

**AN INVESTIGATION OF
SOURCE OF GASOLINE
CONTAMINATION OF
WATER WELLS IN
RENFROW, OKLAHOMA**

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OKLAHOMA WATER RESOURCES BOARD

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SECTION I

ACKNOWLEDGEMENTS

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This investigation would not have been completed without the utmost cooperation of several residents of the towns of Renfrow and Medford, Oklahoma, especially Mr. and Mrs. Lloyd White and Mr. Pat Allen, owner of the gasoline station. Their help in acquiring drilling personnel and earth moving machinery in severe weather conditions is greatly appreciated.

The authors sincerely extend their appreciation to Mrs. Sherbie Kiffin for her assistance in editing, typing and proofreading this report.

Shirazi, et.al.
1978

SECTION II

CONCLUSIONS

This investigation was designed to determine the source of the gasoline which contaminated several water wells in Renfrow, Oklahoma. Based upon our investigation, the following conclusions have been reached:

1. The hydraulic gradient of the ground water table is in the general direction of West North West.
2. The gasoline appears to have moved through the cracks in the soil profile, both horizontally and vertically, as evidenced from the trenching operation in the vicinity of the buried tank. Once the gasoline leached to the static water table, a gasoline-water interface was established. It is hypothesized that further movement of the gasoline was dictated by the hydraulic gradient and the changing drawdown conditions of the area.
3. The probable source of the gasoline in the water wells is the abandoned gasoline storage tank located at the single gasoline station in Renfrow, Oklahoma.
4. Inasmuch as the probable source of the gasoline has been removed, no more preventive measures regarding this particular pollution problem are called for.
5. Preventive action to preclude similar future pollution occurrences are appropriate for the state to consider.

SECTION III

RECOMMENDATIONS

In view of the fact that ground water pollution abatement is a costly, time consuming and in many cases, even unsuccessful activity, we feel that preventive measures are the best approach for water quality management of the ground water. Cases such as Renfrow are not uncommon. Future occurrences of similar nature can and must be minimized. Based on these assumptions, the following recommendations are offered:

General:

1. Where sub-soil conditions are indicative of potential adverse affects upon the ground water resources and where the ground water table is shallow, the appropriate regulatory agency should consider adopting rules and regulations requiring installation of an impervious liner around gasoline storage tanks.
2. In order to detect any damage to the storage tank, periodic pressure leak tests should be performed and the results of such tests submitted to the appropriate regulatory agency.

Specific:

1. That the State take no action against Mr. Pat Allen.
2. Advising the town of Renfrow of possible alternate water supply sources since reclamation of the ground water may not be cost-effective.

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SECTION IV

DESCRIPTION AND THE SCOPE OF THE INVESTIGATION

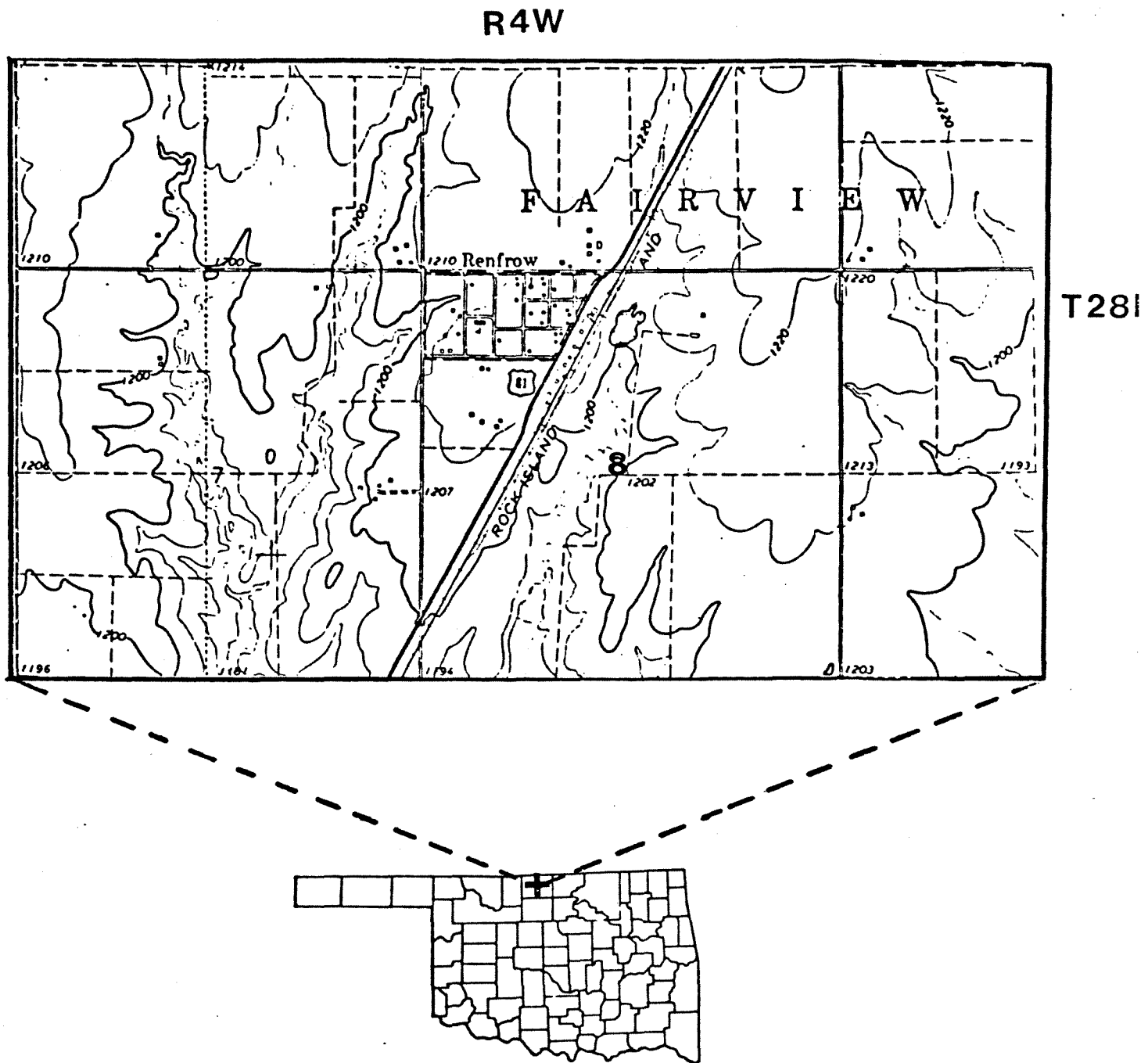
IV. a Introduction

The town of Renfrow is located in the northern part of Grant County, Oklahoma, on State Highway #81. It is nine (9) miles north of Medford, the county seat. The majority of the houses are located in the NW $\frac{1}{4}$ of Section 8, Township 28 North (T28N) and Range 4 West (R4W) (Figure 1). According to the 1970 census, the population of Renfrow was 39 people — recent estimates indicated that at present at least 29 people make their home in Renfrow.

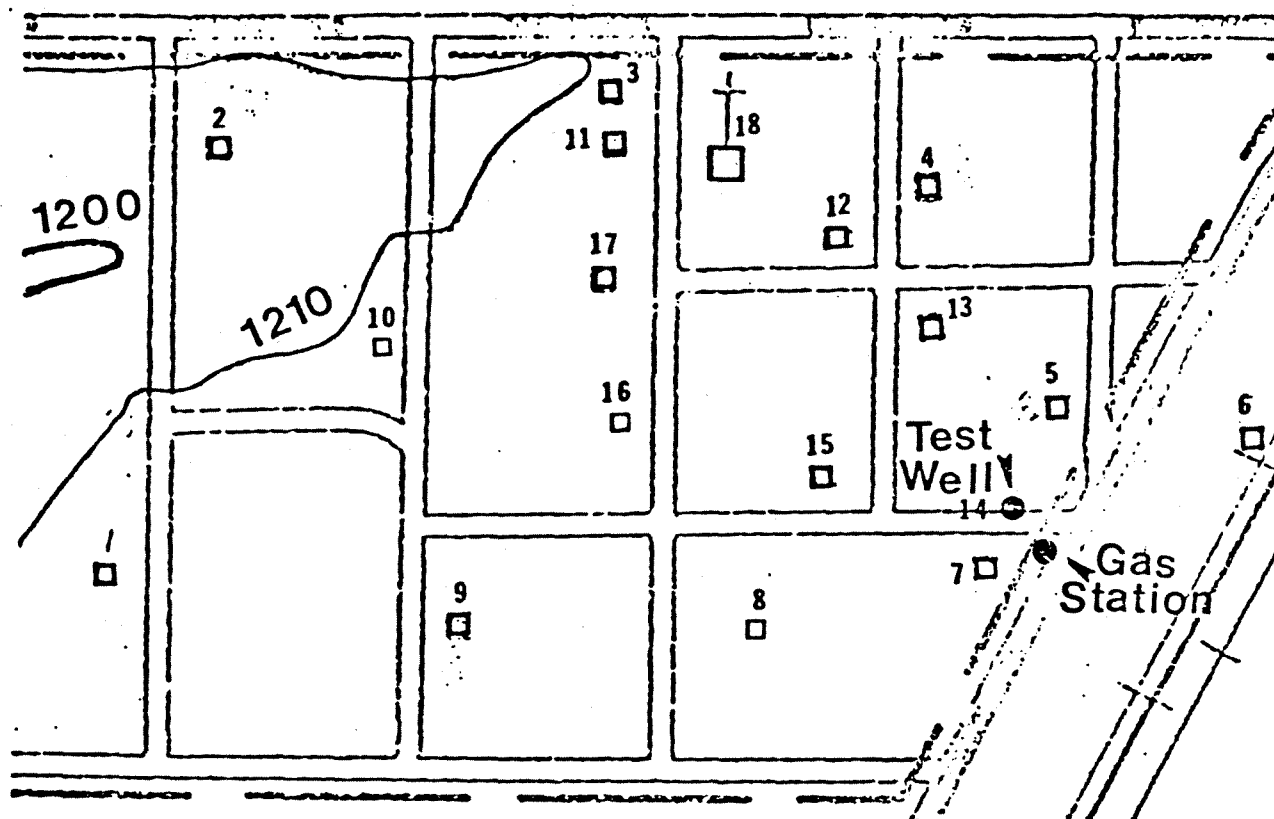
The town of Renfrow has only one gasoline station which is owned by Mr. Pat Allen. It is an independent station and does not sell any one particular brand of gasoline. Mr. Allen bought the gasoline station from the Co-op in the spring of 1973 during the oil embargo. At that time, he had two 500-gallon capacity underground storage tanks in existence; one stored regular gasoline, the other stored premium gasoline. Both tanks were located on the north side of the filling station. The tank which was used to store premium gasoline is being used to store unleaded gasoline at the present time, whereas the tank which stored regular gasoline was disconnected from its line and pump in April, 1974, and was left in place. Mr. Allen did not know when the previous owner had installed those tanks.

An average volume of sale at Allen's station varied from 450 gallons per day during the summer to 250 gallons per day during the winter. A certain amount of gasoline was pumped out for personal use, but records were not maintained for that portion of the gasoline.

The gasoline was first observed by Mrs. Lloyd White in well #18 (Church Well) during the early part of October, 1977. Later on, large quantities of gasoline showings were also found in well #17 (Grandaddy) (see Fig. 2). The complaint was first brought to the attention of state officials on November 4, 1977, and subsequently referred to the office of the Fire Marshal (see Shakley, November 8, 1977).



Renfrow



WELL #	NAME	WELL #	NAME
1	Hitchcock	10	Renfrow School
2	Kath	11	White
3	Partain	12	Daily
4	Frieowf, Perry	13	Scott
5	Hill	14	Test Hole #1
6	Co-op Well	15	Rutherford
7	Service Station Well	16	Peach Can
8	Lebeda	17	Granddaddy
9	Frieowf, Harry	18	Church

FIGURE 2

Location of Water Wells and Test Hole in Reference to the Gasoline Station in Renfrow, Oklahoma

The Oil and Gas Division of the Oklahoma Corporation Commission maintained that their agency did not have jurisdiction over gasoline service stations (see Shakley, November 19, 1977).

Earlier, Mr. Shakley had advised the State Fire Marshal's office of the complaint. The Fire Marshal's office (King, November 14, 1977) worked with the owner of the gasoline station and concurred with the suggestion that a green dye be introduced in the tank and the gasoline in various wells be monitored in order to attempt to establish a "cause-effect" relationship. The dye was introduced in the tank on December 2, 1977, and was monitored in well #17 every day. The results showed no change in the color of the gasoline in any well.

The Oklahoma Water Resources Board was notified of the problem on December 15, 1977, by the Department of Pollution Control. An inquiry by the OWRB officials indicated that the dye test was not completed and that the wells were being monitored at that time. Finally, when the dye test failed, the OWRB initiated its investigation on January 4, 1978. The objective of OWRB's involvement was to identify the source and magnitude of the pollution and any possible solutions.

IV. b Topography and Soils of the Area

Grant County is in the north-central part of Oklahoma. It is almost a square in outline and lies in the plain region which slopes slightly toward the east. The topography in the area is generally smooth, consisting of small areas of undissected upland. The elevation in the area ranges from 1210 ft. to 1220 ft. above the mean sea level.

The soils in the area are generally loam or clay and are shown in Fig. 3. The major portion of the area in question is composed of Oswego silt loam (O1) while the Renfrow silt loam (Rt) is extensively distributed in the vicinity of Renfrow. The valleys and low lying areas are covered with the Miller Clay loam and Vernon Clay loam. A detail description of the soil type is as follows:

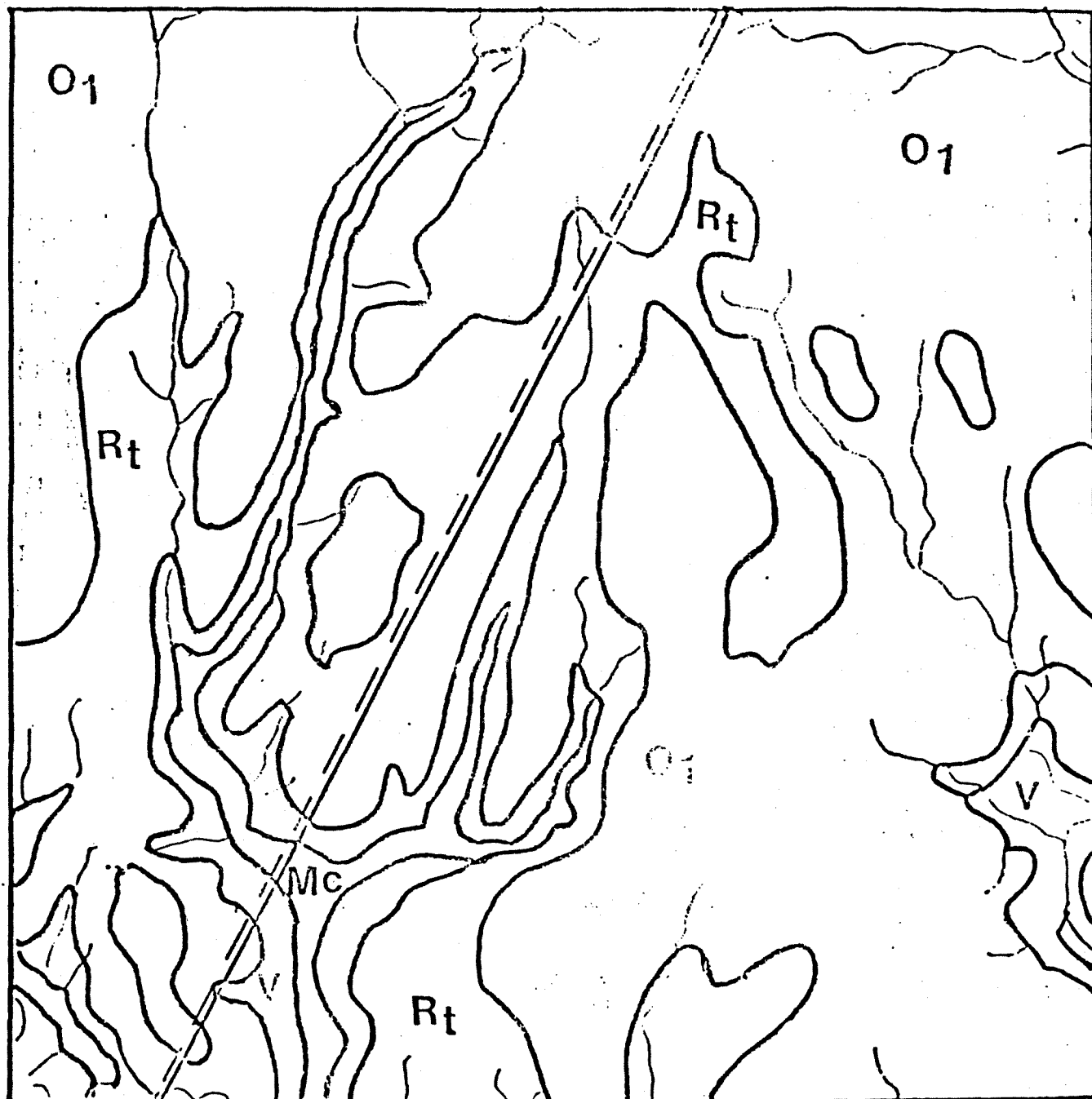
O₁Oswego Silty
Clay**R_t**Renfrow
Silt Loam**Mc**Miller
Clay**V**Vernon Clay
Loam

FIGURE 3

Soil Classification Map of the Renfrow Area
Showing the Distribution of Major Soil Series

OSWEGO SILT LOAM. Oswego silt loam has a gray or brownish-gray friable surface soil that grades, at a depth of 6 or 8 inches, into a friable very dark grayish-brown or black granular subsoil. This material continues downward, merging into a heavy brown or black plastic claypan at depth of about 60 inches. In most places lime is present beneath the claypan layer at a depth of 36 inches.

The subsoil material in Oswego silt loam is also friable, but it is more granular than the surface soil. When dry it falls easily into small granular pieces. The subsoil is also darker, but in some places it is sprinkled with gray material that has sifted down from the surface soil. It has a higher content of the clay material than the surface soil. The material in the claypan layer below the subsoil is very plastic and compact when wet. During the dry part of the summer it becomes very hard and shrinks, forming cracks that extend upward to the surface and that range from one-half to 1 1/2 inches in width.

Oswego silt loam is typically developed on flat and gently undulating uplands where surface drainage is slow.

RENFROW SILT LOAM. Renfrow silt loam has a dark-brown friable surface layer which passes, at a depth of 6 inches, into a brown subsurface layer that is slightly heavier in texture. The subsurface layer, in turn, continues downward and passes into a brown or reddish-brown claypan of plastic tough clay at a depth ranging from 12 to 18 inches. Lime is present at a depth of 36 inches. In some parts, the surface soil, when very dry, appears slightly red when viewed over a plowed field. The subsoil of Renfrow silt loam is unusually red.

This soil occupies land of smooth or gently rolling relief adjacent to the drainageways and along ridges. Surface drainage is good. The soil differs from Oswego silt loam in that it has a brown subsoil and in some places has a

browner surface soil. The surface relief is somewhat more undulating than that on which Oswego silt loam lies, and surface drainage is better.

MILLER CLAY LOAM. Miller clay loam has a reddish-brown surface soil which passes, at a depth of 4 or 6 inches, into a reddish-brown plastic clay subsoil. This material continues downward to a depth of 36 or more inches without any change in either color or texture. The subsoil is rich in lime to a depth of many feet. In a few places the surface soil has a high content of lime.

Miller clay loam is very similar in general characteristics to Renfrow clay loam, and the only difference between these two soils is that Miller clay loam occurs in the valley, whereas Renfrow clay loam prevails on the uplands.

VERNON CLAY LOAM. Vernon clay loam typically includes rough and badly eroded areas commonly known as "red-clay land". The surface of the land occupied by this soil is cut by many gullies. Wherever any part of the land is smooth, the red unweathered clay is exposed on the surface. The material is rich in lime in the surface soil. The surface soil when moderately moist is friable and granular, but the subsoil is very heavy and plastic. When dry the subsoil material is extremely hard to break.

IV. c Geological Description of the Area

The study area is situated in the eastern half of Grant County, Oklahoma. It is underlain by sandstone, shale and siltstone. Generally, the shale layers are thicker northward and the sandstone layers thicken southward. The area of investigation overlies the Garber Sandstone and Wellington Formation, (see Fig. 4 and Table 1). The Garber Sandstone (Pg) is mostly fine-to-medium-grained quartzose sandstone gradational northward into shale, calcitic siltstone, and conglomerate. The Wellington Formation is mostly shale to the north, gradational into fine-grained sandstone and mudstone.

In the vicinity of Renfrow, the top of the Garber Sandstone is graded into

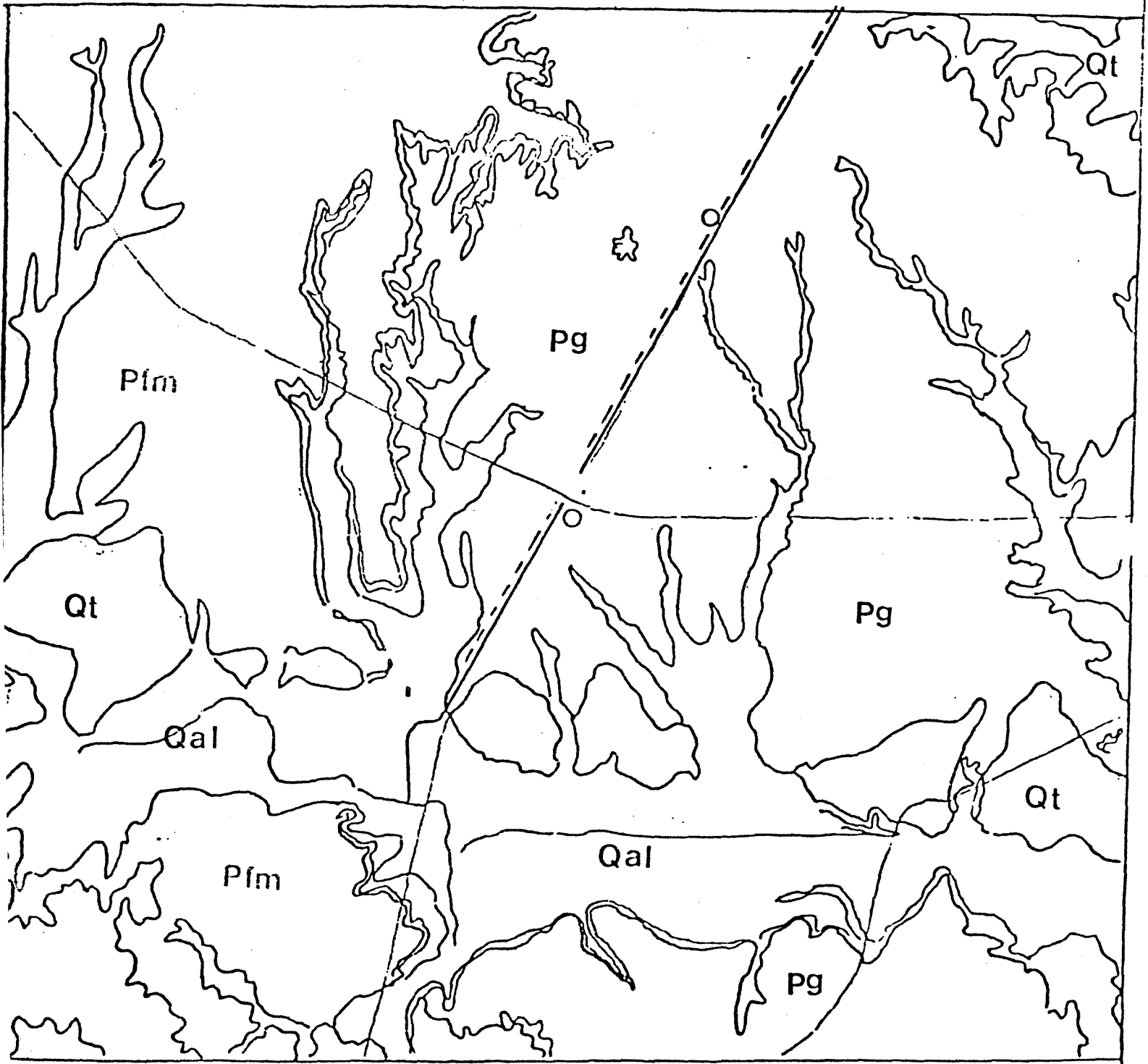


FIGURE 4

Geological Map of the Renfrow Area Showing the
Distribution of Major Geological Formations

TABLE 1
Explanation of the Legends

Qal	ALLUVIUM - Sand, silt, clay, and locally gravel. The maximum thickness ranges from 30 to 80 ft (9 to 25 m) along major streams and from 0 to 60 ft along minor streams
Qt	TERRACE DEPOSITS - Sand, silt, clay, and gravel. Maximum thickness is about 75 ft (23 m) along major streams
Pfm	FAIRMONT SHALE - Mainly shale with many thin layers of calcitic siltstone in the upper 60 ft (18 m). Total thickness about 150 ft (45 m)
Pg	GARBER SANDSTONE - Mostly fine - to medium-grained quartzose sandstone gradational northward into shale, calcitic siltstone, and conglomerate. Thickness about 600 ft (180 m)
Pw	WELLINGTON FORMATION - Mostly shale to the north, gradational into fine-grained sandstone and mudstone conglomerate southward into Logan County. Thickness about 850 ft (260 m)

reddish brown silty clay. In the southern part of the study area, certain amounts of alluvial deposits are encountered along the major streams. The area west of Medford is composed of Fairmont Shale.

IV.d. Hydrological Description of the Area

According to the U.S. Weather Bureau, the average rainfall at Jefferson, Grant County, is 29.52 inches. Most of the rainfall occurs during the period from April to October inclusive.

The soil infiltration capacity is moderately high due to favorable structure. Most wells were excavated to a depth of about 60-70 ft., with the exception of well #6, which was measured to a total depth of 115 ft.

In early thirties (30s) most wells were manually excavated (dug well), and reached to a maximum depth of about 50 ft. (personal communication, Mr. Dave Williams, Driller). Historical records indicated only three (3) wells in Section 8 where water was encountered at an average depth of 25 ft. from the ground level, (Dott and Wood, 1938). Our investigation indicated that the static water level in well #6 (Co-op well) was highest at 1197.120 ft. above the mean sea level, while the Renfrow School's well #10 and Hitchcock's well #1, were among the lowest where water level was measured at 1189 and 1188 ft. (m.s.l.), respectively. Most wells have rather low yield due to low transmissivity of the shale. However, since the demands are low, the wells seem to supply an adequate amount of water for the community's need.

A detailed hydrological study of this area is underway. A preliminary ground water availability map, (Fig. 5), indicates that in the Renfrow area most wells are shallow and water stands at about 21 ft. below the surface. The water quality was measured to be from moderate to poor with respect to total dissolved solids.

OKLAHOMA GEOLOGICAL SURVEY

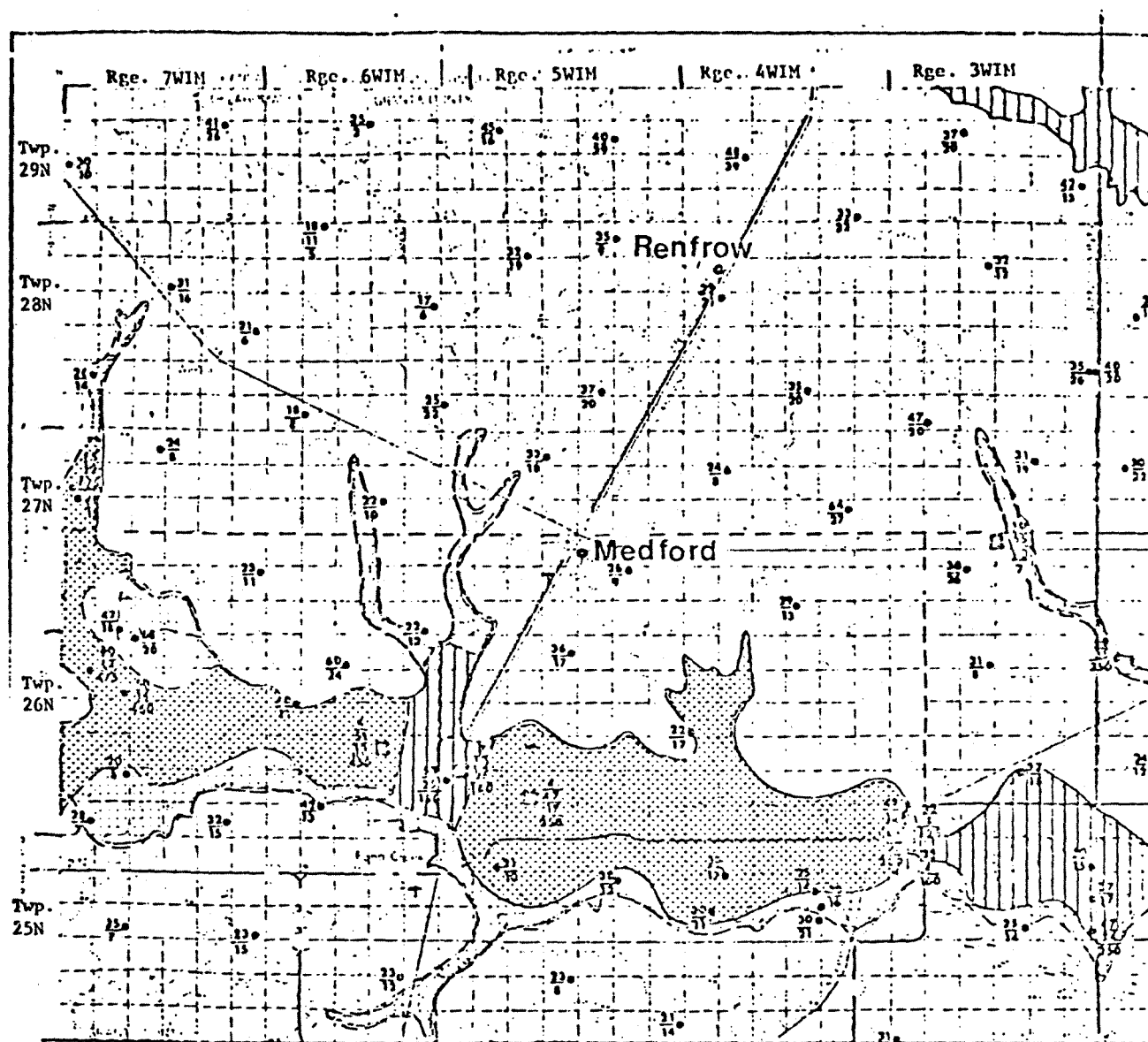


FIGURE 5

Preliminary Ground Water Availability Map
East half of Grant County, Oklahoma

Hydrologic Atlas 7, by U. S. Geological Survey and the Oklahoma
Geological Survey, in preparation

EXPLANATION

- $\frac{58}{21}$
15
- Upper number is depth of well, in feet; middle number is depth to water, in feet below land surface; lower number is well yield, in gallons per minute. Where only two numbers are shown, they are well depth and depth to water.

SECTION V

METHODOLOGY OF THE INVESTIGATION

V. a Hydrological Investigation

In order to determine the nature and the extent of the contamination of ground water, it was necessary to establish the gradient (slope) of the water table. Usually, the ground water table follows the regional topography, but since topographical changes in Renfrow are not significant, a hydrological map was prepared.

The static water levels and total depths of various wells were measured using the chalk-tape method. The steel tape (Lufkin & Co.) was divided in metric scale. The depth could be recorded to the nearest 1/100 of a foot. The ground elevations were recorded using K E Mode Ni 2. Surveying was done using a transit model Teledyne Gurley OP-52, Troy, N.Y. Field measurement of the salinity of water was obtained using a conductivity bridge (Lab Line Instruments, Melrose Park, Il). An NX size rotary rig, using water as circulating fluid, was used to drill a test hole up to a depth of 41 ft. The test hole was backfilled and plugged according to OWRB's rules and regulations for such practices. Water samples were collected and preserved for subsequent analysis.

The slope of the water table was determined using the triangulation method for calculating the equipotential lines, (Todd, 1959).

V. b Gasoline Investigation

It is obvious from various pertinent documents, (Appendix A), that the gasoline loss was investigated from various points of view. Quantity evaluation was examined from sale and purchase records, rate of possible leakage and the quantity of gasoline recovered in different wells. The quality

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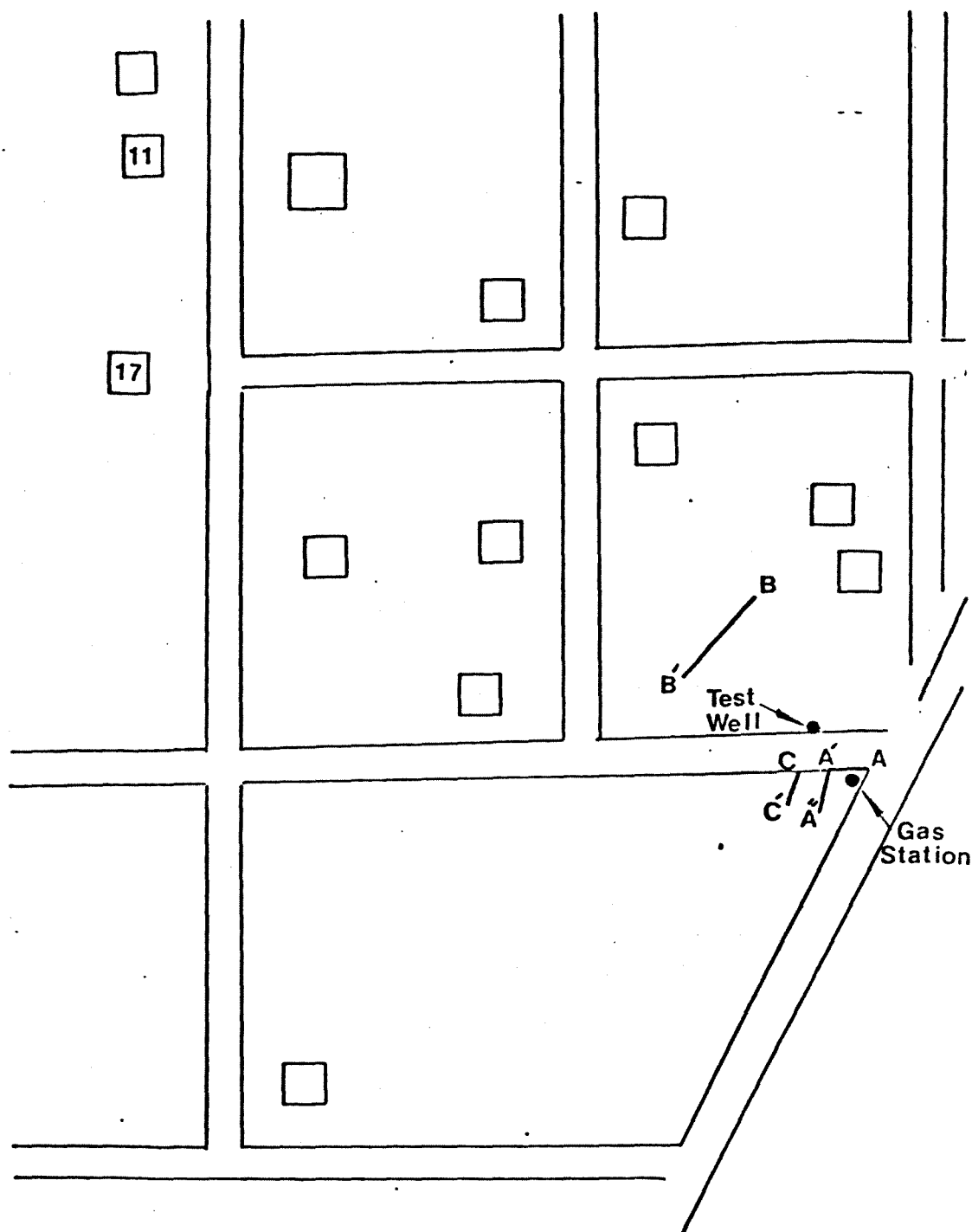


FIGURE 6

Location of the Investigation Trenches in
Relation to the Gas Station in Renfrow, Oklahoma

considerations were confined to the nature of the gasoline and its additives, the effect of weathering on the quality of gasoline, lead poisoning of the water and possible flow characteristics and their relationship to migration velocity in different soil types.

Gasoline samples were sent for detailed analysis to the Oklahoma State Department of Health and the Oklahoma Corporation Commission laboratories. Another set of samples was sent to the Environmental Protection Agency laboratory in Houston.

A test hole was drilled in the possible direction of the ground water flow using a rotary drilling rig (Fig. 2).

Three trenches were excavated using a backhoe with a 36-inch wide bucket, (see Fig. 6).

Alignment A-A' was about 10 ft. north of the gasoline station, and the alignment A'-A" was 15 ft. away from the storage tank. The trenches A-A' and A'-A" were 8 ft. and 18 ft. long respectively, and were excavated to a depth of 8 ft., at which depth the contact between the Oswego silty loam and red shale was exposed. The soil types were logged both horizontally and vertically, and soil samples were collected from the zone of contamination.

Trench B-B' was located about 100 ft. northwest of the storage tank, (Fig. 6), and was 48 ft. in length. The trench was excavated to a depth of 8 ft. The contact between the Oswego and red shale was established. The trench was logged and sampled before it was backfilled.

The trench C-C' was about 40 ft. further west of the A'-A". It was excavated to a length of 15 ft. and red shale contact was established between a 5 and 6 ft. depth. The trench was logged, and soil samples were collected at the zone of contamination.

SECTION VI

RESULTS AND DISCUSSION

VI. a Hydrological Profile

The ground water hydrological investigation of the Renfrow area and its vicinity indicated that all water wells were comparatively shallow. The total depth in most cases did not exceed 50 feet, and the average depth to the water table was about twenty-one (21) feet from the top of the ground. Table 2 and Table 3 summarize the ground level and depth to the water table respectively in terms of a mean sea level. Using the information provided in these tables, hydraulic gradients were plotted perpendicular to the equipotential lines for each set of three points (Fig. 1, using method of Todd, 1959). The lines of equal potential were then joined to draw water table contours in the area. The general direction of the hydraulic gradient was found to be West Northwest and is illustrated in Fig. 8.

The results obtained from the test hole indicated that the red shale was distributed at least up to the depth of 41 feet. An overnight percolation of the ground water in the test hole resulted in a static water table 18 feet below the ground surface. Since the test hole was drilled using water as a circulatory fluid, it is not possible to estimate when the water was encountered during drilling.

The hydrological profile established to a certain degree the direction from which the gasoline could have migrated. That conclusion was based upon the assumption that a point source of gasoline existed and that flow of gasoline took place simultaneously with the movement of the ground water. However, the results were not conclusive.

TABLE 2

GROUND ELEVATIONS OF WELLS AND TEST HOLE IN RENFROW AREA
 BASED ON USGS TOPOGRAPHIC QUADRANGLE MAP, RENFROW, OKLA.- KANSAS
 N3652.5-W9737.5/7.5

<u>SITE #</u>	<u>LOCATIONS</u>	<u>ELEVATIONS (FEET)</u>
	Bench Mark is a standard disk, stamped "E 13 1933". The Bench Mark is located 1.0 mile south along the Chicago, Rock Island & Pacific Railroad from Renfrow, Grant County, between poles 303+32 and 303+33, at a concrete culvert, in the top of the east head wall, 1 foot west of east face, and 1 foot north of the south end.	1173.295
1	Hitchcock Well	1209.742
2	Kath Well	1207.648
3	Partain Well	1211.613
4	Frieowf, Perry Well	1215.889
5	Hill Well	1216.330
6	Co-op well	1213.810
7	Service Station Well	1214.755
8	Lebeda	1213.506
9	Frieowf, Harry Well	1212.903
10	Renfrow School Well	1209.316
11	White Well	1212.799
12	Daily Well	1214.619
13	Scott Well	1215.317
14	Test Hole #1	1213.465
15	Rutherford Well	1214.408
16	Peach Can Well	1213.039
17	Graddaddy Well	1212.645
18	Church Well	1215.395

TABLE 3
ELEVATIONS TO WATER TABLE IN RENFROW AREA
BASED ON USGS TOPOGRAPHIC QUADRANGLE MAP, RENFROW, OKLA.- KANSAS
N3652.5-W9737.5/7.5

<u>SITE #</u>	<u>LOCATIONS</u>	<u>ELEVATIONS (FEET)</u>
	Bench Mark is a standard disk, stamped "E 13 1933". The Bench Mark is located 1.0 mile south along the Chicago, Rock Island & Pacific Railroad from Renfrow, Grant County, between poles 303+32 and 303+33, at a concrete culvert, in the top of the east head wall, 1 foot west of east face, and 1 foot north of the south end.	1173.295
1	Hill Type same as on ground elevations table	1188.742
2	Kath Well	1190.028
3	Partain Well	1191.243
4	Frieowf, Perry Well	1194.319
5	Hill Well	1190.240
6	Co-op Well	1197.120
7	Service Station Well	1191.775
8	Lebeda	1191.926
9	Frieowf, Harry Well	1191.763
10	Renfrow School Well	1189.856
11	White Well	1191.629
12	Daily Well	1192.829
13	Scott Well	1193.957
14	Test Hole #1	1195.365
15	Rutherford Well	1191.778
16	Peach Can Well	1191.839
17	Graddaddy Well	1191.345
18	Church Well	1190.505

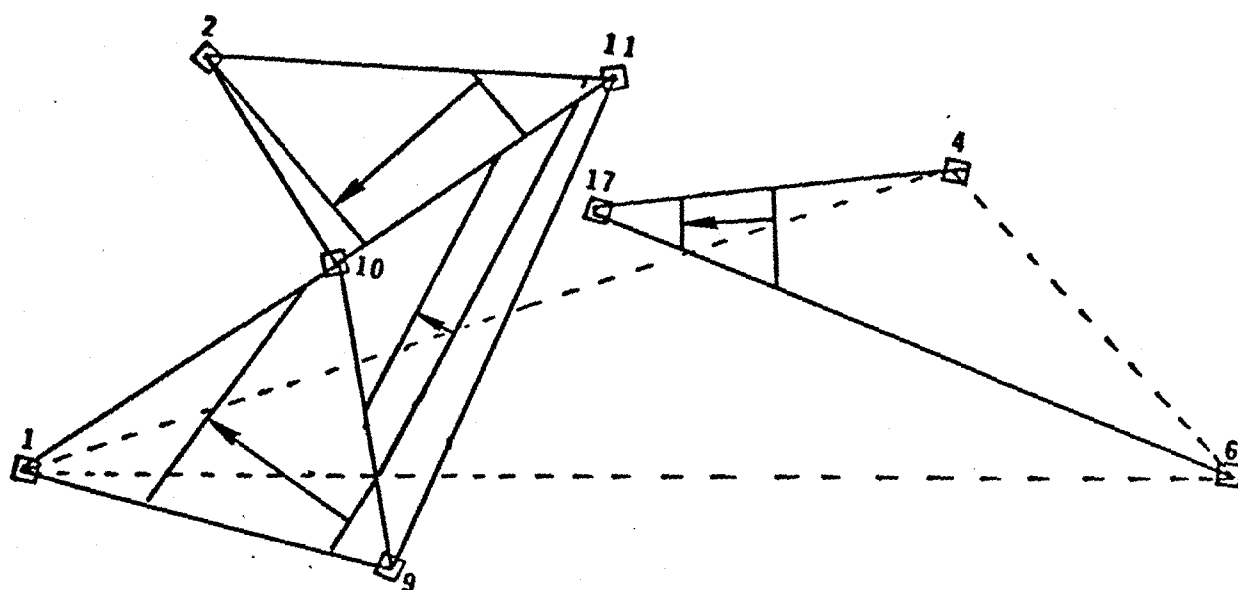


FIGURE 7
Ground Water Hydrological Profile Analysis Using
the Triangulation Technique (Todd, 1959) for
Equipotential Lines

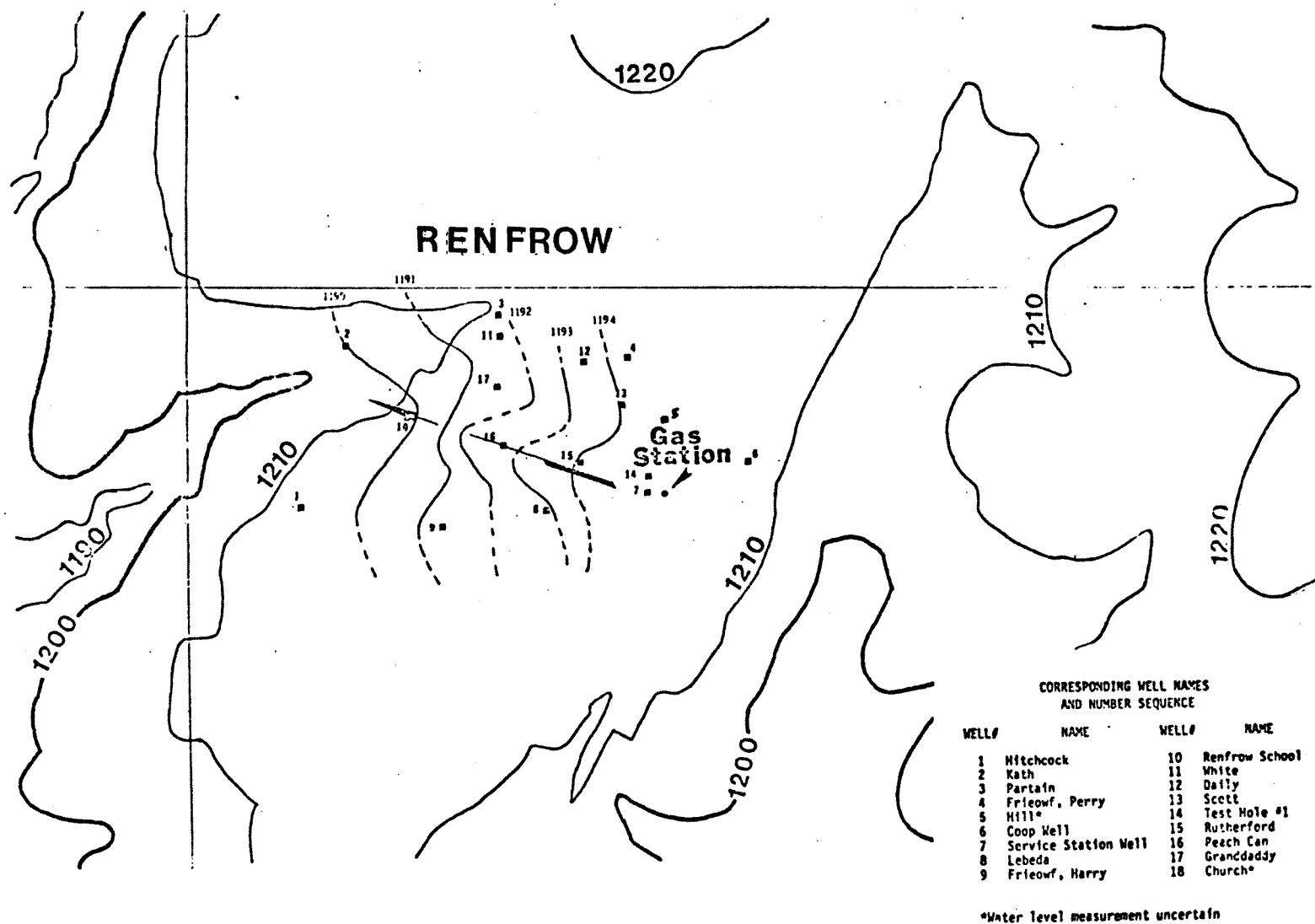


FIGURE 8

Ground Water Contours and the General Direction of the Slope of the Water Table in the Renfrow Area

VI. b Gasoline Contamination of the Ground Water

The nature and the aerial extent of the gasoline contamination of the ground water, beyond the observed wells, cannot be ascertained due to the lack of data. The conductivity of the silty clay is usually low for a polar fluid such as water. However, the gasoline being a nonwetttable and nonpolar compound is expected to travel at a higher rate (Personal Communication, Dr. J. F. Stone and Dr. J. V. Parcher, Oklahoma State University). Generally, the flow-through-porous-media approach described in the area of reservoir mechanics is applicable to confined sands; such is not the case in Renfrow. In the absence of any available data, it is not possible to estimate a numerical value for conductivity through soils and develop projections to determine the extent of pollution.

In our study area 13 wells were found to be polluted by the gasoline. In some cases, a thin layer of gasoline was established on top of the water table. This was determined when steel tape was lowered for static water level measurements. A few well owners are drawing their water needs from several feet below the water level and therefore are not able to visually identify the the presence of gasoline.

The chemical analysis of the water in some wells in presented in Table 4. It is obvious that a certain amount of hydrocarbon pollution has taken place in these wells.

Several gasoline samples were collected from different wells and were analyzed by the Oklahoma State Department of Health laboratory and the Oklahoma Corporation Commission laboratory. The results are presented in Table 4. and Table 5. The results from both labs indicated that the gasoline is a regular grade of about 90 octane number and contains as much as 4.0 grams of lead in each gallon of gasoline.

TABLE 4

RESULTS OF CHEMICAL ANALYSIS OF SAMPLES TAKEN
AT RENFROW, OKLAHOMA

(Analyzed by Oklahoma State Department of Health, Water Quality Laboratory)

Well #	5	6	14	15	16	17
OWRB Sample #	2462	2463	2461	2433	2432	2431
Date of Collection	1-5-78	1-5-78	1-5-78	1-4-78	1-4-78	1-4-78
Hydrocarbons	trace 0.01 mg/l	trace 0.01 mg/l	1.6 mg/l	greater than 95% gasoline	greater than 95% gasoline	greater than 95% gasoline
Carbon Range	—	—	C ₆ to C ₈	—	—	—
Lead (micrograms/liter) (grams/gallon)	73 —	—	75 —	— 4.0	— 3.4	— 3.7

TABLE 5

RESULTS OF CHEMICAL ANALYSIS OF SAMPLES TAKEN
AT RENFROW, OKLAHOMA

(Analyzed by Corporation Commission, Fuel Inspection Division Lab)

Well #	15	16	17
OWRB Sample Number:	2433	2432	2431
Initial Boiling Point (F°)	92	98	100
End Point (F°)	412	418	*
Octane Number	92.8	92.8	ND
Lead Content (grams/gallon)	1.7	1.5	1.7
Grade of Gasoline	Regular	Regular	Regular

*Water in Sample - unable to finish test

VI. c Gasoline Contamination of the Soil

The information generated during the hydrological study and the investigation of gasoline pollution indicated that possible sources of gasoline could be:

- (a) the single gasoline station in the town of Renfrow,
- (b) nearby pipelines carrying gasoline, or
- (c) the underground storage facilities of the two oil refineries in Medford, Oklahoma.

Option (a) was examined on site through the technical efforts of the Oklahoma Water Resources Board staff. The Oklahoma Tax Commission staff was involved in balancing the quantity of gasoline purchased and the quantity sold.

Options (b) and (c) were investigated by the staff of the State Fire Marshall. Information submitted by King, 1977, 1978 (see Appendix A) indicated that Continental Oil Company at Medford uses the pipeline for transmitting propane, iso-butane and jet fuel only. No refined gasoline is produced or stored at this facility. Similar results were obtained from Koch Oil Company at Medford. The direction of alignment of these pipelines is presented in Figure 9.

We believed that both pipelines were too far from Renfrow to have caused the pollution. However, the OWRB staff extended their investigation around the general area of Renfrow, using the location of the polluted wells as a nucleus. The results were negative.

With respect to option (c), we believed that while both refineries stored their products in "salt domes", the nature of the product stored was quite different from what was encountered in Renfrow. Therefore, options (b) and (c) were not pursued further.

During this investigation, Mr. Pat Allen, the owner of the gas station, indicated that when he bought the station in 1973, a 500 gallon capacity gasoline storage tank was used for regular gasoline. The tank was old and worn-out, and hence its use was discontinued in April 1974 (King, January 9, 1978).

On January 14, 1978, Mr. Allen removed that tank and stated that the bottom of the tank was "rusted out" (King, January 9, 1978). Our examination of the tank did not indicate any rusted holes. However, the possibility of several pin holes cannot be discounted. That can be ascertained only by a pressure leak test. It was at this point in time that we decided to obtain direct evidence and started trenching operations.

The location and the direction of the trenches were described elsewhere (Section V. b). Figure 10 illustrates the trench A-A'-A" and identifies the two soil types and the zone of contamination. The contaminated zone was logged and soil samples were collected. The detail lithology is described in Table 6. Section A'-A" indicated the presence of gasoline contaminated soil at a depth of about 3 to 6 feet.

The trench B-B' is presented in Figure 11. The trench was logged, but no samples were collected since no contaminated soil was encountered (Table 7).

The trench C-C' is illustrated in Figure 12. The trench was logged, and the soil samples were collected from the zone of contamination (see Table 8).

An examination of the soil profile at the zone of contamination indicated that in both cases the top soil (Oswego silty clay) was fractured. The presence of fractures of as much as $1\frac{1}{2}$ inches in width in Oswego silty clay were documented by Goke, 1933. It appears that the gasoline traveled through the cracks horizontally and vertically before establishing a gasoline-water interface. The movement of the gasoline was therefore dictated more by the pattern of the cracks and not by the hydraulic gradient. It is safe to assume that the gasoline might have traveled quite rapidly through the cracks, but since most crack patterns are extremely tortuous, the total distance traveled by the gasoline may be considerably more than the distance between two points. Therefore, the apparent time lag of several years between the span of leakage and detection of the gasoline is not considered unusual.

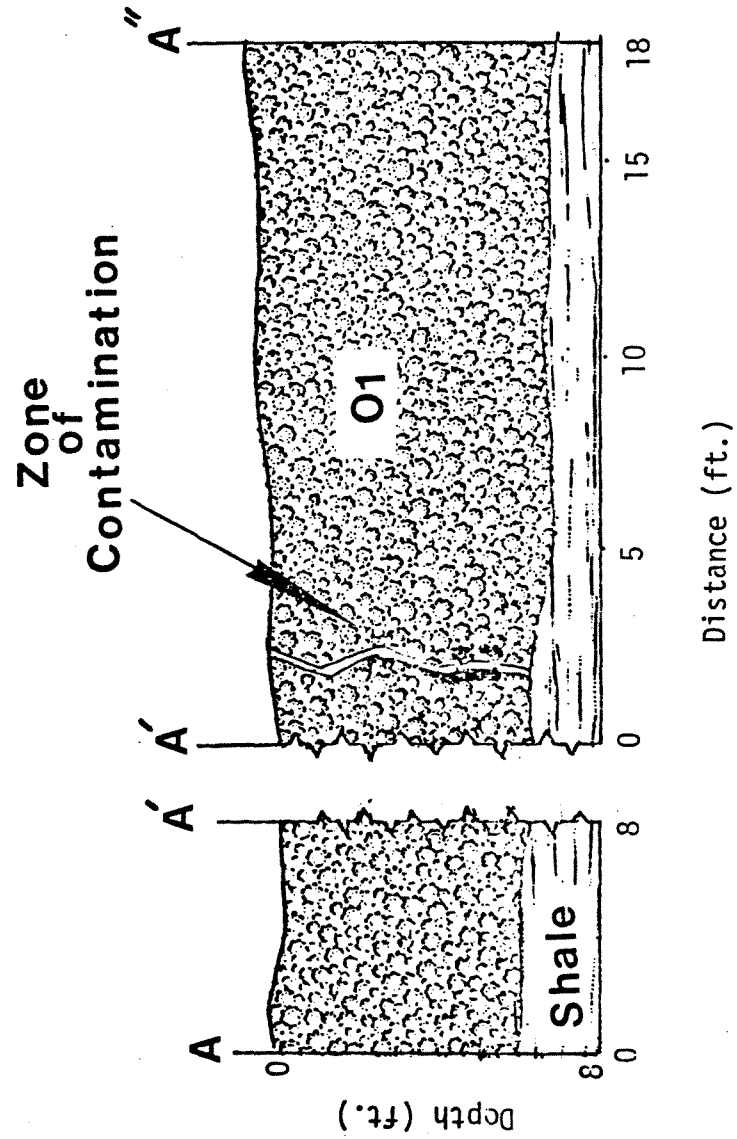


FIGURE 10
Cross-sectional Profile of the Investigation Trench A-A'-A'',
Showing the Distribution of Shale and Clay

TABLE 6
Lithological Description of the Depth
Profile in Trench A-A'-A" at the Zone
of Contamination

<u>Depth (ft.)</u>	<u>Description</u>
0 -1	medium hard to hard, dark colored weathered granular silty clay with occassional roots.
1 -2	medium hard to hard, dark colored silty clay with visible cracks.
2 -3	hard, blocky, plastic silty clay with occasional concretions
3 -4	hard, dark colored plastic silty clay with strong smell of gasoline
4 -5	dark colored plastic silty clay with strong smell of gasoline
5 -6	dark colored plastic silty clay with strong smell of gasoline
6 -7	hard, light brown colored silty clay, presence of lime concretions and smell of gasoline.
7 -8	reddish brown plastic silty clay with mild smell of gasoline

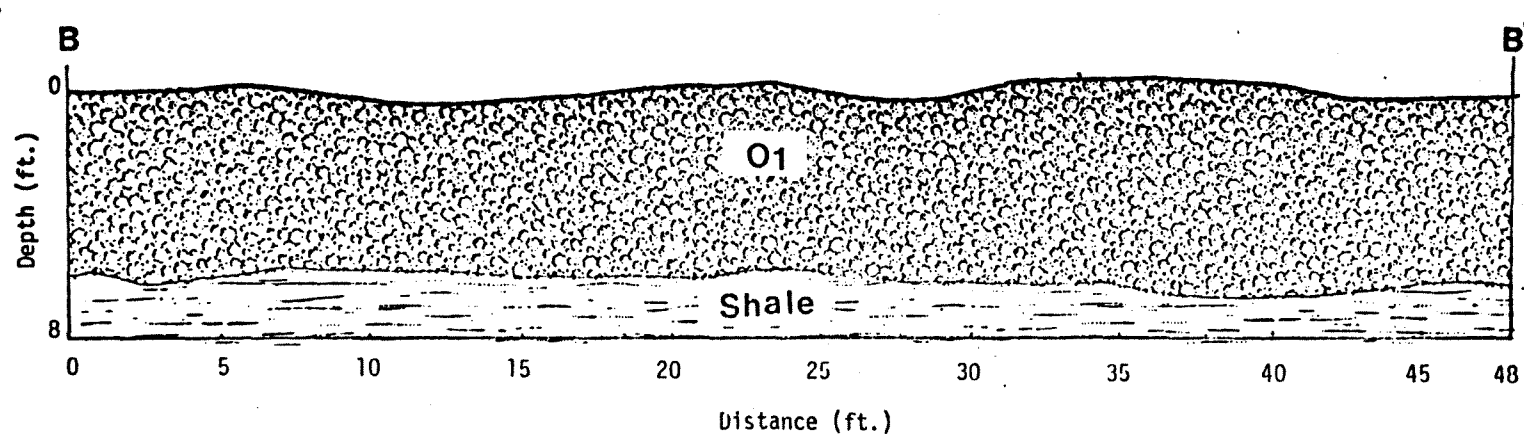


FIGURE 11

Cross-sectional Profile of the Investigation Trench B-B',
Showing the Distribution of Shale and Clay

TABLE 7
Lithological Description of the Depth
Profile in Trench B-E'

Depth (ft.)	<u>Description</u>
0 -1	medium hard to hard, dark colored highly weathered grannular silty clay with occasional presence of roots
1 -2	medium hard to hard, dark colored tight silty clay with some fractures.
2 -3	medium hard, blocky structure, dark colored silty clay with some lime concretion and fractures.
3 -4	medium hard, dark silty clay grading to brown silty clay
4 -5	light brown, medium hard silty clay
5 -6	reddish brown, medium hard silty clay with some concretion
6 -8	reddish brown, medium hard silty clay

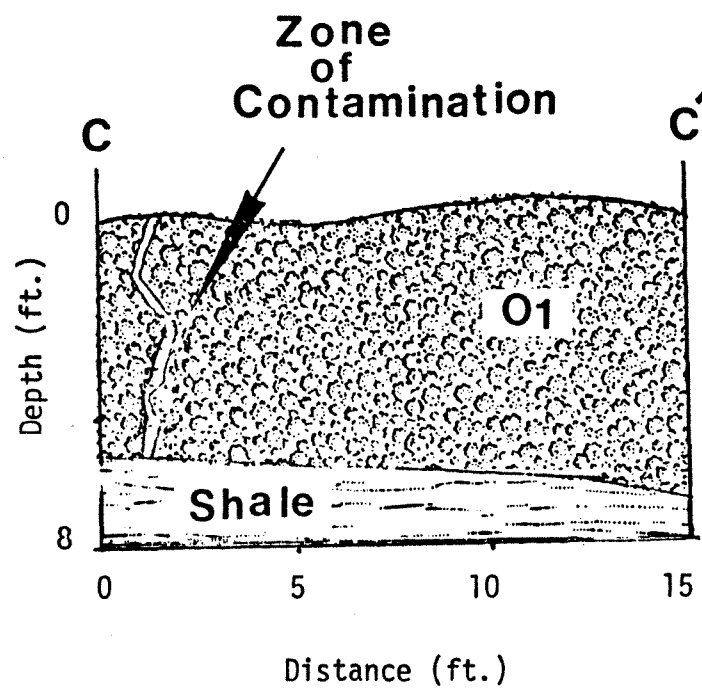


FIGURE 12

Cross-sectional Profile of the Investigation Trench C-C',
Showing the Zone of Gasoline Contamination

TABLE 8

Lithological Description of the Depth
Profile in Trench C-C' at the Zone of
Contamination

<u>Depth (ft.)</u>	<u>Description</u>
0 -1	medium hard to hard, dark colored, highly weathered silty clay.
1 -2	medium hard to hard, dark colored silty clay, with visible cracks and lime concretions.
2 -3	medium hard, dark colored silty clay with occasional fractures.
3 -4	medium hard, dark colored silty clay with strong smell of gasoline.
4 -5	light brown, medium hard silty clay with smell of gasoline
5 -6	reddish brown, medium hard silty clay with smell of gasoline.
6 -7	reddish brown, medium hard silty clay with lime concretion and mild smell of gasoline.

VI. d Lead (Pb) Contamination of the Ground Water

A preliminary investigation of the chemical quality of the waters in various wells indicated the presence of higher than acceptable levels of lead. According to Mr. Frank McGreevey, (King, January 9, 1978), Coordinator, Product Technical Services, Champlin Petroleum Co. in Enid, the gasoline contains tetraethyle lead which can be leached into the ground water. Our findings reveal an excess of lead and dictate the State Department of Health's advising the users of such water to take necessary precautions. It is desirable that the chemical quality of the waters in the wells in the Renfrow area continue to be monitored for an extended time to insure the health of the community.

At this point in time, we cannot determine the exact age of the gasoline. However, indications from the EPA laboratory in Houston suggest that the gasoline was significantly "weathered". This gasoline could have leaked for several years before Mr. Pat Allen discontinued the use of the underground storage tank. In view of the fact that the lines, pump, and perhaps the tank was deteriorated, the action taken by Mr. Allen in reviewing the suspected tank was in the best interest of the environment. Continued use of faulty equipment could have only added to the potential for further pollution.

It is possible to flush the aquifer by backfilling the polluted wells, thereby creating positive pressure and then pumping out the water in several cycles. Thus the reclamation of the polluted wells is technically feasible, although we do not recommend such action primarily due to its exorbitant cost. In addition, complete flushing of the aquifer may never be possible because of the high clay content of the soils. A significant amount of gasoline will be adsorbed on the clay complex, and a time variant release will render the quality of the water unsuitable for drinking purposes for a long period of time.

SECTION VII

REFERENCES

1. Dott, R. H., and Wood, F. C. 1938. "Water Well Data for Grant County", Oklahoma Geological Survey Report.
2. Goke, A. W., Hollopeter, C. A., and Carr, M. E. 1933. "Soil Survey of Grant County, Oklahoma", U.S.D.A. Publication #10, Series 1931.
3. Todd, D. K. 1959. "Ground Water Hydrology", John Wiley & Sons, N.Y.
4. U. S. Geological Survey 1978. "Preliminary Geological Map, East Half Grant County", Publication # HA-7 (In Preparation).

SECTION VIII

APPENDIX A



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

FIRST INTERNATIONAL BUILDING

1201 ELM STREET

DALLAS, TEXAS 75270

March 6, 1978

Mr. James R. Barnett
Acting Executive Director
Oklahoma Water Resources Board
Jim Thorpe Building
Oklahoma City, Oklahoma 73105

Dear Mr. Barnett:

I am enclosing a copy of the results of our laboratory analysis of two gasoline samples taken at Renfrow, Oklahoma. These samples were collected on January 11 and 12 by Dwight Hoenig, groundwater geologist with the Water Supply Branch. These samples were transmitted to William Langly, Chief of Laboratory Services, via certified, "chain-of-custody" transfer.

One of the samples was taken from the dug water well belonging to Mrs. Arterburn. The comparison sample was taken directly from the "regular-grade" gasoline pump at Mr. Allen's Renfrow service station. As stated in Mr. Langly's memo, the samples were analyzed by gas chromatography and were found to be, in the opinion of EPA's laboratory, "derived from a common source".

We are happy to provide you with technical assistance on this matter and we hope that this analysis will be beneficial to your study of this problem.

Sincerely,

A handwritten signature in cursive script, reading "Charles W. Sever".

Charles W. Sever
Chief, Water Supply Branch

cc: Ms. Eva White
Mr. Pat Allen

RECEIVED
MAR 8 1978
OKLA. WATER RESOURCES BOARD

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
6608 Hornwood Drive
Houston, Texas 77074

SUBJECT: Gasoline Sample Fingerprinting Analyses

DATE: 1/21/78

FROM: Chief, Laboratory Services Section, Houston Branch

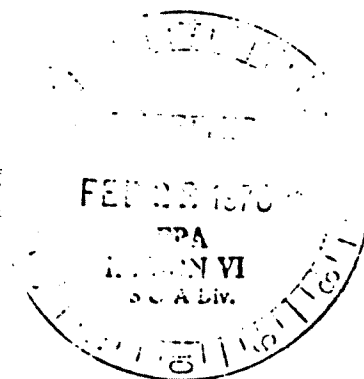
TO: Oscar Ramirez Jr., Acting Director, S&A Division

THRU: Chief, Houston Branch

Two gasoline samples were transmitted to us by Mr. Dick McLaughlin. One of these samples was taken from a contaminated water well in Renfrow, Oklahoma, and the other was from a gas pump at a Renfrow service station.

These samples have been comparatively analyzed by Mr. Medardo Garza using the gas chromatographic "fingerprinting" method normally employed by this laboratory for hydrocarbon source identification. The results of the analyses indicate the samples are virtually identical in hydrocarbon and sulfur component content except for apparent "weathering" effects resulting in a lower relative content of the more volatile components in the sample from the contaminated water well. It is, therefore, our opinion that the two gasoline samples submitted to us are one and the same or derive from a common source.

William D. Langley
William D. Langley



RECEIVED
MAR 3 1978
OKLA. WATER RESOURCES BOARD

OFFICE OF THE FIRE MARSHAL FEB 10 1978

Form #7A

FILE NUMBER 2677-350	INSPECTION OF GASOLINE CONTAMINATED WATER WELLS RENFLOW, OKLA.	REQUESTED BY:	OKLA WATER RESOURCES BOARD	REQUEST DATE
		FILE MEMORANDUM INSPECTOR: JAMES W. KING		RESPONSE DATE 1/31/78

On January 14, 1978, Saturday, Mr. Pat Allen telephoned with the information that he had dug up an abandoned underground gasoline storage tank, and stated the bottom of the tank was "rusted out".

On January 3., 1978, Tuesday, I met with Mr. Allen and Dr. G. M. Shirazi, Director, Oklahoma Water Resources Board, at Mr. Allen's Renfrow Station. We examined the subject tank and were unable to locate any obvious holes, or "rusted out" areas. We determined the only way to ascertain if this tank did leak, would be to have it pressure-tested.

Mr. Allen explained that it had been just after sundown when the tank was finally dug up and that in the headlights of the tractor, the tank had appeared to be in much worse condition than it is.

Dr. Shirazi had decided to dig at least one trench on Mr. Allens' property; the trench to run diagonally across the property and west of the site where the tank was dug up. While he was directing the machine operator, I went to the Lloyd White residence.

The Whites stated they had dipped another 210 gallons of gasoline, since January 9, 1978, for a total of 1,975 gallons. Mr. White stated he thinks the gasoline supply is "slowing down," as the abandoned well which initially supplied an average of seven (7) gallons per day, now supplies "about one (1) gallon every two weeks." He stated the largest remaining amount of gasoline

COPIES TO:	DATE SENT	AUTHORITY OF	REPORT APPROVED
Lloyd White, Route #3, Box 107, Medford, Okla. 74759		<i>F.L.S.</i>	<i>F.L.S.</i>
Pat Allen, Route #2, Caldwell, Kansas 67022		<i>F.L.S.</i>	
Oklahoma Water Resources Board, Oklahoma City Attn: Steve Houghton	2-9-78	<i>F.L.S.</i>	
Sam Shakely, Mgr., Pollution Abatement, Okla. Corp. Comm. Room 236- Jim Thorpe Building, OKC 73105		<i>F.L.S.</i>	

FILE #2G77-350
GASOLINE CONTAMINATED WATER WELLS
RENFROW, OKLAHOMA

CONTINUED: File Memo - 1/31/78

seems to be in the well on his mother-in-law's property.

I went back to the service station, where digging had begun. Dr. Shirazi had already found earth samples which bore a smell like gasoline. He stated it did not appear that the smell was from fresh gasoline, but was due to gasoline having passed through the earth long enough ago that there was "not much left, except the smell." I left, at this point, to keep a prior appointment.

In a subsequent telephone conversation, Dr. Shirazi told me that excavations in two other areas, further west, revealed gasoline residue in only one of them. He stated it appeared the gasoline had followed a crack in the strata for some distance, before leaching into the underground water supply.

Dr. Shirazi stated it appears that the abandoned tank dug up by Mr. Allen is the probable source of the gasoline which has contaminated the eleven (11) water wells in the Renfrow Community.

Due to the evidence produced by Dr. Shirazi, I am also of this opinion.

James W. King
Agent
STATE FIRE MARSHAL

JWK:dm
2/6/78



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

FIRST INTERNATIONAL BUILDING

1201 ELM STREET

DALLAS, TEXAS 75270

January 25, 1978

Mr. James R. Barnett
Acting Executive Director
Oklahoma Water Resources Board
Jim Thorpe Bldg.
Oklahoma City, Oklahoma 73105

Dear Mr. Barnett:

I have received your letter requesting technical assistance on the groundwater problem in Renfro, Oklahoma.

I have asked Mr. Charles Sever of the Water Supply Branch to conduct a review of the technical aspects of this problem and advise me of his findings as soon as possible. Upon completion of this review Mr. Sever will recommend any further assistance needed to assess this problem.

Sincerely,

A handwritten signature in cursive script, appearing to read "Adlene Harrison".

for Adlene Harrison
Regional Administrator

RECEIVED
FEB 6 1978
OKLA. WATER RESOURCES BOARD.

OKLAHOMA WATER RESOURCES BOARD

FIFTH FLOOR • JIM THORPE BUILDING • OKLAHOMA CITY, OKLA. 73105 • (405) 521-3945

January 13, 1978

Ms. Adlene Harrison
Regional Administrator
U.S. Environmental Protection Agency
Region VI
First International Building
1201 Elm Street
Dallas, Texas 75270

Dear Ms. Harrison:

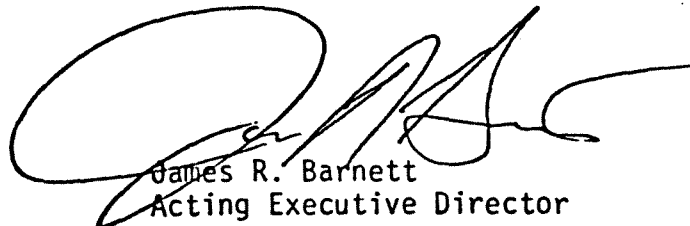
As you may already be aware, an interesting and challenging situation involving ground water pollution has arisen in the town of Renfrow, Oklahoma, where refined gasoline has been found in nine domestic water wells. Renfrow is a small community of approximately 30 people depending heavily upon ground water, and due to the contamination, most of the town's water is not now suitable for domestic use.

The Oklahoma Water Resources Board is presently investigating the situation, and we have determined that more extensive and intensive work is needed in order to identify the source and magnitude of the problem. An immediate problem is the fact that our agency is inadequately staffed and funded to pursue such a sustained and complex pollution problem.

We are therefore, requesting the assistance of the Environmental Protection Agency in providing support in the form of such technical expertise, equipment (drilling rig, etc.) and/or funding as may be available.

Please advise as to whether you will be able to assist us in this matter, or if you desire further information.

Sincerely,



James R. Barnett
Acting Executive Director

JRB:GS:meg

cc: Richard Duty
Dr. Denver Talley

Form #7A

OFFICE OF THE FIRE MARSHAL

FILE NUMBER 2G77-350	INSPECTION OF GASOLINE CONTAMINATED WATER WELLS	REQUESTED BY: FILE MEMO	REQUEST DATE
ADDRESS: Renfrow,	OKLA.	INSPECTOR: James W. King	RESPONSE DATE 1/9/78

On January 9, 1978, I met with Lloyd White at his home in Renfrow, Oklahoma. He stated that no more gasoline was being removed from any of the water wells on his property, due to his fear that he and his wife would be forced to pay a tax, per gallon, on whatever amount they might remove from the wells. I was unable to persuade him to resume "dipping" the gasoline from the wells, or to hire a company to pump the gasoline from the wells, with approved equipment.

When I stated the leaving of the gasoline to accumulate in the wells creates a danger of explosion due to the accumulation of vapors, Mr. White stated he realized this, but that he and his wife are financially unable to pay for the pumping out of the wells, and would certainly be unable to pay whatever tax might be assessed by representatives of the Tax Commission.

MRS. MARY GREEN, Analyst, Continental Oil Company, Medford Plant. Upon leaving Renfrow, I went to the Conoco facility at Medford. Mrs. Green was very cooperative and supplied all information available to her. She stated the Medford Plant is a storage and transmission facility for propane, iso-butane, field butane, "natural," or casinghead gas, etc. There is no refined gasoline produced or stored at this facility. The products that are transmitted from the plant go directly to the Conoco Refinery in Ponca City, via a 12-inch pipeline, or to Cities Service Company in Blackwell, via a combination 4-inch and 6-inch line. Both of these lines run Eastward from the Medford Plant. Two pipeline maps were examined.

RECEIVED

JAN 26

OKLA. WATER RESOURCES BOARD

COPIES TO:	DATE SENT	AUTHORITY OF	REPORT APPROVED
Mr. & Mrs. Lloyd White, Route #3, Box 107, Medford, Oklahoma 74759		<i>[Signature]</i>	<i>[Signature]</i>
Mr. Pat Allen, Route #2, Caldwell, Kansas 67022		<i>[Signature]</i>	
Okla. Water Resources Board, OKC Attn: Steve Houghton	1-25-78	<i>[Signature]</i>	
Sam Shakely, Mgr., Pollution Abatement, Okla. Corp. Commission, Room 236, Tim Thomas Bldg., OKC		<i>[Signature]</i>	

FILE #2G77-350
GASOLINE CONTAMINATED WATER WELLS
Renfrow, Oklahoma

CONTINUED:

MR. CHUCK JOHNSON, Division Manager, Koch Oil Company, Medford Facility. I proceeded to the Koch Oil Company facility, where I spoke to Mr. Johnson. He stated, virtually, the same information as had Mrs. Green. This Koch Company facility does not store or transmit any refined gasoline. There are above-ground storage tanks and storage underground in what is called the "salt dome," as at the Conoco facility. The same products found at the Conoco facility are handled at the Koch facility.

There are two transmission lines running from this facility, North, to Conway, Kansas. Various products are transmitted through each line at different times. Each line is monitored from point-to-point.

On January 10, 1978, I went to the Champlin Oil Company, Enid, Oklahoma, where I spoke with Mr. MAX A. WAGGONER, Superintendent of Pipeline Operations. Mr. Waggoner stated Champlin does not store any products underground in the "salt dome," but keeps all products in surface tanks. There is a 6-inch transmission line running from Enid, North through Hutchinson, Kansas and into Northern Iowa; this line is about 11 miles West of Renfrow. The line is used to transmit refined gasoline, as well as other fuels such as #1 and #2 diesel. He stated there is no schedule for shipping the various products; a "batch" is sent through the line as it is needed.

Mr. Waggoner stated the regular gasoline that was brought to Champlin by a member of the Oklahoma Tax Commission, for analysis, proved to be standard, pump-grade gasoline. The gasoline which is transmitted through the Champlin pipeline picks up traces of the other products which have been transmitted. There was no trace of such other fuels as #1 and #2 diesel fuel in the sample from Renfrow.

A "batch" leaving the refinery is metered out, then metered into each terminal. It might take several hundred gallons of fuel leaked out of the line for the meters to register the loss, but not "thousands" of gallons. No leak has been recorded in the line since December, 1976, when some diesel fuel was lost, South

FILE #2G77-350
GAOLINE CONTAMINATED WATER WELLS
Renfrow, Oklahoma

CONTINUED:

of the Salt Fork River. Mr. Waggoner's records showed no other leaks recorded in this line for several years.

I, then, went to Renfrow, where I met with Mr. Lloyd White, Mr. Joe Partain and later, a work crew from the Oklahoma Water Resources Board. Having spoken to Mr. Frank McGreevey, Coordinator, Product Technical Services, Champlin Petroleum Company, I learned of his and his colleagues' concern that anyone using water from the contaminated wells may be exposed to lead poisoning. Mr. McGreevey stated the Tetraethyl Lead found in the samples from Renfrow is Hydrocarbon-soluable, and will "leach" into the water from the gasoline.

I informed Mr. White and Mr. Partain of this and urged them not to use the water; and, I also recommended the gasoline be removed from the wells as regularly as possible, to lessen the danger of explosive vapors.

The members of the Water Resources Board Exploration Team were at the White residence when I arrived from the Partains; Mr. Steve Houghton was charting the water wells in Renfrow, in order to ascertain the direction of flow of the underground water supply.

The team members were convinced that the gasoline had to have been leaked from the service station owned by Mr. Pat Allen. I had inspected Mr. Allen's station; all tanks and piping seemed to be in good condition, and his records showed no appreciable loss of gasoline, although the records are not complete, I disagreed with the Water Resources Team, but decided to inquire into the possibility.

I telephoned Mr. Frank McGreevey, at Champlin Petroleum, who assured me that the gasoline could have leaked into the water supply "several years ago" and not have been detected until the water table dropped to a point low enough to reach the foot valve in a water well.

After receiving my report, dated 12/27/77, Mr. Pat Allen had telephoned to request that I meet with him; we met in Medford, Oklahoma on January 13, 1978.

FILE #2G77-350
GASOLINE CONTAMINATED WATER WELLS
Renfrow, Oklahoma

CONTINUED:

Mr. Allen stated he feared he had misinformed me, but that he had not realized it until reading the portion of my report which quoted him as stating "there was only the one, underground tank."

He stated when he bought the station in 1973, there had been another gasoline pump for Regular, which had been supplied by its own 500-gallon underground tank. The pump was so old and worn that in April, 1974, he disconnected all the piping, removed the pump and left the tank in place. Up until that time, the tank had been kept full of Regular-grade gasoline.

Mr. Allen was very upset at not having informed me of this, and stated he was going to dig the tank up for inspection, as all the piping had been disconnected and there was no way to pressure-test the tank. I agreed that this should be done. I assured Mr. Allen there was no fault attached to his not having mentioned this tank earlier, as I had thought the gasoline in the water supply must be from a current leak, until speaking to Mr. McGreevey; and, I might not have considered this tank as a source, had I known of it.

On January 14, 1978, Saturday evening, Mr. Allen telephoned to say that he had dug the tank up and placed it near the rear, West line, of his property. He stated the bottom of the tank is "rusted out".

There is no way of ascertaining how long the tank has had holes rusted through the bottom; Mr. Allen has not had any gasoline stored in it for almost four years. According to expert information, the gasoline currently contaminating the Renfrow waterwells could have been leaked that long ago, or longer.

Mr. JIM SHIRAZI of the Oklahoma Water Resources Board, stated by telephone that the underground water flow, as charted by the board team, is from the direction of the service station, toward the wells where the contamination was first noticed. Mr. Shirazi stated no one can be positive, but there is a possibility that the gasoline did leak from the tank in question. I agree with him that it is

FILE #2G77-350
GASOLINE CONTAMINATED WATER WELLS
Renfrow, Oklahoma

CONTINUED:

possible; and, I will go to Renfrow to inspect the tank as soon as time and road conditions permit. However, such inspection must be inconclusive as far as determining that this tank was the source of the water well contamination.

James W. King
Agent
STATE FIRE MARSHAL

JWK:dm
1/20/78

OFFICE OF THE FIRE MARSHAL

JAN 4 1978

Form #7A

NUMBER 2677-350	INSPECTION OF GASOLINE-CONTAMINATED WATER WELLS	REQUESTED BY: FILE MEMORANDUM	REQUEST DATE
ADDRESS: Renfrow,	OKLA.	INSPECTOR: JAMES W. KING	RESPONSE DATE 12/27/77

Met with Mr. and Mrs. Lloyd White and Mr. Pat Allen in Renfrow, Oklahoma, to ascertain the results, if any, of pouring an approved dye into the gasoline storage tanks at Mr. Allen's "Renfrow Station," and to see if the various water wells involved were still contaminated with gasoline, and to what degree.

The three (3) storage tanks at Mr. Allen's station were gauged: Tank #1, 12,000 gallon capacity, contained 200 gallons; Tank #2, 8,000 gallon capacity contained 150 - 160 gallons and Tank #3, 10,000 gallon capacity, contained 200 to 400 gallons. Tanks #2 and #3 contained the same amount of gasoline as they had at the previous gauging on 12/2/77, and the level in all three tanks is at, or below the discharge opening. These three tanks are the only tanks which contain Regular-grade gasoline, and all are above-ground tanks. The only below-ground tank Mr. Allen has, contains unleaded gasoline, which is clear, or "white" in color, rather than the cooper-bronze color of the gasoline in the water wells.

Mr. Allen had installed new tanks in the above-ground location to replace the old badly-rusted tanks which were in place when he purchased the station; installation of the new tanks and the necessary piping was completed about May 1, 1977. Mr. Allen stated he did not replace the underground, 500 gallon tank, as it was in good condition. He did dig a trench for piping from the above-ground tanks, which passed over the underground tank. The piping is, however, about three (3) feet below grade level. Mr. Allen stated there was only the one, below-ground tank.

COPIES TO:	DATE SENT	AUTHORITY OF	REPRODUCTION APPROVED
Mr. & Mrs. Lloyd White, Route #3, Box 107, Medford, Okla. 74759			
Mr. Pat Allen, Route #2, Caldwell, Kansas 67022			
Sam Shakely, Mgr., Pollution Abatement, Oklahoma Corporation Commission, Room 236, Jim Thorpe Building.			
Oklahoma Water Resources Board, OKC . Attn: Steve Houghton	1- 3- 78		

FILE #2G77-350
GASOLINE-CONTAMINATED WATER WELLS
RENFROW, OKLAHOMA

CONTINUED:

Mr. and Mrs. White stated they opened the well on her mother's property on 12/14/77. The well pump had not been operated since mid-September, 1977. From 12/14/77 until 12/27/77, they have removed, in five-gallon buckets, a total of 1,177 gallons of usable, refined gasoline from this well. They have taken a total of 467 gallons from the abandoned well on her mother's property; 17 gallons from their own well, 17 gallons from a Mrs. Rutherford's well and 15 gallons from the church well, for a grand total of 1,693 gallons. All of this from 9/22/77 until 12/27/77.

The amounts of gasoline removed from Mrs. White's mother's well varied greatly, from as much as 410 gallons on 12/25/77, to as little as 15 gallons on 12/17/77. The amounts since 12/19/77 (110 gallons) have been not more than 50 gallons per day, with only 22 gallons removed on 12/27/77. There were only 2 gallons removed from the abandoned well on 12/27/77; they had been averaging 7 gallons per day from this well.

The amounts of gasoline being removed from the two main wells seems to be diminishing, and it appears that the source of the gasoline has either been exhausted, or cut off.

On 12/27/77, I contacted, by telephone, Mr. Jim Reddick, Right-of-Way & Claims Superintendent for the Champlin Oil Company. He stated Champlin Oil does have a gasoline transmission line running from Enid, north past Medford and Renfrow; the line is located about ten miles west of Medford and about 12 miles west of Renfrow, Oklahoma. He stated there has not been a leak in this line in several years, and that the line is monitored by metering devices which immediately shut the line down whenever a leak is detected. The devices apparently work by relating the amount pumped into the line to the amounts delivered at various points along the line; a slight variance will cause the line to be shut down.

FILE #2G77-350
GASOLINE-CONTAMINATED WATER WELLS
RENFROW, OKLAHOMA

CONTINUED:

I also spoke to Mrs. Mary Green, Analyst for the Continental Oil Company processing plant located south of Medford. She stated the company has a transmission line which runs east toward Ponca City, but none running north. The line, however, transmits only casinghead gas, not refined gasoline. She stated she did not know if the Koch Oil Company, also located south of Medford, has any gasoline transmission lines, but to her certain knowledge, such a line from that facility would contain only casinghead gas, as the facility is not equipped to refine the raw product.

A further check will be made to see if the amount of gasoline in the wells continues to diminish, or if the wells finally clear up.

James W. King
James W. King
Agent
STATE FIRE MARSHAL

JWK:dm
1/3/78

OFFICE OF THE FIRE MARSHAL

Form #7A

FILE NUMBER 2677-350	INSPECTION OF GASOLINE/CONTAMINATED WATER WELLS	REQUESTED BY: Mrs. Lloyd (Eva) White	REL. SET
ADDRESS: Renfrow,	OKLA.	INSPECTOR: James W. King	RESPONSE 12/2/77

Met with Mr. Pat Allen and Mr. Lloyd White, at Mr. Allen's "Renfrow Station" in Renfrow, Oklahoma, for the purpose of pouring a container of dye into the main storage tank of "regular" gasoline. Two other tanks which are normally filled with regular gasoline were empty at this time.

The dye used, Green in color, was obtained by Mr. Allen from the Ethel Corporation, Tulsa, Oklahoma, and is approved for use in "motor gasolines," etc. The dye was mixed according to the manufacturer's instructions, before being poured into the storage tank. The tank fuel level was gauged before the dye was poured in; the 12,000 gallon tank contained slightly over 8,200 gallons.

The other tanks (2) normally storing regular gasoline were also gauged. Tank #2, 8,000 gallon capacity, contained about 150 to 160 gallons; tank #3, a 10,000 gallon capacity, contained about 200 to 240 gallons. (Both of these are gallonage estimates, as Mr. Allen's measure is calibrated for the 12,000 gallon tank.) The fuel level on both, Tank #2 and Tank #3, was below the level of the outlet valve.

If the gasoline in the Whites' water wells does not change color within two weeks, by which time Mr. Allen estimates he will have emptied the remaining tank of regular gasoline, he will telephone me; at which time, I will return to his service station and witness the gauging of the fuel level in all three tanks.

If the gasoline in the Whites' water well has not changed color, from Copper-Bronze to Green, and if the fuel level in Mr. Allen's storage tanks #2 and #3 remains approximately the same, then further inquiries as to the source of the contamination will have to be made.

James W. King

James W. King
Agent
STATE FIRE MARSHAL

JWK:dm
12/7/77

COPIES TO:	DATE SENT	AUTHORITY OF	REC. APPROV.
Pat Allen, Route #2, Caldwell, Kansas 67022	12-12-77	<i>F.L.D.</i>	<i>J.W.K.</i>
Mr. & Mrs. Lloyd White, Rt. #3, Box 107, Medford, Okla. 74759	12-12-77	<i>F.L.D.</i>	
Sam Shakely, Mgr., Pollution Abatement, Okla. Corp. Comm. Room 236, Jim Thorpe Bldg., OKC 73105	12-12-77	<i>F.L.D.</i>	
Steve Houghton, Okla. Water Resources Board, 5th Floor, Jim Thorpe Bldg., OKC 73105	12/30/77		

OFFICE OF THE FIRE MARSHAL

Form #7A

FILE NUMBER 2G77-350	INSPECTION OF GASOLINE/CONTAMINATED WATER WELLS	REQUESTED BY: Mrs. Lloyd (Eva) White	REQUE 11/
ADDRESS: RENFROW,	OKLA.	INSPECTOR: James W. King	RESPO 11/

Met with Mr. and Mrs. Lloyd White at their home in Renfrow (no street number address) regarding the contamination of their, and several other, water well by gasoline. The number of wells includes their own, Mrs. White's mother's well, an abandoned well on her mother's property, the Methodist Church's well, and one neighbor's well -- total of five wells.

The abandoned well is named particularly, as the Whites and a neighbor, Mr. Partain have dipped a measured 284 gallons of usable gasoline from the well, since October 7, 1977. This gasoline has been and is being used in a total of six cars and/or pickup trucks. The four gallons listed (284) were dipped out of the well by Mr. White, while I was interviewing Mr. Pat Allen at his service station.

Mrs. White said she first noticed the gasoline while cleaning the church restroom; the restroom soon became unusable due to the odor and fumes. The gasoline, then, began to flow into the drinking water well on her mother's property, soon rendering it unusable. Their own well was the last to be contaminated.

On Friday, 10/7/77, a tin can was lowered into the abandoned well South of Mrs. White's mother's house. When pulled up, it was found to contain relatively pure gasoline, of a coppery-bronze color. Both color and odor are of fresh gasoline and the gasoline is usable in several newer motor vehicles.

RECEIVED
JAN 3 1978

COPIES TO:	DATE SENT	AUTHORITY OF
Pat Allen, Route #2, Caldwell, Kansas 67022	11-23-77	J.L.S.
Mr. & Mrs. Lloyd White, Route #3, Box 107, Medford, Oklahoma 74759	11-23-77	J.L.S.
Sam F. Shakely, Mgr., Pollution Abatement, Oklahoma Corp. Commission, Room 236, Jim Thorpe Bldg., OKC 73105	11-23-77	J.L.S.
Steve Houghton, Okla. Water Resources Bd., 5th Floor Jim Thorpe Bldg.	12/30/77	

FILE #2677-350
GASOLINE/CONTAMINATED WATER WELLS
RENFROW, OKLAHOMA

CONTINUED:

The Whites have checked with Mr. Pat Allen, local service station owner, who states, as nearly as he can determine, that he is not losing gasoline from his tanks.

I visited with Mr. Allen at his service station. He has one, underground, tank of 550-gallon capacity; all other tanks are above-ground. He states he has always kept good records and that he has been especially careful to check his deliveries, gallons sold and gallons on hand, since this problem was first brought to his attention. The Whites have dipped a measured 284 gallons of gasoline out of the abandoned well since 10/7/77; yet, Allen's records indicate he has lost less than 25 gallons per month, "usual loss" and which he states is allowed by the oil refinery people for their company owned stations.

Pat Allen stated he had thought about pouring a coloring dye into each of his tanks, to see if the gasoline in the wells changed color, also. He agreed to do so, when asked, and stated he will have this done by 12/1/77, if he can obtain an approved dye from a refinery. He stated he will notify the Whites of the day he does put the dye in his tanks, and request that they be present; the Whites have agreed to this, and also have stated they will dip gasoline out of the abandoned well no less than once each day for at least one week after the dye is put in the tanks at Pat Allen's Renfrow Station.

Disposition of this inquiry awaits the results of the dye test.

James W. King
James W. King
Agent
STATE FIRE MARSHAL

JWK:dm
11/21/77

December 19, 1977

Mr. Lawrence R. Edmison
Department of Pollution Control
Box 53504
Oklahoma City, OK 73105

Dear Mr. Edmison:

Please refer to Department of Pollution Control Complaint No. 12-77-003, complaint of Mr. Lloyd White of gasoline in a fresh water well in Renfrow, Oklahoma.

This complaint came to my attention by a call from Mrs. Eva White on November 4, 1977. This complaint was referred to the State Fire Marshal by letter on November 8, 1977. Information has been received that an investigation is under way with introduction of dye into the storage tanks of the adjacent service station to determine the source, if possible.

The Corporation Commission, Oil & Gas Conservation Division, does not have jurisdiction over gasoline service stations.

Yours very truly,

Sam F. Shakely, Manager
Pollution Abatement

SFS:alh

OKLAHOMA WATER RESOURCES BOARD-COMPLAINTS

OWRB COMPLAINT # WR-77-1205 DPC COMPLAINT # 12-77-003

COMPLAINT REPORTED BY: Lawrence R. Edmison, DPC for Mr. Lloyd White
 ADDRESS: Route 3, Box 1076
 CITY: Medford ZIP CODE 73759
 PHONE: 405 849-6769 (NUMBER CAN BE FOUND AT DURING DAY)
 DATE RECEIVED 12-15-77
 SOURCE: _____

LOCATION: Near Renfrow, OK
 HOW TO GET THERE: _____

TYPE OF POLLUTION: Gasoline contamination of water wells,
(400 gallons pumped from one water well)

REMARKS: _____

- *****
- METHOD COMPLAINT REPORTED: Letter from DPC PERSON TAKING COMPLAI
 DATE: 12-15-77
 - INITIAL ACTION TAKEN: _____
 - COMPLAINT ASSIGNED TO: Jim Long - Taken back DATE: 12-20-77
 - DATE INSPECTED: _____ . INSPECTOR: _____
 - ACTION TAKEN: State Fire Marshall's Office Investigating, 12-25-77; Called State Fire Mar
Office 12-30-77 talked to John Guess. * On 1-3-78 called Mr. Sanders, **
Mr. Barnett called N.P. Reporter Kay McCurtly, 524-3344, 1-3-77
 - FOLLOW-UP ASSIGNED TO: _____ DATE: _____
 - ACTION TAKEN: _____
 - DATE COMPLAINT COMPLETED: _____

COMMENTS: _____

* Mr. Guess stated that the service station tanks appeared not to leak, he is going to meet with the Corporation Commission to see if any transmission lines run through the area.
 ** stated that there was a Champion Pipeline 10 miles west, 400 gallons have been recovered. Wells have been affected. Looks like Regular Gasoline. Inspector Jim King. Several

November 8, 1977

Mr. Jack Sanders
State Fire Marshal
4030 North Lincoln Blvd.
Oklahoma City, OK 73105

Dear Mr. Sanders:

Please be advised that a report has been received relative to the presence of gasoline in several fresh water wells in the town of Renfrow, Grant County.

These wells are adjacent to the Renfrow Gasoline Station operated by Pat Allen.

Yours very truly,

Sam F. Shakely, Manager
Pollution Abatement

SFS:alh

cc: Mrs. Eva White
Route 3, Box 107
Madford, OK 73759