 1:12:08 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840

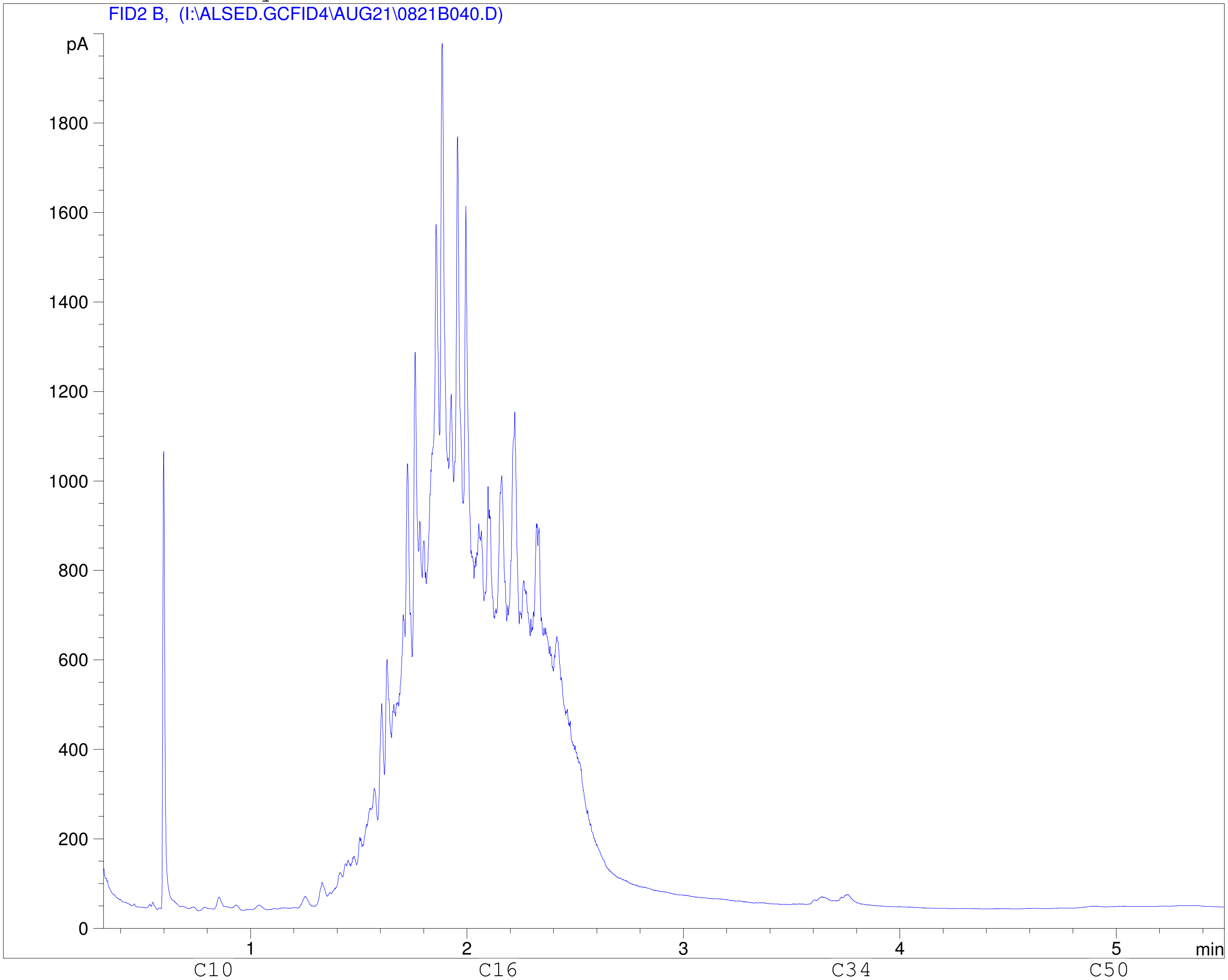


Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

Client ID: BLF09-SS-099

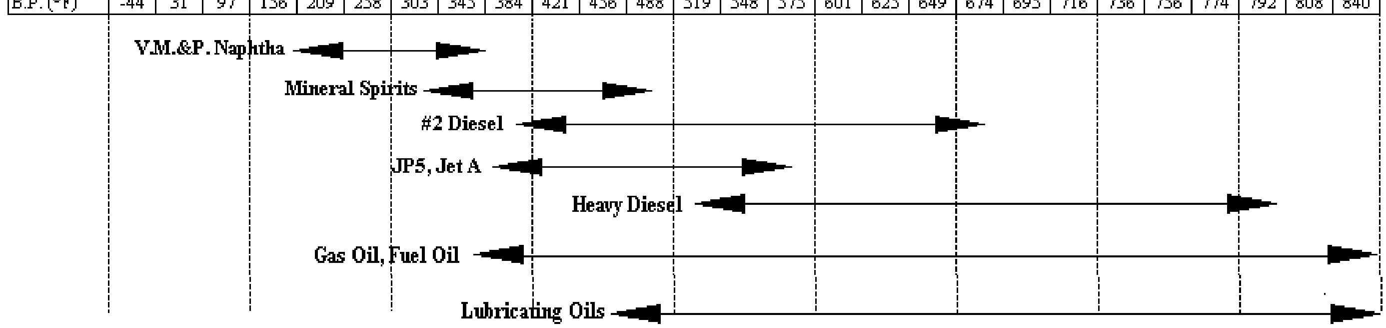
Sample ID: L806542-99 30
Injection Date: 8/22/2009 4:15:27 AM
Instrument: 6890

Total Extractable Hydrocarbons



Boiling Point Distribution Range of Petroleum Based Fuel Products

Carbon #	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30
B.P. (°C)	-42	-0.5	36	69	98	126	151	174	196	216	235	253	270	287	302	316	329	343	356	369	380	391	402	412	422	431	449
B.P. (°F)	-44	31	97	156	209	258	303	345	384	421	456	488	519	548	575	601	625	649	674	695	716	736	756	774	792	808	840



Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # ____________

Report To
Company: WESA
Contact: Wayne Ingham
Address: 3533-B McDonald Drive, Yellowknife, NT X1A 2H2
Phone: 867-446-2346 Fax: 867-873-3500

Invoice To Same as Report ? ☐ Yes ☑ No
Company: WESA
Contact: Wayne Ingham
Address: 3108 Carp Road, P.O. Box 430
Carp, ON K0A 1L0
Phone: (613) 839-3053 Fax: (613) 839-5376

Report Format / Distribution
☑ Standard ☐ Other
☑ PDF ☑ Excel ☐ Digital ☐ Fax
Email 1: ajenney@wesa.ca
Email 2: alaudrum@srk.com

Client / Project Information
Job #: YB7997
PO / AFE: Hope Bay
LSD:
Quote #: 21168

Service Requested (Rush for routine analysis subject to availability)
◉ Regular (Default)
○ Priority (Specify Date Required → →) Surcharges apply
○ Emergency (1 Business Day) - 100% Surcharge
○ For Emergency < 1 Day, ASAP or Weekend - Contact ALS

Lab Work Order # (lab use only): L806542
ALS Contact:
Sampler: WI/AJ

Analysis Request
Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	QWS F2-F4	BETX/F1	PAH	Metal Suite	Number of Containers
-1	PLF09-SS-001	13-Aug-09		Soil	X				1
-2	PLF09-SS-002	13-Aug-09		Soil	X				1
-3	PLF09-SS-003	13-Aug-09		Soil	X				1
-4	PLF09-SS-004	13-Aug-09		Soil	X				1
-5	PLF09-SS-005	13-Aug-09		Soil	X				1
-6	PLF09-SS-006	13-Aug-09		Soil	X				1
-7	PLF09-SS-007	13-Aug-09		Soil	X				1
-8	PLF09-SS-008	13-Aug-09		Soil	X			X	1
-9	PLF09-SS-009	13-Aug-09		Soil	X				1
-10	PLF09-SS-010	13-Aug-09		Soil	X				1
-11	PLF09-SS-011	13-Aug-09		Soil	X				1
-12	PLF09-SS-012	13-Aug-09		Soil	X				1

Special Instructions / Regulations / Hazardous Details

etc-tvh, Tehl-calc-ed

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

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Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # ______

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	WESA	☑ Standard ☐ Other		◉ Regular (Default)
Contact:	Wayne Ingham	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (Specify Date Required → →) Surcharges apply
Address:	3533-B McDonald Drive, Yellowknife, NT X1A 2H2	Email 1:	ajenney@wesa.ca	○ Emergency (1 Business Day) - 100% Surcharge
		Email 2:	alaudrum@srk.com	○ For Emergency < 1 Day, ASAP or Weekend - Contact ALS
Phone:	867-446-2346 Fax: 867-873-3500			**Analysis Request**
Invoice To	Same as Report ? ☐ Yes ☑ No	**Client / Project Information**		Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:	WESA	Job #:	YB7997	
Contact:	Wayne Ingham	PO / AFE:	Hope Bay	
Address:	3108 Carp Road, P.O. Box 430	LSD:		
	Carp, ON K0A 1L0			
Phone:	(613) 839-3053 Fax: (867) 839-5376	Quote #:	21168	
Lab Work Order # (lab use only)		ALS Contact:	Sampler: WI/AJ	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	QWS F2-F4	BTEX/F1	PAH	Metals Suite	Number of Containers
-13	WLF09-SS-013	14-Aug-09		Soil	X				1
-14	WLF09-SS-014	14-Aug-09		Soil	X				1
-15	WLF09-SS-015	14-Aug-09		Soil	X				1
-16	WLF09-SS-016	14-Aug-09		Soil	X				1
-17	WLF09-SS-017	14-Aug-09		Soil	X				1
-18	WLF09-SS-018	14-Aug-09		Soil	X				1
-19	WLF09-SS-019	14-Aug-09		Soil	X				1
-20	WLF09-SS-020	14-Aug-09		Soil	X				1
-21	WLF09-SS-021	14-Aug-09		Soil	X				1
-22	WLF09-SS-022	14-Aug-09		Soil	X				1
-23	WLF09-SS-023	14-Aug-09		Soil	X				1
-24	WLF09-SS-024 > broken	14-Aug-09		Soil	X	X			1

Special Instructions / Regulations / Hazardous Details

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Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

Chain of Custody / Analytical Request Form

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www.alsglobal.com

COC #

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	WESA	☑ Standard ☐ Other		◉ Regular (Default)
Contact:	Wayne Ingham	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (Specify Date Required → →) Surcharges apply
Address:	3533-B McDonald Drive, Yellowknife, NT X1A 2H2	Email 1:	ajenney@wesa.ca	○ Emergency (1 Business Day) - 100% Surcharge
		Email 2:	alaudrum@srk.com	○ For Emergency < 1 Day, ASAP or Weekend - Contact ALS
Phone:	867-446-2346 Fax: 867-873-3500			Analysis Request

Invoice To	Same as Report ? ☐ Yes ☑ No	Client / Project Information	
Company:	WESA	Job #:	YB7997
Contact:	Wayne Ingham	PO / AFE:	Hope Bay
Address:	3108 Carp Road, P.O. Box 430	LSD:	
	Carp, ON K0A 1L0		
Phone:	(613) 839-3053 Fax: (867) 839-5376	Quote #:	21168
Lab Work Order # (lab use only)		ALS Contact:	Sampler: WI/AJ

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	QWS F2-F4	BTEX/F1	PAH	Metals Suite	TCE	Number of Containers
-25	WLF09-SS-025	14-Aug-09		Soil	X					1
-26	WLF09-SS-026	14-Aug-09		Soil	X			X		1
-27	WLF09-SS-027	14-Aug-09		Soil	X			X		1
-28	WLF09-SS-028	14-Aug-09		Soil	X					1
-29	WLF09-SS-029	14-Aug-09		Soil	X					1
-30	WLF09-SS-030	14-Aug-09		Soil	X	X				1
-31	WLF09-SS-031	14-Aug-09		Soil	X	X				1
-32	WLF09-SS-032	14-Aug-09		Soil	X		X		X	1
-33	WLF09-SS-033	14-Aug-09		Soil	X		X			1
-34	WLF09-SS-034	14-Aug-09		Soil	X			X		1
-35	WLF09-SS-035	14-Aug-09		Soil	X					1
-36	WLF09-SS-036	14-Aug-09		Soil	X					1

Special Instructions / Regulations / Hazardous Details

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Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

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Environmental Division

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
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COC #

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	WESA	☑ Standard ☐ Other		◉ Regular (Default)
Contact:	Wayne Ingham	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (Specify Date Required → →) Surcharges apply
Address:	3533-B McDonald Drive, Yellowknife, NT X1A 2H2	Email 1:	ajenney@wesa.ca	○ Emergency (1 Business Day) - 100% Surcharge
		Email 2:	alaudrum@srk.com	○ For Emergency < 1 Day, ASAP or Weekend - Contact ALS
Phone:	867-446-2346 Fax: 867-873-3500			

Invoice To	Same as Report ? ☐ Yes ☑ No	Client / Project Information	
Company:	WESA	Job #:	YB7997
Contact:	Wayne Ingham	PO / AFE:	Hope Bay
Address:	3108 Carp Road, P.O. Box 430	LSD:	
	Carp, ON K0A 1L0		
Phone:	(613) 839-3053 Fax: (867) 839-5376	Quote #:	21168
Lab Work Order # (lab use only)		ALS Contact:	Sampler: WI/AJ

Analysis Request — Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	QWS F2-F4	BETX/F1	PAH	Metals Suite									Number of Containers
-37	WLF09-SS-037	14-Aug-09		Soil	X												1
-38	PLF09-SS-038	15-Aug-09		Soil	X												1
-39	PLF09-SS-039	15-Aug-09		Soil	X												1
-40	PLF09-SS-040	15-Aug-09		Soil	X												1
-41	PLF09-SS-041	15-Aug-09		Soil	X												1
-42	PLF09-SS-042	15-Aug-09		Soil	X												1
-43	PLF09-SS-043	15-Aug-09		Soil	X												1
-44	PLF09-SS-044	15-Aug-09		Soil	X												1
-45	PLF09-SS-045	15-Aug-09		Soil	X												1
-46	PLF09-SS-046	15-Aug-09		Soil	X												1
-47	PLF09-SS-047	15-Aug-09		Soil	X	X											1
-48	PLF09-SS-048	15-Aug-09		Soil	X			X									1

Special Instructions / Regulations / Hazardous Details

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SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # ______

Report To		Report Format / Distribution	Service Requested (Rush for routine analysis subject to availability)
Company:	WESA	☑ Standard ☐ Other	◉ Regular (Default)
Contact:	Wayne Ingham	☑ PDF ☑ Excel ☐ Digital ☐ Fax	○ Priority (Specify Date Required → →) Surcharges apply
Address:	3533-B McDonald Drive, Yellowknife, NT X1A 2H2	Email 1: ajenney@wesa.ca	○ Emergency (1 Business Day) - 100% Surcharge
		Email 2: alaudrum@srk.com	○ For Emergency < 1 Day, ASAP or Weekend - Contact ALS
Phone:	867-446-2346 Fax: 867-873-3500		

Invoice To	Same as Report ? ☐ Yes ☑ No	Client / Project Information
Company:	WESA	Job #: YB7997
Contact:	Wayne Ingham	PO / AFE: Hope Bay
Address:	3108 Carp Road, P.O. Box 430	LSD:
	Carp, ON K0A 1L0	
Phone:	(613) 839-3053 Fax: (867) 839-5376	Quote #: 21168
Lab Work Order # (lab use only)		ALS Contact: / Sampler: WI/AJ

Analysis Request — Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	QWS F2-F4	BETX/F1	PAH	Metals Suite	TCE								Number of Containers
-49	PLF09-SS-049	15-Aug-09		Soil	X	X		X									1
-50	PLF09-SS-050	15-Aug-09		Soil	X												1
-51	PLF09-SS-051	15-Aug-09		Soil	X												1
-52	PLF09-SS-052	15-Aug-09		Soil	X												1
-53	PLF09-SS-053	15-Aug-09		Soil	X												1
-54	PLF09-SS-054	15-Aug-09		Soil	X												1
-55	PLF09-SS-055	15-Aug-09		Soil	X	X											1
-56	PLF09-SS-056	15-Aug-09		Soil	X				X								1
-57	PLF09-SS-057	15-Aug-09		Soil	X												1
-58	PLF09-SS-058	15-Aug-09		Soil	X												1
-59	PLF09-SS-059	15-Aug-09		Soil	X												1
-60	PLF09-SS-060	15-Aug-09		Soil	X												1

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SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

ALS Laboratory Group
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Environmental Division

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COC # ____________

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Company:	WESA	☑ Standard ☐ Other	◉ Regular (Default)
Contact:	Wayne Ingham	☑ PDF ☑ Excel ☐ Digital ☐ Fax	○ Priority (Specify Date Required → →) Surcharges apply
Address:	3533-B McDonald Drive, Yellowknife, NT X1A 2H2	Email 1: ajenney@wesa.ca	○ Emergency (1 Business Day) - 100% Surcharge
		Email 2: alaudrum@srk.com	○ For Emergency < 1 Day, ASAP or Weekend - Contact ALS
Phone:	867-446-2346 Fax: 867-873-3500		

Invoice To	Same as Report ? ☐ Yes ☑ No	Client / Project Information	
Company:	WESA	Job #:	YB7997
Contact:	Wayne Ingham	PO / AFE:	Hope Bay
Address:	3108 Carp Road, P.O. Box 430	LSD:	
	Carp, ON K0A 1L0		
Phone:	(613) 839-3053 Fax: (867) 839-5376	Quote #:	21168

Lab Work Order # (lab use only) | ALS Contact: | Sampler: WI/AJ

Analysis Request
Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	QWS F2-F4	BETX/F1	PAH	TCE									Number of Containers
-61	PLF09-SS-061	15-Aug-09		Soil	X												1
-62	PLF09-SS-062	15-Aug-09		Soil	X	X		X									1
-63	PLF09-SS-063	15-Aug-09		Soil	X												1
-64	PLF09-SS-064	15-Aug-09		Soil	X												1
-65	PLF09-SS-065	15-Aug-09		Soil	X												1
-66	PLF09-SS-066	15-Aug-09		Soil	X												1
-67	PLF09-SS-067	15-Aug-09		Soil	X												1
-68	PLF09-SS-068	15-Aug-09		Soil	X												1
-69	PLF09-SS-069	15-Aug-09		Soil	X												1
-70	PLF09-SS-070	15-Aug-09		Soil	X												1
-71	PLF09-SS-071	15-Aug-09		Soil	X												1
-72	WLF09-SS-072	15-Aug-09		Soil	X												1

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SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

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Company:	WESA	☑ Standard ☐ Other		◉ Regular (Default)
Contact:	Wayne Ingham	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (Specify Date Required → →) Surcharges apply
Address:	3533-B McDonald Drive, Yellowknife, NT X1A 2H2	Email 1:	ajenney@wesa.ca	○ Emergency (1 Business Day) - 100% Surcharge
		Email 2:	alaudrum@srk.com	○ For Emergency < 1 Day, ASAP or Weekend - Contact ALS
Phone:	867-446-2346 Fax: 867-873-3500			**Analysis Request**
Invoice To	Same as Report ? ☐ Yes ☑ No	Client / Project Information		Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:	WESA	Job #:	YB7997	
Contact:	Wayne Ingham	PO / AFE:	Hope Bay	
Address:	3108 Carp Road, P.O. Box 430	LSD:		
	Carp, ON K0A 1L0			
Phone:	(613) 839-3053 Fax: (613) 839-5376	Quote #:	21168	
Lab Work Order # (lab use only)		ALS Contact:	Sampler: WI/AJ	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	QWS F2-F4	BTEX/F1	PAH	Metals Suite	TCE								Number of Containers
-73	WLF09-SS-073	15-Aug-09		Soil	X	X											1
-74	WLF09-SS-074	15-Aug-09		Soil	X												1
-75	WLF09-SS-075	15-Aug-09		Soil	X												1
-76	WLF09-SS-076	15-Aug-09		Soil	X												1
-77	PLF09-SS-077	16-Aug-09		Soil	X		X	X									1
-78	PLF09-SS-078	16-Aug-09		Soil	X												1
-79	PLF09-SS-079	16-Aug-09		Soil	X		X	X									1
-80	PLF09-SS-080	16-Aug-09		Soil	X			X									1
-81	PLF09-SS-081	16-Aug-09		Soil	X			X									1
-82	PLF09-SS-082	16-Aug-09		Soil	X												1
-83	PLF09-SS-083	16-Aug-09		Soil	X		X	X	X								1
-84	PLF09-SS-084	16-Aug-09		Soil	X			X									1

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SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

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COC # ____________

Report To
Company: WESA
Contact: Wayne Ingham
Address: 3533-B McDonald Drive, Yellowknife, NT X1A 2H2
Phone: 867-446-2346 Fax: 867-873-3500

Invoice To Same as Report ? ☐ Yes ☑ No
Company: WESA
Contact: Wayne Ingham
Address: 3108 Carp Road, P.O. Box 430
Carp, ON K0A 1L0
Phone: (613) 839-3053 Fax: (613) 839-5376

Report Format / Distribution
☑ Standard ☐ Other
☑ PDF ☑ Excel ☐ Digital ☐ Fax
Email 1: ajenney@wesa.ca
Email 2: alaudrum@srk.com

Client / Project Information
Job #: YB7997
PO / AFE: Hope Bay
LSD:
Quote #: 21168

ALS Contact:
Sampler: WI/AJ

Service Requested (Rush for routine analysis subject to availability)
◉ Regular (Default)
○ Priority (Specify Date Required → →) Surcharges apply
○ Emergency (1 Business Day) - 100% Surcharge
○ For Emergency < 1 Day, ASAP or Weekend - Contact ALS

Analysis Request
Please indicate below Filtered, Preserved or both (F, P, F/P)

Lab Work Order # (lab use only)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	QWS F2-F4	BTEX/F1	PAH	Metals Suite	TCE	Number of Containers
-85	PLF09-SS-085	16-Aug-09		Soil	X			X		1
-86	PLF09-SS-086	16-Aug-09		Soil	X					1
-87	WLF09-SS-087	16-Aug-09		Soil	X			X		1
-88	WLF09-SS-088	16-Aug-09		Soil	X					1
-89	WLF09-SS-089	16-Aug-09		Soil	X					1
-90	WLF09-SS-090	16-Aug-09		Soil	X			X		1
-91	WLF09-SS-091	16-Aug-09		Soil	X					1
-92	WLF09-SS-092	16-Aug-09		Soil	X				X	1
-93	WLF09-SS-093	16-Aug-09		Soil	X	X				1
-94	WLF09-SS-094	16-Aug-09		Soil	X	X				1
-95	BLF09-SS-095	16-Aug-09		Soil	X					1
-96	BLF09-SS-096	16-Aug-09		Soil	X					1

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Contact:	Wayne Ingham	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (Specify Date Required → →) Surcharges apply
Address:	3533-B McDonald Drive, Yellowknife, NT X1A 2H2	Email 1:	ajenney@wesa.ca	○ Emergency (1 Business Day) - 100% Surcharge
		Email 2:	alaudrum@srk.com	○ For Emergency < 1 Day, ASAP or Weekend - Contact ALS
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Contact:	Wayne Ingham	PO / AFE:	Hope Bay	
Address:	3108 Carp Road, P.O. Box 430	LSD:		
	Carp, ON K0A 1L0			
Phone:	(613) 839-3053 Fax:	Quote #:	21168	
Lab Work Order # (lab use only)		ALS Contact:	Sampler: WI/AJ	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	QWS F2-F4	BTEX/F1	PAH										Number of Containers
-97	BLF09-SS-097	16-Aug-09		Soil	X												1
-98	BLF09-SS-098	16-Aug-09		Soil	X												1
-99	BLF09-SS-099	16-Aug-09		Soil	X												1
-100	BLF09-SS-100	16-Aug-09		Soil	X												1
-101	BLF09-SS-101	16-Aug-09		Soil	X												1
102	BLF09-SS-102	16-Aug-09		Soil	X												1
103	BLF09-SS-103	16-Aug-09		Soil	X												1
104	BLF09-SS-104	16-Aug-09		Soil	X												1
105	BLF09-SS-105	16-Aug-09		Soil	X												1
106	PLF09-GW-106	16-Aug-09		Groundwater	X												1
107	PLF09-GW-107 → rec'd broken ml	16-Aug-09		Groundwater	X												1
108	PLF09-GW-108	16-Aug-09		Groundwater	X												1

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Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

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ANALYTICAL CHEMISTRY & TESTING SERVICES

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COC # ____________

Report To
Company: WESA
Contact: Wayne Ingham
Address: 3533-B McDonald Drive, Yellowknife, NT X1A 2H2
Phone: 867-446-2346 Fax: 867-873-3500

Invoice To Same as Report ? ☐ Yes ☑ No
Company: WESA
Contact: Wayne Ingham
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Report Format / Distribution
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Client / Project Information
Job #: YB7997
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Analysis Request
Please indicate below Filtered, Preserved or both (F, P, F/P)

Lab Work Order # (lab use only)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	QWS F2-F4	BTEX/F1	PAH	Number of Containers
109	PLF09-GW-109 — rec broken [illegible]	16-Aug-09		Groundwater	X			1
110	PLF09-GW-110	16-Aug-09			X	X		4
111	WLF09-GW-111	16-Aug-09			X			1
112	WLF09-GW-112	16-Aug-09			X			1
113	WLF09-GW-113	16-Aug-09			X	X		4
								1
								1
								1
								1
								1
								1
								1

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ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

Certificate of Analysis

WESA
ATTN: WAYNE INGHAM
3533-B MCDONALD DRIVE
YELLOWKNIFE NT X1A 2H2

Report Date: 28-AUG-09 16:57 (MT)
Version: FINAL

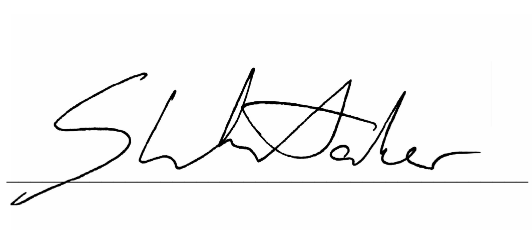
Lab Work Order #: **L809610** **Date Received:** **25-AUG-09**

Project P.O. #: HOPE BAY
Job Reference: YB7997
Legal Site Desc:
CofC Numbers:

Other Information:

Comments: Here are the two water samples submitted on Monday.

Regards
Sean Whitaker



ALS LABORATORY GROUP ANALYTICAL REPORT

	Sample ID	L809610-1	L809610-2			
	Description	GROUND WATE	GROUND WATE			
	Sampled Date	24-AUG-09	24-AUG-09			
	Sampled Time					
	Client ID	PLF-GW-109	PLF-GW-115			
Grouping	**Analyte**					
WATER						
Hydrocarbons	F2 (>C10-C16) (mg/L)	<0.25	<0.25			
	F3 (C16-C34) (mg/L)	<0.25	<0.25			
	F4 (C34-C50) (mg/L)	<0.25	<0.25			

Reference Information

Additional Comments for Sample Listed:

Samplenum	Matrix	Report Remarks	Sample Comments

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
F2,F3,F4-ED	Water	F2, F3, F4	EPA 3510/CCME PHC CWS-GC-FID

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.
The last two letters of the above ALS Test Code column indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
ED	ALS LABORATORY GROUP - EDMONTON, ALBERTA, CANADA		

GLOSSARY OF REPORT TERMS
Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in enviromental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.
The reported surrogate recovery value provides a measure of method efficiency.
mg/kg (units) - unit of concentration based on mass, parts per million
mg/L (units) - unit of concentration based on volume, parts per million
N/A - Result not available. Refer to qualifier code and definition for explanation

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

ALS Laboratory Group Quality Control Report

Workorder: L809610 Report Date: 28-AUG-09

Client: WESA
3533-B MCDONALD DRIVE
YELLOWKNIFE NT X1A 2H2
Contact: WAYNE INGHAM

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2,F3,F4-ED	**Water**							
Batch **R924927**								
WG995585-2 **LCS**								
F2 (>C10-C16)			98		%		65-135	27-AUG-09
F3 (C16-C34)			98		%		65-135	27-AUG-09
F4 (C34-C50)			98		%		65-135	27-AUG-09
WG995585-1 **MB**								
F2 (>C10-C16)			<0.25		mg/L		0.25	27-AUG-09
F3 (C16-C34)			<0.25		mg/L		0.25	27-AUG-09
F4 (C34-C50)			<0.25		mg/L		0.25	27-AUG-09
WG995585-3 **MS**		**L810381-4**						
F2 (>C10-C16)			101		%		50-150	27-AUG-09
F3 (C16-C34)			101		%		50-150	27-AUG-09
F4 (C34-C50)			101		%		50-150	27-AUG-09

ALS Laboratory Group Quality Control Report

Legend:

Limit	99% Confidence Interval (Laboratory Control Limits)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

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COC #

Report To		Report Format / Distribution	Service Requested (Rush for routine analysis subject to availability)
Company:	WESA	☑ Standard ☐ Other	◉ Regular (Default)
Contact:	Wayne Ingham	☑ PDF ☑ Excel ☐ Digital ☐ Fax	○ Priority (Specify Date Required → →) Surcharges apply
Address:	3533-B McDonald Drive, Yellowknife, NT X1A 2H2	Email 1: ajenney@wesa.ca	○ Emergency (1 Business Day) - 100% Surcharge
		Email 2: alaudrum@srk.com	○ For Emergency < 1 Day, ASAP or Weekend - Contact ALS
Phone:	867-446-2346 Fax: 867-873-3500		Analysis Request
Invoice To	Same as Report ? ☐ Yes ☑ No	Client / Project Information	Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:	WESA	Job #: YB7997	
Contact:	Wayne Ingham	PO / AFE: Hope Bay	
Address:	3108 Carp Road, P.O. Box 430	LSD:	
Phone:	(613) 839-3053 Fax: (613) 839-5376	Quote #: 21168	
Lab Work Order # (lab use only)		ALS Contact: Sampler: WI/AJ	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	QWS F2-F4	BTEX/F1	PAH										Number of Containers
	PLF-GW-109	24-Aug-00		Groundwater	X												1
	PLF-GW-115	24-Aug-00		Groundwater	X												1

Special Instructions / Regulations / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

Appendix B.3

WESA 2009 – Derivation of Risk-Based Hydrocarbon Remediation Criteria

2009

Hope Bay Gold Project: Derivation of Risk-Based Hydrocarbon Remediation Criteria for Patch Lake Workshop and Windy Camp

Prepared for:

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WESA

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EXECUTIVE SUMMARY

Impacted soil (principally due to the presence of petroleum hydrocarbons) has been identified at two facilities that are part of the Hope Bay Regional Exploration Project located on Inuit owned land in the West Kitikmeot region of Nunavut, Canada.

Hope Bay Mining Limited (HBML) proposes to progressively reclaim Patch Lake Workshop and Windy Camp facilities and submit updated Closure and Reclamation Plans to the Nunavut Water Board as required by Licence No. 2BE-HOP0712.

One of the early steps in the overall process of identifying where and how soil, surface water, groundwater, or sediment may need to be remediated or otherwise managed is to compare measured concentrations of chemicals in those environmental media to maximum acceptable concentrations set by government agencies.

For the facilities at Hope Bay, an appropriate source of maximum acceptable concentrations is the Canadian Council of Ministers of the Environment (CCME) and the generic guidelines and similar values that the CCME has recommended for soil, water, and sediment. Another source is the Nunavut Site Remediation Guidelines.

This report describes a preliminary derivation of risk-based, site specific values (referred to in this report as "criteria") that subsequently could be used use during remediation activities at the Patch Lake and Windy Camp facilities in place of most stringent of the generic CCME values. The site specific criteria are not based on the detailed calculations of exposure and risk typically found in risk assessments. Rather they are selected from values published in CCME reports that describe the risk-based steps in the processes used by the CCME to arrive at the final generic values that are intended to be broadly applicable across the country. Due to the remote Arctic locations of the sites, some of the steps in those processes are not relevant or applicable to Patch Lake and Windy Camp, the site specific values can be different than the final generic values.

The chemicals of potential concern (COPCs) are the four fractions of petroleum hydrocarbons (often abbreviated as PHC F1, F2, F3, and F4). Each of these parameters has been measured in one or more soil samples that exceed the corresponding CCME generic value. There are no COPCs in ground water.

For the four PHC fractions, the site specific criteria are higher than the generic CCME values initially used to identify the four fractions as COPCs. The generic values consider various exposure pathways or scenarios, some of which will not exist when the Patch Lake and Windy Camp facilities have been closed and remediated. For example, no structures will remain, so the inhalation of indoor vapours (a key consideration in the generic value for PHC F1) will not be possible. For the other three fractions, the site specific remediation criteria are set equal to ecological values recommended by the CCME but for less stringent site uses or soil texture than originally assumed to identify these fractions as COPCs.

All of the site specific criteria are less than any of the other relevant exposure pathway values published by the CCME for the COPCs. None of the site specific criteria exceed the maximum acceptable concentrations for protecting human health from exposures due to soil ingestion or dermal contact. None exceed the “management limits” set for the PHC fractions.

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1.0 INTRODUCTION

1.1 TERMS OF REFERENCE

Impacted soil (principally due to the presence of petroleum hydrocarbons) has been identified at two facilities that are part of the Hope Bay Regional Exploration Project located on Inuit owned land in the West Kitikmeot region of Nunavut, Canada.

Hope Bay Mining Limited (HBML) propose to progressively reclaim Patch Lake Workshop and Windy Camp facilities and submit updated Closure and Reclamation Plans to the Nunavut Water Board as required by Licence No. 2BE-HOP0712.

The Closure and Reclamation Plans need to reflect the information presented in the Indian and Northern Affairs Canada (INAC) *Mine Site Reclamation Policy for Nunavut, 2002*, the INAC *Mine Site Reclamation Guidelines for the Northwest Territories, 2006* and meet requirements specified in Licence No. 2BE-HOP0712.

One of the early steps in the overall process of identifying where and how soil, surface, water, ground water, or sediment may need to be remediated or otherwise managed is to compare measured concentrations of chemicals in those environmental media to maximum acceptable concentrations set by government agencies.

For the facilities at Hope Bay, an appropriate source of maximum acceptable concentrations is the document entitled *Canada-wide Standards for Petroleum Hydrocarbons (PHC) in Soil* (CCME, 2008).

The majority of the Canada-wide standards for PHCs in soil are intended to be protective of human health and the environment for a wide range of locations and environmental conditions. There are relatively few situations where the values are not adequately protective and many situations where the values are overly protective. When it is felt that the "generic" values are inappropriate, there is the option to use risk assessment to recommend "site specific" values.

Risk assessment often involves the use of equations (typically assembled into spreadsheets or models) to estimate the potential risks that chemicals in the environment can pose to the people and ecological receptors (plants and animals) that can come into contact with the chemicals. The models often include many parameters that describe the specific site, the people, and the animals and plants. The values assigned to these parameters can be based on site specific measurements, values reported in the literature, or based on professional judgment.

In August 2009, WESA Inc. was retained by SRK on behalf of HBML to develop risk-based, site specific remedial objectives or values (referred to in this report as "criteria") that subsequently could be used in place of generic CCME values.

This report describes a preliminary derivation of risk-based, site specific criteria for use during remediation activities at the Patch Lake and Windy Camp facilities. The site specific criteria are not based on the detailed calculations of exposure and risk typically found in risk assessments. Rather they are selected from values published in CCME reports that describe the risk-based steps in the processes used by the CCME to arrive at the final generic values that are intended to be broadly applicable across the country. Since some of the steps in those processes are not relevant or applicable to Patch Lake and Windy Camp, the site specific values can be different than the final generic values.

The approach described in this report largely is a qualitative evaluation of the potential for chemicals in the environment to affect human health and ecological organisms including plants and animals. Although qualitative, it addresses the same questions that would need to be addressed in a quantitative risk assessment: What are the chemicals of interest? Where have those chemicals been found and at what concentrations? Who might come into contact with the chemicals? How could this contact or exposure occur? What types of effects can be caused by the exposure? At what doses can those effects occur?

The site specific information used in this report comes from investigations described in reports prepared by SRK Consulting and a recent soil and ground water quality investigation by WESA. Sample collection and handling methodologies, quality control procedures, and the original laboratory data sheets are provided in those reports and are not repeated in this report.

1.2 THE FACILITIES

The Hope Bay project is located in the West Kitikmeot region of Nunavut approximately 135 km southwest of Cambridge Bay and 50 km east of Umingmaktok. It is centered at approximately 68º 09' N and 106º 40' W. There are facilities at several locations that extend from the head of Roberts Bay (an extension of Melville Sound) in the north to the Boston site located approximately 60 km to the south (SRK, 2009a).

The Patch Lake facilities are located near the north end of Patch Lake (see Figure 1). It is located on a bedrock ridge approximately 60 m west of the lake and approximately 10 to 14 m above the high water level in the lake. The facilities have included a drill maintenance workshop (also referred to as the Major Drilling shop complex), laydown yards, and fuel storage facilities (six new above ground storage tanks). The drill maintenance shop has been decommissioned and materials removed. The fuel storage facilities will continue to be utilized for exploration activities in the Hope Bay Belt.

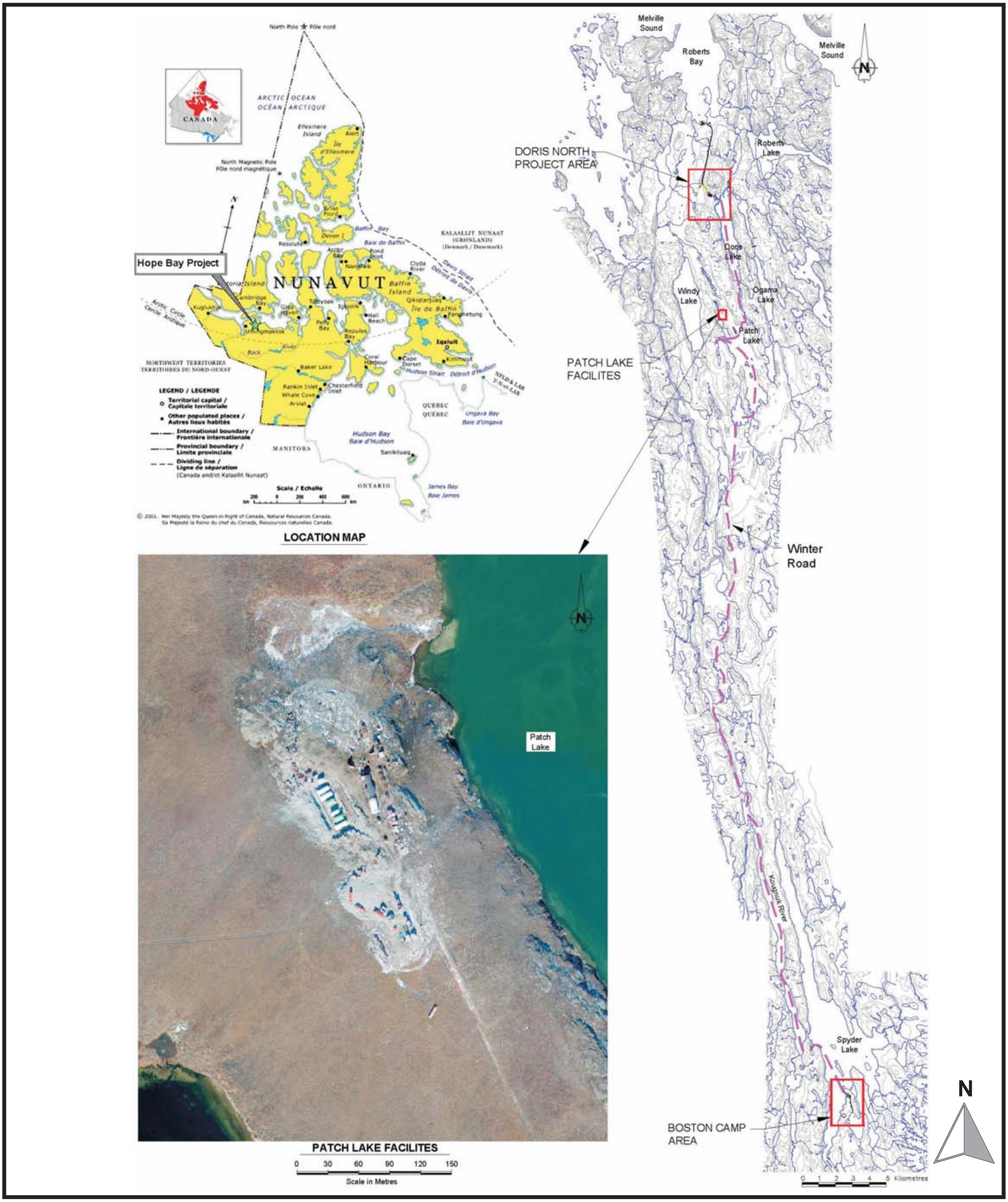
Prior to the laboratory analysis of samples in 2009, soil appearance, odours, vapour readings, and field tests of total petroleum hydrocarbon content were used to identify five areas at Patch Lake where soil is impacted with petroleum hydrocarbons:

- The staging area at the north end of the site and the alternative winter access road route to the lake.
- The area around the drill shop, adjacent storage yard, and surface water drainage pathway leading away from those areas.
- A former tank farm and fuel storage area at the south end of the site and the associated surface water drainage paths leading toward Patch Lake.
- Soil within the existing Fuel Tank Farm basin.
- The area where discharge from the existing Fuel Tank Farm settles.

Windy Camp is located approximately 2 km southwest of the Patch Lake facilities (Figure 2). It included tents/tent frames for temporary residences, office, dining room, kitchen and to store supplies. A short distance to the southeast is a laydown area for old barrels, scrap metal and equipment, a helicopter pad and fuel storage area.

The facilities are accessible from other Hope Bay facilities by winter roads. In summer, the facilities are accessible by foot or helicopter. Diesel powered generating stations are used to provide electricity. Water is/was drawn from Patch Lake and Windy Lake. Ground water is not used.

Both facilities store and use petroleum hydrocarbons, principally diesel fuel and Jet B.



MAP REFERENCE: SRK CONSULTING CANADA - MAY 2009

FIGURE 1:

PATCH LAKE FACILITIES AND SITE LOCATION MAP

HOPE BAY PROJECT

YB7997-PL-SLM

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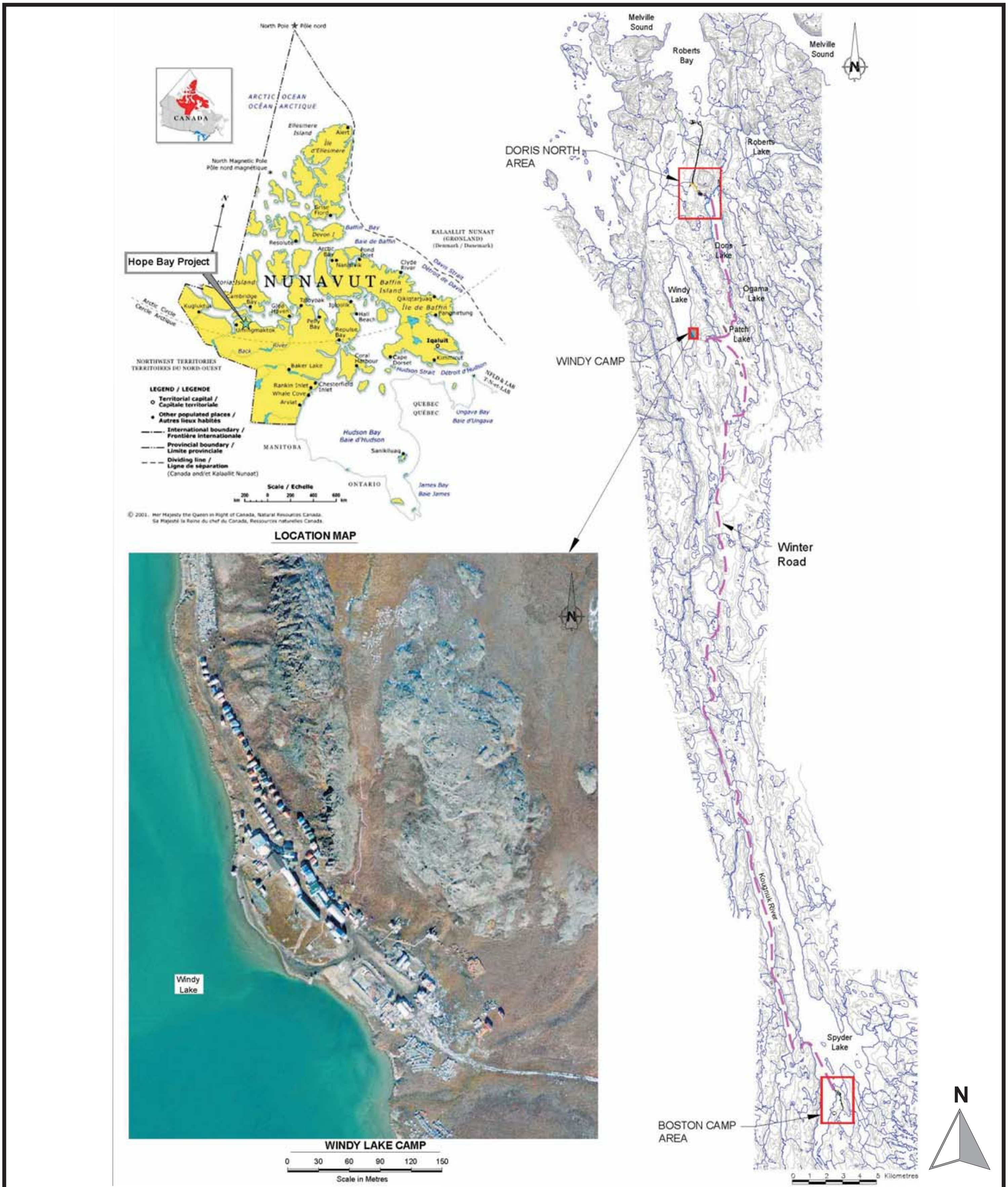

MAP REFERENCE: SRK CONSULTING CANADA - MAY 2009

FIGURE 2:

WINDY CAMP FACILITIES AND SITE LOCATION MAP

HOPE BAY PROJECT

YB7997-WC-SLM

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1.3 ENVIRONMENTAL CONDITIONS OF INTEREST

The following text is a shortened version of longer descriptions provided in the Phase II Screening Assessment report (SRK, 2009a) where there are numerous references and more discussion of the monitoring programs that have been conducted at the Hope Bay Project area since the mid-1990s.

Climate

The Hope Bay Belt has a low arctic eco-climate with a mean annual temperature of –12.1 °C. The average monthly air temperature is above 0 °C between June and September with the peak in July, and below freezing between October and May with the coldest temperatures usually occurring in February. Mean daily temperatures range from - 50 to +11°C in winter (October to May), and -14 to +30 °C in summer (June to September).

Mean annual precipitation ranges from 94 to 207 mm with 41% occurring as rain between May and October and 59% as snow through the remainder of the year.

Annual lake evaporation (typically occurring between June and September) is estimated to be 220 mm.

Concentrations of total suspended particulate (TSP) matter were consistently low, ranging from 3.9 to 5.5 μg/m³, which is less than 5% of the federal objective (120 μg/m³) for TSP. Concentrations of sulphur dioxide, oxides of nitrogen and fine particles are also expected to be low in the Project area.

Geomorphology

The Project area is coastal lowland with numerous lakes and ponds separated by glacial landforms and parallel bedrock ridges of diabase dykes and sills. The drainage basins are generally long and narrow and predominantly oriented along the north-south axis. Bedrock units show the erosive effects of the northward flowing Pleistocene (Keewatin Lobe) continental glacier ice over 10,000 years ago.

The topography within the Project ranges from sea level at Roberts Bay to 158 m above sea level (asl) at the summit of Doris mesa, 3 km inland. The ridge separating Doris and Tail lake drainages rises to 70 m asl.

Surficial Geology and Permafrost Conditions

Ground temperature measurements in the Hope Bay Project area indicate an active zone thickness ranging between 1.5 to 2.6 m.

Most of the soils are of marine origin and include clay, silt and some sand. Surface materials include frost-churned mineral and organic soils mantled by a thin cover of tundra vegetation.

Small, frost-heaved clay-silt polygons are common. Linear frost cracks occur in raised marine spit deposits. Ice wedge polygons are common.

Pleistocene deposits, including till, are buried beneath marine sediments deposited during the post-glacial marine emergence.

Continuous permafrost extends to depths of more than 500 m.

Bedrock Geology

The Hope Bay Belt occurs in the Slave Structural Province, a geological sub-province of the Canadian Shield. The region is underlain by the late Archean Hope Bay Greenstone Belt. This geological formation ranges from 7 to 20 km wide and is more than 80 km long. It is oriented in a north-south direction. It is mainly comprised of mafic volcanic and sedimentary rocks that are bound by Archean granite intrusives and gneisses. Archean volcanic greenstone hosts many of Canada's precious and base metal mines (*e.g.*, Yellowknife, Timmins, Rouyn-Noranda).

Ground Water Conditions

The permafrost underlying the area is generally impervious to groundwater movements. Groundwater movement will only occur in the shallow active layer (to a depth of between 1.5 to 2.6 m) during its seasonal thaw period. This was confirmed by water levels measured in August 2009.

Hydrology

The Hope Bay Project area drains north into the Arctic Ocean. Windy Camp and Patch Lake drain into Roberts Bay and Boston drains into Hope Bay. Peak flows typically occur in June during snowmelt. A second smaller peak may occur from rainfall in late August or early September. The streams in the study area are usually frozen with negligible flow from November until May.

Water Quality

Water quality samples were collected from area lakes, streams, and the nearby marine environment between 1995 and 2006.

Water in the takes is soft, neutral to slightly acidic, and has low to moderate buffering capacity. Total phosphorus levels were low, indicating oligotrophic to mesotrophic conditions.

Chloride, sodium, and potassium concentrations are elevated compared to typical lakes in the Slave Structural Province. The concentrations of some metals (aluminum, iron, copper, cadmium, chromium, lead, and manganese) exceed Canadian Water Quality Guidelines (CWQG) on a seasonal basis in some lakes, but in general, the concentrations of metals are typical of lakes in undisturbed northern regions.

In summer, the lakes were generally well mixed. In shallow lakes, wind appeared to cause complete lake turnover. Winter data generally indicated a shallow upper layer of water at or near 0 °C, with constant temperatures, not exceeding 2 to 3 °C, throughout the remaining water column. The lakes were typically well aerated during the summer; depressed dissolved oxygen (DO) concentrations were recorded near-bottom in winter. With the exception of Ogama Lake, this DO depression occurred in lakes with relatively high total organic carbon levels in sediments. This suggested that sediment oxygen demand was the underlying cause of the low DO levels.

Sediment

Sediment samples were collected from eight lakes in the area. Metal concentrations in sediments were compared with the Canadian Interim Sediment Quality Guidelines (CISQG) for the Protection of Aquatic Life. The CISQG contains two types of guidelines: the Threshold Effect Level (TEL) – the concentration below which adverse effects are rare; and the Probable Effect Level (PEL) - the concentration above which adverse effects are likely. Most of the concentrations were less than the CISQG. The exceptions were total chromium, total copper, total arsenic, and total cadmium. Of these, total chromium exceeds the guidelines most widely and most frequently, with concentrations exceeding the CISQG PEL in three of the eight lakes (Doris, Tail and Patch). Overall, concentrations of metals are within the range of natural variability for the Slave Structural Province.

Freshwater Biota and Habitat

Aquatic biota was sampled in nine lakes in the area. A comparison of periphyton abundance in the outflows of the lakes suggests that Doris, Ogama, and Windy are highly productive and that Tail and Pelvic Lakes are the least productive. A comparison of phytoplankton chlorophyll results indicates that Doris is highly productive, and Tail is the least productive.

The benthic communities of the lakes sampled are similar in many respects to the communities of other small lakes in the Canadian Arctic and sub-Arctic.

Seven fish species are commonly found in the lakes of the area: Arctic Char, broad whitefish, cisco, least cisco, lake trout, Lake Whitefish, and ninespine stickleback. Physical features such as the 4.3 m waterfall between Doris and Little Roberts Lake prevent the movement of some species.

Three species dominate the fish populations found in local streams. Arctic char were the most common (61% of total catch); most of these fish were captured at a fish fence installed in Roberts Outflow during 2002 and 2003 to monitor the number of migratory Arctic char from Roberts Bay to Roberts Lake. Ninespine stickleback was second in abundance (23%) and was the most widely distributed species and encountered in each of the 14 streams sampled. Lake trout was third in abundance (13% of the total catch) and second in distribution (encountered in ten of 14 streams). Juveniles and adults were present in the catch, suggesting that the larger streams provide both rearing and feeding habitat.

Baseline metal concentrations in fish tissue (dorsal muscle, liver, and kidney) were analyzed from lake trout, Lake Whitefish, and cisco taken from six of the lakes. In general, low concentrations were measured, with the exceptions of arsenic and mercury. The highest mean concentration of arsenic (1.95 µg/g dry weight) was recorded in a lake trout liver from Windy

Lake. Similarly, the highest mean mercury concentration (3.31 μg/g dry weight, was recorded in a lake trout liver from Patch Lake. Metal concentrations in fish tissues from Pelvic Lake (selected as a control basin for long-term monitoring) were similar or intermediate to corresponding levels from the other lakes. A small proportion of lake trout muscle tissue samples (8 of 113) exceeded the Health Canada food consumption guideline of 0.5 μg/g wet weight (roughly equivalent to 2.5 μg/g dry weight) for mercury (six fish from Patch Lake, one from Doris Lake, and one from Roberts Lake). Older and larger lake trout had greater concentrations of mercury in their tissues and these fish were most likely to have muscle mercury concentrations above the Health Canada guideline. All Lake Whitefish and Arctic char muscle tissues contained mercury levels that were below Health Canada guidelines.

None of the fish species that occur in the Hope Bay Project area are designated as endangered or threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Vegetation

Vegetation is characteristic of sub-arctic tundra vegetation. Three ecosystem units dominate the area: the ocean shoreline association; lowland ecosystems; and the rock outcrop and upland ecosystems. Several plant communities make up each of these ecosystems. Plant species identified include 19 shrubs, 92 herbs, 18 grasses, 32 sedges and rushes, 21 mosses, and 8 species and/or genera of lichen. Inuit traditionally use many local plant species and understand the relationship between plants and caribou habitat requirements including the early showing of plants in snow free areas and the importance of such areas to caribou calving locations in the region.

None of the local plants identified during the course of baseline studies are designated as endangered or threatened by COSEWIC.

Wildlife

The Hope Bay Project area provides habitat for a variety of mammals including: shrews, voles and lemmings, hares, ground squirrels, weasels, wolves and foxes, grizzly bears, caribou, and muskox. Many are year-round residents, while others such as caribou and musk-ox, are nomadic or migratory. Some large predators/scavengers such as grizzly bear, wolverine and wolf have large ranges that can extend across or beyond the Project area. The small mammal species present, including ground squirrels and Arctic hare, spend their entire life in a small area.

Vole and lemming populations are cyclic affecting the abundance and productivity of both bird and mammal predators. Weasel populations will cycle in synchrony with vole and lemming populations.

The Hope Bay Project area is on the fringes of areas used by the Dolphin-Union, Ahiak, and the Bathurst herds of caribou. The Dolphin-Union herd is of special interest from a resource management and conservation perspective.

The area provides breeding habitat for a wide range of resident and migratory birds including songbirds, upland birds, shorebirds, waterfowl, seabirds and raptors. The raptors in the area include peregrine falcon, gyrfalcon and golden eagle. Some birds such as peregrine falcon have been the focus of special conservation and management efforts in Canada since the 1970s.

Land and Water Use
The Hope Bay Project is situated almost entirely on Inuit owned land administered by the KIA with minerals development authority vested within Nunavut Tunngavik Inc. (NTI). Mineral rights are also held by the Crown on select areas of the Hope Bay Belt, which include Boston, part of Windy Camp, the Madrid exploration area, and the Patch Lake drill shop.

Pre-development land use can be classified as wildlife habitat with occasional use by Inuit people for subsistence hunting and fishing.

Protected Areas
There are no protected areas in, or adjacent to the Project area. The closest designated land use restriction is the Queen Maud Gulf Bird Sanctuary approximately 40 km to the east.

Archaeological/Special Sites
The West Kitikmeot has a diversity of archaeological and historic resources, and such resources comprise an important aspect of Inuit culture, spirituality and perspectives with respect to relationships with the land. HBML has completed comprehensive baseline surveys for historic and cultural resources in the Project area and has identified over 100 sites with some being in close proximity to Project features.

2.0 OVERVIEW OF THE RISK ASSESSMENT PROCESS

2.1 ASSESSING RISKS TO HUMAN HEALTH

Human health risk assessment often is divided into four main stages:

- problem formulation or hazard identification;
- exposure assessment;
- toxicity assessment also called dose response assessment or hazard assessment; and
- risk characterization.

In the problem formulation stage, information about the area of interest is reviewed with the goals of describing the area(s) where impacts are found, describing the nature and extent of the impacts, and identifying the chemicals that need to be assessed further. These tasks are discussed in Chapter 3.

In the exposure assessment stage, the potential for people ("receptors") to come into contact with the chemicals of interest via "exposure pathways" is estimated. Monitoring will provide some information to describe the material (such as soil or groundwater) that the receptor contacts, but mathematical equations or models often are used to estimate concentrations in other materials such as vapours in air, contaminated soil particles in air, or at locations other than those where samples have been collected. This report does not attempt to quantify exposures. Instead, it reviews the various generic exposure assessments made by the CCME as part of the process the CCME uses to set values for broad application across the country and determines which of those assessments are relevant for Patch Lake and Windy Camp and which are not relevant (with the latter then eliminated as a basis for setting site specific values). This process is described in Chapter 4.

In the toxicity assessment stage, information is assembled from the published literature that describes the types of health effects that can be caused by exposure to the chemicals of interest. This report relies on toxicity information published and/or used by the CCME and Health Canada to set generic maximum acceptable concentrations of chemicals in soil and groundwater.

The risk characterization stage combines the results of the exposure assessment and the toxicity assessment to estimate the likelihood of adverse effects occurring. This report does not attempt to quantify risks. Instead, it recommends site specific values on the basis of the most stringent of the relevant exposure pathways as assessed by CCME. This is described in Chapter 4 also.

2.2 ECOLOGICAL (NON-HUMAN) RECEPTORS

Ecological risk assessment (ERA) is divided into four stages that are very similar to those used in human health risk assessment. Like the human health risk assessment, this report does not estimate exposures or risks posed by the chemicals of potential concern. Instead it relies upon the ecological assessments undertaken by the CCME when setting maximum acceptable values for chemicals at contaminated sites. The CCME includes various types of ecological considerations in the value setting process.

An Ecological Risk Evaluation (ERE) Framework has been developed as a tool for analyzing ecological risks at federal sites to support priority ranking under the Federal Contaminated Sites Action Plan. The Framework provides for input by custodial departments, as well as analysis by expert departments at Environment Canada and Fisheries and Oceans Canada.

Input to the ERE Framework comes from two sources: Indian and Northern Affairs Canada input which represents 40% of the total score; and, Expert Input which represents 60% of the total score.

Since no federal departments were involved in this report, the ERE Framework has not been used.

3.0 CONTAMINANTS OF POTENTIAL CONCERN

3.1 INITIAL REVIEW OF SOIL DATA

Prior to the summer of 2009, several types of information were collected to develop a general understanding of petroleum hydrocarbon impacts at Patch Lake and Windy Camp. These included visual observations (i.e. stained surfaces), noting where petroleum odours were evident, noting the presence of oily sheen on puddles, the use of a portable meter to measure petroleum hydrocarbon vapours, and the use of a field test kit that gives general indications of total concentrations of hydrocarbons in samples (SRK, 2009c).

In August 2009, WESA collected 56 soil samples from the Patch Lake facility, and another 38 soil samples from Windy Camp. The soils primarily consisted clay, silt and some sand with coarse grained soils at the surface (within 30 cm below ground surface) underlain fine grained soils. All soil samples were analyzed for the PHC Fractions 2, 3, and 4 (often abbreviated as F2, F3, F4). Section 3.3 describes the differences between these fractions. Some of the samples also were measured for inorganic parameters (mostly metals), PHC Fraction 1, benzene, toluene, ethylbenzene, and xylenes (collectively referred to as BTEX), and polycyclic aromatic hydrocarbons (PAHs).

To identify the chemicals of potential concern (COPCs), all concentrations of chemicals measured in soil samples in 2009 are compared to the generic values recommended by the CCME. When measured concentrations do not exceed the generic values, unwanted effects or impacts should not occur and do not require further evaluation. The generic values recommended by the CCME take into account conditions such as land use, soil texture, groundwater use, and depth of impacts below ground surface.

Those comparisons identify the following COPCs in soil: the four PHC fractions, chromium, copper, nickel, and zinc. Table 1 is a summary of the generic CCME values used to evaluate those chemicals. (Concentrations of other chemicals do not exceed CCME values and therefore are not COPCs.) The CCME values come from the following sources:

- Values for metals, BTEX, PCBs, and PAHs come from the CCME document entitled *Canadian Environmental Quality Guidelines*. The values used are those for residential/parkland sites.

- Values for PHC fractions come from the 2008 CCME document entitled *Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil*. The soils Patch Lake and Windy Camp primarily consisted clay, silt and some sand with coarse grained soils at the surface (within 30 cm below ground surface) underlain fine grained soils. Approximately one-half of the soil samples collected by WESA are described as coarse grained. The CCME standards for PHC fractions are more stringent for coarse grained soils, so using the values for coarse grained soil is an appropriate and conservative assumption.

Table 1

SUMMARY OF NUMERIC VALUES USED TO IDENTIFY COPCS IN SOIL

Chemical	CCME Value	Maximum Measured Concentration
PHC Fraction 1	30	PL – exceeded in 0 of 4 samples WC - Exceeded in 1 of 6 samples; max = 31
PHC Fraction 2	150	PL – exceeded in 17 of 56 samples; max = 27,100 WC - Exceeded in 6 of 38 samples; max = 1,870
PHC Fraction 3	300	PL – exceeded in 25 of 56 samples; max = 258,000 WC - Exceeded in 3 of 38 samples; max = 589
PHC Fraction 4	2,800	PL – exceeded in 7 of 56 samples; max = 29,900 WC - Exceeded in 0 of 38 samples
Chromium	64	PL – exceeded in 2 of 10 samples; max = 71.7 WC - Exceeded in 0 of 5 samples
Copper	63	PL – exceeded in 1 of 10 samples; max = 104 WC - Exceeded in 0 of 5 samples
Nickel	50	PL – exceeded in 1 of 10 samples; max = 131 WC - Exceeded in 0 of 5 samples
Zinc	200	PL – exceeded in 3 of 10 samples; max = 344 WC - Exceeded in 0 of 5 samples

Notes:

- PL – Patch Lake
- WC – Windy Camp
- All values are expressed as µg/g.
- CCME values for PHC fractions come from the Canada-Wide Standards for PHCs (CCME, 2008) and are to be applied to coarse-grained surface soils at residential/parkland sites. The generic values for metals are Canadian Soil Quality Guidelines for residential/parkland sites.

3.2 Some General Observations on the Distribution of Impacts in Soil

The majority of the impacted soil is due to releases at the current above ground storage tank (AGST) area, along surface drainage from that area, at a former tank storage area, around the drill shop, at a staging area at the north end of the site, and the alternative winter access road route to the lake. Releases around AGSTs and storage drums usually are evident by surface staining.

At Patch Lake, three of the COPCs are PHC F2, F3, and F4. The impacted areas are found to the north of the drill shop, at the south end of the drill shop, in storage yards immediately east of the drill shop, immediately to the northeast and east of the rock pad, and at one isolated location just north of the vehicle and equipment storage area. The other four COPCs are chromium, copper, nickel, and zinc. The elevated concentrations were measured in samples from four widely dispersed locations. All four locations also display PHC impacts. None of the impacted locations is closer than approximately 80 m from the shore of Patch Lake.

At Windy Camp, the COPCs are PHC F1, F2, and F3. The impacted areas are next to the workshop and generator building, a small area immediately south of the workshop and generator building, and an area even further south where petroleum products were stored. None of these locations is closer than approximately 30 m from the shore of Windy Lake.

3.3 DIVIDING PHC INTO FRACTIONS

Petroleum hydrocarbons (PHC) present a challenge to risk assessment because many individual chemicals can contribute to measurements of PHC. The chemicals present in PHC can vary widely from site to site.

The Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) was formed in 1993 to develop scientifically defensible methods for establishing risk-based criteria for petroleum hydrocarbons. TPHCWG reports describe an approach that divides TPH into numerous fractions, each of which is assigned physical-chemical and toxicological properties based on the chemicals that can be present in that fraction (TPHCWG, 1997; Gustafson *et al.*, 1997).

The fractions are defined by molecular structure and the number of carbon atoms present. On the basis of structure, all compounds are either aromatic (those with ring-like structures) or aliphatic (those with straight or branched structures). Compounds in both groups are divided further using the number of carbon atoms present (or more correctly the equivalent carbon number or EC). For example, one fraction is defined as all the aromatic hydrocarbons with EC values of greater than 12 but not more than 16. This is abbreviated $EC_{>12}$ to EC_{16} or as $C_{>12}$ to C_{16} if the more familiar carbon notation is used, as is the case in the remainder of this report. (Even the TPHCWG documents do not use the EC notation consistently.) Additional details are presented in Supplement A.

The work of the TPHCWG subsequently was used as a basis by the CCME to develop another approach that divides PHC into four fractions:

- Fraction 1 (F1) includes all aromatics and aliphatics (excluding BTEX) up to C_{10}. The compounds in F1 will account for the majority of the PHC measured in gasoline or jet fuel. Once released into the environment, the compounds in F1 will degrade and volatilize at relatively fast rates. Eventually, the relative proportion of the F2 fraction will increase.
- Fraction 2 (F2) includes all aromatics and aliphatics in the range of $C_{>10}$ to C_{16}. The compounds in F2 will account for the majority of the PHC measured in "fresh" kerosene and approximately half the constituents in diesel fuel, home heating oil or fuel oil (three relatively similar products).
- Fraction 3 (F3) includes all aromatics and aliphatics in the range of $C_{>16}$ to C_{34}. The compounds in F3 will account for the other half of the constituents in diesel fuel, as well as the majority of the PHC measured in lubricants such as motor oil, paraffin wax, and petroleum jelly.
- Fraction 4 (F4) includes all aromatics and aliphatics beyond C_{34}. This fraction includes tars and resins.

3.4 Initial Review of Groundwater Data

In August 2009, groundwater monitoring wells were installed at from five locations at Patch Lake and three locations at Windy Camp. The wells are relatively shallow (typically not more than 2 m deep). Drilling stopped upon encountering bedrock or continuous permafrost. Groundwater samples were collected from the eight locations. All of the samples were analyzed for PHC F2, F3, and F4. One sample from each location also was analyzed for PHC F1 and BTEX (WESA, 2009).

The CCME has not established values for PHC fractions in groundwater; however, none of the fractions were detected in any of the samples and therefore none of the PHC fractions are identified as COPCs in groundwater.

To assess BTEX concentrations, the values from the *Canadian Water Quality Guidelines* (for community water supplies, to protect freshwater aquatic organisms, and for agricultural uses) and the *Guidelines for Canadian Drinking Water Quality* were compiled. BTEX was not detected in either sample and the detection limits were lower than any of the values noted above. Therefore, none of the BTEX compounds are identified as COPCs in ground water.

That there are no COPCs in groundwater strongly suggests that the COPCs in soil are having no measurable effect on groundwater quality, and that the lateral movement of groundwater is not carrying COPCs to Patch or Windy Lake.

3.5 Taking Degradation Products into Consideration

Some chemicals can degrade to form other chemicals that pose concerns equal to or greater than the original chemical. Although a degradation product may not have been measured in the environment, it may be prudent to carry it forward in the risk assessment. The degradation products of gasoline, diesel fuel, and fuel oil do not raise this concern.

3.6 Other Types of Data Gathered

Various types of information have been collected during investigations at and around the facilities. These include: organic vapour readings; and qualitative observations such as the presence of staining or odours. These are general indicators of conditions and are used to select samples for chemical analysis, or delineate the lateral or vertical extent of impacts, but are not directly useable for quantifying potential risks.

Surface water and sediment samples have also been collected at Patch Lake, Windy Lake, and several other lakes in the Hope Bay Project area.

As noted in Section 1.3, the lakes in the area are soft, neutral to slightly acidic, and have low to moderate buffering capacity. Total phosphorus levels were low, indicating oligotrophic to mesotrophic conditions. Chloride, sodium, and potassium concentrations are elevated compared to typical lakes in the Slave Structural Province. The concentrations of some metals (aluminum, iron, copper, cadmium, chromium, lead, and manganese) exceed Canadian Water Quality Guidelines (CWQG) on a seasonal basis in some lakes, but in general, the concentrations of metals are typical of lakes in undisturbed northern regions.

Section 1.3 also indicates that concentrations of metals in sediment generally are less than the Canadian Interim Sediment Quality Guidelines (CISQG) for the Protection of Aquatic Life. The exceptions were total chromium, total copper, total arsenic, and total cadmium. Of these, total chromium exceeds the guidelines most widely and most frequently. Overall, concentrations of metals are within the range of natural variability for the Slave Structural Province.

4.0 DETAILED REVIEW OF PHC FRACTIONS

4.1 HOW GENERIC VALUES ARE SET BY THE CCME

The generic values recommended by the CCME for PHC fractions reflect as many as 11 different considerations (CCME, 2008). The values for residential/parkland uses are based upon nine such "exposure pathways" (that is the term used in the CCME documentation). Each pathway is described below along with a discussion of its relevance as a basis for setting a site specific value for Patch Lake and Windy Camp.

Direct Contact (ingestion and dermal contact) – Clearly relevant since it is assumed that people will visit or travel across the facilities after they have been closed and reclaimed.

Vapour Inhalation (indoor, building with a basement) – Clearly irrelevant since there are no such buildings at either facility and there will be no such buildings after they have been closed and reclaimed.

Vapour Inhalation (indoor, slab-on-grade building) – Clearly irrelevant since there are no such buildings at either facility and there will be no such buildings after they have been closed and reclaimed. (Tents and other types of temporary structures have high air change rates. They lack the potential to accumulate vapours that migrate from underlying soil such as if assumed in this exposure pathway.)

Protection of Potable Groundwater – Not relevant since ground water is not used as a potable water supply.

Protection of Groundwater for Aquatic Life – Relevant; however, the values for this pathway are based on the assumption that the surface water body is 10 m from the site. This distance is more than 80 m at Patch Lake and 30 m at Windy Camp. Furthermore, no signs of impacts have been detected in groundwater quality monitoring. Therefore, this exposure pathway does not need to be considered further.

Nutrient Cycling – Relevant, since wherever there are impacts in the natural environment there is potential for the chemicals to influence the cycling of nutrients from the soil to various types of terrestrial organisms.

Ecological Direct Soil Contact – Appears to be relevant since there are various types of plants, insects, birds, and mammals in the Hope Bay Project area that can come into direct contact with soil; however, this exposure pathway needs to be examined in more detail since the values are based on assessments of organisms such as earthworms and clearly that may not be appropriate representatives of the organisms in the study area.

Produce – Possibly relevant assuming that wildlife, notably caribou, could spend time at the closed and reclaimed facilities and subsequently be consumed. The CCME has found insufficient information to calculate these values.

Management Limit – Likely relevant due to the various factors considered by the CCME. These values are set to avoid: free phase formation; exposures to vapours by workers in trenches; fire and explosive hazards; effects on buried infrastructure, aesthetic considerations, and technological factors (the latter largely based on the capability of bioremediation as a treatment option). While some of these factors such as workers in trenches are not relevant, others are appropriate for Patch Lake and Windy Camp.

Overall, the exposure pathways relevant or possibly relevant for Patch Lake and Windy Camp are:

- Direct Contact (ingestion and dermal contact)
- Nutrient Cycling
- Ecological Direct Soil Contact
- Produce
- Management Limit

4.2 PHC FRACTION F1

Only one soil sample (Sample 024 at the storage tank farm at Windy Camp) produced a concentration (31 µg/g) slightly higher than the generic CCME value of 30 µg/g.

To recommend a site specific value for PHC F1, the relevant exposure pathways and the corresponding maximum acceptable values recommended by the CCME for residential/parkland sites with coarse-grained soils are:

Direct Contact (ingestion and dermal contact) – 12,000 µg/g
Nutrient Cycling – not calculated, insufficient information to be derived
Ecological Direct Soil Contact – 210 µg/g
Produce – not calculated, insufficient information to be derived
Management Limit – 700 µg/g

Based on the most stringent of those values, the initial candidate for a site specific value for Patch Lake and Windy Camp is the Ecological Direct Soil Contact value of 210 µg/g.

Section 4.3 contains a detailed review of how the Ecological Direct Soil Contact value was derived for PHC F2. A very similar process was used for PHC F1, but as shown below, the appropriateness of the Ecological Direct Soil Contact value is much less of a concern for PHC F1 because PHC F1 seldom is a COPC (only once in ten samples) and the maximum concentrations measured in 2009 of 31 µg/g is only marginally above the generic CCME value of 30 µg/g.

Since none of the measured concentrations exceed the suggested site specific value, none of the sample soils pose undue risks or need to be remediated or otherwise managed. If future sampling includes PHC F1, samples that exceed Eco Soil Contact value for coarse grained surface soils of 210 µg/g should be remediated or otherwise managed.

While the sites remain active, it is recommended that the Eco Soil Contact value of 320 µg/g for fine grained soils for industrial land use be applied.

4.3 PHC FRACTION 2

Seventeen of 56 soil samples from Patch Lake and six of 38 samples from Windy Camp produced concentrations higher than the generic CCME value of 150 µg/g.

To recommend a site specific value for PHC F2, the relevant exposure pathways and the corresponding maximum acceptable values recommended by the CCME for residential/parkland sites with coarse-grained soils are:

Direct Contact (ingestion and dermal contact) – 6,800 µg/g
Nutrient Cycling – not calculated, insufficient information to be derived
Ecological Direct Soil Contact – 150 µg/g
Produce – not calculated, insufficient information to be derived
Management Limit – 1,000 µg/g

Based on the most stringent of those values, the initial candidate for a site specific value for Patch Lake and Windy Camp is the Ecological Direct Soil Contact value of 150 µg/g.

The 150 µg/g value was recommended in 2008 on the basis of toxicity information for three plant species (alfalfa, barley, and northern wheatgrass), a species of earthworm, and a species of springtail (a soil-dwelling invertebrate). The value of 150 µg/g corresponds to the 25th percentile of concentrations that caused effects in the tested organisms. The specific effects include reduced root length and weight in northern wheat grass, reduced number of progeny in the earthworm species, and reduced mass of progeny in the earthworm species.

Although it is not practical to test species that are representative of all ecological communities or zones,it is important to note that the five tested species do not occur naturally in the Arctic. (This includes the species of springtail used in the toxicity tests, although there is another species that is found in the Arctic.) Furthermore, the species of springtail used in the toxicity tests is known to be more sensitive to the effects of PHCs relative to the other species of springtail for which toxicity information is available.

Collectively, these factors mean that the Ecological Direct Soil Contact value may be inappropriate for the Hope Bay Project area and Patch Lake and Windy Camp; however, “better” information does not exist at this time.

To recommend a site specific value, consideration also needs to be given to the small sizes of impacted areas relative to the vastness of the unimpacted surrounding land. Some effects on some types of vegetation and soil-dwelling organisms at relatively small areas would be of no consequence to the viability of ecological communities present in the surrounding area. As a result, and based largely on professional judgement, this report looks beyond the 25th percentile to recommend that the site specific value be set equal to the 50th percentile which corresponds to a value of 260 μg/g. This also happens to be the generic value recommended by the CCME for industrial and commercial sites for fine grained soils.

That site specific value is exceeded in 17 of 56 samples from Patch Lake and in 6 of 38 samples from Windy Camp. Those soils and any found in the future where the concentration of PHC F2 exceeds 260 μg/g should be remediated or otherwise managed.

4.4 PHC Fraction 3

Twenty-five of 56 soil samples from Patch Lake and three of 38 samples from Windy Camp produced concentrations higher than the generic CCME value of 300 μg/g.

To recommend a site specific value for PHC F3, the relevant exposure pathways and the corresponding maximum acceptable values recommended by the CCME for residential/parkland sites with coarse-grained soils are:

Direct Contact (ingestion and dermal contact) – 15,000 μg/g
Nutrient Cycling – not calculated, insufficient information to be derived
Ecological Direct Soil Contact – 300 μg/g
Produce – not calculated, insufficient information to be derived
Management Limit – 2,500 μg/g

Based on the most stringent of those values, the initial candidate for a site specific value for Patch Lake and Windy Camp is the Ecological Direct Soil Contact value of 300 μg/g.

The 300 μg/g value was recommended in 2008 on the basis of toxicity information for two plant species (alfalfa and northern wheatgrass), two species of earthworm, and a species of springtail (a soil-dwelling invertebrate). It reflects professional judgement made by the CCME based on toxicity data that suggests 400 μg/g is protective of plants but that a value less than 330 μg/g is protective of soil invertebrates. Those toxicity data come from a study in Richmond, British Columbia where fresh oil was added to a coarse soil.

Although it is not practical to test species that are representative of all ecological communities or zones, it is important to note that the five tested species do not occur naturally in the Arctic. (This includes the species of springtail used in the toxicity tests, although there is another species that is found in the Arctic.) Furthermore, the species of springtail used in the toxicity tests is known to be more sensitive to the effects of PHCs relative to the other species of springtail for which toxicity information is available. Finally, some of the key toxicity tests were conducted in a temperature climate.

Collectively, these factors mean that the Ecological Direct Soil Contact value may be inappropriate for the Hope Bay Project area and Patch Lake and Windy Camp; however, "better" information does not exist at this time.

To recommend a site specific value, consideration also needs to be given to the small sizes of impacted areas relative to the vastness of the unimpacted surrounding land. Some effects on some types of vegetation and soil-dwelling organisms at relatively small areas would be of no consequence to the viability of ecological communities present in the surrounding area. As a result, and based largely on professional judgement, this report looks beyond the 300 μg/g for agriculture/residential land use to recommend that the site specific value be set equal to 1,300 μg/g, the value recommended by the CCME for residential/parkland if the soil is fine textured. Soils at Patch Lake and Windy Camp primarily consisted clay, silt and some sand with coarse grained soils at the surface (within 30 cm below ground surface) underlain fine grained soils. As a result, the soil sometimes is described as coarse textured and sometimes described as fine textured.

The site specific value of 1,300 μg/g is exceeded in nine of 56 samples from Patch Lake and in none of 37 samples from Windy Camp. Those soils and any found in the future where the concentration of PHC F3 exceeds 1,300 μg/g should be remediated or otherwise managed.

While the sites remain active, it is recommended that the Eco Soil Contact value of 2500 μg/g for fine grained soils for industrial land use be applied.

4.5 PHC Fraction 4

Seven of 56 soil samples from Patch Lake and zero of 38 samples from Windy Camp produced concentrations higher than the generic CCME value of 2,800 μg/g.

To recommend a site specific value for PHC F4, the relevant exposure pathways and the corresponding maximum acceptable values recommended by the CCME for residential/parkland sites with coarse-grained soils are:

Direct Contact (ingestion and dermal contact) – 21,000 μg/g
Nutrient Cycling – not calculated, insufficient information to be derived
Ecological Direct Soil Contact – 2,800 μg/g
Produce – not calculated, insufficient information to be derived
Management Limit – 10,000 μg/g

Based on the most stringent of those values, the initial candidate for a site specific value for Patch Lake and Windy Camp is the Ecological Direct Soil Contact value of 2,800 μg/g.

The 2,800 μg/g value was originally set in 2001 by extrapolating from data for whole crude oil. Since that time, additional toxicity studies have been conducted for three plant species (alfalfa, barely, and northern wheatgrass), and two species of earthworm but for fine soil only. The value of 2,800 μg/g is a professional judgement made by the CCME based on a lack of "better" data for coarse soil.

Although it is not practical to test species that are representative of all ecological communities or zones, it is important to note that the five tested species do not occur naturally in the Arctic. Furthermore, the toxicity tests were not conducted on PHC F4 *per se* but extrapolated from whole crude oil.

Collectively, these factors mean that the Ecological Direct Soil Contact value may be inappropriate for the Hope Bay Project area and Patch Lake and Windy Camp; however, "better" information does not exist at this time.

To recommend a site specific value, consideration also needs to be given to the small sizes of impacted areas relative to the vastness of the unimpacted surrounding land. Some effects on some types of vegetation and soil-dwelling organisms at relatively small areas would be of no consequence to the viability of ecological communities present in the surrounding area. As a result, and based largely on professional judgement, this report looks beyond the 2,800 μg/g for Residential/Parkland land use to recommend that the site specific value be set equal to 5,600 μg/g, the value recommended by the CCME for agricultural/residential land if the soil is fine textured. Soils at Patch Lake and Windy Camp primarily consisted clay, silt and some sand with coarse grained soils at the surface (within 30 cm below ground surface) underlain fine grained soils. As a result, the soil sometimes is described as coarse textured and sometimes described as fine textured.

The site specific value of 5,600 μg/g is exceeded in six of 56 samples from Patch Lake and in none of 37 samples from Windy Camp. Those soils and any found in the future where the concentration of PHC F4 exceeds 5,600 μg/g should be remediated or otherwise managed.

While the sites remain active, it is recommended that the Eco Soil Contact value of 6600 μg/g for fine grained soils for industrial land use be applied.

5.0 DETAILED REVIEW OF INORGANIC PARAMETERS

A detailed review of inorganic parameters was not completed as this was beyond the scope of this project.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 SUMMARY OF SITE SPECIFIC CRITERIA

Table 2 is a summary of the COPCs, the generic CCME values used to identify the COPCs, the site specific remediation criteria, and the basis for each criterion.

The site specific criteria are not based on the detailed calculations of exposure and risk typically found in risk assessments. Rather they are selected from values published in various CCME reports that describe the risk-based processes used by the CCME.

For the four PHC fractions, the site specific criteria are higher than the generic CCME values initially used to identify the four fractions as COPC. The generic values consider various exposure pathways or scenarios, some of which will not exist when the Patch Lake and Windy Camp facilities have been closed and remediated. For example, no structures will remain so the inhalation of indoor vapours (a key consideration in the generic value for PHC F1) will not be possible. For the other three fractions, the site specific remediation criteria are set equal to ecological values recommended by the CCME but for less stringent site uses or soil texture than originally assumed to identify these fractions as COPCs.

All of the PHC site specific criteria are less than any of the other relevant exposure pathway values published by the CCME for the COPCs. None of the site specific criteria exceed the maximum acceptable concentrations for protecting human health from exposures due to soil ingestion or dermal contact. None exceed the “management limits” set for the PHC fractions.

Table 2

SUMMARY OF SITE SPECIFIC REMEDIATION CRITERIA

COPC	Generic CCME Value	Site Specific Criterion and its Basis
Current Land Use (Industrial)		
PHC Fraction 1	30	320 – Ecological Direct Soil Contact (for fine textured soil)
PHC Fraction 2	150	260 – Ecological Direct Soil Contact (for fine textured soil)
PHC Fraction 3	300	2,500 – Ecological Direct Soil Contact (for fine textured soil)
PHC Fraction 4	2,800	6,600 – Ecological Direct Soil Contact (for fine textured soil)
Post Closure Land Use (Residential/Parkland)		
PHC Fraction 1	30	210 – Ecological Direct Soil Contact
PHC Fraction 2	150	260 – Ecological Direct Soil Contact
PHC Fraction 3	300	1,300 – Ecological Direct Soil Contact (for fine textured soil)
PHC Fraction 4	2,800	5,600 – Ecological Direct Soil Contact (for fine textured soil)

Notes:

- All values are expressed as µg/g.

Virtually every aspect of a risk assessment has some degree of uncertainty associated with it. Some sources of uncertainty can be reduced (often by collecting more information about site specific conditions), but many are outside the scope or influence of individual risk assessments.

A major source of uncertainty in this report concerns the appropriateness of using published ecological toxicity information to assess the ecological receptors present at the Hope Bay Project area. Few if any of the published studies involve the types of organisms, climate, or soil type found around Patch Lake and Windy Camp. Unfortunately, there is no "better" information.

One approach to compensating for uncertainty is to make conservative assumptions to avoid underestimating exposures and risks. This is particularly the case when recommending values that may be used across Canada and so the CCME takes a conservative approach to the interpreting of information that eventually leads to setting generic values such as the Canada-wide Standard for PHCs in soil and the Canadian Soil Quality Guidelines.

6.2 RECOMMENDATIONS

Site specific risk based remediation criteria listed in Table 2 above are recommended for use at Patch Lake Worksop and Windy Camp. Based on those criteria, there are many locations at Patch Lake where soil remediation is recommended, and a few locations at Windy Camp where soil remediation is recommended.

It is recommended that wherever remediation activities can lead to direct contact with impacted soil, there should be a health and safety plan to reduce exposures.

Relatively simple precautions routinely taken by workers (such as wearing gloves and long-sleeved shirts) should reduce dermal contact sufficiently. Confined spaces and excavations more than 2 m deep are very unlikely, but should be monitored for vapours before entering and be ventilated if necessary to reduce exposures to vapours. Workers should not stand directly down wind of activities that generate dust.

7.0 STATEMENT OF LIMITING CONDITIONS

The conclusions presented in this report represent our professional opinion and are based upon the work described in this report and any limiting conditions in the terms of reference, scope of work, or conditions noted herein.

The findings presented in this report are based on conditions observed by others at the specified dates and locations, and on the analysis of samples for the specified parameters by others. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, portions of the site that were not investigated directly, or types of analysis not performed.

WESA makes no warranty as to the accuracy or completeness of the information provided by others, or of conclusions and recommendations predicated on the accuracy of that information.

Nothing in this report is intended to constitute or provide a legal opinion. WESA makes no representation as to compliance with environmental laws, rules, regulations or policies established by regulatory agencies.

This report has been prepared for SRK Consulting (Canada) Inc. and Hope Bay Mining Ltd. Any use a third party makes of this report, any reliance on the report, or decisions based upon the report, are the responsibility of those third parties unless authorization is received from WESA in writing. WESA accepts no responsibility for any loss or damages suffered by any unauthorized third party as a result of decisions made or actions taken based on this report.

This report has been written by Brett Ibbotson of WESA.

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