ANALYSIS AND REMEDIATION OF AN UNDERGROUND STORAGE TANK PROBLEM IN THE ALBUQUERQUE BASIN

By

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ABSTRACT

Contamination of groundwater in Albuquerque's south valley poses a potential threat to the health of the city residents, to continued industrial growth in the area, and to the principal aquifer of the Rio Grande basin. The Rio Grande underground water basin is regulated as a sole source of potable water by the State of New Mexico.

The purpose of this study was to take the perspective of the consultant hired to investigate two sites suspected of contamination. The sites are located in Albuquerque's south valley. The consultant must determine, through a series of logical steps, whether contamination exists, where the contamination is most likely to be located, what the contaminants are, what the lateral and vertical extent of the contamination is, and how to remediate the problem.

The consultant used a stepwise approach,which involved a description of the study area, a site investigation, and a remedial investigation/feasibility study to evaluate the sites. Using this approach, monitoring wells were installed at the site and water samples were collected. Available analyses of the water samples verified the presence of contamination and determined the type and concentration of the contaminants (see table III, p. 24). A soil gas survey and additional water sampling was recommended for defining where the contamination was most likely to be located and to determine the lateral and vertical extent of the contamination. A remediation scheme was proposed based on the data available, but was not refined or implemented pending further information.

It was concluded that information about local aquifer parameters needed to be ascertained before a detailed remediation plan could be developed. Preparation of a groundwater model would be useful for adjusting the remediation systems and in evaluating the impact of the remediation methods on the contaminant plume(s).

ACKNOWLEDGMENTS

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ACRONYMS

AFB	Air Force Base
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EPA	Environmental Protection Agency
GC/MS	Gas Chromatograph/Mass Spectrometer
HAZWRAP	Hazardous Waste Remedial Actions Program
IRP	Installation Restoration Program
MCL	Maximum Concentration Level
MSL	Mean Sea Level
ND	Nondetectable
NGVD	National Geodetic Vertical Datum
NMEID	New Mexico Environmental Improvement Division
NMSA	New Mexico Statutory Authority
PA	Preliminary Assessment
ppb	parts per billion
USGS	U.S. Geological Survey
WRIR	Water-Resources Investigations Report
Company A	A carwash
Company B	A drilling firm

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1. INTRODUCTION

Contamination of groundwater in the inner valley of the Rio Grande south of Albuquerque, New Mexico, poses a potential threat to health of city residents and to continued industrial growth in the area. The shallow water table is highly susceptible to contamination from activities on the land surface. Contaminated groundwater is known to have moved from the alluvium to the Quaternary and Tertiary Santa Fe Group, affecting the water supply for the City of Albuquerque and its population of 400,000 (Peter, 1987, p. 2).

Abandoned underground storage tanks are being investigated through the U.S. Environmental Protection Agency's (EPA) "Superfund" program in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and in accordance with New Mexico's underground storage tank statutes and regulations. These regulations and statutes include the Ground Water Regulations promulgated under the Water Quality Act (74-6-1 et seq. NMSA 1978), the Petroleum Storage Clean Up Act (recently signed into law), fire code regulations promulgated under the state's Flammable Liquids Code (59A-52-l et seq. NMSA 1978), the Hazardous Waste Act (74-4-1 et seq. NMSA 1978), and underground storage tank regulations being promulgated under the Hazardous Waste Act. These regulations apply to all tanks used to store hydrocarbon fuels and tanks used to store hazardous substances (Souder, 1988).

Aquifer hydraulics and the area geology need to be understood to predict migration pathways and rates of contaminant movement so that potential hazards caused by contamination may be evaluated. Many factors affect the direction and rate of contaminant movement:

1) proximity of the water table to the contaminant source,
2) horizontal and vertical gradient of the groundwater flow,
3) aquifer porosity,
4) aquifer hydraulic conductivity,
5) variations in climatic conditions,
6) irrigation practices,
7) withdrawal rates,

8) surface water conditions,
9) magnitude of the source and whether it is intermittent or steady state,
10) nature of contaminants, and
11) structure of the vadose zone.

1.1 RELEVANCE OF RESEARCH

Throughout the United States, federal, state, and local agencies have been studying and identifying a wide variety of potentially hazardous contaminants which, upon introduction into groundwater, lead to undesirable water quality. The emphasis is now shifting to cleaning up these sites and preventing future pollution of our fragile groundwater system.

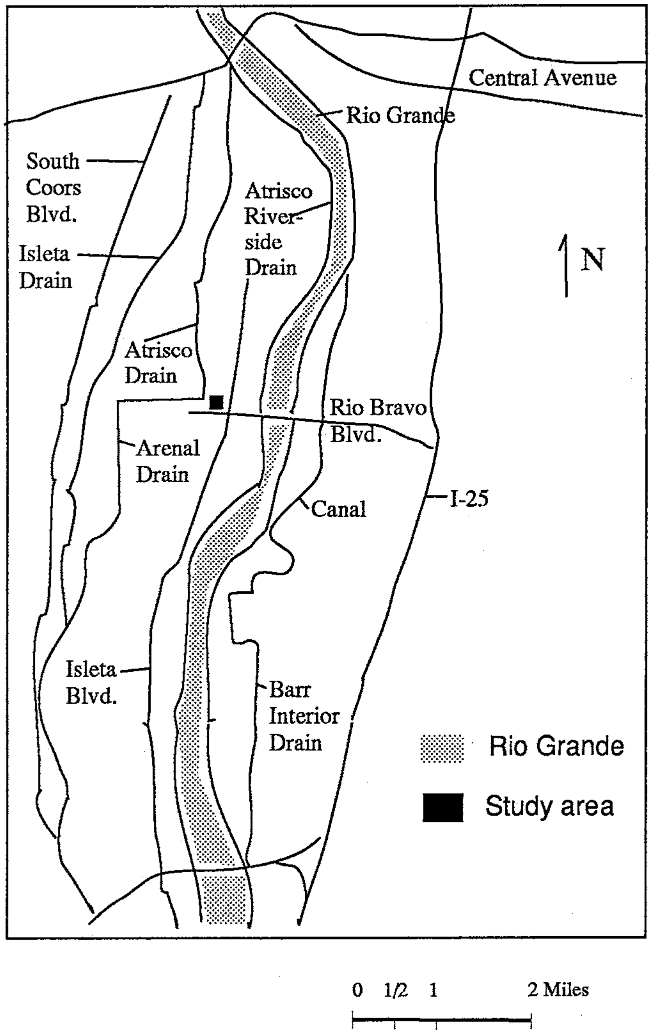
1.2 OBJECTIVES

The objective of this paper is to take the perspective of the consultant presented with a site suspected of contamination. The consultant must determine whether contamination exists, where the contamination is most likely to be located, what the contaminants are, what the lateral and vertical extent of contamination is, and how to remediate the problem. This will be accomplished through a series of steps:

1) a description of the study area,
2) a site investigation,
3) a remedial investigation/feasibility study, and
4) a remedial design.

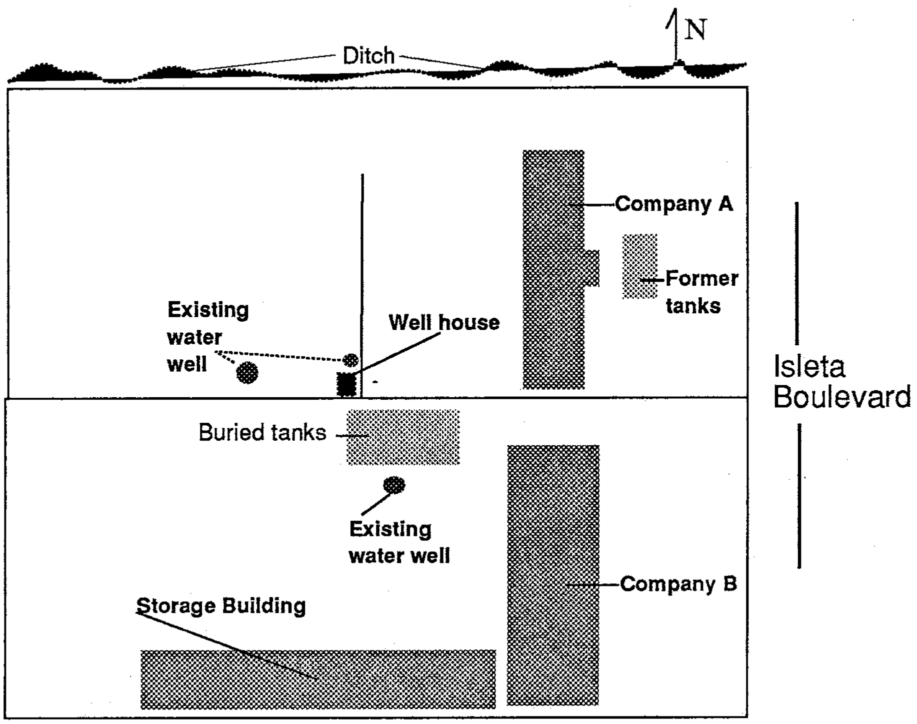
2. DESCRIPTION OF THE STUDY AREA

The study area is located in central New Mexico, city of Albuquerque, in the 2600 block of Isleta Boulevard, SW (Fig. 1). The area consists of two businesses, Company A (a carwash) and Company B (a drilling company), on approximately 3 acres of sparsely vegetated desert land. Only small businesses are operating in the immediate vicinity of the site (Fig. 2).



Source: Modified from Peters, 1987.

Figure 1. Location of study area.



Source: NMEID, 1988

• Not drawn to scale

Figure 2. Layout of the study area.

2.1 PHYSICAL SETTING

In this section, the geology, hydrology, meteorological conditions, and local land use that may affect migration of potential contaminants, will be examined. The ecological setting will also be considered as an indicator of environmentally sensitive habitats or of environmental stress.

2.1.1 Geology

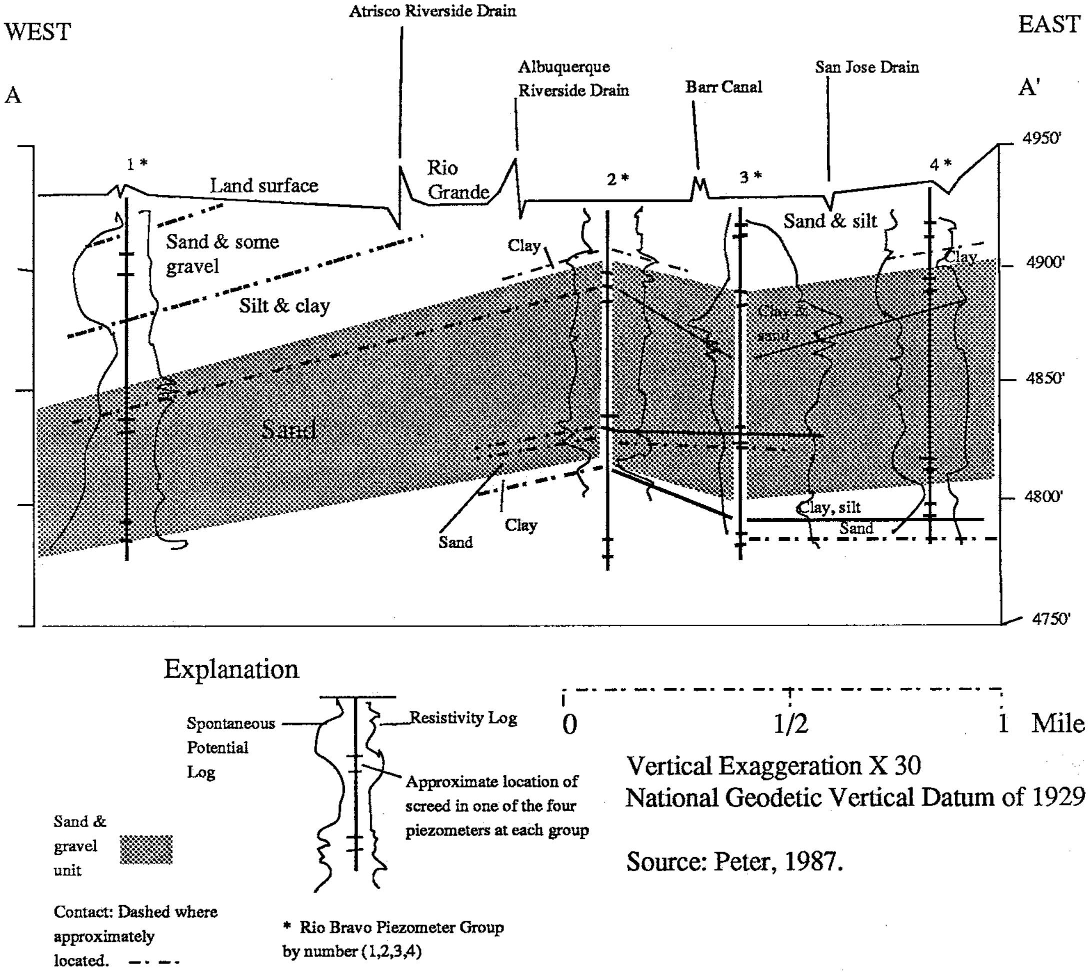
The USGS used geophysical logs taken in piezometers set 150 feet deep along Rio Bravo Boulevard to describe the subsurface geology in the study area (Peter, 1987). Results from this study indicate that alluvium of Holocene age underlies the flood plain of the Rio Grande and consists of cobbles, gravels, sand, silt, and clay. A clay and silt unit 6 to 15 feet thick underlies a sand and gravel unit, while the deepest unit that was penetrated consists of sand as shown in Fig. 3 (Peter, 1987). The alluvium is similar in appearance and composition to the underlying Santa Fe Group of Miocene-Pleistocene age. The principal source of alluvial material is the Santa Fe Group. Spontaneous-potential and resistivity logs indicate that the alluvium is a unit 60 to 95 feet thick.

2 .1.1.1 Stratigraphy

Table I describes the geologic units in the Albuquerque area. The lithologies of the units consist of unconsolidated materials, made up of fragments of sedimentary, metamorphic, and igneous rocks (Installation Restoration Program (IRP), Preliminary Assessment (PA) for Kirtland Air Force Base (AFB), Albuquerque, N.M., 1981). Although the contact between the alluvium and the Santa Fe Group is difficult to identify, it is believed to lie from 80 to 120 feet below the surface based on changes in lithology and consolidation.

2.1.1.2 Structure

The Albuquerque Basin occupies 4300 square miles in the Mexican Highland Subdivision of the Basin and Range Physiographic Province



Vertical Exaggeration X 30
National Geodetic Vertical Datum of 1929

Source: Peter, 1987.

Figure 3. Generalized geologic section along Rio Bravo Boulevard and piezometer locations.

Table I. Geologic Formations in the Albuquerque Area.

System	Series	Age (M.Y) *	Formations	Thickness (ft)
Quaternary	Holocene		Gravel, sand, mud in lowlands, arroyos, low terrace, and alluvial fans	5 – 100
	Pleistocene	1.5 – 2	Gravel, sand, caliche; lava flows	10 – 50
Tertiary	Miocene – Pliocene	7 –20	Sante Fe Formation: sand, clay, and gravel	0 – 21,000+
	Eocene	53 – 54	Galisteo Formation: red and buff sandstone and mudstone	1,000±
Cretaceous	Upper	100	Mesaverde Formation: shale, sandstone, and coal	1,500
			Mancos Shale: shale with thin limestone and sandstone beds	
	Lower	136	Dakota Formation: sandstone, conglomerate, shale	
Jurassic	Upper	154	Morrison Formation: variegated mudstone and sandstone	400 – 800
			Summerville Formation: red and buff mudstone and sandstone	200
			Todilto Formation: gypsum and limestone	
			Estrada Sandstone: red and buff sandstone	150 – 200
Triassic	Upper	200	Chinle Formation: red and tan mudstone and claystone	1,500
			Santa Rosa Formation: sandstone and conglomerate	200 – 400

* M.Y. = Millions of years from the beginning of the system or series.

Table I. Geologic Formations in the Albuquerque Area (continued).

System	Series	Age (M.Y) *	Formations	Thickness (ft)
	Upper	235	Bernal Formation: sandstone, siltstone and limestone	100
			San Andrea Formation: limestone	30 – 100
Permian	Middle	250	Glorieta Sandstone	50 – 100
			Yeso Formation: red and tan sandstone, limestone and gypsum	600 – 900
	Lower	280	Abo Formation: red sandstone and mudstone	600 – 900
Pennsylvanian		300	Madera Formation: limestone, shale, and sandstone	1,000±
			Sandia Formation: sandstone, shale, and limestone	100 – 200
Mississippian		340	Arroyo Penasco Formation	0 – 100
Precambrian		580+ 2,500+	Sandia Granite, gneiss, quartzite, greenstone, and schist	

* M.Y. = Millions of years from the beginning of the system or series.

Source: IRP, Preliminary Assessment for Kirtland Air Force Base, Albuquerque, New Mexico, 1981.

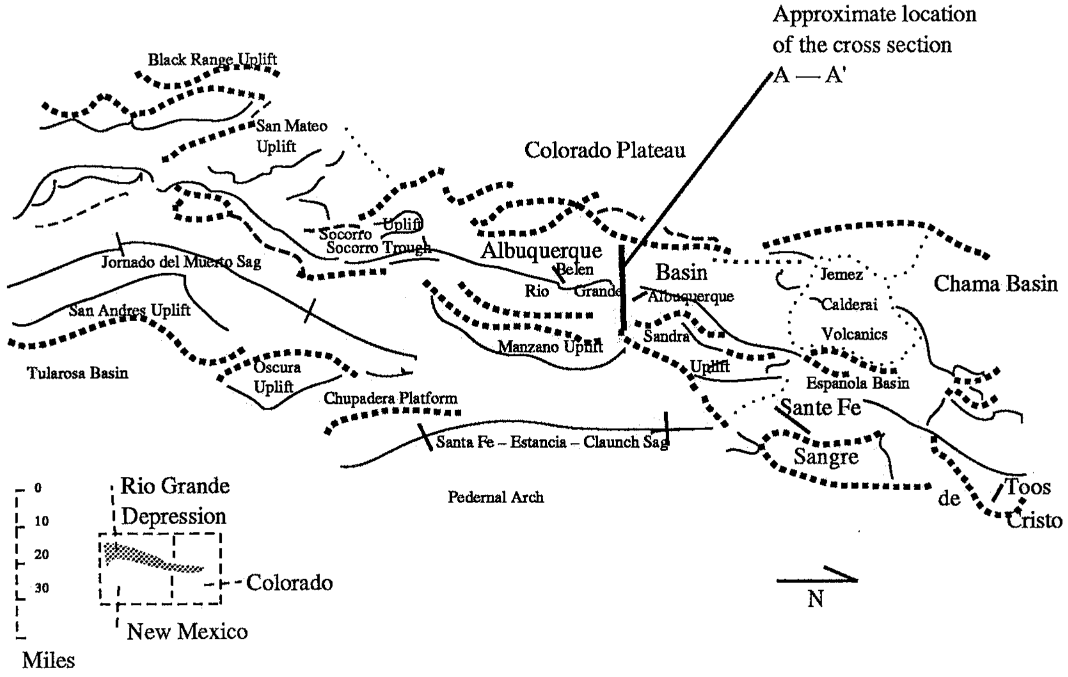
including the Rio Grande valley. The valley is a depressed linear feature extending in a north-south direction from Colorado through New Mexico (Fig. 4) and is comprised of a connected series of structural basins and grabens arranged en echelon. The Rio Puerco fault zone and the Rio Puerco highlands define the basin's western boundary, while a complex fault system and the Manzano-Sandia Mountains delineate the eastern border of the basin. Faulted blocks form the highlands and mountainous areas. The basin was filled by sediments accumulated on the graben floor. Sediment thickness varies from a few feet near the Sandias to 21,000 feet near the Rio Grande (IRP, PA for Kirtland AFB, Albuquerque, N.M., 1981). Figure 5 is a structural block diagram of the Albuquerque Area.

2.2 HYDROLOGY

The study area lies within the declared Rio Grande underground water basin (Fig. 6), as defined by the State of New Mexico. It is regulated as a sole source of potable water. The principal aquifer of the Rio Grande Basin consists of valley fill and is composed of unconsolidated and semi-consolidated sands, gravels, silts, and clays of the Pliocene Santa Fe Formation, alluvial fan deposits associated with upland area erosion, and valley alluvium associated with stream development. The valley fill has definite limits, bounded to the west and east by the upfaulted block mountains, and a distinct lower limit, formed by the consolidated rocks of the graben floor. The aquifer "ends" are considered open in the Albuquerque area because the valley fill contains groundwater along the entire extent of the Rio Grande.

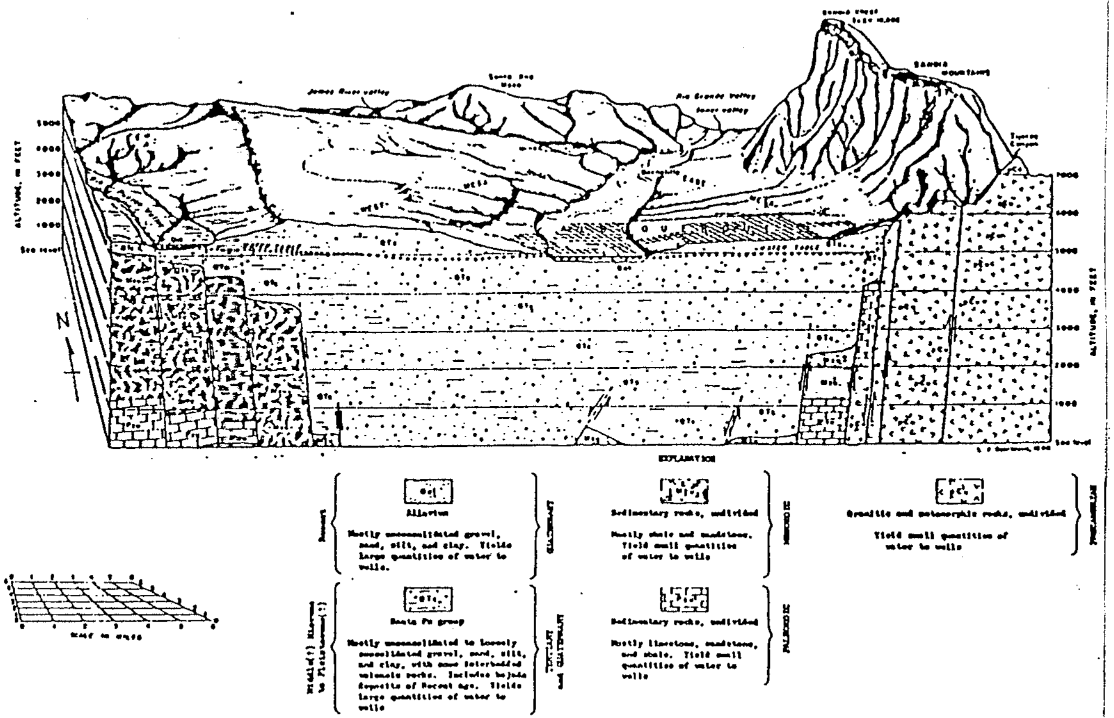
The water table is known to be an irregular, sloping surface, due to changes in local permeability, saturated soil thickness, and local additions or withdrawals of groundwater (Fig. 7). Groundwater use increased as Albuquerque grew, modifying the geometry of the water table surface. Wells over 200 feet in depth have removed water from storage, lowering the water table in and near the city. The direction of flow near the study area is almost due south.

Irrigation, topography, river stage, and groundwater withdrawals affect the depth to the water table both in space and time. Land to the



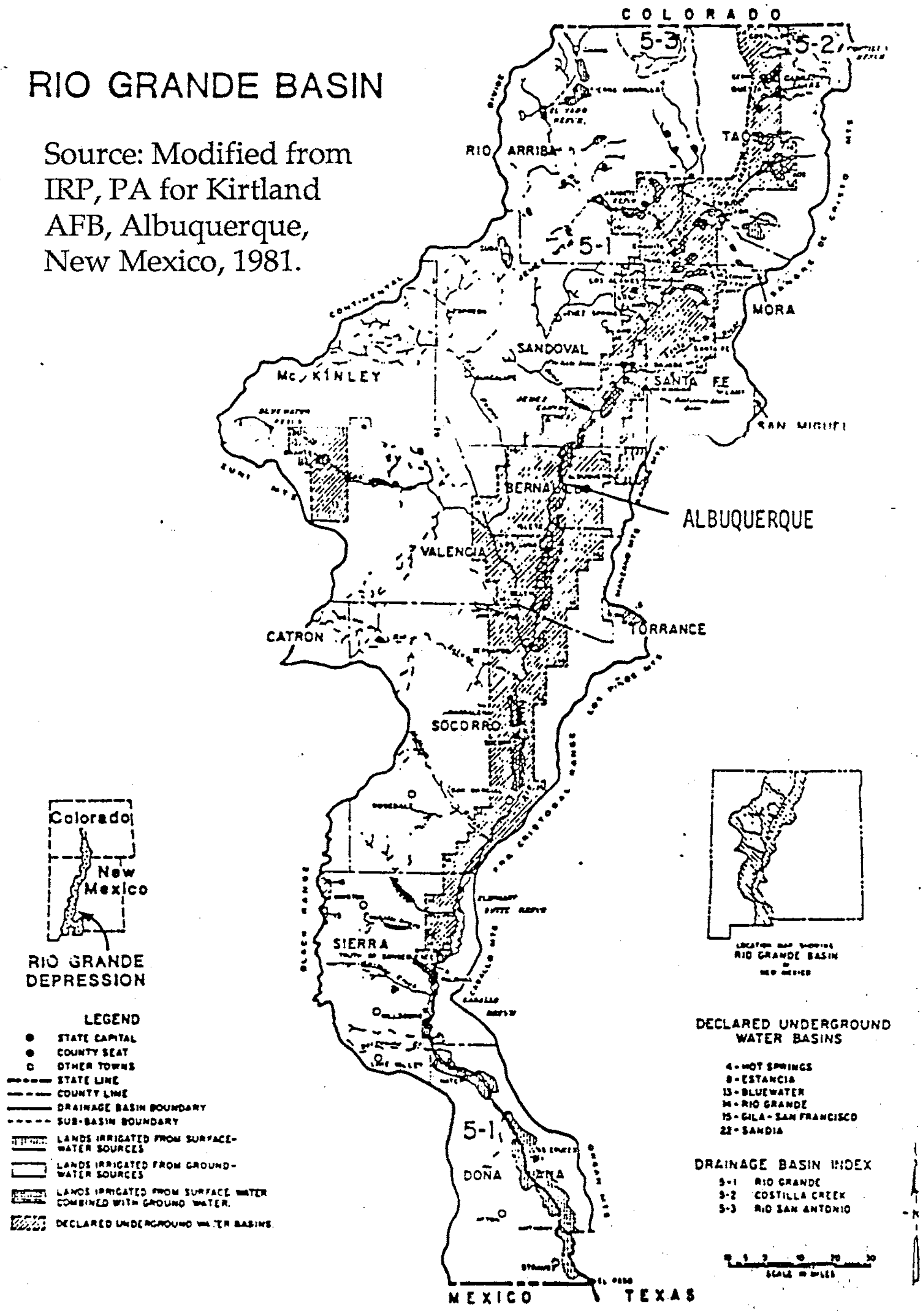
Source: Modified from IRP, PA for Kirtland AFB, Albuquerque, New Mexico, 1981.

Figure 4. Regional tectonic divisions and location of cross section A — A'.



Source: IRF, Preliminary Assessment for Kirtland Air Force Base, Albuquerque, New Mexico, 1981.

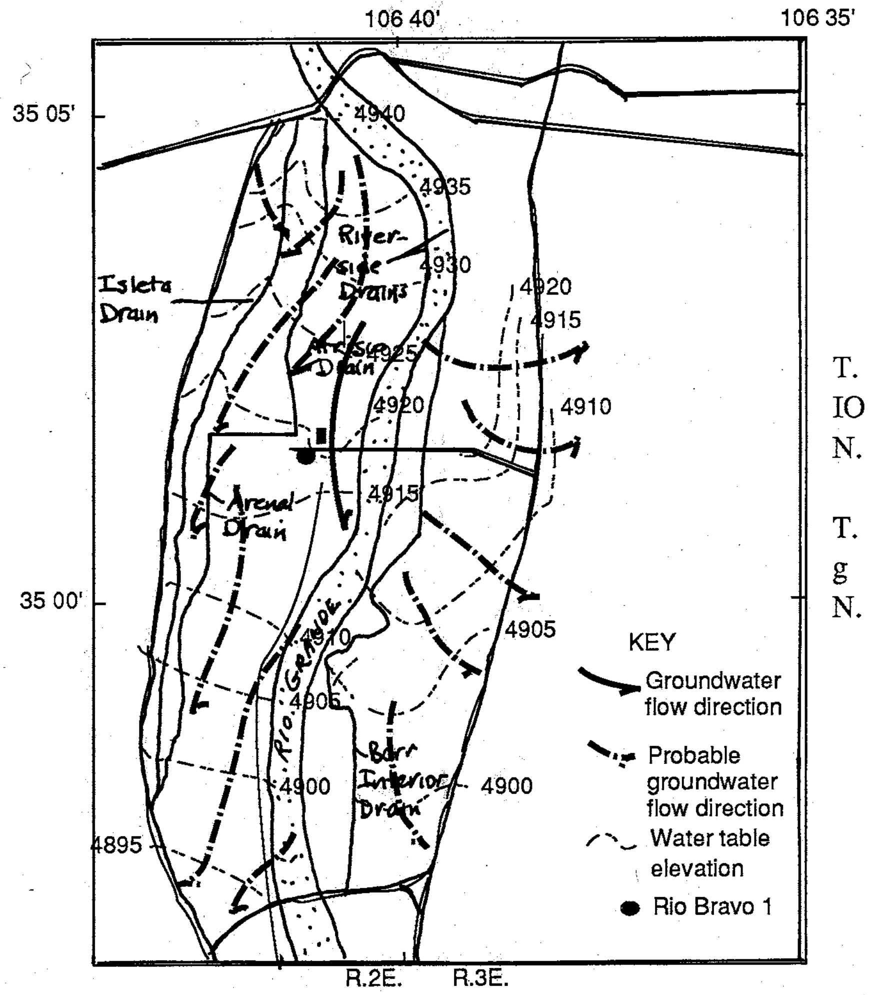
Figure 5. Structural block diagram of the Albuquerque Area.



RIO GRANDE BASIN

Source: Modified from IRP, PA for Kirtland AFB, Albuquerque, New Mexico, 1981.

Figure 6. Rio Grande Basin.



Source: Modified from Peter, 1987

Figure 7. Water table elevations, groundwater flow directions.

south of the study area is used primarily for agriculture. The water table generally rises in the summer, as the land is irrigated. October marks the end of the irrigation season, and the water table declines as the water added to the system finishes draining by late February. The water table is within 11 feet of the surface in most of the area around Rio Bravo Boulevard (see Table II). The groundwater system is recharged through precipitation, underflow of groundwater from nearby areas, and seepage from streams, canals, drains, surface reservoirs, and irrigation water (Peter, 1987).

Depth to the water table affects the occurrence and movement of groundwater contamination. Gasoline, for example, floats on the water table and moves horizontally as well as vertically as the water table level fluctuates. Upward vertical movement of the water table allows contaminants in the unsaturated zone to dissolve into the laterally moving groundwater, causing dispersion through the system.

2.2.1 Climate

Arid to semi-arid conditions exist in the Albuquerque area. The mean annual precipitation is 8.4 inches (represented by the area under the curve in Fig. 8), and the mean annual snowfall is 10 inches. Potential evapotranspiration (evaporation occurring when no soil-water deficits exist) is 30.9 inches (represented by the total area under the curve in Fig.8) for the Albuquerque area, but actual evapotranspiration has been determined to be about 95% of precipitation under arid to semi-arid conditions (Fig. 8). Runoff and recharge account for the remaining 5% of precipitation (IRP, PA for Kirtland AFB, Albuquerque, New Mexico, 1981).

2.2.2 Drainage

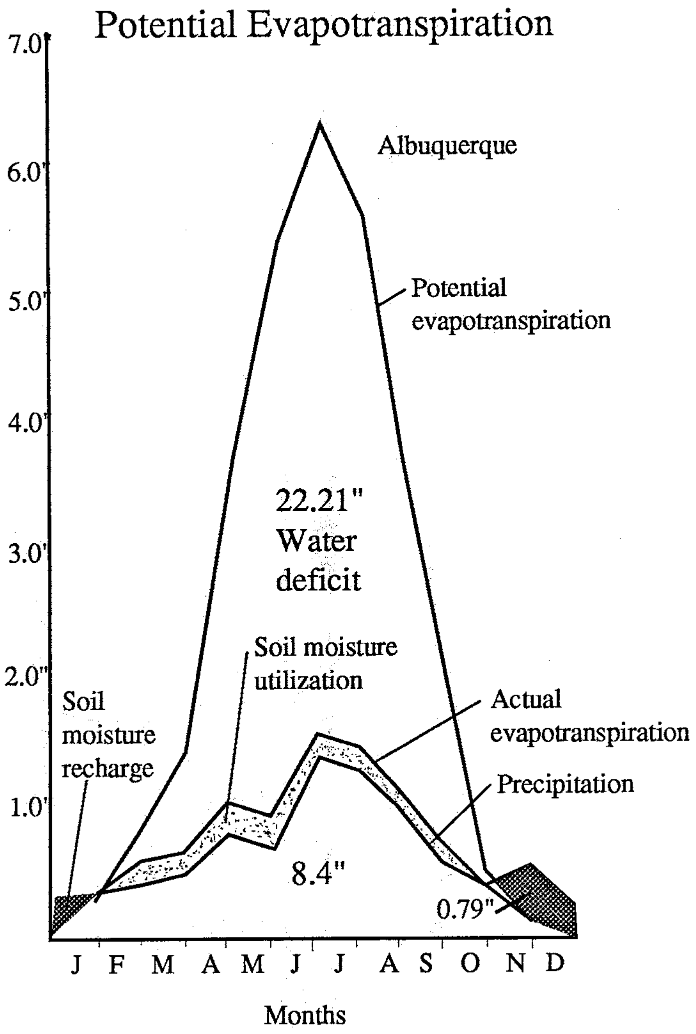
The study area is located in the Rio Grande valley, just west of the river channel. The inner valley is drained via overland flow to arroyos and then to canals and drains (installed in the early 1930s by the Middle Rio Grande Conservancy District and the U.S. Bureau of Reclamation), or to surface soils through infiltration. Once the water enters the canals or drains, it is redirected to the Rio Grande (see overlay on Fig. 7 for

Table II. Water-level measurements, February 28, 1986.

Piezometer Group	Well depth, in feet below measuring point*	Depth to water, in feet below measuring point*	Altitude of measuring point, in feet above NGVD**
Rio Bravo 1-04	13.50	11.26	4931.28
Rio Bravo 1-03	38.40	10.55	4930.58
Rio Bravo 1-02	103.80	10.99	4930.81
Rio Bravo 1-01	148.50	11.05	4930.88

Table adapted from Peter, 1987, p. 6.

Measuring point * = top of casing
NGVD ** = National Geodetic Vertical Datum of 1929



Source: Modified from IRP, PA for Kirtland AFB, Albuquerque, New Mexico, 1981.

Figure 8. Climatic data for Albuquerque, New Mexico.

drain locations).

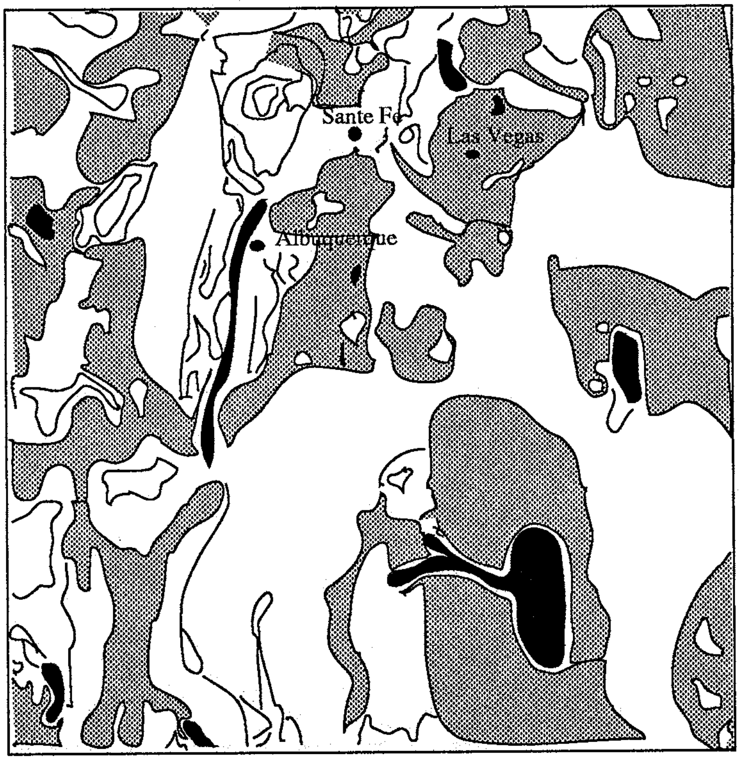
2.3 ENVIRONMENTALLY SENSITIVE CONDITIONS

Environmentally sensitive conditions are the key driving force behind the need for remediation. Environmentally sensitive conditions refer to potable public water supplies, humans, aquatic and terrestrial animals and plants, and their respective habitats that will be or are presently being adversely affected by contaminants at the site. When threatened or endangered species of plants and animals are present at a site, the field activities must be designed to have a minimum impact on them. If environmentally sensitive conditions are not considered, an endangered species could become extinct or a critical habitat could be destroyed. There are no threatened or endangered species nor wetland areas near the study site. However, the Albuquerque Basin is considered to be in an environmentally sensitive condition because the State has designated it a sole-source aquifer. Figure 9 shows a map of New Mexico's major aquifers relative to their potential vulnerability to contamination from surface sources. It indicates that the study area lies in a highly vulnerable zone because of very permeable valley fill overlying a shallow water table aquifer. The aquifer is "vulnerable" to destruction as a potable water source for the city of Albuquerque.

3. SITE INVESTIGATION

The primary objectives of the site investigation are to acquire the necessary data to either confirm or deny the existence of suspected environmental contamination and to assess the potential risks associated with confirmed contamination to human health, welfare, and the environment. Under the authority of the Water Quality Act, leaks or spills of any listed substance (referenced in the Water Quality Control Commission regulations 1-101.uu and 3-103, see Appendix A) are required to be addressed (Souder, 1988). For this site, this might include benzene, toluene, ethylbenzene, total xylenes, 1,2-dichloroethane (a leaded gasoline additive), and ethylene dibromide.

Results from this site investigation will serve as the basis for either making a recommendation to continue the work into the remedial



Key

■ Highly vulnerable (shallow water table)

▨ Moderately vulnerable (water table less than 200' below surface

☐ Less vulnerable (water table 200' – 500' below surface)

Source: Modified from IRP, PA for Kirtland AFB, Albuquerque, New Mexico, 1981

Figure 9. Relative vulnerability of aquifers to contamination from surface discharges.

investigation stage or to take no further action. If no further action is recommended, the recommendation should be supported by a risk assessment and a decision document.

3.1 SITE DESCRIPTION

The two properties under investigation are Company A and Company B. Company A (a carwash) is bounded by Isleta Boulevard to the east, a drainage ditch to the north, and a property line to the west and south (see Fig. 2). An old gas station, located to the east of Company A, was closed in 1974, and the storage tanks were removed. The tanks were reported by the owner to have been "in a pool of gas" at the time of their removal. Immediately to the south of Company A's property line is Company B (a drilling company). Company B is located on T9N, R2E, Section 1, Val Verde Tracts, Lot 8A. It is bounded to the north, south, and west by a property line and by Isleta Boulevard to the east. The elevation of the site is approximately 4920 feet above mean sea level (New Mexico Environmental Improvement Division (NMEID), 1988).

3.2 SITE HISTORY

In 1983, Company B reported that they had had an "odor" in their water supply for several years. The water comes from a 200-foot deep well screened over the 185 to 200 foot interval. Deep wells are common in the South Valley. Water quality near the water table is very poor because of contamination from local industry. Deep wells are drilled to reach water of better quality. Company B suspected their gasoline storage tank of being the source of the odor, had the tank removed, and replaced it with a new tank. The old tank was tested, and no leaks were found. Company B then suspected the source might be the abandoned underground storage tanks that had been removed in 1974 from Company A's property. Company B had water tested from the well that supplied the Company B office building and a private residence (the line to the house had been disconnected because of the odor). The water was analyzed for oil and grease and total organic carbons at Anacore Labs, Analytical and Environmental Services, 7300 Jefferson St., NE, Albuquerque, NM 87109 [Anacore is now known as ASSAIGAI

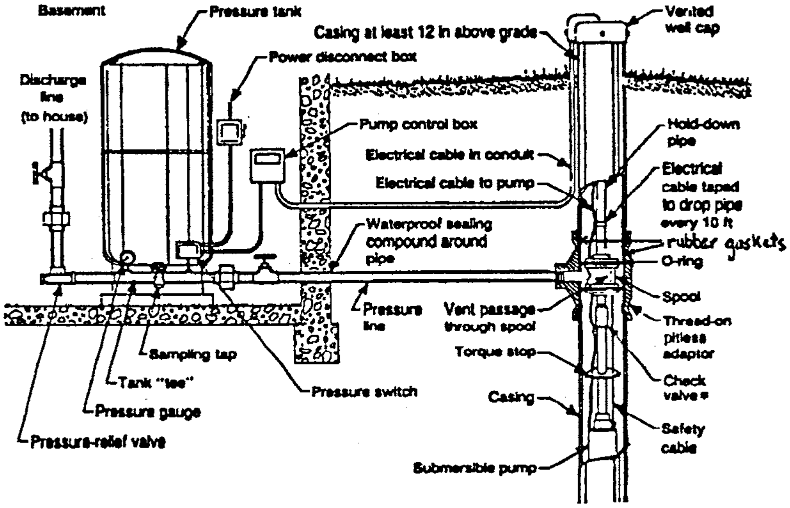
Analytical Laboratories]. The results showed well contamination. Further well testing revealed a faulty pitless adapter. A pitless adapter (see Fig. 10) is a device made of brass and a rubber gasket. It attaches directly to the well casing and extends the casing above the ground surface. The rubber gasket fits onto the outer well casing and has a brass outlet which can be threaded onto the water supply line to the house. The portion of the adapter inside the casing provides a watertight subsurface connection for attachment of the pump at the bottom of the well (Driscoll, 1986). It was then hypothesized that surface spillage of gasoline at the loading area may have contaminated the water supply well. The pitless adapter was replaced and a 10-foot concrete collar was placed around the well casing. The water supply well was purged with MUD-NOX (an oil emulsifier), and water samples from the well and Company B's office were tested. Lab results showed no gasoline in the well but that gasoline was present in the water reaching Company B's office. Gasoline in the water supply poses two immediate dangers to humans; one is the poisoning of the drinking water, the other is the potential for an explosion due to the accumulation of flammable gases in an enclosed space. To eliminate gasoline in the office water supply, the old water line was bypassed and the building connected to a different well (the York Well). Further investigation of the problem to determine the source of the contamination in the old water line is warranted.

3.3 SUSPECTED CONTAMINANTS

The study area is suspected of being contaminated with leaded and unleaded gasoline and diesel fuel. This suspicion is based on a report received by the New Mexico Environmental Improvement Division in 1983 from Company B complaining of an "odor" in their water supply. A site investigation needs to be conducted to confirm the presence or absence of these potential contaminants.

3.4 FIELD INVESTIGATION

Company B thought that the gasoline might be underground around the pipes leading from the water supply well to the office building. Gasoline could potentially migrate into the pipes during the lag time



Source: *Groundwater and Wells*, Driscoll, 1986.

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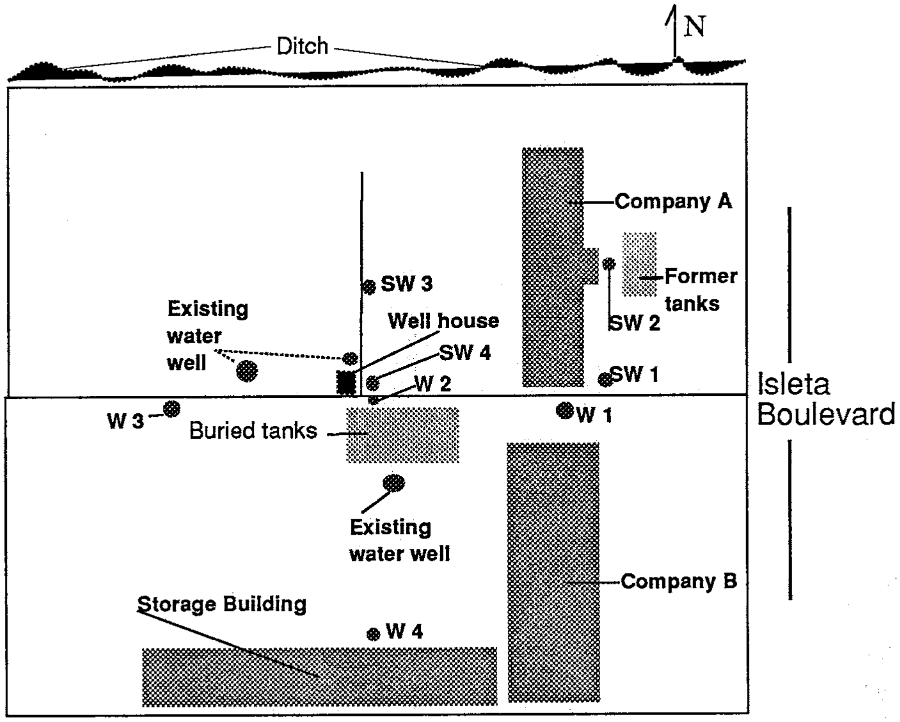
Figure 10. Pitless adapter and piping to the pressure tank in well equipped with a submersible pump.

between the relay switch turning the pump in the well on or off and the following change in pressure in the pipe. Gasoline could enter the pipe through poorly sealed joints, cracks, pinholes, or a poorly fitted pitless adapter. To ascertain if, and to what extent, gasoline might be present, Company B drilled four test holes (W-1 through W-4) on their property. NMEID convinced Company A to allow the installation of four temporary monitoring wells (SW-1 through SW-4) on their property to determine if the old gas station underground storage tanks might be the source of the contamination. Well locations are shown on Fig. 11. Well construction diagrams and well logs are given in Appendix B. Water samples were collected from all the wells on both properties, plus a water sample was taken from Company A's bathroom tap (because the water was not softened there). The samples were analyzed for purgeable halocarbons (EPA Method 601) and purgeable aromatics (EPA Method 602) at NMEID Scientific Laboratory Division, 700 Camino de Salud NE, Albuquerque, New Mexico 87106.

3.5 DISCUSSION OF RESULTS

Table III lists the results of the water quality sampling for all the wells located on Company A and Company B's properties (see Appendix C for water sample analyses and methods). It appears that at least two sources of contamination may be present: one associated with four underground storage tanks at Company B and one associated with two tanks formerly located near monitor well SW-2 on the Company A property. Wells SW-2, SW-3, SW-4, and W-4 had the highest contaminant concentrations. Well W-2 was not sampled because a relatively localized lens (approximately 4 inches) of gasoline was detected floating on top of the water table (see Fig. 12). Lower concentrations of benzene, toluene, ethylbenzene, and total xylenes were measured in wells W-1 and SW-1. Concentrations were below analytical detection limits in well W-3 and in the deeper supply wells on both properties (NMEID, 1988).

Poor records were kept on how the wells were developed and sampled. Most of the wells were sampled using a hand bailer, but NMEID apparently does not have a standardized procedure for sample collection and handling. Records in Appendix C show that some



Source: NMEID, 1988

• Not drawn to scale

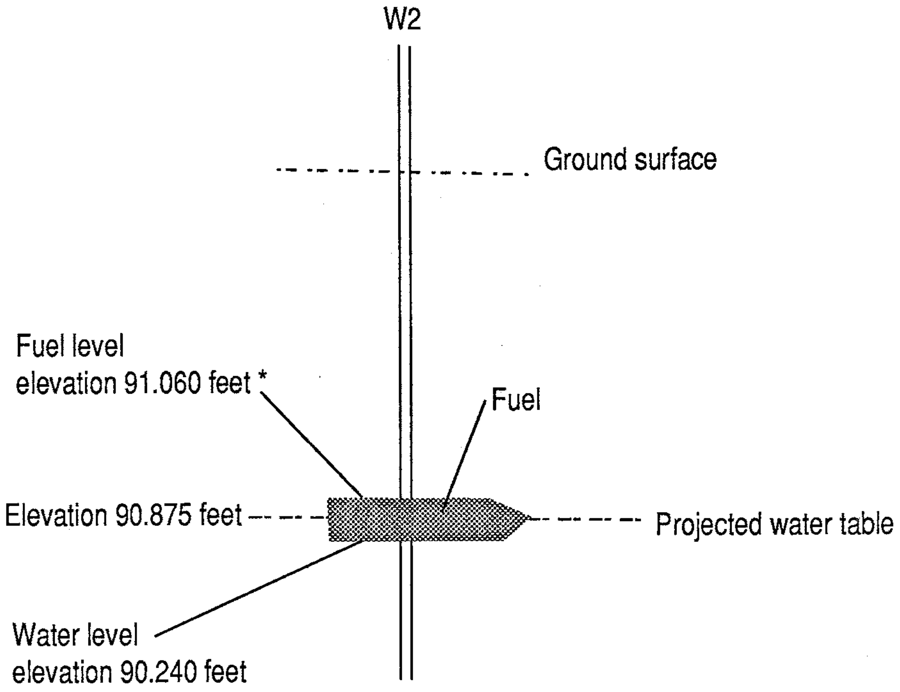
Figure 11. Monitoring Well Locations.

Table III. Water Quality Results From Samples Collected October 24–30, 1985 (in ppb).

Analyte	W-1	W-2†	W-3	W-4	SW-1	SW-2	SW-3	SW-4	Water well	Bath-room tap
Aromatic purgeable screen	—	—	ND*	—	—	—	—	—	ND	ND
Halogenated purgeable screen	ND	—	ND	—	ND	ND	ND	ND	ND	ND
Benzene	120	—	—	11,000	340	700	6,000	1,300	—	—
Toluene	10**	—	—	12,000	ND	4,200	39,000	4,800	—	—
Ethylbenzene	530	—	—	470	280	3,100	14,000	1,300	—	—
Total Xylenes	1110	—	—	4,820	140	11,200	74,000	7,200	—	—
1,2 Dichloroethane	—	—	—	200	—	—	—	—	—	—
Ethylene Dibromide	—	—	—	53	—	—	—	—	—	—
Detection Limit ***	25	—	2	25	3	100	200	15	1,3	2

† = well not sampled.
ND* = Nondetectable.
** = Number reported is suspect because it is below the detection limit.
*** = Detection limits vary because of the dilution factor of the sample.

Source: NMEID, 1988.



* Local datum

Source: NMEID, 1988.

Figure 12. Diagrammatic cross section.

samples were not preserved with $HgCl_2$ and were kept at room temperature, while other samples were preserved with $HgCl_2$ and were stored in an ice bath. NMEID needs a quality control/quality assurance procedure that includes a specific sampling and handling protocol. Samples containing <200-300 ppb aromatic hydrocarbons should be refrigerated or placed in an ice bath. If concentrations are >300 ppb, floating product is usually present and how the sample is stored does not make a big difference. However, when collecting samples in the field, the concentration levels are usually unknown, so all of the samples should be placed in an ice bath or otherwise preserved. There is no mention of trip blanks or decontamination procedures used to decontaminate the sampling equipment between samples. A trip blank is a 40-ml volatile organic analyte vial filled with organic-free water and carried through the sampling and handling protocol. It is used to verify that contamination of the samples has not occurred by diffusion of organic volatiles through the seal on the sample vial during shipment and storage.

Many of the lab analyses report five to six other compounds being detected by the purgeable aromatic screen (EPA method 602) but that they were not identified. These unknown compounds could have been identified if EPA method 624 had been used instead of EPA methods 601 and 602. Methods 601 and 602 use a gas chromatograph with two columns. In method 601, the gas chromatograph is temperature-programmed to separate the halocarbons, which are then detected with a halide-specific detector. The second column is used to confirm the measurements made with the primary column. Similarly, method 602 uses a two-column gas chromatograph which is temperature-programmed to separate the aromatics which are then detected with a photoionization detector.

EPA method 624 is a better choice when initially screening a site with unknown contaminants. This method can detect and tentatively identify compounds in a water sample to 10 ppb. Method 624 is a purge and trap gas-chromatographic/mass spectrometer (GC/MS) method. The gas chromatograph is temperature-programmed to separate the purgeables, which are then detected with a mass spectrometer.

3.6 CONCLUSIONS AND RECOMMENDATIONS

The maximum allowable concentration levels (MCL) for groundwater as regulated by the Water Quality Commission Regulation 3-103 for compounds detected in the water samples are as follows:

Compound	Maximum Concentration Level (in ppb)
Benzene	10
Toluene	750
Ethylbenzene	750
Total Xylenes	620
1,2-dichloroethane	10
Ethylene dibromide	0.1

As seen in Table III, these maximum concentration levels are exceeded in the water samples of wells W-l, W-4, and SW-l through SW-4. The water quality is therefore considered to be harmful to human health and must be improved. The water sample results indicate the presence of gasoline contamination of groundwater below both properties, but does not provide an accurate picture of the source or extent of the contamination. A more thorough remedial investigation of the site is recommended.

4. REMEDIAL INVESTIGATION/FEASIBILITY STUDY

The remedial investigation includes any further fieldwork necessary to characterize the site and fill in data gaps, analysis of new data, and evaluation of all existing data. Additionally, a general survey of underground storage tanks will be conducted on Company A and Company B's properties in compliance with CERCLA which requires that all underground storage tanks abandoned before January 1, 1984 be investigated as potential sites. The survey will include: number of tanks, size, age, construction type, protection, contents, date taken out of service (if abandoned), and a record of leaks.

The feasibility study will review all technologies relevant to remedying the site problems identified in the remedial investigation. These technologies will be screened on the basis of engineering feasibility, cost, environmental and public health impacts, and regulatory requirements.

4. 1 FIELDWORK

No attempt was made by NMEID, during the site investigation, to detect identifying signature compounds in the gasoline used at the old gas station (located on Company A's property) versus the gasoline used by Company B. Research should be done during the remedial investigation to see if the two companies did buy gasoline from different suppliers and whether or not each has its own identifying additive. If so, when the wells are resampled the sample analysis should include testing for these identifying compounds. This should aid in confirming the plume source(s).

All the monitoring wells should be resampled once, with special attention given to sampling technique and handling, to verify the contaminant concentrations obtained during the site investigation. The monitoring well data should also be used to determine groundwater flow direction and hydraulic gradient at the site. Additionally, wells north of Company A should be sampled to determine if contaminants are coming from a source off-site. The nearby York production well should be sampled to see if contaminants have migrated south of Company B. Slug and pump tests should be run to determine in situ hydraulic conductivity, transmissivity, and storativity in the aquifer.

A geophysical survey should be conducted using electromagnetics, a magnetometer, or a metal detector to locate the underground storage tanks and their associated piping. The survey will help determine depth to the tanks, their orientation and dimensions, and locate interconnecting tank piping and underground obstructions that could impact tank removal operations. Local utility companies should be consulted to locate utility lines.

A soil gas survey should be implemented to define the areal extent, composition, and magnitude of contamination, and source(s) of contamination. I recommend using Target Environmental Services, Inc., Oakland Center, 8940-A Route 108, Columbia, MD 21045 to perform the survey. Target uses a small-volume stainless steel probe to collect soil gas samples, which are then analyzed on a gas chromatograph equipped with detectors specific to the category of compounds sought. Target can collect 30 to 70 samples per day per team through the asphalt caps covering both properties with a minimum of disturbance to the site or subsurface. Only one day of sampling should be required to thoroughly cover the site, thus minimizing the effects of diurnal atmospheric changes. Target's lab is capable of detecting benzene, toluene, ethylbenzene, total xylenes, and other fuel compounds such as aromatics, alkanes, and gasoline additives. In-field analysis is available but not recommended by Target. Target feels that laboratory gas chromatographs are better at discriminating peaks of compounds and produce more refined signatures than portable field gas chromatographs. Their lab has 24 to 48 hour turnaround on sample analysis. Within one week of sampling Target will produce an interpretive report complete with isoconcentration maps for each contaminant detected. The report should, along with the data from other fieldwork, aid in developing an appropriate remediation plan.

4.2 SCREENING OF REMEDIAL ALTERNATIVES

Each remedial alternative will be evaluated based on advantages and disadvantages of the method, its effectiveness, and implementability. A brief discussion of how each technology works will precede the evaluation.

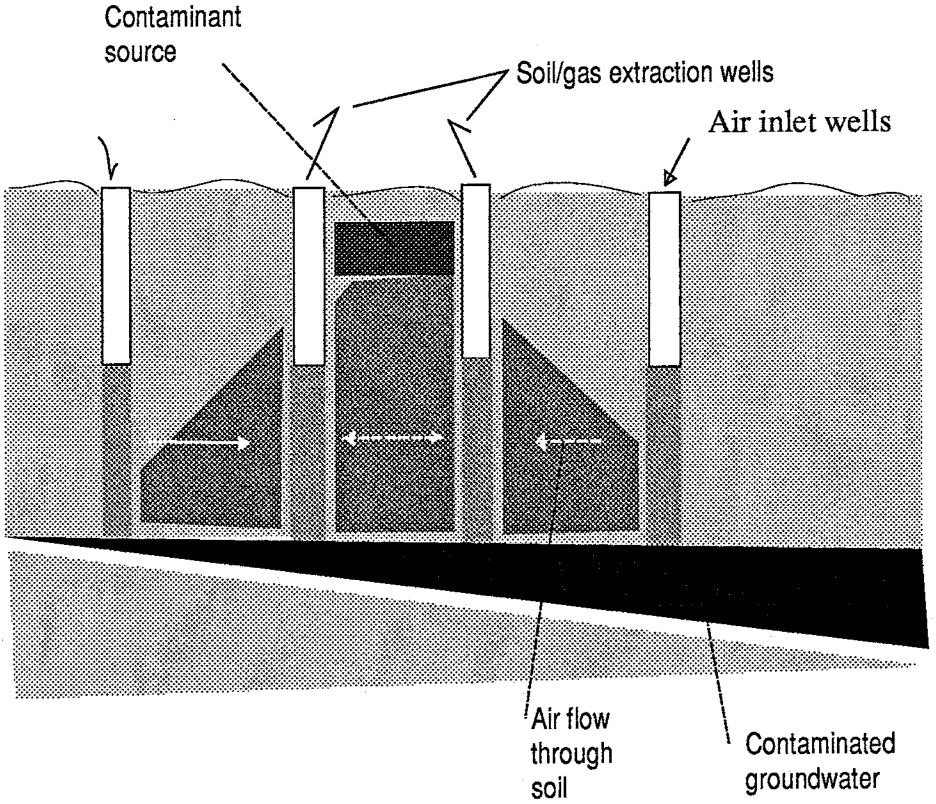
In situ soil venting and bioremediation are the two methods being considered for soil decontamination. Air stripping, double diffuser, and hydrogen peroxide-ultra violet light will be examined for the remediation of the groundwater.

4.2.1 SOIL DECONTAMINATION TECHNOLOGIES

To avoid further contamination of the groundwater residual hydrocarbons in the soil need to be eliminated. Rainwater percolating through the soil will dissolve residual hydrocarbons and contaminate the groundwater.

One method used for decontamination of the vadose zone is in situ soil venting (also known as in situ volatilization, in situ air stripping, or vapor extraction). The soil is decontaminated in place by passing air through the soil, removing the soil gas and disrupting the equilibrium existing between hydrocarbons that are sorbed onto the soil, existing as a free liquid, dissolved in pore space water, or in a vapor state. This causes volatilization of the contaminants and subsequent removal in the air stream. A vacuum pump is used to extract air (in hundreds of cubic feet per minute) through vents in the soil. The vents are constructed of a perforated pipe placed in a borehole to a depth above the water table. The air stream may be discharged directly to the atmosphere or sent to an air emissions control device depending on flow rate, contaminant type and concentration, and local environmental regulations (see Figure 13).

In situ soil venting is generally applicable to spills of volatile organic compounds in permeable soils (e.g., greater than 10^{-8} cm/s), and is effective for removing contaminants with a vapor pressure of greater than 1.0 mm Hg at 20 degrees C, or a Henry's Law constant greater than 0.01. In situ soil venting is a cost effective remediation technology with estimates of less than $20/yd3 of soil treated. The major cost associated with operating the system is for sampling and analysis of the extracted soil gas to determine the effectiveness of the method. The analysis can usually be accomplished with a gas chromatograph. Other costs include drilling permits, well drilling and casing, and treatment of air emissions. Field implementations have demonstrated removal of gasoline and other solvents from spill sites with minimal disruption of normal site activities (Singh et al., 1987, Hazardous Waste Consultant, Sept./Oct., 1987). Further specifications on in situ soil venting can be obtained by contacting: Magnus B. Bennedsen, Woodward-Clyde Consultants, 100 Pringle Ave., Suite 300, Walnut Creek, California,



Source: Modified from M.B. Bennedsen

Figure 13. Schematic of upper extraction system.

94596-3564.

In situ biodegradation may be able to affect contaminants sorbed to or occluded in the soil. The process involves enhancing the subsurface environment by adding oxygen and nutrients to encourage the biological growth of hydrocarbon-degrading bacteria. The advantages of biodegradation are that required surface facilities are minimal and there are no air emissions. The major problem with this technology is transferring the method from the laboratory to the field. Difficulties arise in determining the conditions needed to enhance biodegradation and in engineering a system for delivery of the oxygen source and nutrients to the subsurface. Delivery of the oxygen source and nutrients requires a well designed hydraulic system and chemical solutions that will cause minimum adverse reactions in the vadose zone.

The most commonly applied soil remediation process is soil excavation. The excavated soil is either treated and returned to the excavation area, or disposed of off-site in a hazardous waste management facility. Off-site disposal is costly. This method was not considered because of businesses operating on the spill site. Excavation would disrupt business and would involve destruction of and rebuilding of structures if contamination extends beneath buildings or if the spill proves to be extensive. In both cases, excavation costs would become prohibitive.

4.2.2 GROUNDWATER REMEDIATION TECHNOLOGIES

Natural degradation of dissolved hydrocarbons in groundwater is very slow so an artificial means of removal must be applied to prevent further deterioration of the environment.

Air stripping is a commonly used method for groundwater remediation. Contaminated water may be purified by transferring the contaminant from the water to the air. The most effective processes involve a specially designed gas-liquid contactor such as a packed column. In a packed column, water moves as a thin film over the packing material, then breaks and reforms. Polypropylene, available in varying sizes and shapes, is the most commonly used packing material.

The water flows through the column by gravity and air is supplied by a blower at the base of the column. Because the quantity of air used in air stripping is large, the concentration of the volatile organic compounds in the air emissions is usually low. Because air emissions are regulated an emission control device for the air stream will be necessary. Common emission control devices include: adsorption onto activated carbon, catalytic destruction, and thermal incineration. Air stripping is effective at all concentrations, mechanically simple, and relatively inexpensive. The addition of an air emissions control device increases the cost substantially. To reduce the cost, a lower gas-to-liquid ratio should be used (Singh et al ., 1987). Hydro Group, Inc., Environmental Products Division, 97 Chimney Rock Road, Bridgewater, New Jersey, 08807 manufactures packed column air strippers and can provide detailed information on air stripper applications and costs.

The double diffuser is a modification of air stripper technology manufactured by Carbtrol Corporation. Carbtrol Corporation is located at 39 Riverside Avenue, Westport, Connecticut 06880 . In diffused air systems, compressed air is bubbled through the holding tank. The double diffuser is a more compact unit than an air stripper with a packed column.

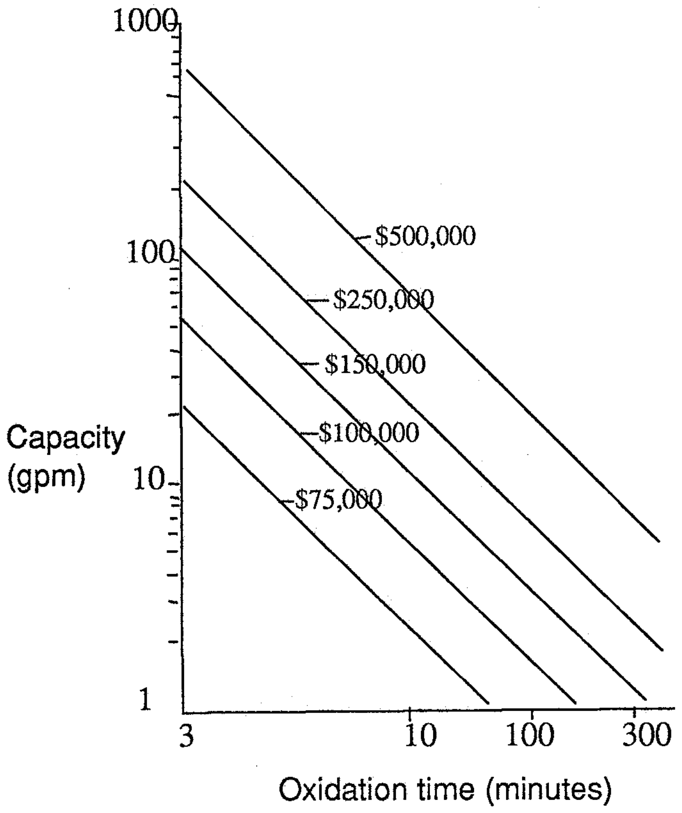
Hydrogen peroxide-ultra violet light, a relatively new technology offered by Perox-Pure of Tucson, Arizona, involves the destruction of dissolved organic contaminants in water by oxidizing them using ultra violet light and hydrogen peroxide. High intensity ultra violet light is used to rapidly convert hydrogen peroxide to hydroxyl radicals, which are powerful oxidizers. Meanwhile, organic molecules absorb energy from the ultra violet light making them more receptive to the hydroxyl radicals. The combination of the high intensity ultra violet light and the concentrated hydroxyl radicals promotes rapid breakdown of organic molecules. When the reaction goes to completion hydrocarbons are converted to carbon dioxide and water. Any halogens present in the organic molecule are converted to halides. There are no air emissions and no waste by-products generated by this process. It works effectively at all contaminant concentration levels. The disadvantages of the process are the high cost of hydrogen peroxide and its toxicity to microbes at levels above 50 to 100 mg/l, and high power consumption associated with the high-intensity ultra violet light required for the reaction. Field problems often occur when phosphates used to stabilize the peroxide react with calcium in the subsurface and form a precipitate that eventually clogs the injection wells. Figure 14 shows typical costs for operating an ultra violet/hydrogen peroxide system. Costs are waste specific and depend on the degree of clean up desired (i.e., 95% reduction in contaminants versus 99.98% contaminant reduction). Further information on the ultra violet/hydrogen peroxide technology can be obtained by contacting: Donald G. Hager, Peroxidation Systems, Inc., 4400 Broadway, Suite 602, Tucson, Arizona 87511-3558.

4.3 TANK REMOVAL

Four remaining underground storage tanks and the majority of the associated underground galvanized steel piping and suction dispensing pumps were removed from Company B's property in May 1988 in accordance with a proposed EPA rule on underground storage tanks. This rule was issued on April 17, 1987 and states that existing underground storage tanks that do not already have secondary containment systems must undergo an initial integrity check and then be tested annually for leaks. The integrity assessment includes leak testing, internal inspection, visual inspection, and/or tank system tightness testing. Any tank found to be leaking or otherwise unfit for service must be immediately removed and equipped with secondary containment before being returned to service. When the tank reaches 15 years of age, it must be replaced or retrofitted with secondary containment regardless of whether or not it passes the integrity and leak tests (Hazardous Waste Consultant, Nov./Dec. 1987).

4.3.1 A BRIEF TANK HISTORY

In 1971, two underground storage tanks (one 1000 gallon tank containing unleaded gasoline , and one 2,000 gallon tank containing leaded gasoline) were installed by the Conoco Station that was previously located at the site now occupied by Company A. Company A sold gasoline for a few years in addition to operating the carwash. Gasoline sales were discontinued in 1974 and the tanks were removed from a pool of gas.



Source: The Hazardous Waste Consultant, September/October 1987, p. 4–7.

Figure 14. Estimated capital cost for typical ultraviolet/hydrogen peroxide treatment systems

Seven different underground storage tanks containing leaded gasoline, unleaded gasoline, and diesel fuel were used at Company B's site from 1966 to 1988. An eighth tank contained water. A history of each tank, its contents, size, volume, construction material, installation date, and removal date are given in Appendix D. Six of the seven fuel tanks are still owned by Company B, the seventh was sold in August 1977. Company B plans to reinstall the tanks for future fuel storage use in an above-ground installation (Metric, 1988).

4.3.2 PROCEDURE FOR TANK REMOVAL

The procedure for removing an underground storage tank involves knowledge of the size, dimensions, orientation, and depth to the tank to be removed, as well as the type and volume of the stored material. Additionally, all underground utilities in the excavation area should be located and marked by utility companies (see Plate 1 in the pocket and Appendix D for all this information).

Next, the tank system should be uncovered and the liquid should be drained and cleaned form the tank and associated lines. The tank is usually drained by a vacuum truck capable of removing the last few inches of material and sludge. The services of a professional tank cleaning firm should be engaged to drain and clean the tank because of potentially explosive or toxic materials and fumes (Company B hired D & R Tank Company, 1210 Prosperity SE, Albuquerque, New Mexico 87105). Cleaning the tank without entry is achieved using steam or chemical cleaning solutions. Wash water generated during the cleaning process should be disposed of or recycled in accordance with applicable regulations, and its disposition should be documented. All the connecting lines should be capped and removed.

Purging the tank of volatile vapors should be done after excavation but prior to moving the tank. One of the simpler processes displaces the vapors using carbon dioxide in the form of dry ice. About 1.5 pounds of evenly distributed, crushed dry ice is required per 100 gallons of tank capacity. Tanks can also be ventilated with air using an air driver operated by a compressor. This method requires two tank openings preferably at opposite ends of the tank. The best approach is to determine the molecular weight of the residual volatile vapors and select a heavier purging gas, which will force the lighter vapors to be displaced.

In-place purging does not always last. Occasionally, material that has leaked into the surrounding soil may seep back into the tank. For this reason, an explosimeter should be used to check the tank immediately before removal operations begin to ensure that vapors have remained at nonexplosive levels. The tank can now be removed and prepared for recycling- steamed, blasted, primed, painted, and tested for tightness.

Prior to backfilling the excavation hole, soil samples should be taken from the soils directly underlying the tank bottom to a depth of two to three feet and analyzed for the contaminants of concern. Occupational Safety and Health Administration regulations prohibit personnel from entering the excavation area so a backhoe must be used to collect representative composite samples. If contamination is detected, remedial action will be required. If the soil is found to be clean, the excavation hole can be backfilled with sand or some other noncompactible material (Hazardous Waste Consultant, Nov./Dec. 1987) .

4.4 DISCUSSION OF RESULTS

NMEID did resample some of the monitoring wells in January and June of 1988, this time paying careful attention to sampling and handling procedures. The results of the analysis can be seen in Table IV along with the results from analyzing those same wells in October of 1985. I do not know why NMEID did not resample all the wells. The new results confirm that there is a definite contamination problem and that the problem is more severe than originally thought.

Table IV. Water Quality Analyses (in ppb).

Well	Date	Benzene	Toluene	Xylenes
W-1	10-85	120	10	1110
W-2	10-85	Not sampled because of lens of floating product.		
W-3	10-85	nd	nd	nd
W-4	10-85	11,000	12,000	4820
W-1	1-88	297	—	—
W-2	1-88	12,100	—	—
W-3	1-88	nd	—	—
W-4	1-88	15,500	—	—
W-2	6-88	12,500	27,000	14,100
W-4	6-88	21 ,600	26,400	13,000

nd=nondetectable

Data taken from Metric, 1988.

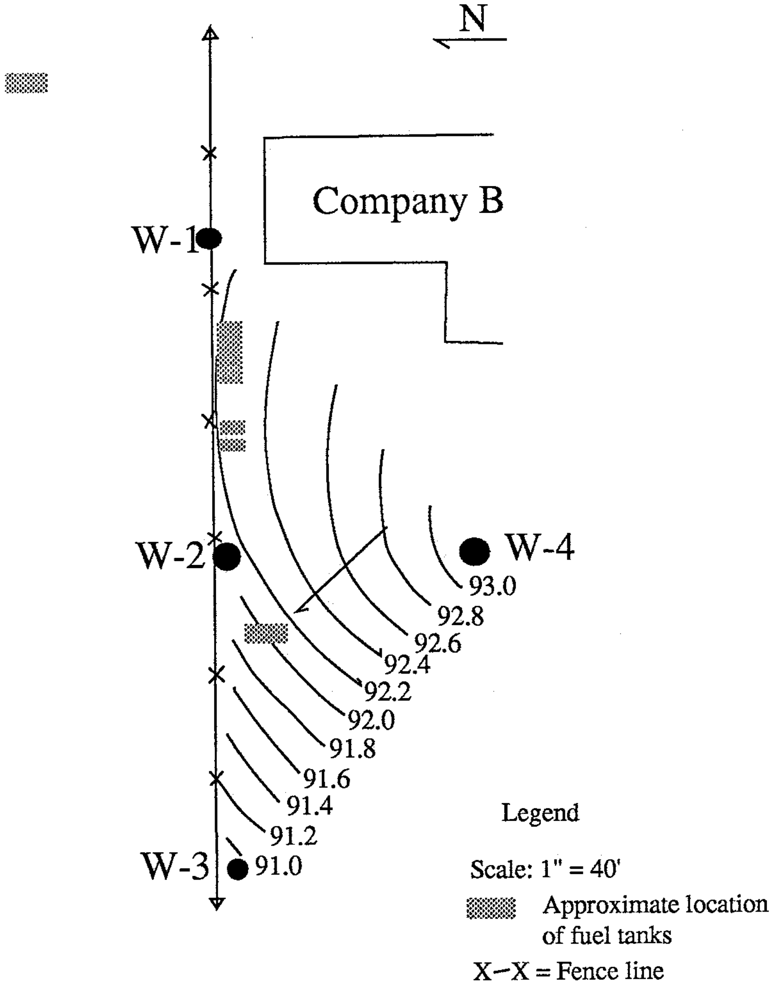
Water table measurements were made in the monitoring wells at Company B's site on five separate occasions from July 7,1985, to July 25,1988 (see Table V). Based on this data the groundwater flow direction is generally from north to south which agrees with the groundwater flow direction indicated by Peter (1987). However, the data in table V fluctuate quite a bit and should be viewed with suspicion . Heavy groundwater pumpage in the area may cause variations in the groundwater flow direction. For example, an anomalous groundwater flow direction to the northwest can be seen in the measurements recorded on July 25,1988 (Fig. 15). A possible explanation for this change in flow direction could be the heavy pumping of Company A's well (carwash) during the preceding weekend resulting in a groundwater flow direction towards the Company A supply well. It should be noted on Plate 1 (in pocket) that a drainage divide exists on Company B's property near W-1. The area to the east of the divide drains onto Isleta Boulevard, while the area to the west drains to a graveled area used for equipment storage by Company B (Metric,1988).

NMEID conducted a soil gas survey using an HNU System (brand name) portable photoionization detector. The results of the survey were inconclusive. NMEID says that interpretation of the survey results were hampered by the possible interference of vapors from the asphalt covering and the geology of the sites. I think it was due to the sampling technique used and the equipment chosen for the job. I feel Target, a company specializing in soil gas surveys (see p.29), could have done a satisfactory job and produced results which would have aided in pinpointing the source of the contaminants and the extent of the contamination.

NMEID was not notified by Company B when they had their underground storage tanks removed. Consequently, no soil samples were collected from the excavation hole before it was backfilled. Valuable information was lost. It will never be known whether or not the soil beneath the tanks was contaminated. If contaminated, a soil analysis may have detected a signature compound or gasoline additive that may have identified the source(s) of the contaminants.

Table V. Water Table Elevations (modified from Metric, 1988).

Well	Depth to Water (ft.)	Water Table Elevation (ft.)
7/07/85		
W-1	9.02	90.99
W-2	8.68	90.99
W-3	7.68	91.35
W-4	9.37	90.92
7/26/85		
W-1	11.905	90.917
W-2	12.25	90.24
W-3	9.85	90.84
W-4	11.75	90.83
12/29/87		
W-1	10.93	91.90
W-2	10.60	91.91
W-3	8.68	91.91
W-4	10.69	91.86
7/20/88		
W-1	7.05	92.23
W-2	5.54	93.42
W-3	5.88	92.20
W-4	6.94	92.19
7/25/88		
W-1	7.15	92.13
W-2	6.84	92.12
W-3	7.15	90.93
W-4	5.97	93.16



Source: Modified from Metric, 1988

Figure 15. Water table contour map for 07/25/'88

Company B has tightness-tested six of their seven underground fuel storage tanks over the years (see Appendix D). The tank tightness tests were conducted by several different companies: Kachina Petroleum Equipment Company, P. C. I., Claude L. Lyons, D & R Tank Company, and Company B itself. Two different methods were employed, the standpipe test and the pressure test.

The standpipe test is the simplest and most economical of the liquid level monitoring methods. A 4 inch diameter standpipe is attached to a tank opening, and the tank is filled until the product level has risen into the standpipe. Temperature sensors should be placed in the tank to account for thermal effects. The product level in the standpipe can be measured with a dipstick from the top of the standpipe or with a pressure sensor from a fixed point below the product level in the standpipe.

To pressure-test a tank system, the portion of the system to be tested must be completely sealed. The sealed portion is pressurized by adding a gas (i.e., helium) or liquid. The pressure is monitored for a period of one hour to one day. Any changes in pressure not explained by temperature fluctuations, vapor pockets, etc. are attributed to a potential leak. The advantage of pressure testing over standpipe testing is that both the tank and its piping can be checked for leaks and the location of the leak narrowed down to the tank or a portion of the piping. The disadvantage of this method is the possibility of damaging the tank or increasing the size of the leak.

None of Company B's tanks were found to be leaky.

4.5 CONCLUSIONS AND RECOMMENDATIONS

It is obvious from the data collected in the field that both sites must be remediated. Unfortunately, the source(s) of the contamination and whether or not the source(s) are located on either of these sites is not known. The regulations governing tank removal procedures need to be more strictly enforced. NMEID should have been notified and should have been present at the site when Company B had its remaining underground storage tanks removed, thus ensuring soil sampling in the excavation hole before backfilling was allowed.

I recommend using the double diffuser to decontaminate the sites because it requires less space, costs about the same or a little less than an air stripping operation would and can be set up in a corner where it will not hinder ongoing site activities. In situ soil vapor extraction should be used to remediate the soil because it will not disrupt normal site activities. Unfortunately, the available literature pertaining to the various technologies evaluated in Section 4.2 is incomplete. Articles reviewed typically discussed site geology and contaminants, but not plume size, contaminant concentration levels, or remediation costs. Other articles discussed the estimated costs but failed to mention the hydrogeology of the study site. This practice makes it difficult to find comparable case studies.The details of the remediation scheme will be discussed further in the next chapter.

Had one of the sites been found to be free of contamination a decision document, such as the one in Appendix E, would have been written to justify the decision of no further action on that site.

5. REMEDIAL DESIGN

The remedial design should include at least engineering drawings and technical specifications, a detailed construction cost estimate, health and safety plan requirements, field and analytical quality assurance/quality control requirements, identification of all required permits for completing the work, and a schedule of implementation.

Due to insufficient information (i.e., no soil gas survey results defining the lateral and vertical extent of the plume(s), no geophysical survey, no soil samples underneath the underground tanks, and an incomplete resampling of the monitoring wells as recommended and discussed in Sections 4.1 and 4.4) only a preliminary remedial design can be proposed. When more is known about the extent of the contamination, the preliminary design should be evaluated and refined to meet remediation criteria or rejected if the design is inadequate. Once this adjustment of the remedial design is made, then appropriate health and safety plans, a sampling plan, and field and analytical quality assurance/quality control requirements can be specified.

5.1 DESIGN AND CONSTRUCTION

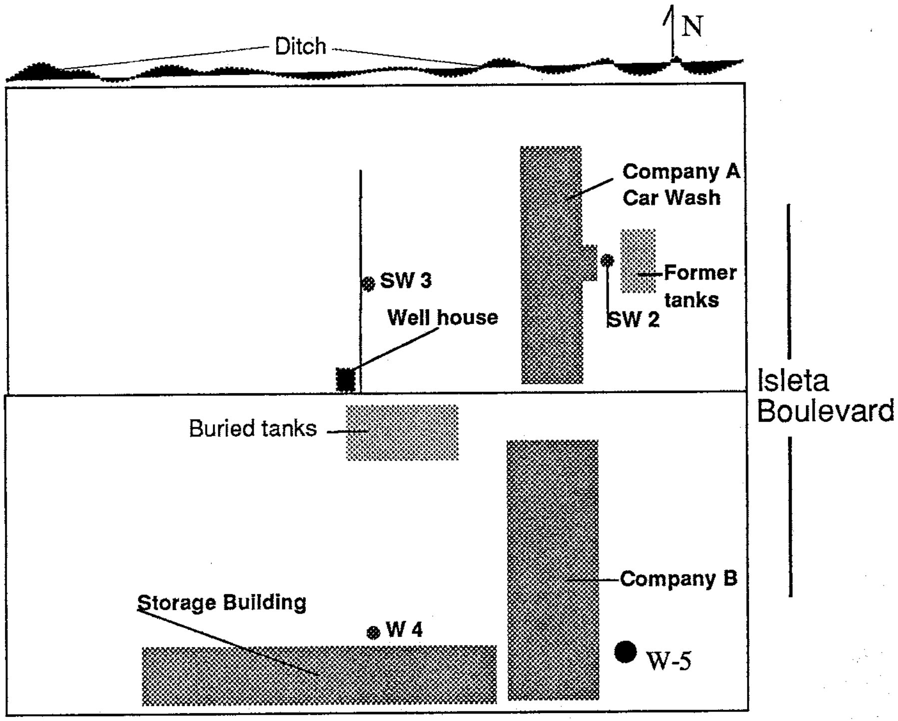
The proposed recovery equipment for the sites is designed to remove dissolved hydrocarbons from the vadose zone and from the groundwater. The recovery system design is based on the concept that "simpler is better". That is, the equipment should contain a minimum of moving and/or electronic parts that might fail during the course of the remediation. The groundwater system will consist of four "total fluids ejector pumps" (which allow pumping of both product and groundwater together without a lot of mixing action) to remove contaminated groundwater, a 55-gallon oil/water separator, two air diffusers with blowers in series, and an activated carbon canister for removing any remaining organic contaminants from the air emissions. The total fluids ejector pumps, manufactured by Ejector Systems, Inc., located at 910 National Avenue, Addison, Illinois 60101,will be installed in three existing monitoring wells (SW-2, SW-3, and W-4) and a proposed recovery well W-5. See Figure 16 for recovery well locations.

These pumps remove water by utilizing a small amount of air pressure. This design prevents mixing of immiscible fluids and allows rapid phase separation at the surface. These pumps are capable of pumping at a constant rate of 10 gallons per minute (gpm).

The pumping rate will be based on the results of the pump test, completed during the fieldwork phase of the remedial investigation, to induce an approximate 2-3 foot drawdown in the recovery wells and thereby facilitate groundwater flow towards the recovery wells.

The groundwater will be treated with equipment manufactured by Carbtrol Corporation, 39 Riverside Avenue, Westport, Connecticut 06880, and will consist of: 1) a small 55-gallon oil/water separator which separates product from water on the basis of their density differences, and 2) two small air diffusers with blowers in series, incorporating diffused aeration for removal of volatile organics.

A shut-off control will be installed in the 55-gallon oil/water



Source: Modified from NMEID, 1986.

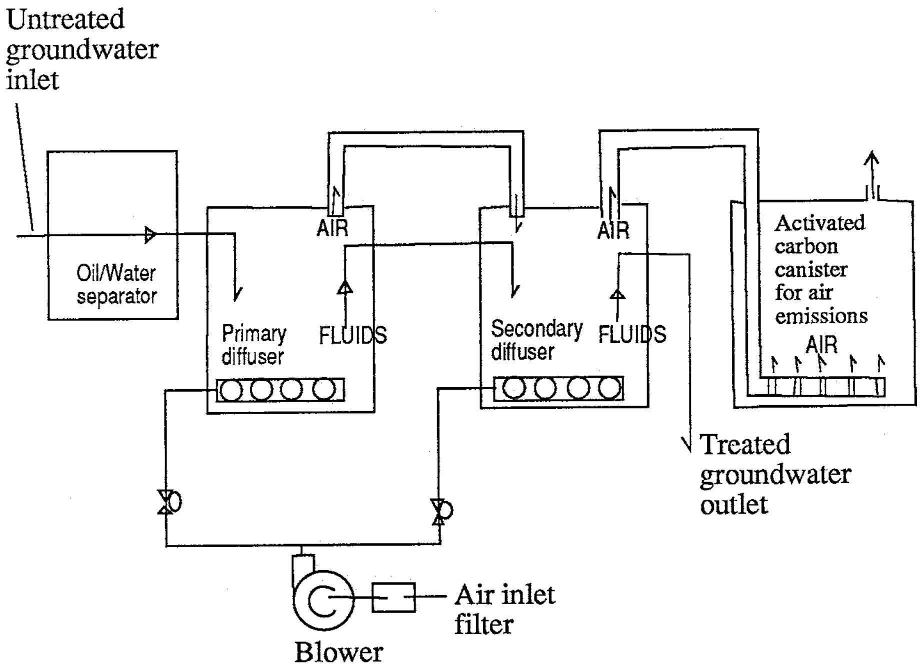
- Not drawn to scale

Figure 16. Location of proposed recovery wells (SW-2, SW-3, W-4, W-5).

separator drum to minimize the possibility of overfilling the drum or of pumping pure gasoline (product) through the diffusers. If this electronic device senses free product, the pumps in the four recovery wells will immediately shut down. This should prevent the spread of free product through the system. In the event that free product accumulates in the oil/water separator tank, it will be removed and disposed of properly by a licensed waste-oil hauler.

It is proposed that the cleaned groundwater be disposed of either into the Albuquerque sanitary sewer system (which Company B connected to in 1979 when the service became available in their area) or recirculated back into the ground via an infiltration gallery located upgradient of wells containing contaminated groundwater. Figure 17 is a schematic which illustrates the proposed groundwater recovery system. (Ejector Systems, Inc. has a brand new design called a Cascade Low Profile Air Stripper but no performance data are available at this time. It should be considered as an alternative to the proposed double diffuser.) The Air Quality Department for Bernalillo County should be contacted about required permits for operating the double diffuser system and NMEID, Groundwater Division, should be contacted for groundwater discharge permits if an infiltration gallery is used.

A soil vapor-extraction system will be used to remove hydrocarbon vapors from the soils. The design of the extraction system begins with placing all the contamination data on scale drawings. Flow nets should be constructed on the drawings to determine the expected movement of air through the soil when a vacuum is applied through vapor extraction wells. This process will aid in determining the best locations for the air inlet and air extraction wells. Based on the results of the flow nets, system components and vacuum equipment will be specified. A small-scale field study should be conducted to provide information on the appropriate spacing of wells, the volatile organic compound extraction rate, and the need for emission controls. The results of the field study would then be used to design the full scale vapor-extraction system (Bennedsen et al,1987).



Source: Modified from Ejector Systems, Inc. drawing P-12, 1987.

Figure 17. Schematic flow diagram of proposed groundwater recovery system.

5.2 SYSTEMS OPERATIONS

During the first month of operation, weekly inspections of the equipment should be scheduled to check for any malfunctions, to check the oil/water separator for accumulation of free product, and to effect any needed repairs. All inspection activities and any repairs made should be recorded in an onsite log book. Follow-up inspections should be scheduled on an as-needed basis. Other tasks that will ocassionally need to be scheduled (according to a sampling plan) include: measuring water levels in the monitoring and recovery wells, collecting water samples for analyses to monitor the effectiveness of the groundwater remediation, and collecting samples of the extracted gas from the soil vapor-extraction system to monitor the concentration of volatile organics present and to determine the effectiveness of the soil decontamination equipment. Generally, a gas chromatograph with an appropriate detector for the contaminant compounds will provide the necessary data.

6. CONCLUSIONS

The stepwise approach used to solve the problem presented to the contractor in this paper appears to be an effective method for evaluating and designing an appropriate remediation plan for a contaminanted site. Using this approach, the presence of contamination was verified and the type and concentration of the contaminants was determined. Methods were recommended for defining where the contamination was most likely to be located and to determine the lateral and vertical extent of the contamination.

It was suggested that slug and pump tests be run to determine local aquifer parameters. Pump test results would be used to determine the pumping rate needed to induce groundwater flow towards the recovery wells for groundwater remediation. Additionally, the aquifer parameters derived from the slug and pump tests are needed for construction of a mathematical model of the groundwater system. Peters (1987) offers the following estimates of other aquifer parameters based on the results of four groups of piezometers located along Rio Bravo Boulevard (see Figure 3). For the sand and gravel unit, the hydraulic conductivity ranged from 100 to 1000 feet per day, porosity ranged from about 0.1 to 0.3, the horizontal gradient was 0.001, and the estimated average interstitial velocity ranged from 0.3 to 10 feet per day. The parameters for the 15-foot thick clay and silt unit were estimated to be: horizontal hydraulic conductivity of 0.001 feet per day, a gradient of 0.081, a range of 0.1 to 0.3 for effective porosity, and the average interstitial velocity ranged from 0.0002 to 0.0005 feet per day.

The model could be used to examine the effects of drawdown in the pumped recovery wells and to evaluate whether the contaminant plume(s) were being effectively reduced. Based on the results of the groundwater model, the groundwater remediation system could be adjusted to promote optimal remediation of the site(s).

REFERENCES:

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Environmental Protection Agency, 40 CFR (7-1-87 Edition) Ch.1, Part 136, Appendix A, *Methods for Organic Chemical Analysis of Municipal and Industrlal Wastewater*, published by the Office of the National Archives, Washington, D.C.

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Installation Restoration Program, Preliminary Assessment Report for Kirtland Air Force Base. Albuquerque, New Mexico, November 1981, report prepared by Engineering Science, Inc., 710 S. Illinois Avenue, Oak Ridge, Tennessee.

Metric Corporation, 8429 Washington Place, N.E., Suite A, Albuquerque, New Mexico, 87109. Contact: Gary Richardson. September 1988, *Underground Storage Tank Questionnaire Response For 2615 Isleta Boulevard SW, Albuquerque, New Mexico.*

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New Mexico Water Quality Control Commission Regulations as Amended Through December 24. 1987, New Mexico Environmental Improvement Division of the Health and Environment Department, Santa Fe, New Mexico, 82 pp.

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Singh, S. P., Depaoli, D.W., and Begovich, J.M.,1987, *Review of Methods for RemovingVOCs from the Environment*, Proceedings of the Annual AIChE Meeting with Biotechnology Conference, New York, N.Y., November 15-20, 1987.

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APPENDIX A

STATUTES AND REGULATIONS

Water Quality Control Commission Regulations:

1.101. UU. "toxic pollutant" means a water contaminant or combination of water contaminants in concentration(s) which, upon exposure, ingestion, or assimilation either directly from the environment or indirectly by ingestion through food chains, will unreasonably threaten to injure human health, or the health of animals or plants which are commonly hatched, bred, cultivated or protected for use by man for food or economic benefit. As used in this definition injuries to health include death, histiopathologic change, clinical symptoms of disease, behavioral abnormalities, genetic mutation, physiological malfunctions or physical deformations in such organisms or their offspring. In order to be considered a toxic pollutant a contaminant must be one or a combination of the potential toxic pollutants listed below and be at a concentration shown by scientific information currently available to the public to have potential for causing one or more of the effects listed above.

3-103. STANDARDS FOR GROUND WATER OF 10,000 mg/l TDS CONCENTRATION OR LESS. — The following standards are the allowable pH range and the maximum allowable concentration in ground water for the contaminants specified unless the existing condition exceeds the standard or unless otherwise provided in Subsection 3-109.D. or Section 3-110. Regardless of whether there is one contaminant or more than one contaminant present in ground water, when an existing pH or concentration of any water contaminant exceeds the standard specified in Subsection A, B, or C, the existing pH or concentration shall be the allowable limit, provided that the discharge at such concentrations will not result in concentrations at any place of withdrawal for present or reasonably foreseeable future use in excess of the standards of this section.

These standards shall apply to the dissolved portion of the contaminants specified with a definition of dissolved being that given in the publication "Methods for Chemical Analysis of Water and Waste of the U.S. Environmental Protection Agency," with the exception that standards for mercury and the organic compounds shall apply to the total unfiltered concentrations of the contaminants.

A. Human Health Standards — Ground water shall meet the standards of Section A and B unless otherwise provided. If more than one water contaminant affecting human health is present,the toxic pollutant criteria of Section 1-101.UU. for the combination of contaminants, or the Human Health Standard of Section 3-103.A. for each contaminant shall apply, whichever is more stringent.

Arsenic(As)	0.1 mg/l
Barium (Ba)	1.0 mg/l
Cadmium (Cd)	0.01 mg/l
Chromium (Cr)	0.05 mg/l
Cyanide (CN)	0.2 mg/l
Fluoride (F)	1.6 mg/l
Lead (Pb)	0.05 mg/l
Total Mercury (Hg)	0.002 mg/l
Nitrate (N03 as N)	10.0 mg/l
Selenium (Se)	0.05 mg/l
Silver (Ag)	0.05 mg/l
Uranium (U)	5.0 mg/l
Radioactivity: Combined Radium-226 and Radium-228	30.0 pCi/l
Benzene	0.01 mg/l
Polychlorinated Biphenyls (PCB's)	0.001 mg/l
Toluene	0 .75 mg/l
Carbon Tetrachloride	0.01 mg/l
1,2-Dichloroethane(EDC)	0.01 mg/l
1,1-Dichloroethylene(1, 1-DCE)	0.005 mg/l
1,1,2, 2-Tetrachloroethylene (PCE)	0.02 mg/l
1,1, 2-Trichloroethylene (TCE)	0.1 mg/l
Ethyl Benzene	0.75 mg/l
Total Xylenes	0.62 mg/l
Methylene Chloride	0.1 mg/l
Chloroform	0.1 mg/l
1,1-Dichloroethane	0.025 mg/l
Ethylenedibromide(ED8)	0.0001 mg/l
1,1,1 -Trichloroethane	0.06 mg/l
1,1,2-Trichloroethane	0.01 mg/l

1,1,2,2-Tetrachloroethane	0.01 mg/l
Vinyl Chloride	0.001 mg/l
PAHs: Total Naphthalene plus Monomethylnaphthalenes	0 .03 mg/l
Benzo-a-pyrene	0.0007 mg/l

B. Other Standards for Domestic Water Supply:

Chloride (Cl)	250. mg/l
Copper (Cu)	1.0 mg/l
Iron (Fe)	1.0 mg/l
Manganese (Mn)	0.2 mg/l
Phenols	0.005 mg/l
Sulfate (SO_4)	600. mg/l
Total Dissolved Solids (TDS)	1000. mg/l
Zinc (Zn)	10.0 mg/l
pH	between 6 and 9

C. Standards for Irrigation Use — Ground water shall meet the standards of subsections A, B, and C unless otherwise provided .

Aluminum (Al)	5.0 mg/l
Boron (B)	0.75 mg/l
Cobalt (Co)	0.05 mg/l
Molybdenum (Mo)	1.0 mg/l
Nickel (Ni)	0.2 mg/l

Source: *New Mexico Water Quality Control Commission Regulations as Amended Through December 24. 1987,* New Mexico Environmental Improvement Division of the Heaslth and Environment Department, Santa Fe, New Mexico, 82 pp.

APPENDIX B

MONITOR WELL CONSTRUCTION DIAGRAMS
and
WELL LOGS

WELL LOG

Company A Old Supply Well

Depth (Feet)		Material
From	To	
0'	12'	Sand
12'	25'	Gravel
25'	47'	Sand
47'	58'	Gravel
58'	84'	Sand
84'	85'	Clay
85'	97'	Sand
97'	110'	Fine to coarse sand

WELL LOG

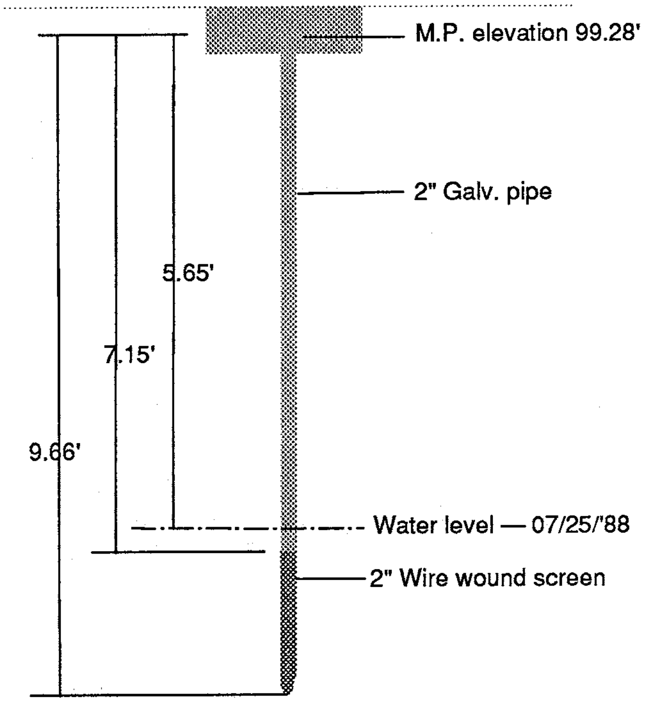
Company A Supply Well

Depth (Feet)		Material
From	To	
0'	7'	Sandy clay
7'	18'	Clay
18'	26'	Sand
26'	32'	Sand and small gravel
32'	51'	Sand and gravel
51'	80'	Sandy clay
80'	105'	Clay
105'	115'	Clay and sandy clay layers
115'	148'	Clay
148'	187'	Clay and sandy clay Layers
187'	201'	Clay
201'	205'	Clay with imbedded coarse sand
205'	215'	Medium sand and clay layers
215'	237'	Clay
237'	242'	Medium sand
242'	250'	Clay

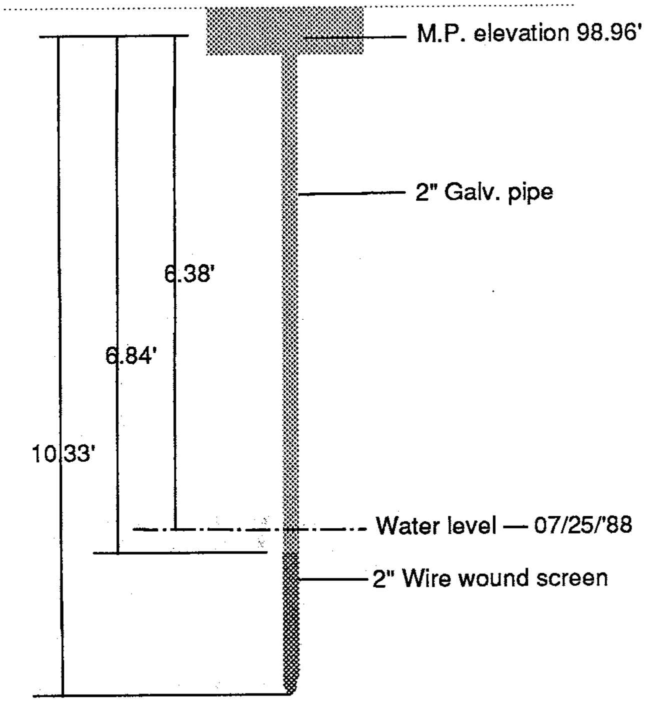
WELL LOG

York Well

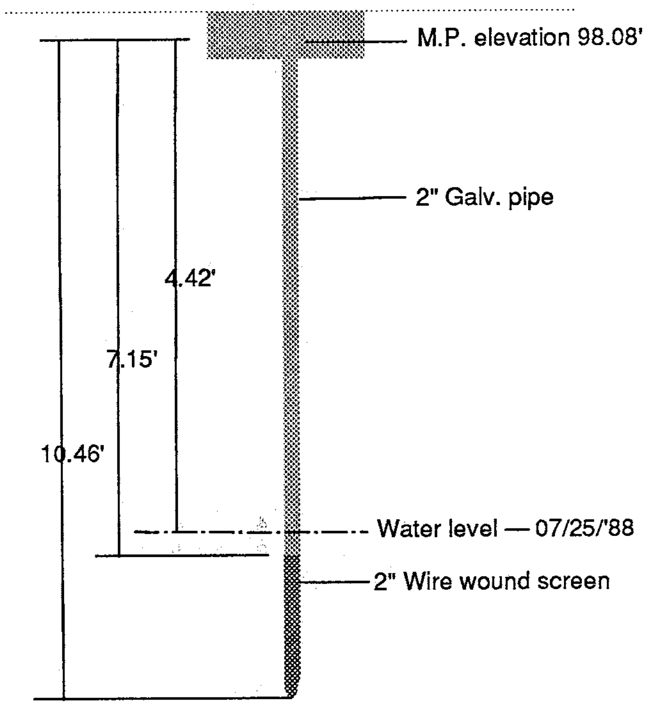
Depth (Feet)		Material
From	To	
0'	5'	Sandy clay
5'	45'	Sand and small gravel
45'	55'	Gravel
55'	93'	Clay
93'	115'	Fine sand and clay layers
115'	140'	Fine silty sand
140'	170'	Clay
170'	205'	Medium coarse sand
205'	210'	Clay



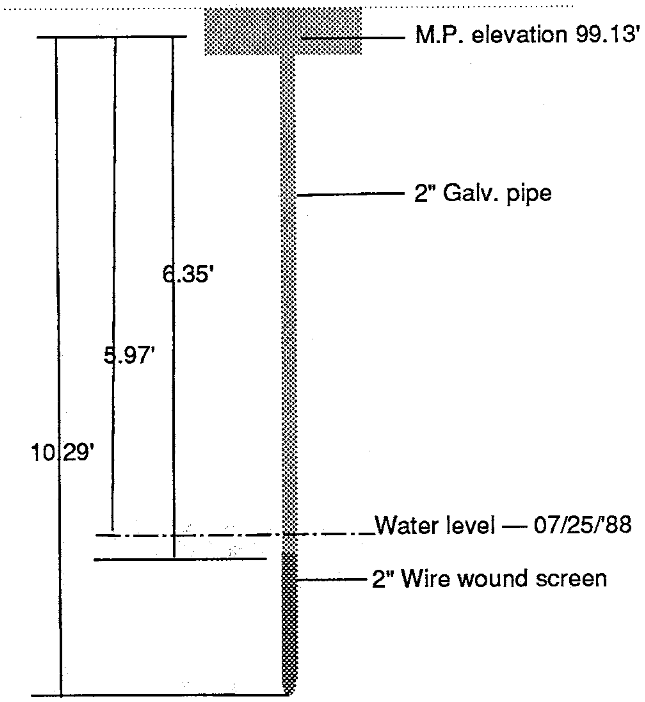
W-1. Construction diagram.



W-2. Construction diagram.



W-3. Construction diagram.



W-4. Construction diagram.

NOTE: Wells SW–1 through SW–4 were all hand augered, 4 inch diameter holes left open. PVC pipe was used for construction because they were only intended to be temporary.

APPENDIX C

WATER SAMPLING ANALYSES AND METHODS

STATE OF NEW MEXICO
ENVIRONMENT

SCIENTIFIC LABORATORY DIVISION

700 Camino de Salud NE
Albuquerque, NM 87106 841-2570

Company A SW-1

REPORT TO: D. EARP GW/HW BUREAU
PLEASE PRINT
ENVIRONMENTAL IMPROV DIVISION
P.O. BOX 968
SANTA FE NM 87504-0968

S.L.D. No.: OR- 1101-1, B
DATE REC. : 10/25/85

PHONE(S): 827-2913

USER CODE: 5 9 3 0 0

SUBMITTER: D. EARP

SUBMITTER CODE: ☐☐☐☐☐

SAMPLE TYPE: WATER ☒, SOIL ☐, OTHER ______

SAMPLE TYPE CODE: ☐☐

COLLECTED: 10/24/85 - 14:30 BY DE.
DATE TIME INITIALS

CODE: Y Y M M D D H H M M I I I

SOURCE: MON. WELL SW - 1 [illegible]

CODE: AQUIFER DEPTH

NEAREST CITY: ALBQ

CODE:

LOCATION: 2615 ISLETA BLVD.

CODE: TOWNSHIP RANGE SECTION TRACTS

pH= ______; Conductivity= ______ umho/cm at ______ °C; Chlorine Residual= ______

Dissolved Oxygen= ______ mg/l; Alkalinity= ______; Flow Rate= ______

Sampling Location, Methods and Remarks (i.e. odors, etc.)

hand bailed
gasoline smell

RECEIVED
DEC 19 1985
LIQUID WASTE/[illegible]
SURVEIL[illegible]

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Douglas Earp

Method of shipment to the Laboratory OF 6143

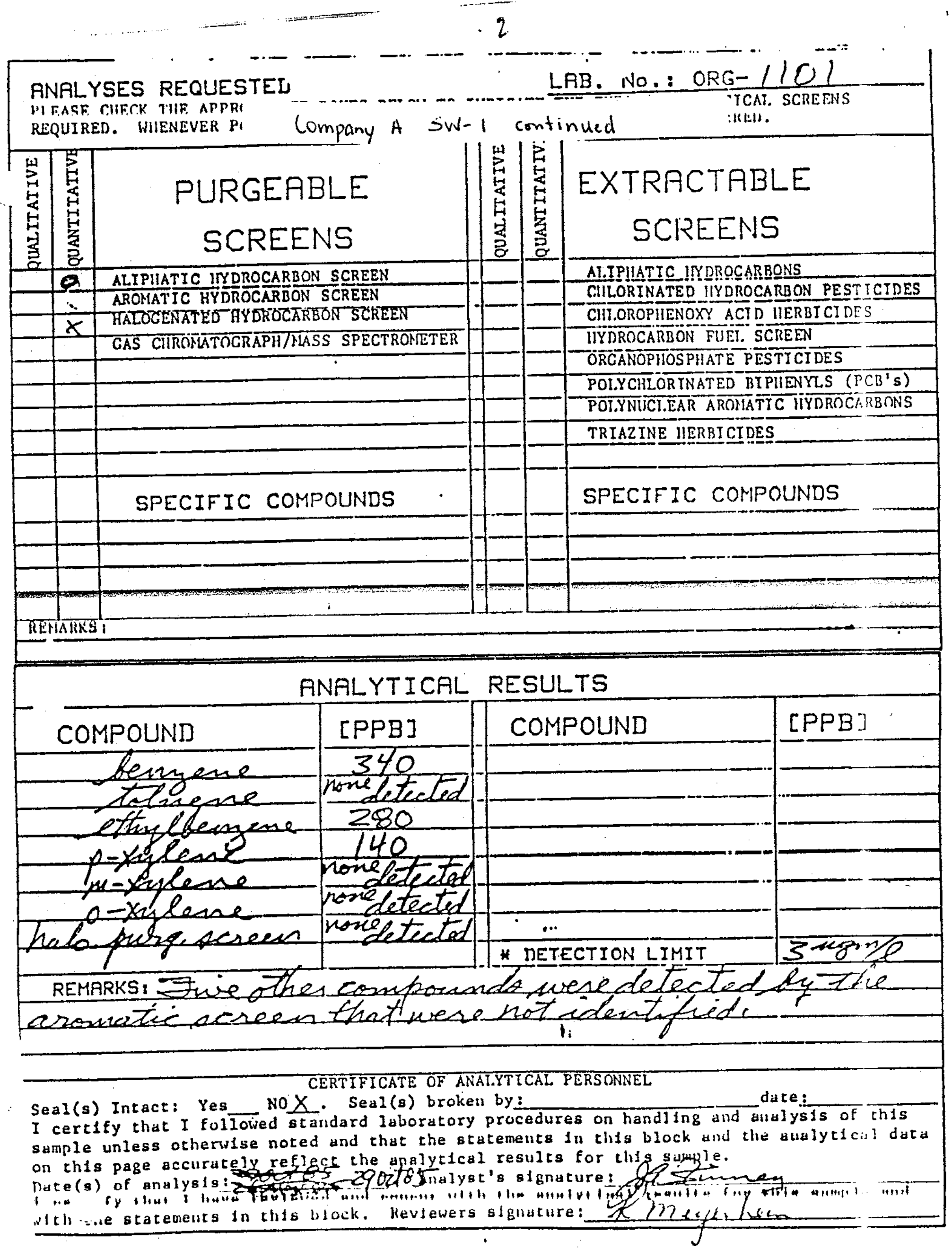
This form accompanies 2 Sept Vials, ___ Glass Jugs, ___ ______

Containers are marked as follows to indicate preservation:

- ☐ NP: No preservation; sample stored at room temperature.
- ☒ P-Ice Sample stored in an ice bath (not frozen).
- ☐ P-$Na_2S_2O_3$; Sample preserved with $Na_2S_2O_3$ to remove chlorine residual.

I (we) certify that this sample was transferred from ______
to ______ at (location) ______ on
__/__/__ - __:__ and that the statements in this block are correct.
DATE AND TIME
Evidentiary Seals: Not Sealed ☐ Seals Intact: Yes ☐ No ☐
Signatures ______ ______

(we) certify that this sample was transferred from ______
to ______ at (location) ______ on
__/__/__ - __:__ and that the statements in this block are correct.
DATE AND TIME
Evidentiary Seals: Not Sealed ☐ Seals Intact: Yes ☐ No ☐
Signatures ______ ______



2

ANALYSES REQUESTED
LAB. No.: ORG-1101

PLEASE CHECK THE APPR ... ICAL SCREENS
REQUIRED. WHENEVER P ... RED.

Company A SW-1 continued

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
		AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
	X	HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
benzene	340		
toluene	none detected		
ethylbenzene	280		
p-xylene	140		
m-xylene	none detected		
o-xylene	none detected		
halo purg. screen	none detected		
		* DETECTION LIMIT	3 ug/l

REMARKS: Five other compounds were detected by the aromatic screen that were not identified.

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X. Seal(s) broken by:__________ date:______
I certify that I followed standard laboratory procedures on handling and analysis of this
sample unless otherwise noted and that the statements in this block and the analytical data
on this page accurately reflect the analytical results for this sample.
Date(s) of analysis: ~~[illegible]~~ 29Oct85 Analyst's signature:
I certify that I have reviewed and concur with the analytical results for this sample and
with the statements in this block. Reviewers signature:

STATE OF NEW MEXICO
ENVIRONMENT

SCIENTI: :LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106 841-2570

Company A SW-2

REPORT TO: D. EARP GW/HW BUREAU
PLEASE PRINT
ENVIRONMENTAL IMPROV DIVISION
P.O. BOX 968
SANTA FE NM 87504-0968

.L.D. No.: OR- 1105
DATE REC. :

RECEIVED DEC 19 1985 LIQUID WASTE/GROUND WATER SURVEILLANCE

PHONE(S): 827-2913

USER CODE: 5 9 3 0 0

SUBMITTER: D. EARP

SUBMITTER CODE: ☐☐☐☐☐

SAMPLE TYPE: WATER ☒, SOIL ☐, OTHER ____

SAMPLE TYPE CODE: ☐☐

COLLECTED: 10/24/85 - 15:30 BY DE.
DATE TIME INITIALS

CODE: Y Y M M D D H H M M I I I

SOURCE: MON. WELL SW-2 Spray wash

CODE: AQUIFER DEPTH

NEAREST CITY: ALBQ

CODE:

LOCATION: 2615 ISLETA BLVD.

CODE: TOWNSHIP RANGE SECTION TRACTS

pH=____; Conductivity=____umho/cm at ____°C; Chlorine Residual=____

Dissolved Oxygen=____mg/l; Alkalinity=____; Flow Rate=____

Sampling Location, Methods and Remarks (i.e. odors, etc.)

Hand bailed
gasoline smell

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Douglas Earp

Method of shipment to the Laboratory OF 6143

This form accompanies 2 Septum Vials, ___ Glass Jugs, ____

Containers are marked as follows to indicate preservation:

☐ NP: No preservation; sample stored at room temperature.
☒ P-Ice Sample stored in an ice bath (not frozen).
☐ P-$Na_2S_2O_3$: Sample preserved with $Na_2S_2O_3$ to remove chlorine residual.

I (we) certify that this sample was transferred from ____
to ____ at (location) ____ on
__/__/__-__:__ and that the statements in this block are correct.
DATE AND TIME
Evidentiary Seals: Not Sealed ☐ Seals Intact: Yes ☐ No ☐
Signatures ____ ____

(we) certify that this sample was transferred from ____
to ____ at (location) ____ on
__/__/__-__:__ and that the statements in this block are correct.
DATE AND TIME
Evidentiary Seals: Not Sealed ☐ Seals Intact: Yes ☐ No ☐
Signatures ____ ____

ANALYSES REQUESTED
LAB. No.: ORG- 1105
PLEASE CHECK THE AP LYTICAL SCREENS
REQUIRED. WHENEVER Company A SW-2 continued QUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
	X	ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
	X	HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
benzene	700		
toluene	4200		
ethylbenzene	3100		
p-xylene	2600		
m-xylene	5100		
o-xylene	3500		
halo purg. screen	none detected		
		* DETECTION LIMIT	100 ugm/l

REMARKS: Six other compounds were detected by the aromatic screen that were not identified

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X. Seal(s) broken by:______________ date:________
I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.
Date(s) of analysis: 29Oct85. Analyst's signature:
I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature:

STATE OF NEW MEXICO
ENVIRONMENT

SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106 841-2570

Company A SW-3

S.L.D. No.: OR- 1131-F.B
DATE REC.: 10/30/85

REPORT TO: Doug Earp
PLEASE PRINT
NMEID - GW/HW BUREAU
P.O. Box 968
Santa Fe, NM 87504

PHONE(S): 827-2913

SUBMITTER: D. Earp

SAMPLE TYPE: WATER ☒, SOIL ☐, OTHER ______

COLLECTED: 10 / 30 / 85 - 11 : 05 BY DE
DATE TIME INITIALS

SOURCE: Mon. Well SW-3

NEAREST CITY: Albq.

LOCATION: ______

USER CODE: ☐☐☐☐☐

SUBMITTER CODE: ☐☐☐☐

SAMPLE TYPE CODE: ☐☐

CODE: Y Y M M D D H H M M I I I

CODE: AQUIFER DEPTH

CODE:

CODE: TOWNSHIP RANGE SECTION TRACTS

pH= ______; Conductivity= ______ umho/cm at ______ °C; Chlorine Residual= ______

Dissolved Oxygen= ______ mg/l; Alkalinity= ______; Flow Rate= ______

Sampling Location, Methods and Remarks (i.e. odors, etc

augered hole; bailed out of drive point

RECEIVED
DEC 10 1985
GROUND WATER/HAZARDOUS WASTE

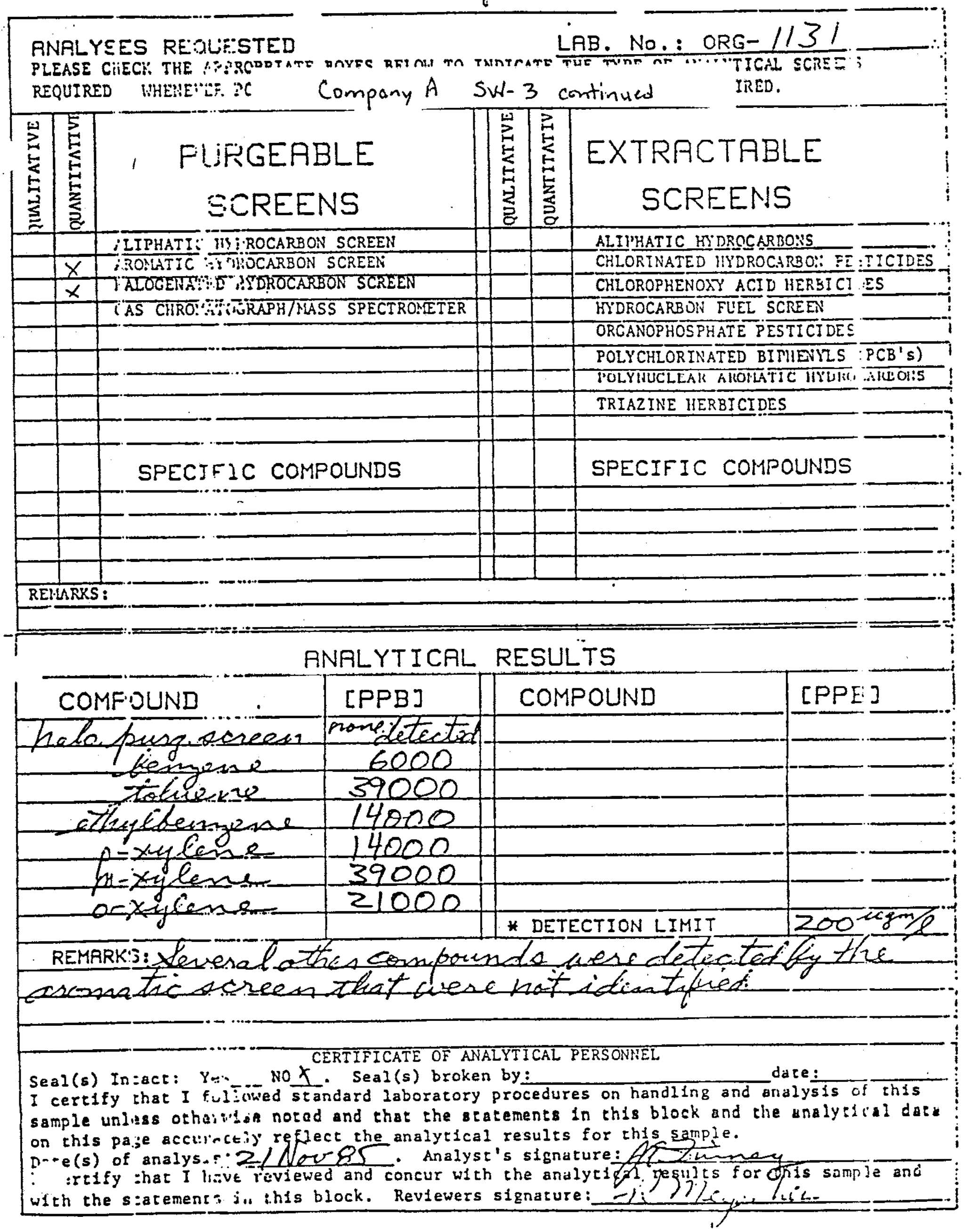
I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Douglas Earp

Method of shipment to the Laboratory personal vehicle

This form accompanies 2 Septum Vials, ___ Glass Jugs, ______
Containers are marked as follows to indicate preservation:
☒ NP: No preservation; sample stored at room temperature.
☐ P-Ice Sample stored in an ice bath (not frozen).
☐ P-$Na_2S_2O_3$: Sample preserved with $Na_2S_2O_3$ to remove chlorine residual.

I (we) certify that this sample was transferred from ______
to ______ at (location) ______ on
___/___/___-___:___ and that the statements in this block are correct.
DATE AND TIME
Evidentiary Seals: Not Sealed ☐ Seals Intact: Yes ☐ No ☐
Signatures ______ ______

(we) certify that this sample was transferred from ______
to ______ at (location) ______ on
___/___/___-___:___ and that the statements in this block are correct.
DATE AND TIME
Evidentiary Seals: Not Sealed ☐ Seals Intact: Yes ☐ No ☐
Signatures ______ ______



ANALYSES REQUESTED LAB. No.: ORG- 1131

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED WHENEVER PC Company A SW-3 continued IRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
	X	HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
halo. purg. screen	none detected		
benzene	6000		
toluene	39000		
ethylbenzene	14000		
p-xylene	14000		
m-xylene	39000		
o-xylene	21000		
		* DETECTION LIMIT	200 ugm/l

REMARKS: Several other compounds were detected by the aromatic screen that were not identified.

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X. Seal(s) broken by:____________ date:________

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 21 Nov 85. Analyst's signature: A. Turney

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature:

7

ENVIRONMENT STATE OF NEW MEXICO

SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106 841-2570

Company A SW-4

REPORT TO: Doug Earp
PLEASE PRINT NMEID - GW/HW Bureau
P.O. Box 968
Santa Fe, NM 87504

S.L.D. No.: OR-1130
DATE REC.: 10/30/85

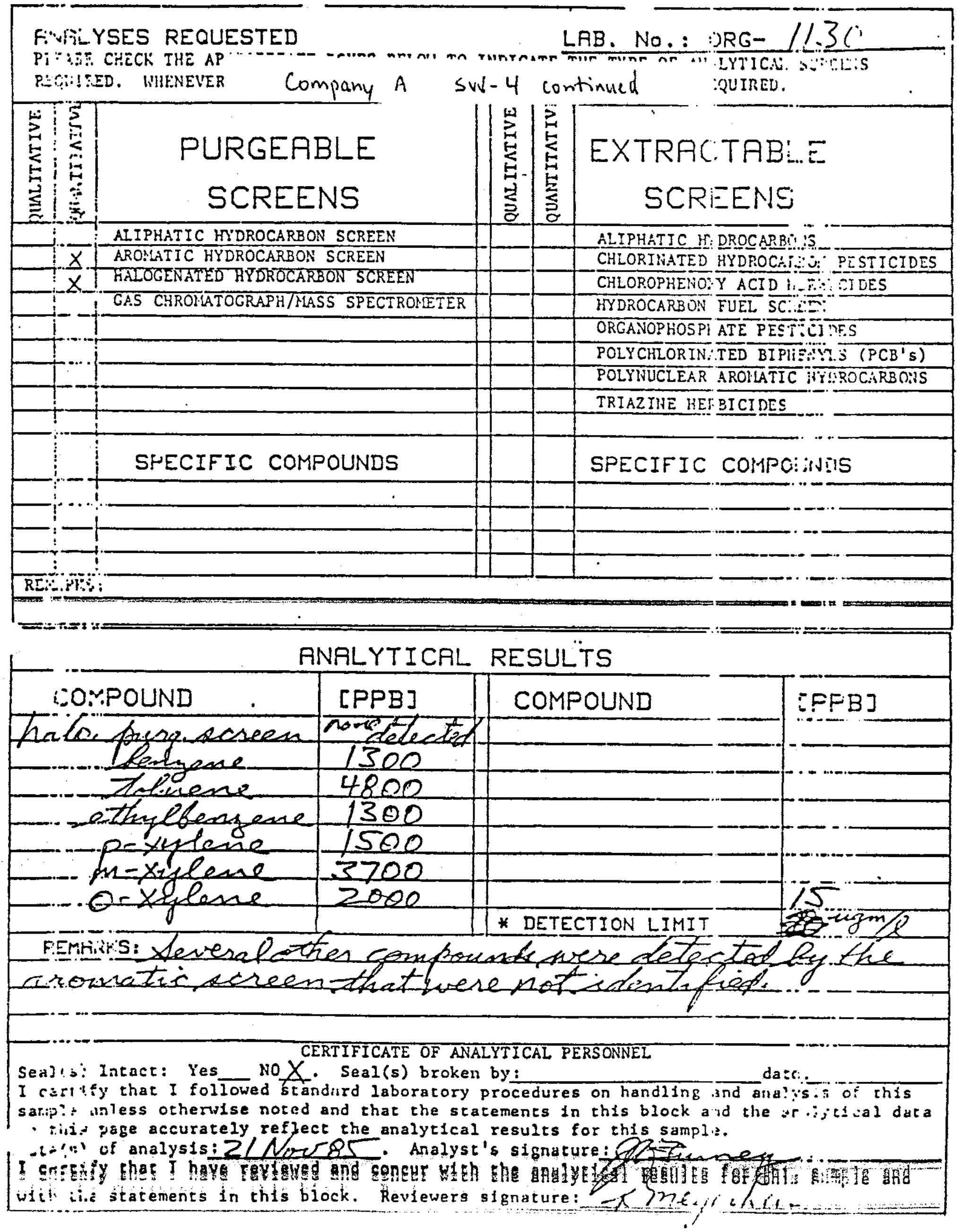
PHONE(S): 827-2913
USER CODE: 5 9 3 0 0
SUBMITTER: D. Earp
SUBMITTER CODE:
SAMPLE TYPE: WATER ☒, SOIL ☐, OTHER ______
SAMPLE TYPE CODE:
COLLECTED: 10 / 30 / 85 - 13 : 00 BY DE
DATE TIME INITIALS
CODE: Y Y M M D D H H M M I I I
SOURCE: Mon. Well SW-4
CODE: AQUIFER DEPTH
NEAREST CITY: Albq.
CODE:
LOCATION: ______
CODE: TOWNSHIP RANGE SECTION TRACTS
pH= ______; Conductivity= ______ umho/cm at ______ °C; Chlorine Residual= ______
Dissolved Oxygen= ______ mg/l; Alkalinity= ______; Flow Rate= ______
Sampling Location, Methods and Remarks (i.e. odors, etc.)
augered hole, bailed out of drive point

DEC 10 1985
HAZARDOUS WASTE

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Douglas Earp
Method of shipment to the Laboratory personal vehicle
This form accompanies 2 Septum Vials, ___ Glass Jugs, ______
Containers are marked as follows to indicate preservation:
☒ NP: No preservation; sample stored at room temperature.
☐ P-Ice Sample stored in an ice bath (not frozen).
☐ P-$Na_2S_2O_3$: Sample preserved with $Na_2S_2O_3$ to remove chlorine residual.

I (we) certify that this sample was transferred from ______
to ______ at (location) ______ on
___/___/___-___:___ and that the statements in this block are correct.
DATE AND TIME
Evidentiary Seals: Not Sealed ☐ Seals Intact: Yes ☐ No ☐
Signatures ______ ______

(we) certify that this sample was transferred from ______
to ______ at (location) ______ on
___/___/___-___:___ and that the statements in this block are correct.
DATE AND TIME
Evidentiary Seals: Not Sealed ☐ Seals Intact: Yes ☐ No ☐
Signatures ______ ______



0

ANALYSES REQUESTED LAB. No.: ORG- 1130

PLEASE CHECK THE AP LYTICAL SCREENS REQUIRED. WHENEVER Company A SW-4 continued QUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
	X	HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
halo. purg. screen	none detected		
Benzene	1300		
Toluene	4800		
ethylbenzene	1300		
p-xylene	1500		
m-xylene	3700		
o-xylene	2000		
		* DETECTION LIMIT	~~20~~ 15 ugm/l

REMARKS: Several other compounds were detected by the aromatic screen that were not identified.

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X. Seal(s) broken by:__________ date.____

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 21 Nov 85. Analyst's signature:

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature:

93

STATE OF NEW MEXICO
ENVIRONMENT

SCIENTII LABORATORY DIVISION
700 Camino de Salud NE
841-2570

Company A Bathroom Tap

REPORT TO: D. EARP GW/HW BUREAU
PLEASE PRINT
ENVIRONMENTAL IMPROV. DIVISION
P.O. BOX 968
SANTA FE NM 87504-0968

S.L.D. No.: OR- 1163-1-B
DATE REC. : 10/25/85

PHONE(S): 827-2913

USER CODE: 5 9 3 0 0

SUBMITTER: D. EARP

SUBMITTER CODE: ☐☐☐☐

SAMPLE TYPE: WATER ☒, SOIL ☐, OTHER ______

SAMPLE TYPE CODE: ☐☐

COLLECTED: 10/24/85 - 12:05 BY DE
DATE TIME INITIALS

CODE: Y Y M M D D H H M M I I I

SOURCE: SPRAY WASH EQUIP. - BATHROOM TAP

CODE: AQUIFER DEPTH

NEAREST CITY: ALBQ

CODE:

LOCATION: 2615 ISLETA BLVD.

CODE: TOWNSHIP RANGE SECTION TRACTS

pH= ______; Conductivity= ______ umho/cm at ______ °C; Chlorine Residual= ______

Dissolved Oxygen= ______ mg/l; Alkalinity= ______; Flow Rate= ______

Sampling Location, Methods and Remarks (i.e. odors, etc.)

~~[illegible]~~ TC

~~[illegible]~~ TC

RECEIVED
DEC 19 1985
LIQUID WASTE/GROUND WATER
SURVEILLANCE

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Douglas Earp

Method of shipment to the Laboratory OF 6143

This form accompanies 2 Septum Vials, ___ Glass Jugs, ______

Containers are marked as follows to indicate preservation:

☐ NP: No preservation; sample stored at room temperature.

☒ P-Ice Sample stored in an ice bath (not frozen).

☐ P-$Na_2S_2O_3$: Sample preserved with $Na_2S_2O_3$ to remove chlorine residual:

I (we) certify that this sample was transferred from ______
to ______ at (location) ______ on
__/__/__-__:__ and that the statements in this block are correct.
DATE AND TIME
Evidentiary Seals: Not Sealed ☐ Seals Intact: Yes ☐ No ☐
Signatures ______ ______

(we) certify that this sample was transferred from ______
to ______ at (location) ______ on
__/__/__-__:__ and that the statements in this block are correct.
DATE AND TIME
Evidentiary Seals: Not Sealed ☐ Seals Intact: Yes ☐ No ☐
Signatures ______ ______

ANALYSES REQUESTED LAB. No.: ORG- 1103

PLEASE CHECK THE API .YTICAL SCREENS
REQUIRED. WHENEVER Company A Bathroom Tap continued)UIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
	✓	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
	X	HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
arom. purg. screen*	none detected		
halo. purg. screen⊕	none detected		
		⊕ DETECTION LIMIT	1 ugm/l
		* DETECTION LIMIT	3 ugm/l

REMARKS: No purgeables detected.

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X. Seal(s) broken by:_______________ date:_______

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

·e(s) of analysis: 29Oct85, 26Nov85 Analyst's signature: Furney

·ertify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. 26Nov85 Reviewers signature: R Meyerhein

14

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106 — (505) 841-2555

PN

GENERAL WATER CHEMISTRY and NITROGEN ANALYSIS

DATE RECEIVED 10 | 25 | 85 LAB NO. WC-4974
USER CODE ☒ 59300 ☐ 59600 ☐ OTHER:

Collection DATE 10 | 24 | 85
Collection TIME 1205
Collected by — Person/Agency D EARP / EID/GW/HWB

SITE INFORMATION ▸
Sai — Company A Bathroom Tap continued
Collection site description BATH ROOM TAP

SEND FINAL REPORT TO ▸
GROUND WATER & HAZARDOUS WASTE BUREAU
NM ENVIRONMENT IMPROVEMENT DIVISION/HED
Crown Building, PO Box 968
Santa Fe, NM 87504-0968
Attn: Doug Earp

Station/well code
Owner

SAMPLING CONDITIONS

☒ Bailed ☐ Pump ☐ Dipped ☒ Tap	Water level 8 ft	Discharge	Sample type
pH (00400)	Conductivity (Uncorrected) µmho	Water Temp. (00010) °C	Conductivity at 25 °C (00094) µmho

Field comments

SAMPLE FIELD TREATMENT — *Check proper boxes*

No. of samples submitted
☒ NF: Whole sample (Non-filtered)
☐ F: Filtered in field with 0.45 µmembrane filter
☒ A: 2 ml H_2SO_4/L added
☐ NA: No acid added ☐ Other-*specify:*

ANALYTICAL RESULTS from SAMPLES

NF, NA		Units	Date analyzed
☐ Conductivity (Corrected) 25 °C (00095)		µmho	
☐ Total non-filterable residue (suspended) (00530)		mg/l	
☐ Other:			
☐ Other:			
☐ Other:			

NF, A-H_2SO_4		Units	Date analyzed
☒ Nitrate-N +, Nitrate-N total (00630)	0.7	mg/l	11/8
☒ Ammonia-N total (00610)	<0.10	mg/l	11/14
☒ Total Kjeldahl-N ( )	<0.1	mg/l	11/8
☐ Chemical oxygen demand (00340)		mg/l	
☐ Total organic carbon ( )		mg/l	
☐ Other:			
☐ Other:			

F, NA		Units	Date analyzed
☐ Calcium (00915)		mg/l	
☐ Magnesium (00925)		mg/l	
☐ Sodium (00930)		mg/l	
☐ Potassium (00935)		mg/l	
☐ Bicarbonate (00440)		mg/l	
☐ Chloride (00940)		mg/l	
☐ Sulfate (00945)		mg/l	
☐ Total filterable residue (dissolved) (70300)		mg/l	
☐ Other:			

F, A-H_2SO_4		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N dissolved (00631)		mg/l	
☐ Ammonia-N dissolved (00608)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Other:			

Analyst	Date Reported	Reviewed by
	11 | 20 | 85	

RECEIVED
DEC 4 1985

Laboratory remarks

SLD 726 (12/84) *DISTRIBUTION:* WHITE — EID, GW&HW Bureau CANARY — Y System PINK — EID Local Office GOLDENROD — SLD

PN

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106 — (505) 841-2555

GENERAL WATER CHEMISTRY and NITROGEN ANALYSIS

DATE RECEIVED 10 | 29 | 85 LAB NO. [illegible]

USER CODE ☑ [illegible] ☐ [illegible] ☐ OTHER:

Collection DATE 10 | 24 | 85

Collection TIME 1205

Collected by — Person/Agency EARP / KOSCHAL

SITE INFORMATION ▶ Sa — Company A Bathroom Tap continued

Collection site description

SEND FINAL REPORT TO ▶
GROUND WATER & HAZARDOUS WASTE BUREAU
NM ENVIRONMENT IMPROVEMENT DIVISION/HED
Crown Building, PO Box 968
Santa Fe, NM 87504-0968
Attn: D. EARP

RECEIVED
DEC 19 1985
GROUND WATER/HAZARDOUS WASTE BUREAU

Station/well code

Owner

SAMPLING CONDITIONS

☐ Bailed ☐ Pump ☐ Dipped ☒ Tap	Water level	Discharge	Sample type
pH (00400)	Conductivity (Uncorrected) µmho	Water Temp. (00010) °C	Conductivity at 25°C (00094) µmho

Field comments

SAMPLE FIELD TREATMENT — *Check proper boxes*

No. of samples submitted

☒ NF: Whole sample (Non-filtered) ☐ F: Filtered in field with 0.45 µmembrane filter ☐ A: 2 ml H_2SO_4/L added

☐ NA: No acid added ☒ Other-*specify:* HNO_3 (5ml) ICAP Scan

ANALYTICAL RESULTS from SAMPLES

NF, NA		Units	Date analyzed
☐ Conductivity (Corrected) 25°C (00095)		µmho	
☐ Total non-filterable residue (suspended) (00530)		mg/l	
☐ Other:			
☐ Other:			
☐ Other:			

F, NA		Units	Date analyzed
☐ Calcium (00915)		mg/l	
☐ Magnesium (00925)		mg/l	
☐ Sodium (00930)		mg/l	
☐ Potassium (00935)		mg/l	
☐ Bicarbonate (00440)		mg/l	
☐ Chloride (00940)		mg/l	
☐ Sulfate (00945)		mg/l	
☐ Total filterable residue (dissolved) (70300)		mg/l	
☐ Other:			

NF, A-H_2SO_4		Units	Date analyzed
☐ Nitrate-N + Nitrate-N total (00630)		mg/l	
☐ Ammonia-N total (00610)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Chemical oxygen demand (00340)		mg/l	
☐ Total organic carbon ( )		mg/l	
☐ Other:			
☐ Other:			

F, A-H_2SO_4		Units	Date analyzed
☐ Nitrate-N + Nitrate-N dissolved (00631)		mg/l	
☐ Ammonia-N dissolved (00608)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Other:			

Analyst	Date Reported	Reviewed by
	12 | 13 | 85	Jim Ashby

Laboratory remarks See attached Sheet

SLD 726 (12/84) *DISTRIBUTION:* WHITE — EID, GW&HW Bureau CANARY — WS System PINK — EID Local Office GOLDENROD — SLD

Lab Number: #M 1853

Date Submitted: 10/24/85

By: D. Earp

Company A Bathroom Tap continued

Date Analyzed: 12/12/85

Reviewed By: J. Ashby

Date Reported: 12/13/85

Element	ICAP VALUE (MG/L)	AA VALUE (MG/L)
Aluminum	<0.1	
Barium	<0.1	
Berylium	<0.1	
Boron	0.3	
Cadmium	<0.1	
Calcium	9.6	
Chromium	<0.1	
Cobalt	<0.1	
Copper	<0.1	
Iron	<0.1	
Lead	<0.1	
Magnesium	1.4	
Manganese	<0.1	
Molybdenum	<0.1	
Nickel	<0.1	
Silicon	20.	
Silver	<0.1	
Strontium	0.1	
Tin	<0.1	
Vanadium	<0.1	
Zinc	<0.1	
Arsenic		
Selenium		
Mercury		

1:3
NN

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106 — (505) 841-2555

GENERAL WATER CHEMISTRY and NITROGEN ANALYSIS

DATE RECEIVED 10|25|85 LAB NO. WC-4475 USER CODE ☐ 59300 ☒ 59600 ☐ OTHER:

Collection DATE 10|24|85

Collection TIME 1205

Collected by — Person/Agency D EARP/EID/GW/HWB

SITE INFORMATION ► Company A Bathroom Tap continued

Collection site description BATHROOM TAP

Station/well code

Owner

SEND FINAL REPORT TO ►
GROUND WATER & HAZARDOUS WASTE BUREAU
NM ENVIRONMENT IMPROVEMENT DIVISION/HED
Crown Building, PO Box 968
Santa Fe, NM 87504-0968
Attn: Doug Earp

RECEIVED
DEC 19 1985
LIQUID WASTE/GROUND WATER SURVEILLANCE

SAMPLING CONDITIONS

☒ Bailed ☐ Pump ☐ Dipped ☒ Tap	Water level 8 Ft	Discharge	Sample type
pH (00400)	Conductivity (Uncorrected) µmho	Water Temp. (00010) °C	Conductivity at 25°C (00094) µmho

Field comments

SAMPLE FIELD TREATMENT — *Check proper boxes*

No. of samples submitted ☒ NF: Whole sample (Non-filtered) ☐ F: Filtered in field with 0.45 µmembrane filter ☐ A: 2 ml H_2SO_4/L added

☒ NA: No acid added ☐ Other-*specify:*

ANALYTICAL RESULTS from SAMPLES

NF, NA		Units	Date analyzed
☐ Conductivity (Corrected) 25°C (00095)		µmho	
☐ Total non-filterable residue (suspended) (00530)		mg/l	
☐ Other:			
☐ Other:			
☐ Other:			

F, NA		Units	Date analyzed
☒ Calcium (00915)	14.4	mg/l	11/8
☒ Magnesium (00925)	13.18	mg/l	〃
☒ Sodium (00930)	171.9	mg/l	〃
☒ Potassium (00935)	4.79	mg/l	〃
☒ Bicarbonate (00440)	125.4	mg/l	12/3
☒ Chloride (00940)	18.8	mg/l	12/9
☒ Sulfate (00945)	142	mg/l	11/27
☒ Total filterable residue (dissolved) (70300)	418	mg/l	
☒ Other: Fluoride	1.39		11/20/85
SiO2	18.1		11/20/

NF, A-H_2SO_4		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N total (00630)		mg/l	
☐ Ammonia-N total (00610)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Chemical oxygen demand (00340)		mg/l	
☐ Total organic carbon ( )		mg/l	
☐ Other:			
Other:			

F, A-H_2SO_4		Units	Date analyzed
☐ Nitrate-N +, Nitrate-N dissolved (00631)		mg/l	
☐ Ammonia-N dissolved (00608)		mg/l	
☐ Total Kjeldahl-N ( )		mg/l	
☐ Other:			

Analyst	Date Reported	Reviewed by
	12/3/85	

Laboratory remarks

SLD 726 (12/84) *DISTRIBUTION:* WHITE — EID, GW&HW Bureau CANARY — WS System PINK — EID Local Office GOLDENROD — SLD

ENVIRONMENT
ATE OF NEW MEXICO

4

SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Auquerque, NM 87106 841-2570

Company B Supply Well

[redacted]

REPORT TO: Doug Earp
PLEASE PRINT
NMEID - GW/HW BUREAU
P.O. Box 968
SANTA FE, NM 87504

S.L.D. No.: OR- 1129-A.B
DATE REC. : 10/30/85

PHONE(S): 827-2913
USER CODE: 5 9 3 0 0
SUBMITTER: D. EARP
SUBMITTER CODE:
SAMPLE TYPE: WATER ☒, SOIL ☐, OTHER ______
SAMPLE TYPE CODE:
COLLECTED: 10/30/65 - 13:30 BY DE
DATE TIME INITIALS
CODE: Y Y M M D D H H M M I I I
SOURCE: RODGERS & Co. WELLHEAD
CODE: AQUIFER DEPTH
NEAREST CITY: ALBQ.
CODE:
LOCATION: ______
CODE: TOWNSHIP RANGE SECTION TRACTS

pH= ______; Conductivity= ______ umho/cm at ______ °C; Chlorine Residual= ______

Dissolved Oxygen= ______ mg/l; Alkalinity= ______; Flow Rate= ______

Sampling Location, Methods and Remarks (i.e. odors, etc.)

tap in well casing

RECEIVED
DEC 10 1965
GROUND WATER/HAZARDOUS WASTE BUREAU

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Douglas Earp

Method of shipment to the Laboratory personal vehicle

This form accompanies 2 Septum Vials, ___ Glass Jugs, ___ ______

Containers are marked as follows to indicate preservation:

☒ NP: No preservation; sample stored at room temperature.
☐ P-Ice Sample stored in an ice bath (not frozen).
☐ P-$Na_2S_2O_3$; Sample preserved with $Na_2S_2O_3$ to remove chlorine residual:

I (we) certify that this sample was transferred from ______
to ______ at (location) ______ on
__/__/__ - __:__ and that the statements in this block are correct.
DATE AND TIME
Evidentiary Seals: Not Sealed ☐ Seals Intact: Yes ☐ No ☐
Signatures ______ ______

(we) certify that this sample was transferred from ______
to ______ at (location) ______ on
__/__/__ - __:__ and that the statements in this block are correct.
DATE AND TIME
Evidentiary Seals: Not Sealed ☐ Seals Intact: Yes ☐ No ☐
Signatures ______ ______

5

ANALYSES REQUESTED LAB. No.: ORG- 1129

PLEASE CHECK THE ANALYTICAL SCREENS
REQUIRED. WHENE Company B Supply Well continued R REQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
	X	HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
arom. purg. screen	none detected		
halo. purg. screen	none detected		
		* DETECTION LIMIT	2 ugm/l

REMARKS: No purgeables detected.

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X. Seal(s) broken by:____________ date:______

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

te(s) of analysis: 21 Nov 85 . Analyst's signature: B Finney

- certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: R Meyerhen

SCIENTII LABORATORY DIVISION
700 Camino de Salud NE
841-2570

Company B W-1

'EPORT TO: D. EARP GW/HW BUREAU
PLEASE PRINT
ENVIRONMENTAL IMPROV. DIVISION
P.O. BOX 968
SANTA FE NM 87504-0968

S.L.D. No.: OR- 1102 .H,B
DATE REC. : 10/25/85

PHONE(S): 827-2913 "
USER CODE: 5|9|3|0|0

SUBMITTER: D. EARP
SUBMITTER CODE:

SAMPLE TYPE: WATER ☒, SOIL ☐, OTHER ______
SAMPLE TYPE CODE:

COLLECTED: 10/24/85 - 11:20 BY DE.
DATE TIME INITIALS
CODE: Y Y M M D D H H M M I I I

SOURCE: WELL W-1 Rodgers & Co
CODE: AQUIFER DEPTH

NEAREST CITY: ALBQ
CODE:

LOCATION: 2615 ISLETA BLVD.
CODE: TOWNSHIP RANGE SECTION TRACTS

pH= ______; Conductivity= ______ umho/cm at ______ °C; Chlorine Residual= ______

Dissolved Oxygen= ______ mg/l; Alkalinity= ______; Flow Rate= ______

Sampling Location, Methods and Remarks (i.e. odors, etc.)

hand bailed
gasoline smell

RECEIVED
DEC 19 1985
LIQUID WASTE/GROUND WATER
SURVEILLANCE

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Douglas Earp

Method of shipment to the Laboratory OF 6143

This form accompanies 2 Septum Vials, ___ Glass Jugs, ______

Containers are marked as follows to indicate preservation:

☐ NP: No preservation; sample stored at room temperature.
☒ P-Ice Sample stored in an ice bath (not frozen).
☐ P-$Na_2S_2O_3$; Sample preserved with $Na_2S_2O_3$ to remove chlorine residual.

I (we) certify that this sample was transferred from ______
to ______ at (location) ______ on
___/___/___ - ___:___ and that the statements in this block are correct.
DATE AND TIME
Evidentiary Seals: Not Sealed ☐ Seals Intact: Yes ☐ No ☐
Signatures ______ ______

(we) certify that this sample was transferred from ______
to ______ at (location) ______ on
___/___/___ - ___:___ and that the statements in this block are correct.
DATE AND TIME
Evidentiary Seals: Not Sealed ☐ Seals Intact: Yes ☐ No ☐
Signatures ______ ______

7

ANALYSES REQUESTED LAB. No.: ORG- 1102

PLEASE CHECK THE A ALYTICAL SCREENS
EQUIRED. WHENEVE Company B W-1 continued EQUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
	X	ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
	X	HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
benzene	120		
toluene	10		
ethylbenzene	530		
p-xylene	500		
m-xylene	380		
o-xylene	230		
halo. purg. screen	none detected		
		* DETECTION LIMIT	25 ppb

REMARKS: Six other compounds were detected by the aromatic screen that were not identified.

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X. Seal(s) broken by:______________ date:______

I certify that I followed standard laboratory procedures on handling and analysis of this sa e unless otherwise noted and that the statements in this block and the analytical data on .is page accurately reflect the analytical results for this sample.

Date(s) of analysis: 29 Oct 85 26 Nov 85. Analyst's signature:

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature: L Meyerhun

STATE OF NEW MEXICO
ENVIRONMENT

…00 Camino de Salud NE
Albuquerque, NM 87106 841-2570

Company B W-3

PORT TO: Doug Earp
NMEID - GW/HW Bureau
P.O. Box 968
Santa Fe, NM 87504

PHONE(S): 827-2913

SUBMITTER: D. Earp

SAMPLE TYPE: WATER ☒, SOIL ☐, OTHER ______

COLLECTED: 10/30/85 - 14:15 BY DE
DATE TIME INITIALS

SOURCE: Mon. well W-3

NEAREST CITY: Albq.

LOCATION: ______

S.L.D. No.: OR-11132 FB

DATE REC.: 10/30/85

USER CODE:

SUBMITTER CODE:

SAMPLE TYPE CODE:

CODE: Y Y M M D D H H M M I I I

CODE: AQUIFER DEPTH

CODE:

CODE: TOWNSHIP RANGE SECTION TRACTS

pH= ______; Conductivity= ______ umho/cm at ______ °C; Chlorine Residual= ______

Dissolved Oxygen= ______ mg/l; Alkalinity= ______; Flow Rate= ______

Sampling Location, Methods and Remarks (i.e. odors, etc.)

bailed from well driven by Rodgers & Co ;

RECEIVED
DEC 10 1985
GROUND WATER/HAZARDOUS WASTE BUREAU

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Douglas Earp

Method of shipment to the Laboratory: personal vehicle

This form accompanies 2 Septum Vials, ___ Glass Jugs, ______

Containers are marked as follows to indicate preservation:

☒ NP: No preservation; sample stored at room temperature.
☐ P-Ice Sample stored in an ice bath (not frozen).
☐ P-$Na_2S_2O_3$: Sample preserved with $Na_2S_2O_3$ to remove chlorine residual.

I (we) certify that this sample was transferred from ______
to ______ at (location) ______ on
___/___/___ - ___:___ and that the statements in this block are correct.
DATE AND TIME

Evidentiary Seals: Not Sealed ☐ Seals Intact: Yes ☐ No ☐

Signatures ______ ______

I (we) certify that this sample was transferred from ______
to ______ at (location) ______ on
___/___/___ - ___:___ and that the statements in this block are correct.
DATE AND TIME

Evidentiary Seals: Not Sealed ☐ Seals Intact: Yes ☐ No ☐

Signatures ______ ______

ANALYSES REQUESTED LAB. No.: ORG- 1132

PLEASE CHECK THE APPROI YTICAL SCREENS

REQUIRED. WHENEVER PO: Company B W-3 continued UIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS	QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBON SCREEN			ALIPHATIC HYDROCARBONS
	X	AROMATIC HYDROCARBON SCREEN			CHLORINATED HYDROCARBON PESTICIDES
	X	HALOGENATED HYDROCARBON SCREEN			CHLOROPHENOXY ACID HERBICIDES
		GAS CHROMATOGRAPH/MASS SPECTROMETER			HYDROCARBON FUEL SCREEN
					ORGANOPHOSPHATE PESTICIDES
					POLYCHLORINATED BIPHENYLS (PCB's)
					POLYNUCLEAR AROMATIC HYDROCARBONS
					TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS			SPECIFIC COMPOUNDS

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
arom. purg. screen	none detected		
halo. purg. screen	none detected		
		* DETECTION LIMIT	2 ug/l

REMARKS: No purgeables detected.

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes __ NO X. Seal(s) broken by: ____ date: ____

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 21 Nov 85 Analyst's signature:

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewer's signature:

STATE OF NEW MEXICO
ENVIRONMENT

SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106 841-2570

Company B W-4

REPORT TO: D. EARP GW/HW BUREAU
PLEASE PRINT
ENVIRONMENTAL IMPROV. DIVISION
P.O. BOX 968
SANTA FE NM 87504-0968

S.L.D. No.: OR- 1104-A B
DATE REC. : 10/25/85

PHONE(S): 827-2913 "

USER CODE: 5 9 3 0 0

SUBMITTER: D. EARP

SUBMITTER CODE: ☐☐☐☐

SAMPLE TYPE: WATER ☒, SOIL ☐, OTHER ___

SAMPLE TYPE CODE: ☐☐

COLLECTED: 10/24/85 - 11 : 45 BY DE.
DATE TIME INITIALS

CODE: ☐☐☐☐☐☐☐☐☐☐☐☐☐
Y Y M M D D H H M M I I I

SOURCE: Well W-4 ' Rodgers & Co.

CODE: ☐☐☐☐☐☐☐☐☐☐☐
AQUIFER DEPTH

NEAREST CITY: ALBQ

CODE: ☐☐☐☐☐☐

LOCATION: 2615 ISLETA BLVD.

CODE: ☐☐☐☐☐☐☐☐☐☐☐
TOWNSHIP RANGE SECTION TRACTS

pH=______; Conductivity=______umho/cm at ______°C; Chlorine Residual=______

Dissolved Oxygen=______mg/l; Alkalinity=__________; Flow Rate=__________

Sampling Location, Methods and Remarks (i.e. odors, etc.)

hand bailed
gasoline smell

RECEIVED
DEC 19 1985
LIQUID WASTE/GROUND
SURVEILLANCE

I certify that the statements in this block accurately reflect the results of my field analyses, observations and activities. Douglas Earp

Method of shipment to the Laboratory OF 6143

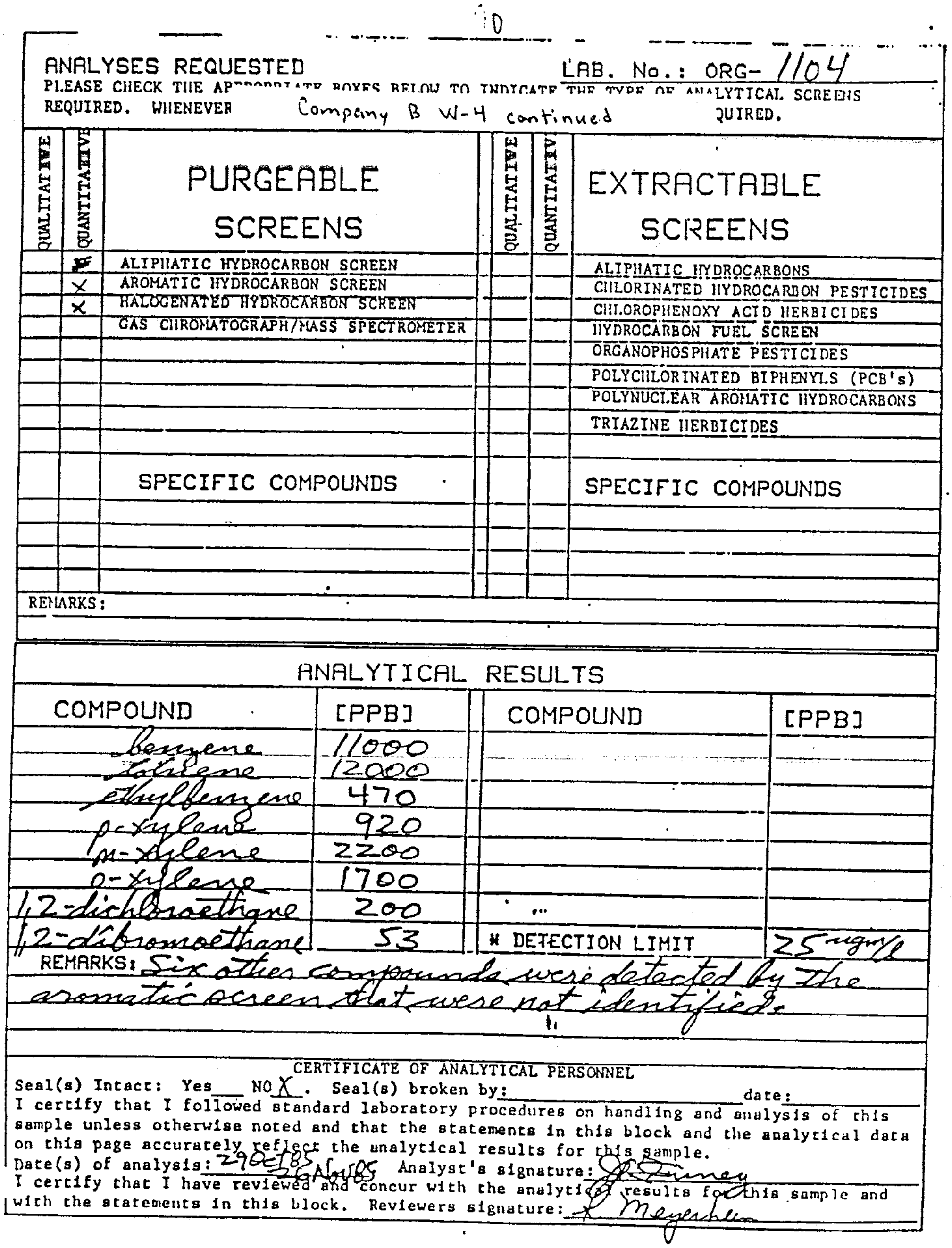
This form accompanies 2 Septum Vials, ___ Glass Jugs, ___

Containers are marked as follows to indicate preservation:

☐ NP: No preservation; sample stored at room temperature.
☒ P-Ice Sample stored in an ice bath (not frozen).
☐ P-$Na_2S_2O_3$: Sample preserved with $Na_2S_2O_3$ to remove chlorine residual.

I (we) certify that this sample was transferred from __________
to __________ at (location) __________ on
___/___/___ - ___:___ and that the statements in this block are correct.
DATE AND TIME
Evidentiary Seals: Not Sealed ☐ Seals Intact: Yes ☐ No ☐
Signatures __________ __________

I (we) certify that this sample was transferred from __________
to __________ at (location) __________ on
___/___/___ - ___:___ and that the statements in this block are correct.
DATE AND TIME
Evidentiary Seals: Not Sealed ☐ Seals Intact: Yes ☐ No ☐
Signatures __________ __________



ANALYSES REQUESTED

LAB. No.: ORG- 1104

PLEASE CHECK THE APPROPRIATE BOXES BELOW TO INDICATE THE TYPE OF ANALYTICAL SCREENS REQUIRED. WHENEVER Company B W-4 continued QUIRED.

QUALITATIVE	QUANTITATIVE	PURGEABLE SCREENS
	X	ALIPHATIC HYDROCARBON SCREEN
	X	AROMATIC HYDROCARBON SCREEN
	X	HALOGENATED HYDROCARBON SCREEN
		GAS CHROMATOGRAPH/MASS SPECTROMETER
		SPECIFIC COMPOUNDS

QUALITATIVE	QUANTITATIVE	EXTRACTABLE SCREENS
		ALIPHATIC HYDROCARBONS
		CHLORINATED HYDROCARBON PESTICIDES
		CHLOROPHENOXY ACID HERBICIDES
		HYDROCARBON FUEL SCREEN
		ORGANOPHOSPHATE PESTICIDES
		POLYCHLORINATED BIPHENYLS (PCB's)
		POLYNUCLEAR AROMATIC HYDROCARBONS
		TRIAZINE HERBICIDES
		SPECIFIC COMPOUNDS

REMARKS:

ANALYTICAL RESULTS

COMPOUND	[PPB]	COMPOUND	[PPB]
benzene	11000		
toluene	12000		
ethylbenzene	470		
p-xylene	920		
m-xylene	2200		
o-xylene	1700		
1,2-dichloroethane	200		
1,2-dibromoethane	53	* DETECTION LIMIT	25 ug/l

REMARKS: Six other compounds were detected by the aromatic screen that were not identified.

CERTIFICATE OF ANALYTICAL PERSONNEL

Seal(s) Intact: Yes___ NO X. Seal(s) broken by:________________ date:________

I certify that I followed standard laboratory procedures on handling and analysis of this sample unless otherwise noted and that the statements in this block and the analytical data on this page accurately reflect the analytical results for this sample.

Date(s) of analysis: 29Oct85 26Nov85 Analyst's signature:

I certify that I have reviewed and concur with the analytical results for this sample and with the statements in this block. Reviewers signature:

ENVIRONMENTAL PROTECTION AGENCY

NOTE: Not all of the tables and figures are included herein. These may be found in 40 CFR.

METHOD 601 — PURGEABLE HALOCARBONS

1. Scope and Application

1.1 This method covers the determination of 29 purgeable halocarbons. The following parameters may be determined by this method:

Parameter	STORET No.	CAS No.
Bromodichloromethane	32101	75-27-4
Bromoform +D32104		75-25-2
Bromomethane	34413	74-83-9
Carbon tetrachloride	32102	56-23-5
Chlorobenzene	34301	108-90-7
Chloroethane	34311	75-00-3
2-Chloroethylvinyl ether	34576	110-75-8
Chloroform	32106	67-66-3
Chloromethane	34418	74-87-3
Dibromochloromethane	32105	124-48-1
1,2-Dichlorobenzene	34536	95-50-1
1,3-Dichlorobenzene	34566	541-73-1
1,4-Dichlorobenzene	34571	106-46-7
Dichlorodifluoromethane	34666	75-71-8
1,1-Dichloroethane	34496	75-34-3
1,2-Dichloroethane	34531	107-06-2
1,1-Dichloroethane	34501	75-35-4
Trans- 1,2-Dichloroethene	34546	156-60-5
1,2-Dichloropropane	34541	78-87-5
Cis-1,3-Dichloropropane	34704	100061-01-5
Trans-1,3-Dichloropropene	34699	10061-02-6
Methylene chloride	34423	75-09-2
1,1,2,2-Tetrachloroethene	34516	76-34-5

Tetrachloroethene	34475	127-18-4
Trichlorofluoromethane	34488	75-69-4
Vinyl chloride	39175	75-01-4

1.2 This is a purge and trap gas chromatographic (GC) method applicable to the determination of the compounds listed above in municipal and industrial discharges as provided under 40 CFR 136.1. When this method is used to analyze unfamiliar samples for any or all of the compounds above, compound identifications should be supported by at least one additional qualitative technique. This method describes analytical conditions for a second gas chromatographic column that can be used to confirm measurements made with the primary column. Method 624 provides gas chromatograph/mass spectrometer (GC/MS) conditions appropriate for the qualitative and quantitative confirmation of results for most of the parameters listed above.

1.3 The method detection limit (MDL, defined in Section 12.1) for each parameter is listed in Table 1. The MDL for a specific wastewater may differ from those listed, depending upon the nature of interferences in the sample matrix.

1.4 Any modification of this method, beyond those expressly permitted, shall be considered as a major modification subject to application and approval of alternate test procedures under 40 CFR 136.4 and 136.5.

1.5 This method is restricted to use by or under the supervision of analysts experienced in the operation of a purge and trap system and a gas chromatograph and in the interpretation of gas chromatograms. Each analyst must demonstrate the ability to generate acceptable results with this method using the procedure described in Section 8.2.

2. Summary of Method

2.1 An inert gas is bubbled through a 5 mL water sample contained in a specially-designed purging chamber at ambient temperature. The halocarbons are efficiently transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent trap where the halocarbons are trapped. After purging is completed, the trap is heated and backflushed with the inert gas to desorb the halocarbons onto a gas chromatographic column. The gas chromatograph is temperature programmed to separate the halocarbons which are then detected with a halide-specific detector.

2.2 The method provides an optional gas chromatographic column that may be helpful in resolving the compounds of interest from interferences that may occur.

3. Interferences

3.1 Impurities in the purge gas and organic compounds outgassing from the plumbing ahead of the trap account for the majority of contamination problems. The analytical system must be demonstrated to be free from contamination under the conditions of the analysis by running laboratory reagent blanks as described in Section 8.1.3. The use of non-Teflon plastic tubing, non-Teflon thread sealants, or flow controllers with rubber components in the purge and trap system should be avoided.

3.2 Samples can be contaminated by diffusion of volatile organics (particularly fluorocarbons and methylene chloride) through the septum seal into the sample during shipment and storage. A field reagent blank prepared from reagent water and carried through the sampling and handling protocol can serve as a check on such contamination.

3.3 Contamination by carry-over can occur whenever high level and low level samples are sequentially analyzed. To reduce carry-over, the purging device and sample syringe must be rinsed with reagent water between sample analyses. Whenever an unusually concentrated sample is encountered, it should be followed by an analysis of reagent water to check for cross contamination. For samples containing large amounts of water-soluble materials, suspended solids, high boiling compounds or high organohalide levels, it may be necessary to wash out the purging device with a detergent solution, rinse it with distilled water, and then dry it in a 105 degree C oven between analyses. The trap and other parts of the system are also subject to contamination; therefore, frequent bakeout and purging of the entire system may be required.

4. Safety

4.1 The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of material data handling sheets should also be made available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available and have been identified for the information of the analyst.

4.2 The following parameters covered by this method have been tentatively classified as known or suspected, human or mammalian carcinogens: carbon tetrachloride, chloroform, 1,4-dichlorobenzene, and vinyl chloride. Primary standards of these toxic compounds should be prepared in a hood. A NIOSH/MESA approved toxic gas respirator should be worn when the analyst handles high concentrations of these toxic compounds.

5. Apparatus and Materials

5.1 Sampling equipment, for discrete sampling.

5.1.1 Vial—25-mL capacity or larger, equipped wlth a screw cap with a hole in the center (Pierce #13075 or equivalent). Detergent wash, rinse with tap and distilled water, and dry at 105 degrees C before use.

5.1.2 Septum—Teflon-faced silicone (Pierce #12722 or equivalent). Detergent wash, rinse with tap and distilled water, and dry at 105 degrees C for 1 h before use.

5.2 Purge and trap system — The purge and trap system consists of three separate pieces of equipment: a purging device, trap, and desorber. Several complete systems are now commercially available.

5.2.1 The purging device must be designed to accept 5-mL samples with a water column at least 3 cm deep. The gaseous head space between the water column and the trap must have a total volume of less than 15 mL. The purge gas must pass through the water column as finely divided bubbles with a diameter of less than 3 mm at the origin. The purge gas must be introduced no more than 5 mm from the base of the water column. The purging device illustrated in Figure 1 meets these design criteria.

5.2.2 The trap must be at least 25 cm long and have an inside diameter of at least 0.105 in. The trap must be packed to contain the following minimum lengths of adsorbents: 1.0 cm of methyl silicone coated packing (Section 6.3.3), 7.7 cm of 2,6-diphenylene oxide polymer (Section 6.3.2), 7.7 cm of silica gel (Section 6.3.4), 7.7 cm of coconut charcoal (Section 6.3.1). If it is not necessary to analyze for dichlorodifluoromethane, the charcoal can be eliminated, and the polymer section lengthened to 15 cm. The minimum specifications for the trap are illustrated in Figure 2.

5.2.3 The desorber must be capable of rapidly heating the trap to 180 degrees C. The polymer section of the trap should not be heated higher than 180 degrees C and the remaining sections should not exceed 200 degrees C. The desorber illustrated in FIgure 2 meets these design criteria.

5.2.4 The purge and trap system may be assembled as a separate unit or be coupled to a gas chromatograph as illustrated in Figures 3 and 4.

5.3 Gas chromatograph — An analytical system complete with a temperature programmable gas chromatograph suitable for on-column injection and all required accessories including syringes, analytical columns, gases, detector and strip-chart recorder. A data system is recommended for measuring peak areas.

METHOD 602—PURGEABLE AROMATICS

1. Scope and Application

1.1 This method covers the determination of various purgeable aromatics. The following parameters may be determined by this method:

Parameter	Storet No.	CAS No.
Benzene	34030	71-43-2
Chlorobenzene	34301	108-90-7
1,2-Dichlorobenzene	34536	95-50-1
1,3-Dichlorobenzene	34566	541-73-1
1,4-Dichlorobenzene	34571	106-46-7
Ethylbenzene	34371	100-41-4
Toluene	34010	108-88-3

1.2 This is a purge and trap gas chromatographic (GC) method applicable to the determination of the compounds listed above in municipal and industrial discharges as provided under 40 CFR 136.1. When this method is used to analyze unfamiliar samples for any or all of the compounds above, compound identifications should be supported by at least one additional qualitative technique. This method describes analytical conditions for a second gas chromatographic column that can be used to confirm measurements made with the primary column. Method 624 provides gas chromatograph/mass spectrometer (GC/MS) conditions appropriate for the qualitative and quantitative confirmation of results for all of the parameters listed above.

1.3 The method detection limit (MDL defined in Section 12.1) for each parameter is listed in Table 1. The MDL for a specific wastewater may differ from those listed, depending upon the nature of interferences in the sample matrix.

1.4 Any modification of this method, beyond those expressly permitted, shall be considered as a major modification subject to application and approval of alternate test procedures under 40 CFR 136.4 and 136.5.

1.5 This method is restricted to use by or under the supervision of analysts experienced in the operation of a purge and trap system and a gas chromatograph and in the interpretation of gas chromatograms. Each analyst must demonstrate the ability to generate acceptable results with this method using the procedure described in Section 8.2.

2. Summary of Method

2.1 An inert gas is bubbled through a 5-mL water sample contained in a specially designed purging chamber at ambient temperature. The aromatics are efficiently transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent trap where the aromatics are trapped. After purging is completed, the trap is heated and backflushed with the inert gas to desorb the aromatics onto a gas chromatographic column. The gas chromatograph is temperature programmed to separate the aromatics which are then detected with a photoionization detector.

2.2 The method provides an optional gas chromatographic column that may be helpful in resolving the compounds of interest from interferences that may occur.

3. Interferences

3.1 Impurities in the purge gas and organic compounds outgassing from the plumbing ahead of the trap account for the majority of contamination problems. The analytical system must be demonstrated to be free from contamination under the conditions of the analysis by running laboratory reagent blanks as described in Section 8.1.3. The use of non-Teflon plastic tubing, non-Teflon thread sealants, or flow controllers with rubber components in the purge and trap system should be avoided.

3.2 Samples can be contaminated by diffusion of volatile organics through the septum seal into the sample during shipment and storage. A field reagent blank prepared from reagent water and carried through the sampling and handling protocol can serve as a check on such contamination.

3.3 Contamination by carry-over can occur whenever high level and low level samples are sequentially analyzed. To reduce carry-over, the purging device and sample syringe must be rinsed with reagent water between sample analyses. Whenever an unusually concentrated sample is encountered, it should be followed by an analysis of reagent water to check for cross contamination. For samples containing large amounts of water-soluble materials, suspended solids, high boiling compounds or high aromatic levels, it may be necessary to wash the purging device with a detergent solution, rinse it with distilled water, and then dry it in an oven at 105 degrees C between analyses. The trap and other parts of the system are also subject to contamination; therefore, frequent bakeout and purging of the entire system may be required.

4. Safety

4.1 The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of material data handling sheets should also be made available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available and have been identfied for the information of the analyst.

4.2 The following parameters covered by this method have been tentatively classified as known or suspected, human or mammalian carcinogens: benzene and 1,4-dichlorobenzene. Primary standards of these toxic compounds should be prepared in a hood. A NIOSH/MESA approved toxic gas respirator should be worn when the analyst handles high concentrations of these toxic compounds.

5. Apparatus and Materials

5.1 Sampling equipment, for discrete sampling.

5.1.1 Vial 125-mL capacity or larger, equipped with a screw cap with a hole in the center (Pierce #13075 or equivalent). Detergent wash, rinse with tap and distilled water, and dry at 105 degrees C before use.

5.1.2 Septum—Teflon-faced silicone (Pierce #12722 or equivalent). Detergent wash, rinse with tap and distilled water, and dry at 105 degrees C for 1 h before use.

5.2 Purge and trap system—The purge and trap system consists of three separate pieces of equipment: A purging device, trap and desorber. Several complete systems are now commercially available.

5.2.1 The purging device must be designed to accept 5-mL samples with a water column at least 3 cm deep. The gaseous head space between the water column and the trap must have a total volume of less than 15 mL. The purge gas must pass through the water column as finely divided bubbles with a diameter of less than 3 mm at the origin. The purge gas must be introduced no more than 5 mm from the base of the water column. The purging device illustrated in Figure 1 meets these design criteria.

5.2.2 The trap must be at least 25 cm long and have an inside diameter of at least 0.105 in.

5.2.2.1 The trap is packed with 1 cm of methyl silicone coated packing (Sectlon 6.4.2) and 23 cm of 2,6-diphenylene oxide polymer (Sectlon 6.4.1) as shown in Figure 2. This trap was used to develop the method performance statements in Section 12.

5.2.2.2 Alternatively, either of the two traps described in Method 601 may be used although water vapor will preclude the measurement of low concentrations of benzene.

5.2.3 The desorber must be capable of rapidly heating the trap to 180 degrees C. The polymer section of the trap should not be heated higher than 180 degrees C and the remaining sections should not exceed 200 degrees C. The desorber illustrated in Figure 2 meets these design criteria.

5.2.4 The purge and tap system may be assembled as a separate unit or be coupled to a gas chromatograph as illustrated in Figures 3, 4, and 5.

5.3 Gas chromatograph — An analytical system complete with a temperature programmable gas chromatograph suitable for on-column injection and all required accessories including syringes, analytical columns, gases, detector, and strip-chart recorder. A data system is recommended for measuring peak areas.

5.3.1 Column l – 6 ft long x 0.082 in. ID stainless steel or glass, packed with 5% SP- 1200 and 1.75% Bentone-34 on Supelcoport (100/120 mesh) or equlvalent. This column was used to develop the method performance statements in Section 12. Guidelines for the use of alternate column packings are provided in Section 10.1.

5.3.2 Column 2-8 ft long x 0.1 in ID stainless steel or glass, packed wlth 5% 1,2,3- Tris(2-cyanoethoxy)propane on Chromosorb W-AW (60/80 mesh) or equivalent.

5.3.3 Detector—Photoionization detector (h-Nu Systems. Inc. Model PI-51-02 or equivalent). This type of detector has been proven effective in the analysis of wastewaters for the parameters listed in the scope (Section 1.1), and was used to develop the method performance statements in Section 12. Guidelines for the use of alternate detectors are provided in Section 10.1.

5.4 Syringes—5-mL glass hypodermic with Luerlok tip (two each), if applicable to the purging device.

5.5 Micro syringes—25-µL, 0.006 in. ID needle.

5.6 Syringe valve—2-way, wlth Luer ends (three each).

5.7 Bottle—15-mL, screw-cap, with Teflon cap liner.

5.8 Balance—Analytical, capable of accurately weighing 0.0001 g.

6. Reagents

6.1 Reagent water—Reagent water is defined as a water in which an interferent is not observed at the MDL of the parameters of interest.

6.1.1 Reagent water can be generated by passing tap water through a carbon filter bed containing about 1 lb of activated carbon (Filtrasorb-300, Calgon Corp., or equivalent).

6.1.2 A water purification system (Millipore Super-Q or equivalent) may be used to generate reagent water.

6.1.3 Reagent water may also be prepared by boiling water for 15 min. subsequently, while maintaining the temperature at 90 degrees C, bubble a contaminant-free inert gas through the water for 1 h. While still applicable, through the valve bore, then close the valve.

10.5 Attach the syringe-syringe valve assembly to the syringe valve on the purging device. Open the syringe valves and inject the sample into the purging chamber.

10.6 Close both valves and purge the sample for 12.0 ± 0.1 min at ambient temperature.

10.7 After the 12-min purge time, disconnect the purging device from the trap. Dry the trap by maintaining a flow of 40 mL/ min of dry purge gas through it for 6 min (Figure 4). If the purging device has no provision for bypassing the purger for this step a dry purger should be inserted into the device to minimize moisture in the gas. Attach the trap to the chromatograph; adjust the purge and trap system to the desorb mode (Figure 5), and begin to temperature program the gas chromatograph. Introduce the trapped materials to the GC column by rapidly heating the trap to 180 degrees C while backlushing the trap with an inert gas between 20 and 60 mL/min for 4 min. If rapid heating of the trap cannot be achieved, the GC column must be used as a secondary trap by cooling it to 30 degrees C (subambient temperature, if poor peak geometry and random retention time problems persist) instead of the initial program temperature of 50 degrees C.

10.8 While the trap is being desorbed into the gas chromatograph column, empty the purging chamber using the sample introduction syringe. Wash the chamber with two 5-mL flushes of reagent water.

10.9 After desorbing the sample for 4 min, recondition the trap by returning the purge and trap system to the purge mode. Wait 15 s. then close the syringe valve on the purging device to begin gas flow through the trap. The trap temperature should be maintained at 180 degrees C. After approximately 7 min, turn off the trap heater and open the syringe valve to stop the gas flow through the trap. When the trap is cool, the next sample can be analyzed.

10.10 Identify the parameters in the sample by comparing the retention times of the peaks in the sample chromatogram with those of the peaks in standard chromatograms. The width of the retention time window used to make identifications should be based upon measurements of actual retention time variations of standards over the course of a day. Three times the standard deviation of a retention time for a compound can be used to calculate a suggested window size; however, the experience of the analyst should weigh heavily in the interpretation of chromatograms.

10.11 If the response for a peak exceeds the working range of the system, prepare a dilution of the sample with reagent water from the aliquot in the second syringe and reanalyze.

11. Calculations

11.1 Determine the concentration of individual compounds in the sample.

11.1.1 If the external standard calibration procedure is used calculate the concentratlon of the parameter being measured from the peak response using the calibration curve or calibration factor determined in Section 7.3.2.

11.1.2 If the internal standard calibration procedure is used, calculate the concentration in the sample using the response factor (RF) determined in Section 7.4.3 and Equation 2.

$$\text{Concentration } (\mu g/L) = \frac{(As)(Cis)}{(Ais)(RF)}$$

where:

As = Response for the parameter to be measured.
Ais = Response for the internal standard.
Cis = Concentration of the internal standard.

11.2 Report results in µg/L without correction for recovery data. All QC data obtained should be reported with the sample results.

12. Method Performance

12.1 The method detection limit (MDL) is defined as the minimum concentration of substance that can be measured and reported with 99% confidence that the value is above zero. The MDL concentrations listed in Table 1 were obtained using reagent water. Similar results were achieved using representative wastewaters. The MDL actually achieved in a given analysis will vary depending on instrument sensitivity and matrix effects.

12.2 This method has been demonstrated to be applicable for the concentration range from the MDL to 100 X MDL. Direct aqueous injection techniques should be used to measure concentration levels above 1000 x MDL.

12.3 This method was tested by 20 laboratories using reagent water, drinking water, surface water, and three industrial wastewaters spiked at six concentrations over thc range 2.1 to 550 µg/L. Single operator precision, overall precision, and method accuracy were found to be directly related to the concentration of the parameter and essentially independent of the sample matrix. Linear equations to describe these relationships are presented in Table 3.

References

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3. Bellar, T.A., and Lichtenberg, J.J. "Semi-Automated Headspace Analysis of Drinking Waters and Industrial Waters for Purgeable Volatile Organic Compounds," Proceedings of Symposium on Measurement of Organic Pollutants in Water and Wastewater. American Society for Testing and Materials, STP 686, C.E Van Hall, editor, 1978.
4. '"Carcinogens—Working with Carcinogens," Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health. Publication No. 77-206, August 1977.
5. "OSHA Safety and Health Standards, General Industry," (29 CFR Part 1910), Occupational Safety and Health Administration. OSHA 2206 (Revised, January 1976).
6. "Safety in Academic Chemistry Laboratories," American Chemical Society Publication. Committee on Safety, 3rd Edition 1979.
7. Provost, L.P., and Elder, R.S. "Interpretation of Percent Recovery Data," *American Laboratory*, 15, 58-63 (1983). (The value 2.44 used in the equation in Section 8.3.3. is two times the value 1.22 derived in this report.)
8. "Methods 330.4 (Titrimetric, DPD-FAS) and 330.5 (Spectrophotometric, DPD) for Chlorine, Total Residual." Methods for Chemical Analysis of Water and Wastes EPA-600/4-79-020, U.S.Environmental Protection Agency, Office of Research and Development, Environmental Monitoring and Support Laboratory,

Cincinnati. Ohio 45268. March 1979.

9. "EPA Method Study 25, Method 602, Purgeable Aromatics," EPA 600/4-84-042, National Technical Information Service, PB84-196682, Springfield, Virginia 22161, May 1984.

TABLE 1—CHROMATOGRAPHIC CONDITIONS AND METHOD DETECTION LIMITS

Parameter	Retention time (min)		Method detection limit (µg/L)
	Col.#1	Col.#2	
Benzene	3.33	2.75	0.2
Toluene	5.75	4.25	0.2
Ethylbenzene	8.25	6.25	0.2
Chlorobenzene	9.17	8.02	0.2
1,4-Dichlorobenzene	16.8	16.2	0.4
1,3-Dichlorobenzene	18.2	15.0	0.4
1,2-Dichlorobenzene	25.9	19.4	0.4

Column 1 conditions: Supelcoport (100/120 mesh) coated with 5% SP-1200/1.75% Bentone -34 packed in a 6 ft. X 0.085 in. ID stainless steel column with helium carrier gas at 36 mL/min flow rate. Column temperature held at 50 degree C for 2 min then programmed at 6 degrees C/min to 90 degrees C for a final hold.

Column 2 conditons: Chromosorb W-AW (60/80 mesh) coated with 5% 1,2,3 Tris(2 - cyanoethyoxy)propane packed in a 6 ft x 0.085 in ID stainless steel column with helium carrier gas at 30 mL/min flow rate. Column temperature held at 40 degrees C for 2 min then programmed at 2 degrees C/min to 100 degrees C for a final hold.

TABLE 2.—CALIBRATION AND QC ACCEPTANCE CRITERIA—METHOD 602

Parameter	Range for Q (µg/L)	Limit for s (µg/L)	Range for X (µg/L)	Range for P, P (%)
Benzene	15.4-24.6	4.1	10.0-27.9	39-150
Chlorobenzene	16.1-23.9	3.5	12.7-25.4	55-135
1,2-Dichlorobenzene	13.6-26.4	5.8	10.6-27.6	37-154
1,3-Dichlorobenzene	13.9-26.1	5.5	11.6-25.5	42-143
1,4-Dichlorobenzene	13.9-26.1	5.5	11.6-25.5	42-143
Ethylbenzene	12.6-27.4	6.7	10.0-28.2	32-160
Toluene	15.5	4.0	11.2-27.7	46-148

a = Concentration measured in QC check sample,in µg/L (Section 7.5.3)
s =Standard deviation of four recovery measurements in µg/L (Section 8.2.4)
X = Average recovery for four recovery measurements, in µg/L (Section 8.2.4).
P, P Percent recovery measured (Section 8.3.2, (Section 8.4.2)
• Criteria were calculated assuming a QC check sample concentration of 20 µg/L.

Note: These criteria are based directly upon the method performance data in Table 3. Where necessary, the limits for recovery have been broadened to assure applicability of the limits to concentrations below those used to develop Table 3.

METHOD 624 – PURGEABLES

1. Scope und Application

1.1 This method covers the determination of a number of purgeable organics. The following parameters may be determined by this method:

Parameter	STORET No.	CAS No.
Benzene	34030	71-43-2
Bromodichloromethane	32101	75-27-4
Bromoform	32104	75-25-2
Carbon tetrachloride	32102	56-23-5
Chlorobenzene	34301	108-90-7
Chloroethane	34311	75-00-3
2-Chloroethylvinyl ether	34576	110-75-8
Chloroform	32106	67-66-3
Chloromethane	34418	74-87-3
Dibromochloromethane	32105	124-48-1
1,2-Dichlorobenzene	34536	95-50-1
1,3-Dichlorobenzene	34566	541-73-1
1,4-Dichlorobenzene	34571	106-46-7
1,1-Dichloroethane	34496	75-34-3
1,2-Dichloroethane	34531	107-06-2
1,1-Dichloroethane	34501	75-35-4
Trans- 1,2-Dichloroethane	34546	156-60-5
1,2-Dichloropropane	34541	78-87-5
Cis-1,3-Dichloropropane	34704	100061-01-5
Trans-1,3-Dichloropropane	34699	10061-02-6
Ethyl benezene	34371	100-41-4
Methylene chloride	34423	75-09-2
1,1,2,2-Tetrachloroethane	34516	76-34-5
Tetrachloroethene	34475	127-18-4
Toluene	34010	108-88-3
1,1,1-Trichloroethene	34506	71-55-6
1,1,2-Trichloroethene	34511	79-00-5
Trichloroethane	39108	79-01-6
Trichlorofluoromethane	34488	75-69-4
Vinyl chloride	39175	75-01-4

1.2 The method may be extended to screen samples for acrolein (STORET No. 34210, CAS No. 107-02-8) and acrylonitrile (STORET No. 34215, CAS No. 107-13-l), however, the preferred method for these two compounds is Method 603.

1.3 This is a purge and trap gas chromatographic/mass spectrometer (GC/MS) method applicable to the determination of the compounds listed above in municipal and industrial discharges as provided under 40 CFR 136.1.

1.4 The method detection limit (MDL, defined in Section 14.1) for each parameter is listed in Table 1. The MDL for a specific wastewater may differ from those listed, depending upon the nature of interferences in the sample matrix.

1.5 Any modification to this method, beyond those expressly permitted, shall be considered as a major modification subject to application and approval of alternate test procedures under 40 CFR 136.4 and 136.5. Depending upon the nature of the modification and the extent of intended use, the applicant may be required to demonstrate that the modifications will produce equivalent results when applied to relevant wastewaters.

1.6 This method is restricted to use by or under the supervision of analysts experienced in the operation of a purge and trap system and a gas chromatograph/mass spectrometer and in the interpretation of mass spectra. Each analyst must demonstrate the ability to generate acceptable results with this method using the procedure described in section 8.2.

2. Summary of Method

2.1 An inert gas is bubbled through a 5-mL water sample contained in a specially-designed purging chamber at ambient temperature. The purgeables are efficiently transferred from the aqueous phase to the vapor phase. The vapor is swept through sorbent trap where the purgeables are trapped. After purging is completed, the trap is heated and backflushed with the inert gas to desorb the purgeables onto a gas chromatographic column. The gas chromatograph is temperature programmed to separate the purgeables which are then detected with a mass spectrometer.

3. Interferences

3.1 Impurities in the purge gas, organic compounds outgassing from the plumbing ahead of the trap, and solvent vapors in the laboratory account for the majority of contamination problems. The analytical system must be demonstrated to be free from contamination under the conditions of the analysis by running laboratory reagent blanks as described in Section 8.1.3. The use of non-Teflon plastic thread sealants, or flow controllers with rubber components in the purge and trap system should be avoided.

3.2 Samples can be contaminated by diffusion of volatile organics (particularly fluorocarbons and methylene chloride) through the septum seal into the sample during shipment and storage. A field reagent blank prepared from reagent water and carried through the sampling and handling protocol can serve as a check on such contamination.

3.3 Contamination by carry-over can occur whenever high levels and low level samples are sequentially analyzed. To reduce carry-over, the purging device and sample syringe must be rinsed with reagent water between sample analyses. Whenever an unusually concentrated sample is encountered, it should be followed by an analysis of reagent water to check for cross contamination. For samples containing large amounts of water-soluble materials, suspended solids, high boiling compounds or high pureeable levels, it may be necessary to wash the purging device with a detergent solution, rinse it with distilled water, and then dry it in a 105 degree C oven between analyses. The trap and other parts of the system are also subject to contamination; therefore, frequent bakeout and purging of the entire system may be required.

4. Safety

4.1 The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of material data handling sheets should also be made available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available and have been identified for the information of the analyst.

4.2 The following parameters covered by this method have been tentatively classified as known or suspected, human or mammalian carcinogens: benzene, carbon tetrachloride, chloroform, 1,4-dichlorobenzene, and vinyl chloride. Primary standards of these toxic compounds should be prepared in a hood. A NIOSH/MESA approved toxic gas respirator should be worn when the analyst handles high concentrations of these toxic compounds.

5. Apparatus and Materials

5.1 Sampling equipment, for discrete sampling.

5.1.1 Vial—25-mL capacity or larger, equipped with a screw cap with a hole in the center (Pierce #13075 or equivalent). Detergent wash, rinse with tap and distilled water, and dry at 105 degree C before use.

5.1.2 Septum—Teflon-faced silicane (Pierce #12722 or equivalent). Detergent wash, rinse with tap and distilled water, and dry at 105 degrees C for 1 h before use.

5.2 Purge and trap system—The purge and trap system consists of three separate pieces of equipment: A purging device, trap, and desorber. Several complete systems are now commercially available.

5.2.1 The purging device must be designed to accept 5-mL samples with a water column at least 3 cm deep. The gaseous head space between the water column and the trap must have a total volume of less than 15 mL. The purge gas must pass though the water column as finely divided bubbles with a diameter of less than 3 mm at the origin. The purge gas must be introduced no more than 5 mm from the base of the water column. The purging device illustrated in Figure 1 meets these design criteria.

5.2.2 The trap must be at least 25 cm long and have an inside diameter of at least 0.105 in. The trap must be packed to contain the following minimum lengths of adsorbents: 1.0 cm of methyl silicone coated packing (Section 6.3.2), 15 cm of 2,6-dyphenylene oxide polymer (Section 6.3.1), and 8 cm of silica gel (Section 6.3.3). The minimum specifications for the trap are illustrated in Figure 2.

5.2.3 The desorber should be capable of rapidly heating the trap to 180 degrees C. The polymer section of the trap should not be heated higher than 180 degrees C and the remaining sections should not exceed 200 degrees C. The desorber illustrated in Figure 2 meets these design criteria.

5.2.4 The purge and trap system may be assembled as a separate unit or be coupled to a gas chromatograph as illustrated in Figures 3 and 4.

5.3 GC/MS system:

5.3.1 Gas chromatograph—An analytical system complete with a temperature programmable gas chromatograph suitable for on-column injection and all required accessories including syrlnges. analytical columns, and gases.

5.3.2 Column—6 ft long x 0.1 in ID stainless steel or glass, packed wlth 1% SP-1000 on Carbopack B (60/80 mesh) or equivalent. This column was used to develop the method performance statements in Sectlon 14. Guidelines for the use of alternate column packings are provided in Section 11.1.

5.3.3 Mass spectrometer—Capable of scanning from 20 to 280 amu every 7 s or less, utilizing 70 V (nominal) electron energy in the electron impact ionization mode, and producing a mass spectrum which meets all the criteria in Table 2 when 50 ng of 4-bromofluorobenzene (BFB) is injected through the GC inlet.

5.3.4 GC/MS interface—Any GC to MS interface that gives acceptable calibration points at 50 ng or less per injection for each of the parameters of interest and achieves all acceptable performance criteria (Section 10) may be used. GC to MS interfaces constructed of all glass or glass-lined materials are recommended. Glass can be deactivated by silanizing with dichlorodimethylsilane.

5.3.5 Data system—A computer system must be interfaced to the mass spectrometer that allows the continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of the chromatographic program. The computer must have software that allows searching any GC/MS data file for specific m/z (masses) and plotting such m/z abundances.

APPENDIX D

UNDERGROUND STORAGE TANK INFORMATION FOR COMPANY B

Eight underground fuel storage tanks have been used at 2615 Isleta Blvd., S.W., since 1966. A history of each tank is presented below:

Tank UL #F343954 (Gasoline)

Size - 4' x 6'
Volume - 560 gal.
Material - Welded Steel (Asphalt Coated)
Installed - Date: December 1966
By: Company B
Condition: New
Removed - Date: October 1983
By: Company B
Condition: Good - based on visual examination at time of removal and subsequent testing
Present Location - Company B yard (Portable Tank)

Tank UL #F343949 (Gasoline)

Size - 4' x 6'
Volume - 560 gal.
Material - Welded Steel (Asphalt Coated)
Installed - Date: December 1966
By: Company B
Condition: New
Removed - Date: October 1983
By: Company B
Condition: Good - based on visual examination at time of removal and subsequent testing
Present Location: Company B yard (Portable Tank)

Tank #Unknown (Gasoline)

Size - 5' x 10'
Volume - 1460 gal.
Material - Welded Steel (Asphalt Coated)
Installed - Date: December 1966
By: Company B
Condition: New
Removed - Date: August 1977
By: Company B
Condition: Good - based on visual examination at time of removal
Present Location: Sold, location unknown

Tank #G927039 (Gasoline)

Size - 6'x 14'
Volume - 2960 gal.
Material - Welded Steel (Asphalt Coated & Plastic Bag)
Installed - Date: August 1977
By: Company B
Condition: New
Removed - Date: May 1988
By: Company B
Condition: Good - based on visual examination at time of removal and subsequent testing
Present Location: Company B yard (above ground use)

Tank #687542 (Diesel fuel)

Size - 6' x 14'
Volume - 2960-gal.
Material - Welded Steel (Asphalt Coated & Plastic Bag)
Installed - Date: September 1979
By: Company B
Condition: New Removed - Date: May 1988
By: Company B

Condition: Good - based on visual examination at time of removal and subsequent testing
Present Location: Company B yard (above ground use

Tank #J104408 (Gasoline)

Size - 4' x 8'
Volume - 750 gal.
Material - Welded Steel (Asphalt Coated & Plastic Bag)
Installed - Date: October 1983
By: Company B
Condition: New
Removed - Date: May 1988
By: Company B
Condition: Good - based on visual examination at time of removal and subsequent testing
Present Location: Company B yard (above ground use)

Tank #J104409 (Gasoline)

Size - 4' x 12'
Volume - 1120 gal.
Material - Welded Steel (Asphalt Coated & Plastic Bag)
Installed - Date: October 1983
By: Company B
Condition: New
Removed - Date: May 1988 By: Company B
Condition: Good - based on visual examination at time of removal and subsequent testing
Present Location: Company B yard (above ground use)

Tank #687540 (Water)

Size - 6' x 16'
Volume - 2960 gal.
Material - Welded Steel (Asphalt Coated)
Installed - Date: September 1979
By: Company B
Condition: New
Removed - Date: Not removed
By:
Condition:
Present Location - Company B yard (still installed)

Source: Metric Corporation report.

APPENDIX E

Example of a Decision Document For a Hypothetical Site Found to be Uncontaminated, Thus Requiring No Further Action.

DECISION DOCUMENT
HYPOTHETICALLY UNCONTAMINATED SITE NO. 1

FOR

LUCKY FURNITURE COMPANY
ALBUQUERQUE, NEW MEXICO

MARCH 1989

Prepared for

LUCKY FURNITURE COMPANY
70 OAKWOOD STREET
ALBUQUERQUE, NEW MEXICO

Prepared by

GEHWEILER, INC.
404 1/2 SCHOOL OF MINES, # C
SOCORRO, NEW MEXICO

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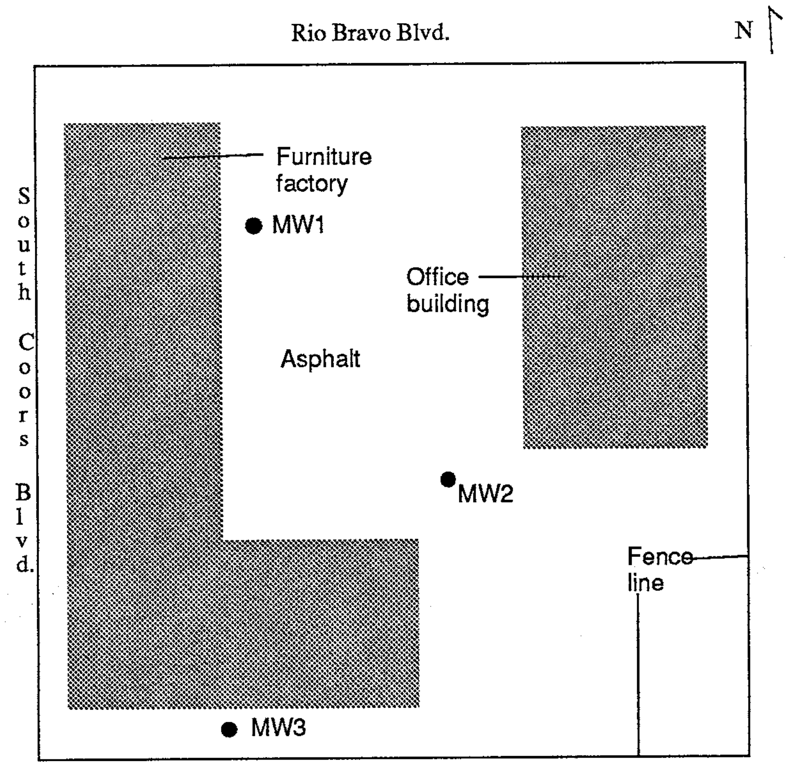
1.1 INTRODUCTION

The objectives of this Decision Document are to describe the history of Site No. 1, present a description of the hydrogeological setting at the site, and to identify why no further action will be taken at the site. This site was initially identified in the Preliminary Assessment of Lucky Furniture Company's property, Albuquerque, New Mexico, in August 1983. The reader should refer to the Preliminary Assessment report for more details. Figure 1 shows the location of Site No. 1, Lucky Furniture Company, Albuquerque, New Mexico. The Preliminary Assessment report can be found at the following locations: Lucky Furniture Company and Gehweiler, Inc.

1.2 BACKGROUND

The background information for Site No. 1 was obtained from a review of company records and interviews with 12 past and present employees and subsequent site inspections by Gehweiler, Inc. personnel resulting in identification of the site. Site No. 1, Furniture Factory (Figure 1), located in a separate building across from Lucky Furniture Company's office building, housed twenty-five (25) 55-gallon drums containing mineral spirits, adhesives, varnishes, and phenols. These chemicals were used in the construction and finishing of furniture manufactured at this site. The factory building was described as having burned down in 1969. Some drums were successfully removed before they caught fire, but it was reported that as many as 10 drums may have burned. It should be noted that the chemicals are highly volatile and flammable in nature. All that currently remains of the furniture factory is its slab with foundation walls. Also, the current status of the site since the time of the incident, remains unchanged.

The hydrogeologic setting is controlled by the presence of alluvium of Holocene Age underlying the flood plain of the Rio Grande and consisting of cobbles, gravels, sand, silt, and clay. Groundwater in the shallow aquifer occurs at a depth of 8 to 12 feet below the ground surface and is underlain by a primary source of potable water called the Albuquerque Aquifer. A clay and silt unit 15 to 30 feet thick underlies the sand and gravel unit, while the deepest unit that was penetrated



Source: Gehweiler, Inc., 1987.

Figure 1. Location of Site No.1.

consists of sand. This clay layer separates the shallow aquifer and the Albuquerque Aquifer. The site is located within the Rio Grande drainage basin. Surface drainage is collected by a system of drains and canals which ultimately empty into the Rio Grande.

Possible Receptors and Pathways

Possible receptors and pathways of contaminants are surface water and groundwater. Surface water is considered as a possible pathway because of the good natural drainage in the area of the site. Surface water drainage through the site is channeled through ditches into the drains and canals and eventually into the Rio Grande. Groundwater has been considered to be a possible receptor and/or pathway because of the sandy and gravelly nature of the soil, coupled with the high water table (8 to 12 feet below ground surface) thus providing direct access to the shallow aquifer.

Chemical Characteristics

The quantity and type of chemicals which were consumed in the fire included as many as 550 gallons of mineral spirits, adhesives, varnishes, and phenols. These chemicals are highly volatile and flammable in nature.

1.3 CONCLUSIONS

It was reported that the chemicals were consumed in the fire. Any slight release of contaminants would pose no direct threat because of the impermeable nature of the concrete slab with foundation walls existing at the site. Three monitoring wells were installed and sampled (Fig.1). Results from the water sample analysis indicated no contamination in the shallow aquifer. Analysis of soil samples collected around the perimeter of the factory building confirmed that no contaminants had been released into the soil. It was concluded that Site No. 1 poses no direct threat to the drinking water.

1.4 RECOMMENDATIONS

Based on available information, there is no evidence to support further action at the site and recommendation is made to remove Site No. 1, Lucky Furniture Company's Furniture Factory from additional investigation.

The President of Lucky Furniture Company has reviewed the available data and concurs that no further actions are required at this site.

______________________________ Date____________________19___

President,
Lucky Furniture Company

N.M. Environmental Improvement Division ☐ concur
☐ nonconcur (please provide reasons).