



Chemicals Assessment &
Management Division
Groundwater Protection Branch



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May 8, 1996

FILE #: 4040-BA04-1

Mr. Bradley Mersereau, P.Eng.
Canadian Turbo Inc.
630 - 4 Avenue SW
Calgary, Alberta
T2P 0J9

Dear Mr. Mersereau:

Re: Barons Turbo Bulk Plant and Barons Hardware Store

I have reviewed the September 17, 1993 Seacor report for this site. The site investigation shows that subsurface petroleum hydrocarbon contamination exceeding the risk management criteria of the draft 1994 "Remediation Guidelines for Petroleum Storage Tank Sites" was discovered upgradient from the hardware store, near the pump island and under the southeast corner of the building.

To date, the extent and degree of the contamination have not been fully evaluated. Since this site was supplied by Canadian Turbo at the time the contamination was discovered, I am seeking your co-operation in assessing the remedial options for these sites. I would appreciate a response by June 1, 1996. I suggest that we meet with the owners of the hardware store property to discuss the remedial proposals. Please call me at 381-4255 to arrange a meeting time.

Thank you for your prompt attention to this situation.

Yours truly,


Don Wyrostock

DW/tlm

*mailed
5/9/96*



4640-BAD
#2

SEACOR
ENVIRONMENTAL
ENGINEERING, INC.

September 17, 1993

Canadian Turbo Inc.
400 - 630 4th Avenue S.W.
Calgary, AB. T2P 0J9

Attention: Mr. Keith Madsen, P.Eng

Dear Sir:

**SITE INVESTIGATION
BARONS TURBO BULK PLANT # 9056
235 MAIN STREET
BARONS, ALBERTA**

SEACOR Job No. H0031-093

INTRODUCTION

The following report presents the results of a site investigation conducted at Baron's Turbo Bulk Plant # 9056 at 235 Main Street in Barons, Alberta. A previous investigation conducted by Hazmacon Environmental Services Ltd. (Hazmacon) identified hydrocarbon contamination on the site. The objective of the SEACOR investigation was to correlate the results of the Hazmacon results through drilling and laboratory analysis programs. The investigation included the following:

- Delineation of the hydrocarbon contamination plumes identified in the previous assessment.
- Laboratory analysis to assess subsurface soil and groundwater conditions.

SCOPE OF WORK

The scope of work consisted of the following:

- Advancing nine boreholes and field screening seventy-six soil samples for hydrocarbon vapour levels.
- Completing three boreholes as groundwater monitoring wells.
- Analysis of three soil samples and one groundwater sample for hydrocarbon contamination according to Alberta Environment MUST guidelines and one soil sample for flashpoint.
- Site survey.

SITE DESCRIPTION

Surrounding land uses are summarized in Table 1 and shown on Figure 1.

TABLE 1: SITE DETAILS																																			
STATION No. & ADDRESS		Baron's Turbo Bulk Plant # 9056 235 Main Street, Barons, Alberta																																	
PROPERTY SIZE		38 m x 53 m																																	
LEGAL DESCRIPTION		Lots 21-27, Block 6 Plan # 2605X																																	
ON-SITE FACILITIES		office building, warehouse, tank farm, loading rack																																	
TANKAGE INFORMATION		4 x 31 000 litre, above ground, age unknown 2 x 13 600 litre, above ground, age unknown 1 x 56 000 litre, above ground, age unknown 1 x 5 000 litre, above ground, age unknown																																	
PROTECTION SYSTEMS		Catch Basins: No Overfill Boxes: No Monitoring Wells: No																																	
PUMPS/LINES		4 turbine pumps																																	
STATION HISTORY		Facility established in early 1950's. Purchased by Turbo in 1988.																																	
SURROUNDING LAND USE		<table><tr><td>N</td><td>Alley</td><td>Residential</td><td>30 m</td></tr><tr><td>NE</td><td>Progress Avenue</td><td>Residential</td><td>30 m</td></tr><tr><td>E</td><td>Progress Avenue</td><td>Commercial</td><td>20 m</td></tr><tr><td>SE</td><td>Progress Avenue</td><td>Residential</td><td>35 m</td></tr><tr><td>S</td><td>Main Street</td><td>Commercial</td><td>30 m</td></tr><tr><td>SW</td><td>Main Street</td><td>Residential</td><td>35 m</td></tr><tr><td>W</td><td>Street</td><td>Residential</td><td>20 m</td></tr><tr><td>NW</td><td>Alley</td><td>Residential</td><td>30 m</td></tr></table>		N	Alley	Residential	30 m	NE	Progress Avenue	Residential	30 m	E	Progress Avenue	Commercial	20 m	SE	Progress Avenue	Residential	35 m	S	Main Street	Commercial	30 m	SW	Main Street	Residential	35 m	W	Street	Residential	20 m	NW	Alley	Residential	30 m
N	Alley	Residential	30 m																																
NE	Progress Avenue	Residential	30 m																																
E	Progress Avenue	Commercial	20 m																																
SE	Progress Avenue	Residential	35 m																																
S	Main Street	Commercial	30 m																																
SW	Main Street	Residential	35 m																																
W	Street	Residential	20 m																																
NW	Alley	Residential	30 m																																
GEOGRAPHY		Gradient: flat Drainage: south Streams: none Climate: semi-arid																																	
HYDROGEOLOGY		Geology: silt, clay and clay till overlying sandstone Water Table: 2.3 m Wells: none known																																	
NOTES		Surfacing: asphalt Station: closed																																	

The property was established in the early 1950's and consisted of a bulk plant and gas station. The bulk plant facilities occupied the east end of the site and contained an office building, storage warehouse and tank farm. The tank farm contained six vertical and three horizontal above ground storage tanks, surrounded by a concrete berm. Two tanks were being stored behind the warehouse. The loading rack was located at the southwest corner of the tank farm. The gas station facility was located in the west end of the site, adjacent to the hardware store. The facility included gasoline and diesel pumps. The service station was originally supplied by two sets of underground lines from the tank farm. The pumps are now supplied by two horizontal above ground storage tanks located east of the hardware store. The tanks were surrounded by a concrete berm.

FIELD INVESTIGATION

The field investigation was conducted on July 27, 1993. The borehole locations are shown on Figure 2 with detailed boreholes logs appended to this report.

Soil Conditions

The description of the site profile was generated from the data collected during the borehole program. Soil stratigraphy generally consisted of silt to 1.5 to 3.0 m, clay to 2.7 to 3.7 m and clay till to 3.7 to 4.9 m. The clay till was underlain by a weathered sandstone bedrock to the maximum depth drilled (9.4 m).

The soil characteristics noted from the field investigation are presented in Table 2.

TABLE 2: FIELD OBSERVATIONS						
Borehole No.	Borehole Completion Depth (m)	Hydrocarbon Staining	Soil Headspace Vapour Levels >5% LEL (m)	Maximum Soil Headspace Vapour Levels		Monitoring Well Vapour Levels July 27, 1993
				Levels	Depth (m)	
1	6.1	1.5 - 3.0	1.5 - 3.0	30% LEL	1.5	25% LEL
2	5.5	none	none	110 ppm	0.8	
3	6.1	none	none	80 ppm	1.5	
4	6.1	none	3.0	35% LEL	3.0	
5	7.6	none	2.3 - 6.1	40% LEL	2.3	350 ppm 85% LEL
6	9.4	2.3 - 3.0	2.3 - 6.1, 8.4 - 9.1	+100% LEL	2.3	
7	7.6	1.5 - 3.0	2.3 - 3.0, 6.1	35% LEL	2.3-3.0	
8	9.1	1.8 - 2.4	2.3 - 6.1	46% LEL	4.6	
9	3.0	none	none	25 ppm	0.8	

Notes: • % LEL - % of Lower Explosive Limit
• ppm - parts per million total organic vapour

Hydrocarbon staining was observed in BH's 1, 6, 7 and 8 at depths of between 1.5 and 3.0 m. Elevated soil headspace vapour levels (>5% LEL) were encountered at depths ranging from 1.5 to 9.1 m in the majority of the boreholes with the exception of BH's 2, 3 and 9. The most extensive contamination was in BH6 with a maximum soil headspace vapour level of greater than 100% LEL at a depth of 2.3 m. Monitoring well vapour levels ranged from 350 ppm in BH5 to 85% LEL in BH6.

Groundwater Conditions

Groundwater was encountered in each of the monitoring wells at depths of 2.3 to 2.4 m below grade. The groundwater elevation data is presented in Table 3 and shown on Figure 3.

TABLE 3: GROUNDWATER ELEVATION DATA (JULY 27, 1993)					
Monitoring Well No.	Well Elevation ¹ Top of Riser Pipe(m)	Screened Interval (m)	Depth to Water (m)	Groundwater Elevation (m)	PSH ² Thickness (mm)
BH1	99.18	1.5 - 6.1	2.36	96.82	0
BH5	98.75	1.5 - 7.6	2.30	96.45	0
BH6	98.81	1.8 - 9.4	2.35	96.46	0

Note: 1. Benchmark - Top of hydrant east of site = 100.0 m.
2. PSH - Phase-separated hydrocarbons

The hydraulic gradient could not be determined with the locations of the monitoring wells. Phase-separated hydrocarbons were not encountered in any of the monitoring wells.

LABORATORY RESULTS

Three soil samples and one groundwater sample were recovered from BH's 1, 4 and 6 and submitted for laboratory analysis to Analytical Services Laboratories Ltd. (ASL) of Vancouver, British Columbia. The results of the soil analysis are presented in Table 4 with the detailed technical report appended to this report.

Table 4: SOIL ANALYTICAL RESULTS					
Sample Location	BH1	BH4	BH6	Alberta Level II	Alberta Level III
Depth (m)	1.5	3.0	2.3		
Soil Vapour Headspace	30% LEL	35% LEL	100% LEL		
Benzene	<u>5.2</u>	<u>3.0</u>	<u>8.4</u>	0.5	2.0
Ethylbenzene	20	4.1	45	5	100
Toluene	<1	14	140	10	100
Xylenes	78	25	370	5	50
TPH	1,200	360	<u>5,000</u>	400	2000
Phenols	1.7	0.06	0.37	1.0	10
Lead	13	12	24	200	600
Flashpoint °C	na	na	>61 °C	ns	ns

- Notes:
- all concentrations in parts per million (ppm) equivalent to milligrams per kilogram unless otherwise noted
 - % LEL - % of lower explosive limit
 - TPH - total petroleum hydrocarbons
 - < - less than detection limit
 - *Level II & Level III* - soil clean-up criteria as outlined in Alberta MUST project document, "Subsurface Remediation Guidelines for Underground Storage Tanks",
 - ns - no applicable standard in Alberta MUST Guidelines
 - **bold** - indicates levels in excess of Alberta *Level II*
 - **bold & underlined** - indicates levels in excess of Alberta *Level III*

Analytical results indicated benzene (BH's 1, 4 and 6), toluene (BH6), xylenes (BH's 1 and 6) and TPH (BH6) in excess of Alberta *Level III* criteria. Ethylbenzene (BH's 1 and 6), toluene (BH4) and phenols (BH1) concentrations were between Alberta *Level II* and *Level III*. The chromatograms were indicative of gasoline and diesel residuals.

The results of the groundwater analysis of BH6 are summarized in Table 5.

Table 5: GROUNDWATER ANALYTICAL RESULTS			
Sample Location	BH6	Alberta <i>Level II</i>	Alberta <i>Level III</i>
Benzene	<u>2.7</u>	0.05	0.25
Ethylbenzene	0.69	10	50
Toluene	3.9	40	100
Xylenes	4.6	5	20
TPH	93	50	200
Phenols	0.18	ns	ns
Lead	<0.001	ns	ns

- all concentrations in parts per million (ppm) equivalent to milligrams per litre (mg/L) unless otherwise noted
- TPH - total petroleum hydrocarbons
- < - less than detection limit
- *Level II & Level III* - soil clean-up criteria as outlined in Alberta MUST project document, "Subsurface Remediation Guidelines for Underground Storage Tanks",
- ns - no applicable standard in Alberta MUST Guidelines
- **bold** - indicates levels in excess of Alberta *Level II*
- **bold & underlined** - indicates levels in excess of Alberta *Level III*

The results indicated dissolved benzene and TPH concentrations in excess of Alberta *Level III* and *Level II* criteria, respectively. The chromatograms were indicative of both gasoline and diesel residues.

DISCUSSIONS

The drilling program confirmed the results of the soil vapour survey. Elevated soil headspace vapour levels ($>5\%$ LEL) and constituent concentrations in excess of Alberta *Level III* criteria were measured in BH's 1, 4, 5, 6 and 8 drilled in the areas of the contamination plumes delineated in the soil vapour report.

The boreholes drilled at the bulk plant facility (BH's 1 to 4) delineated the hydrocarbon contamination plume to the west, south and east. An elevated soil headspace vapour level in BH4 at 3.0 m (clay/clay till interface) indicated a potential preferential seepage path to the west along the interface. The concrete berm of the tank farm to the north prevented delineation of the plume to the north. Gasoline and diesel based residuals in excess of Alberta *Level III* criteria were found in BH1.

Boreholes drilled at the gas station facility (BH's 5 to 9) delineated the plume to the north only. Elevated soil headspace vapour levels in BH5 indicated a potential of off-site migration. Gasoline and diesel based residuals were found in BH's 5 and 6 in excess of Alberta *Level III* criteria

Groundwater levels after drilling indicated a hydraulic gradient to the west. No phase-separated hydrocarbons were observed in the monitoring wells. Laboratory analysis however, indicated dissolved hydrocarbons in excess of Alberta *Level III* were present. Additional monitoring will be required to confirm groundwater conditions.

The inferred soil contamination plume for soils in excess of Alberta *Level III* are shown on Figure 4. Impacted soils were observed to a depth of 3.0 m at the tank farm facility. The estimated soil volume in excess of Alberta *Level III* criteria would be in the order of 300 m^3 . Additional contamination is likely present within and underneath the tank farm itself with the possible migration to the west underneath the storage warehouse and office structures. Test pits should be excavated within the tank farm if the bulk facility is to be decommissioned to determine the volume and extent of impacted soil.

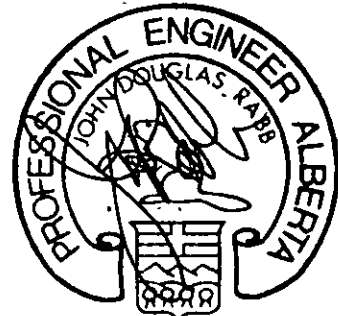
CLOSURE

The assessment is based on the interpretation of data collected from field investigations and the results of the laboratory analysis, which was limited to the quantification of common hydrocarbon indicators in select samples. SEACOR expresses no warranty with respect to the accuracy of the laboratory analysis, methodologies used, or presentation of analytical results by the laboratory. Actual hydrocarbon concentration in the samples submitted may vary according to the extraction and testing procedures used. The evaluation and conclusions reported herein do not preclude the existence of other chemical compounds and/or that variations of conditions within the site may be possible. Hence, this report should be used for informational purposes only and should not be construed as a comprehensive hydrogeological or chemical characterization of the site. This report is for the exclusive use of Canadian Turbo Inc. and its authorized agents.

Yours truly,



M. B. Humbert, P.Eng
Senior Engineer



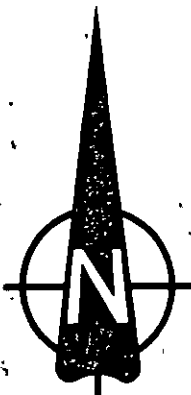
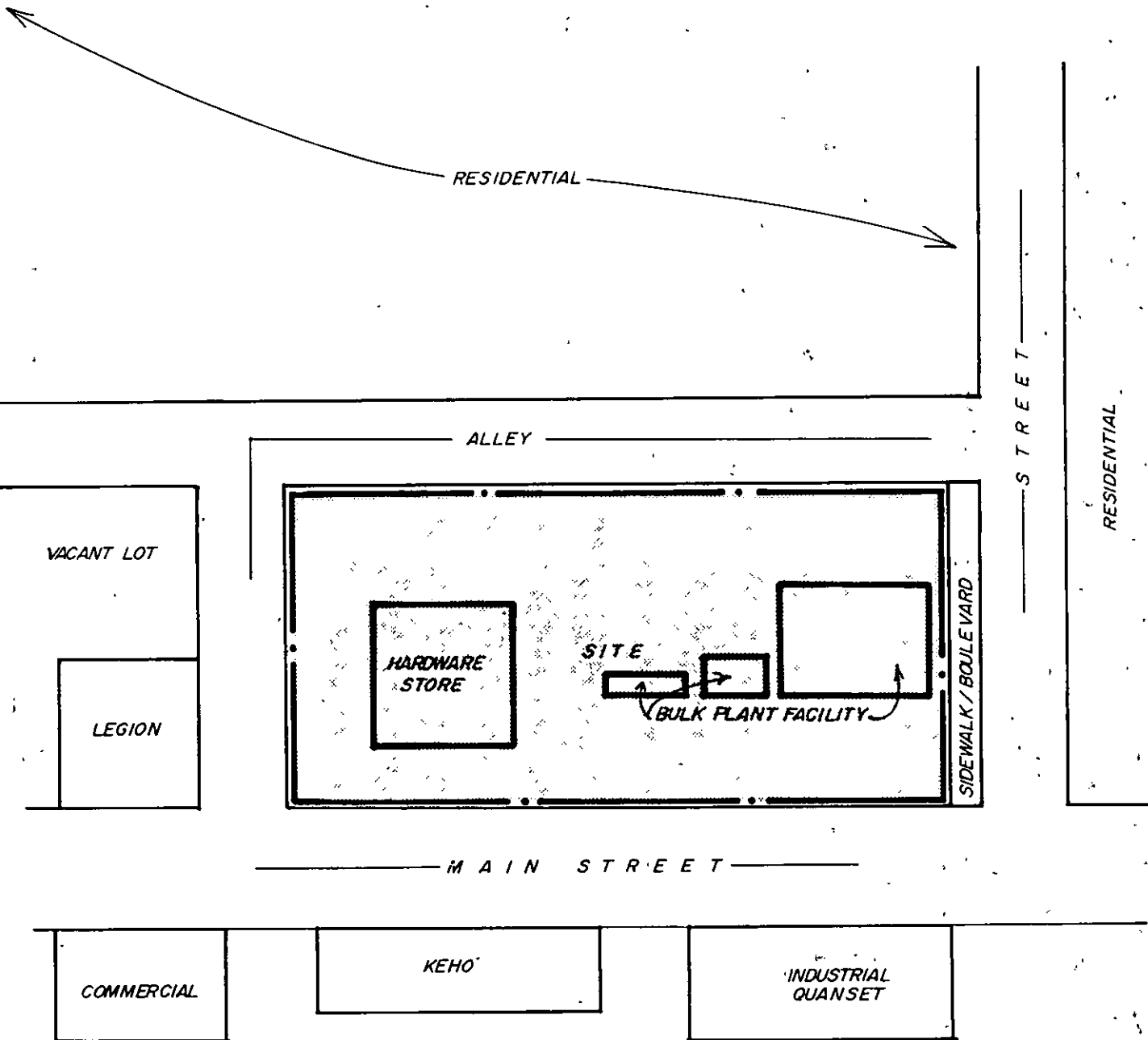
Reviewed by,

A.J. Sheppard, P.Geo.(B.C.)
Hydrogeologist

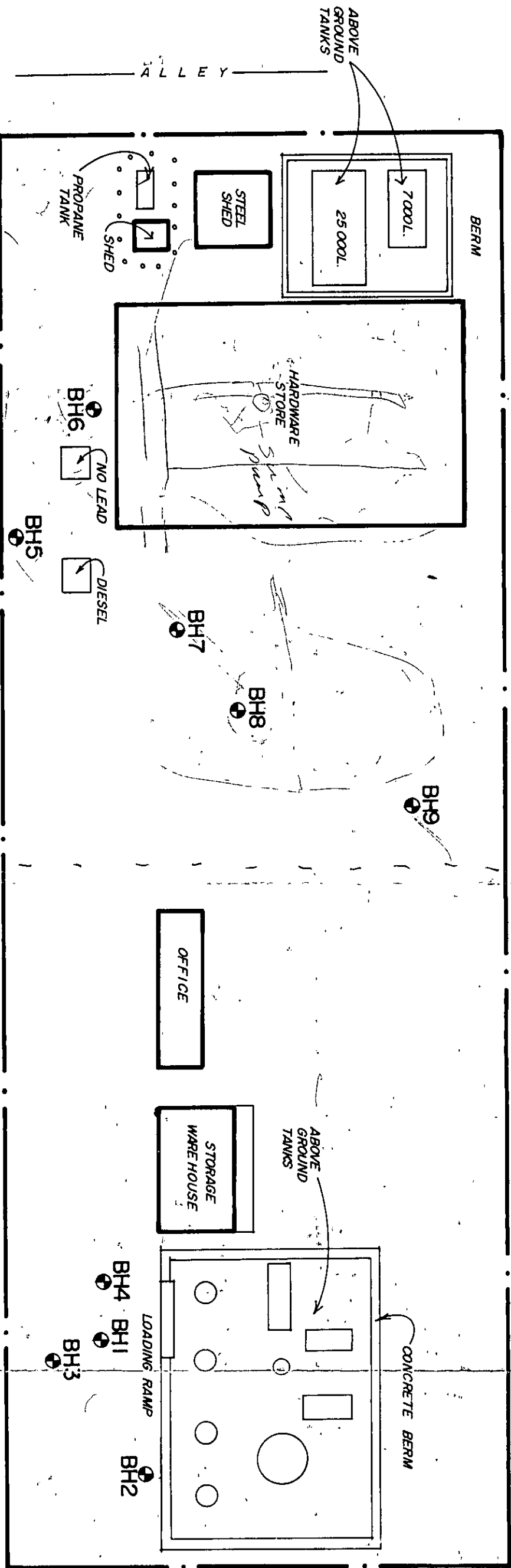
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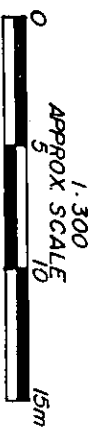
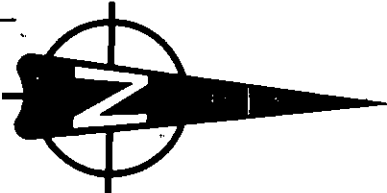
SEACOR		TURBO		CANADIAN TURBO INC. BARONS TURBO Bulk Plant #9056 235 Main St., BARONS, ALTA.	
				SURROUNDING LAND USE PLAN	
SCALE NTS	DATE AUG. / 93	MADE MH / cm	CHKD:	JOB NO. H0031-093	FIG 1



ALLEY

MAIN STREET

STREET



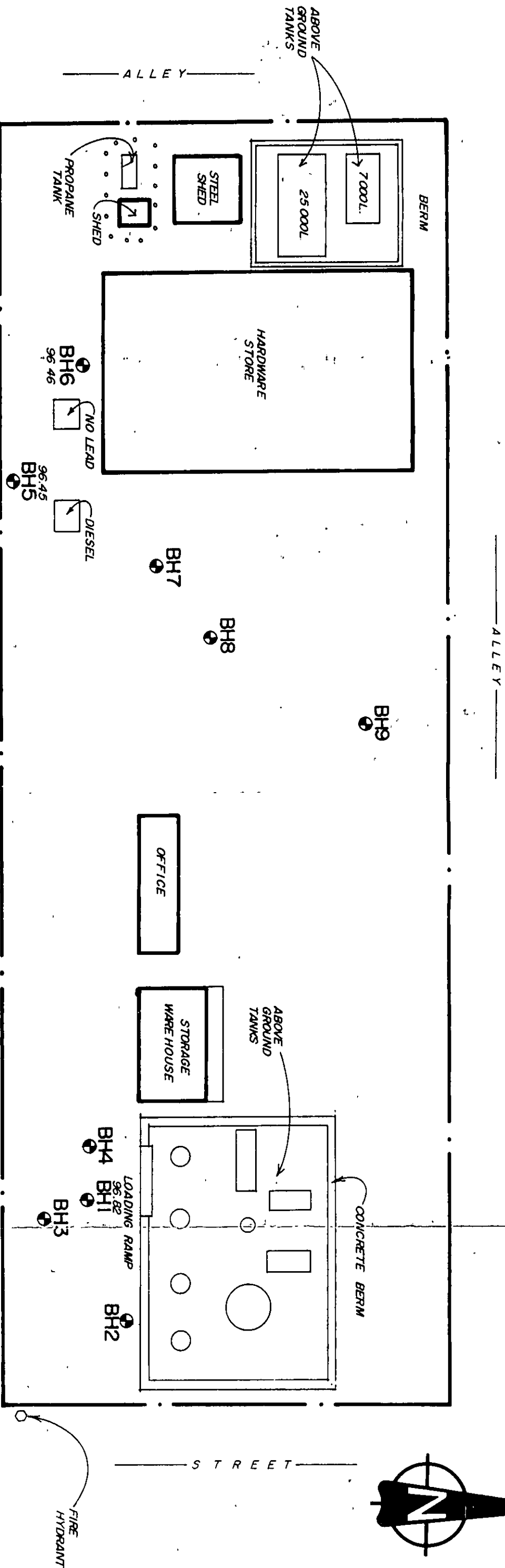
SEACOR

TURBO CANADIAN TURBO INC
BARONS TURBO Bulk plant #9056
235 Main St., BARONS, ALTA

SITE PLAN

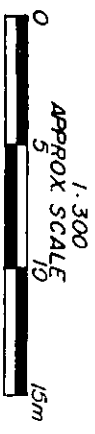
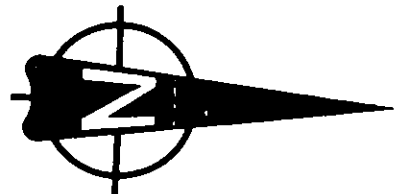
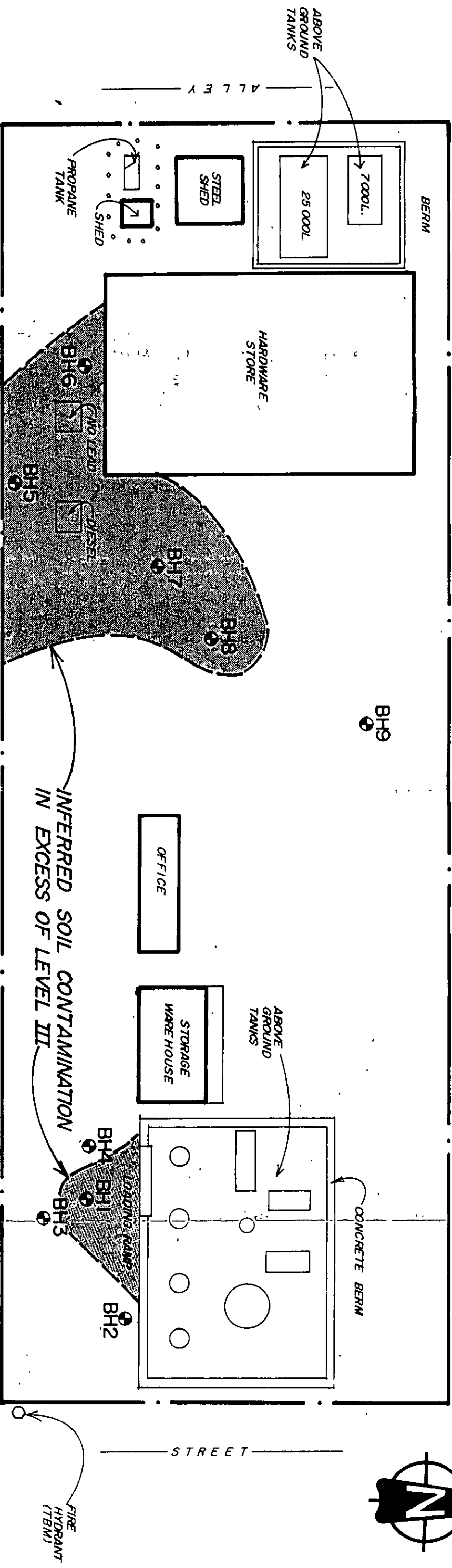
SCALE: 1 : 300 DATE: AUG. / 93 MADE: MH / cm CHKO: JOB NO: H0031 - 093 FIG. 2

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.



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SEACOR		CANADIAN TURBO INC BARONS TURBO Bulk Plant # 9056 235 Main St., BARONS, ALTA	
GROUNDWATER LEVELS			
SCALE: 1 : 300	DATE: AUG. / 93	MADE: MH / gm	CHKD:
		JOB NO: H0031 - 093	FIG 3



SEACOR		TURBO	
CANADIAN TURBO INC.		BARONS TURBO Bulk Plant # 9056	
235 Main St., BARONS, ALTA		INFERRED SOIL CONTAMINANT PLUME	
SCALE 1 : 300	DATE: AUG. / 93	MADE: MH / cm	CHKD: .
JOB NO: H0031 - 093		FIG. 4	

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN



BOREHOLE LOGS

<i>GENERAL INFORMATION TABLE</i>	
SEACOR JOB NO.	H0031-093
JOB LOCATION	Baron's Turbo Bulk Plant # 9056 235 Main Street, Barons, Alberta
DATE SAMPLED	July 27, 1993
DRILL RIG USED	Truck mounted continuous flight auger drill rig
LOGGED BY	Tracey Forbister
WEATHER	25 °C, Sunny
VAPOUR DETECTOR	Gastechtor Explosimeter 1238
DATUM	Surveyed July 27, 1993

Note: The following soil bore hole logs provide a description of the ground conditions encountered, samples taken and subsequent laboratory analysis. The soil descriptions were made from on site visual observations and have not been confirmed by laboratory classification testing. Hydrocarbon odours and staining noted only where apparent. These logs should not be used for geotechnical design.

BOREHOLE LOG
Borehole 1
CTI Bulk Plant # 9056

Location: South of tank farm			Elevation: 99.18 m	
Depth (m)	Soil Description	Sample Depth (m)	Hydrocarbon Vapour Concentration	Other Tests
0.0 - 1.5	SILT (NATIVE) - brown, stiff, low plastic, damp - clayey from 1.4 to 1.5 m - no hydrocarbon odour or staining	0.8	300 ppm	
1.5 - 3.0	CLAY (NATIVE) - silty, brown, firm, low plastic, moist - hydrocarbon odour - staining from 1.5 to 3.0 m	1.5 2.3	30% LEL 25% LEL	BTEX,TPH phenols, lead
3.0 - 4.3	CLAY (TILL) - silty, brown, stiff, low plastic, moist, oxides - slight hydrocarbon odour upper 0.3 m - no hydrocarbon staining	3.0 3.8	25% LEL 30 ppm	
4.3 - 6.1	SANDSTONE (BEDROCK) - weathered, fine, brown, dense, damp - oxides and minor hydrocarbon staining at 4.9 m - gray sand seams below 5.8 m	4.6 5.3 6.1	50 ppm 200 ppm 450 ppm	

End of Borehole at 6.1 m

Notes: Volatile hydrocarbon vapour concentrations recorded using field headspace techniques

Monitoring well installation details:

machine slotted PVC	6.1 - 1.5 m
solid riser PVC	1.5 - 0.1 m
Frac sand	6.1 - 1.4 m
bentonite seal	1.4 - 0.5 m
sand/bentonite mixture	0.5 - 0.0 m
casing	0.15 m - surface

Groundwater observations on	July 27, 1993
water level	2.36 m
phase-separated hydrocarbons	none

BOREHOLE LOG
Borehole 2
 CTI Bulk Plant # 9056

Location: Southeast of tank farm			Elevation: 99.30 m	
Depth (m)	Soil Description	Sample Depth (m)	Hydrocarbon Vapour Concentration	Other Tests
0.0 - 1.5	SILT (NATIVE) - brown, firm, low plastic, damp - no hydrocarbon odour or staining			
1.5 - 3.0	CLAY (NATIVE) - silty, brown, stiff, low plastic, moist, oxides, coal intrusions throughout - no hydrocarbon odour or staining	0.8	110 ppm	
3.0 - 4.6	CLAY (TILL) - silty, brown, stiff, low plastic, damp - no hydrocarbon odour or staining	1.5 2.3	50 ppm 25 ppm	
4.6 - 5.5	SANDSTONE (BEDROCK) - weathered, brown, fine, dense, damp - no hydrocarbon odour or staining	3.0 3.8 4.6	25 ppm 60 ppm 60 ppm	

End of Borehole at 5.5 m

Notes: Volatile hydrocarbon vapour concentrations recorded using field headspace techniques.

No monitoring well installed.

Borehole backfilled with soil cuttings, bentonite seal top 0.3 m.

BOREHOLE LOG
Borehole 3
 CTI Bulk Plant # 9056

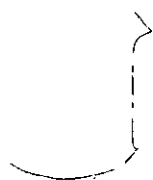
Location: South of tank farm			Elevation: 99.20 m	
Depth (m)	Soil Description	Sample Depth (m)	Hydrocarbon Vapour Concentration	Other Tests
0.0 - 1.5	SILT (NATIVE) - brown, firm, low plastic, damp - no hydrocarbon odour or staining	0.8	75 ppm	
1.5 - 3.0	CLAY (NATIVE) - silty, brown, stiff, low plastic, moist, oxides, fissured - no hydrocarbon odour or staining	1.5 2.3	80 ppm 70 ppm	
3.0 - 3.7	CLAY (TILL) - silty, brown, stiff, low plastic, moist, oxides - no hydrocarbon odour or staining	3.0	55 ppm	
3.7 - 6.1	SANDSTONE (BEDROCK) - weathered, fine, brown, dense, damp - no hydrocarbon odour or staining - seepage at 5.5 m.	4.6 5.3 6.1	75 ppm 50 ppm 70 ppm	

End of Borehole at 6.1 m

Notes: Volatile hydrocarbon vapour concentrations recorded using field headspace techniques

No monitoring well installed.

Borehole backfilled with soil cuttings, bentonite seal top 0.3 m.



BOREHOLE LOG
Borehole 4
CTI Bulk Plant # 9056

Location: Southwest corner of tank nest			Elevation: 99.16 m	
Depth (m)	Soil Description	Sample Depth (m)	Hydrocarbon Vapour Concentration	Other Tests
0.0 - 1.5	SILT (NATIVE) - brown, stiff, low plastic, damp - no hydrocarbon odour or staining	0.8	70 ppm	
1.5 - 3.0	CLAY (NATIVE) - silty, brown, stiff, low plastic, moist - hydrocarbon odour at 3.0 m - no hydrocarbon staining	1.5 2.3	85 ppm 350 ppm	
3.0 - 4.9	CLAY (TILL) - silty, brown, stiff, low plastic, moist, coal intrusions, oxides - no hydrocarbon odour or staining	3.0 3.8 4.6	35% LEL 30 ppm 25 ppm	BTEX, TPH phenols, lead
4.9 - 6.1	SANDSTONE (BEDROCK) - weathered, fine, brown, dense, damp - seepage at 5.5 m - no hydrocarbon odour or staining	5.3 6.1	25 ppm 25 ppm	

End of borehole at 6.1 m

Notes: Volatile hydrocarbon vapour concentrations recorded using field headspace techniques

No monitoring well installed.

Borehole backfilled with soil cuttings, bentonite seal top 0.3 m

BOREHOLE LOG
Borehole 5
CTI Bulk Plant # 9056

Location: Southeast of hardware store			Elevation: 98.75 m	
Depth (m)	Soil Description	Sample Depth (m)	Hydrocarbon Vapour Concentration	Other Tests
0.0 - 2.4	SILT (NATIVE) - brown, stiff, low plastic, damp, some gravel sizes - no hydrocarbon odour or staining	0.8	125 ppm	
2.4 - 3.7	CLAY (NATIVE) - silty, moist, firm, low plastic, brown - hydrocarbon odour at 2.3 m - no hydrocarbon staining	1.5 2.3	140 ppm 40% LEL	
3.7 - 4.3	CLAY (TILL) - silty, brown, very stiff, low plastic, damp - hydrocarbon odour - no hydrocarbon staining	3.0 3.8 4.6	15% LEL 6% LEL 400 ppm	
4.3 - 5.5	SAND (NATIVE) - fine, brown, compact, damp - hydrocarbon odour - no hydrocarbon staining	5.3	7% LEL	
5.5 - 7.6	CLAY (NATIVE) - silty, brown, stiff, low plastic, moist, oxides - hydrocarbon odour at 5.5 m - no hydrocarbon staining - seepage at 6.4 m	6.1 7.6	10% LEL 125 ppm	

End of Borehole at 7.6 m

Notes: Volatile hydrocarbon vapour concentrations recorded using field headspace techniques

Monitoring well installation details:	machine slotted PVC	7.6 - 1.5 m
	solid riser PVC	1.5 - 0.1 m
	Frac sand	7.6 - 1.0 m
	bentonite seal	1.0 - 0.2 m
	sand/bentonite mixture	0.2 - 0.0 m
	casing	0.15 m - surface

Groundwater observations on	July 27, 1993
water level	2.30 m
phase-separated hydrocarbons	none

BOREHOLE LOG
Borehole 6
CTI Bulk Plant # 9056

Location: South of hardware store			Elevation: 98.81 m	
Depth (m)	Soil Description	Sample Depth (m)	Hydrocarbon Vapour Concentration	Other Tests
0 - .08	CONCRETE			
0.08 - 1.5	SILT (NATIVE) - brown, stiff, low plastic, moist - no hydrocarbon odour or staining	0.8	140 ppm	
1.5 - 2.7	CLAY (NATIVE) - silty, brown, stiff, low plastic, moist - minor staining from 2.3 to 3.0 m - hydrocarbon odour at 2.3 m	1.5 2.3	180 ppm +100% LEL	BTEX, TPH phenols, lead flashpoint
2.7 - 4.9	CLAY (TILL) - silty, brown, very stiff, low plastic, moist - hydrocarbon odour throughout - no hydrocarbon staining	3.0 3.8 4.6	45% LEL 10% LEL 10% LEL	
4.9 - 9.4	SANDSTONE (BEDROCK) - weathered, fine, brown, dense, damp - hydrocarbon odour throughout - no hydrocarbon staining - seepage at 9.1 m	5.3 6.1 6.9 7.6 8.4 9.1	55% LEL 60% LEL 60 ppm 50 ppm 5% LEL 25% LEL	

End of Borehole at 9.4 m

Notes: Volatile hydrocarbon vapour concentrations recorded using field headspace techniques

Monitoring well installation details:

machine slotted PVC	9.4 - 1.8 m
solid riser PVC	1.8 - 0.1 m
Frac sand	9.4 - 1.5 m
bentonite seal	1.5 - 0.5 m
sand/bentonite mixture	0.5 - 0.0 m
casing	0.15 m - surface

Groundwater observations on July 27, 1993

water level	2.35 m
phase-separated hydrocarbons	none

Water sample recovered and analyzed for BTEX, TPH, phenols and lead.

BOREHOLE LOG
Borehole 7
CTI Bulk Plant # 9056

Location: East of hardware store			Elevation: 99.01 m	
Depth (m)	Soil Description	Sample Depth (m)	Hydrocarbon Vapour Concentration	Other Tests
0.0 - 1.5	SILT (NATIVE) - brown, stiff, low plastic, moist	0.8	25 ppm	
1.5 - 3.0	CLAY (NATIVE) - silty, brown, stiff, low plastic, moist - hydrocarbon odour - hydrocarbon staining from 1.5 to 3.0 m	1.5 2.3	50 ppm 35% LEL	
3.0 - 4.5	CLAY (TILL) - silty, brown, stiff, low plastic, damp, coal intrusions, oxides - hydrocarbon odour at 3.0 m - no hydrocarbon staining	3.0 3.8	35% LEL 250 ppm	
4.5 - 7.6	SANDSTONE (BEDROCK) - weathered, fine, brown, dense, damp - minor staining at 6.1 m - hydrocarbon odour	4.6 5.3 6.1 6.9 7.6	5% LEL 490 ppm 6% LEL 190 ppm 50 ppm	

End of Borehole at 7.6 m

Notes: Volatile hydrocarbon vapour concentrations recorded using field headspace techniques

No monitoring well installed.

Borehole backfilled with soil cuttings, bentonite seal top 0.3 m

BOREHOLE LOG
Borehole 8
CTI Bulk Plant # 9056

Location: East of hardware store			Elevation: 99.26 m	
Depth (m)	Soil Description	Sample Depth (m)	Hydrocarbon Vapour Concentration	Other Tests
0.0 - 1.5	SILT - moist, firm, low plastic, brown	0.8	30 ppm	
1.5 - 3.0	CLAY - silty, moist, firm, medium plastic, brown - minor staining from 1.8 to 2.4 m	1.5 2.3	50 ppm 30% LEL	
3.0 - 4.6	CLAY TILL - silty, moist, stiff, low plastic, brown - coal intrusions, oxides	3.0 3.8	15% LEL 25% LEL	
4.6 - 9.1	BEDROCK (weathered sandstone) - damp, fine grained, dense, brown	4.6 5.3 6.1 6.9 7.6 8.4 9.1	46% LEL 5% LEL 10% LEL 5% LEL 5% LEL 90 ppm 125 ppm	

End of Borehole at 9.1 m

Notes: Volatile hydrocarbon vapour concentrations recorded using field headspace techniques

No monitoring well installed.

Borehole backfilled with soil cuttings

BOREHOLE LOG
Borehole 9
CTI Bulk Plant # 9056

Location: East of hardware store			Elevation: 99.31 m	
Depth (m)	Soil Description	Sample Depth (m)	Hydrocarbon Vapour Concentration	Other Tests
0.0 - 1.5	SILT (NATIVE) - brown, stiff, low plastic, moist - no hydrocarbon odour or staining	0.8	25 ppm	
1.5 - 3.0	CLAY (NATIVE) - silty, brown, stiff, medium plastic, moist - no hydrocarbon odour or staining	1.5 2.3 3.0	25 ppm 25 ppm < 5 ppm	

End of Borehole at 3.0 m

Notes: Volatile hydrocarbon vapour concentrations recorded using field headspace techniques

No monitoring well installed.

Borehole backfilled with soil cuttings, bentonite seal top 0.3 m.

SOIL AND WATER ANALYSIS

service

laboratories

ltd.



CHEMICAL ANALYSIS REPORT

Date: August 19, 1993
ASL File No. D3154
Report On: H0031-093-CC
Soil and Water Analysis
Report To: **SEACOR Environmental Eng. Inc.**
130 - 630 4th Avenue SW
Calgary, AB
T2P 0J9
Attention: **Mr. Brad Follett**
Received: August 3, 1993

ASL ANALYTICAL SERVICE LABORATORIES LTD.

per:

A handwritten signature in black ink, appearing to read 'Dawn Gilbert'.

Dawn Gilbert
Project Chemist

A handwritten signature in black ink, appearing to read 'Jasper van de Wetering'.

Jasper van de Wetering, B.Sc.
Project Chemist

cc: Alan Sheppard - SEACOR Vanc.





REMARKS

File No. D3154

It was necessary to increase the detection limits for Toluene and ortho-Xylene in the sample identified as "BH1 1.5m". The sample contained hydrocarbon material that interferes with the quantitation of these compounds.

RESULTS OF ANALYSIS - Sediment/Soil¹

File No. D3154

	BH1 1.5m 93 07 27	BH4 3.0m 93 07 27	BH6 2.3m 93 07 27
<u>Physical Tests</u>			
Flashpoint Degrees C.	-	-	>61
Moisture %	23.4	20.2	24.6
<u>Total Metals</u>			
Lead T-Pb	13.1	11.9	23.7
<u>Non-halogenated Volatiles</u>			
Benzene	5.15	2.97	8.35
Ethylbenzene	20.3	4.12	44.5
Toluene	<1	13.7	138
meta- & para-Xylene	77.8	17.9	255
ortho-Xylene	<1	6.57	110
Light Hydrocarbons	1220	351	4380
<u>Extractables</u>			
Total Extractable Hydrocarbons	460	170	1320
Total Petroleum Hydrocarbons	1220	360	4970
<u>Organic Parameters</u>			
Phenols	1.72	0.06	0.37

Remarks regarding the analyses appear at the beginning of this report.
< = Less than the detection limit indicated.
¹Results are expressed as milligrams per dry kilogram except where noted.

**RESULTS OF ANALYSIS - Water¹**

File No: D3154

BH6

93 07 27

Total Metals

Lead	T-Pb	<0.001
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Non-halogenated Volatiles

Benzene	2.74
Ethylbenzene	0.695
Toluene	3.90
meta- & para-Xylene	3.23
ortho-Xylene	1.41
Light Hydrocarbons	50.7

Extractables

Total Extractable Hydrocarbons	79.0
Total Petroleum Hydrocarbons	93.4

Organic Parameters

Phenols	0.175
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Remarks regarding the analyses appear at the beginning of this report.

< = Less than the detection limit indicated.

¹Results are expressed as milligrams per litre except where noted.



METHODOLOGY

File No. D3154

Samples were analyzed by methods acceptable to the appropriate regulatory agency. Outlines of the methodologies utilized are as follows:

Flashpoint of Sediment/Soil

This analysis is carried out in accordance with ASTM Method D3828-79. The procedure involves heating a subsample to a specific temperature in a Setaflash closed cup tester. A test flame is then applied and an observation made as to whether or not a flash occurred, indicating ignition of the sample.

Moisture

This analysis is carried out gravimetrically by drying the sample to constant weight at 103 C.

Metals in Sediment/Soil

These analyses are carried out using procedures that are consistent with the requirements of the appropriate regulatory agencies and adapted from U.S. EPA Method 3050 (Publ. # SW-846, 3rd ed., Washington, DC 20460). The procedures involve a digestion using a combination of nitric and hydrochloric acids. The resulting extract is bulked to volume with deionized/distilled water. The digested portion is then analysed by a variety of instrumental techniques, which may include specific atomic absorption spectrophotometric techniques (AAS) and/or atomic emission spectrophotometry (ICP), to obtain the required detection limit for each element. Specific details are available upon request.

PLEASE NOTE (When the following elements are reported):

Aluminum, barium, calcium, chromium, iron, magnesium, manganese, molybdenum and vanadium are often associated with the silicate matrix of the sediment. Because of this, the recoveries of these elements may be low using the specified digestion. From an environmental standpoint, this is not usually of concern since the "available" metals are typically the fraction of interest.

Non-halogenated Volatiles in Sediment/Soil - Headspace Method

This analysis is carried out in accordance with U.S. EPA Methods 3580/3810 and 8020/8015 (Publ. # SW-846, 3rd ed., Washington, DC 20460). The procedure involves extracting the sample with methanol. An aliquot of this methanol extract is then added to a sealed vial containing a constant volume of water. This vial is sealed and heated, causing the volatile compounds to partition into the gaseous headspace above the sample. A portion of this headspace is then analysed by capillary column gas chromatography with photo-ionization



METHODOLOGY (cont'd)

File No. D3154

detection in conjunction with flame ionization detection.

Total Extractable Hydrocarbons in Sediment/Soil

This analysis is carried out in accordance with U.S. EPA Method 3500/8015. This procedure involves hexane extraction followed by analysis of the extract by capillary column gas chromatography with flame ionization detection.

Total Petroleum Hydrocarbons (Calculated) in Sediment/Soil

The result is obtained by summing the results for Total Extractable Hydrocarbons (EPA Method 3500/8015) and Light Hydrocarbons (EPA Method 3810/8015), and adjusting to allow for overlap of the analyses.

Conventional Parameters in Sediment/Soil

These analyses are carried out on a leachable basis. The procedure involves mixing with reagent grade water and leaching for several hours. The leachate is centrifuged and analysed in accordance with "Standard Methods for the Examination of Water and Wastewater" 17th ed. published by the American Public Health Association, 1989.

Metals in Water

These analyses are carried out in accordance with procedures described in "Standard Methods for the Examination of Water and Wastewater" 18th Edition published by the American Public Health Association, 1992. The procedures involve a variety of instrumental analyses including atomic emission spectrophotometry (ICP) and atomic absorption spectrophotometry (AA) to obtain the required detection limit for each element. Specific details are available on request.

Non-halogenated Volatiles in Water - Headspace Method

This analysis is carried out in accordance with U.S. EPA Methods 3810/8020 and 3810/8015 (Publ. # SW-846, 3rd ed., Washington, DC 20460). The procedure involves the use of a headspace technique in which the volatile non-halogenated compounds volatilize into the headspace of a sealed vial. A portion of this gaseous headspace is then analysed by capillary column gas chromatography with photo-ionization and flame-ionization detection. Samples requiring further confirmation are re-analysed in accordance with U.S. EPA Methods 5030/8240. This procedure uses a purge and trap extraction, with subsequent analysis by capillary column gas chromatography with mass spectrometric detection.



METHODOLOGY (cont'd)

File No. D3154

Total Extractable Hydrocarbons in Water

This analysis is carried out in accordance with U.S. EPA Method 3510/8015 (Publ. #SW-846, 3rd Ed., Washington, DC 20460). The procedure involves extraction with methylene chloride. The extract is then reduced in volume and analysed by capillary column gas chromatography with flame ionization detection.

Total Petroleum Hydrocarbons (Calculated) in Water

The result is obtained by summing the results for Total Extractable Hydrocarbons (EPA Method 3500/8015) and Light Hydrocarbons (EPA Method 5030/8015), and adjusting to allow for overlap of the analyses.

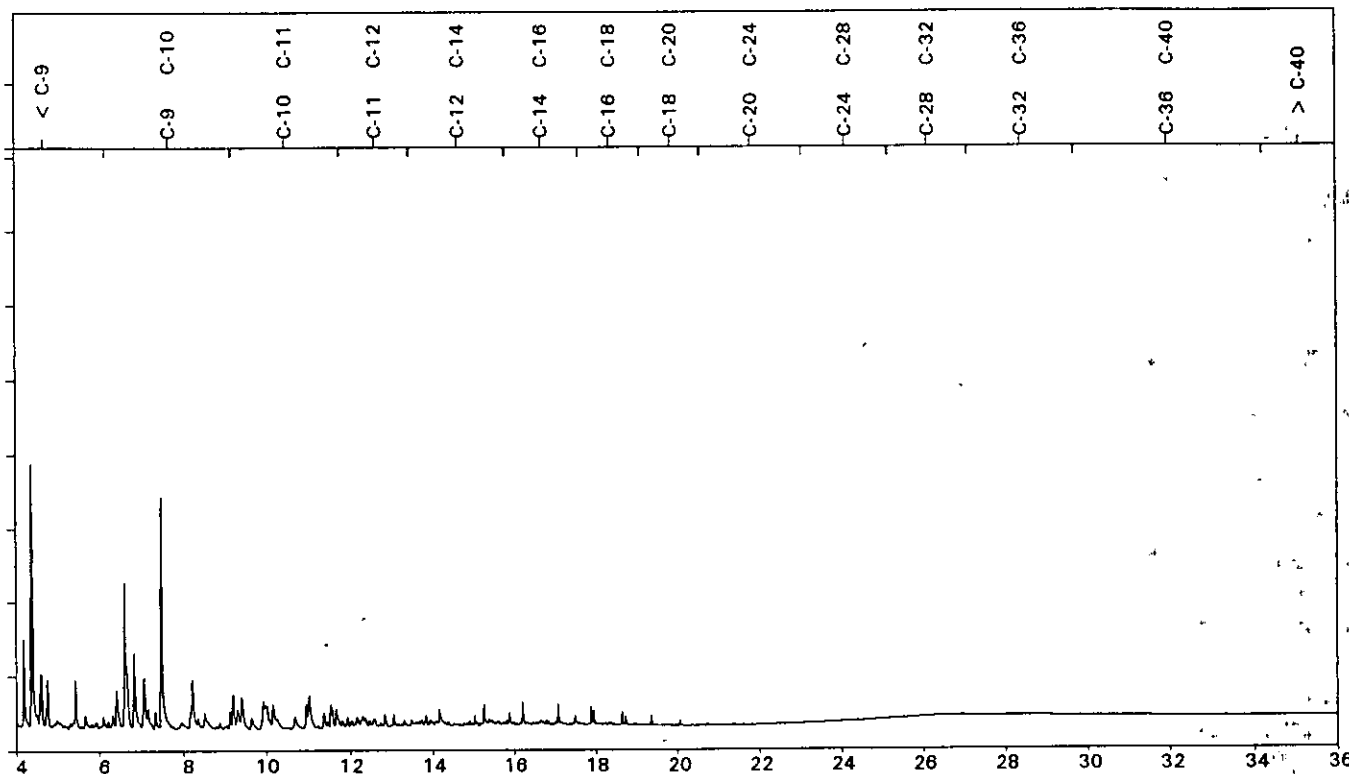
Conventional Parameters in Water

These analyses are carried out in accordance with procedures described in "Standard Methods for the Examination of Water and Wastewater" 18th Ed. published by the American Public Health Association, 1992. Further details are available on request.

End of Report

Sample Name: 154-1

0 to 36 min. Low Y=-1.0 High Y=50.0 mv Span=51.0



HYDROCARBON DISTRIBUTION REPORT

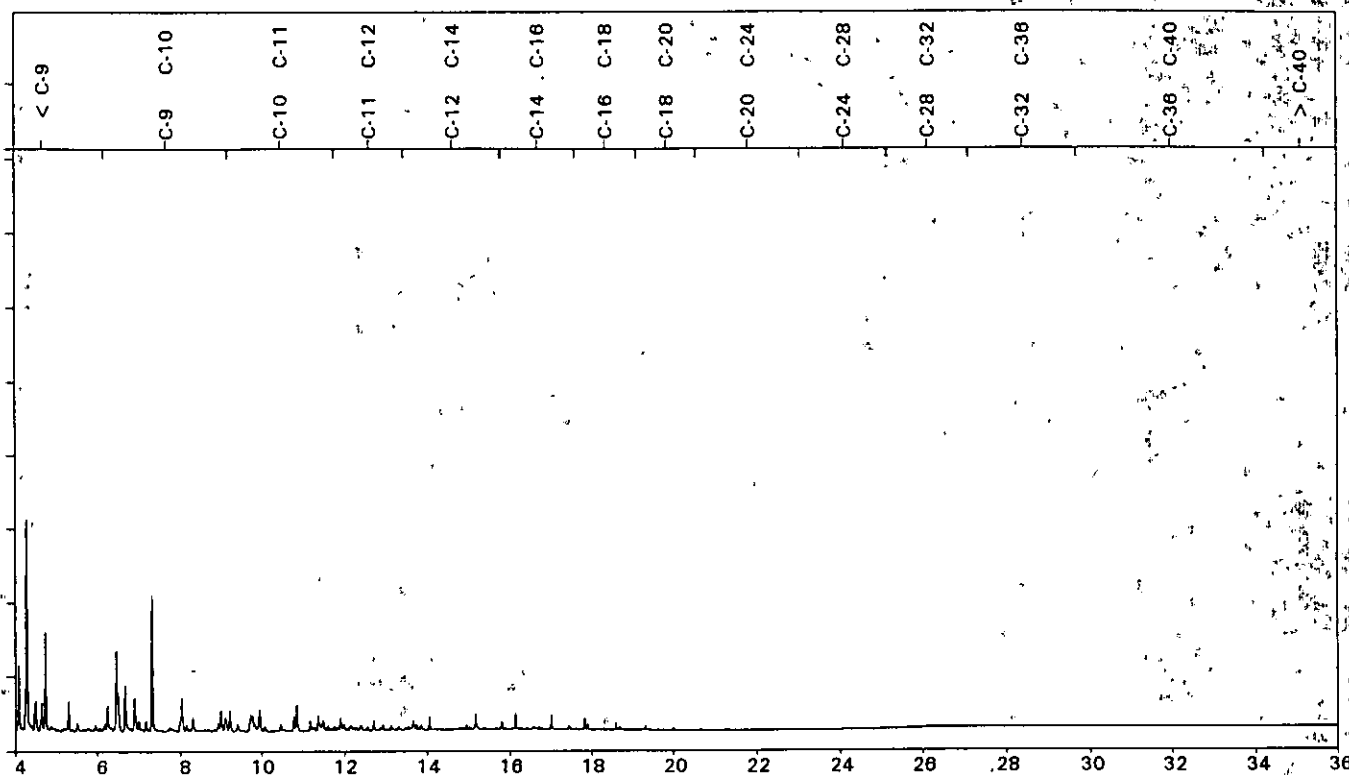
SAMPLE: BH1 1.5m

Petroleum Constituents Table

Name	Carbon Number
Gasolines	C-5 to C-14
Aviation Fuels	C-6 to C-18
Diesel Fuels	C-8 to C-20
Kerosenes	C-9 to C-18
Bunker Oil	C-9 and higher
Lubricating Oils	C-17 and higher
Waxes	C-20 and higher

The above table can be used to obtain a qualitative determination of the type of petroleum product present in any given sample. However the use of carbon number ranges is limited since many of the products listed in the table have overlapping carbon number ranges. A secondary confirmation of the type of material present in the sample can be obtained from comparision of the sample chromatogram to those obtained from pure commercial petroleum formulations.

File=C:\T\TEHAUG11.25R Date printed=08-12-1993 Time= 03:10:37
 Sample Name=154-2
 0 to 36.0 min. Low Y=-1.0 High Y=50.0 mv Span=51.0



HYDROCARBON DISTRIBUTION REPORT

SAMPLE: BH4 3.0m

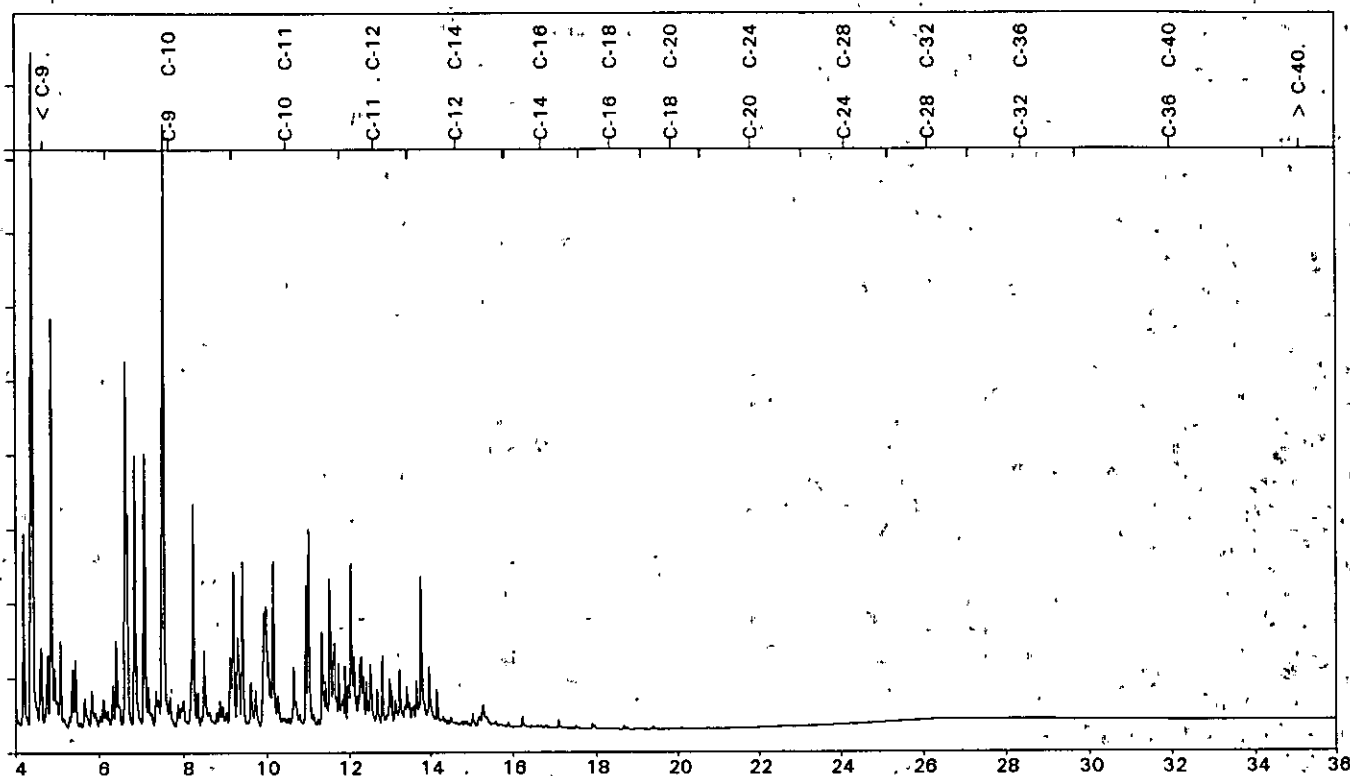
Petroleum Constituents Table

Name	Carbon Number
Gasolines	C-5 to C-14
Aviation Fuels	C-6 to C-18
Diesel Fuels	C-8 to C-20
Kerosenes	C-9 to C-18
Bunker Oil	C-9 and higher
Lubricating Oils	C-17 and higher
Waxes	C-20 and higher

The above table can be used to obtain a qualitative determination of the type of petroleum product present in any given sample. However, the use of carbon number ranges is limited since many of the products listed in the table have overlapping carbon number ranges. A secondary confirmation of the type of material present in the sample can be obtained from comparison of the sample chromatogram to those obtained from pure commercial petroleum formulations.

Sample Name 154-3

0 to 36 min. Low Y=-1.0 High Y=50.0 mv Span=51.0



HYDROCARBON DISTRIBUTION REPORT

SAMPLE: BH6 2.3m

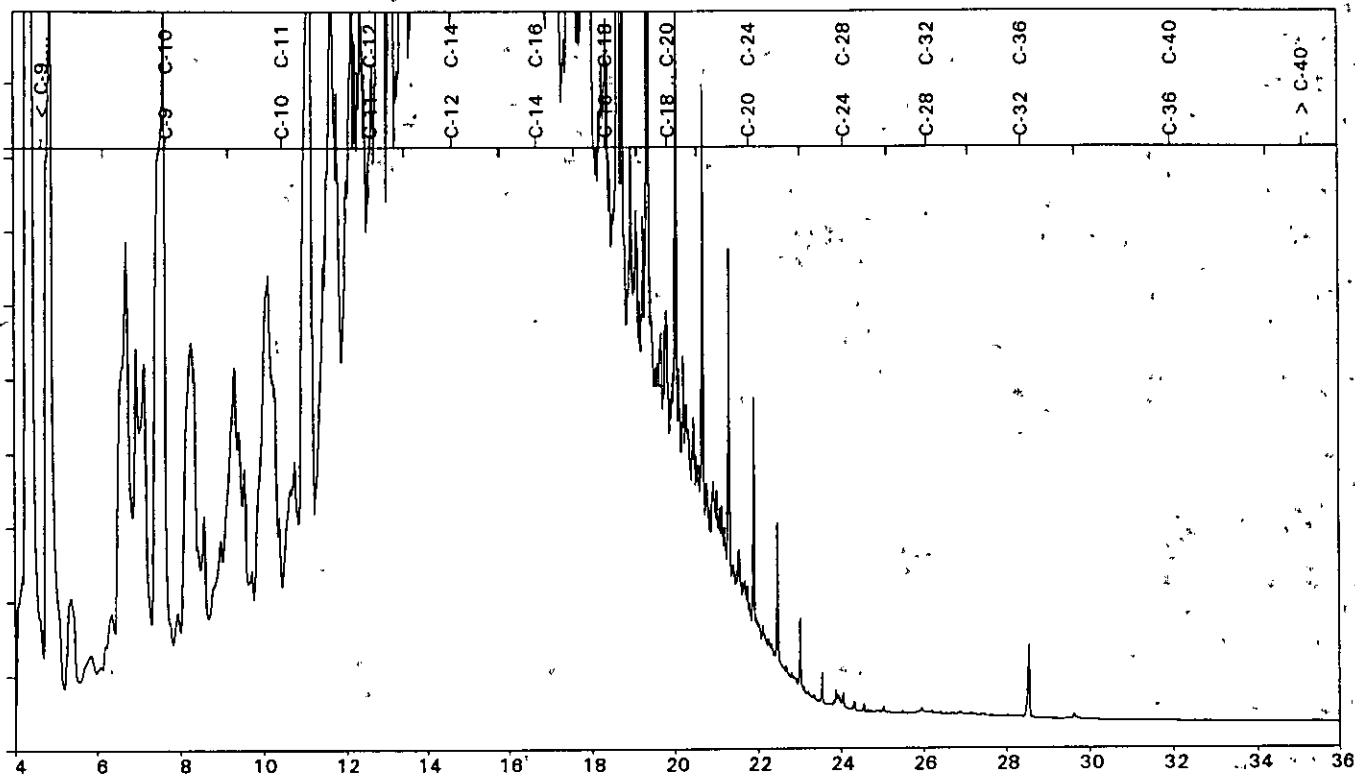
Petroleum Constituents Table

Name	Carbon Number
Gasolines	C-5 to C-14
Aviation Fuels	C-6 to C-18
Diesel Fuels	C-8 to C-20
Kerosenes	C-9 to C-18
Bunker Oil	C-9 and higher
Lubricating Oils	C-17 and higher
Waxes	C-20 and higher

The above table can be used to obtain a qualitative determination of the type of petroleum product present in any given sample. However the use of carbon number ranges is limited since many of the products listed in the table have overlapping carbon number ranges. A secondary confirmation of the type of material present in the sample can be obtained from comparison of the sample chromatogram to those obtained from pure commercial petroleum formulations.

Sample Name 154-4

0 to 36 min Low Y=-1.0 High Y=50.0 mv Span=51.0



HYDROCARBON DISTRIBUTION REPORT

SAMPLE: BH6

Petroleum Constituents Table

Name	Carbon Number
Gasolines	C-5 to C-14
Aviation Fuels	C-6 to C-18
Diesel Fuels	C-8 to C-20
Kerosenes	C-9 to C-18
Bunker Oil	C-9 and higher
Lubricating Oils	C-17 and higher
Waxes	C-20 and higher

The above table can be used to obtain a qualitative determination of the type of petroleum product present in any given sample. However the use of carbon number ranges is limited since many of the products listed in the table have overlapping carbon number ranges. A secondary confirmation of the type of material present in the sample can be obtained from comparison of the sample chromatogram to those obtained from pure commercial petroleum formulations.