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REPORTS

DATE:

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October 11, 1984

Texas-New Mexico Pipe Line Company
Crude Oil Pipe Line Leak
Monument, New Mexico

Mr. B. L. Lednicky
Texas-New Mexico Pipe Line Company
P. O. Box 2528
Braomoor Bldg.
Hobbs, New Mexico 88240

Dear Mr. Lednicky:

Attached is a report on the subject leak site investigation conducted by Dr. W. R. Deever on September 24 and 25, 1984. Mr. Garrison A. McCaslin, New Mexico Environmental Improvement Division, and Mr. W. E. Copeland, President of the Monument Water Users Association accompanied you and Dr. Deever during the site visit on the 24th.

One of the two water wells that serve the town of Monument had apparently been contaminated by the leak. This well, which is only about 100 feet from the pipe line leak, was examined. The hydrocarbon vapors in the casing were above the explosive limits and phase separated hydrocarbon (free crude oil) was on the surface of the water table. The pump was turned on and water samples were taken immediately and again after about 30 minutes.

On the 25th the soil in the leak area and the remaining uncontaminated water well were sampled. Copies of the well logs of the contaminated well were obtained from Mr. Copeland. A visit was also made to the New Mexico Oil Conservation Commission. The existing situation and the possible mitigation procedures were outlined and discussed with Mr. Jerry T. Sexton, Supervisor District I, and Mr. Eddie W. Seay, Field Representative, of the Oil Conservation Commission.

The attached report covers the site visit, sample analyses, and recommendations. It was recommended that an engineering firm be retained to perform an investigation and begin mitigation procedures to prevent further migration of the crude oil toward the one uncontaminated well. Since Texaco has a national contract with Groundwater Technology Inc. (GTI) to perform this type of work, and since they are currently engaged in numerous such projects for Texaco, they were recommended. GTI has had an engineer on site since October 3.

Also attached are copies of four newspaper articles. Three are from the Hobbs Daily News-Sun and one is from the Rocky Mountain News of Denver, Colorado. This leak was also reported on one of the Albuquerque TV stations.

Additional groundwater samples from the one uncontaminated well have been requested from the GTI engineer who is conducting the investigation. Data from these samples will be forwarded as soon as they have been obtained. If you need additional information or have any questions please contact Dr. W. R. Deever.

Very truly yours,

WR Coover

/WRD
Attachment
CJB
BJL
RAC
UVH
JSL

LEAK ASSESSMENT REPORT

TEXAS-NEW MEXICO PIPE LINE COMPANY
CRUDE OIL PIPE LINE LEAK - MONUMENT, NEW MEXICO

SITUATION: Monument, New Mexico is located about 20 miles southwest of Hobbs, New Mexico in the southeast corner of the state. The town is near an area referred to as Monument Draw and to Monument Springs. On Friday September 14, 1984 the residents complained of an oily taste in the town drinking water. The source was found to be one of the town's water wells which supplied about 28 gpm to the water system. A crude oil pipe line, belonging to the Texas-New Mexico Pipe Line Company (T-NMPLC) and located about 100 feet away from the well, was found to be leaking. This well was shut-in and the town's water system flushed with water from the one uncontaminated well. Drinking water was supplied in the interim by the Army National Guard from Hobbs. When the system cleared, the residents went back on town water from the one good well. The T-NMPLC removed large amounts of the oil soaked soil and replaced it with clean dirt. The portion of the pipe line in the area of the wells was replaced with a temporary plastic line and the leaking line repaired. As a final measure, the temporary line will probably be placed inside the old six-inch line in the vicinity of the wells.

There are about 72 hookups on the Monument Water Users Association system which obtains its water from two wells which deliver 28 gpm and 120 gpm, respectively. The water is pumped to a storage tank and hence to the users. The pumps are operated by a level control in the storage tank which turns on both pumps when the level drops below about three feet. The 120 gpm produced by the one well is estimated by Mr. W. C. Copeland, President of the Monument Water Users Association, to probably be sufficient for winter demands, but not for summer.

SITE DESCRIPTION: The pipe line which leaked is a six-inch, gravity-flow, crude-oil line which was installed about 1936 and was constructed of threaded pipe. The leak was found at a collar connecting two of the pipe lengths. The line is located in a low drainage area or draw, which runs northwest to southeast. The pipe line is about three to four feet below grade in a trench cut into the caliche. The draw appears to carry a lot of water when there is a run-off. The caliche is exposed at several points in the draw. It is thought that the pipe line trench in the caliche was probably cut using dynamite which may have resulted in the fracturing of the caliche below the pipe line. The leaking collar is about 100 feet from the 28 gpm well.

The contaminated 28 gpm well is 70 feet deep. The first ten feet are described as hard caliche, the next ten feet as soft caliche and the next 35 feet as water, sand and gravel. At 55 feet the Red Bed is encountered and the well is terminated 15 feet into this formation. This may be the same Red Bed as is found at the base of the Ogallala aquifer, and in fact the water bearing zone may be a part of this aquifer. The well is cased with 70 feet of eight inch pipe which is perforated from 20 feet to 55 feet. The first 20 feet was drilled to a 20 inch diameter and then grouted with cement. The top of the casing stands about one foot above the concrete pad. The pump is set at a depth of about 66 feet. The well was drilled in 1967 by Mr. W. L. Van Noy of Oil Center, New Mexico.

The uncontaminated 120 gpm well is located about 1800 feet southeast and downgradient from the 28 gpm well. It is on the west side of the draw, the same as the 28 gpm well, and about the same distance(100 feet) from the same six-inch crude oil pipe line as is the 28 gpm well. This well originally belonged to the local school, on whose property it is located; however, the school has been closed for quite some time. If the aquifer properties are favorable and if the well was constructed correctly, then the extra 28 gpm needed for summer operation might be available by simply increasing the pumping rate of the 120 gpm well. There is an area about 25 feet northwest of this well where some debris and trash have been discarded. Drilling logs of this well were not obtained at this time.

There is another school well, currently out of service, located about 400 feet west of the 120 gpm well. The well is covered with a corrugated steel shed, has an old pump and is surrounded by a concrete slab. The electrical power line which supplies the 120 gpm well passes within about 30 feet of this well. This well could possibly be reworked to supply the 28 gpm needed by the town in the summer months. No drilling logs were obtained for this well at this time.

SPILL EVALUATION: The contamination of the well probably occurred in the following manner. The oil leaking from the pipe line moved downward until it encountered the caliche where it filled the pipe line trench and moved along the trench both downgradient and upgradient. Some of the oil began to move downward as soon as it encountered the caliche. As the trench became full, the oil would have spread laterally above the caliche moving easily at first and then with more difficulty as the soil became more saturated with oil. As the resistance to spreading increased, the oil eventually came to the surface and even pooled in some places. Caliche would normally be expected to be rather impermeable, but if the pipe line trench was cut using dynamite, then the caliche below and near the pipe line could be highly fractured, and would have allowed oil to move further downward. Since the oil in the trench would have begun to move downward through the caliche before the oil above the caliche spread very extensively, there was probably a large amount of oil that migrated downward. When the downward migrating oil reached the water table, it too began to spread laterally. However, the 28 gpm well, which does not appear to be directly downgradient of the leak area, would have, in the process of being pumped, created a cone of depression which would have guided the oil directly into the well casing.

Although the taste and odor problems were first noticed on Friday the 14th of September the spill probably began a few weeks before. The reasons why this is probably true are the following:

1. The oil in the pipe line moved by gravity and therefore was not under a very large head or pressure and would not have leaked at a very rapid rate.

2. The oil which did not seep downward moved laterally above the caliche and eventually came to the surface covering an area of about one acre more or less. This would have probably taken more than a week.

ou that contaminated one of the association's two wells. The water table in the area is 40

3. In order to get in the well and affect the taste and odor, the oil had to travel downward through the caliche and laterally about 100 feet to the well and this action probably began before the surface spreading.

There was some dead vegetation in the area of the contaminated soil, which was probably caused by the oil, but the length of time it had been dead could not be estimated.

When the 28 gpm well was investigated on the 24th, the depth to the liquid level was 17 feet 2.5 inches below the top of the casing. The oil layer on the surface of the water was slightly less than 1/4 inch in thickness, as measured in the well. Since the water level was above the perforated part of the casing, as recorded in the drilling log, this thickness measurement probably does not accurately reflect the thickness in the soil formation.

The 28 gpm well was sampled immediately after the pump was turned on and after about 30 minutes. The 120 gpm well was also sampled. The samples were analyzed for benzene, toluene, ethylbenzene, and xylene. The results of these analyses are shown in Table I.

These data show that the 28 gpm well is quite contaminated. The increase in concentration with pumping time is probably due to the lowering of the water table surface, and hence the oil, until it is closer to the intake of the pump. Volatile organics in the vapor space above the water in the well were quite noticeable and when measured with an explosion meter gave a reading above 100% of the lower explosive limit.

Samples were taken of the saturated soil in the trench and beneath the pipe line and of uncontaminated soil near the pipe line. The uncontaminated soil was composed of 51.65 wt% sand, 28.86 wt% silt, and 19.49 wt% clay. This amount of clay indicates that the holding capacity for oil could be considerable. Table II, attached, gives the particle size analysis for all three soil samples. Samples S1 and S2 were both oily which may have affected the particle size analysis.

The bulk density of the oily soil was determined from measurements to be in the range of 2000 to 2500 pounds per cubic yard. Table III shows the results of the solvent extraction to determine the amount of oil in the soil. The oil content was 4.5% by weight. This is the solvent extractable for S2, 5.1 wt%, minus that for S3, 0.6 wt%, which is the background. All material more volatile than toluene is lost in this method of determination. If an estimate of the volatile material is included, the oil content is about 10% by weight. Assuming that the crude oil has an API gravity of 35, the oil weighs 297 lbs/bbl. Therefore, the oily soil removed from the leak area is estimated to contain from 0.3 to 0.8 barrels of oil per cubic yard of soil. If the area of the oil saturated soil is about one acre and has a depth of about two feet, then there are about 3000 cubic yards of contaminated soil. This soil would contain about 900 to 2400 barrels of oil. This is much more than was thought to have leaked and does not include the oil that migrated downward through the caliche.

MITIGATON ACTIONS: The oil that is in the soil above the caliche should be quite stable. Limited migration might occur during a rain fall, but even then only soluble components would be able to migrate. This oil will slowly undergo biological degradation. The oil that has moved to the water table will slowly migrate downgradient toward the one remaining uncontaminated well. This action should be prevented.

The migration of the oil can be controlled by the use of accepted techniques. The 28 gpm well may never be restored to its former use, but the 120 gpm well should never become contaminated from this leak. Such control measures would involve the following actions:

1. Install monitoring wells (probably 4 to 10) to determine the areal extent of the leak and to determine the thickness of the oil on the surface of the water table. These wells will also be used to determine the direction of groundwater flow and be used in a pump test to determine the aquifer properties.

2. The 28 gpm well would be used as a recovery well and would be pumped at constant rate, determined from the aquifer properties, to create a cone of depression in the water table. This cone of depression would draw the oil toward the 28 gpm well where it would be recovered.

3. The well could be operated with a single pump, which would recover both oil and water in the same line for separation later and create the cone of depression. If a two pump system is used, one pump recovers just the oil, while the second pumps only water to create the cone of depression.

4. The recovered oil would be reused, but the produced water may create a disposal problem. The water may contain dissolved hydrocarbons in a high enough concentration so that direct discharge on the land would not be permitted. Other methods of disposal would then have to be found, such as being added to other oil field produced waters as suggested by T-NMPLC, or the water would have to be cleaned up. Air stripping is one such method that is currently in use. If the contaminants were removed to some agreed upon limit, the water might be discharged directly to the land or reinjected into the groundwater to aid in the recovery and clean-up of the oil.

RECOMMENDATIONS: Though these methods of mitigation are accepted and well known techniques, they are in many ways very specialized. Therefore, it was recommended that an engineering firm that specializes in the recovery of underground oil be retained to implement the mitigation and recovery program. One such firm, with which Texaco USA has a national contract, is

Groundwater Technology Inc.
5047 Clayton Road
Concord, CA 94521
415/671-2387

This firm was contacted on the 1st of October 1984 and they had an engineer on site on the 3rd to begin the preliminary work.

TABLE I

VOLATILE ORGANIC ANALYSIS OF GROUNDWATER
MONUMENT, NEW MEXICO WATER SYSTEM
(all values in mg/L, ppm)

	BENZENE	TOLUENE	ETHYLBENZENE	XYLENE
28 GPM WELL				
0 TIME	1.19	0.82	0.046	0.12
30 MIN	7.38	7.35	1.24	1.28
120 GPM WELL	ND (0.017)	ND	ND	ND

The 120 gpm well was sampled and analyzed in triplicate and one sample indicated some benzene on the first analysis but none when it was reanalyzed. The well is being sampled again since the sample is suspect due to being transported with a soil sample that was known to be contaminated.

TABLE II

CRUDE OIL SPILL SITE
MOMUMENT, NEW MEXICO

PARTICLE SIZE ANALYSIS

SAMPLE	WT % CLAY*	WT % SILT*	WT % SAND*	USDA CLASSIFICATION
CONT. SOIL S1	8.76	10.13	81.11	LOAMY SAND
CONT. SOIL S2	14.40	12.02	73.58	SANDY LOAM
BACKGROUND S3	19.49	28.86	51.65	LOAM

*CLAY < 0.002 mm DIAMETER
SILT 0.002 TO 0.05 mm DIAMETER
SAND > 0.05 mm DIAMETER

S1 = OILY SOIL FROM DIRECTLY BENEATH AND IN CONTACT WITH THE PIPE LINE
S2 = OILY SOIL THAT WAS BEING REMOVED FOR DISPOSAL

TABLE III

CRUDE OIL SPILL SITE
MOMUMENT, NEW MEXICO

MATRIX COMPONENTS

SAMPLE	WATER	ASH	COMBUSTIBLES		
			SOLVENT EXTRACTABLE	NON-EXTRACTABLE	COMB. TOTAL
CONT. SOIL S1	13.7	71.2	12.0	3.1	15.1
CONT. SOIL S2	7.0	84.8	5.1	3.1	8.2
BACKGROUND S3	5.2	90.3	.6	3.9	4.5

All values are percent.

S1 = OILY SOIL BENEATH AND IN DIRECT CONTACT WITH THE PIPE LINE
S2 = OILY SOIL THAT WAS BEING REMOVED FOR DISPOSAL