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REPORTS

DATE:

July 24, 2002

CLOSURE PETITION
ATOKA-1 COMPRESSOR STATION
ARTESIA, NEW MEXICO

RECEIVED

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ENVIRONMENTAL BUREAU
OIL CONSERVATION DIVISION

Prepared for:

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July 24, 2002

1.0 INTRODUCTION

On behalf of Transwestern Pipeline Company (Transwestern), Tetra Tech EM Inc. (Tetra Tech) has prepared this petition for termination of remediation and monitoring activities at the Atoka-1 compressor station located approximately 10 miles southeast of Artesia, New Mexico. The objective of this document is to support a site closure request by demonstrating that the shallow water-bearing zones present beneath the site should be classified as a non-protectable resource based on lack of potential beneficial uses for the groundwater. Tetra Tech has modeled this closure request after the standardized procedure outlined in *Hearings for Exceptions to Order No. R-3221, Southeast New Mexico, "No-Pit" Order* (Anaya, 1985), where an applicant before the New Mexico Oil Conservation Division (OCD) can reasonably demonstrate a lack of beneficial water use when there is:

1. Poor quality water nearing the 10,000 milligrams-per-liter (mg/1) criteria for total dissolved solids (TDS) for which the applicant presents projected water use to demonstrate that there is no reasonable relationship between the economic and social costs of failure to grant the exception and benefits to be gained from continuing to protect or restore the water for domestic or agricultural use now or in the future.

2. Insufficient groundwater to provide a viable water supply for beneficial use, including domestic or stock use. This commonly occurs when shallow water is located within discontinuous stratigraphic zones or lens of limited areal extent.

The following sections provide a detailed discussion of local hydrogeologic conditions and potential beneficial uses of the limited water source, information regarding site characterization and remediation activities, a description of current site conditions in regard to the remaining contamination, and a justification for an exception to the New Mexico Water Quality Control Commission (NMWQCC) groundwater standards to support the request for closure of remediation and monitoring activities at the site.

2.0 SITE BACKGROUND

The site occupies approximately 1.5 acres in the northeast ¼ of the northeast ¼ of Section 1, Township 18 South, and Range 27 East within Eddy County. The parcel is leased from the U.S Bureau of Land Management (BLM). A topographic map showing the location of the facility and surrounding watershed is provided as Figure 1. The site consists of five compressor units and associated piping, a control building, a dehydrator unit, and various aboveground storage tanks (ASTs). A concrete-line surface impoundment was also present at the facility prior to site remediation. The site plan illustrates the layout of these various structures (Figure 2).

The former concrete lined surface impoundment located in the southeast corner of the property was used to store waste liquids. Interviews with plant personnel and site diagrams indicated that two bermed areas, containing pipeline liquid tanks, were located west of the lined surface impoundment for the purpose of pipeline liquid storage. The berms were composed of native soil. The area of soil and groundwater contamination originating from use of these structures was addressed by various corrective actions along the southern fence line as described in Section 4.

3.0 HYDROGEOLOGIC SETTING

The site is located in the Pecos Valley section of the Southern High Plains physiographic province which is characterized by broad plains and rolling hills. The surrounding area slopes westward from the Mescalero Escarpment located in the northeast corner of Eddy County to almost the Pecos River. The westward slope is broken by numerous depressions ranging in size from less than 1-square mile to more than 100-square miles that are typically mantled by dune sand. Near the site, the pediment is dissected by many short arroyos draining less than a few square miles each toward the Pecos River Valley.

The strata east of the Pecos River dip gently to the east and southeast; as a result progressively younger units are encountered as one travels east of the Pecos River. The Permian age Chalk Bluff formation, more commonly known as the Artesia group, is present near the surface within a 5 to 10 mile wide band extending from Lake Avalon in the Pecos River Valley northward to the Eddy County line. The formation is the lateral equivalent of the Tansil, Yates, Seven Rivers, and Queen formations of the Artesia group (Hendrickson, 1952). The thick sedimentary sequence represents a rapid lateral change in depositional environments from the southern massive reef complexes near Carlsbad to the northern clastic and evaporitic sequences representative of back reef and shelf environments (Kelly, 1971). Near the site, the Chalk Bluff formation/Artesia group is several hundred feet thick and contains abundant interbeds of claystone, gypsum, and anhydrite. As a result, groundwater typically contains high concentrations of sulfate and TDS (Table 1).

Only the Quaternary age river alluvium, and cavernous limestone and gypsum deposits within the Permian age Rustler formation, produce large quantities of water east of the Pecos River (Hendrickson, 1952). Water of varying quantity and quality are obtained from the Artesia group, Rustler formation, and sandstones within the Dockum group between the Pecos River and the Mescalero Escarpment; however, much of the water is highly mineralized. Although, potash companies use large quantities of highly mineralized water for industrial purposes, in most areas groundwater use is limited to stock and domestic purposes where present. Beneath the compressor station, only the Upper Artesia group is present. The compressor station obtains its water from a pipeline that originates roughly 30 miles to the east where good quality water from the Ogallala aquifer is available. The pipeline is operated by Double Eagle Water System, and serves many facilities within the region of limited groundwater between the Pecos River and Mescalero Escarpment.

Quaternary age alluvium east of the river consists chiefly of scattered patches of reddish brown silt, clay, and sand of the Gatuna formation deposited within depressions, caliche, and as dune sand. The Gatuna formation is only slightly permeable where exposed at the surface, but in some cases yields small quantities of water adequate for stock. Quaternary age dune sands and caliche mantle much of the area above the Gatuna formation.

4.0 ENVIRONMENTAL INVESTIGATIONS

Two hydrogeologic investigations have been conducted to delineate the extent of subsurface impacts originating from former waste management practices (Brown & Root Environmental [B&R], 1993; Brown and Caldwell [B&C], 1995). In addition to the delineation of the soil and groundwater impacts, Cypress Engineering Services, Inc. (CES) implemented a work plan to excavate and treat near-surface soils underlying the former liquid storage areas (CES, 1994).

B&R advanced a total of 12 soil borings and completed 4 of the borings as monitor wells, shown as MW-1 through MW-4 on Figure 2. Soil and groundwater samples were collected and analyzed for total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). Based on the analyses of samples collected by B&R, the primary VOCs exceeding the New Mexico Oil Conservation Division guidelines (NMOCD, 1993) were benzene, toluene, ethylbenzene, and xylene (BTEX). In addition, the investigation indicated that soil contamination was present between monitor wells MW-1 and MW-2 (Figure 2). The soil beneath the former liquid storage areas was impacted from near ground surface to approximately 60 feet below ground surface (bgs). In addition, B&R determined that phase-separated hydrocarbons (PSH) were present in contact with the perched water-bearing zone detected near monitor well MW-1.

In 1994, B&C advanced 11 additional soil borings and completed 4 of these borings as monitor wells (MW-5 through MW-8 on Figure 2). The investigation defined the extent of shallow soil contamination near the former liquid storage areas and determined that a measurable thickness of PSH was present in monitor well MW-2. The site hydrogeology and the original extent of subsurface contamination are described below:

Hydrogeology

- Borings intersected sediments consisting primarily of fine-grained silts and clays. Discontinuous perched water lenses are present at depths ranging from 30 to 60 feet bgs. As evidenced by several borings that did not encounter groundwater and the limited watershed area (<0.5-square miles), the perched system is of limited extent and likely originates from station operations rather than from natural recharge. Borings drilled into thick claystone sequences typically did not encounter water even when allowed to stay open overnight. Figure 3 depicts the top elevation of the reddish-brown claystone unit of the Upper Artesia group based on lithologic logs from each boring. The depression within the claystone surface between monitor wells MW-4 and MW-7 contains a thicker sequence of Quaternary age sand, silt, and caliche.

- In general, water is not present within the Quaternary age sediments. The water-bearing zone(s) are typically reddish-brown sand containing large amounts of silt and clay. Figure 2 shows the locations of two cross-sections; one trending west-to-east (Figure 4), and the second trending north -to-south (Figure 5). The generalized cross-sections show roughly 30 feet of Quaternary age, tan to pink silts and caliche underlain by the Permian age reddish-brown claystone with interbedded sand (typically less than 2-feet thick), gypsum, and anhydrite.

- Discontinuous water-bearing zones are bound by claystone in both the lateral and vertical sense. Water was not encountered in seven of the soil borings drilled during the investigations (AT1-11, AT1-12, AT1-13, AT1-18, AT1-19, ATI-20, and ATI-21). Cross-section A-A' (Figure 4) shows a significant downward head gradient between water-bearing zones based on monitor well screen placement and hydraulic heads measured in March 2002. The actual thickness of each water-bearing zones is unknown but likely less than a few feet based on the lithologic description of the encountered sediments. The significant downward gradient suggests that the thin water-bearing zones are hydraulically isolated due to the suspected low vertical hydraulic conductivity ($K_v < 10^{-6}$ centimeters per second [cm/sec]) of the claystone sediments that separates them.

- Permeability of the water-bearing zones is also quite low as evidenced by slow water level recovery rates subsequent to purging the wells for groundwater sampling. Monitor wells MW-1 and MW-4, completed in the lowest water-bearing zone (Figure 4), require several days to recover to static conditions upon purging. Monitor well MW-3 requires several hours, while MW-2 could not be bailed dry during the purging process. This information indicates that the permeability of the water-bearing zones decreases with depth. The average horizontal hydraulic conductivity (K_h) for the uppermost water-bearing zone is likely on the order of 10^{-4} to 10^{-5} cm/sec.

- The presence of hydrocarbons southwest of the site indicate that water has moved downgradient toward the southwest, or coincident with the topographic grade as shown on Figure 1. The potentiometric surface for the monitoring well network is shown in Figure 6. Only hydraulic heads from the uppermost water-bearing zone were used for contouring. Groundwater flow is consistent with the orientation of the depression within the Permian age sediments and distribution of VOCs in groundwater.

- The dry borings (AT1-11, AT1-12, AT1-13, AT1-18, AT1-19, AT1-20, and AT1-21) were left open for several hours to allow water to flow into the open borings. The borings did not yield water and were subsequently abandoned. The thick claystone sequence encountered at the above locations is likely near saturation, but transmits miniscule quantities of water downgradient of the more transmissive zones measured by the monitoring network.

- Groundwater within the clay likely migrates at a slow rate toward the southwest or Scoggin Draw under a much steeper horizontal hydraulic gradient than observed in the existing monitoring network due to the tight nature of the sediments. There is no evidence of groundwater seepage or discharge into the draw.

Contaminant Distribution and Movement

- Field headspace and laboratory analyses indicated that soil contamination was originally present near the former storage areas from near ground surface to at least 60 feet bgs. The vertical extent of contaminated soil diminished as one moved away from the two former storage areas.

- The majority of the contaminant mass was present in the sorbed and vapor phase within the soil and as PSH in contact with the perched water.

- In 1994, PSH was present along the southern fence line as evidenced explicitly by PSH measured in monitor wells MW-1 and MW-2, and implicitly by total BTEX concentrations of 27,700 μg/L in monitor well MW-5. Table 2 provides a historical summary of water quality data.

- The areal extent of the groundwater plume is roughly 0.8 acres with dimensions of 320 feet long by 100 feet wide. The average linear velocity of groundwater is on the order of 10 feet per year assuming an upper limit horizontal hydraulic conductivity (K_h) of 10^{-4} cm/sec for the more transmissive zones, an average hydraulic gradient of 0.01 feet-per-foot (gradient between MW-5 and MW-6), and an effective porosity of 0.1.

- Assuming an average K_h for the entire water-bearing zone of 10^{-5} cm/sec, a hydraulic gradient of 0.01 feet-per-foot, and a cross-sectional area 100 feet wide by 30 feet thick, the estimated groundwater flux through the groundwater plume is roughly 2,500 gallons-per-year.

5.0 SITE REMEDIATION

In October and November 1994, CES implemented a work plan to remediate near-surface soils below the two former liquid storage areas. This remediation program included the excavation of approximately 3,200 cubic yards of soil underneath the former AST and surface impoundment. Soils were excavated to depths of approximately 10 to 15 feet bgs. The excavated soil was then processed through a Royer soil shredding plant, augmented with a nutrient solution to enhance biodegradation of hydrocarbons, and placed back into the excavated area.

Additional corrective action measures include the removal of PSH and the reduction of elevated TPH in the shallow (0 to 60 feet bgs) soils near the former liquid storage areas. The approach relied on the removal of subsurface contaminants by using soil vapor extraction (SVE) to recover sorbed-phase and vapor-phase TPH, and PSH contamination. Due to the presence of fine-grained sediments, the SVE well field was conservatively designed to ensure that the impacted area was effectively covered. The SVE system consisted of 13 SVE wells, soil vapor conveyance piping, and a 200-standard-cubic-feet-per-minute (scfm) thermal oxidizer. The SVE wells were placed on 40-foot centers. Routine operation and maintenance of the SVE system occurred from November 1997 through October 2001 when the system was shut down for the winter. Figure 7 shows the decline of SVE emissions since initial system startup in November 1997. After approximately 1-year of system operation, the thermal oxidizer was replaced with a 200-cfm regenerative blower because air emission controls were no longer required.

A water recovery system was also operated on a limited basis between December 1999 and October 2001. The purpose was to establish a maximum sustainable recovery rate for the water-bearing zones and to evaluate the effectiveness of the water recovery system on the dissolved phase plume concentrations. The maximum sustainable recovery rate from any of the three wells utilized (MW-5, MW-6, and MW-7) was about 60 gallons-per-day. There was no noticeable effect on the dissolved-phase plume concentrations; therefore, operation of the water recovery system was discontinued.

Site assessment and remediation activities have been ongoing since 1993. During that time, the source area has been effectively remediated and the stability of the existing groundwater plume as been documented by approximately 19 monitoring events (Table 2). The results of these extensive efforts are evidenced by the following observations regarding current site conditions:

1. Shallow groundwater continues to be present at depths ranging from 30 to 60 feet bgs in transmissive yet discontinuous lenses within the dense claystone. Based on drilling observations, the water-bearing zones are thin and require hours to days to reach static levels after well purging for groundwater monitoring.

2. A small volume of groundwater is transmitted through a thin cross-sectional area where preferential flow paths exist in coarse sediment zones. The groundwater plume appears deceptively large (approximately 320 feet by 100 feet) based on areal extent; however, the volume of contaminated groundwater is quite small.

3. Past sampling events identified the presence of PSH in wells MW-1, MW-2, and SVE-13; however, PSH has not been detected in these wells in the course of the last three sampling events. The SVE system has effectively removed the PSH from above the water-bearing zone. Figure 8 graphically illustrates this PSH trend in monitor well MW-1 since monitoring began in 1993.

4. The plume is stable, as defined by 19-groundwater monitoring events in most of the site wells. The distribution of soil contamination has been adequately delineated – and has been treated in the vicinity of the original release.

5. Benzene concentrations have stabilized well above the NMWQCC groundwater standard in several wells (Figures 9 through 12 and Table 3). Toluene, ethylbenzene, and total xylene concentrations are below NMWQCC groundwater standards at seven of eight monitoring locations.

Supporting concentration trend graphs are provided as Attachment 1.

6.0 JUSTIFICATION FOR SITE CLOSURE PETITION

The shallow water-bearing zones beneath the compressor station should be classified as a non-protectable resource based on the lack of potential beneficial uses for the groundwater. With that in mind, Transwestern proposes that the criteria outlined in the procedures for granting exceptions to New Mexico Oil Conservation Commission Order No. R-3221 be used to evaluate this site closure request. Order No. R-3221 prohibits the disposal of water produced in conjunction with the production of oil or gas in a manner which would constitute a hazard to fresh water supplies in the area encompassed by Lea, Eddy, Chaves, and Roosevelt Counties. To date, more than 25 cases requesting exceptions to Order No. R-3221 have been approved by the OCD for sites located immediately east of the Atoka-1 compressor station because these sites posed no threat to the foreseeable use of the groundwater resources. Although the order is focused primarily on brine water impacts, the same process can be extended to address other types of oil and gas operational impacts, such as the release of fluids from the Atoka-1 compressor station.

The evaluation criteria for R-3221 exceptions as they apply to the Atoka-1 compressor station are addressed below. The provided justification also serves to support an alternate abatement standard, should it be determined that the Order No. R-3221 exception procedure does not apply to compressor station sites.

(1) ***There is no reasonable relationship between economic cost, social cost, and benefits obtained by continuing to attempt to achieve the NMWQCC groundwater standard for benzene.*** Information on local groundwater resources and use demonstrate that the water resource is limited even at greater depths (>500 feet bgs). It is unlikely that the impacted water-bearing zone will be put to any beneficial use, such as livestock watering or domestic supply, due to the high concentration of sulfate and TDS, poor well yields, and low range carrying capacity for livestock.

Potential water uses other than very limited livestock watering are precluded due to poor water quality. Analytical data from the existing monitoring network, indicate that sulfate and TDS concentrations are as high as 4,900 mg/L and 7,700 mg/L, respectively, in the vicinity of the site. Cattle can survive on water containing greater than 5,000 mg/L TDS but struggle with water containing greater than 1,000 mg/L sulfate. Consumption of high TDS and sulfate water result in livestock weaknesses such as persistent diarrhea.

According to the BLM office located in Roswell, the local range carrying capacity is approximately 6 cattle per section under year round grazing. Daily water needs for cattle typically range from 10 to 15 gallons-per-day. Therefore, the minimum water demand for livestock grazing at full capacity is roughly 60 to 90 gallons-per-day or 0.1 acre foot per year (ac-ft/yr) per section of land. Insufficient water is available along the southern fence line to support stock over the long term due to the discontinuous nature and limited areal extent of the water-bearing zones, and limited recharge. At least two wells would be required to meet the potential water demand within the section. Exploration would be required to locate a more favorable location in respect to water yield and quality, if one exists at all. The current market value for 1 ac-ft of good quality water in New Mexico is approximately $250; therefore, the potential livestock water demand of 0.1ac-ft/yr represents a market value of approximately $25 per section for the water source.

Comparing the continued economic cost of attempting to achieve non-attainable NMWQCC groundwater standards to the potential social and economic gain from obtaining water along the southern fence line to support ranching clearly indicate that the diverted financial resources would better serve society in another capacity. The estimated annual cost for continued site remediation and monitoring is $20,000, while the maximum annual economic gain from providing water to livestock is roughly $2,500 – assuming six feeder calves can be sold annually at local livestock auctions for approximately $1 per pound (USDA, 2002). The estimated sale price does not account for ranching expenses such as veterinary care, ranch upkeep, and transportation to market.

In summary, the economic requirements for putting the water to beneficial use are unfavorable when the marginal nature of the resource is considered.

(2) ***The NMWQCC groundwater standard is not technically achievable with the maximum technology.*** The contaminant source area has been effectively remediated through soil excavation and PSH removal efforts. Contaminant trends indicate that the groundwater plume is stable and in

some places shrinking, and that the likelihood of surface discharge to an arroyo or capture by a livestock well is quite low.

However, following eight years of remedial efforts the dissolved-phase concentrations of benzene still exceed NMWQCC groundwater standards at 5 of the 8 monitoring locations (Table 3). At best, contaminant reduction trends indicate that at least 10 more years may be required to approach the NMWQCC groundwater standard for benzene in the vicinity of monitor well MW-1. A similar time frame is likely for the ½-acre of land presently impacted off-site using currently available remediation methods. Operation of the water recovery system established an upper well yield limit of 60 gallons-per-day with no measurable reduction in contaminant concentration attributable to system operation over a 2-year period.

The contaminant recovery methods available to address hydrocarbon contamination within tight clays are very limited. In this situation, the current technological trend is to remove the source area and allow natural attenuation processes to degrade the remaining hydrocarbon mass. Transwestern has employed all technically feasible active remediation approaches to remove the majority of the contaminant mass. At this point, natural attenuation is perhaps the only economically feasible alternative for further contaminant mass reduction.

(3) ***The proposed site closure will not create a present or future hazard to public health or undue damage to property.*** Over the last nine years, site monitoring has demonstrated that the dissolved-phase plume is at least stable and is possibly shrinking in areal extent. The contributing surface watershed upgradient of the site is less than 0.5-square miles in area; therefore, flooding or surface discharge of contaminated water to the surrounding environment is highly unlikely. Impacted groundwater remains at depths of 30 feet bgs or more. The impacted horizon is well below any surface activities that could pose a hazard to public health such as trenching and construction activities, or livestock grazing.

The nearest use of shallow groundwater is located approximately 2-miles downgradient of the site along Scoggin Draw. At this time, there are no receptors of groundwater contamination from the release at the site. The impacted area is limited to approximately ½-acre beyond the southern site fence line.

In summary, current and future potential uses of the groundwater resource near the site are limited, and the potential long-term risk to the public has been alleviated by removal of source area contamination. Based on this information, Transwestern is requesting that active remediation and monitoring efforts at the site be terminated, and that all wells be abandoned.

7.0 REFERENCES

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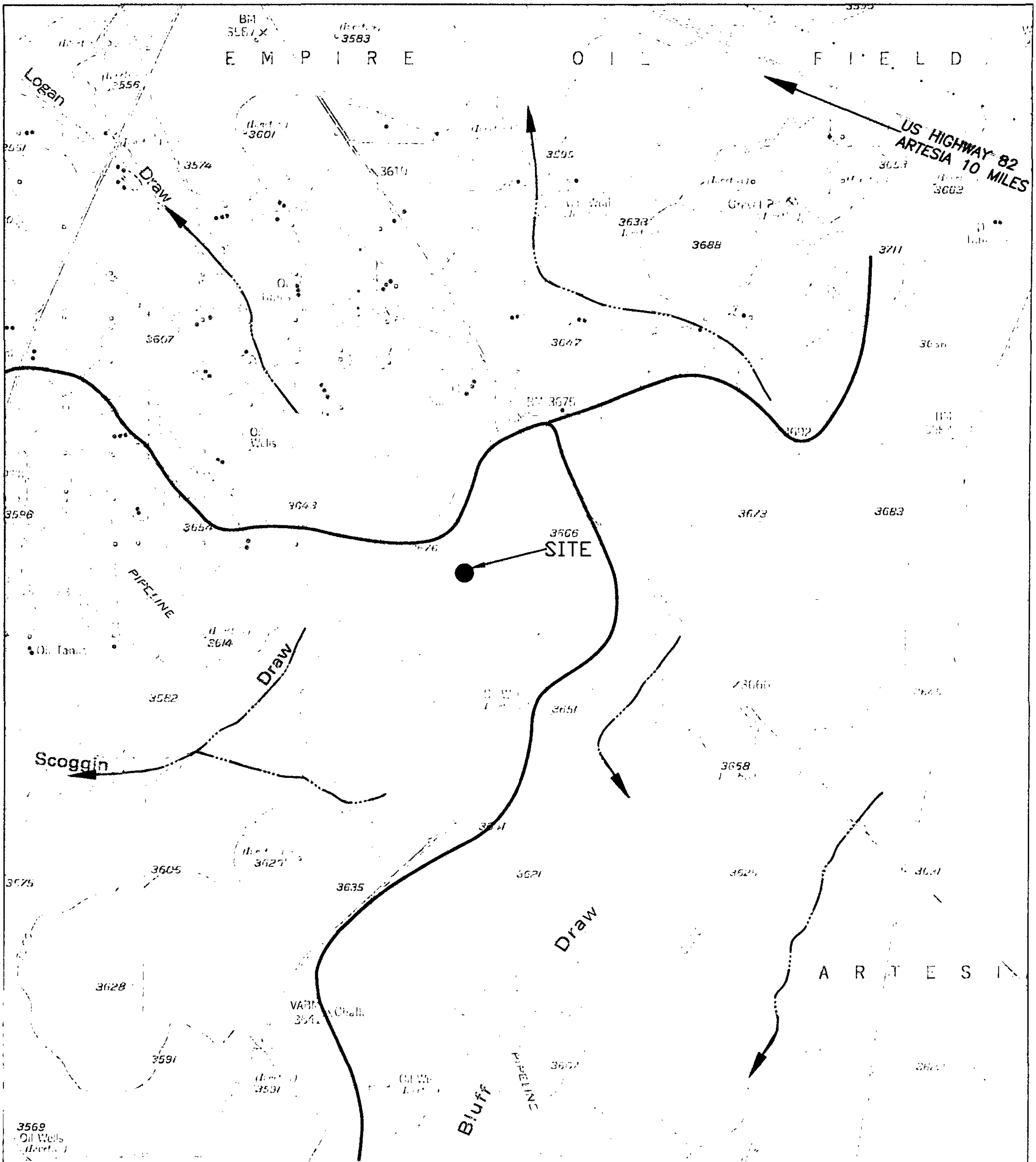
FIGURES



LEGEND

WATERSHED DIVIDE

DIRECTION OF SURFACE WATER FLOW

1000' 0 1000' 2000'

SCALE: 1" = 2000'

SOURCE: USGS 1975. RED LAKE, N. MEX 32104-G2-TF-024

ATOKA-1 COMPRESSOR STATION

FIGURE 1
LOCATION MAP

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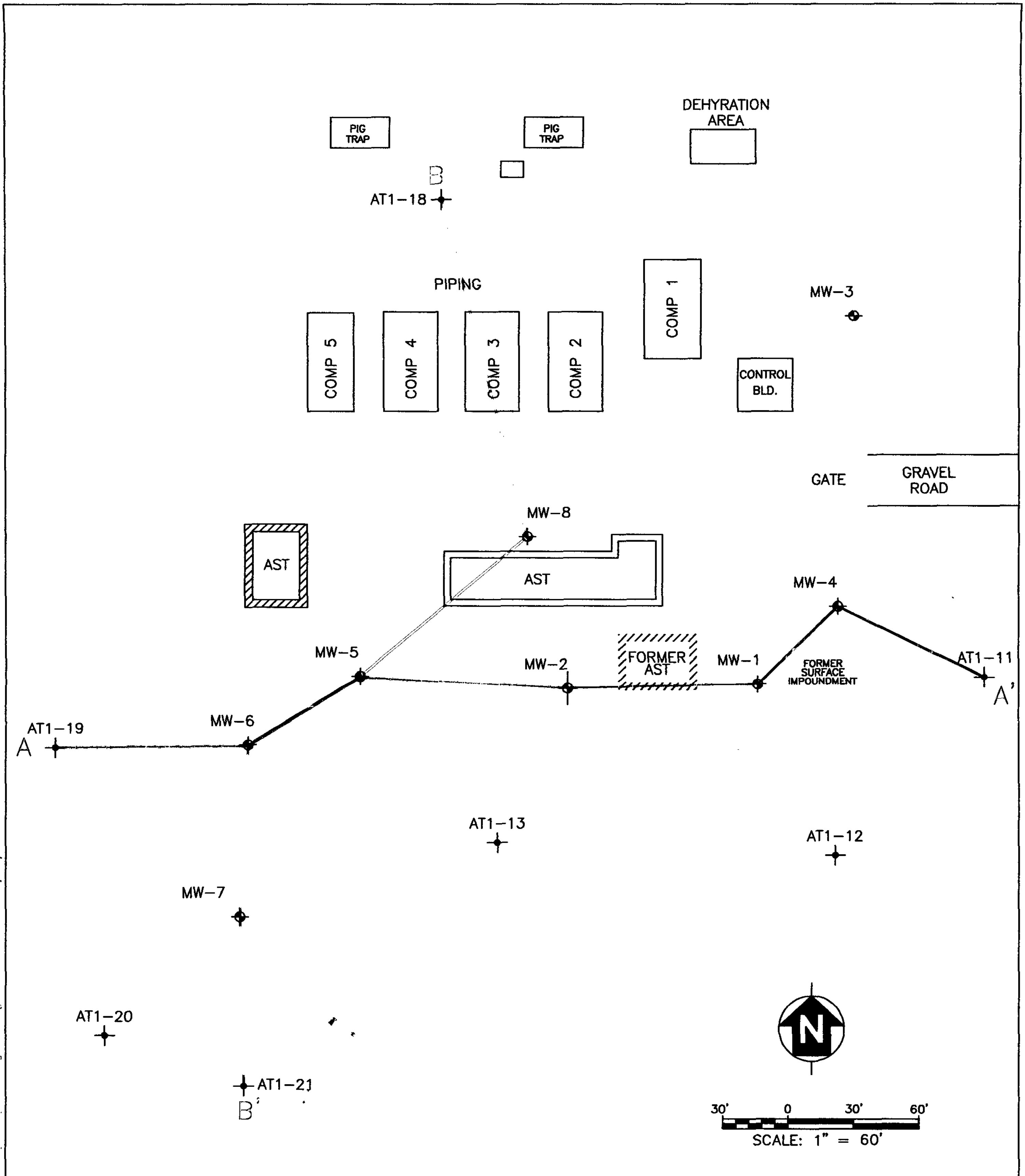

LEGEND

AT1-21 SOIL BORING

MW-7 MONITORING WELL

A—A' CROSS SECTION

CONTAINMENT WALL

ATOKA-1 COMPRESSOR STATION

FIGURE 2
SITE MAP

Tetra Tech EM Inc.

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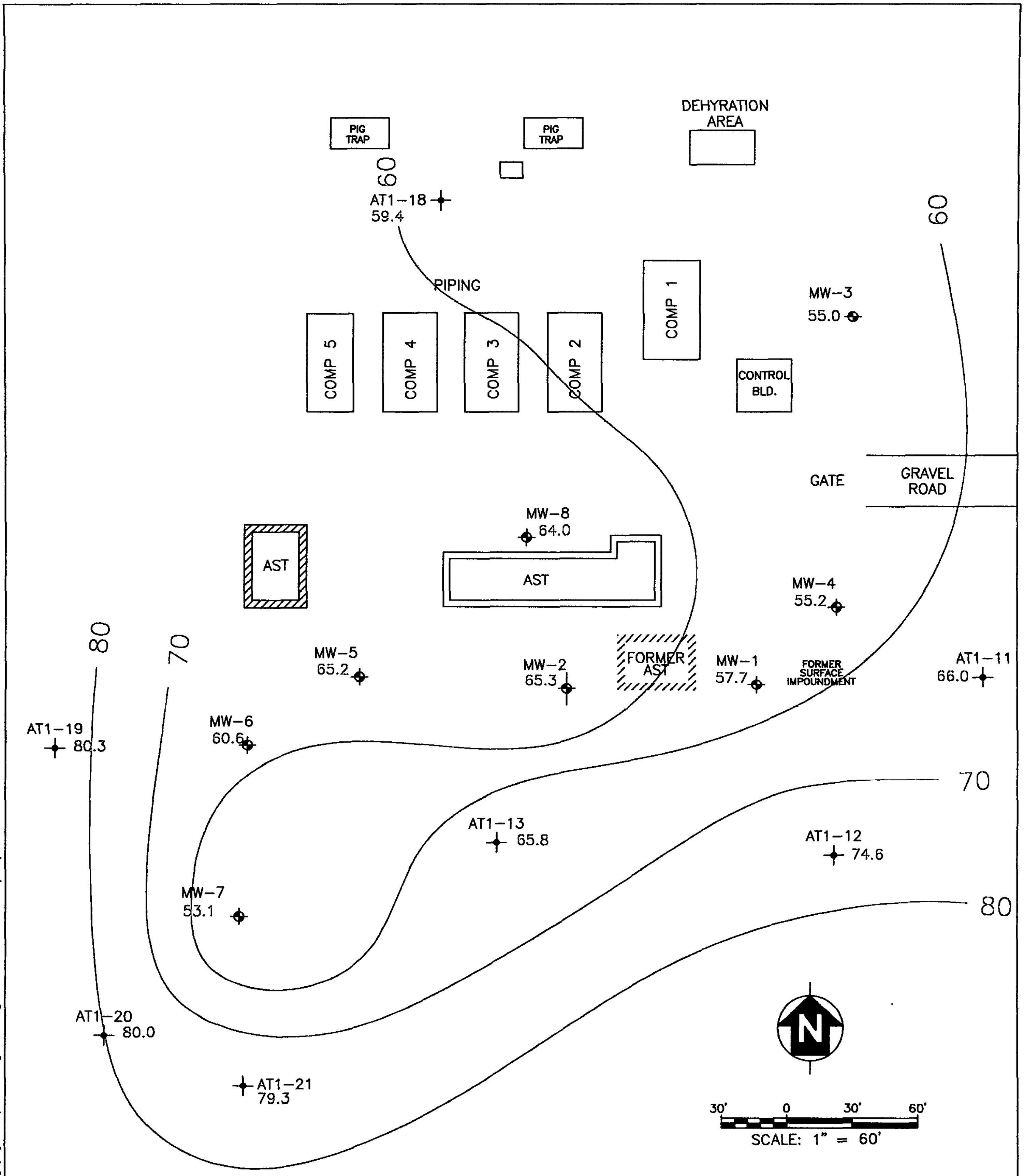


LEGEND

AT1-21 SOIL BORING

MW-7 MONITORING WELL

CONTAINMENT WALL

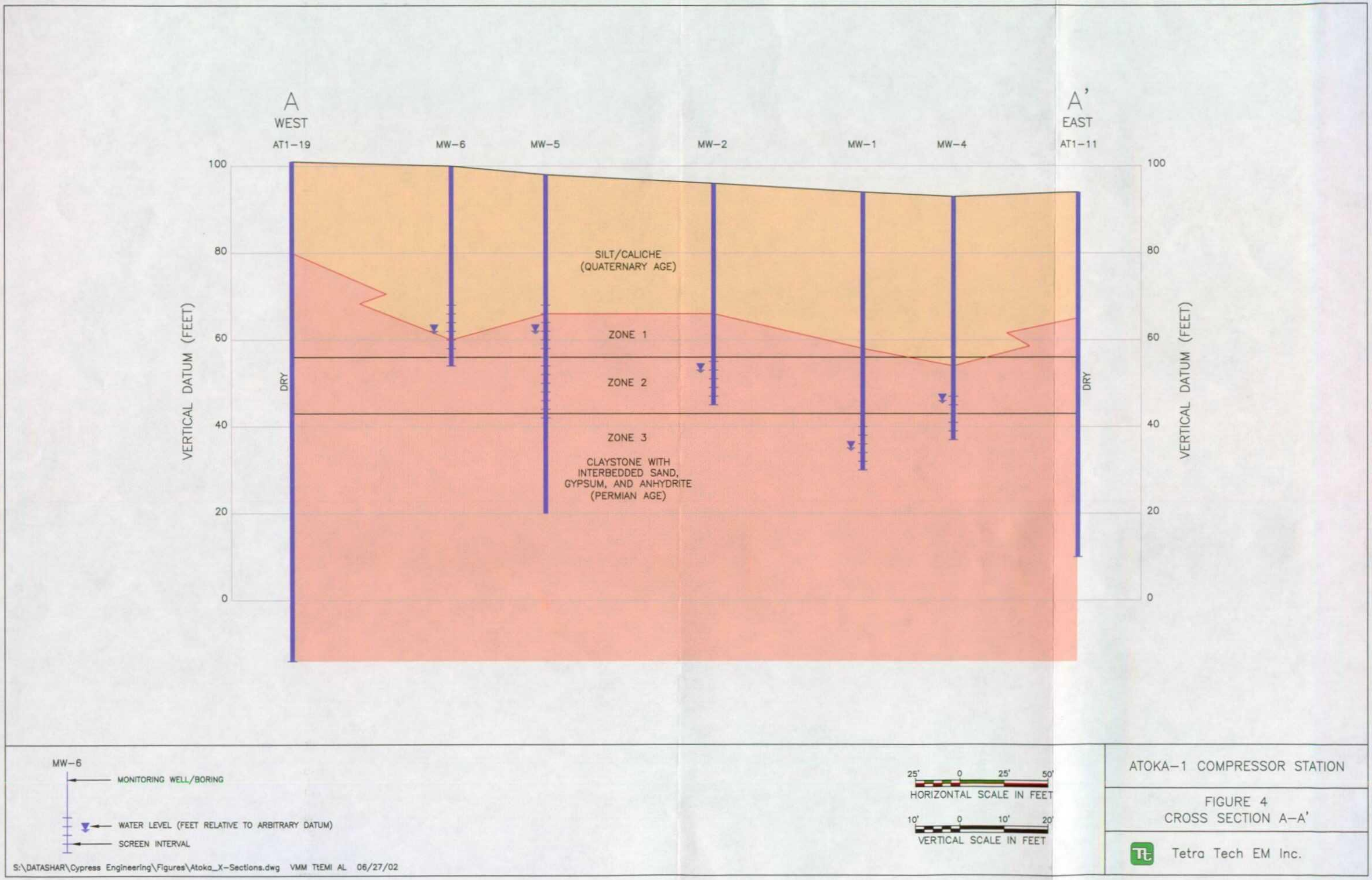
—60— UPPER CLAY CONTACT CONTOUR (FEET)

AT1-21 79.3 UPPER CLAY CONTACT (FEET)

ATOKA-1 COMPRESSOR STATION

FIGURE 3
ELEVATION OF UPPER CLAY CONTACT

Tetra Tech EM Inc.


A
WEST
A'
EAST
AT1-19
MW-6
MW-5
MW-2
MW-1
MW-4
AT1-11
100
80
60
40
20
0
VERTICAL DATUM (FEET)
SILT/CALICHE
(QUATERNARY AGE)
ZONE 1
ZONE 2
ZONE 3
CLAYSTONE WITH
INTERBEDDED SAND,
GYPSUM, AND ANHYDRITE
(PERMIAN AGE)
DRY
DRY
MW-6
MONITORING WELL/BORING
WATER LEVEL (FEET RELATIVE TO ARBITRARY DATUM)
SCREEN INTERVAL
25' 0 25' 50'
HORIZONTAL SCALE IN FEET
10' 0 10' 20'
VERTICAL SCALE IN FEET
ATOKA-1 COMPRESSOR STATION
FIGURE 4
CROSS SECTION A-A'
Tetra Tech EM Inc.
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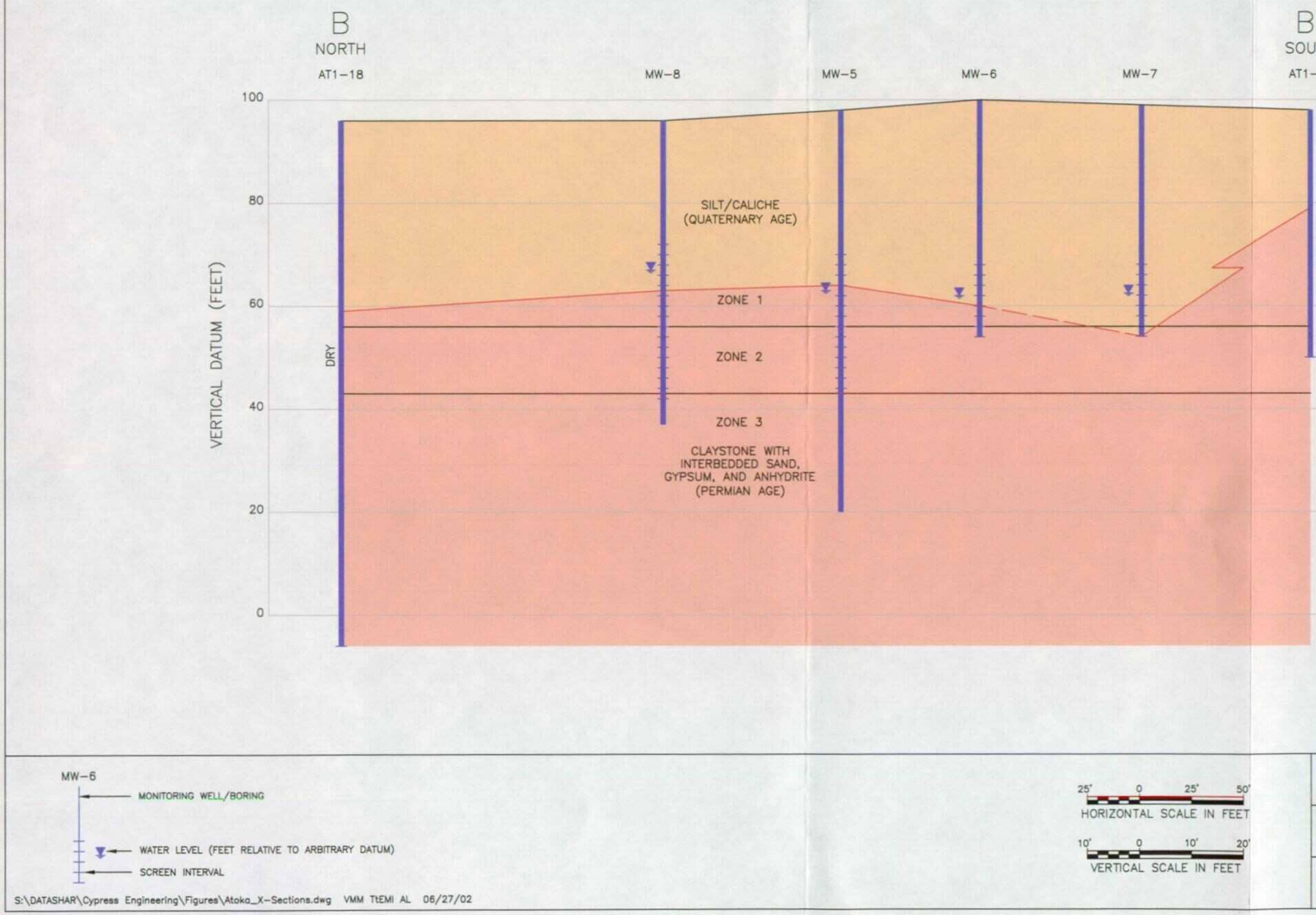

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ATOKA-1 COMPRESSOR STATION

FIGURE 5
CROSS SECTION B-B'

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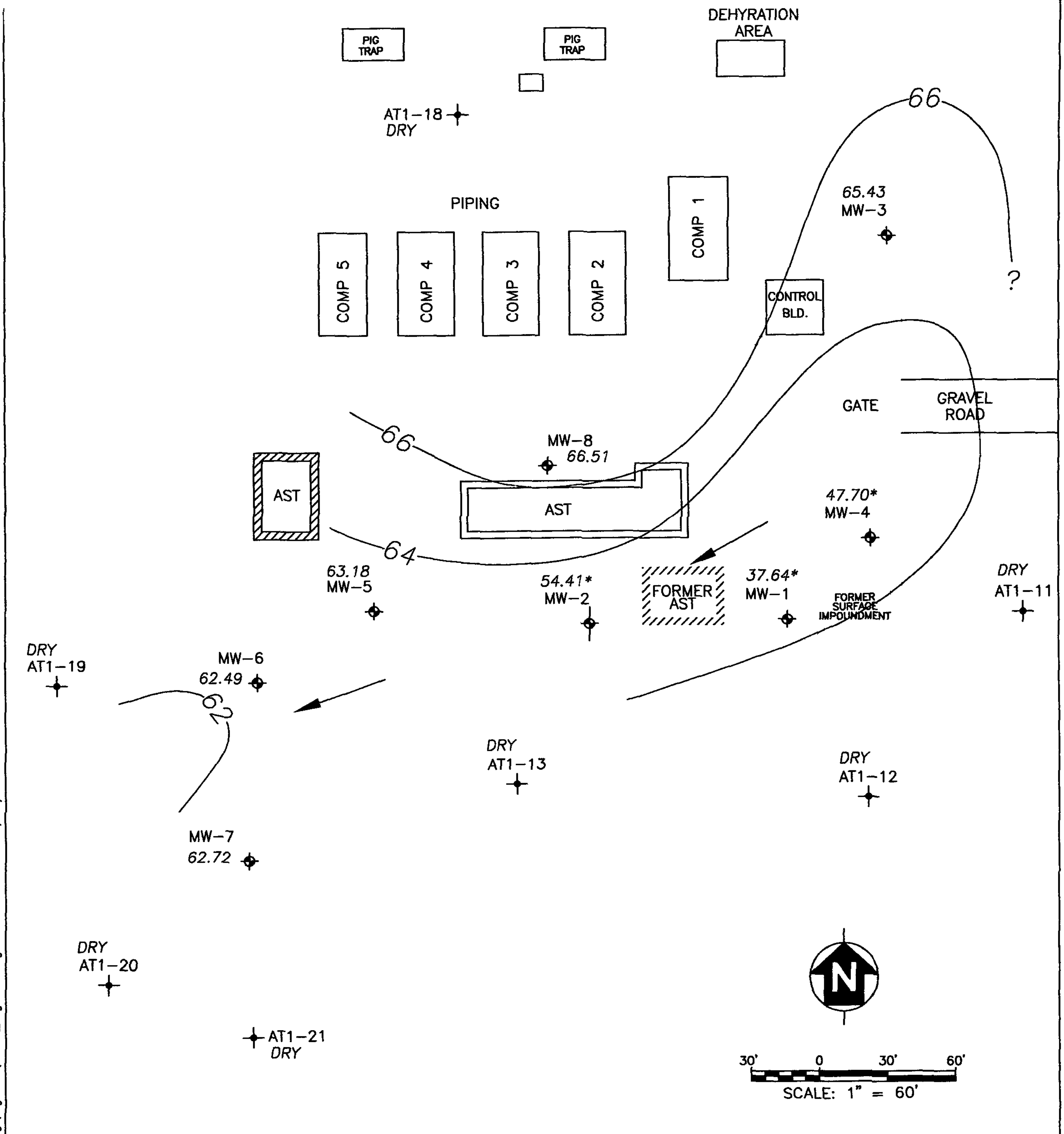

LEGEND

AT1–21	SOIL BORING	—66—	GROUNDWATER LEVEL CONTOUR (FEET)
MW–7	MONITORING WELL	←	ESTIMATED DIRECTION OF GROUNDWATER FLOW
▨	CONTAINMENT WALL	MW–5 63.18	GROUNDWATER LEVEL (FEET)
		*	WELL COMPLETED IN LOWER WATER–BEARING ZONE

ATOKA–1 COMPRESSOR STATION

FIGURE 6
POTENTIOMETRIC GROUNDWATER SURFACE ELEVATIONS
MARCH 1, 2002

Tetra Tech EM Inc.

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Figure 7 Soil Vapor Extraction Emissions
Atoka-1 Compressor Station

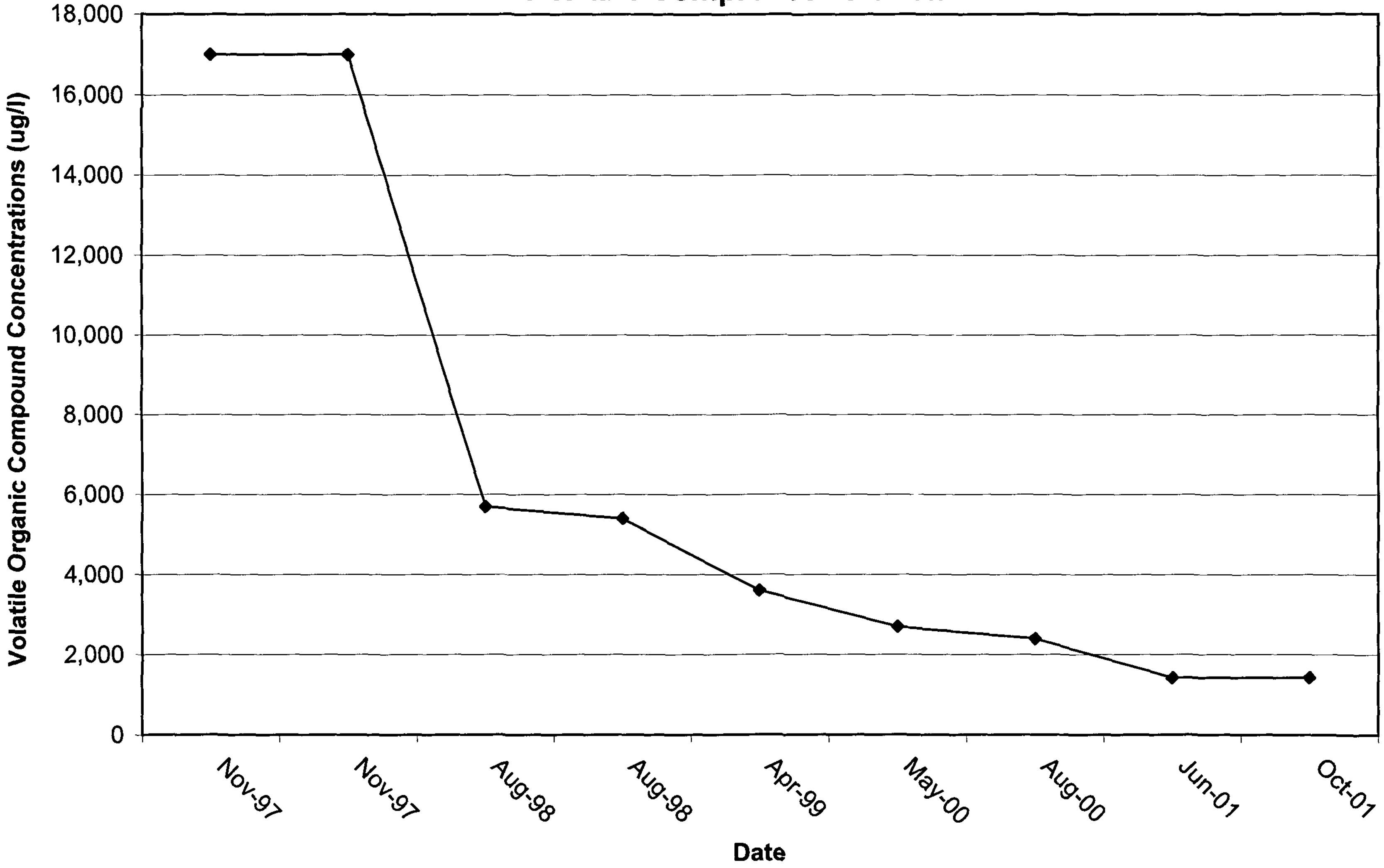
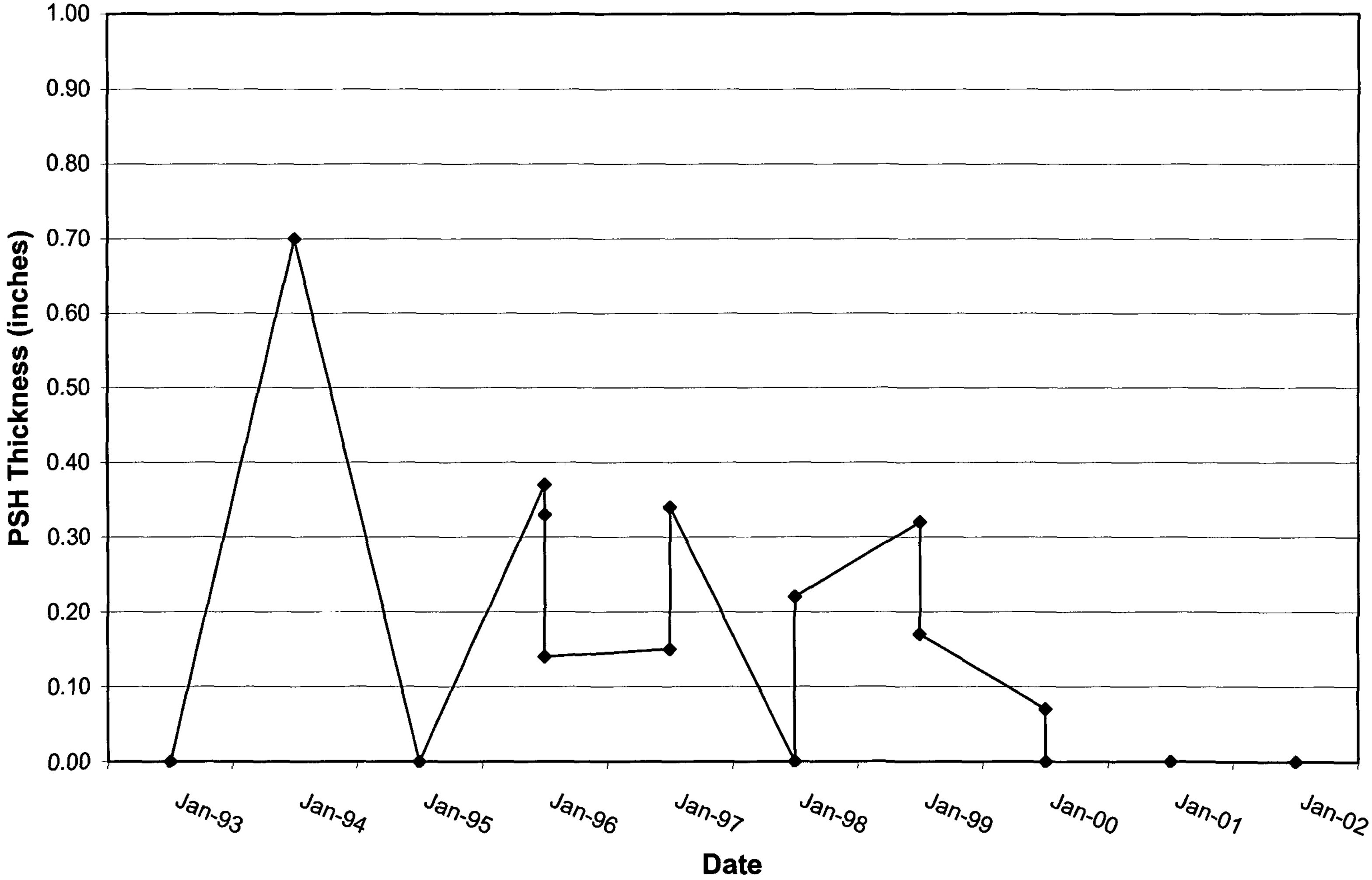
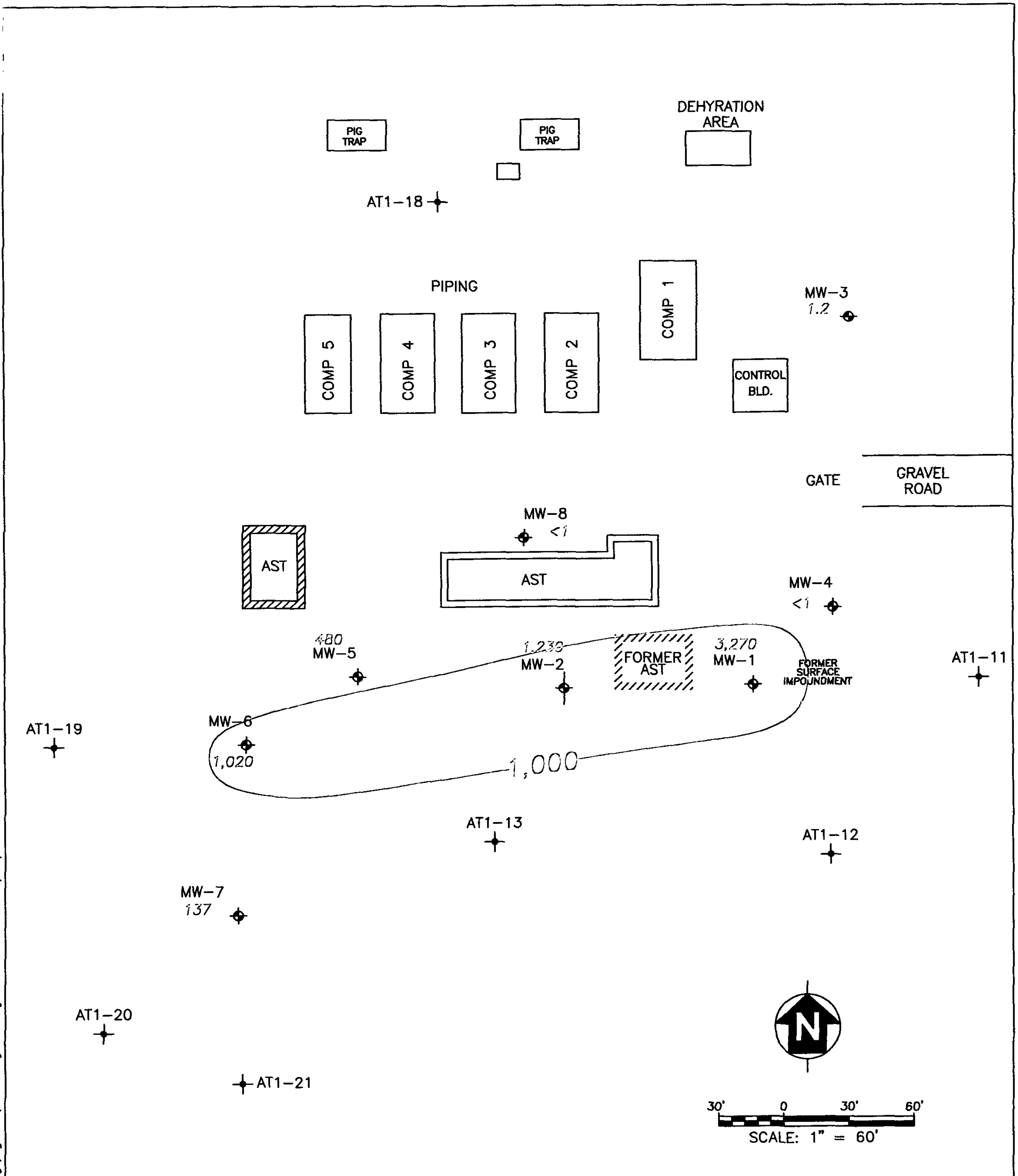


Figure 8 Phase-Separated Hydrocarbons in Monitor Well MW-1
Atoka-1 Compressor Station





LEGEND

AT1-21	SOIL BORING
MW-7	MONITORING WELL
(hatched)	CONTAINMENT WALL
480 MW-5	BENZENE CONCENTRATION IN ug/L

ATOKA-1 COMPRESSOR STATION

FIGURE 9
DISTRIBUTION OF BENZENE IN GROUNDWATER
MARCH 1, 2002

Tetra Tech EM Inc.

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Figure 10 Benzene and BTEX Trends for Monitor Well MW-2
Atoka-1 Compressor Station

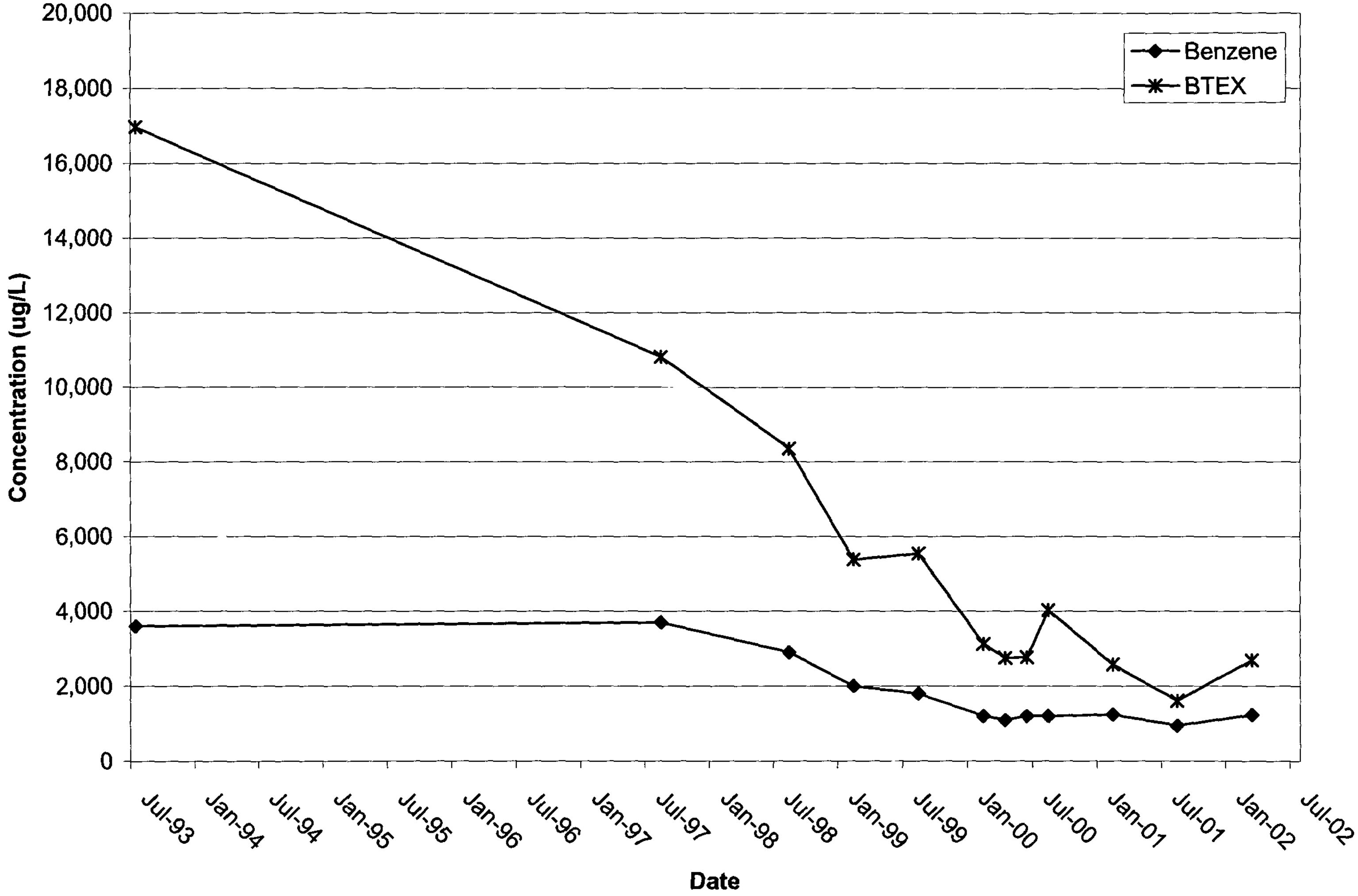


Figure 11 Benzene and BTEX Trends for Monitor Well MW- 5
Atoka-1 Compressor Station

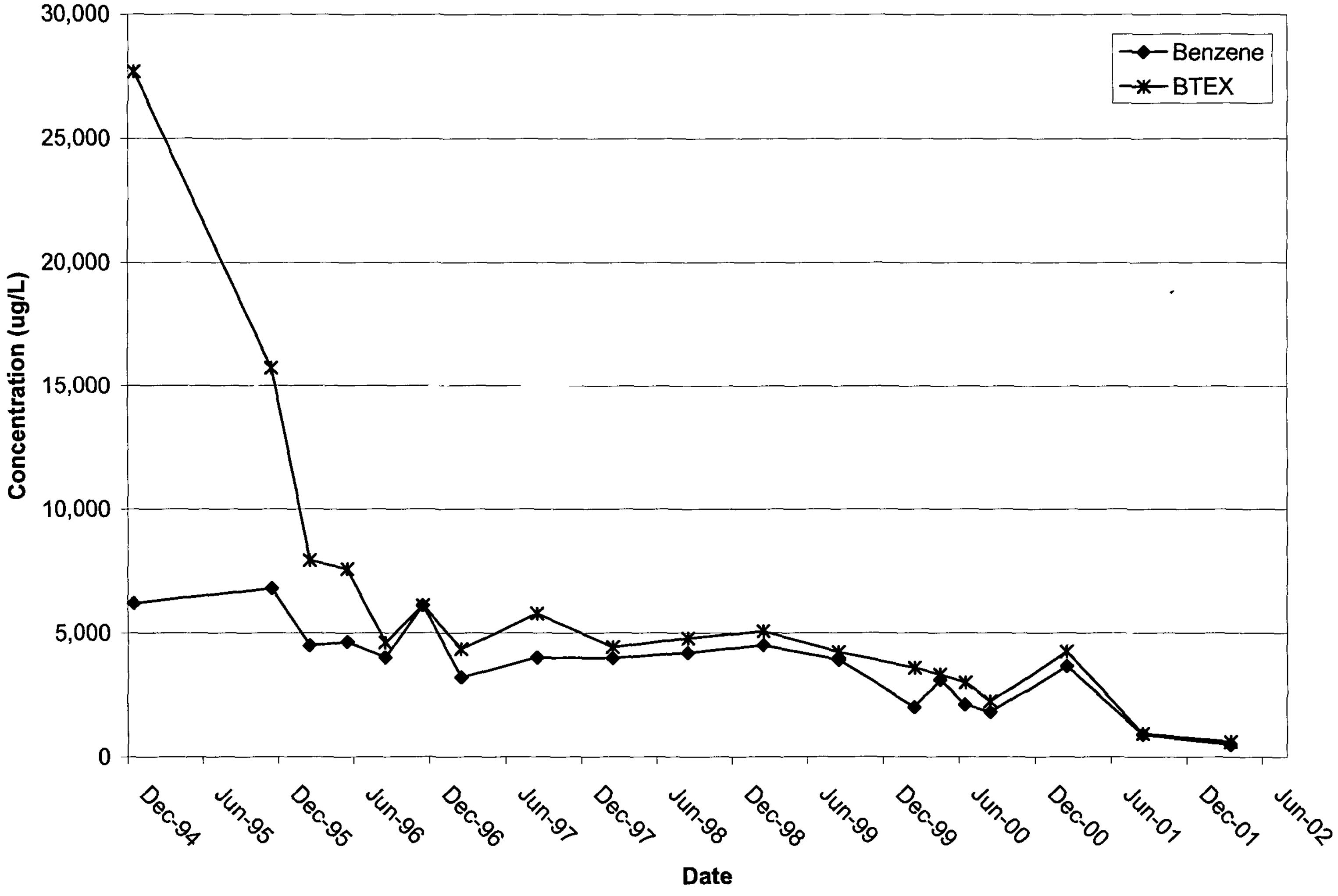


Figure 12 Benzene and BTEX Trends for Monitor Well MW- 6
Atoka-1 Compressor Station

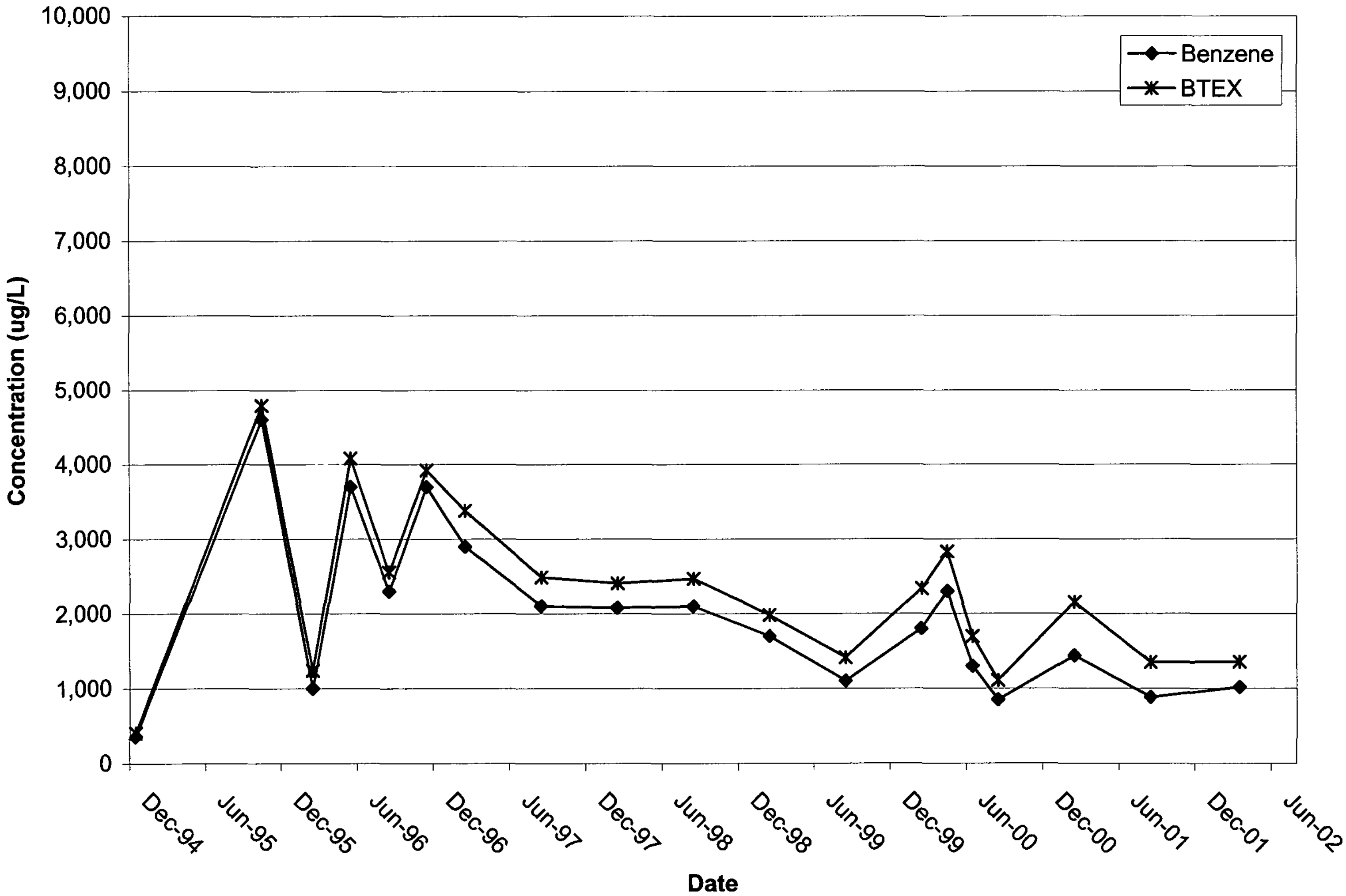


TABLE 1
INORGANIC WATER QUALITY
ATOKA-1 COMPRESSOR STATION

Monitor Well	Date of Collection	Sulfate (mg/L)	Chloride (mg/L)	Total Dissolved Solids (mg/L)
MW-1	--	--	--	7700
MW-2	--	--	--	5800
MW-3	12/2/94	4900	470	5800
MW-4	12/2/94	1900	170	4600
MW-5	12/2/94	1400	530	--
MW-6	12/2/94	940	420	--
MW-7	12/2/94	1100	350	--
MW-8	12/2/94	2100	610	4800
Average Concentration		*2057*	*425*	*5067*

mg/L = milligram-per-liter

TABLE 2
HISTORICAL ANALYTICAL RESULTS
ATOKA-1 COMPRESSOR STATION

Field Measured Parameters						BTEX Concentration - (ug/L)				
Well	Sampling Date	DO (mg/l)	pH (Units)	Temp. (C)	Conductivity (ms/cm)	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX
NMWQCC Standard		none	6-9	none	none	10	750	750	620	2130
MW-1	**Prior to 2/20/01 sampling event the well contained PSH**									
	02/20/01	0.0	6.7	21.9	5940	**2,960**	**1,090**	**1,040**	**7,230**	12320
	08/13/01	1.3	6.88	22.1	6240	**2,850**	**1,030**	**1,050**	**6,510**	11440
	03/01/02	-	-	-	-	**3,270**	671	**874**	**6,240**	11055
MW-2	07/21/93	-	-	-	-	**3,600**	**9,800**	400	**3,170**	16970
	08/04/97	0.0	6.95	22.2	3760	**3,700**	**4,900**	620	**1,600**	10820
	08/06/98	-	-	-	-	**2,900**	**3,600**	550	**1,300**	8350
	02/12/99	1.0	7.18	18.4	3790	**2,000**	**2,300**	330	**750**	5380
	08/12/99	-	-	-	-	**1,800**	**2,500**	350	**890**	5540
	02/13/00	-	-	-	-	**1,200**	**1,200**	270	460	3130
	04/23/00	-	-	-	-	**1,100**	**970**	250	430	2750
	06/20/00	-	-	-	-	**1,200**	**1,000**	220	350	2770
	08/16/00	2.6	7.19	21.3	3300	**1,200**	**1,900**	280	**650**	4030
	02/20/01	-	7.22	21.0	3340	**1,240**	745	138	451	2574
	08/13/01	1.3	7.38	21.0	3570	**951**	390	69.1	201.5	1612
	03/01/02	-	-	-	-	**1,230**	**983**	95.5	381	2690
MW-3	07/21/93	-	-	-	-	7	<2	6	<2	13
	12/02/94	-	-	-	-	**14**	<2	<2	<4	14
	10/30/95	-	-	-	-	8.8	<0.5	<0.5	<0.5	8.8
	02/23/96	-	7.58	19.9	4800	6	3	<2	<2	9
	05/14/96	-	7.27	25.7	5380	6	<2	<2	<2	6
	08/12/96	-	7.25	27.1	5070	8	<2	<2	<2	8
	11/11/96	-	7.17	18.8	-	<2	<2	<2	<2	<2
	02/03/97	-	-	-	-	<2	<2	<2	<2	<2
	08/04/97	-	7.22	23.2	6130	7.4	<2	<2	<2	7
	02/23/98	3.5	7.32	19.6	5770	6.93	< 5.00	< 5.00	< 5.00	6.93
	08/05/98	3.7	7.21	20.1	6160	1.4	< 1.0	< 1.0	< 1.0	1
	02/12/99	3.4/3.4	7.36	18	6130	2	< 1.0	< 1.0	< 1.0	2
	08/12/99	6.7	7.35	20.5	6020	3	<2	<2	<2	3
	02/13/00	3.9	7.21	20	6270	7.2	<1	<1	<1	7.2
	08/16/00	5.1	7.33	21.5	5560	3	<2	<2	<4	3
	02/20/01	4.8	7.30	19.4	5500	3.16	<0.500	<0.500	<0.10	3.16
	08/13/01	4.4	7.51	20.3	5930	<1	<1	<1	<2	<2
	03/01/02	3.5	7.24	21.6	6240	1.2	<1	<1	<1	1.2

TABLE 2
HISTORICAL ANALYTICAL RESULTS
ATOKA-1 COMPRESSOR STATION

Field Measured Parameters						BTEX Concentration - (ug/L)				
Well	Sampling Date	DO (mg/l)	pH (Units)	Temp. (C)	Conductivity (ms/cm)	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX
NMWQCC Standard		none	6-9	none	none	10	750	750	620	2130
MW-4	07/21/93	-	-	-	-	**61**	4	20	68	153
	12/02/94	-	-	-	-	**230**	<2	60	130	420
	10/30/95	-	-	-	-	**240**	2.1	<0.5	92	334.1
	02/23/96	-	6.61	20.2	3500	**83**	5	<2	36	124
	05/14/96	-	6.75	27.4	4140	**171**	17	<2	54	242
	08/12/96	-	6.6	26.9	3790	**170**	11	7	43	231
	11/11/96	-	6.66	19.1	-	**180**	10	<2	120	310
	02/03/97	-	-	-	-	**170**	<2	<2	<2	170
	08/04/97	-	6.68	24.0	4470	**130**	3.3	<2	4.7	138
	02/23/98	2.0	6.74	20.8	3930	**13.9**	< 5.00	< 5.00	< 5.00	14
	08/06/98	2.5	6.74	19.8	4400	3.7	< 1.0	< 1.0	< 1.0	4
	02/12/99	3.7	6.87	18.7	4250	< 1.0	< 1.0	< 1.0	< 1.0	<1
	08/12/99	5.25/5.0	6.92	21.0	3820	<2	<2	<2	<2	<2
	02/13/00	6.3	6.95	20.3	3960	<1	<1	<1	<1	<1
	08/16/00	6.5	6.99	22.6	3560	<1	<2	<2	<4	<4
	02/20/01	5.6	7.03	21.5	3390	<0.500	<0.500	<0.500	<0.10	<.5
	08/13/01	7.4	7.27	21.1	3790	1.54	<1	<1	<2	1.54
	03/01/02	6.9	7.02	22.6	4300	<1	<1	<1	<1	<1
MW-5	12/02/94	-	-	-	-	**6,200**	**13,000**	**1,100**	**7,400**	27700
	11/02/95	-	-	-	-	**6,800**	**4,500**	**930**	**3,500**	15730
	02/23/96	-	6.92	21.8	4110	**4,490**	**1,820**	388	**1,235**	7933
	05/14/96	-	7.02	26.6	5380	**4,630**	573	**775**	**1,600**	7578
	08/12/96	-	7.04	25.3	3630	**4,000**	<82	500	99	4599
	11/11/96	-	7.12	19.6	-	**6,100**	<200	430	<200	6100
	02/03/97	-	-	-	-	**3,200**	<100	590	550	4340
	08/04/97	3.5	7.05	23.5	4580	**4,000**	**1,100**	420	250	5770
	02/23/98	1.6	7.12	19.8	5110	**3,980**	52.5	373	15.0	4421
	08/06/98	1.6	7.04	21.3	5530	**4,200**	130	390	60	4780
	02/12/99	4.9/3.2	7.18	18.5	5150	**4,500**	280	240	46	5066
	08/12/99	2.0	7.1	20.7	5310	**3,900**	68	220	31	4219
	02/13/00	2.6	6.86	20.3	4480	**2,000**	**750**	72	**760**	3582
	04/23/00	-	-	-	-	**3,100**	60	110	45	3315
	06/20/00	-	-	-	-	**2,100**	130	72	**690**	2992
	08/16/00	2.7	6.92	21.7	4170	**1,800**	240	100	91	2231
	02/20/01	-	7.04	21.7	4490	**3,650**	349	145	93.5	4238
	08/13/01	1.2	7.30	21.6	4360	**900**	17.7	5.86	15.68	939
	03/01/02	1.3	6.89	22.0	5050	**480**	83	6.7	38.1	608
	3/1/2002*	-	-	-	-	**434**	122	9.8	57.4	623

TABLE 2
HISTORICAL ANALYTICAL RESULTS
ATOKA-1 COMPRESSOR STATION
Page 3 of 4

Field Measured Parameters						BTEX Concentration - (ug/L)				
Well	Sampling Date	DO (mg/l)	pH (Units)	Temp. (C)	Conductivity (ms/cm)	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX
NMWQCC Standard		none	6-9	none	none	10	750	750	620	2130
MW-6	12/02/94	-	-	-	-	**360**	<10	50	<20	410
	10/30/95	-	-	-	-	**4,600**	<5.0	190	<5.0	4790
	02/23/96	-	7.34	21.1	3330	**1,000**	9	222	9	1240
	05/14/96	-	7.01	25.2	2660	**3,700**	56	234	88	4078
	08/12/96	-	6.67	26.4	4650	**2,300**	8	250	<15	2558
	11/11/96	-	7.38	18.9	-	**3,700**	<10	220	<10	3920
	02/03/97	-	-	-	-	**2,900**	<100	250	230	3380
	08/04/97	3.9	6.99	24.2	2720	**2,100**	<100	390	<100	2490
	02/23/98	3.1	7.2	20.2	2980	**2,080**	< 5.00	320	5.71	2406
	08/06/98	4.9	7.14	20.7	3250	**2,100**	< 5.0	370	< 5.0	2470
	02/12/99	2.3	7.29	19.1	4330	**1,700**	< 1.0	280	2	1982
	08/12/99	4.5	7.32	20.8	3460	**1,100**	<2	310	2	1412
	02/13/00	3.2	7.16	20.1	3850	**1,800**	<25	460	77	2337
	04/23/00	-	-	-	-	**2,300**	20	410	100	2830
	06/20/00	-	-	-	-	**1,300**	18	280	96	1694
	08/16/00	-	-	-	-	**850**	3	180	75	1108
	02/20/01	3.8	7.22	27.1	2570	**1,440**	<25.0	282	433	2155
	08/13/01	5.8	7.24	27.1	2780	**885**	10.5	231	225	1352
	03/01/02	2.7	6.98	22.6	2900	**1,020**	<5	318	17.6	1356
MW-7	12/02/94	-	-	-	-	**620**	170	**1,100**	**1,100**	2990
	10/30/95	-	-	-	-	**2,200**	440	460	270	3370
	02/23/96	-	-	-	-	**832**	463	318	422	2035
	05/14/96	-	6.76	25.8	2890	**1,610**	**2,880**	649	**3,030**	8169
	08/12/96	-	6.83	27.6	3150	**850**	**850**	360	**720**	2780
	11/11/96	-	7.07	19.6	-	**720**	**970**	170	390	2250
	02/03/97	-	-	-	-	**620**	**870**	300	**1,000**	2790
	08/04/97	0.8	6.81	24.1	2830	**1,200**	710	330	490	2730
	02/23/98	0.9	6.91	21.2	2510	**860**	**770**	312	**748**	2690
	08/06/98	1.1	6.90	20.3	2610	**870**	**900**	440	**1,000**	3210
	02/12/99	1.7	6.99	18.7	2550	**970**	**820**	380	**730**	2900
	08/12/99	1.8	7.02	20.9	2410	**860**	**850**	420	**830**	2960
	02/13/00	3.5	7.04	20.5	2520	**650**	670	350	**740**	2410
	04/23/00	-	-	-	-	**1,200**	93	240	**690**	2223
	06/20/00	-	-	-	-	**1,100**	340	320	340	2100
	08/16/00	5	7.09	22.1	4250	**1,100**	20	310	28	1458
	02/20/01	-	7.15	21.7	4440	**1,650**	<25.0	404	<50.0	2054
	08/13/01	1.7	7.10	21.4	4660	**201**	<1	36.2	<2	237
	03/01/02	-	-	-	-	**137**	<5	6.9	5	149

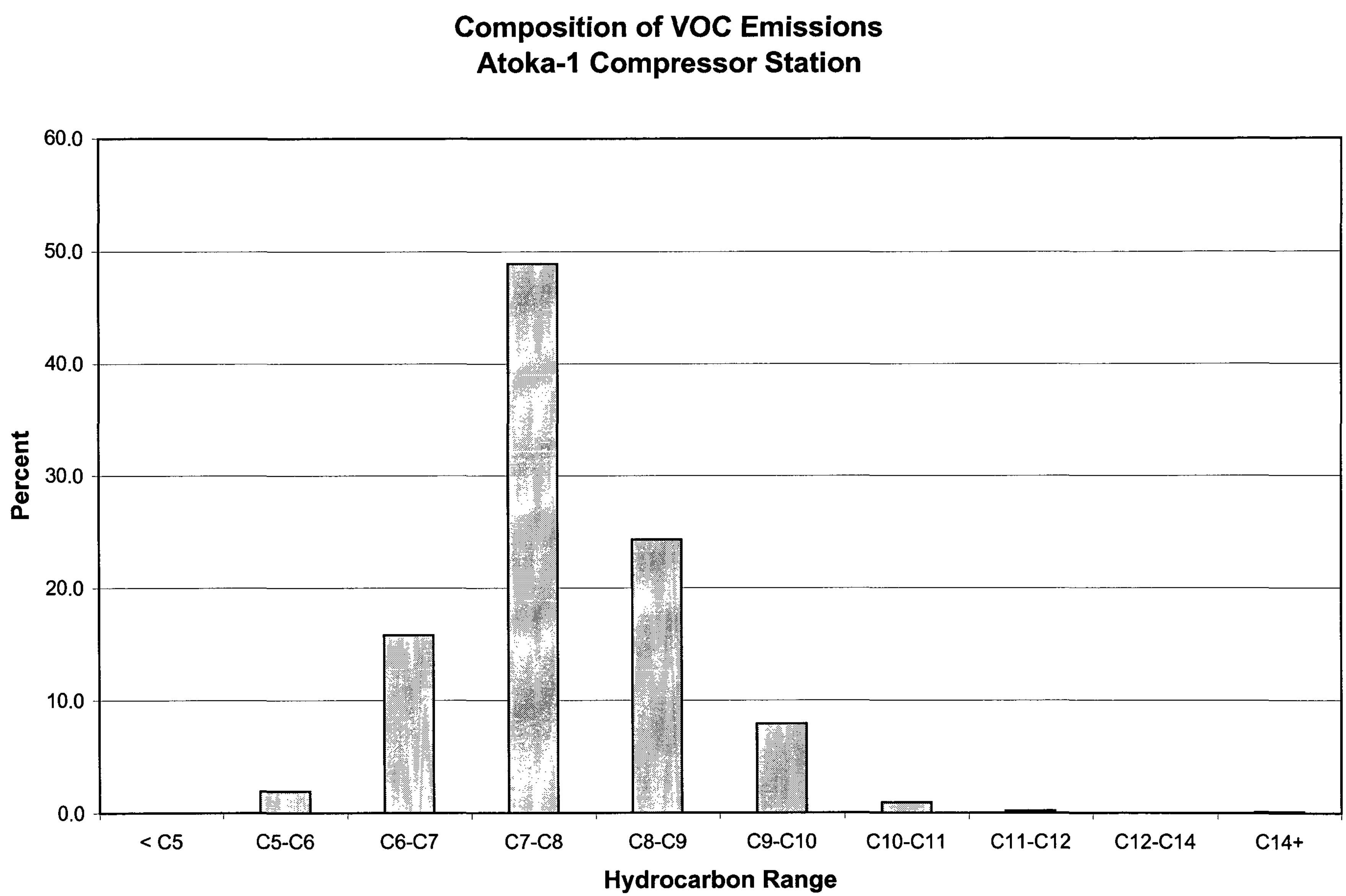
TABLE 2
HISTORICAL ANALYTICAL RESULTS
ATOKA-1 COMPRESSOR STATION

Field Measured Parameters						BTEX Concentration - (ug/L)				
Well	Sampling Date	DO (mg/l)	pH (Units)	Temp. (C)	Conductivity (ms/cm)	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX
NMWQCC Standard		none	6-9	none	none	10	750	750	620	2130
MW-8	01/01/95	-	-	-	-	<2	<2	<2	<4	<4
	10/30/95	-	-	-	-	**110**	1.3	<0.5	130	241.3
	02/23/96	-	7.15	20.9	4810	6	<2	<2	<2	6
	05/14/96	-	6.96	23.3	5260	2	<2	<2	3	5
	08/12/96	-	7.17	26.7	5370	<2	<2	<2	<3	<3
	11/11/96	-	6.93	18.8	-	**11**	<2	<2	19	30
	02/03/97	-	-	-	-	6	<2	<2	<2	6
	08/04/97	-	7.14	25.6	5920	<2	<2	<2	<2	<2
	02/23/98	3.8	7.14	20.5	5960	9.25	< 5.00	< 5.00	< 5.00	9
	08/05/98	3.8	7.14	21.3	6120	2.7	< 1.0	< 1.0	< 1.0	2.7
	02/12/99	3.5	7.16	19.3	6150	2	< 1.0	< 1.0	< 1.0	2
	08/12/99	5.3/5.0	7.14	21.3	6050	<2	<2	<2	<2	<2
	02/13/00	4.9/4.4	6.99	20.3	6140	<1	<1	<1	<1	<1
	08/16/00	4.9	7.09	21.8	5580	<1	<2	<2	<4	<4
	02/20/01	2.7	6.99	21.2	5420	<0.500	<0.500	<0.500	<0.10	<.5
	08/13/01	2.5	7.29	21.3	5920	2.81	<1	<1	<2	2.81
	03/01/02	2.8	7.04	22.4	6310	<1	<1	<1	<1	<1

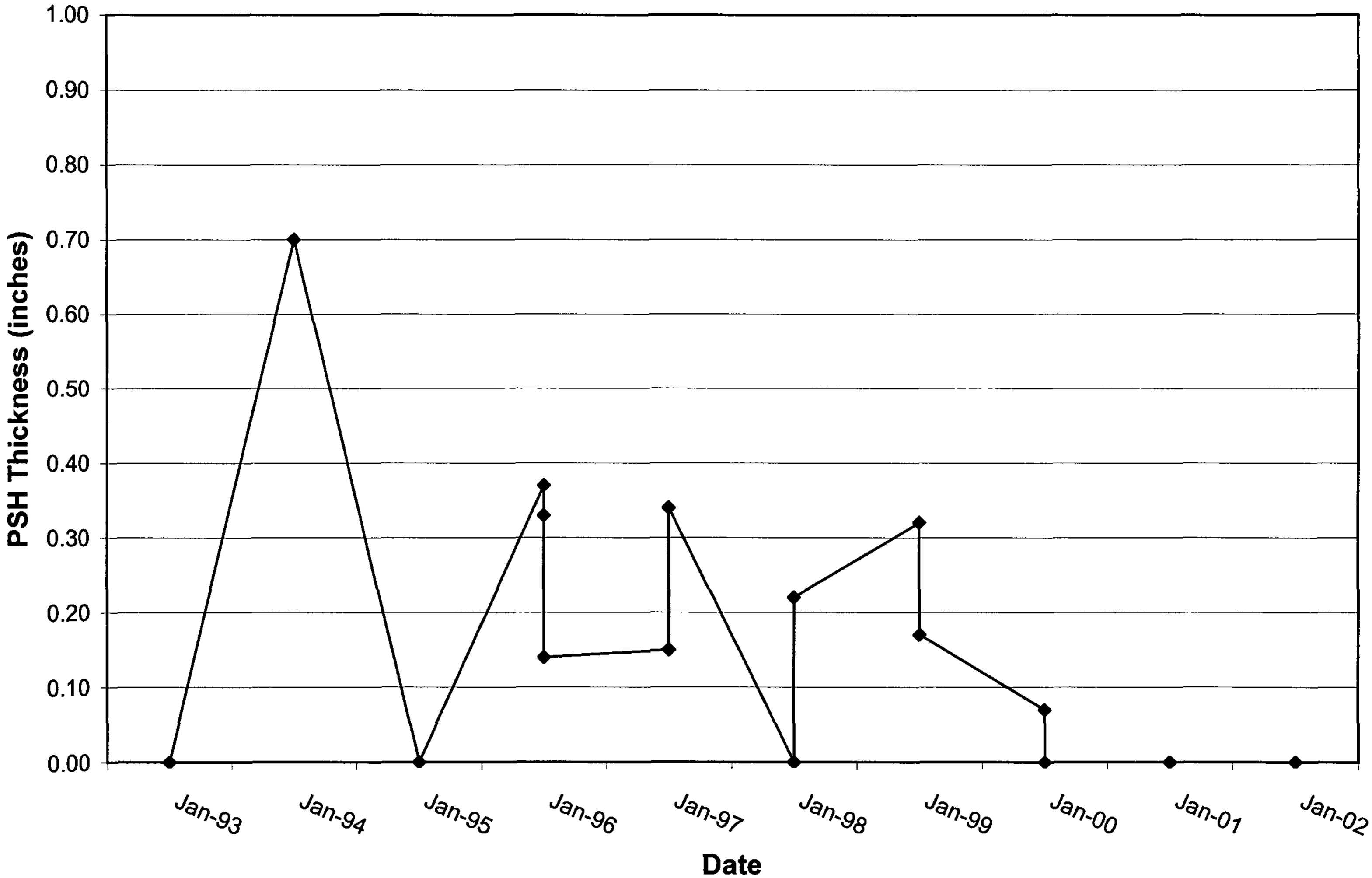
Bold indicates concentration exceeds standard
NMWQCC = New Mexico Water Quality Control Commission
DO = Dissolved oxygen
PSH = Phase-separated hydrocarbons
*Denotes duplicate sample

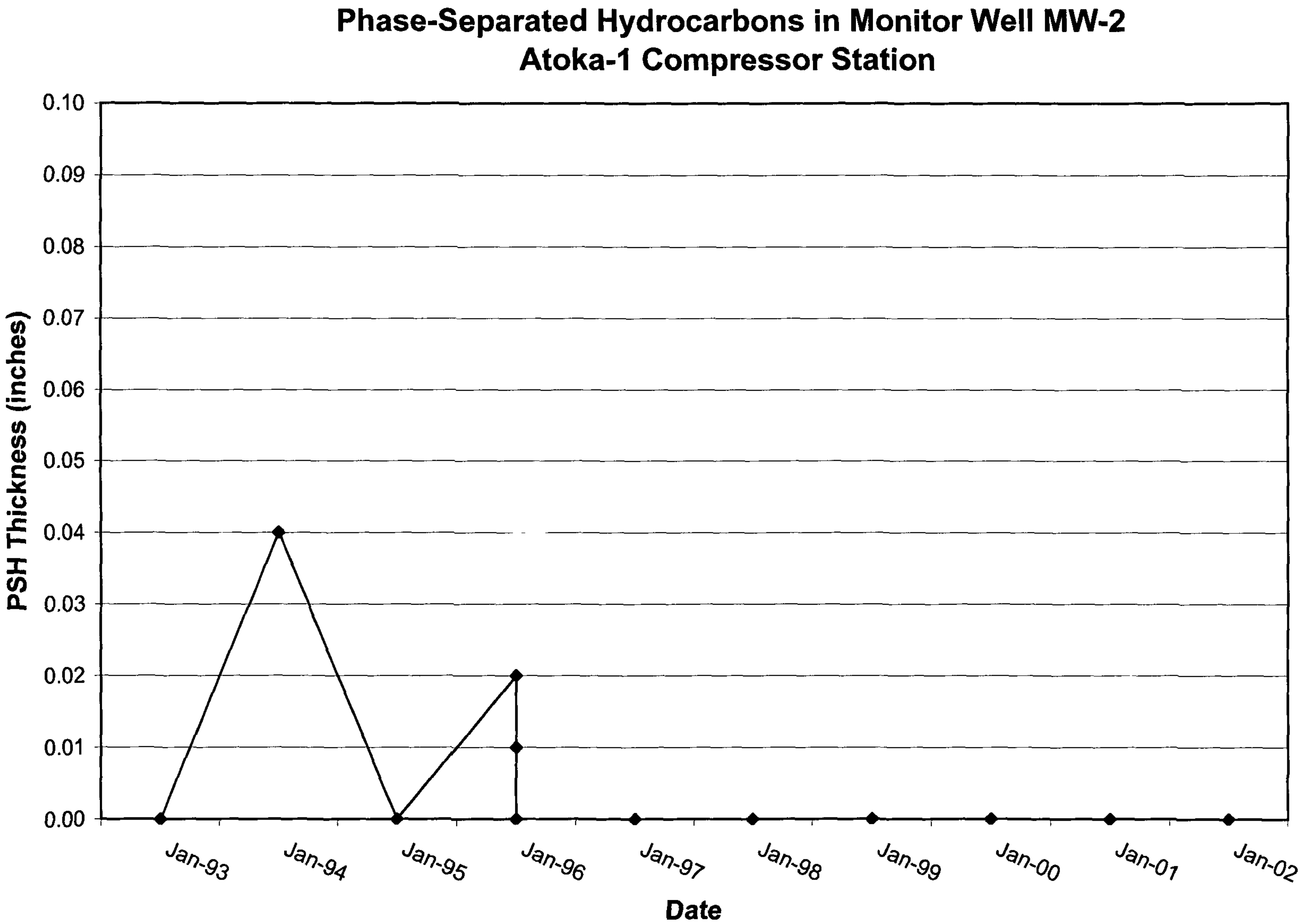
TABLE 3
ANALYTICAL RESULTS FOR MARCH 2002
ATOKA-1 COMPRESSOR STATION

Field Measured Parameters						BTEX Concentration - (ug/L)				
Well	Sampling Date	DO (mg/l)	pH (Units)	Temp. (C)	Conductivity (ms/cm)	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total BTEX
NMWQCC Standard		none	6-9	none	none	10	750	750	620	2130
MW-1	03/01/02	-	-	-	-	**3,270**	671	**874**	**6,240**	11055
MW-2	03/01/02	-	-	-	-	**1,230**	**983**	95.5	381	2690
MW-3	03/01/02	3.5	7.24	21.6	6240	1.2	<1	<1	<1	1.2
MW-4	03/01/02	6.9	7.02	22.6	4300	<1	<1	<1	<1	<1
MW-5	03/01/02	1.3	6.89	22.0	5050	**480**	83	6.7	38.1	608
MW-6	03/01/02	2.7	6.98	22.6	2900	**1,020**	<5	318	17.6	1356
MW-7	03/01/02	-	-	-	-	**137**	<5	6.9	5	149
MW-8	03/01/02	2.8	7.04	22.4	6310	<1	<1	<1	<1	<1
Summary Statistics for Monitor Wells MW-1 through MW-8										
Minimum		1.3	6.9	21.6	2900	1	1	1	1	1.2
Maximum		6.9	7.2	22.6	6310	3270	983	874	6240	11055
Average		3.4	7.0	22.2	4960	**768**	219	163	**836**	2643
Standard Deviation		2.1	0.1	0.4	1427	1120	386	307	2188	4237

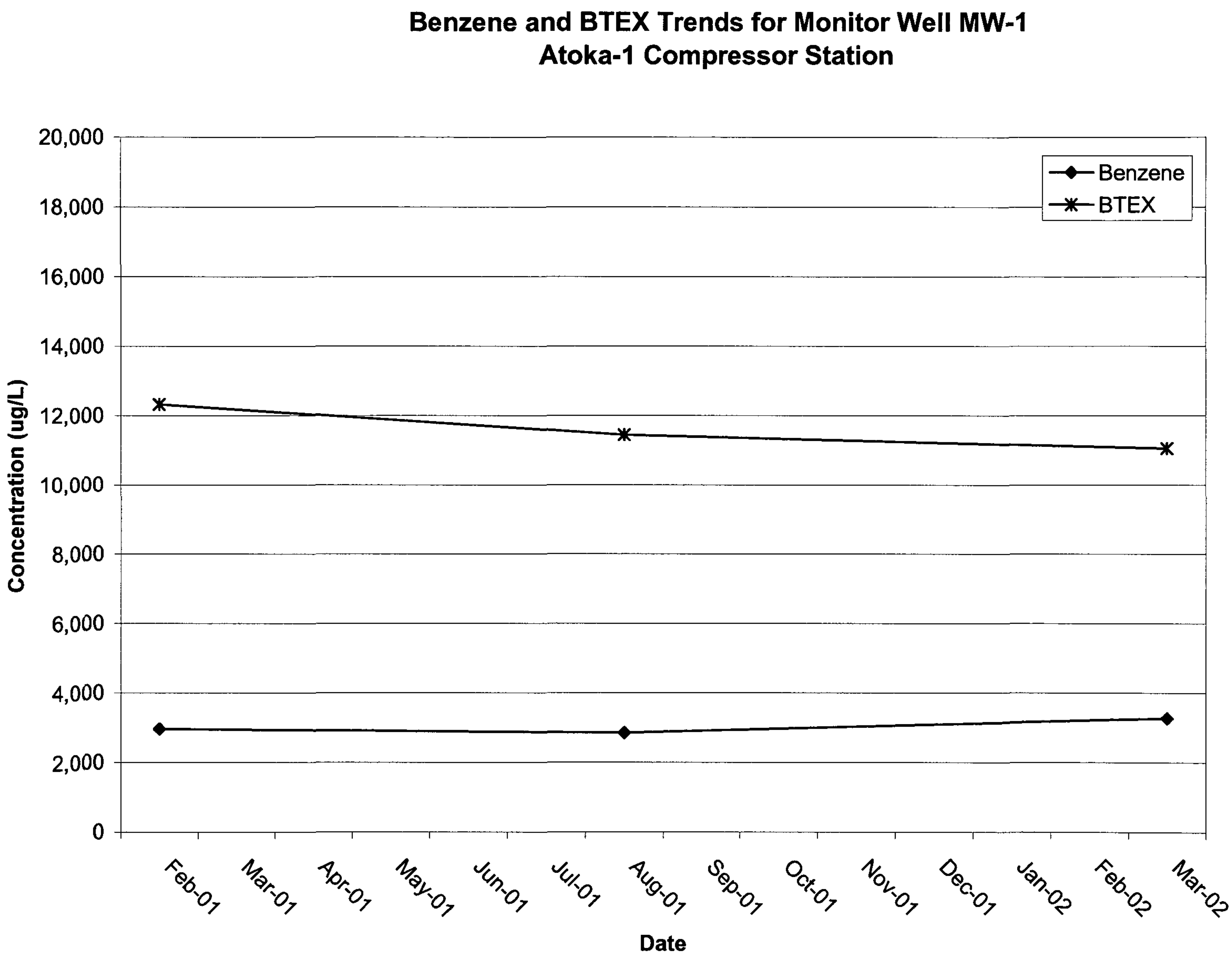

Composition of VOC Emissions
Atoka-1 Compressor Station
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Percent
< C5
C5-C6
C6-C7
C7-C8
C8-C9
C9-C10
C10-C11
C11-C12
C12-C14
C14+
Hydrocarbon Range

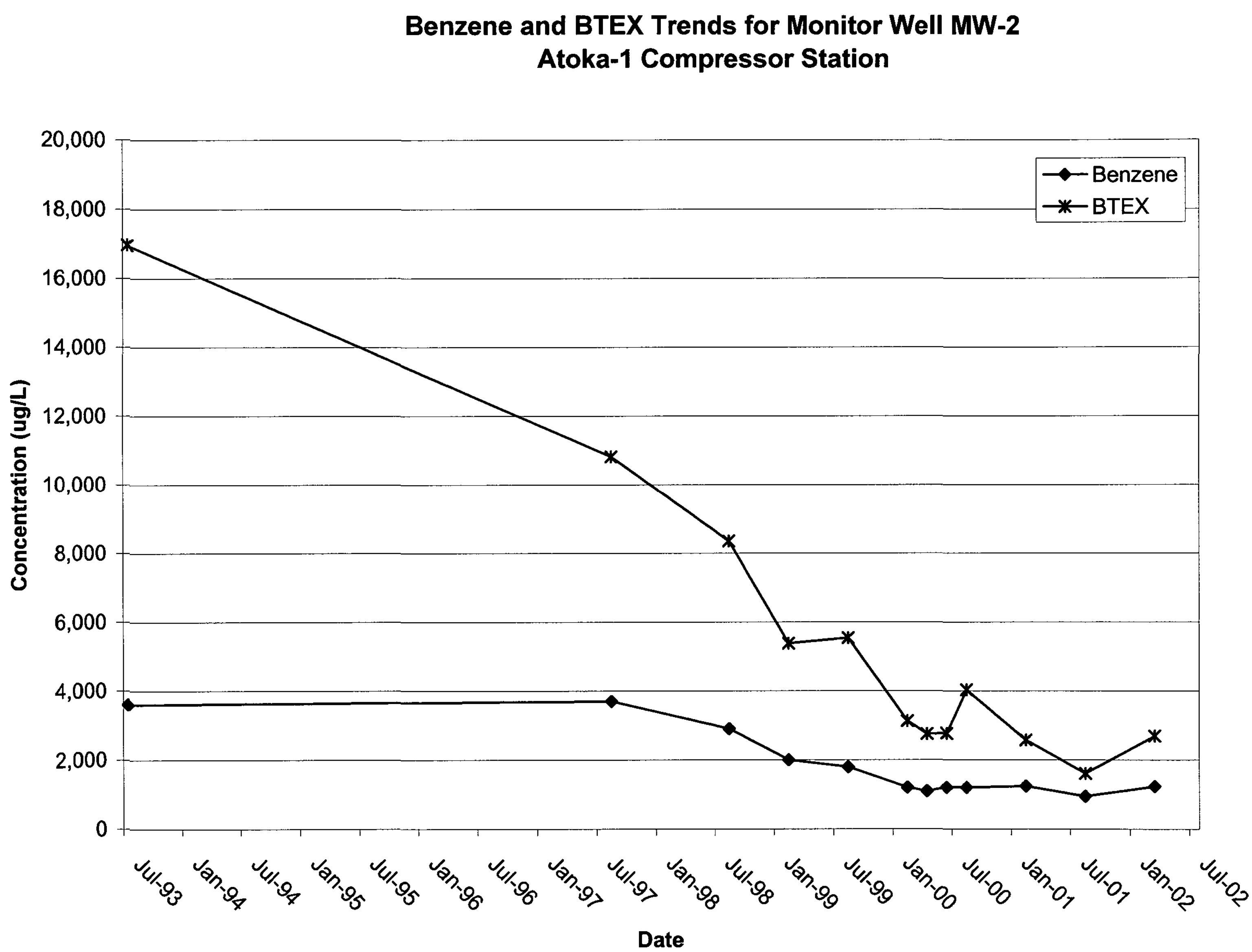
Phase-Separated Hydrocarbons in Monitor Well MW-1
Atoka-1 Compressor Station



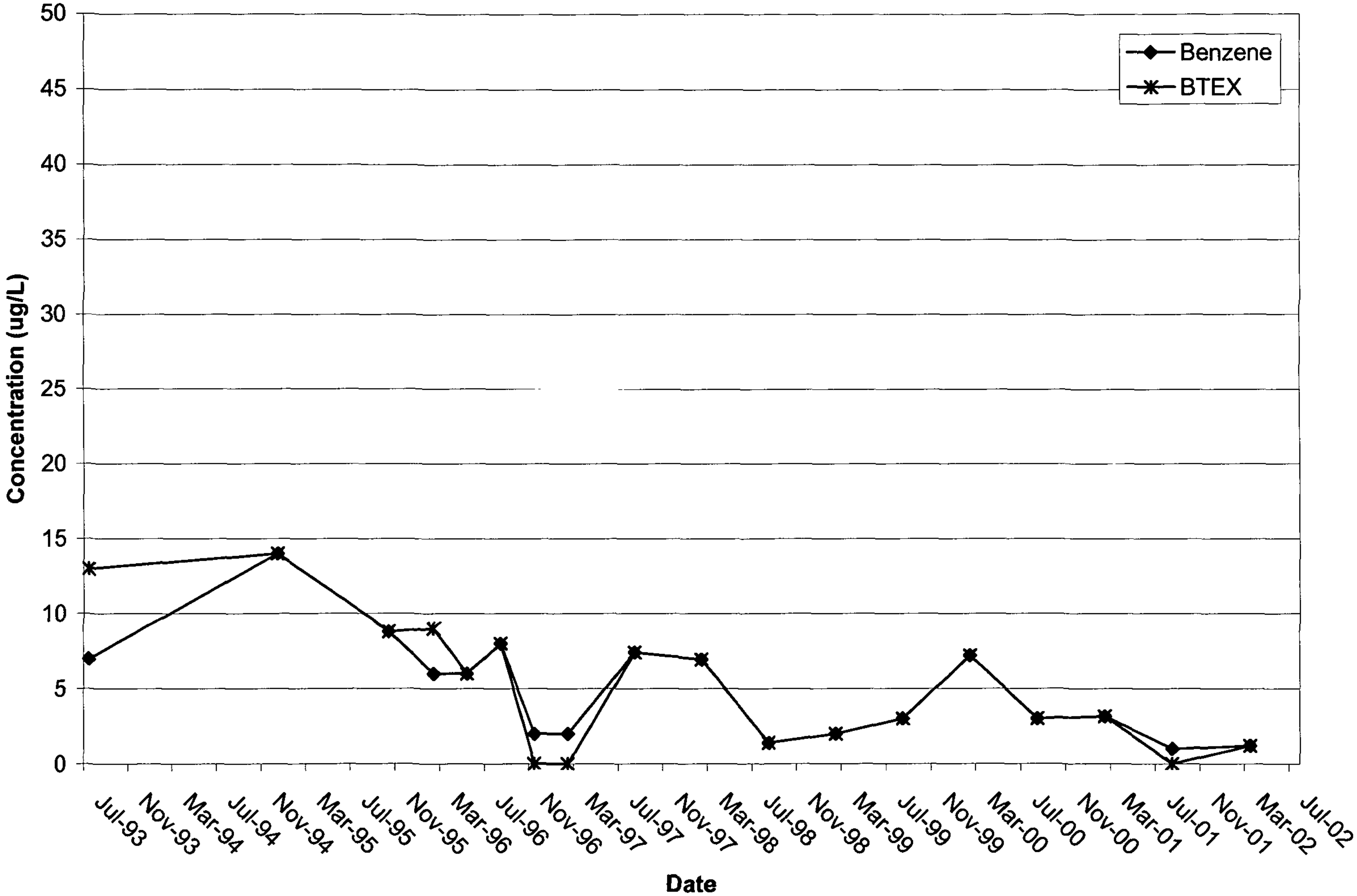


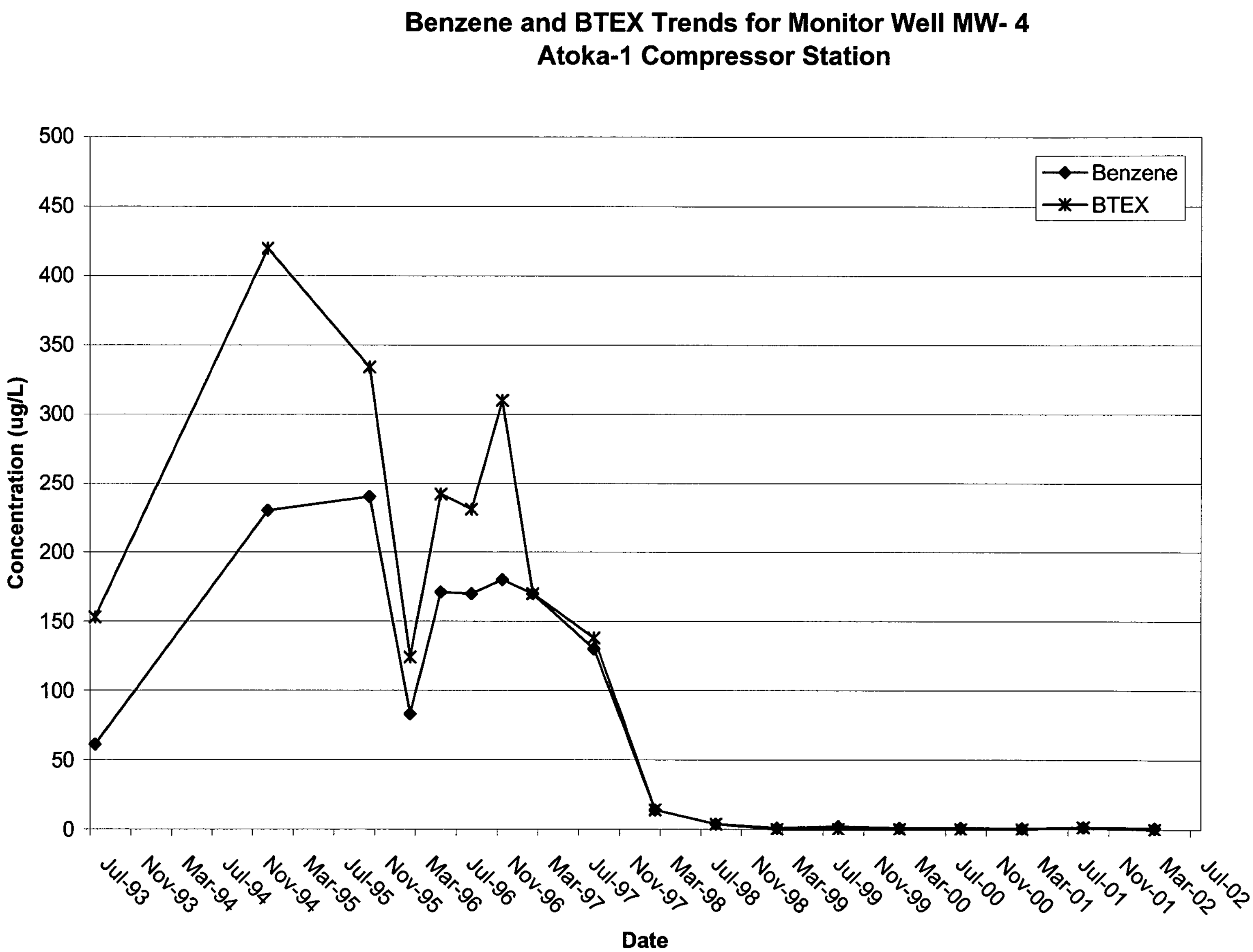
Phase-Separated Hydrocarbons in Monitor Well MW-2
Atoka-1 Compressor Station
PSH Thickness (inches)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Date


Benzene and BTEX Trends for Monitor Well MW-1
Atoka-1 Compressor Station
Benzene
BTEX
Concentration (ug/L)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Feb-01
Mar-01
Apr-01
May-01
Jun-01
Jul-01
Aug-01
Sep-01
Oct-01
Nov-01
Dec-01
Jan-02
Feb-02
Mar-02
Date


Benzene and BTEX Trends for Monitor Well MW-2
Atoka-1 Compressor Station
Benzene
BTEX
Concentration (ug/L)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Jul-93
Jan-94
Jul-94
Jan-95
Jul-95
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Date

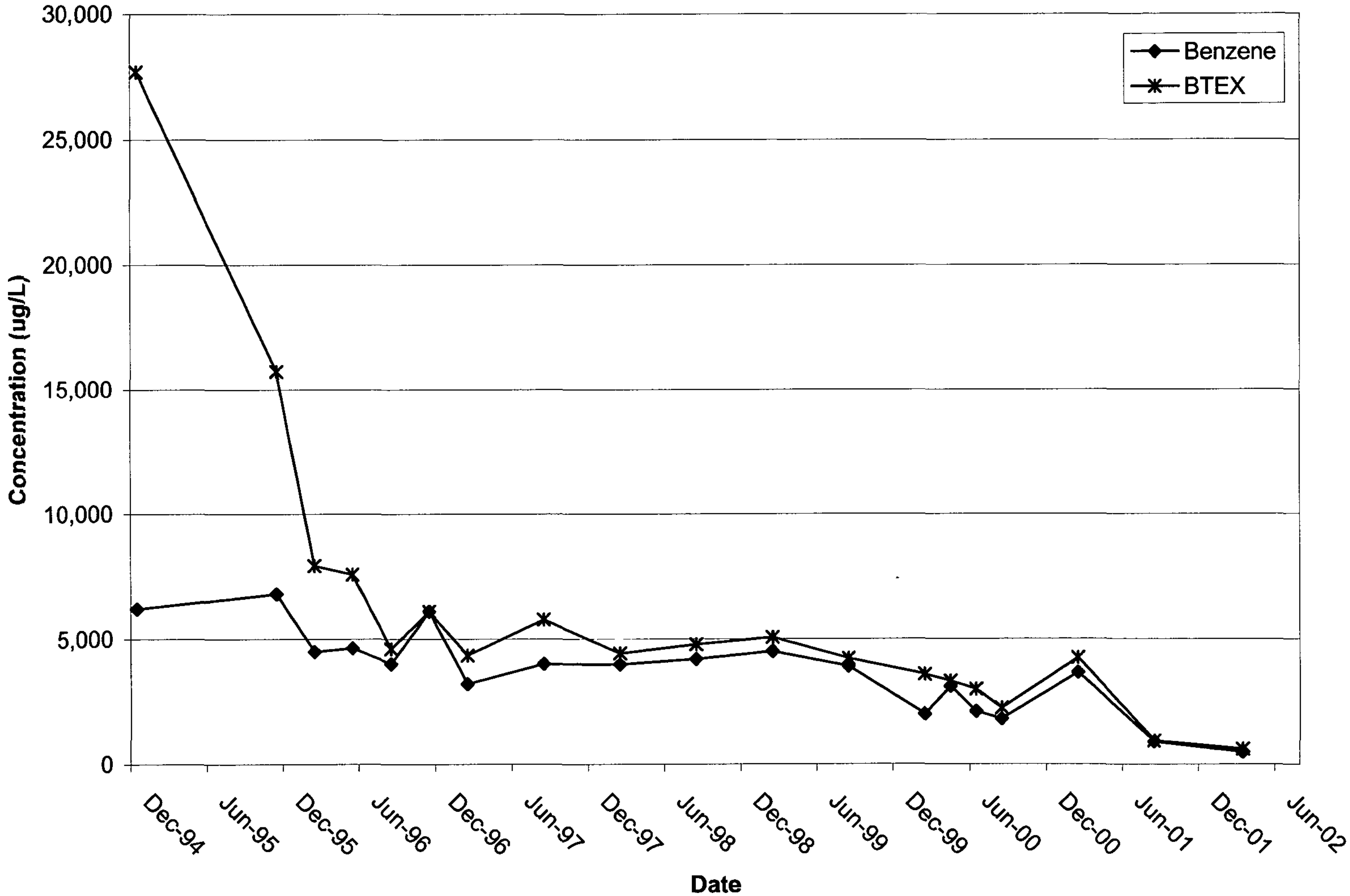
Benzene and BTEX Trends for Monitor Well MW-3
Atoka-1 Compressor Station

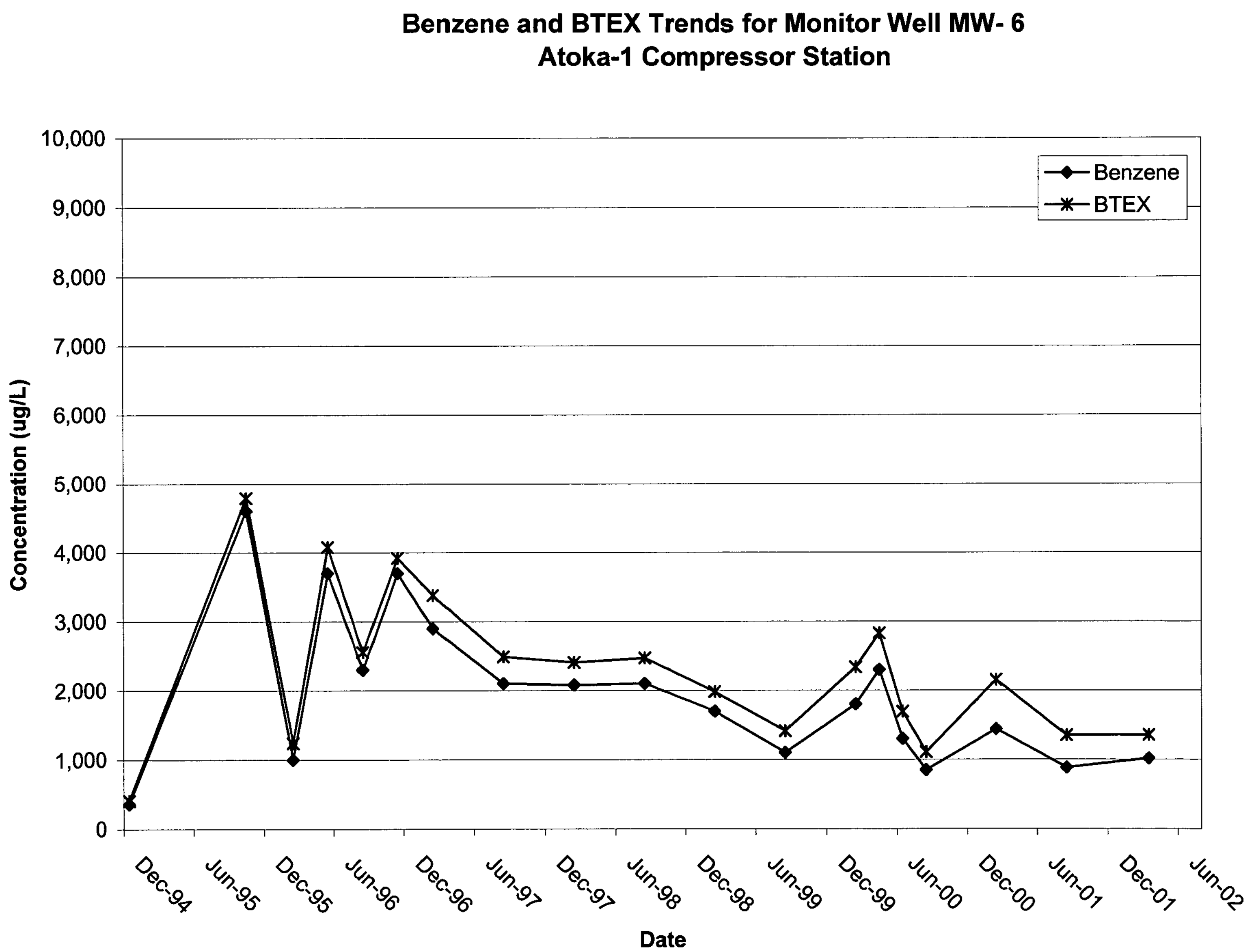




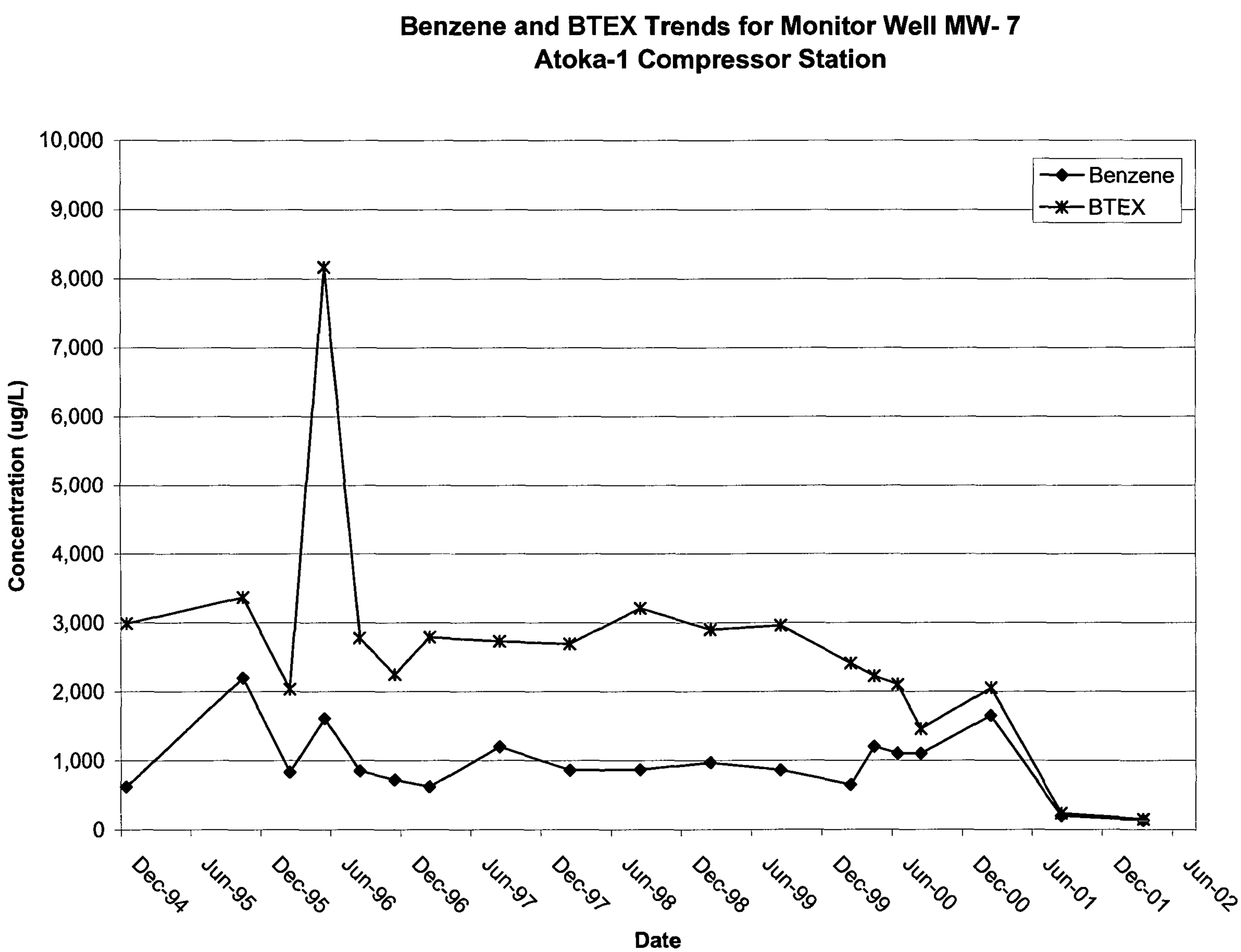
Benzene and BTEX Trends for Monitor Well MW- 4
Atoka-1 Compressor Station
Benzene
BTEX
Concentration (ug/L)
500
450
400
350
300
250
200
150
100
50
0
Jul-93
Nov-93
Mar-94
Jul-94
Nov-94
Mar-95
Jul-95
Nov-95
Mar-96
Jul-96
Nov-96
Mar-97
Jul-97
Nov-97
Mar-98
Jul-98
Nov-98
Mar-99
Jul-99
Nov-99
Mar-00
Jul-00
Nov-00
Mar-01
Jul-01
Nov-01
Mar-02
Jul-02
Date

Benzene and BTEX Trends for Monitor Well MW- 5
Atoka-1 Compressor Station





Benzene and BTEX Trends for Monitor Well MW- 6
Atoka-1 Compressor Station
Benzene
BTEX
Concentration (ug/L)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Dec-94
Jun-95
Dec-95
Jun-96
Dec-96
Jun-97
Dec-97
Jun-98
Dec-98
Jun-99
Dec-99
Jun-00
Dec-00
Jun-01
Dec-01
Jun-02
Date


Benzene and BTEX Trends for Monitor Well MW- 7
Atoka-1 Compressor Station
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Concentration (ug/L)
Benzene
BTEX
Dec-94
Jun-95
Dec-95
Jun-96
Dec-96
Jun-97
Dec-97
Jun-98
Dec-98
Jun-99
Dec-99
Jun-00
Dec-00
Jun-01
Dec-01
Jun-02
Date

Benzene and BTEX Trends for Monitor Well MW- 8
Atoka-1 Compressor Station