ORIENTATION STUDY, OUACHITA MOUNTAIN AREA, ARKANSAS

MASTER

NATIONAL URANIUM RESOURCE
EVALUATION PROGRAM

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HYDROGEOCHEMICAL AND STREAM
SEDIMENT RECONNAISSANCE

KENNETH F. STEELE

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ABSTRACT

A hydrogeochemical ground water orientation study was conducted in the multi-mineralized area of the Ouachita Mountains, Arkansas in order to evaluate the usefulness of ground water as a sampling medium for uranium exploration in similar areas. Ninety-three springs and nine wells were sampled in Clark, Garland, Hot Springs, Howard, Montgomery, Pike, Polk, and Sevier Counties. Manganese, barite, celestite, cinnabar, stibnite, copper, lead, and zinc are present. The following parameters were determined: pH, conductivity, alkalinity, U, Br, Cl, F, He, Mn, Na, V, Al, Dy, NO₃, NH₃, SO₄, and PO₄. The minerals appear to significantly affect the chemistry of the ground water.

This report is issued in draft form, without detailed technical and copy editing. This was done to make the report available to the public before the end of the National Uranium Resource Evaluation.

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ORIENTATION STUDY, OUACHITA MOUNTAIN AREA, ARKANSAS

INTRODUCTION

The National Uranium Resource Evaluation (NURE) was established to evaluate uranium resources in the United States and to identify areas favorable for uranium exploration. The Grand Junction Office of the U.S. Department of Energy (DOE) was responsible for administration of the program. The Savannah River Laboratory (SRL) has been involved in the NURE program since 1974 and has had the responsibility for the hydrogeochemical and stream sediment reconnaissance of 3.9 million square kilometers (1.5 million square miles) in 30 eastern and 7 western states.

This report includes two parts; Part 1 presents the typical SRL data for ground water, and Part 2 presents additional analyses and data supplied by a subcontractor. Both SRL and the subcontractor have analyzed the samples for a few of the same parameters. There has been no analysis of the differences between the SRL data and the subcontractor's data, and therefore no selection of "best" values. Both sets of data are presented.

This report contains the chemical analysis of water samples from 93 springs and nine wells. Springs, when free from metal plumbing, provide an uncontaminated source of the ground water. A few wells were added, usually because of their unique location in an area. An uncontaminated sample of ground water may be interesting because of its quality (purity), its subsurface temperature, or its application in mineral exploration.

The study area is a 135 x 103 km area that extends west from Hot Springs, Arkansas, to the Oklahoma line; it is south of latitude 35° N. (Fig. 1). It encompasses the core area of the Ouachita Mountains and the Athens Plateau, and includes some of the Gulf Coastal Plain. Table A-1 gives the location of the springs that were sampled. They were selected from topographic maps of the U.S. Geological Survey, from literature on warm springs in Arkansas (Billingsley and Hubble; Miser and Purdue, 1929; Bryan, 1922), and from discussions with local inhabitants.

GEOLOGY

The study area can be divided into two sub-areas, based on contrasting lithologies and mineral occurrences (Fig. 1). The major mineralized areas are shown in Figure 2. The areas are designated Area I and Area II.

Area I. (Mn, Fe, Ba, with minor Cu, Zn, Pb)

As shown in Figure 1, this area includes parts of Montgomery, Polk, Pike, Howard, and Garl and Counties in west-central Arkansas. This is the core of the Ouachita Mountains, with relief of 152 to 304 m and ridges 450 to 701 m above sea level. The region has some small farms, but it is mostly forested, much of it being included in Ouachita National Forest.

A stratigraphic column for Area I is shown in Figure 3. The formations range in age from Cambrian to Carboniferous. Shales, Arkansas Novaculite (chert), and sandstone are dominant, with minor limestone in the Crystal Mountain and Womble Shale Formations. The upper member of the Arkansas Novaculite can be highly calcareous. Folding is intense, and the east-to-west ridges are corrugated by the steeply dipping strata.

Manganese minerals are widespread. The manganese oxide minerals lithiophorite ($\text{Li}_2\text{Al}_8\text{Mn}_{12}\text{O}_{35} \cdot 14\text{H}_2\text{O}$), cryptomelane ($\text{K}_x\text{Mn}_8\text{O}_{16}$), psilomelane ($\text{BaMnMn}_8\text{O}_{16}(\text{OH})_4$), and pyrolusite (MnO_2) are scattered among more than 100 manganese prospects and mines. These minerals, particularly lithiophorite, may contain as much as 1% by weight each of the base metals Co, Ni, Cu, and Zn (Wagner and others, 1979). These minerals and iron oxides are found in the bedding planes and cracks of the lower and upper division of the Arkansas Novaculite. Native copper has also been found in the novaculite.

Two barite districts are known. Barite in each is in the first few meters of the lower Stanley Shale Formation. The barite was deposited by replacement or fracture filling. Quartz veins in shale are associated with silver-containing sphalerite and galena in the eastern extremity of Area I.

Area II. (Hg, Sb, Sr, Ba, with minor Zn, Pb)

This area consists mainly of the Athens Plateau in the Gulf Coastal Region of Arkansas. The ages of the rocks include Mississippian (Stanley Shale), Pennsylvanian (Jackfork sandstone and Atoka sandstone, shale, and siltstone), Cretaceous (Trinity limestone, gravel, siltstone, and sandstone and some barite), and Quaternary (terrace deposits and alluvium of gravel, sand, and silt). Along the northern edge, there is a gradation from Area I to Area II rocks. There are kimberlite necks at Murfreesboro, in the central part of the area.

There are three mineral districts. A mercury district with several mines covers essentially the central and eastern half of Area II (Clardy and Bush, 1976). An antimony district covers the western half of Area II, with the antimony and mercury districts overlapping in the central part of Area I (Stroud and others, 1969). Strontium ores have been mined from the DeQueen Limestone member of the Trinity Formation in Howard County. Similar deposits occur sporadically across the area. Ore minerals for the three districts are mainly cinnabar (HgS), stibnite (Sb_2S_3), celestite (SrSO_4), and strontianite (SrCO_3). Some barite (BaSO_4) is found with the strontium. Barite occurs in Howard and Pike Counties as a cementing material in gravels and sandstone. Gypsum deposits occur in the central part of Area II.

PART 1: SRL GROUND WATER DATA

Tables A-1 and A-2 present the analytical and field data for the ground water samples and the site locations. Table A-3 presents hydrocarbon data (methane, ethane, propane, and butane). A hyphen (-) represents a concentration less than the detection limit. Missing data are indicated by "M."

pH, COND, AKMXD, WATERTEMP

Water temperature (WATERTEMP), alkalinity (AKMXD), conductivity (COND.), and pH were measured in the field. Conductivity is reported in micromhos/cm. Alkalinity is reported as milliequivalents of sulfuric acid required per liter of sample to titrate to a pH of about 4.5. The water temperature is reported in degrees Celsius.

U

The uranium concentration was determined by delayed neutron counting of uranium from ground water concentrated on ion-exchange resin and is reported in parts per billion (ppb). The values have been rounded to appropriate significant figures; however, values below 0.040 ppb exhibit a high coefficient of variation.

Br, Cl, F, Mn, Na, Al, and Dy

These elements were all determined by neutron activation analysis of resin exchanged with the ground water. They are reported in ppb.

He

Helium (^4He) was determined by a specially developed mass spectrometric procedure. When available, helium concentrations are reported in standard cubic centimeters of helium per 1000 liters of air (ppm by volume) corrected to a constant ^{22}Ne content. This method introduces a nearly constant background of 5.2 ppm He from air; thus all samples analyzed were above the detection limit.

U/COND

The concentration of uranium in ppb multiplied by 1000 and divided by conductivity is listed in this column. This value gives an approximation of the ratio of uranium to total dissolved solids.

SAMPDATE

The date of sampling (month/day/year). For example, 7/17/77 is July 15, 1977.

NH_3

Ammonia (ppm) by colorimetry.

PO₄

Orthophosphate (ppm) by colorimetry.

NO₃

Nitrate plus nitrite (ppm) by colorimetry.

SO₄

Sulfate (ppm) by barium sulfate turbidimetry.

AGE

The ages of sampled wells are recorded to the nearest whole year. When only minimum ages are known, they are recorded. A "U" means the age of the well is unknown. Wells <1 year old were not sampled.

WELLTYPE

Sampled wells are classified by method of construction. The types listed are:

1. Drilled; denotes wells formed by rotary drills or augers.
2. Dug; denotes wells dug by manual or mechanical scooping equipment.
3. Driven; denotes wells formed by vertical pile drivers.
4. Unknown

WELLODOR

Hydrogen sulfide odors in well water are noted. The entries in this column and their meanings are:

1. No odor
2. Weak H₂S odor
3. Strong H₂S odor
4. Other

WELPOINT

1. Immediately after storage tank
2. From pipe before storage tank
3. Direct from pump
4. Direct from well or spring
5. From municipal system
6. Unknown
7. Other

WELLUSE

This column describes the primary use of water from the well.

1. Human drinking
2. Animal drinking
3. Irrigation
4. All other purposes

WELLFREQ

This column lists the frequency of use of sampled wells.
The entries and their meanings are:

1. Continuous (>once daily)
2. Once daily
3. Once weekly
4. Once monthly
5. <Once monthly
6. Not in use

Wells used less frequently than once weekly are generally not sampled.

PART 2: ADDITIONAL ANALYSES BY SUBCONTRACTOR

Table A-4 gives the location of each site by township and range to the quarter-section, the county and topographic quadrangle map in which the site is situated, and other information. Table A-5 summarizes the analytical methods discussed below.

Analytical Methods

In the collection, storage, and analysis of the water samples, the recommended procedures outlined in EPA (1974) and APHA (1971) were followed. All samples were collected and stored in polyethylene containers. Polyethylene caps (for 1-gallon containers) that might be compounded with a filler were avoided; and only clear polyethylene caps were used. All polyethylene containers were rinsed with concentrated nitric acid and allowed to stand capped from an hour to several hours. They were rinsed several times with deionized distilled water before use.

At each site, 5 liters of raw water were collected, 4 liters of which were immediately filtered through a 0.4 μm (142 mm) Nuclepore membrane filter and stored in a 1-gallon polyethylene container to which 12 ml of 1:1 HNO_3 were added. Another 500 ml of water that had been filtered through the 0.4 μm filter was stored in a polyethylene container at 4°C for SiO_2 , SO_4 , Cl, PO_4 , NO_3 , and NH_3 analyses. Anion analyses were made within 3 days after collection of the samples. Alkalinity, pH, and conductivity were measured at the site on unfiltered samples.

A special filter devised by SRL was used for the filtrations (Ferguson and others, 1977). This filter, with 142 mm diameter membrane, was pressurized to 40 psi with Freon to filter 1 liter of water per filling. New filters were washed by filtering at least 100 ml of raw water to remove any soluble contaminants.

All cation analyses were by either atomic absorption (AA) or flame emission spectrophotometry. Both a Perkin Elmer Model 303 AA unit and a Jarrel-Ash modernized solid state Model 82-500 unit were used. The particular flames and other adaptations of these units are summarized in Table A-5, along with the anion analytical schemes. Heavy metals (Fe, Cu, Ni, Cu, Zn, Pb) were chelated and extracted by methyl isobutyl ketone after Nix and Goodwin (1970) before being determined by AA.

Temperature was measured by a mercury thermometer that was calibrated against an A.S.T.M certified thermometer. The pH was measured with a Markson Model 80 pH meter. Conductivity was measured with a KCl (soln.) calibrated YSI Model 33 S-C-T conductivity meter. Total alkalinity was measured by titration to the methyl red endpoint, using a methyl red-bromocresol green mixed indicator and 0.02N H_2SO_4 . All determinations except barium were made on the acidified raw water. For barium, the acidified raw water was first concentrated 10-25 times by evaporation from a Teflon beaker to improve sensitivity. No loss of Ba is expected on evaporation, since there was no observed loss of Na, K, Mg, or Ba. However, there was some loss of Sb, so raw water was used for the determination of Sb.

Total mercury was determined by flameless atomic absorption (EPA, 1974, p. 118). The samples of raw water were first oxidized as follows to convert any organic mercury compounds to inorganic form: (1) Add 5 ml of 5.6N HNO₃ to 100 ml of acidified raw water from a 1-gallon storage container. (2) Wait 15 seconds and add 5 ml of 18N H₂SO₄. (3) Wait 45 seconds and add 15 ml of 5% KMnO₄ and 8 ml of 5% aqueous potassium persulfate. (4) Heat 2 hrs at 95°C. (5) Cool to room temperature, and add 5 ml of NH₂OH-NaCl solution (15 g/100 ml of each). (6) Add 5 ml of 10% SnCl₂ solution and analyze immediately, using a Perkin Elmer Model 303 AA with a Perkin Elmer aerator and analyzer cell.

Antimony was analyzed by the volatile hydride method after Fernandez (1973). A Perkin Elmer (PE) hydride generation sampling system (303-0849) was adapted to a Jarrell-Ash modernized solid-state Model 82-500 atomic absorption spectrophotometer. A 20 ml sample of acidified spring water was added to the PE generator, along with 8 ml of conc. HCl. A pellet (10/32 inch diameter) of solid sodium borohydride (from Alfa Inorganic Division of Ventron Corp., Beverly, Mass.) was added to the generator to form antimony hydrides that were fed to a hydrogen-nitrogen flame. Peak heights on a recorder were calibrated against antimony standards.

Analytical data are summarized in Tables A-6 to A-8. The precision for most cation analyses in Tables A-6 to A-8 is estimated to be $\pm 10\%$. This is generally true when the concentration is several times the detection limit---the "less than" values being the detection limits. The detection limits may vary because of change in sample size, instrument noise, or size of the blank. The percent error at low concentration is much larger; it is calculated as $[(\text{detection limit} \times 100) / \text{concentration}]$. The reproducibility of the various anion analyses by various investigators has been studied in part by EPA and APHA. For our concentration ranges, the reproducibility is given in the concluding lines of Table A-6. Any available precision data of EPA (1974) and APHA (1971) are used.

CONCLUSIONS

Preliminary examination of the ground water chemistry for the Ouachita Mountain area of Arkansas indicates that the water is bicarbonate type, relatively free of metals. However, a number of anomalously high values of base metals in spring water exist, and many of them appear to be associated with nearby mineral occurrences (usually manganese). The data suggest also that high concentrations of barium in ground water may be useful in detecting nearby barite. The high values for silica in several samples and several warm springs indicate the presence of thermal water. However, the highest geotemperature calculated from silica values, using Truesdell's empirical equation (Swanberg and Morgan, 1978), is only 91°C. In summary, the use of ground water chemistry for mineral and geothermal exploration in the Ouachita Mountain area appears to deserve additional investigation.

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Figure 1. Location of sites and boundary between Area I and II.

Figure 2. MAJOR MINERALIZED AREAS IN THE OUACHITA MOUNTAINS OF ARKANSAS
MODIFIED FROM SCULL (1959)

SYSTEM	SERIES	FORMATION	MEMBER	THICKNESS (METERS)	LITHOLOGY		
QUATERNARY		ALLUVIUM			SILT, SAND, AND GRAVEL ALONG STREAM CHANNELS.		
		TERRACE DEPOSITS			GRAVEL, SAND, AND SILT OCCURRING ALONG MAJOR STREAMS.		
CRETACEOUS		TRINITY FORMATION			GRAVEL, SILT, CLAY, SILTSTONE, AND SANDSTONE WITH SOME BARITE IN WESTERN PART OF ITS OUTCROP.		
PENNSYLVANIAN	ATOKAN	ATOKA	UPPER	8000+	SHALE, LIGHT GRAY, SILTY, MICACEOUS, AND FLAKY WITH INTERBEDDED FINE TO COARSE-GRAINED, MICACEOUS SANDSTONE WITH VERY ABUNDANT SOLE MARKINGS. THIN SILICEOUS SHALES NEAR BASE AND IN LOWER PART OF FORMATION.		
			MIDDLE				
			LOWER				
	BORROWAN	JOHNS VALLEY SHALE		800	SHALE, LIGHT GRAY TO TAN, DARK GRAY NEAR BASE, AND THIN BEDS OF SANDSTONE AND LIMESTONE. LARGE ERRATIC MASSES OF LIMESTONE OR SHALE ARE FOUND NEAR THE BASE OF THE FORMATION, AND EXOTIC BOULDERS, PEBBLES, AND GRANULES OCCUR AT NUMEROUS HORIZONS.		
JACKFORD SANDSTONE			2300	SANDSTONE, MEDIUM TO COARSE GRAINED, HARD, WITH INTERBEDDED SHALE. SOLE MARKINGS ARE ABUNDANT IN THE SANDSTONES. FOUR BEDS OF SILICEOUS SHALE AND ONE BED OF MAROON TO GREEN SHALE ARE IDENTIFIABLE OVER LONG DISTANCES AND FORM MARKER BEDS.			
MISSISSIPPIAN	CHESTERIAN	STANLEY GROUP	CHICKASAW CREEK		SHALE, DARK COLORED, MOSTLY GRAY, INTERBEDDED WITH DARK GRAY ARGILLACEOUS SILTSTONE AND VERY POORLY SORTED FINE- TO VERY FINE-GRAINED ARGILLACEOUS CHLORITIC SANDSTONE. BEDS OF SILICEOUS SHALE ARE IDENTIFIABLE OVER LONG DISTANCES IN SEVERAL HORIZONS. CONE-IN-CONE CONCRETIONS ARE ABUNDANT AT PLACES.		
	MERAMECIAN		HATTON TUFF	0-30		4000	FELSIC VITRIC TUFF.
			HOT SPRINGS SANDSTONE	0-20			SANDSTONE, HARD, QUARTZOSE, FINE TO VERY FINE GRAINED, SMALL AMOUNTS OF INTERBEDDED SHALE AND LOCALLY CONGLOMERATIC NEAR BASE. CROPS OUT ONLY IN RELATIVELY SMALL AREA NEAR HOT SPRINGS.
	OSAGEAN	ARKANSAS NOVACULITE	UPPER	310	GREEN, BROWN, AND GRAY RADIOLARIAN CHERT AND RADIOLARIAN SHALE.		
	KINDERHOOKIAN		UPPER MIDDLE		RED AND GREEN RADIOLARIAN SHALE SILICEOUS SHALE. RADIOLARIAN CHERT AND BITUMINOUS CHERT.		
DEVONIAN	UPPER AND MIDDLE	LOWER MIDDLE	LIGHT GRAY TO BLACK BITUMINOUS SPORE-BEARING CHERT AND BLACK PAPERY BITUMINOUS SHALE.				
		LOWER	WHITE TO GREEN MASSIVE SPICULITIC CHERT AND GREEN LAMINATED SILICEOUS SHALE.				
SILURIAN	NIAGARAN	MISSOURI MOUNTAIN SHALE		100	SHALE, HARD, GREEN SILICEOUS, SANDY IN PART. THIN BEDS OF FINELY LAMINATED CHERT AND QUARTZOSE SANDSTONE AND LOCAL LENSES OF SANDY CHERT CONGLOMERATE.		
	ALEXANDRIAN	BLAYLOCK SANDSTONE		800	SANDSTONE, GRAY TO GREEN, THIN BEDDED, FINE GRAINED, WITH INTERBEDDED SHALEY MICACEOUS SILTSTONE AND DARK FISSILE SHALES. VEINS OF QUARTZ AND 'SMOKEY' QUARTZ ARE ABUNDANT. FORMATION PRESENT ONLY IN PART OF BROWN BOW-BENTON UPLIFT.		
MIDDLE AND UPPER ORDOVICIAN	CINCINNATIAN	POLK CREEK SHALE		98	SHALE, SOFT, BROWN, PLATY IN MOST OF FORMATION; HARD, BLACK, BITUMINOUS, AND SILICEOUS NEAR BASE. ABUNDANT GRAPTOLITES. THIN STREAKS OF QUARTZITIC SANDSTONE AND OOLITIC LIMESTONE.		
	TRENTONIAN	BIG FORK CHERT	UPPER	260	BLACK, NONCALCAREOUS, BITUMINOUS CHERT AND BLACK BITUMINOUS PAPERY SHALE.		
LOWER			GRAY TO BROWN CALCAREOUS CHERT, SILICEOUS LIMESTONE, CLASTIC LIMESTONE AND CHERTY SHALE.				
LOWER ORDOVICIAN	BLACKRIVERIAN	WOMBLE SHALE		1100	SHALE, BLACK TO GREEN, WITH THIN INTERBEDS OF QUARTZOSE SANDSTONE AND LIMESTONE. SOME SILICEOUS BITUMINOUS SHALE NEAR CONTACT WITH BIGFORK CHERT.		
	CANADIAN	BLAKELY SANDSTONE		130	SHALE, BLACK TO GREEN, INTERBEDDED WITH FINE TO MEDIUM GRAINED QUARTZOSE SANDSTONE. SOME VEINS OF 'SMOKEY' QUARTZ.		
		MAZARN SHALE		1000	SHALE, BLACK TO GREEN, BANDED, CLAYEY, FISSILE, WITH THIN LAYERS OF GREEN SANDSTONE AND BLuish-BLACK LIMESTONE. VEINS OF QUARTZ AND CALCITE.		
		CRYSTAL MOUNTAIN SANDSTONE		280	SANDSTONE, MASSIVE, LIGHT GRAY, CALCAREOUS TO QUARTZITIC. MANY QUARTZ VEINS AND CRYSTALS.		
		COLLIER SHALE		330	SHALE, BLACK, GRAPHITIC, AND DARK-COLORED SILICEOUS LIMESTONE. SOME DENSE BLACK CHERT.		

Figure 3. Generalized stratigraphic column for the Ouachita Mountains.

TABLE A-1. TABULATION OF KEY FIELD MEASUREMENTS AND ANALYTICAL DATA - GROUND WATER.
 U, BR, CL, F, MN, NA, AND V: ELEMENTAL CONCENTRATIONS IN PPB
 HE IN PPM. IN TWO CC AIR GAP ABOVE 500 CC OF H2O. SCINT. IN CPS.

1

SRL I.D. *****	LATITUDE	LONGITUDE	PH	COND. UM/CM	AKMXD MEQ/L	U	BR	CL	F	HE	MN	NA	V	U/COND X 1000
AALR851R	34.7633	93.0690	7.4	210	78.10	0.105	68.9	8200	86	8.0	137.7	29210	-0.1	0.50
AALR852R	34.7635	93.0648	6.5	10	3.50	0.025	.	4200	.	6.0	120.5	11530	-0.1	2.51
AALR853R	34.4666	93.7139	7.5	270	57.10	0.532	51.6	6200	69	6.0	327.1	15850	-0.1	1.97
AALR854R	34.4829	93.5912	6.7	52	60.50	0.074	51.6	4300	120	6.0	103.3	11950	-0.1	1.42
AALR855R	34.4539	93.8409	7.3	140	61.10	0.052	.	27700	.	6.0	.	M	-0.1	0.37
AALR856R	34.5328	93.3629	7.6	173	44.10	0.194	.	4500	241	6.0	120.5	12530	1.7	1.12
AALR857R	34.4814	94.3060	6.7	72	41.25	0.023	.	4700	341	5.0	120.5	12190	-0.1	0.31
AALR858R	34.3232	94.4286	7.2	300	36.10	0.056	.	4200	482	5.0	120.5	12840	-0.1	0.19
AALR859R	34.6765	94.3901	5.8	22	1.10	0.035	34.4	4300	413	6.0	120.5	12500	-0.1	1.61
AALR860R	34.6703	94.3904	6.4	50	1.25	0.026	.	5100	172	6.0	137.7	12720	-0.1	0.52
AALR861R	34.4896	94.0600	6.9	92	24.10	0.835	.	4400	86	6.0	137.7	11950	-0.1	9.07
AALR862R	34.4757	93.9380	7.0	122	20.10	0.077	51.6	4600	396	6.0	137.7	12510	-0.1	0.63
AALR863R	34.6194	93.1777	6.9	207	30.10	0.140	.	4300	36	7.0	154.9	13130	-0.1	0.68
AALR864R	34.4774	93.3617	5.6	18	5.50	0.015	34.4	4100	52	7.0	137.7	11530	-0.1	0.82
AALR865R	34.4775	93.3617	6.0	18	5.50	0.019	51.6	5000	86	7.0	378.7	12170	-0.1	1.04
AALR866R	34.4755	93.3669	6.3	95	33.25	0.005	17.2	4200	34	7.0	154.9	12260	-0.1	0.06
AALR867R	34.4641	93.4487	5.7	55	12.50	0.009	17.2	3900	155	6.0	671.3	11480	-0.1	0.17
AALR868R	34.3832	93.5250	5.8	15	5.50	0.023	34.4	4100	.	6.0	120.5	12200	-0.1	1.54
AALR869R	34.3704	93.4911	6.6	118	42.25	0.038	361.5	M	.	6.0	17.2	M	-0.1	0.32
AALR870R	34.3737	93.4881	7.2	179	10.50	0.020	.	3800	52	9.0	361.5	14100	-0.1	0.11
AALR871R	34.3330	93.6521	5.6	22	10.50	0.033	17.2	4500	113	6.0	137.7	11840	-0.1	1.51
AALR872R	34.3958	93.6032	7.3	200	25.10	0.017	.	4600	52	6.0	206.6	12530	-0.1	0.09
AALR873R	34.6603	93.9931	3.8	25	0.10	0.018	68.9	4600	413	6.0	120.5	13550	-0.1	0.74
AALR874R	34.3658	94.3801	5.1	24	8.10	0.040	.	4500	344	5.0	671.3	13080	-0.1	1.65
AALR875R	34.3420	94.4114	6.1	40	7.10	0.016	17.2	3700	155	6.0	120.5	12650	-0.1	0.39
AALR876R	34.3919	94.1928	7.5	330	94.20	0.019	568.1	43200	310	500.0	137.7	70040	-0.1	0.06
AALR877R	34.3945	94.1893	7.6	335	64.10	0.043	568.1	52400	432	530.0	137.7	78940	-0.1	0.13
AALR878R	34.3900	93.9980	6.8	155	39.10	0.101	.	4100	155	13.0	568.1	14720	-0.1	0.65
AALR879R	34.3712	93.8758	6.4	30	14.10	0.021	.	4200	52	6.0	120.5	12930	-0.1	0.70
AALR880R	34.3801	93.8760	6.8	35	8.25	0.032	51.6	3700	.	7.0	120.5	12530	-0.1	0.92
AALR881R	34.4001	93.6034	6.9	152	25.10	0.031	.	4400	86	18.0	309.9	12640	-0.1	0.21
AALR882R	34.4002	93.6034	6.4	70	14.10	0.025	34.4	3500	52	6.0	120.5	13560	-0.1	0.36
AALR883R	34.4001	93.6034	7.3	200	25.10	0.017	34.4	3300	103	5.0	172.1	4960	-0.1	0.09
AALR884R	34.4001	93.6034	5.5	23	3.10	0.030	34.4	4000	34	6.0	172.1	13130	-0.1	1.31
AALR885R	34.3859	93.5995	6.4	35	6.10	0.031	.	4300	34	6.0	120.5	12140	-0.1	0.88
AALR886R	34.3925	93.6021	7.0	240	25.10	0.014	34.4	3600	103	6.0	223.8	12690	-0.1	0.06
AALR887R	34.4223	93.6101	4.4	20	12.10	0.033	.	4000	86	6.0	120.5	12840	1.7	1.67
AALR888R	34.4244	93.6069	6.5	105	22.10	0.017	51.6	4000	69	6.0	137.7	13050	-0.1	0.16
AALR889R	34.4252	93.6058	4.4	20	0.10	0.063	34.4	3900	17	6.0	120.5	12840	-0.1	3.14
AALR890R	34.4055	93.6124	4.6	20	6.10	0.008	34.4	4400	.	5.0	137.7	13190	-0.1	0.39
AALR891R	34.4039	93.6098	4.7	20	6.10	0.026	.	4100	34	5.0	120.5	13010	-0.1	1.31
AALR892R	34.4039	93.6096	5.1	14	2.10	0.023	.	4000	69	6.0	120.5	13010	-0.1	1.68
AALR893R	34.5224	93.3352	7.1	235	50.10	0.042	17.2	4400	103	6.0	206.6	13340	-0.1	0.18
AALR894R	34.5218	93.3378	7.3	240	44.10	0.102	17.2	3800	52	6.0	172.1	13480	-0.1	0.43
AALR895R	34.5218	93.3377	7.6	254	64.10	0.022	.	3500	103	6.0	206.6	13410	-0.1	0.09
AALR896R	34.5218	93.3377	7.3	217	36.10	0.024	34.4	4300	103	6.0	189.4	14920	-0.1	0.11
AALR897R	34.5218	93.3377	7.9	242	50.10	0.036	.	4300	86	6.0	206.6	13510	-0.1	0.15
AALR898R	34.5218	93.3377	7.0	248	0.15	0.053	86.1	4000	241	5.0	241.0	13550	-0.1	0.21
AALR899R	34.8020	93.4241	7.9	90	60.20	0.048	.	4800	17	6.0	103.3	14940	-0.1	0.54
AALR900R	34.3613	93.2847	6.2	30	40.20	0.034	.	3400	52	6.0	103.3	13270	-0.1	1.12
AALR901R	34.3596	93.2897	6.9	115	45.20	0.015	.	3700	17	6.0	395.9	14100	-0.1	0.13
AALR902R	34.3537	93.2957	6.4	25	20.20	0.035	.	5200	52	5.0	103.3	14050	-0.1	1.38
AALR903R	34.3461	93.3190	6.3	95	28.20	0.022	68.9	3800	17	7.0	103.3	13620	-0.1	0.23

TABLE A-1 TABULATION OF KEY FIELD MEASUREMENTS AND ANALYTICAL DATA -GROUND WATER.
U, BR, CL, F, MH, NA, AND V: ELEMENTAL CONCENTRATIONS IN PPB
HE IN PPM. IN TWO CC AIR GAP ABOVE 300 CC OF H2O. SCINT. IN CPS.

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SRL I.D. *****	LATITUDE	LONGITUDE	PH	COND. UM/CM	AKMXD MEQ/L	U	BR	CL	F	HE	MH	NA	V	U/COND X 1000
AALR904R	34.0998	93.6293	4.1	95	0.20	0.069	.	6300	34	6.0	137.7	16590	-0.1	0.73
AALR905R	34.1098	93.6244	6.2	275	50.20	0.043	.	3200	86	9.0	86.1	32500	-0.1	0.16
AALR906R	34.1051	93.6239	4.3	50	4.20	0.011	17.2	4500	17	6.0	103.3	14680	-0.1	0.23
AALR907R	34.1772	93.6519	6.2	175	27.10	-0.002	.	3900	103	5.0	241.0	20050	-0.1	M
AALR908R	34.2010	93.5356	7.1	50	10.20	0.019	17.2	4700	34	5.0	378.7	14060	-0.1	0.37
AALR909R	34.1855	93.5854	7.2	15	2.10	0.014	51.6	3900	.	6.0	103.3	14050	-0.1	0.93
AALR910R	34.0915	93.7002	5.8	50	1.20	0.047	.	5800	17	6.0	137.7	14630	-0.1	0.94
AALR911R	34.4660	93.7955	5.4	155	70.20	0.302	34.4	3200	17	6.0	103.3	14510	-0.1	1.95
AALR912R	34.4411	93.7795	5.8	115	28.20	0.024	17.2	2900	17	6.0	86.1	13870	-0.1	0.21
AALR913R	34.4930	93.8770	4.1	230	54.20	0.042	34.4	4300	258	31.0	137.7	20660	-0.1	0.18
AALR914R	34.5528	94.0937	5.5	42	9.20	0.004	17.2	3400	.	7.0	103.3	14750	-0.1	0.09
AALR915R	34.3858	93.6086	5.7	250	49.20	0.106	86.1	4600	34	8.0	103.3	15530	3.4	0.42
AALR916R	34.3771	93.8208	5.8	85	16.20	0.013	34.4	3900	.	6.0	154.9	15110	-0.1	0.16
AALR917R	34.3810	93.8139	7.2	50	7.20	0.007	34.4	3500	69	5.0	172.1	14820	-0.1	0.13
AALR918R	34.3771	93.7879	5.7	50	15.20	0.007	34.4	2800	34	6.0	86.1	14250	-0.1	0.13
AALR919R	34.2388	93.8861	5.9	75	5.20	0.019	34.4	5600	.	5.0	103.3	16630	-0.1	0.25
AALR920R	34.1379	93.8987	4.8	0	2.20	0.024	.	4200	.	6.0	86.1	14680	-0.1	M
AALR921R	34.3693	93.6501	6.4	250	52.20	0.142	.	4300	17	7.0	103.3	15560	-0.1	0.57
AALR922R	34.9793	93.5637	6.2	82	6.50	0.019	.	5900	.	6.0	137.7	16970	-0.1	0.23
AALR923R	34.3702	93.6387	7.4	130	50.25	0.009	.	1500	.	6.0	258.2	16660	-0.1	0.07
AALR924R	34.3321	93.7489	7.2	210	72.25	0.005	.	1700	34	6.0	223.8	14270	-0.1	0.02
AALR925R	34.1766	93.6472	7.2	15	11.50	0.000	.	M	.	6.0	86.1	14340	1.7	0.02
AALR926R	34.1769	93.6562	7.0	15	9.50	0.040	.	1300	.	6.0	86.1	13360	1.7	2.66
AALR927R	33.9170	93.8622	7.6	330	93.25	0.005	34.4	2600	.	5.0	120.5	37030	-0.1	0.01
AALR928R	33.8739	93.9223	6.9	55	21.50	0.026	34.4	2800	103	5.0	258.2	14890	-0.1	0.48
AALR929R	34.1441	93.9333	5.0	15	1.50	0.119	34.4	1900	.	5.0	86.1	13290	-0.1	7.90
AALR930R	34.0861	93.6651	5.1	15	1.50	0.005	34.4	2300	.	6.0	86.1	13750	-0.1	0.35
AALR931R	34.1569	93.6497	5.0	12	2.50	0.031	51.6	1400	.	5.0	68.9	13790	-0.1	2.59
AALR932R	34.2258	93.8308	6.8	90	58.50	0.030	.	3500	103	6.0	240.6	31930	-0.1	0.33
AALR933R	34.1055	94.1042	4.8	30	0.50	0.058	.	5200	.	6.0	171.8	27150	-0.1	1.94
AALR934R	34.1128	94.1061	4.7	50	0.50	0.084	.	4900	103	6.0	171.8	29210	-0.1	1.68
AALR935R	34.1101	94.0741	5.1	10	0.50	0.011	.	1500	.	5.0	86.1	14510	-0.1	1.13
AALR936R	34.1906	93.7655	6.8	85	56.50	0.003	.	2600	34	6.0	258.2	17700	-0.1	0.09
AALR937R	34.1921	93.7700	8.7	420	53.10	0.045	68.7	16300	481	21.0	137.5	97940	-0.1	0.11
AALR938R	34.3321	93.6185	6.9	85	50.50	0.071	34.4	3700	.	5.0	171.8	28590	-0.1	0.83
AALR939R	34.5300	94.2427	7.1	200	20.10	-0.002	34.4	M	.	6.0	.	M	-0.1	M
AALR940R	34.4921	93.9564	5.9	210	28.10	0.073	17.2	1700	52	6.0	103.3	14060	-0.1	0.35
AALR941R	34.5361	93.8333	6.5	260	29.10	0.146	51.6	2400	69	6.0	103.3	15030	-0.1	0.56
AALR942R	34.6023	93.6363	5.3	30	4.10	0.027	.	M	.	6.0	.	M	-0.1	0.90
AALR943R	34.3739	93.4881	6.4	275	19.10	0.018	.	2000	52	7.0	568.1	14700	-0.1	0.07
AALR944R	34.1439	93.9331	4.6	20	2.10	0.155	51.6	2400	17	6.0	103.3	15630	-0.1	7.74
AALR945R	34.4049	93.9046	7.1	112	12.10	0.021	.	1400	34	7.0	86.1	14270	-0.1	0.19
AALR946R	34.3137	93.9988	5.8	15	4.10	0.021	51.6	2400	.	6.0	86.1	15180	-0.1	1.37
AALR947R	34.3112	94.1648	5.6	20	3.10	0.003	.	1700	17	6.0	103.3	14720	-0.1	0.15
AALR948R	34.1124	94.1118	4.1	150	0.10	0.079	17.2	5000	69	6.0	154.9	17020	-0.1	0.53
AALR949R	34.1503	94.2388	4.7	30	4.10	0.007	.	1500	34	6.0	86.1	15920	-0.1	0.22
AALR950R	34.1552	94.3127	4.7	180	3.10	0.038	.	2800	.	7.0	103.3	15940	-0.1	0.21
AALR951R	34.1382	94.3244	7.4	410	33.10	0.045	17.2	2200	52	6.0	206.6	18230	-0.1	0.11
AALR952R	34.1863	94.3371	4.7	50	2.10	0.006	51.6	4800	.	6.0	103.3	17330	-0.1	0.11
AALR953R	34.5776	94.2459	4.5	60	2.10	0.001	.	3800	.	6.0	103.3	17580	-0.1	0.02

TABLE A-2 SUPPLEMENTARY FIELD AND ANALYTICAL DATA --- GROUND WATER.

SRL I.D.	AL PPB	DY PPB	SAMPDATE	NO3 PPM	NH3 PPM	SO4 PPM	PO4 PPM	A G E	W A T E R T E M P E R E T U R E	W E E L L P O U S E	W E E L L F R E E	W E E L L O D O R	P I P E C O M P	W E L C L A S S	W E L D E P T H
AALR851R	69	-0.100	3/ 2/78	2.4	0.1	0.2	0.0		15	13	11	11	6	6	0155
AALR852R	138	-0.100	3/ 2/78	0.0	0.0	0.2	0.0 999		5	4	4	1	1	7	6 0000
AALR853R	52	-0.100	3/ 3/78	0.0	0.0	28.6	0.0 999		15	4	4	1	1	7	2 0000
AALR854R	103	-0.100	3/ 3/78	0.0	0.0	1.0	0.0 999		16	1	4	1	1	7	6 0000
AALR855R	M	-0.100	3/ 3/78	0.0	0.0	1.3	0.1 999		15	4	4	1	1	7	8 0000
AALR856R	103	-0.100	3/ 3/78	0.0	0.4	1.0	0.1 999		18	4	4	1	1	7	8 0000
AALR857R	86	-0.100	3/ 6/78	0.1	0.0	1.0	0.1 999		13	4	4	1	1	7	8 0000
AALR858R	120	-0.100	3/ 6/78	0.1	0.0	2.0	0.1 999		13	4	4	1	1	7	1 0000
AALR859R	293	-0.100	3/ 7/78	1.7	0.1	2.3	0.0 999		10	4	4	1	1	7	8 0000
AALR860R	258	-0.100	3/ 7/78	2.1	0.1	0.5	0.0 999		9	4	4	1	1	7	9 0000
AALR861R	207	-0.100	3/ 7/78	0.1	0.0	4.3	0.0 999		16	4	4	1	1	7	9 0000
AALR862R	120	-0.100	3/ 7/78	0.2	0.1	1.8	0.1 999		16	4	4	1	1	7	9 0000
AALR863R	103	-0.100	4/ 8/78	1.7	0.0	5.5	0.1 999		16	4	4	1	1	2	6 0000
AALR864R	120	-0.100	4/ 8/78	2.3	0.0	0.7	0.0 999		18	4	4	1	1	3	8 0000
AALR865R	103	-0.100	4/ 8/78	0.0	0.0	1.0	0.1 999		17	4	4	1	1	3	8 0000
AALR866R	207	-0.100	4/ 8/78	0.1	0.1	3.1	0.1 999		21	4	4	1	2	7	9 0000
AALR867R	155	-0.100	4/ 8/78	0.1	0.2	9.4	0.4 999		17	4	4	1	1	7	8 0000
AALR868R	327	-0.100	4/ 8/78	1.5	0.1	0.5	0.0 999		15	4	4	1	1	7	9 0000
AALR869R	M	-0.100	4/ 9/78	0.2	0.2	2.3	0.0 999		18	4	4	1	1	7	9 0000
AALR870R	103	-0.100	4/ 9/78	0.1	0.5	2.0	0.0		17	1	4	1	1	3	9 U
AALR871R	120	-0.100	4/ 9/78	1.2	0.2	1.5	0.0 999		17	4	4	1	1	3	6 0000
AALR872R	86	-0.100	4/ 9/78	0.2	0.3	3.1	0.0 999		18	4	4	1	1	4	8 0000
AALR873R	207	-0.100	5/16/78	.	0.1	0.0	0.0 999		14	4	4	1	1	7	8 0000
AALR874R	344	-0.100	5/17/78	0.0	0.5	0.0	0.0 999		16	4	4	6	3	7	8 0000
AALR875R	103	-0.100	5/17/78	0.3	0.1	2.3	0.0 999		17	4	4	1	1	4	6 0000
AALR876R	69	-0.100	5/17/78	0.7	0.6	0.2	0.0 999		17	4	4	6	3	6	6 0000
AALR877R	103	-0.100	5/17/78	0.1	0.5	0.0	0.1 999		18	4	4	1	1	3	7 0000
AALR878R	86	-0.100	5/17/78	0.1	0.3	5.8	0.0 999		15	4	4	1	1	6	6 0000
AALR879R	103	-0.100	5/17/78	3.7	0.1	0.0	0.0 999		17	4	4	1	1	4	6 0000
AALR880R	120	-0.100	5/17/78	4.9	0.0	2.3	0.0 999		15	4	4	1	1	4	6 0000
AALR881R	120	-0.100	5/18/78	3.7	0.1	3.7	0.1 999		17	4	4	1	6	2	6 8 0000
AALR882R	52	-0.100	5/18/78	4.9	0.1	2.6	0.0 999		18	4	4	1	1	2	4 1 0000
AALR883R	52	-0.100	5/18/78	0.1	0.1	3.7	0.0 999		17	4	4	1	6	1	4 1 0000
AALR884R	189	-0.100	5/18/78	.	0.2	1.5	0.0 999		15	4	4	1	1	7	8 0000
AALR885R	155	-0.100	5/18/78	.	0.1	0.2	0.0 999		16	4	4	6	1	7	8 0000
AALR886R	86	-0.100	5/18/78	.	0.2	0.2	0.0 999		18	4	3	1	2	1	1 0000
AALR887R	189	-0.100	5/18/78	3.7	0.1	2.3	0.0 999		15	4	4	1	1	2	4 8 0000
AALR888R	86	-0.100	5/18/78	4.1	0.1	4.6	0.1 999		19	4	4	1	1	2	7 6 0000
AALR889R	207	-0.100	5/18/78	2.2	0.1	2.6	0.0 999		17	4	4	6	1	7	8 0000
AALR890R	120	-0.100	5/18/78	1.8	0.1	1.8	0.0 999		18	4	4	1	6	1	6 1 0000
AALR891R	138	-0.100	5/18/78	1.5	0.1	1.0	0.0 999		16	4	4	1	6	1	6 1 0000
AALR892R	138	-0.100	5/18/78	1.6	0.0	0.7	0.0 999		16	4	4	1	6	1	7 1 0000
AALR893R	86	-0.100	5/19/78	1.1	0.1	3.4	0.1 999		20	4	4	1	6	1	6 8 0000
AALR894R	103	-0.100	5/19/78	.	0.1	1.5	0.0 999		18	4	4	1	1	4	1 0000
AALR895R	103	-0.100	5/19/78	1.6	0.1	1.0	0.1 999		20	4	4	6	1	4	8 0000
AALR896R	86	-0.100	5/19/78	1.8	0.1	4.3	0.1 999		21	4	4	6	2	6	1 0000
AALR897R	120	-0.100	5/19/78	.	0.1	2.6	0.1 999		20	4	4	6	2	6	8 0000
AALR898R	86	-0.100	5/19/78	3.2	0.2	3.1	0.0 999		22	4	4	6	1	6	8 0000
AALR899R	103	-0.100	7/13/78	0.9	0.1	0.0	0.0 999		17	4	4	1	1	7	1 0000
AALR900R	224	-0.100	7/13/78	0.8	0.1	0.2	0.0 999		18	4	4	6	1	7	8 0000

TABLE A-2 SUPPLEMENTARY FIELD AND ANALYTICAL DATA --- GROUND WATER.

SRL I.D.	AL PPB	DY PPB	SAMPDATE	NO3 PPM	NH3 PPM	SO4 PPM	PO4 PPM	AGE	W A T E R T E M P E R E T U R E	W E L L P O I S E R N E M E T	W E L L L O D O R	W E L L L O D O R	W E L L L O D O R	W E L L L O D O R	P I P E C O M P S	W E L L C L A S S	W E L L D E P T H
AALR901R	86	-0.100	7/13/78	0.2	0.2	1.0	0.0	999	18	4	4	1	6	1	7	8	0000
AALR902R	344	-0.100	7/13/78	0.7	0.1	0.5	0.0	999	20	4	4	1	2	1	3	2	0000
AALR903R	86	-0.100	7/13/78	0.7	0.1	0.7	0.1	999	18	4	4	1	1	1	7	3	0000
AALR904R	379	-0.100	7/14/78	3.4	0.1	2.6	0.1	999	18	4	4	4	1	1	7	9	0000
AALR905R	86	-0.100	7/14/78	2.5	0.1	2.0	0.1	999	20	1	7	1	1	1	4	1	0187
AALR906R	120	-0.100	7/14/78	2.2	0.0	1.3	0.2	999	20	4	4	4	1	1	3	9	0000
AALR907R	86	-0.100	7/14/78	0.1	0.2	4.3	0.1	024	19	2	7	1	1	1	1	1	0030
AALR908R	120	-0.100	7/14/78	0.0	1.2	1.5	0.0	999	18	4	4	4	1	1	7	9	0000
AALR909R	189	-0.100	7/14/78	1.0	0.2	2.0	0.1	999	18	4	4	1	6	1	6	8	0000
AALR910R	224	-0.100	7/15/78	1.6	0.6	9.1	0.1	999	18	4	4	4	1	3	7	9	0000
AALR911R	103	-0.100	7/15/78	2.2	0.6	3.7	0.2	999	16	4	4	4	1	1	7	9	0000
AALR912R	103	-0.100	7/15/78	1.2	1.3	2.8	0.1	999	17	4	4	4	1	1	7	9	0000
AALR913R	103	-0.100	7/15/78	1.2	1.3	1.0	0.2	999	17	4	4	4	1	3	7	9	0000
AALR914R	241	-0.100	7/18/78	0.7	0.1	0.2	0.1	999	20	4	4	4	1	1	7	9	0000
AALR915R	930	-0.100	7/18/78	0.3	0.1	0.5	0.1	999	35	4	4	4	1	1	7	9	0000
AALR916R	120	-0.100	7/18/78	0.2	0.2	9.4	0.1	001	18	1	4	4	1	1	3	9	0622
AALR917R	120	-0.100	7/18/78	1.0	0.1	7.4	0.1	001	18	1	4	4	1	1	3	9	0179
AALR918R	172	-0.100	7/18/78	1.5	0.0	1.8	0.0	999	20	4	4	4	1	1	7	9	0000
AALR919R	86	-0.100	7/18/78	2.2	0.2	0.5	0.1	999	21	4	4	4	1	1	7	9	0000
AALR920R	155	-0.100	7/18/78	0.5	0.2	0.2	0.0	999	20	4	4	4	1	1	7	9	0000
AALR921R	103	-0.100	7/18/78	2.7	0.1	2.3	0.1	999	30	4	4	4	1	1	7	9	0000
AALR922R	172	-0.100	3/ 3/79	1.3	0.4	2.8	0.0	999	10	4	4	4	1	1	7	7	0000
AALR923R	52	-0.100	3/ 3/79	2.1	0.3	4.9	0.1	003	22	1	1	1	1	1	6	1	U
AALR924R	69	-0.100	3/ 4/79	0.4	0.3	6.1	0.1	999	25	4	4	4	1	1	7	9	0000
AALR925R	293	-0.100	3/ 4/79	2.2	2.2	3.4	0.0	999	12	4	4	4	1	1	7	9	0000
AALR926R	706	-0.100	3/ 4/79	2.2	2.2	4.3	0.0	999	12	4	4	4	1	1	7	9	0000
AALR927R	86	-0.100	3/ 4/79	1.1	1.5	18.5	0.2	999	18	4	4	4	1	1	6	6	U
AALR928R	34	-0.100	3/ 4/79	0.6	0.8	3.7	0.1	999	16	4	4	4	1	1	7	9	0000
AALR929R	293	-0.100	3/ 4/79	2.2	1.8	3.7	0.0	999	10	4	4	4	1	1	7	8	0000
AALR930R	155	-0.100	3/ 4/79	2.2	2.2	2.6	0.0	999	11	4	4	4	1	1	7	8	0000
AALR931R	138	-0.100	3/ 5/79	1.8	0.5	5.5	0.1	999	11	4	4	4	1	1	7	9	0000
AALR932R	206	-0.100	3/ 5/79	1.6	0.3	3.4	0.1	999	13	4	4	4	1	1	7	9	0000
AALR933R	481	-0.100	3/ 5/79	2.2	0.4	3.7	0.1	999	10	4	4	4	1	1	7	9	0000
AALR934R	447	-0.100	3/ 5/79	0.8	0.4	3.4	0.0	999	12	4	1	1	1	1	7	8	0000
AALR935R	120	-0.100	3/ 5/79	0.5	0.2	1.8	0.0	999	10	4	4	4	1	1	7	9	0000
AALR936R	103	-0.100	3/ 6/79	0.7	0.7	2.6	0.1	999	11	4	4	4	1	1	7	9	0000
AALR937R	206	-0.100	3/ 6/79	2.3	0.6	2.3	0.1	999	8	4	4	4	1	1	7	9	0000
AALR938R	241	-0.100	3/ 6/79	1.7	0.4	5.2	0.0	999	12	4	4	4	1	1	7	9	0000
AALR939R	M	-0.100	5/15/79	4.1	0.1	2.3	0.1	999	19	4	4	4	1	1	7	8	0000
AALR940R	86	-0.100	5/15/79	3.2	0.0	2.8	0.1	999	16	4	4	1	1	1	7	1	0000
AALR941R	86	-0.100	5/15/79	2.2	0.0	4.3	0.1	999	17	4	4	4	1	1	7	9	0000
AALR942R	M	-0.100	5/15/79	2.2	0.1	1.3	0.0	999	15	4	4	4	1	1	7	9	0000
AALR943R	52	-0.100	5/16/79	0.6	0.0	12.5	0.2	999	17	4	4	4	1	1	7	9	0000
AALR944R	172	-0.100	5/16/79	0.2	0.1	1.0	0.1	999	19	4	4	4	1	1	7	9	0000
AALR945R	86	-0.100	5/17/79	3.4	0.0	2.6	0.1	999	23	4	4	4	1	1	7	9	0000
AALR946R	155	-0.100	5/17/79	2.4	0.0	2.6	0.2	999	16	4	4	4	1	1	7	9	0000
AALR947R	138	-0.100	5/17/79	3.0	0.1	0.5	0.1	999	18	4	4	4	1	1	7	9	0000
AALR948R	861	-0.100	5/17/79	4.9	0.1	1.0	0.0	999	16	4	2	1	1	1	4	1	0000
AALR949R	293	-0.100	5/17/79	0.3	0.2	1.5	0.1	999	13	4	4	4	1	1	7	9	0000
AALR950R	396	-0.100	5/17/79	3.2	0.1	2.6	0.1	999	18	4	4	2	1	1	7	7	0000

TABLE A-2 SUPPLEMENTARY FIELD AND ANALYTICAL DATA --- GROUND WATER.

*****									A	W	W	W	W	W	P	W	W
*****									G	A	E	E	E	E	E	I	E
*****									E	T	L	L	L	L	L	P	L
SRL I.D.	AL	DY	SAMPDATE	NO3	NH3	SO4	PO4			E	L	P	L	L	L	E	C
*****	PPB	PPB		PPM	PPM	PPM	PPM			R	T	O	U	F	O	E	L
*****										T	Y	I	S	R	D	C	L
*****										E	P	N	E	E	O	M	A
*****										M	E	T	Q	R	P	S	T
AALR951R	138	-0.100	5/18/79	0.1	0.0	54.0	0.1	005		16	1	7	1	1	1	3	7
AALR952R	275	-0.100	5/18/79	3.0	0.0	1.0	0.1	999		14	4	4	4	1	1	7	9
AALR953R	172	-0.100	5/18/79	2.3	0.0	8.4	0.1	999		16	4	4	4	1	1	1	6
																	0120
																	0000
																	0000

Table A-3 Hydrocarbon Data

SITE	LATITUDE	LONGITUD	METHANE	ETHANE	PROPANE	BUTANE
AALR851	34.7633	93.0690	2.4	.	.	.
AALR852	34.7635	93.0648	4.6	.	.	.
AALR853	34.4666	93.7139	16.0	.	.	.
AALR854	34.4829	93.5912	3.2	.	.	.
AALR855	34.4539	93.8409	6.0	.	.	.
AALR856	34.5328	93.3629	2.7	.	.	.
AALR857	34.4814	94.3060	1200.0	.	.	.
AALR858	34.3232	94.4286	1100.0	.	.	.
AALR859	34.6765	94.3901	1180.0	.	.	.
AALR860	34.6703	94.3904	15.0	.	.	.
AALR861	34.4896	94.0600	1100.0	.	.	.
AALR862	34.4757	93.9380	1000.0	.	.	.
AALR863	34.6194	93.1777	1000.0	.	.	.
AALR864	34.4774	93.3617	2100.0	.	.	.
AALR865	34.4775	93.3617	1700.0	.	.	.
AALR866	34.4755	93.3669	1400.0	.	.	.
AALR867	34.4641	93.4487	500.0	.	1.8	.
AALR868	34.3832	93.5250	630.0	.	.	.
AALR869	34.3714	93.4911	570.0	.	.	.
AALR870	34.3737	93.4881	590.0	.	1.5	.
AALR871	34.3330	93.6521	370.0	.	.	.
AALR872	34.3958	93.6032	360.0	.	.	.
AALR873	34.6603	93.9931	680.0	.	.	.
AALR874	34.3658	94.3801	570.0	.	.	.
AALR875	34.3420	94.4114	670.0	.	.	.
AALR876	34.3919	94.1928	860.0	.	.	.
AALR877	34.3945	94.1893	660.0	.	.	.
AALR878	34.3980	93.9980	790.0	.	.	.
AALR879	34.3712	93.8758	1100.0	.	.	.
AALR880	34.3801	93.8760	850.0	.	.	.
AALR881	34.4001	93.6034	510.0	.	.	.
AALR882	34.4002	93.6034	1000.0	.	.	.
AALR883	34.4001	93.6034	760.0	.	.	.
AALR884	34.4001	93.6034	750.0	.	.	.
AALR885	34.3899	93.5995	390.0	.	.	.
AALR886	34.3935	93.6021	220.0	.	.	.
AALR887	34.4273	93.6101	530.0	.	.	.
AALR888	34.4264	93.6069	410.0	.	.	.
AALR890	34.4055	93.6124	770.0	.	.	.
AALR891	34.4039	93.6098	850.0	.	.	.
AALR892	34.4039	93.6096	850.0	.	9.3	.
AALR893	34.5224	93.3352	30.0	.	12.0	.
AALR894	34.5218	93.3378	18.0	.	15.0	.
AALR895	34.5218	93.3377	670.0	.	.	.
AALR896	34.5218	93.3377	630.0	.	.	.
AALR897	34.5218	93.3377	850.0	.	.	.
AALR898	34.5218	93.3377	850.0	.	.	.
AALR899	34.8020	93.4241	370.0	.	5.8	.
AALR900	34.3613	93.2847	540.0	.	9.1	.
AALR901	34.3596	93.2897	12.0	.	.	.
AALR902	34.3537	93.2957	4.7	.	.	.
AALR903	34.3461	93.3190	2.9	.	.	.
AALR904	34.0998	93.6293	2.6	.	.	.
AALR905	34.1098	93.6244	2.6	.	.	.
AALR906	34.1051	93.6239	2.5	.	4.4	.
AALR907	34.1772	93.6519	1.8	.	8.9	.

Table A-3 Hydrccarbon Data (con't)

SITE	LATITUDE	LONGITUD	METHANE	ETHANE	PROPANE	BUTANE
AALR908	34.2010	93.5356	4.1	.	4.3	.
AALR909	34.1855	93.5854	2.3	.	1.1	.
AALR910	34.0915	93.7002	4.0	.	3.5	.
AALR911	34.4660	93.7955	3.4	.	6.2	.
AALR912	34.4411	93.7795	4.0	.	.	.
AALR913	34.4930	93.8770	2.2	.	.	.
AALR914	34.5528	94.0937	490.0	.	.	.
AALR915	34.3858	93.6086	690.0	.	.	.
AALR916	34.3771	93.8208	420.0	.	.	.
AALR917	34.3810	93.8139	17.0	.	7.8	.
AALR918	34.3771	93.7879	750.0	.	9.5	.
AALR919	34.2388	93.8861	8.5	.	4.6	.
AALR920	34.1379	93.8987	1.7	.	-1.0	.
AALR921	34.3693	93.6501	1.8	.	4.4	.
AALR922	34.9793	93.5637	2.0	.	.	.
AALR923	34.3702	93.6387	4.2	.	.	.
AALR924	34.3321	93.7489	1.8	.	1.2	.
AALR925	34.1766	93.6472	1.6	.	.	.
AALR926	34.1769	93.6562	690.0	.	.	.
AALR927	33.9170	93.8622	580.0	.	.	.
AALR928	33.8739	93.9223	3.8	.	.	.
AALR929	34.1441	93.9333	6.3	.	.	.
AALR930	34.0861	93.6651	2.1	.	3.3	.
AALR931	34.1569	93.6497	1.8	.	1.0	.
AALR932	34.2258	93.8308	860.0	.	.	.
AALR933	34.1055	94.1042	640.0	.	1.4	.
AALR934	34.1128	94.1061	9.1	.	5.0	.
AALR935	34.1101	94.0741	3.8	.	12.0	.
AALR936	34.1906	93.7655	2.6	.	1.0	.
AALR937	34.1921	93.7700	1.8	.	.	.
AALR938	34.3321	93.6185	1.4	.	1.0	.
AALR939	34.5300	94.2427	1.2	.	.	.
AALR940	34.4921	93.9564	1.6	.	9.0	.
AALR941	34.5361	93.8333	2.2	.	.	.
AALR942	34.6023	93.6363	730.0	6.7	.	.
AALR943	34.3739	93.4881	2.1	.	1.9	.
AALR944	34.1439	93.9331	1.0	.	.	.
AALR945	34.4049	93.9046	1.7	.	.	.
AALR946	34.3137	93.9988	1.8	.	1.4	.
AALR947	34.3112	94.1648	750.0	.	3.5	.
AALR948	34.1124	94.1118	6.9	.	4.2	.
AALR949	34.1503	94.2388	3.3	.	.	.
AALR950	34.1552	94.3127	3.5	.	2.4	.
AALR951	34.1382	94.3244	1.8	.	.	.
AALR952	34.1863	94.3371	690.0	.	5.6	.
AALR953	34.5776	94.2459	4.5	.	.	.

Table A-4

Location and Date of Collection of Samples

<u>Sample No.</u>	<u>Name</u>	<u>Location</u>	<u>Area</u>	<u>County</u>	<u>Topo Quad</u>	<u>Date</u>
501*-*	Iron	NE $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 6, T1N, R9W	I	Garland	Nimrod	3/2/78
502	Iron	NE $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 6, T1N, R19W	I	Garland	Nimrod	" "
503	Black	SW $\frac{1}{4}$, SE $\frac{1}{4}$, sec. 19, T3S, R25W	I	Montgomery	Glenwood	3/3/78
504	Collier	SE $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 17, T3S, R24W	I	Montgomery	Glenwood*	" "
505	Caddo Valley	SW $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 25, T3S, R27W	I	Montgomery	Athens*	" "
506	Crystal A	SE $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 28, T2S, R22W	I	Garland	Crystal Spring	" "
507	Goat Brown	NW $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 22, T3S, R31W	I	Polk	Cove	3/6/78
508	Bogg	NW $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 16, T5S, R32W	II	Polk	Cove*	" "
509	Queen Wilhelmina	SE $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 11, T1S, R32W	I	Polk	Rich Mtn.	3/7/78
510	Queen Wilhelmina	SE $\frac{1}{4}$, SE $\frac{1}{4}$, sec. 11, T1S, R32W	I	Polk	Rich Mtn.	" "
511	Silver World	NE $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 14, T3S, R29W	I	Polk	Umpire	" "
512	Abernathy	NW $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 24, T3S, R28W	I	Polk	Athens*	" "
513	Three Sisters	NW $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 29, T1S, R20W	I	Garland	Mtn. Pine	4/8/78
514	(No Name)	NE $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 16, T3S, R22W	I	Garland	Percy	" "
515	(No Name)	NE $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 16, T3S, R22W	I	Garland	Percy	" "
516	(No Name)	NE $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 16, T3S, R22W	I	Garland	Percy	" "
517	Wyatt	SW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 22, T3S, R23W	I	Montgomery	Bonnerdale*	" "
518	(No Name)	NE $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 24, T4S, R24W	I	Montgomery	Glenwood	4/9/78
519	(No Name)	SW $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 20, T4S, R23W	I	Montgomery	Amity	" "
520***,****	Pigeon Roost (W)	SW $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 20, T4S, R23W	I	Montgomery	Amity	" "
521	Dripping	SE $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 11, T5S, R25W	I	Pike	Glenwood*	" "
522	Strawn	SE $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 18, T4S, R24W	I	Montgomery	Glenwood*	" "
523	(No Name)	SE $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 16, T1S, R28W	I	Polk	Oden	5/16/78
524	(No Name)	SE $\frac{1}{4}$, SE $\frac{1}{4}$, sec. 26, T4S, R32W	I	Polk	Cove	" "

Location and Date of Collection of Samples (con't)

<u>Sample No.</u>	<u>Name</u>	<u>Location</u>	<u>Area</u>	<u>County</u>	<u>Topo Quad</u>	<u>Date</u>
525	(No Name)	SW $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 3, T2S, R32W	I	Polk	Cove*	5/17/78
526	Gilham A	SW $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 22, T4S, R30W	I	Polk	Umpire*	" "
527	Gilham B	SW $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 22, T4S, R30W	I	Polk	Umpire*	" "
528	Bard	SW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 20, T4S, R28W	I	Polk	Umpire	" "
529	(No Name)	NW $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 27, T4S, R27W	I	Montgomery	Athens	" "
530	(No Name)	NW $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 22, T4S, R27W	I	Montgomery	Athens	" "
531	McClaine A	SW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 18, T4S, R24W	I	Montgomery	Glenwood	5/18/78
532	McClaine B	SW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 18, T4S, R24W	I	Montgomery	Glenwood	" "
533	McClaine C	SW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 18, T4S, R24W	I	Montgomery	Glenwood	" "
534	McClaine D	SW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 18, T4S, R24W	I	Montgomery	Glenwood	" "
535	W. Jones	NE $\frac{1}{4}$, SE $\frac{1}{4}$, sec. 18, T4S, R24W	I	Montgomery	Glenwood	" "
536	Jones Valley	NE $\frac{1}{4}$, SE $\frac{1}{4}$, sec. 18, T4S, R24W	I	Montgomery	Glenwood	" "
537	Buttermilk A	NW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 6, T4S, R24W	I	Montgomery	Glenwood	" "
538	Buttermilk B	NW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 6, T4S, R24W	I	Montgomery	Glenwood	" "
539	(No Name)	NW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 6, T4S, R24W	I	Montgomery	Glenwood	" "
540	McElhahan	SW $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 7, T4S, R24W	I	Montgomery	Glenwood	" "
541	(No Name)	NW $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 18, T4S, R24W	I	Montgomery	Glenwood	" "
542	(No Name)	NW $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 18, T4S, R24W	I	Montgomery	Glenwood	" "
543	Crystal B	SE $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 34, T2S, R22W	I	Garland	Crystal Spring	5/19/78
544	Brogdams A	SW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 34, T2S, R22W	I	Garland	Crystal Spring	" "
545	Brogdams B	SW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 34, T2S, R22W	I	Garland	Crystal Spring	" "
546	Brogdams C	SW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 34, T2S, R22W	I	Garland	Crystal Spring	" "

Location and Date of Collection of Samples (con't)

<u>Sample No.</u>	<u>Name</u>	<u>Location</u>	<u>Area</u>	<u>County</u>	<u>Topo Quad</u>	<u>Date</u>
547	Brogdams D	SW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 34, T2S, R22W	I	Garland	Crystal Spring	5/19/78
548	Brogdams E	SW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 34, T2S, R22W	I	Garland	Crystal Spring	" "
899	Burrows	SE $\frac{1}{4}$, SE $\frac{1}{4}$, sec. 6, T5S, R22W	I	Clark	Amity	7/13/78
900	Lead Mine Road	SW $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 30, T4S, R21W	I	Hot Spring	Point Cedar	" "
901	Lead Mine Road	SW $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 30, T4S, R21W	I	Hot Spring	Point Cedar	" "
902	(No Name)	SE $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 31, T4S, R21W	I	Hot Spring	Point Cedar*	" "
903	" "	SW $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 36, T4S, R21W	I	Hot Spring	Point Cedar	" "
904	" "	SE $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 35, T7S, R25W	II	Pike	Murfreesboro*	7/14/78
905**	Womack	NW $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 25, T7S, R25W	II	Pike	Delight	" "
906	Womack	SE $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 25, T7S, R25W	II	Pike	Delight	" "
907**	Lolla Bell	NW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 3, T7S, R25W	II	Pike	Narrows Dam	" "
908	(No Name)	NW $\frac{1}{4}$, SE $\frac{1}{4}$, sec. 26, T6S, R24W	II	Pike	Murfreesboro NE	" "
909	" "	SE $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 32, T6S, R24W	II	Pike	Murfreesboro NE	" "
910	" "	SE $\frac{1}{4}$, SE $\frac{1}{4}$, sec. 31, T7S, R25W	I	Pike	Murfreesboro	7/15/78
911	" "	SE $\frac{1}{4}$, SE $\frac{1}{4}$, sec. 20, T3S, R26W	I	Montgomery	Athens	" "
912	" "	SW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 33, T3S, R26W	I	Montgomery	Athens	" "
913	Sulfur	SW $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 10, T3S, R27W	I	Montgomery	Athens	" "
914	Elliott	NE $\frac{1}{4}$, SE $\frac{1}{4}$, sec. 21, T2S, R29W	I	Polk	Board Camp	7/18/78
915	Caddo River	NW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 19, T4S, R24W	I	Montgomery	Glenwood	" "
916***,****	Artesian Well	SE $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 32, T4S, R26W	I	Montgomery	Athens	" "
917***,****	Artesian Well	SW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 30, T4S, R26W	I	Montgomery	Athens	" "
918	(No Name)	NE $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 28, T4S, R26W	I	Montgomery	Athens	" "
919	(No Name)	SW $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 16, T6S, R27W	II	Pike	Newhope	" "

Location and Date of Collection of Samples (con't)

<u>Sample No.</u>	<u>Name</u>	<u>Location</u>	<u>Area</u>	<u>County</u>	<u>Topo Quad</u>	<u>Date</u>
920	(No Name)	SE $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 20, T7S, R27W	II	Howard	Newhope	7/18/78
921	(No Name)	SW $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 26, T4S, R25W	I	Montgomery	Glenwood	" "
922	Chalyceate	NE $\frac{1}{4}$, SE $\frac{1}{4}$, sec. 20, T4N, R24W	I	Yell	Gravelly	3/3/79
923	Caddo Gap Well	SE $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 26, T4S, R25W	I	Montgomery	Glenwood	" "
924	Redland Mtn.	SW $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 12, T5S, R26W	I	Pike	Glenwood	3/4/79
925	Lolla Bell A	NW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 3, T7S, R25W	II	Pike	Narrows Dam	" "
926	" " B	SW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 3, T7S, R25W	II	Pike	Narrows Dam	" "
927**,****	Artesian Well	SE $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 3, T10S, R27W	II	Howard	Nashville	" "
928	Mineral	SW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 19, T10S, R27W	II	Howard	Mineral Springs S	" "
929	Barite Pit	NE $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 24, T7S, R28W	II	Howard	Newhope	" "
930	Murfreesboro Area	NE $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 4, T8S, R25W	II	Pike	Murfreesboro	" "
931	Murfreesboro Area	NE $\frac{1}{4}$, SE $\frac{1}{4}$, sec. 10, T7S, R25W	II	Pike	Narrows Dam	3/5/79
932	Lake Greeson Area	NE $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 24, T6S, R27W	II	Pike	Center Pt. NE	" "
933	Dierks Area	NE $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 4, T8S, R29W	II	Sevier	Dierks	" "
934	Cox Residence	SE $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 33, T7S, R29W	II	Sevier	Dierks	" "
935	Dierks Area	SW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 34, T7S, R29W	II	Howard	Dierks	" "
936	L. Greeson, Sulfur	SW $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 34, T6S, R26W	II	Pike	Center Pt. NE	3/6/79
937	L. Greeson, Possum	NW $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 34, T6S, R26W	II	Pike	Center Pt. NE	" "
933	Salem Area	NE $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 7, T5S, R24W	I	Pike	Glenwood	" "
933	Bethesda	NW $\frac{1}{4}$, SE $\frac{1}{4}$, sec. 31, T2S, R30W	I	Polk	Mena	5/15/79
940	Mine Creek	SW $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 14, T3S, R23W	I	Polk	Athens	" "
941	Rock	SW $\frac{1}{4}$, SE $\frac{1}{4}$, sec. 25, T2S, R27W	I	Montgomery	Oden*	" "
942	West	SE $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 2, T2S, R25W	I	Montgomery	Mt. Ida*	" "
943	Pigeon Roost	SW $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 20, T4S, R23W	I	Montgomery	Amity	5/16/79
944	Barite Pit	NE $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 24, T7S, R28W	II	Howard	Newhope	" "

Location and Date of Collection of Samples (con't)

<u>Sample No.</u>	<u>Name</u>	<u>Location</u>	<u>Area</u>	<u>County</u>	<u>Topo Quad</u>	<u>Date</u>
945	"Warm"	SW $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 8, T4S, R27W	I	Montgomery	Athens	5/17/79
946	Athens Area	SW $\frac{1}{4}$, SE $\frac{1}{4}$, sec. 16, T5S, R28W	II	Howard	Athens	" "
947	Umpire Area	SW $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 13, T5S, R30W	II	Howard	Umpire	" "
948	S. Cox	SW $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 33, T7S, R29W	II	Sevier	Dierks	" "
949	Cossatot	NW $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 19, T7S, R30W	II	Sevier	Gillham Dam	" "
950	Church	NW $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 16, T7S, R31W	II	Sevier	Gillham*	" "
951	Defore Well	NE $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 20, T7S, R31W	II	Sevier	Gillham	5/18/79
952	(No Name)	SE $\frac{1}{4}$, NE $\frac{1}{4}$, sec. 6, T7S, R31W	II	Sevier	Gillham*	" "
953	Mena Park	NE $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 18, T2S, R30W	I	Polk	Mena	" "

* spring is shown on map

** well with metal pipe

*** well with plastic pipe

**** artesian well

NOTE: 944 and 929 are duplicate collections
of the same site.

Table A-5
Summary of Analytical Methods

<u>Measurement</u>	<u>Anions</u>	
	<u>Method</u>	<u>APHA (1971) Page</u>
NO ₃	Cd reduction	--
NH ₃	Nessler	226
PO ₄ (ortho, dissolved)	Ascorbic acid	532
SO ₄	Turbidimetric	334
SiO ₂	Colorimetric	303,336
Cl	Mercuric nitrate	97
Alkalinity(total)	Titration to methy red end pt.	52

Table A-5
Summary of Analytical Methods
(continued)

<u>Element</u>	<u>Instrument*</u>	<u>Cations</u>			<u>Additive</u>
		<u>Mode</u>	<u>Flame</u>		
Na	JA	emission	H ₂ - N ₂		none
K	"	"	"		"
Li	"	"	"		"
Ca	"	absorption	C ₂ H ₂ - N ₂ O		NaCl
Mg	"	"	"		"
Sr	"	emission	"		"
Ba	"	concentration	"		KCl
Fe	"	absorption	C ₂ H ₂ - Air		via chelation
Co	"	"	"		" "
Ni	"	"	"		" "
Cu	"	"	"		" "
Zn	PE	"	"		" "
Pb	PE	"	"		" "
Hg	PE	"	flameless		**
Sb	JA	hydride generation absorption	H ₂ - N ₂		***

PE = Perkin Elmer Model 303 Atomic Absorption Spectrophotometer

*

JA = Jarrel Ash modernized Model 82-500 Atomic Absorption Spectrophotometer

** method of EPA(1974), p. 118

*** method of Fernandez (1973)

Table A-6

Anion Analyses and Miscellaneous Measurements

Name of Spring or Well (W)	Lab No.	Water T °C	pH units	Sp. Cond. $\mu\text{mhos per cm } 25^\circ\text{C}$	Total Alkalinity mg/l as CaCO_3	NO_3 as N ppm	NH_3 as N ppm	PO_4 as P ppm	SO_4 ppm	Cl ppm	SiO_2 ppm
Iron (W)	851	15.0	7.4	252	291	2.28	0.11	0.03	0.3	0.3	7.7
Iron	852	5.0	6.5	14	2	<0.01	0.02	0.04	0.3	1.8	3.2
Black	853	15.0	7.5	324	10	<0.01	0.05	0.04	32.0	0.3	18.3
Collier	854	16.5	6.7	61	44	<0.01	<0.02	0.06	1.1	2.3	12.1
Caddo Valley	855	15.0	7.3	168	225	<0.01	<0.02	0.13	1.4	0.3	7.7
Crystal A	856	18.0	7.6	197	162	<0.01	0.42	0.08	1.1	0.3	12.1
Goat Brown	857	13.0	6.7	89	60	0.06	0.04	0.04	1.1	3.5	13.7
Bogg	858	13.0	7.2	372	130	0.06	0.02	0.05	2.3	0.5	7.7
Queen Wilhelmina S. Park	859	10.0	5.8	29	5	2.02	0.09	0.02	2.6	1.8	10.3
Queen Wilhelmina S. Park	860	9.0	6.4	66	2	2.68	0.13	0.05	0.6	3.8	6.6
Silver World	861	16.0	6.9	109	90	<0.03	0.06	0.03	4.7	1.5	10.2
Abernathy	862	16.0	7.0	144	70	0.37	0.09	0.12	2.0	1.0	8.9
Three Sisters	863	16.0	6.9	244	150	0.76	0.05	0.12	6.9	3.5	19.4
(No Name)	864	18.0	5.6	21	5	1.07	0.04	0.03	0.9	1.5	10.2
(No Name)	865	17.0	6.0	21	5	<0.02	<0.02	0.09	1.3	2.0	9.6
(No Name)	866	21.0	6.3	103	66	0.02	0.11	0.13	4.0	2.0	12.0
Wyatt	867	17.0	5.7	64	12	<0.02	0.25	0.54	12.0	2.5	12.0
(No Name)	868	15.0	5.8	18	5	0.65	0.12	<0.01	0.6	2.0	10.6
(No Name)	869	18.0	6.6	135	84	0.08	0.33	0.01	2.9	2.0	9.4
Pigeon Roost* (W)	870	17.0	7.2	208	160	0.02	0.64	0.03	2.6	1.8	13.5
Dripping	871	17.0	5.6	26	10	0.54	0.29	0.03	1.9	2.0	9.6
Strawn	872	18.0	7.3	228	125	0.05	0.38	0.03	4.0	2.3	9.5
(No Name)	873	22.0	3.8	37	0	-	0.09	0.04	<0.3	2.0	12.0
(No Name)	874	15.5	5.1	30	30	<0.02	0.44	<0.01	<0.3	3.0	15.5
(No Name)	875	15.0	6.1	48	25	0.15	0.05	0.05	3.0	2.0	9.7
Gillham A	876	17.0	7.5	383	170	0.37	0.54	0.06	0.3	86	16.8
Gillham B	877	17.5	7.6	385	230	0.04	0.47	0.11	<0.3	87	16.8
Bard	878	15.5	6.8	184	140	0.03	0.22	0.07	7.6	1.3	16.2
(No Name)	879	17.5	6.4	35	50	2.30	0.08	0.08	<0.3	1.5	9.2
(No Name)	880	15.0	6.8	42	12	--	0.08	0.05	3.0	1.5	9.2

Table A-6 Anion Analyses and Miscellaneous Measurements (con't)

	No.	TOC	pH	Sp. Cond.	Alkalinity	NO ₃	NH ₃	PO ₄	SO ₄	Cl	SiO ₂
McClaine A	881	17.5	6.9	175	90	--	0.09	0.14	4.8	2.0	10.1
McClaine B	882	18.0	6.4	80	50	2.30	0.08	0.08	3.4	2.3	9.7
McClaine C	883	17.5	7.3	230	90	0.05	0.09	0.05	4.8	2.5	10.1
McClaine D	884	15.5	5.5	27	10	--	0.15	0.05	2.0	1.8	7.0
W. Jones	885	16.0	6.4	41	20	--	0.11	0.03	0.3	1.3	7.6
Jones Valley	886	18.0	7.0	274	90	2.50	0.04	0.12	5.6	1.8	9.2
Buttermilk A	887	15.0	4.4	24	40	2.30	0.08	0.07	3.0	1.5	8.3
Buttermilk B	888	19.0	6.5	118	80	2.50	0.11	0.18	6.0	2.0	8.6
(No Name)	889	17.0	4.4	23	0	1.10	0.07	0.06	3.4	2.0	7.6
McElhanon	890	18.0	4.6	23	20	0.92	0.07	0.03	0.3	2.3	7.2
(No Name)	891	16.0	4.7	24	20	0.75	0.05	0.07	1.3	2.5	8.8
(No Name)	892	16.0	5.1	17	10	0.79	0.04	0.05	1.0	2.3	8.5
Crystal B	893	20.0	7.1	259	180	0.55	0.11	0.10	4.5	4.0	9.7
Brogdams A	894	18.0	7.3	274	160	--	0.06	0.07	2.3	3.0	10.1
Brogdams B	895	20.0	7.6	279	230	0.79	0.07	0.10	1.3	1.3	9.7
Brogdams C	896	21.0	7.3	234	130	0.92	0.04	0.13	5.6	2.5	10.1
Brogdams D	897	20.0	7.5	266	180	--	0.09	0.08	3.4	2.5	10.4
Brogdams E	898	22.0	7.0	263	60	1.70	0.17	0.02	4.1	2.0	10.4
Burrous	899	17.0	7.9	104	150	0.63	0.10	0.06	<0.3	2.7	10.8
Lead Mine Road A	900	18.0	6.2	34	100	0.87	0.13	0.06	0.3	1.8	9.3
Lead Mine Road B	901	18.0	6.9	131	112	0.19	0.21	0.04	1.4	1.8	9.1
(No Name)	902	20.0	6.4	28	50	0.67	0.16	0.08	0.7	3.8	10.5
(No Name)	903	18.0	6.3	108	70	0.76	0.14	0.10	1.0	2.5	11.6
(No Name)	904	18.0	4.1	108	0	14.3	0.10	0.13	3.6	9.5	8.7
Womack, W	905	20.0	6.2	303	125	1.35	0.13	0.20	2.8	4.5	9.9
Womack	906	20.0	4.3	55	10	1.62	0.05	0.30	1.7	4.5	5.4
Lolla Bell, W	907	19.0	6.2	196	67	0.31	0.19	0.11	5.9	2.8	37.1
(No Name)	908	18.0	7.1	57	25	1.20	1.39	0.04	2.1	2.3	11.9
(No Name)	909	19.0	7.2	17	5	0.68	0.21	0.08	2.8	3.0	13.2
(No Name)	910	18.0	5.8	57	2	0.83	0.47	0.20	12.6	5.0	19.3
(No Name)	911	16.0	5.4	183	175	1.19	0.47	0.28	5.1	2.3	11.6
(No Name)	912	16.5	5.8	135	70	1.07	0.38	0.21	4.0	1.5	9.3
Sulfur	913	17.0	4.1	267	135	0.68	1.08	0.25	1.4	3.5	14.0
Elllott	914	20.0	5.5	46	22	0.42	0.10	0.09	0.3	3.0	18.2
Caddo River	915	35.0	5.7	200	122	0.17	0.16	0.08	0.7	3.5	17.2
Artesian* Well(W)	916	18.0	5.8	97	40	0.11	0.20	0.24	7.6	3.0	34.9
Artesian* Well(W)	917	18.0	7.2	57	17	0.67	0.10	0.14	10.2	3.0	11.6
(No Name)	918	20.0	5.7	55	37	0.97	0.02	0.08	2.5	2.5	8.7
(No Name)	919	21.0	5.9	81	12	3.77	0.20	0.08	0.7	6.5	17.2

Table A-6 Anion Analyses and Miscellaneous Measurements (con't)

	No.	TOC	pH	Sp. Cond.	Alkalinity	NO ₃	NH ₃	PO ₄	SO ₄	Cl	SiO ₂
(No Name)	920	20.0	4.3	<5	5	0.77	0.21	0.03	0.3	5.0	22.9
(No Name)	921	30.0	6.4	227	130	3.26	0.10	0.12	3.2	2.5	10.5
Chalybeate	922	10.0	6.2	107	6	12.0	0.28	0.05	4.6	13.0	7.7
Caddo Gap (W)	923	22.0	7.4	138	100	0.98	0.23	0.15	5.0	2.5	31.9
Redland Mt.	924	25.0	7.2	210	144	3.86	0.22	0.08	9.7	1.5	18.5
Lolla Bell A	925	12.0	7.2	19	11	0.53	1.52	0.04	5.5	3.0	10.5
Lolla Bell B	926	12.0	7.0	19	9	0.53	1.52	0.04	6.8	1.5	10.0
Artesian Well (W)	927	18.5	7.6	373	186	10.50	1.02	0.34	29.5	3.5	21.3
Mineral	928	16.0	6.9	65	21	0.13	0.52	0.08	5.9	3.0	27.3
Barite Pit	929	10.0	5.0	20	1	0.53	1.31	0.02	0.51	2.5	10.5
Hurfreesboro Area	930	11.0	5.1	19	1	1.02	1.52	0.03	4.1	3.0	7.2
Hurfreesboro Area	931	11.0	5.0	15	2	0.83	0.36	0.09	8.7	0.8	4.8
Lake Greeson Area	932	13.0	6.8	112	58	0.38	0.23	0.14	5.5	4.8	25.6
Dierks Area	933	10.0	4.8	39	0	1.06	0.30	0.08	5.9	5.0	7.6
Cox Residence	934	12.0	4.7	63	0	1.36	0.29	0.06	5.5	4.0	7.4
Dierks Area	935	10.0	5.1	13	0	5.23	0.15	0.05	2.8	1.5	6.6
L. Greeson, Sulfur	936	11.0	6.8	109	56	--	0.50	0.18	4.1	3.5	23.5
L. Greeson, Possum	937	8.0	8.7	563	265	0.55	0.42	0.10	3.7	1.5	12.1
Salem Area	938	12.0	6.9	107	50	0.80	0.25	0.05	8.2	2.5	9.9
Bethesda	939	19.0	7.1	224	121	4.80	0.10	0.09	2.4	2.0	13.2
Mine Creek Area	940	16.0	5.9	248	170	0.20	0.00	0.13	2.9	2.5	9.2
Rock	941	17.0	6.5	299	176	1.24	0.05	0.09	4.3	3.0	13.2
West	942	15.0	5.3	36	24	1.24	0.10	0.06	1.3	1.5	7.9
Pigeon Roost	943	15.0	5.5	218	42	0.30	0.02	0.12	7.1	2.0	11.4
Barite Pit	944	18.5	4.6	23	12	0.08	0.06	0.10	1.0	3.0	10.8
"Warm"	945	23.0	7.1	116	73	5.50	0.00	0.15	2.6	2.5	11.1
Athens Area	946	16.0	5.8	18	24	1.91	0.04	0.23	2.6	2.8	13.6
Umpire Area	947	18.0	5.6	23	18	2.70	0.09	0.13	0.5	1.8	12.4
S. Cox	948	16.0	4.1	177	0	19.7	0.07	0.05	1.0	8.0	8.0
Cossatot	949	13.0	4.7	37	24	0.89	0.20	0.12	1.5	2.5	16.0
Church	950	18.0	4.7	205	18	4.70	0.14	0.10	2.6	5.0	12.4
DeFore (W)	951	16.0	7.4	484	200	0.09	0.02	0.41	55.0	3.5	29.0
(No Name)	952	14.0	4.7	61	12	5.00	0.05	0.13	1.0	5.5	12.9
Mena Park	953	16.0	4.5	71	12	2.41	0.00	0.12	8.5	6.0	12.9
Median	-	16.5	6.2	85	37	0.9	0.15	0.08	3	2.9	11
EPA or APHA precision data	-	-	0.15	4	3.2	-	0.06	<0.01	0.3	-	≈2

* Cored, plastic piping

Table A-7

Alkali and Alkaline Earth Metals

Name of Spring or Well (W)	Lab No.	Na ppm	K ppm	Li ppb	Ca ppm	Mg ppm	Sr ppm	Ba ppm
Iron (W)	851	48.40	0.50	21.0	43.20	12.60	0.597	0.04
Iron	852	0.95	0.12	2.0	0.60	0.81	0.003	<0.01
Black	853	10.00	0.30	8.0	60.80	14.30	0.356	<0.01
Collier	854	2.00	1.25	3.0	8.30	1.95	0.020	0.02
Caddo Valley	855	1.10	0.21	2.0	40.00	1.31	0.140	<0.01
Crystal A	856	1.50	1.70	8.0	40.20	6.21	0.062	<0.01
Goat Brown	857	2.20	0.30	4.0	17.70	1.47	0.031	0.02
Bogg	858	2.80	0.34	3.0	41.50	1.89	0.063	<0.01
Queen Wilhelmina Park	859	2.00	0.42	1.0	1.52	0.93	0.014	<0.01
Queen Wilhelmina Park	860	2.40	0.48	1.0	1.47	1.11	0.011	0.02
Silver World	861	1.30	0.12	1.0	24.50	0.97	0.117	<0.01
Abernathy	862	1.10	0.31	2.0	32.70	1.12	0.138	<0.01
Three Sisters	863	3.10	0.80	7.0	41.20	6.33	0.089	<0.01
(No Name)	864	1.10	0.42	1.9	1.47	0.84	<0.002	<0.01
(No Name)	865	1.10	0.38	2.2	1.47	0.79	<0.002	<0.01
(No Name)	866	1.60	1.05	4.0	14.70	3.02	0.027	<0.01
Wyatt	867	1.20	0.78	3.7	4.25	1.08	<0.002	<0.01
(No Name)	868	1.50	0.23	1.0	0.73	0.62	0.004	<0.01
(No Name)	869	6.00	1.30	3.7	25.00	2.92	0.105	0.11
Pigeon Roost* (W)	870	6.50	1.40	23.0	37.70	3.18	0.317	0.42
Dripping	871	0.95	0.30	1.9	1.91	0.95	0.008	<0.01
Strawn	872	1.80	0.49	4.2	54.40	2.86	0.234	<0.01
(No Name)	873	2.60	0.45	1.9	1.06	0.83	0.012	0.02
(No Name)	874	4.30	1.05	1.9	4.64	1.50	0.015	0.01
(No Name)	875	1.50	0.37	2.2	9.53	1.04	0.033	<0.01
Gillham A	876	131	1.20	70.0	9.99	3.06	0.838	0.22
Gillham B	877	152	1.10	70.0	9.77	3.18	0.802	0.23
Bard	878	6.20	0.72	3.0	31.00	12.40	0.140	<0.01
(No Name)	879	1.50	0.44	1.6	4.05	1.22	0.012	<0.01
(No Name)	880	1.50	0.46	1.6	4.52	1.96	0.016	<0.01
McClaine A	881	2.10	0.80	4.6	44.20	2.73	0.131	0.01
McClaine B	882	1.80	0.58	2.6	17.30	1.56	0.072	0.01
McClaine C	883	2.10	0.75	4.6	50.80	2.95	0.160	<0.01
McClaine D	884	1.20	0.56	<1.0	3.13	0.76	0.018	0.02
W. Jones	885	1.10	0.37	<1.0	6.24	0.68	0.035	<0.01
Jones Valley	886	1.40	0.48	2.4	39.70	2.16	0.197	<0.01
Buttermilk A	887	1.30	0.29	<1.0	1.91	0.35	0.013	<0.01
Buttermilk B	888	1.50	0.40	1.9	35.60	1.22	0.168	<0.01
(No Name)	889	1.30	0.29	<1.0	1.46	0.32	0.010	<0.01
Mcellhanon	890	1.80	0.57	<1.0	2.37	0.46	0.014	<0.01
(No Name)	891	1.60	0.31	<1.0	1.09	0.46	0.003	<0.01
(No Name)	892	1.20	0.04	<1.0	0.033	0.15	0.002	<0.01
Crystal B	893	1.70	0.48	2.6	66.5	2.04	0.161	<0.02
Brogdams A	894	1.90	0.36	2.6	60.1	2.54	0.150	<0.01
Brogdams B	895	1.80	0.46	3.1	61.3	2.14	0.167	<0.02
Brogdams C	896	2.10	0.51	3.3	56.4	2.16	0.143	<0.02

Table A-7 Alkali and Alkaline Earth Metals (con't)

Name of Spring or Well (W)	Lab. No.	Na ppm	K ppm	Li ppb	Ca ppm	Mg ppm	Sr ppm	Ba ppm
Brogdams D	897	2.20	0.48	3.1	58.9	2.33	0.141	<0.02
Brogdams E	898	2.30	0.55	2.9	61.3	2.41	0.149	<0.02
Burrows	899	3.25	0.50	3.8	53.3	2.17	0.119	0.03
Lead Mine Road	900	1.31	0.24	<1.0	5.60	0.89	0.010	0.06
Lead Mine Road	901	1.75	0.37	1.9	35.90	6.16	0.089	0.01
(No Name)	902	1.80	0.24	2.2	2.36	1.08	0.003	0.04
(No Name)	903	1.70	0.24	2.2	25.40	1.21	0.045	0.01
(No Name)	904	10.00	3.80	1.9	4.97	3.05	0.057	0.18
Womack Well (W)	905	82.5	1.15	28.5	8.56	2.67	0.148	0.02
Womack	906	5.15	4.30	<1.0	2.36	1.15	0.018	0.07
Lolla Bell (W)	907	20.00	1.00	16.5	13.10	19.60	0.101	0.27
(No Name)	908	2.10	0.62	7.5	1.30	3.48	0.004	0.06
(No Name)	909	1.00	1.40	1.8	0.75	0.88	0.002	0.02
(No Name)	910	0.85	0.67	14.0	4.47	1.00	0.011	0.08
(No Name)	911	1.50	0.20	2.5	70.10	2.83	0.500	0.06
(No Name)	912	1.23	0.27	1.0	25.20	1.13	0.160	0.02
Sulfur	913	16.50	0.90	17.3	27.54	14.92	2.200	0.07
Elliott	914	1.55	0.24	4.0	1.37	1.91	0.015	0.02
Caddo River	915	5.40	1.00	11.5	42.05	2.45	0.051	0.03
Artesian*Well (W)	916	2.00	0.95	10.0	7.30	2.52	0.044	0.20
Artesian* Well (W)	917	1.13	1.05	8.2	4.18	1.91	0.035	0.08
(No Name)	918	1.65	0.27	2.1	6.83	1.61	0.032	0.08
(No Name)	919	7.60	2.80	4.3	4.18	2.90	0.048	0.08
(No Name)	920	1.23	0.46	2.1	0.60	0.74	0.070	0.02
(No Name)	921	3.83	1.10	4.6	50.41	2.38	0.100	<0.01
Chalybeate	922	10.00	2.90	2.1	6.68	7.75	0.080	0.15
Caddo Gap (W)	923	13.00	0.65	12.5	18.30	2.80	0.088	0.10
Redland Mt.	924	2.50	0.95	7.0	53.35	23.70	0.071	0.02
Lolla Bell A	925	2.00	0.70	2.0	1.54	0.96	0.016	0.02
Lolla Bell B	926	2.50	0.38	2.0	0.91	1.15	0.011	0.03
Artesian Well (W)	927	80.00	5.20	58.0	26.68	4.31	1.44	0.08
Mineral	928	4.60	3.90	20.0	2.66	1.40	0.049	0.01
Barite Pit	929	2.40	0.21	2.1	0.91	0.30	0.032	0.91
Murfreesboro Area	930	1.60	0.38	1.0	1.22	0.61	0.013	0.06
Murfreesboro Area	931	0.90	0.49	1.6	0.91	0.64	0.007	0.02
Lake Greeson Area	932	10.50	1.41	26.0	8.60	4.55	0.042	0.26
Dierks Area	933	3.20	2.11	1.0	1.07	0.77	0.006	0.03
Cox Residence	934	2.60	1.75	1.0	4.51	1.86	0.023	0.03
Dierks Area	935	1.25	0.45	1.6	0.91	0.58	0.013	0.03
Lake Greeson, Sulfur	936	11.00	2.60	17.5	5.57	3.92	0.041	0.15
Lake Greeson Possum	937	162.5	0.48	86.0	1.22	0.19	0.030	0.03
Salem Area	938	1.90	0.80	2.1	20.74	1.40	0.018	0.04
Bathesda	939	2.85	0.80	4.0	46.36	6.44	0.080	<0.02
Mine Creek Area	940	1.24	0.46	2.6	53.90	1.70	0.320	<0.02
Rock	941	3.15	0.42	3.3	65.66	5.68	0.105	<0.02
West	942	0.93	0.49	<1.0	5.66	0.76	0.020	0.02
Pigeon Roost	943	2.00	0.70	8.2	12.64	2.35	0.068	0.19
Barite Pit	944	1.40	0.30	2.0	0.39	0.34	0.020	0.93
"Warm"	945	1.70	0.73	2.2	19.52	2.66	0.033	<0.02
Athens Area	946	2.85	0.78	2.0	0.78	0.47	0.010	0.02

Table A-7 Alkali and Alkaline Earth Metals (con't)

Name of Spring or Well(W)	Lab No.	Na ppm	K ppm	Li ppb	Ca ppm	Mg ppm	Sr ppm	Ba ppm
Umpire Area	947	2.70	0.62	1.6	1.37	0.64	0.010	<0.02
S. Cox	948	6.80	8.50	4.6	9.45	3.45	0.092	0.26
Cossatot	949	5.00	0.95	2.0	2.73	0.64	0.033	<0.02
Church	950	6.25	1.20	2.0	2.82	1.47	0.026	<0.02
Defore Well (W)	951	21.50	1.25	45.0	78.39	9.37	0.275	0.02
(No Name	952	6.50	1.30	2.6	2.62	1.93	0.020	0.03
Mena Park	953	6.70	0.78	2.6	3.68	1.88	0.020	<0.02

* Cored, plastic piping

Table A-8

Heavy Metals (all data in parts per billion)

Name of Spring or Well (W)	Lab No.	Fe	Mn	Zn	Cu	Co	Ni	Pb	Hg	Sb
Iron (W)	851	4	20	1,480	14	<3	<3	<10	<0.1	<0.2
Iron	852	275	12	17	5	<3	<3	<10	<0.1	<0.2
Black	853	36	195	18	1	8	<3	<10	<0.1	<0.2
Collier	854	<2	<5	6	1	<3	<3	<10	<0.1	0.2
Caddo Valley	855	97	25	31	1	<3	<3	<10	<0.1	0.2
Crystal A	856	<2	<5	<2	1	<3	<3	<10	<0.1	0.2
Goat Brown	857	7	<5	25	7	<3	<3	<10	<0.1	0.3
Bogg	858	22	10	2	3	<3	<3	<10	<0.1	0.25
Queen Wilhelmina S. Park	859	29	6	9	7	<3	<3	<10	<0.1	0.12
Queen Wilhelmina S. Park	860	85	8	17	6	<3	<3	<10	<0.1	0.12
Silver World	861	472	35	26	85	8	8	18	<0.1	<0.2
Abernathy	862	165	30	26	5	8	<3	<10	<0.1	0.2
Three Sisters	863	210	18	24	15	<3	3	<10	0.1	<0.2
(No Name)	864	6	17	17	8	<3	<3	<10	<0.1	<0.2
(No Name)	865	3	29	17	8	<3	<3	18	<0.1	<0.2
(No Name)	866	663	316	32	5	13	12	18	<0.1	<0.2
Wyatt	867	3620	1220	69	21	20	29	29	<0.1	0.2
(No Name)	868	43	25	16	9	<3	<3	13	<0.1	<0.2
(No Name)	869	3	5	5	5	<3	<3	10	<0.1	<0.2
Pigeon Roost*(W)	870	323	272	10	3	13	8	33	0.72	<0.2
Dripping	871	7	14	20	7	<3	<3	13	<0.1	<0.2
Strawn	872	880	206	9	7	11	8	18	<0.1	<0.2
(No Name)	873	15	4	10	14	<3	2	<5	<0.1	<0.2
(No Name)	874	4632	664	15	4	19	17	8	0.2	<0.2
(No Name)	875	47	24	14	3	3	7	<5	<0.1	<0.2
Gillham A	876	11	15	2	1	2	4	<5	0.47	<0.2
Gillham B	877	6	15	3	3	2	4	<5	0.30	<0.2
Bard	878	3151	469	5	2	12	9	<5	2.10	<0.2
(No Name)	879	27	20	11	6	7	4	<5	<0.1	<0.2
(No Name)	880	11	2	20	2	2	4	<5	<0.1	<0.2
McClaine A	881	1974	448	28	7	7	18	15	<0.1	<0.2
McClaine B	882	135	9	26	8	2	9	<5	<0.1	<0.2
McClaine C	883	1495	405	22	9	7	18	18	<0.1	<0.2
McClaine D	884	198	62	23	5	8	10	<5	<0.1	<0.2
W. Jones	885	51	6	10	6	4	10	<5	<0.1	<0.2
Jones Valley	886	739	278	143	2	7	21	<5	<0.1	<0.2
Buttermilk A	887	496	9	110	4	6	21	<5	<0.1	<0.2
Buttermilk B	888	804	65	43	1	4	18	<5	<0.1	<0.2
(No Name)	889	68	7	66	8	<2	12	<5	<0.1	<0.2
McElhanon	890	17	3	46	4	<2	9	11	0.16	<0.2
(No Name)	891	19	9	49	6	<2	11	<5	<0.1	<0.2
(No Name)	892	19	6	37	6	<2	9	<5	0.18	<0.2
Crystal B	893	699	210	39	6	2	17	<5	0.1	<0.2
Brogdams A	894	503	189	45	4	<2	15	5	1.86	<0.2
Brogdams B	895	643	205	28	4	<2	15	10	<0.1	<0.2
Brogdams C	896	760	210	27	4	5	17	7	0.29	<0.2

Table A-8 Heavy Metals (all data in parts per billion) (con't)

Name of Spring or Well (W)	Lab		Fe	Mn	Zn	Cu	Co	Ni	Pb	Hg	Sb
	No.										
Brogdams D	897	699	221	32	2	4	17	< 5	<0.1	<0.2	
Brogdams E	898	661	296	13	2	6	16	10	<0.1	<0.2	
Burrows	899	10	5	92	9	<3	8	11	0.72	<0.5	
Lead Mine Road	900	33	5	137	4	2	4	<7	<0.1	<0.5	
Lead Mine Road	901	2236	701	27	2	15	17	30	<0.1	<0.5	
(No Name)	902	39	19	21	2	7	12	11	<0.1	<0.5	
(No Name)	903	41	10	12	1	10	15	15	<0.1	<0.5	
(No Name)	904	25	89	48	14	20	25	34	0.59	<0.5	
Womack (W)	905	7	6	<5	1	10	15	23	0.51	<0.5	
Womack	906	23	25	6	2	18	30	33	<0.1	<0.5	
Lolla Bell (W)	907	2062	344	21	2	15	32	37	0.63	<0.5	
(No Name)	908	10082	6	7	2	39	80	42	2.27	<0.5	
(No Name)	909	146	23	6	4	4	7	17	1.48	<0.5	
(No Name)	910	149	83	20	4	18	21	21	<0.1	<0.5	
(No Name)	911	195	31	144	1	10	19	13	0.68	<0.5	
(No Name)	912	5	1	<5	2	5	8	17	0.75	<0.5	
Sulfur	913	31	7	<5	1	5	10	10	0.29	<0.2	
Elliott	914	1347	32	5	4	13	17	14	0.76	<0.2	
Caddo River	915	80	7	<5	4	8	12	18	0.28	<0.2	
Artesian* Well (W)	916	5222	631	65	2	23	39	37	0.78	0.2	
Artesian* Well (W)	917	1642	351	21	2	18	28	25	0.26	<0.2	
(No Name)	918	49	10	<5	2	6	8	7	0.32	<0.2	
(No Name)	919	49	42	<5	13	10	17	17	0.20	<0.5	
(No Name)	920	15	22	<5	9	8	12	12	0.32	0.5	
(No Name)	921	10	4	<5	3	5	10	12	1.02	<0.5	
Chalybeate	922	43	77	19	10	7	20	21	0.65	-	
Caddo Gap (W)	923	580	436	38	<1	11	17	21	0.75	-	
Redland Mt.	924	226	345	9	<1	22	24	30	<0.2	-	
Lolla Bell A	925	15	5	4	3	4	2	30	0.22	-	
Lolla Bell B	926	43	10	16	5	15	32	42	0.44	-	
Artesian Well (W)	927	85	86	29	3	15	24	46	0.87	-	
Mineral	928	4218	345	16	3	11	21	30	0.65	-	
Barite Pit	929	129	13	10	5	7	9	30	0.65	-	
Murfreesboro Area	930	15	16	9	5	7	13	17	0.90	-	
Murfreesboro Area	931	29	5	5	<1	7	9	34	0.65	-	
Lake Greeson Area	932	1375	70	5	<1	15	28	59	<0.2	-	
Dierks Area	933	175	14	16	5	11	17	34	<0.2	-	
Cox Residence	934	43	16	24	<1	11	24	25	0.22	-	
Dierks Area	935	29	10	10	3	11	24	25	0.65	-	
L. Greeson, Sulfur	936	9930	370	11	<1	38	54	34	0.65	-	
L. Greeson, Possum	937	57	8	8	5	15	20	25	1.10	-	
Salem Area	938	287	24	16	3	22	36	30	0.65	-	
Bethesda	939	301	743	11	2	30	28	24	0.22	-	
Mine Creek	940	60	22	12	2	6	7	9	0.22	-	
Rock	941	2	2	4	5	2	3	<5	<0.2	-	
West	942	10	3	6	2	2	3	20	<0.2	-	
Pigeon Roost	943	3306	800	28	3	31	39	29	0.30	-	
Barite Pit	944	100	12	10	2	6	7	13	0.45	-	
'Warm'	945	5	8	6	2	6	7	9	<0.2	-	
Athens Area	946	13	6	4	2	2	7	18	<0.2	-	

Table A-8 Heavy Metals (all data in parts per billion) (con't)

Name of Spring or Well (W)	Lab	Fe	Mn	Zn	Cu	Co	Ni	Pb	Hg	Sb
	No.									
Umpire Area	947	27	5	6	4	8	7	11	0.2	-
S. Cox	948	20	110	45	7	25	33	31	<0.2	-
Cossatot	949	17	4	6	2	11	7	13	<0.2	<0.5
Church	950	43	11	7	4	11	2	31	<0.2	<0.5
Defore (W)	951	48	283	111	3	34	33	33	<0.2	<0.5
(No Name)	952	18	14	13	2	11	5	22	<0.2	<0.5
Mena Park	953	10	11	8	2	9	7	13	<0.2	-

A Cured, plastic piping