

**REPORT
ON THE INVESTIGATION OF
SUBSURFACE PETROLEUM CONTAMINATION**

**PALMER'S GARAGE
FERRISBURG, VERMONT
SITE #91-1130**

DECEMBER, 1992

Prepared for:

Robinson's, Inc.
P.O. BOX 405
Essex Junction, Vermont 05453

Prepared by:

GRIFFIN INTERNATIONAL, INC
2B Dorset Lane
Williston, Vermont 05495
(802) 879-7708

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1.0 INTRODUCTION

This report details the investigation of subsurface petroleum contamination at the Palmer's Garage in Ferrisburg, Vermont. The investigation has been conducted by Griffin International, Inc. (Griffin) for Robinson's Inc., owner of the underground storage tanks (USTs) at the site which are the suspected sources of the contamination. In a letter to James Robinson of Robinson's Inc., dated 23 October 1991, the Vermont Department of Environmental Conservation (VTDEC) requested this investigation be conducted in response to the discovery of subsurface petroleum contamination at the site on 12 September 1991.

In the letter to James Robinson, the VTDEC requested that the following determinations regarding the contamination be made as part of a limited site assessment:

1. Define the degree and extent of soil and groundwater contamination at this location. As part of a preliminary determination of degree and extent of groundwater contamination, collect water samples from the two westernmost monitoring wells and from the old water supply well to be analyzed to EPA Method 8020. Construction details of all existing on-site wells, including monitoring wells and water supply wells, should be reported.
2. Design and implement a plan to treat and/or dispose of the excavated petroleum contaminated soils.
3. Determine the receptors that may be threatened by this contamination, to include a survey of surrounding buildings to locate any water supply wells.
4. If necessary, develop a remedial plan to treat the residual subsurface contamination, and develop a long term monitoring program to track the contamination over time.
5. Submit a work plan prior to initiation of any of the work requested.
6. Prepare and submit a report to the Sites Managements Section (SMS).

Griffin International has completed the State requested site assessment using a work plan submitted to and approved by the Vermont SMS. Following are the results of this investigation.

2.0 SITE BACKGROUND

2.1 Site description

The site is located immediately west of Route 7, just north of the junction of Stage Road in Ferrisburg, Vermont (see site location map, appendix). The site is located in the central Champlain Valley lowlands, and surficial geology at the site is controlled by the former Lake Vermont and Champlain Sea. Materials at the site are mapped as glaciolacustrine lake bottom sediments, including silt, silty clay and/or clay containing ice rafted boulders. Actual materials observed at the site during the tank pull were reported as coarse sands and loam overlying a clay base. Depth to clay was reported as 7.5 to 8 feet, with groundwater reported at approximately 7.5 feet. Immediately west of the former UST pit, an embankment slopes moderately downward to the west. A groundwater seep exists on the face of this embankment.

The intersection of Route 7 and Stage Road is approximately 1/8 of a mile south of the site. The intersection is at the center of a group of 10-12 buildings which are a combination of residential and commercial properties including a Post Office, a Mobil Station, A Motel and other residences and barns (see area map, appendix). The area surrounding these buildings is rural, primarily open farmland. The commercial and residential properties are served by private water supply wells, both dug and drilled.

2.2 Site History

On 12 September 1991, two 3,000 gallon gasoline underground storage tanks (USTs) were excavated and lifted from their common pit by Delphia Excavating of Vergennes, VT. Oversight services of the tank removal were provided by Champlain Electric, Inc. The tanks were used to store unleaded and super unleaded gasoline. During the tank removal, both USTs were observed to be severely pitted and to have several holes. Soils immediately surrounding the tanks were screened with a photoionization detector (PID), and peak readings of 330 parts per million (ppm) were observed. Readings taken from the soils generally ranged from 100 to 300 ppm. Both USTs passed precision "tightness" tests, conducted by New England Tank Test, Inc. of Marion, Connecticut, on 18 May 1989. Approximately 36 cubic yards of contaminated soils were stored on an adjacent property with the permission of the VTDEC.

A 1979 overfill of the former UST forced the abandonment of the on-site, dug, water supply well, and the installation of a drilled water supply well on 1 October 1979.

3.0 INVESTIGATIVE PROCEDURES

3.1 Existing Monitoring Facilities

During the back-filling of the pit from which the former USTs were removed, four lengths of flexible, 4 inch diameter, perforated, corrugated, drainage tubing was installed at the four corners of the pit by Champlain Electric to serve as groundwater monitoring points (see site map, appendix). These tubes remain in place, but do not have casing, bentonite seals or covers, and do not comply with industry standards for construction of monitoring wells. Construction of these monitoring tubes was visually verified and confirmed in a telephone interview with Champlain Electric.

3.2 Determination Of Groundwater Flow Direction and Gradient

On 13 December 1991, Griffin measured the relative water table elevations in each of the four on-site monitoring tubes. Measurements were made relative to a benchmark (top of tubing at MW-2), which was assigned an arbitrary elevation of 100 feet. Liquid level data is presented in the appendix.

The water table surface was calculated using the water level measurements from each of the four monitoring tubes (see groundwater contour map, appendix). Groundwater in the area of the former USTs was determined to be flowing to the west-southwest at a gradient of approximately 2%. This groundwater flow direction agrees well with the direction suggested by topography at the site. A groundwater seep on the downward sloping embankment west of the UST site also suggests that groundwater is flowing west-southwest.

3.3 Groundwater Sampling and Analysis

Also on 13 December 1991, Griffin collected groundwater samples from the two downgradient monitoring tubes for analysis for VOCs by EPA method 8020 as requested by the VTDEC. Equipment, trip blank and duplicate samples were collected. Results of the Laboratory analyses are summarized below. Laboratory report forms are contained in the appendix.

Parameter	MW-1	MW-2	DUPE MW-1	EQUIP. BLANK	TRIP BLANK	HEALTH ADVISORY
Benzene	51.2	ND	49.4	ND	ND	5.0**
Chlorobenzene	ND	ND	ND	ND	ND	100
1,2 DCB	ND	ND	ND	ND	ND	-
1,3 DCB	ND	ND	ND	ND	ND	-
1,4 DCB	ND	ND	ND	ND	ND	-
Ethylbenzene	11.5	ND	12.0	ND	ND	680
Toluene	3.97	ND	3.94	ND	ND	2420
Xylenes	15.6	ND	16.1	ND	ND	400
Total BTEX	82.3	ND	81.4	ND	ND	-
MTBE	236.	ND	93.6	ND	ND	40

The results indicate that MW-2 contained no detectable concentrations of any of the compounds analyzed for on the sampling date.

MW-1 contained Benzene and MTBE concentrations above Vermont Health Advisory Levels. However, concentrations of all other compounds for which analysis was conducted were well below Vermont Health Advisory Levels.

The trip blank, equipment blank and duplicate samples show that adequate quality control was maintained during sampling.

Griffin was unable to collect a groundwater sample from the abandoned dug water supply well adjacent to Palmer's garage and the former UST pit because this well had been filled in with soil.

3.4 Contaminated Soils

Approximately 36 cubic yards of petroleum contaminated soils were removed from the former UST pit and stored on an adjacent property, also owned by the Palmers. The frozen soil was screened with a field PID and hydrocarbon vapor concentrations of up to 16 ppm, but generally 2-5 ppm, were recorded at the west end of the soil stock-pile. However, about 75% of the soils yielded PID readings of 0 ppm.

The two most common options for treating or disposing of petroleum contaminated soils are summarized in the table below. The costs presented assume an actual soil volume of

36 cubic yards in the case of active recycling, or quarterly monitoring in the case of passive treatment.

TREATMENT/ DISPOSAL METHOD	ESTIMATED TIME FRAME	ESTIMATED COST
ASPHALT BATCHING	Transport soils after spring thaw.	\$4,950 one time shipping and disposal cost.
PASSIVE TREATMENT	Quarterly monitoring for 1-3 years	\$285 per quarter or \$1,140 per year.

If PID readings of 0 ppm can be confirmed in the spring, after the soil has thawed, the cost of asphalt batching may be reduced by separating out soils that remain contaminated from those that are not.

Assuming all 36 cubic yards are to be disposed of through asphalt batching, passive treatment appears to be the least expensive method of handling the contaminated soils.

3.5 Construction of On-Site Water Supply Well

The on-site dug water supply well was abandoned in 1979, after gasoline contamination resulting from an overflow of the UST. A drilled bedrock well was installed as a replacement water supply. In a telephone interview with the groundwater division of the VTDEC, the following information was obtained about the Palmer's drilled well:

Date Drilled: 10-1-79
 Yield: 20 gallons per minute
 Static Water Level: 45 feet
 Water Bearing fracture: 665 feet
 Well Log: 0-40 feet, CLAY
 40-45 feet, fine gray SILT
 45-670 feet, black SLATE
 Casing: 55 feet, steel
 Grouting: Not recorded
 Driller: Spafford

Construction details of the abandoned dug well are not available.

4.0 CONCLUSIONS

Based on the above investigation of subsurface petroleum contamination at Palmer's Garage in Ferrisburg, Griffin has arrived at the following conclusions:

1. There was a release or releases of gasoline to the subsurface in the vicinity of the former UST locations. The source of the release has not been positively identified but it is likely that former USTs were involved due to the presence of elevated PID readings taken from the soils surrounding the tanks, VOCs found in groundwater collected from within the tank pit, and the holes observed in the USTs at the time of their removal. The amount and duration of the release(s) are unknown. Subsurface gasoline contamination from this UST is probably a result of the 1979 overfill in combination with the corrosion produced holes in the UST.

2. The release from the UST resulted in contamination of soils immediately surrounding the tanks in the tank pit. Thirty six cubic yards of these soils were excavated during tank removal and stored on an adjacent property where they remain. Removal of these soils has probably significantly reduced the source strength of any residual contamination.

3. Laboratory analysis indicates that Benzene and MTBE exist in concentrations above the Vermont Health Advisory Levels in groundwater immediately beneath the former USTs. No other parameters were indicated to exist in concentrations above the Health Advisory Levels on the day of sampling. One of the two monitoring tubes sampled (MW-2) contained no contaminant concentrations above detectable levels.

4. The monitoring tubes currently installed at the site, and from which groundwater samples were collected, do not conform to State or Industry construction standards.

5. Removal of the USTs has likely eliminated the source of contamination.

6. Subsurface materials at the location of the former USTs, as determined by the tank pull report and the driller's log from the drilling of the adjacent bedrock well, consist of 7-8 feet of coarse sand overlying 40 feet of clay and 5 feet of silt. This material rests on a black slate. Depth to the water table in the surficial aquifer is approximately 7.5 feet, and it slopes gently to the west-southwest.

7. The thick clay formation underlying the site is likely an effective aquiclude, and is preventing migration of contaminants into the local bedrock aquifer.

8. Gasoline contaminants appear to be moving horizontally to the west-southwest along the upper surface of the clay formation, and ~~emerging from an embankment to the west where they appear as a petroleum sheen on water emerging~~ from a groundwater seep. The volume of contaminants, whether small or large, following this route is unknown.

5.0 RISK ASSESSMENT

Based on the indicated groundwater flow direction it appears that there is at least one water supply well downgradient of the former UST location, the Palmer drilled well.

A clay confining layer observed at the site at a depth of 7.5 to 8 feet, and forty feet thick, is probably protecting the underlying bedrock aquifer, and the Palmer's drilled well, from infiltration of petroleum contaminants introduced by the former UST. The groundwater seep emerging from the embankment southwest of the former UST pit supports this interpretation. However, disturbed soils surrounding the casing of the drilled well could be serving as a preferential pathway, and possible route of contaminant migration.

The petroleum sheen on the water emerging from the embankment has reportedly been present for as much as ten years. The origin if this sheen may have been the 1979 overflow of the former UST. Groundwater flowing down the embankment flows into a level area, reportedly a flood plain, used as a salvage yard.

There appear to be no buildings situated in the direction of the assumed contaminant plume direction which are at risk of accumulating hydrocarbon vapors.

6.0 RECOMMENDATIONS

Based on the above conclusions, Griffin presents the following recommendations regarding the subsurface petroleum contamination at the site:

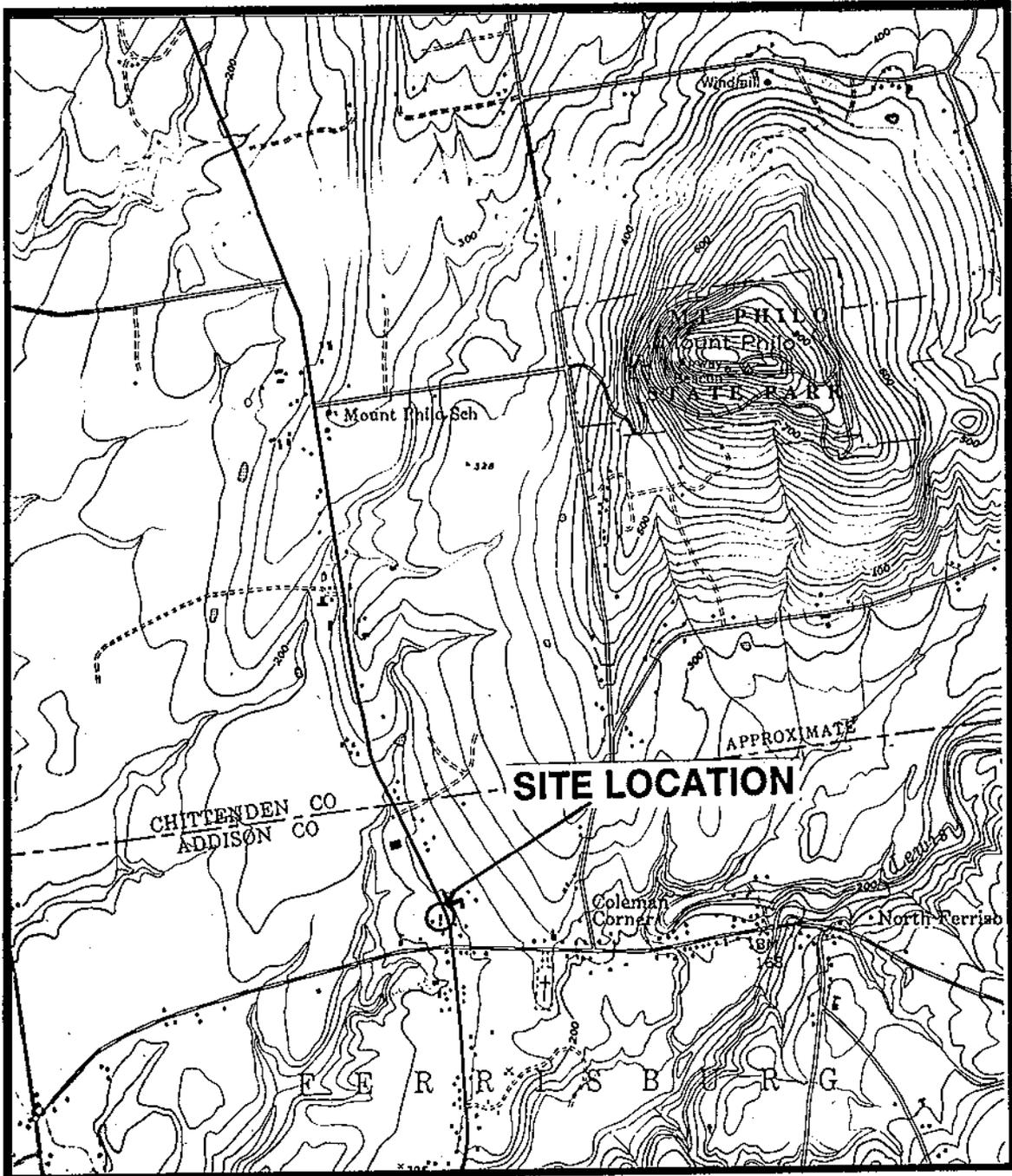
1. Sample the Palmer drilled water supply well and analyze to EPA method 8020 (water). The purpose of this is to determine whether this water supply has been impacted by contaminants migrating into the well via the casing annulus. If this well is found to be contaminated, additional bedrock wells in the area can be sampled to determine if the contamination extends beyond the immediate area.
2. No additional monitoring wells appear necessary, due to the relatively low concentrations of contaminants found in groundwater from within the former UST pit. Additionally, it appears that any contamination which originated from this UST has escaped down the adjacent embankment.
3. Utilize passive treatment as the method to remediate residual contamination in the 36 cubic yards of gasoline contaminated soils stored on the adjacent property. This method should result in the lowest cost of treatment. To monitor passive treatment, the soils should be monitored

quarterly, and field screened with a PID, until vapor borne contaminant concentrations become non-detect. At that time the soils can be returned to grade and landscaped.

4. No water supply wells should be installed within the affected area of the property.

APPENDIX

SITE LOCATION MAP
PROJECT: PALMER'S GARAGE
LOCATION: FERRISBURG, VERMONT



MAP SOURCE: MOUNT PHILO, VERMONT 7.5 MINUTE SERIES PHOTOREVISED 1987

SCALE: 1:24,000





ROUTE 7

ROUTE 7

STAGE ROAD

STAGE ROAD

BORGON

DONNELLY

FORMER UST PIT AND MONITORING POINTS

ABANDONED DUG WELL

PALMER'S GARAGE

SHED

MOBIL STATION

BARN (CHUCK ROSS)

WELL HOUSES

JIMMO'S MOTEL

POST OFFICE

CHUCK'S DELI

BARN (JOHN PIERRE)

MARTIN

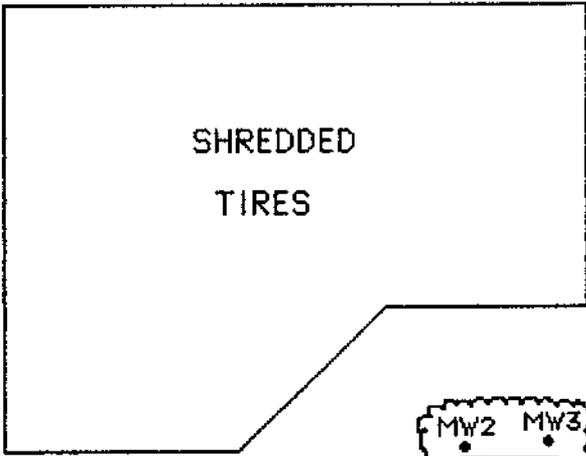
AREA MAP

PROJECT: PALMERS GARAGE
LOCATION: FERRISBURG, VT
GRIFFIN PROJECT #11914147
DISC. PT56

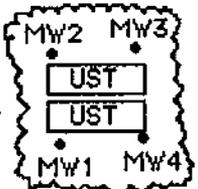
- - - - - MONITORING WELL
- ⊗ - - - - DRILLED WATER SUPPLY WELL
- ◆ - - - - DUG WATER SUPPLY WELL

- SKETCH -

NOT DRAWN TO SCALE



FORMER UST PIT



ROUTE 7

ABANDONED WATER SUPPLY WELL (DUG)

DRILLED WATER SUPPLY WELL (LOCATION APPROXIMATE)

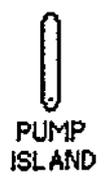
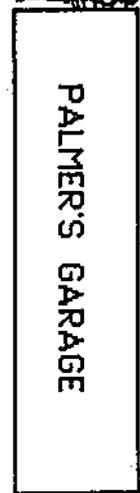
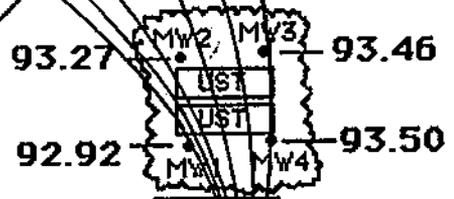
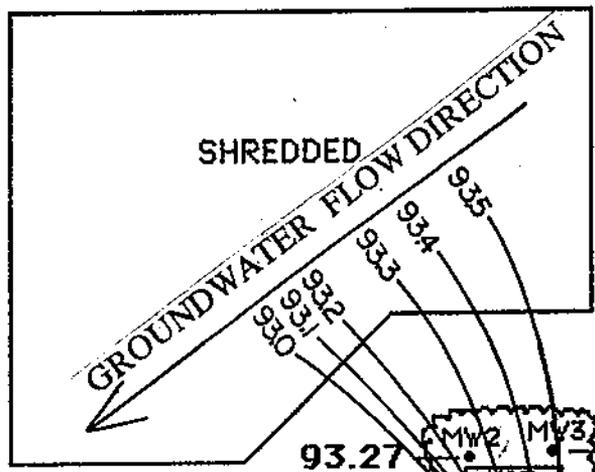
SITE MAP

PROJECT: PALMERS GARAGE
LOCATION: FERRISBURG, VT
GRIFFIN PROJECT #11914147
DISC. PT56

• - - - - MONITORING WELL



GRIFFIN INTERNATIONAL, INC



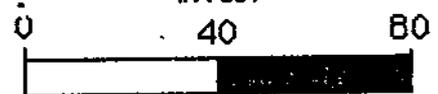
ROUTE 7



GROUNDWATER CONTOUR MAP

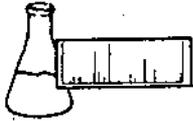
PROJECT: PALMER'S GARAGE
LOCATION: FERRISBURG, VT
GRIFFIN PROJECT #11914147
DISC. PT56
MONITORING DATE: 12-13-91

• - - - - MONITORING WELL
93.27 - WATER TABLE ELEVATION
IN FEET



SCALE IN FEET

GRIFFIN INTERNATIONAL, INC.



ENDYNE, INC.

RECEIVED DEC 30 1991

Laboratory Services

32 James Brown Drive
Williston, Vermont 05495
(802) 879-4333
FAX 879-7103

LABORATORY REPORT

EPA METHOD 602 -- PURGEABLE AROMATICS

CLIENT: Griffin International, Inc.
PROJECT NAME: Palmer's Garage
REPORT DATE: December 26, 1991
SAMPLER: Ron Miller
DATE SAMPLED: December 13, 1991
DATE RECEIVED: December 16, 1991

ANALYSIS DATE: December 23, 1991
STATION: MW 1
REF.#: 26,899
TIME SAMPLED: 15:45

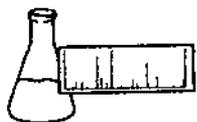
<u>Parameter</u>	<u>Minimum Detection Limit</u>	<u>Concentration (ug/L)</u>
Benzene	2.	51.2
Chlorobenzene	1.	ND ¹
1,2-Dichlorobenzene	2.	ND
1,3-Dichlorobenzene	2.	ND
1,4-Dichlorobenzene	2.	ND
Ethylbenzene	1.	11.5
Toluene	1.	3.97
Xylenes	5.	15.6
MTBE	1.	236.

NUMBER OF UNIDENTIFIED PEAKS FOUND: 16

NOTES:

1 None detected

Reviewed by _____



ENDYNE, INC.

Laboratory Services

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Williston, Vermont 05495
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FAX 879-7103

LABORATORY REPORT

EPA METHOD 602 -- PURGEABLE AROMATICS

CLIENT: Griffin International, Inc.
PROJECT NAME: Palmer's Garage
REPORT DATE: December 26, 1991
SAMPLER: Ron Miller
DATE SAMPLED: December 13, 1991
DATE RECEIVED: December 16, 1991

ANALYSIS DATE: December 23, 1991
STATION: MW 2
REF.#: 26,900
TIME SAMPLED: 16:15

<u>Parameter</u>	<u>Minimum Detection Limit</u>	<u>Concentration (ug/L)</u>
Benzene	2.	ND ¹
Chlorobenzene	1.	ND
1,2-Dichlorobenzene	2.	ND
1,3-Dichlorobenzene	2.	ND
1,4-Dichlorobenzene	2.	ND
Ethylbenzene	1.	ND
Toluene	1.	ND
Xylenes	5.	ND
MTBE	1.	ND

NUMBER OF UNIDENTIFIED PEAKS FOUND: 0

NOTES:

1 None detected

Reviewed by _____



ENDYNE, INC.

Laboratory Services

32 James Brown Drive
Williston, Vermont 05495
(802) 879-4333
FAX 879-7103

LABORATORY REPORT

EPA METHOD 602 -- PURGEABLE AROMATICS

CLIENT: Griffin International, Inc.
PROJECT NAME: Palmer's Garage
REPORT DATE: December 26, 1991
SAMPLER: Ron Miller
DATE SAMPLED: December 13, 1991
DATE RECEIVED: December 16, 1991

ANALYSIS DATE: December 23, 1991
STATION: MW 3 (DUPE TO MW-1)
REF.#: 26,901
TIME SAMPLED: Not Indicated

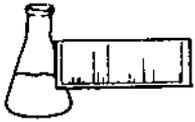
<u>Parameter</u>	<u>Minimum Detection Limit</u>	<u>Concentration (ug/L)</u>
Benzene	2.	49.4
Chlorobenzene	1.	ND ¹
1,2-Dichlorobenzene	2.	ND
1,3-Dichlorobenzene	2.	ND
1,4-Dichlorobenzene	2.	ND
Ethylbenzene	1.	12.0
Toluene	1.	3.94
Xylenes	5.	16.1
MTBE	1.	93.6

NUMBER OF UNIDENTIFIED PEAKS FOUND: 18

NOTES:

1 None detected

Reviewed by _____



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Williston, Vermont 05495
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FAX 879-7103

LABORATORY REPORT

EPA METHOD 602 -- PURGEABLE AROMATICS

CLIENT: Griffin International, Inc.
PROJECT NAME: Palmer's Garage
REPORT DATE: December 26, 1991
SAMPLER: Ron Miller
DATE SAMPLED: December 13, 1991
DATE RECEIVED: December 16, 1991

ANALYSIS DATE: December 23, 1991
STATION: Trip Blank
REF.#: 26,902
TIME SAMPLED: 16:20

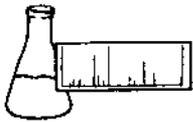
<u>Parameter</u>	<u>Minimum Detection Limit</u>	<u>Concentration (ug/L)</u>
Benzene	2.	ND ¹
Chlorobenzene	1.	ND
1,2-Dichlorobenzene	2.	ND
1,3-Dichlorobenzene	2.	ND
1,4-Dichlorobenzene	2.	ND
Ethylbenzene	1.	ND
Toluene	1.	ND
Xylenes	5.	ND
MTBE	1.	ND

NUMBER OF UNIDENTIFIED PEAKS FOUND: 0

NOTES:

1 None detected

Reviewed by _____



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LABORATORY REPORT

EPA METHOD 602 -- PURGEABLE AROMATICS

CLIENT: Griffin International, Inc.
PROJECT NAME: Palmer's Garage
REPORT DATE: December 26, 1991
SAMPLER: Ron Miller
DATE SAMPLED: December 13, 1991
DATE RECEIVED: December 16, 1991

ANALYSIS DATE: December 23, 1991
STATION: Equipment Blank
REF.#: 26,903
TIME SAMPLED: 16:45

<u>Parameter</u>	<u>Minimum Detection Limit</u>	<u>Concentration (ug/L)</u>
Benzene	2.	ND ¹
Chlorobenzene	1.	ND
1,2-Dichlorobenzene	2.	ND
1,3-Dichlorobenzene	2.	ND
1,4-Dichlorobenzene	2.	ND
Ethylbenzene	1.	ND
Toluene	1.	ND
Xylenes	5.	ND
MTBE	1.	ND

NUMBER OF UNIDENTIFIED PEAKS FOUND: 0

NOTES:

1 None detected

Reviewed by _____