FINAL

SUPERFUND

REMEDIAL INVESTIGATION REPORT

HYDRO-FLEX CORPORATION SITE
2101 N.W. BRICKYARD ROAD
TOPEKA, KANSAS

PROJECT NO. 50905072
SEPTEMBER 18, 1991

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September 18, 1991

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RE: Remedial Investigation Report
Hydro-Flex Corporation Site
Topeka, Kansas
Project No. 50905072

Dear Ms. Miller:

In accordance with the requirements of the Consent Settlement and Consent Order with the Kansas Department of Health and Environment (KDHE), as amended, and on behalf of Hydro-Flex Corporation, we are hereby providing four copies of the final remedial investigation report for the Hydro-Flex Corporation site in Topeka, Kansas. This report incorporates changes made to the draft report of August 22 in response to comments transmitted via your letter of September 6. In view of our discussion of these responses in advance via telephone, we anticipate rapid approval of the final RI report without further change.

Sincerely,

TERRACON ENVIRONMENTAL, INC.

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Attachment

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REMEDIAL INVESTIGATION REPORT

HYDRO-FLEX CORPORATION SITE
2101 N.W. BRICKYARD ROAD
TOPEKA, KANSAS

PROJECT NO. 50905072
SEPTEMBER 18, 1991

1.0 INTRODUCTION

1.1 Purpose of Report

The purpose of a remedial investigation/feasibility study (RI/FS) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) is to ensure that adequate information exists to characterize the nature and extent of risks posed by sites at which hazardous substances may have been released to the environment and to evaluate potential remedial options. This report has been prepared to document the RI portion of the RI/FS process for the Hydro-Flex Corporation site.

Hydro-Flex is a state-lead CERCLA site. Therefore, the Kansas Department of Health and Environment (KDHE) exercised direct oversight authority with respect to this RI. The U.S. Environmental Protection Agency (USEPA) also reviewed all aspects of this RI. This RI involved collection of existing data, planning of field activities, phased conduct of additional field work, performance of associated laboratory analysis, data analysis and evaluation, and report preparation. The data obtained during this RI has been used to characterize the site and conduct a baseline risk assessment.

Considerable background information was collected prior to the conduct of additional field work. This information was presented in detail in the approved workplan for this site dated January 10, 1990. Relevant information in the workplan will be summarized herein. Please refer to the workplan for additional detail and citations to reference documents.

1.2 Site Background

1.2.1 Site Description

The Hydro-Flex Corporation site is located at 2101 N.W. Brickyard Road in Topeka, Kansas. The general vicinity of the site is shown in Figure 1, a portion of the U.S. Geological Survey (USGS) 7.5 minute series Topeka topographical quadrangle. The site is approximately 3.7 miles northwest of the state capitol in downtown Topeka, on a low-lying alluvial plain to the north of the Kansas River. It is located south of Soldier Creek and is nearly midway between that stream and the Kansas River.

A diagram showing the eastern 400 feet of the site, where facilities are located and remedial investigation work was carried out, is provided as Figure 2. Hydro-Flex is a small company. The full site consists of approximately 2.95 acres of land in a rectangular shape with the east-west dimension being 538 feet and the north-south dimension being 240 feet.

There are two buildings located on the site. The main one is a single story building on the northeast side of the property. Production facilities were formerly located in this building. It is currently being used primarily for storage and office space. The other building is a smaller one on the south-central side of the property. It was formerly used for maintenance work and as office space, but is currently unoccupied.

1.2.2 Site History

In the fall of 1970, Hydro-Flex acquired the property at 2101 N.W. Brickyard Road for a new facility. The City of Topeka had designated the area in the vicinity of the new Hydro-Flex site to be developed as an industrial park. The new Hydro-Flex facility was constructed during the winter of 1970-1971 and placed in operation in March 1971. Because it was not possible

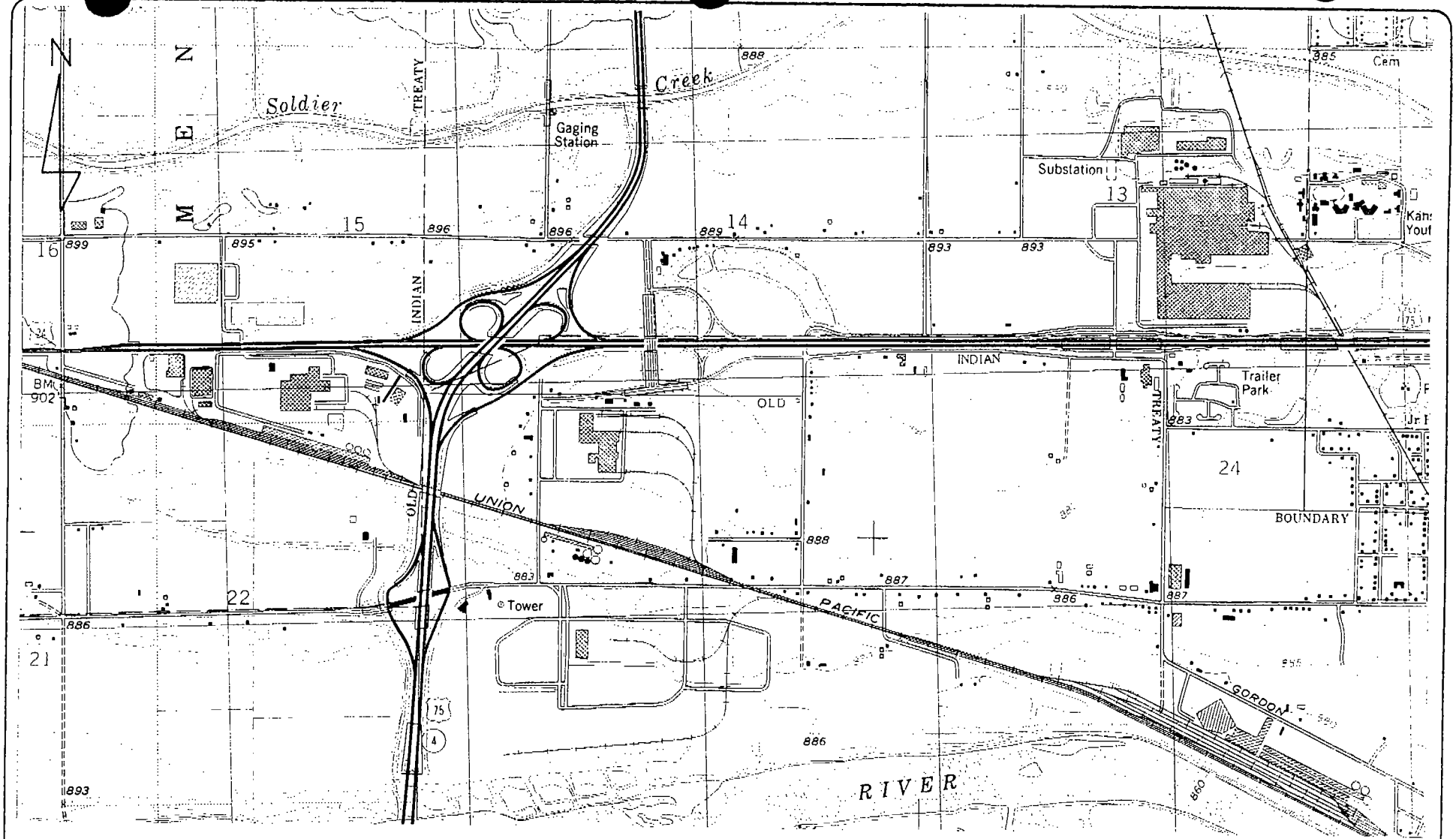

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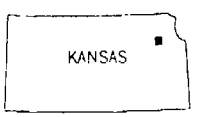
FIGURE 1: Vicinity Map

Hydro-Flex Corporation
2101 N.W. Brickyard Road
Topeka, Kansas



QUADRANGLE LOCATION

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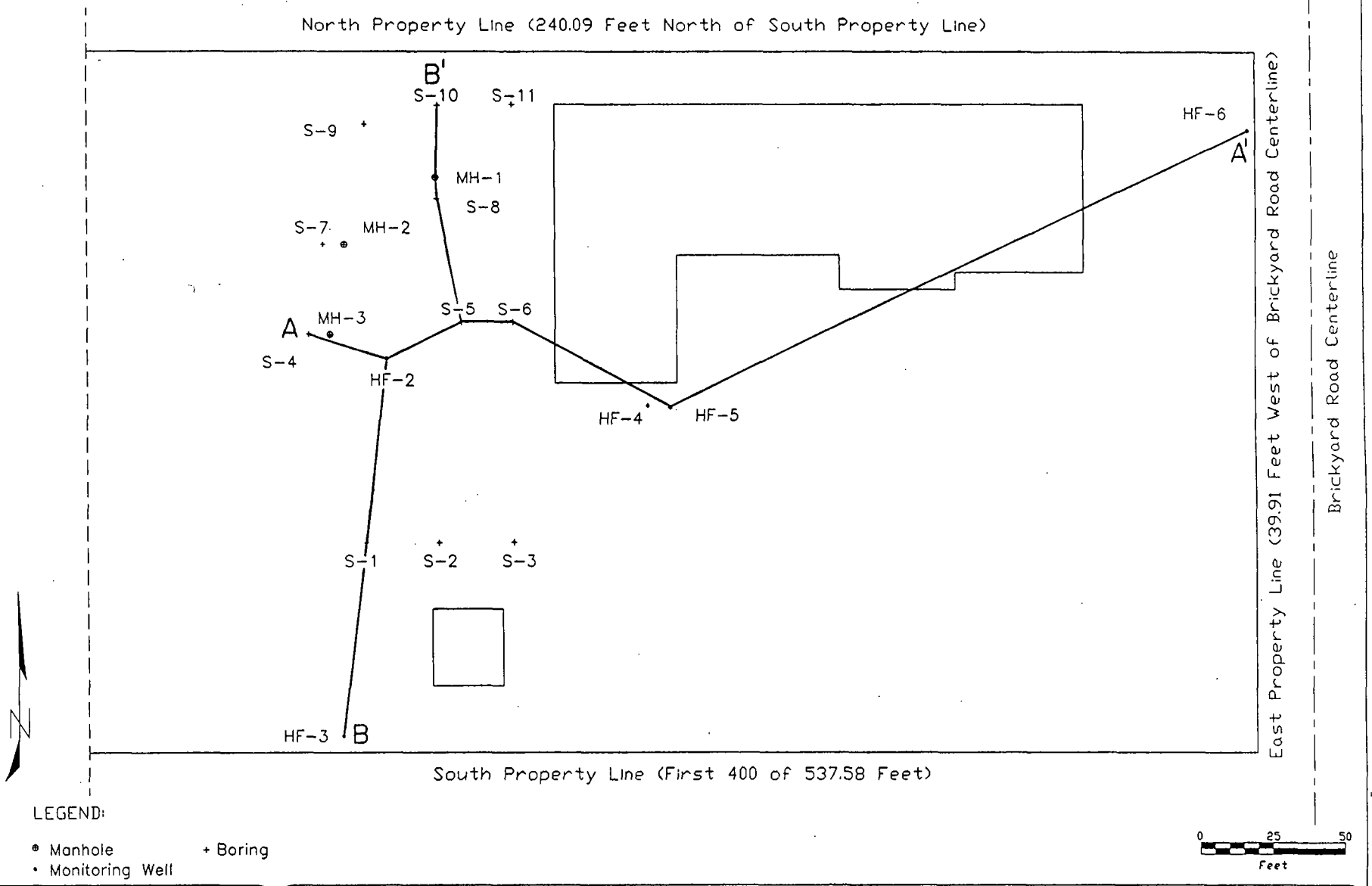

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DATE: December 10, 1990	

FIGURE 2: Site Diagram

Hydro-Flex Corporation
2101 N.W. Brickyard Road
Topeka, Kansas

Terracon

to obtain a connection to the Topeka sewer system at that time, Hydro-Flex was permitted to utilize an on-site wastewater disposal system.

Records indicate that the on-site wastewater disposal system initially consisted of a septic tank in series with a concrete manhole and a soil adsorption field. Two additional manholes were added in series with the first in 1975. The soil adsorption field consisted of perforated 4 inch diameter polyvinyl chloride (PVC) pipe placed in parallel, rock or coarse gravel filled trenches to form laterals.

During the 1970s and into the 1980s, Hydro-Flex manufactured flexible copper couplings at this site. The process required that the couplings be cleaned during production. This was accomplished with an acidic hexavalent chromium cleaning solution. Subsequently, sodium bicarbonate was added to neutralize the solution. Process wastewater was generated in batches that were intermittently discharged. It has been estimated that process wastewater flow during this period averaged 90 gallons/day (gpd) and that the combined flow of process and sanitary wastewater was 400 gpd. It has also been estimated that characteristic concentrations of chromium and copper in the combined wastewater were 122,000 and 107,000 ug/L, respectively.

Difficulties were reportedly encountered in operation of the on-site wastewater disposal system. Wastewater flow occasionally exceeded soil adsorption system ability to receive it and wastewater overflowed the manholes onto the ground. This was likely largely due to the low hydraulic conductivity of the materials involved (i.e., primarily clay, silty clay, and silt) and clogging of soil pore spaces by solids in the wastewater.

Hydro-Flex repeatedly tried to resolve its wastewater disposal problems. These efforts included numerous attempts to obtain a connection to the Topeka sewer system, introduction of "muriatic acid" into the system in 1973, the pumping of sludge from the septic tank and/or manhole(s) and disposal of it to a landfill at least twice[1], and, reportedly, an attempt to pump a batch of wastewater into the unused on-site water supply well. In July 1981, the Hydro-Flex was finally connected to the Topeka sewer system. On-site wastewater disposal ceased at that time. KDHE then approved Hydro-Flex's request to take the system out of operation by filling the manholes with sand, levelling them to the ground, and covering the area with soil.

1.2.3 Previous Investigations

Previous investigations of this site included sequential determinations under both the Resource Conservation and Recovery Act (RCRA) and CERCLA. Hydro-Flex was investigated by KDHE and USEPA as a potential handler of hazardous waste in 1980 and early-1981. As a part of this investigation, KDHE sampled Hydro-Flex's wastewater and sludge in May and June 1981. After review of the results of this sampling both KDHE and USEPA concluded that these wastes were not hazardous under RCRA.

Despite the above conclusion under RCRA, KDHE and USEPA subsequently proceeded to investigate Hydro-Flex under CERCLA. This investigation was conducted at an apparently low level of activity and with no field work between mid-1981 and late-1986.

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[1]Records only exist proving that this occurred on two occasions; however, particularly in view of site characterization information and what is known about the wastewater disposal system, it appears likely that similar sludge pumping and off-site disposal occurred on at least several other occasions between 1973 and 1980.

This situation changed in late-1986 and early-1987. At that time, KDHE conducted its preliminary assessment of the Hydro-Flex site to determine whether or not to place the site on the national priorities list (NPL) under CERCLA. The preliminary assessment of the Hydro-Flex site included the drilling, installation, and sampling of three new monitoring wells (an off-site assumed background well located approximately 560 feet north of the northeast corner of the site, designated HF-1, and two wells on-site, designated HF-2 and HF-4). The locations of HF-2 and HF-3 are indicated in Figure 2. In addition, water and sludge were sampled from the unused on-site water supply well mentioned above (designated HF-4). No soil samples were taken.

Significant concentrations of chromium and copper were reported in both the material sampled (apparently sludge) from monitoring well HF-4 during the preliminary assessment; however, results for chromium and copper in filtered samples were generally substantially lower than for unfiltered (i.e., total). Chromium and copper were reported to be 530 and 450 ug/L in filtered as compared to 484,000 and 525,000 ug/L in unfiltered HF-4 samples, respectively. These results are presented in Table 15 of the approved workplan for this site. It was concluded in the preliminary assessment that Hydro-Flex process wastewater had been discharged into "three 20 ft. deep, open bottom silos" and that, therefore, "wastewater was essentially introduced directly to the aquifer" during an 11 year period.

Information from the preliminary assessment was used by KDHE to generate a hazard ranking score (HRS). In so doing, it was assumed that preliminary assessment results indicated a release of contaminants, that the contaminants were highly persistent and toxic, that the waste quantity released exceeded 500,000 gallons, and that there was a threatened population of 6,551 persons with

no alternative source of drinking water presently available. The HRS so calculated, on the order of 46 to 48, exceeded the minimum of 28.5 required for addition to the NPL. The Hydro-Flex site was subsequently added to the NPL on March 30, 1989.

1.3 Report Organization

As required by KDHE and USEPA, the organization and table of contents of this report precisely follow the suggested RI format in USEPA guidance[2]. Field activities to characterize the site, site physical characteristics, the nature and extent of contamination, contaminant fate and transport, and the baseline risk assessment are described in Sections 2.0 through 6.0, respectively. Section 7.0 presents a summary and conclusions.

2.0 STUDY AREA INVESTIGATION

2.1 Field Activities

Field activities consisted of contaminant source, soil and unsaturated zone, and ground water investigations. These were carried out in two sub-phases, IA (in October 1990) and IB (in March and May 1991). All activities were carried out in general accordance with the approved health and saftey plan of February 22, 1990, and the approved sampling and analysis plan (SAP) of April 11, 1990, as subsequently modified. The SAP consisted of a field sampling plan (FSP) and a quality assurance project plan (QAPP). The QAPP was modified on July 25, 1990, due to a change in the analytical laboratory selected to analyze Hydro-Flex samples. This was necessary for quality assurance reasons. For convenience, elements of the SAP applicable to Phase IA were

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[2]Office of Emergency and Remedial Response. 1988. Guidance for conducting remedial investigations and feasibility studies under CERCLA. Interim Final OSWER Directive 9355.3-01, Office of Solid Waste and Emergency Response, USEPA, Washington, DC, Table 3-13 on p. 3-54.

gathered into one document dated September 26, 1990. After completion of Phase IA, a report detailing methods and results of that work dated December 12, 1990, was submitted to KDHE. At the end of Phase I, KDHE agreed via letter dated June 28, 1991, that further field investigation activities were not necessary.

KDHE provided sample containers and analytical services for the bulk of the samples. Samples which were the responsibility of Hydro-Flex were analyzed for chemical quality by the PACE, Inc., analytical laboratory in Lenexa, Kansas, and for grain size distribution and porosity by Terracon's geotechnical laboratory in Lenexa. Most samples were analyzed solely for chemical quality. Soil samples generally were analyzed for at least total chromium and copper. Initially, total lead was also to be included; however, KDHE approval was received to delete lead after the results of Phase IA work were reviewed. In addition, selected samples were analyzed for hexavalent chromium, pH, organic matter, USEPA extraction procedure toxicity (EP TOX) chromium and lead, other priority pollutant elements, volatile organic compounds (VOCs), and base/neutral and acid extractable organic compounds (B/NAs). KDHE's laboratory analyzed a number of the soil samples in which elements were determined, performed all organics analysis, and was responsible for analysis of all ground water samples taken May 10, 1991. Some of the variables listed in the approved work plan and SAP for those samples were not reported by KDHE's laboratory. These included hexavalent chromium, lead, mercury, selenium, and total dissolved solids.

2.1.1 Surface Features

The only significant surface features at this site consisted of monitoring wells and two buildings. The only field activities relevant to surface features consisted of field measurements and surveying to determine precise locations of these.

2.1.2 Contaminant Source Investigations

Background research identified the source of contaminants as Hydro-Flex's discharge via a septic tank and manholes to the soil adsorption system and a reported single discharge by Hydro-Flex to the unused on-site water supply well. Directly related field activities included borings drilled into the center of and adjacent to each of the three manholes, associated soil and sludge sampling while drilling borings, and sampling of sludge and ground water from the unused water supply well.

Boring locations are indicated in Figure 2 and boring logs are provided as Item A-1 in Appendix A. Borings MH-1, MH-2, and MH-3 were drilled in the approximate centers of their respective manholes for the purpose of determining manhole status (i.e., whether or not sludge was present in them and whether or not they had bottoms). Samples were taken at the surface, nominally at 5 feet below ground level (BGL), and at the bottom of these borings[3]. Borings S-8, S-7, and S-4 were located immediately adjacent to Manhole No. 1, Manhole No. 2, and Manhole No. 3, respectively. These borings were primarily for the purpose of investigating whether contaminants were introduced into the unsaturated zone underneath the manholes. Samples were taken at the surface, nominally at 5 and 10 feet BGL, and at a depth below the bottom of the adjacent manhole[4]. However, after a sample

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[3]This was nominally expected to be approximately 15 feet BGL. Actual depths were nominally 12, 17, and 17 feet BGL for Manhole No. 1, Manhole No. 2, and Manhole No. 3, respectively. Additionally, a sample was obtained from a nominal depth of 19 feet BGL directly underneath Manhole No. 3.

[4]It was anticipated that the deepest samples from these borings would be at a depth of 16 feet BGL. Actual depths were nominally 16 and 18 feet BGL for borings S-8 and S-7. These borings were within 5 feet of Manhole No. 1 and Manhole No. 2, respectively.

was obtained directly underneath Manhole No. 3, KDHE field approval was given to reduce the depth of boring S-4 to be consistent with other borings in the center of the soil adsorption field area.

Contaminant source investigations were carried out in two sub-phases, as follows:

1. Phase IA took place on October 1, 1990, and involved the drilling and sampling of soil or sludge from three initial borings, two in the approximate center of manholes (MH-1 and MH-2) and one in the soil adsorption field area adjacent to Manhole No. 1 (i.e., boring S-8). Borings were drilled using a Central Mine Equipment (CME) Model No. 850 track-mounted hollow-stem auger (HSA) rig with 3.25 inch inner diameter (ID) augers. Surface samples were obtained using hand tools. Deeper samples were obtained using a 2.0 inch outer diameter (OD) split-barrel sampler.

2. Phase IB took place March 18 through 22, 1991. At this time, borings were drilled in the approximate center of Manhole No. 3 and in the soil adsorption field area adjacent to Manhole No. 2 (i.e., boring S-7) and soil or sludge samples obtained. Borings were drilled using a CME Model No. 75 truck-mounted HSA rig with 3.25 inch ID augers. Surface samples were obtained using hand tools. Deeper samples were obtained using a 2.0 inch OD split-barrel sampler. Additionally, sludge and ground water samples were obtained from monitoring well HF-4.

Sludge and ground water were sampled from monitoring well HF-4 on March 22, 1991, and ground water was again sampled on May 10, 1991. The sludge was sampled first on March 22, using a 2 inch OD split-barrel sampler and a Dart bailer, lowered using the drill rig. Three well volumes were subsequently purged from the well using the drill rig's pump at a flow rate of approximately 2 gpm. The well was then sampled using a disposable VOSS polyethylene bailer and nylon cord. Purge water was

containerized in 55 gallon drums for future disposal[5]. On May 10, HF-4 was purged using a Teel Water Systems 0.5 horsepower submersible pump. Purging occurred over a 3.5 hour period at a rate of approximately 10 gpm. Therefore, a total of approximately 30 well volumes were purged at that time. With KDHE field approval, since analysis was not being conducted for organic compounds, the same pump used for purging was used for sampling. The physical appearance of purge water and measured purge variables are listed in Table 1.

2.1.3 Meteorological Investigations

Field meteorological investigations were not a part of the approved work plan and SAP for this site.

2.1.4 Surface Water and Sediment Investigations

Field surface water and sediment investigations were not a part of the approved work plan and SAP for this site.

2.1.5 Geological Investigations

Field geological investigations, per se, were not a part of the approved work plan and SAP for this site. Boring logs were prepared as a part of soil borings performed in order to obtain samples (see Subsection 2.1.6 below). These are provided as Item A-1 in Appendix A. They present information relevant to site geology.

2.1.6 Soil and Vadose Zone Investigations

Field activities to investigate soil and unsaturated zone conditions consisted of the drilling of 11 borings, in addition

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[5]After receipt of analytical results, the Water Pollution Control Division, City of Topeka, approved disposal of purge water to the sewer system.

Table 1: Monitoring Well Purge Variables				
Well [Date]: Appearance	WV[1]	pH[2]	T[3]	COND[4]
HF-1 [May 10, 1991]:				
Highly turbid (moderate brown)	0.0	6.94	14.4	793
Highly turbid (moderate brown)	1.0	6.94	15.6	831
Highly turbid (moderate brown)	2.0	6.95	15.4	830
Highly turbid (moderate brown)	3.0	6.91	15.4	834
HF-2 [May 10, 1991]:				
Slightly turbid (light brown)	0.0	6.99	13.0	911
Moderately turbid (brown)	1.0	7.06	15.2	942
Moderately turbid (brown)	2.0	6.90	14.7	936
Moderately turbid (brown)	3.0	6.90	14.7	933
HF-3 [May 10, 1991]:				
Clear	0.0	7.52	13.4	911
Moderately turbid (gray brown)	1.0	7.10	16.3	938
Slightly turbid (gray brown)	2.0	7.09	15.4	910
Slightly turbid (gray brown)	3.0	7.11	16.3	909
HF-4 [March 22, 1991]:				
Highly turbid (black)	0.0	7.43	22.0	1,378
Highly turbid (black)	0.5	7.48	20.0	987
Highly turbid (black)	1.0	7.20	19.5	902
Moderately turbid (black)	1.5	7.21	18.5	875
Moderately turbid (black)	2.0	6.90	18.2	865
Slightly turbid (black)	2.5	6.91	18.2	858
Clear	3.0	6.91	17.0	845
HF-4 [May 10, 1991]:				
Slightly turbid (light brown)	2.0	7.00	15.3	752
Clear	6.0	7.03	15.0	835
Clear	26.5	7.05	15.6	810
HF-5 [May 10, 1991]:				
Clear	0.0	7.17	18.4	759
Highly turbid (gray)	1.0	7.06	15.8	754
Moderately turbid (gray brown)	2.0	7.06	16.0	754
Moderately turbid (gray brown)	3.0	7.09	15.8	754
HF-6 [May 10, 1991]:				
Clear	0.0	6.95	17.0	865
Moderately turbid (gray brown)	1.0	7.02	16.4	928
Moderately turbid (gray brown)	2.0	6.97	16.1	929
Moderately turbid (gray brown)	3.0	6.97	16.2	926
Moderately turbid (gray brown)	4.0	6.97	15.9	918
Moderately turbid (gray brown)	5.0	6.96	15.8	928

NOTES FOR TABLE 1:

1. Well volume (WV) with the volume of present from the bottom of the well to the water table as 1.0 WVs.

2. pH in standard pH units.

3. Temperature in °C units.

4. Conductivity (COND) in μmhos/cm at 25 °C.

to those drilled for the purpose of source investigation, which were sampled at various depths. The locations of these borings are indicated in Figure 2. Boring logs for each are provided as Item A-1 in Appendix A.

Field activities were conducted during March 18 through 22, 1991. At that time, borings S-1, S-2, S-3, S-4, S-5, S-6, S-9, S-10, and S-11 were drilled in the soil adsorption field area for the investigative purposes. All of these borings except S-5 and S-6 were accomplished using the same drill rig, augers, and sampling equipment used for the contaminant source investigations being conducted at the same time. A 3 inch diameter orchard barrel hand auger was also used in the case of boring S-5 and was used exclusively in the case of boring S-6. Soil samples were taken at the surface and at nominal depths of 5 and 10 feet BGL from the first three and last three of these borings, which were located on the south and north ends of the soil adsorption field area, respectively. Soil samples were taken at the surface and at nominal depths of 3 and 5 feet BGL from the middle three of these borings. These were located to enable delineation of conditions on the west and east edges of the soil adsorption field area and in its center.

It was intended to adjust the location of boring S-5 as necessary in order to intercept a lateral in a rock or gravel filled trench. It became necessary to drill a pattern of a total of 11 borings 1.5 feet apart from 6 feet west to 9 feet east of the planned location of S-5 in order to accomplish this objective. The center five borings of this spread were drilled with a hand auger and the remainder were drilled using the CME Model No. 75 drill rig. Samples of soil were taken at the surface and nominally at 3 feet BGL from the planned location of S-5, samples of soil were taken nominally at 5 and 7 feet BGL from the boring

7.5 feet east of the planned location of S-5[6], and a sample of PVC pipe was taken from approximately 3.5 feet BGL from the boring 9 feet east of the planned location of S-5. A hand auger was used to drill boring S-6. Samples were taken at the surface and 3 feet BGL at the planned location of S-6; however, due to interception of gravel, a second boring was attempted 5 feet west of the planned location of S-6. This boring was terminated at a depth of 4.5 feet BGL, with KDHE field approval, due to the presence of gravel. The final sample from it was taken at that depth.

Boring HF-6 was drilled and sampled using the same rig and size of HSA used for other site activities at the same time. Boring HF-5 was drilled soley with 6.25 inch ID HSA. These borings were drilled for the purpose of subsequent monitoring well installation. The surface sample for HF-6 was obtained using hand tools. Samples from 5 to 25 and 32 feet BGL were obtained using a 2.0 inch OD split-barrel sampler. The 30 feet BGL sample was obtained using a 3.0 inch OD split-barrel sampler with internal brass rings. Samples nominally from 60 feet and 35 feet BGL in borings HF-5 and HF-6, respectively, were obtained directly off auger flights.

2.1.7 Ground Water Investigations

Field activities to investigate ground water conditions consisted of taking ground water level measurements from the four existing monitoring wells during 1990, installing two new wells the week of March 18, 1991, and taking measurements from and sampling all six wells during 1991. The locations of these wells are indicated in Figure 2.

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[6]It is this boring which is indicated in Figure 2 and the boring log for S-5.

Water level measurements were made on a total of 5 occasions: (1) March 5 1990; (2) October 1, 1990; (3) 18 March 1991[7]; (4) April 25, 1991; and (5) May 10, 1991. Surveyors licensed in the State of Kansas determined monitoring well locations and elevations on two occasions. Evans, Bierly, Hutchinson & Associates, Inc., (EBH) of Lawrence surveyed the existing four wells in March 1990, so that information indicating the direction of ground water flow would be available for locating the new wells, and Kramer Engineering, P.A., of Topeka added the two new wells when they surveyed in April 1991.

Installation of monitoring wells HF-5 and HF-6 was completed on March 21 and 19, 1991, respectively. Well diagrams are provided with the boring logs for each well as Item A-1 in Appendix A. Copies of the water well records submitted to KDHE are also provided as Item A-2 in Appendix A. Final drilling in the case of each well was completed using 6.25 inch ID HSA with bottom plates in an effort to prevent fines from entering the HSA prior to well installation. Well installation took place through the HSA as it was retracted. Both wells consist of 2 inch nominal diameter Brainard-Kilman Tri-Loc flush-threaded Schedule 40 PVC screen and casing. Screen size is nominally 10 feet in length with 0.010 inch factory milled slots.

The bottom cap and blank casing for HF-6 extends 0.7 feet from the bottom of the boring to the bottom screen slot. The screen is continous-slot with an actual length of 9.3 feet. A filter pack, consisting of 45-55 Red Flint sand was installed around the bottom of the well from the bottom of the boring to

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[7]Measurement were actually made on two dates: (1) HF-1 through HF-4 on 18 March and HF-4 through HF-5 on 22 March. The well where measurements were made both times, HF-4, had the same water level on both dates.

approximately 2.6 feet above the top slot of the screen. An annular seal approximately 2.7 feet thick was installed above the filter pack using 3/8 inch diameter NL Baroid Wyoming bentonite pellets. Since the top of the seal was below the water table at the time of installation, adequate hydration was assured without the need to add water. Baroid Benseal bentonite grout was mixed with catalyst and water and pumped to fill the annular space from the top of the seal to approximately 2 feet BGL. The well was finished with a square concrete collar and locked metal surface casing.

The depth, type of formation, and size of augers involved in installation of monitoring well HF-5 complicated its installation. In the first attempt to drill HF-5, on March 20, 1991, the boring was located 8 feet east of HF-4. Although a bottom plate was used, it was found that it wasn't possible to prevent fines from entering the HSA. Similar results occurred attempting to redrill HF-5 in the same location. In the third attempt, on March 21, 1991, the boring was relocated 2 feet closer to HF-4 and drilled into the shale, after which the HSA was flushed with water prior to retraction. This made retraction difficult but ultimately enabled satisfactory well installation.

The bottom cap and blank casing for HF-5 extends 3.25 feet from the bottom of the boring to the bottom screen slot. Actual screen length is 8 feet. Due to difficulties in installation of this well and lack of continuous-slot screen strength, it was necessary to thread two 5 foot sections of screen together to make this well, with the bottom section being continuous-slot and the top section being slotted. A filter pack, consisting of 45-55 Red Flint sand was installed around the bottom of the well from the bottom of the boring to approximately 6 feet above the top slot of the screen. The natural sand and gravel of the

formation were allowed to fill in around the casing from that point to a depth of approximately 27 feet BGL. At that depth, the well was finished with a 3 foot thick annular seal, bentonite grout, cement collar, and locked metal surface casing in the same manner as HF-6.

Monitoring wells HF-5 and HF-6 were developed on March 22, 1991. Development consisted of pumping as rapidly as possible using the drill rig's pump with 1 inch PVC riser pipe, moving the suction along the length of the screen, and attempting to surge the screen periodically by securing the pump and allowing water in the suction pipe to backflow. A total of 15 well volumes at a maximum rate of 2 gallons/minute (gpm) were pumped from HF-5. A total of 30 well volumes at a maximum rate of 4 gpm were pumped from HF-6. Water pumped during development was initially highly turbid with light brown silt and clay but became clear in both cases. The turbidity returned and cleared up whenever the suction was repositioned at a different point along the well screen.

Ground water was sampled from all monitoring wells on May 10, 1991. Dedicated, manually operated, WaTerra pump systems were used for both purging and sampling. The flow rate for purging was approximately 1 gpm and a marginally lower rate was used for sampling. Ground water samples were analyzed for the same variables that soil samples were (i.e., USEPA priority pollutant elements, VOCs, and B/NAs). In addition, they were analyzed for total suspended solids (TSS), several other elements, and a selection of general water quality variables. Both filtered and unfiltered samples were analyzed for elements. Furthermore, field measurement of pH, conductivity, and temperature occurred during purging, and alkalinity was

determined in the field for a filtered sample from monitoring well HF-6.

2.1.8 Human Population Survey

Human population surveys were not a part of the approved work plan and SAP for this site.

2.1.9 Ecological Investigations

Field ecological investigations were not a part of the approved work plan and SAP for this site.

2.2 Technical Memoranda

Technical memoranda documenting field activities consist of correspondence exchanged with KDHE in late-June 1991 regarding the adequacy of information from the standpoint of need for further field work. Copies of the June 1991 correspondence, consisting of a letter from G.M. Zemansky (Terracon) to Rachel Miller (KDHE) dated June 18, 1991, and Ms. Miller's response to Dr. Zemansky dated June 26, 1991, are provided as Item A-3 in Appendix A to this report. Summaries of these technical memoranda are not provided here because discussion of the data in them is included below with other results in the main text of this report.

3.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

3.1 Results of Field Activities

3.1.1 Surface Features

The position of site surface features determined as a result of field activities is indicated in Figure 2.

3.1.2 Meteorology

Field meteorological investigations were not a part of the approved work plan and SAP for this site. Therefore, there were no results from such work.

3.1.3 Surface Water Hydrology

Field surface water hydrology investigations were not a part of the approved work plan and SAP for this site. Therefore, there were no results from such work.

3.1.4 Geology

Field geological investigations, per se, were not a part of the approved work plan and SAP for this site. Boring logs were prepared as a part of soil borings for other purposes and provide information relevant to site geology. Information from these is discussed below with regard to soils (see Subsection 3.1.5) and hydrogeology (see Subsection 3.1.6). Lithological cross-sections A-A', B-B', and B-A' were prepared from the boring logs and are presented as Figures 3, 4, and 5, respectively.

3.1.5 Soils

The boring logs indicate that soils at this site consist primarily of light to dark brown clays, silty clays, clayey silts, or silts within the first 10 feet BGL. There are, however, borings where fine sand was either found at shallow depths with finer materials on top and underlying it (e.g., boring S-4 where a layer of fine sand topped with silt and underlain by silty clay was found from 3 to 5 feet BGL) or where fine sand was mixed with clay or silt at relatively shallow depths (e.g., fine sandy clay from 5.7 to 6 feet BGL in boring S-7 and fine sandy silt from 1 to 5 feet BGL in boring S-11). The general case and variations from it are indicated in the lithological cross-sections of Figures 3, 4, and 5.

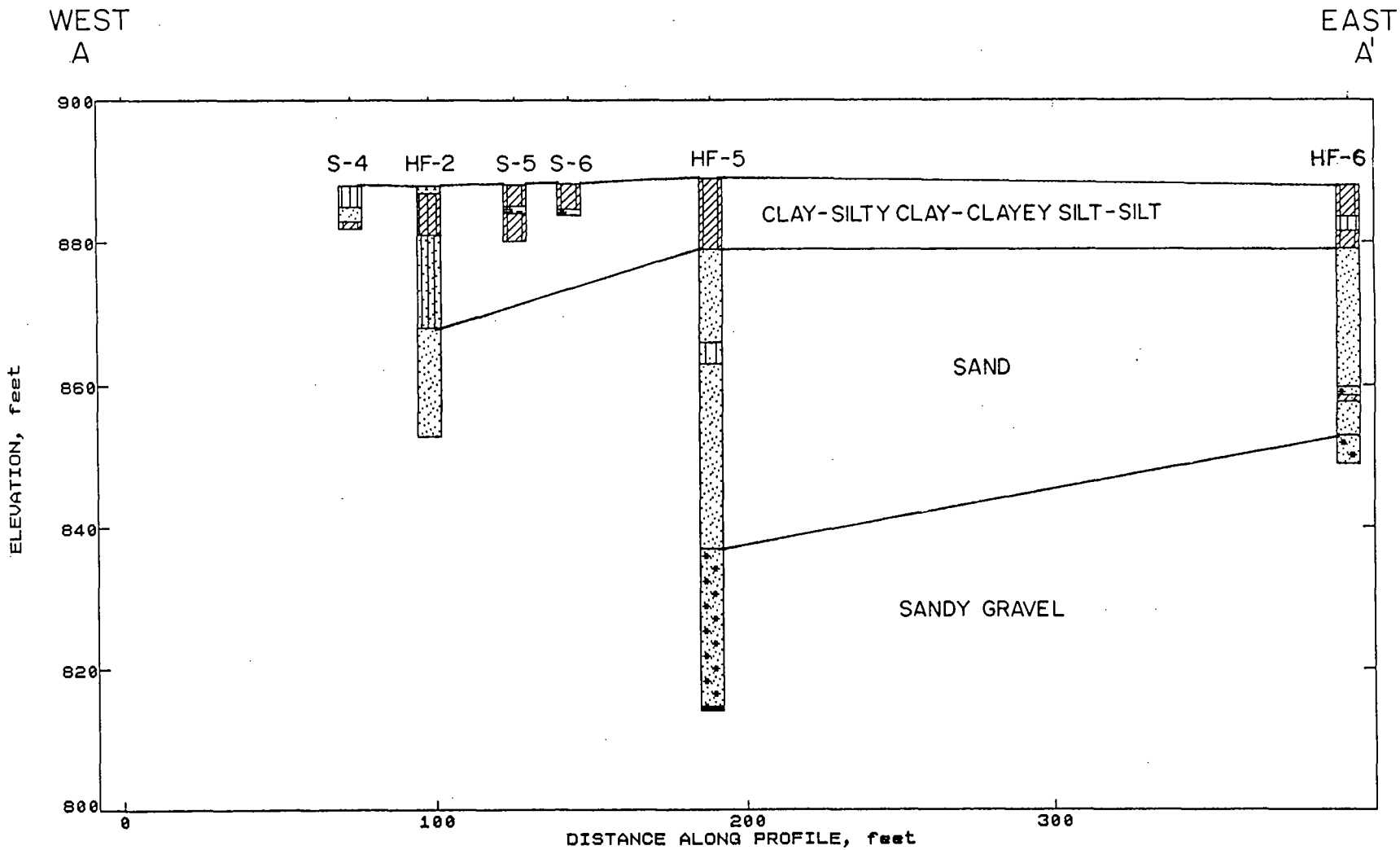

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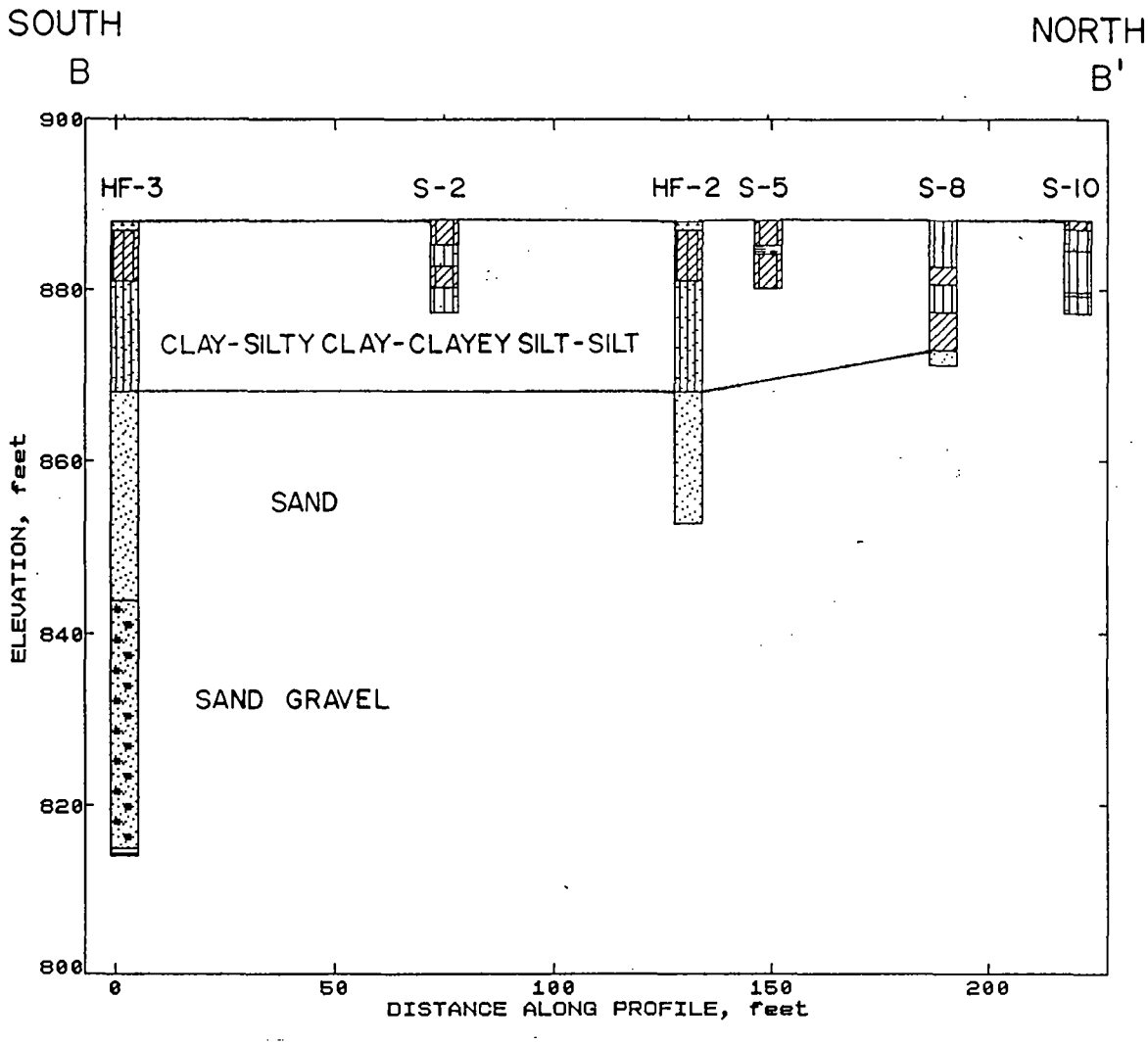
FIGURE 3. LITHOLOGICAL CROSS-SECTION A-A'

HYDRO-FLEX
2101 N.W. BRICKYARD ROAD
TOPEKA, KANSAS

Terracon



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DATE: AUGUST 8, 1991	

FIGURE 4. LITHOLOGICAL CROSS-SECTION B-B'

HYDRO-FLEX
2101 N.W. BRICKYARD ROAD
TOPEKA, KANSAS

Terracon

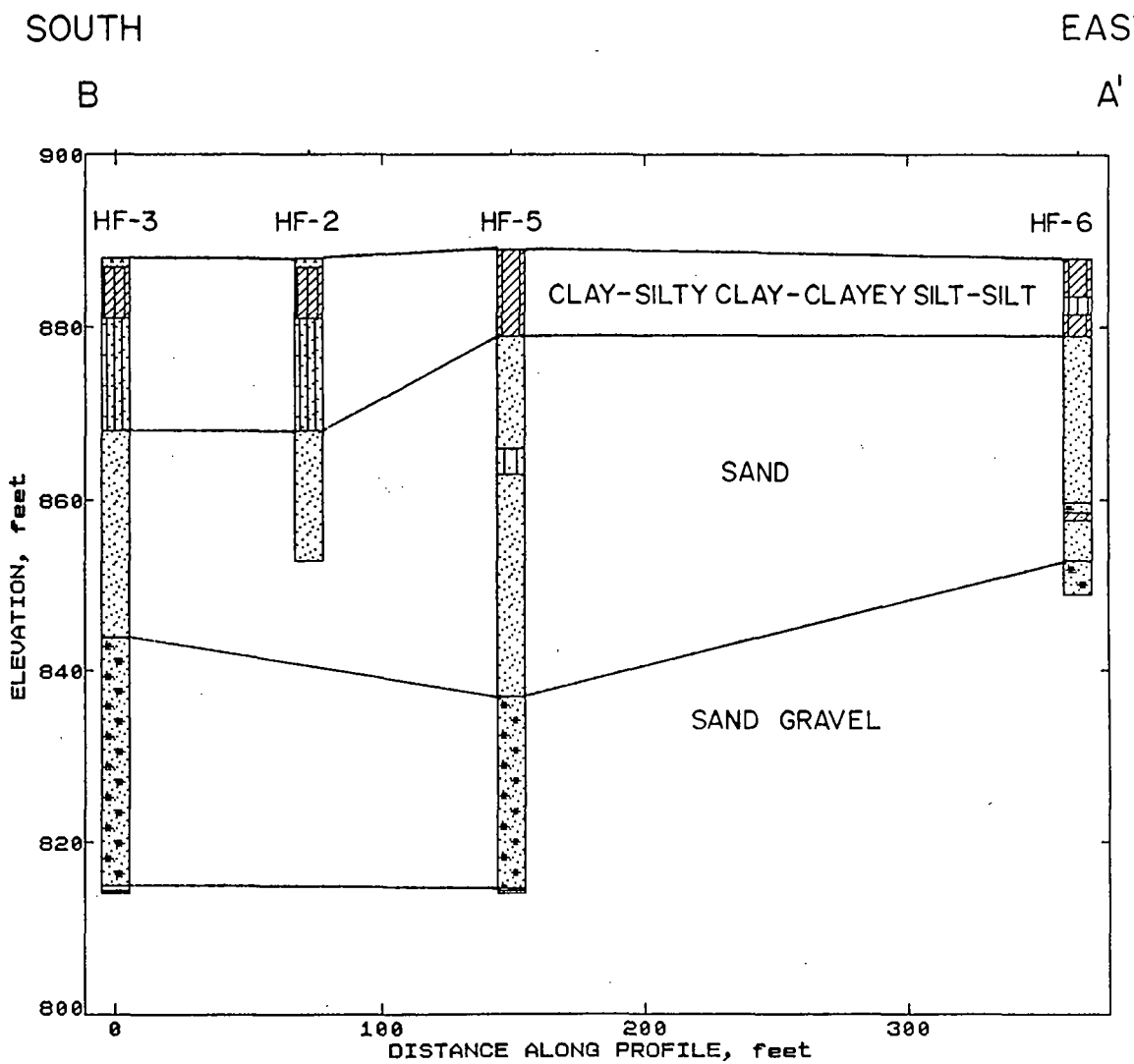

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FIGURE 5. LITHOLOGICAL CROSS-SECTION B-A'

HYDRO-FLEX
2101 N.W. BRICKYARD ROAD
TOPEKA, KANSAS

Terracon

Two samples were also taken from the 3 foot BGL in the soil adsorption field area and analyzed for organic content. These were in borings S-4 and S-6. The analytical data sheet showing results of these analysis is provided with Item B-1 in Appendix B to this report. Organic content results were 1.85 and 3.84 percent, respectively.

3.1.6 Hydrogeology

Field activities that generated hydrogeologic data included information on the direction and gradient of ground water flow from water level measurements and the measurement of grain size distribution and porosity in samples from the saturated zone of boring HF-6.

As noted above, water level measurements were taken on 5 dates. These are summarized in Table 2. Data shown are based on use of the top of the monitoring well casing (TOWC) as the reference point using elevations from the April 22, 1991, survey by Kramer. Previous data based on the top of the surface casing (TOSC) as a reference point have been appropriately adjusted by the difference in casing elevations (TOSC-TOWC). Additionally, the elevation of HF-1, not included in the April 22, 1991, has been adjusted by a factor of minus 0.1 to reflect the difference seen for other monitoring wells.

Water elevation contours from this data are shown in Figures 6 through 10[8]. Figures 6 and 7 reflect data from monitoring

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[8]The contours in Figures 6 through 10 were generated by Version 4 of the Surfer computer program produced by Golden Software, Inc., of Golden, Colorado. This program geostatistically interpolates between data points to estimate contour line positions. Therefore, contour lines should not be considered exact except where they coincide with data points.

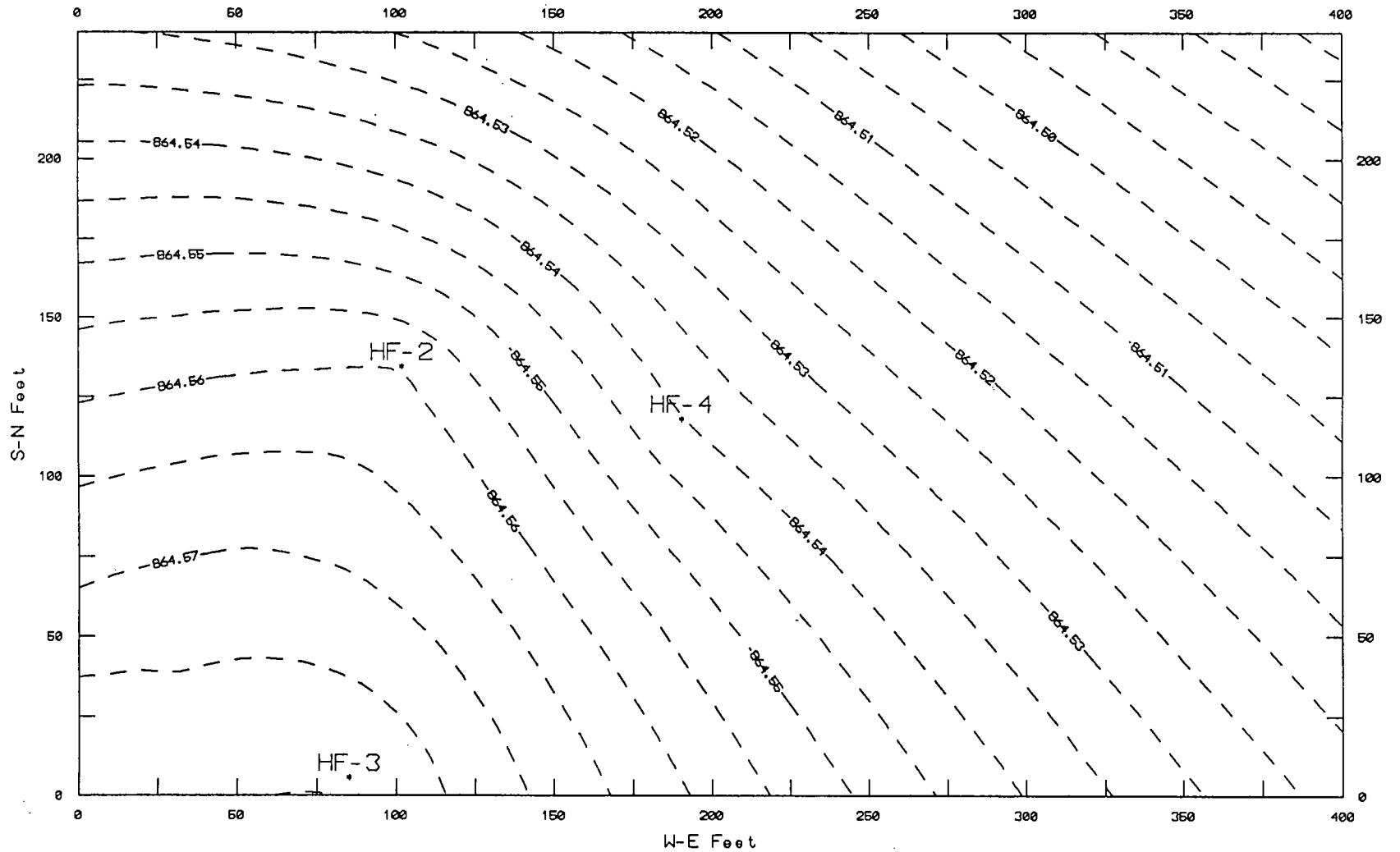

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FIGURE 6. WATER ELEVATION CONTOURS – MARCH 5, 1990

HYDRO–FLEX
2101 N.W. BRICKYARD ROAD
TOPEKA, KANSAS

Terracon

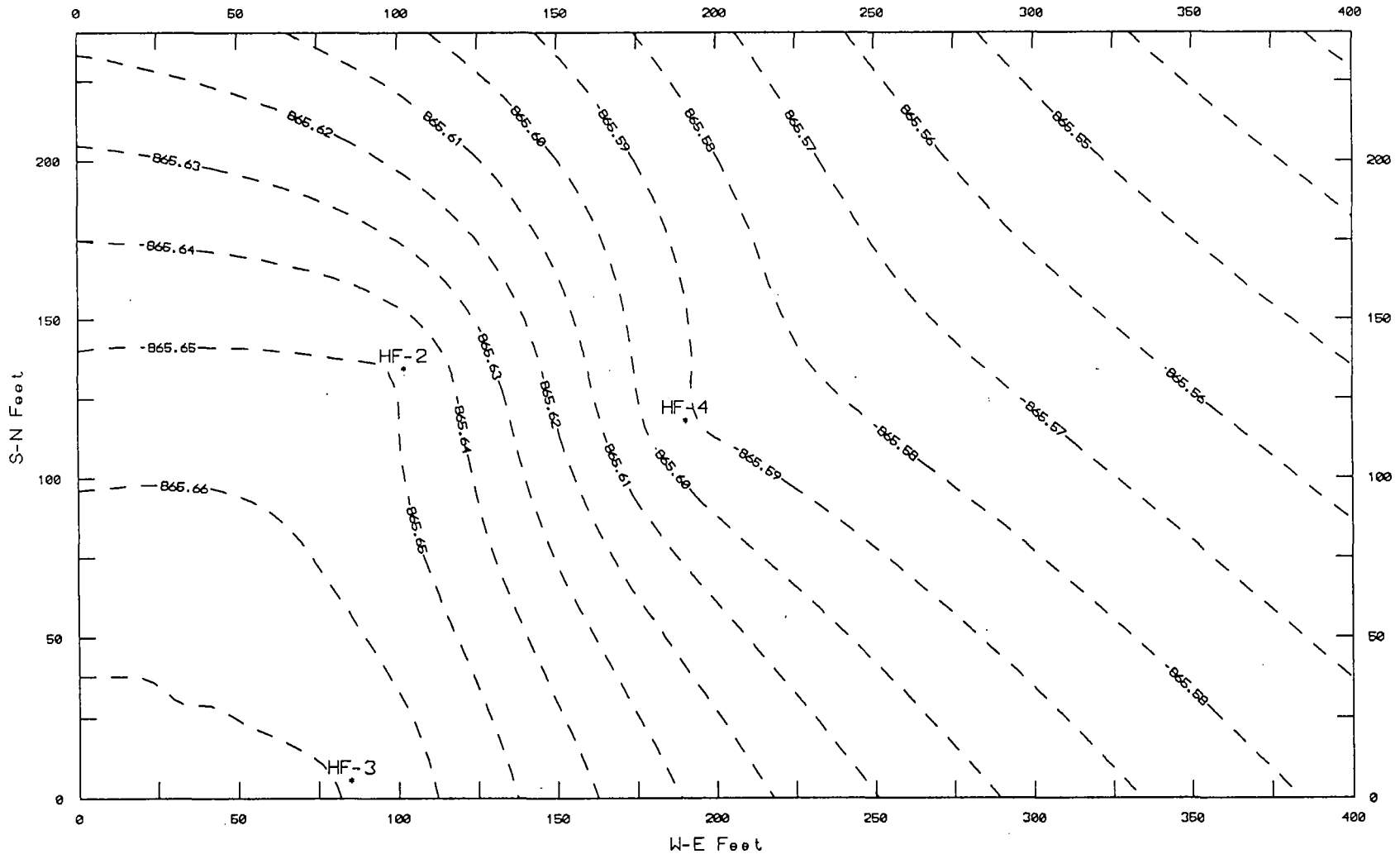

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FIGURE 7. WATER ELEVATION CONTOURS – OCTOBER 1, 1990

HYDRO–FLEX
2101 N.W. BRICKYARD ROAD
TOPEKA, KANSAS

Terracon

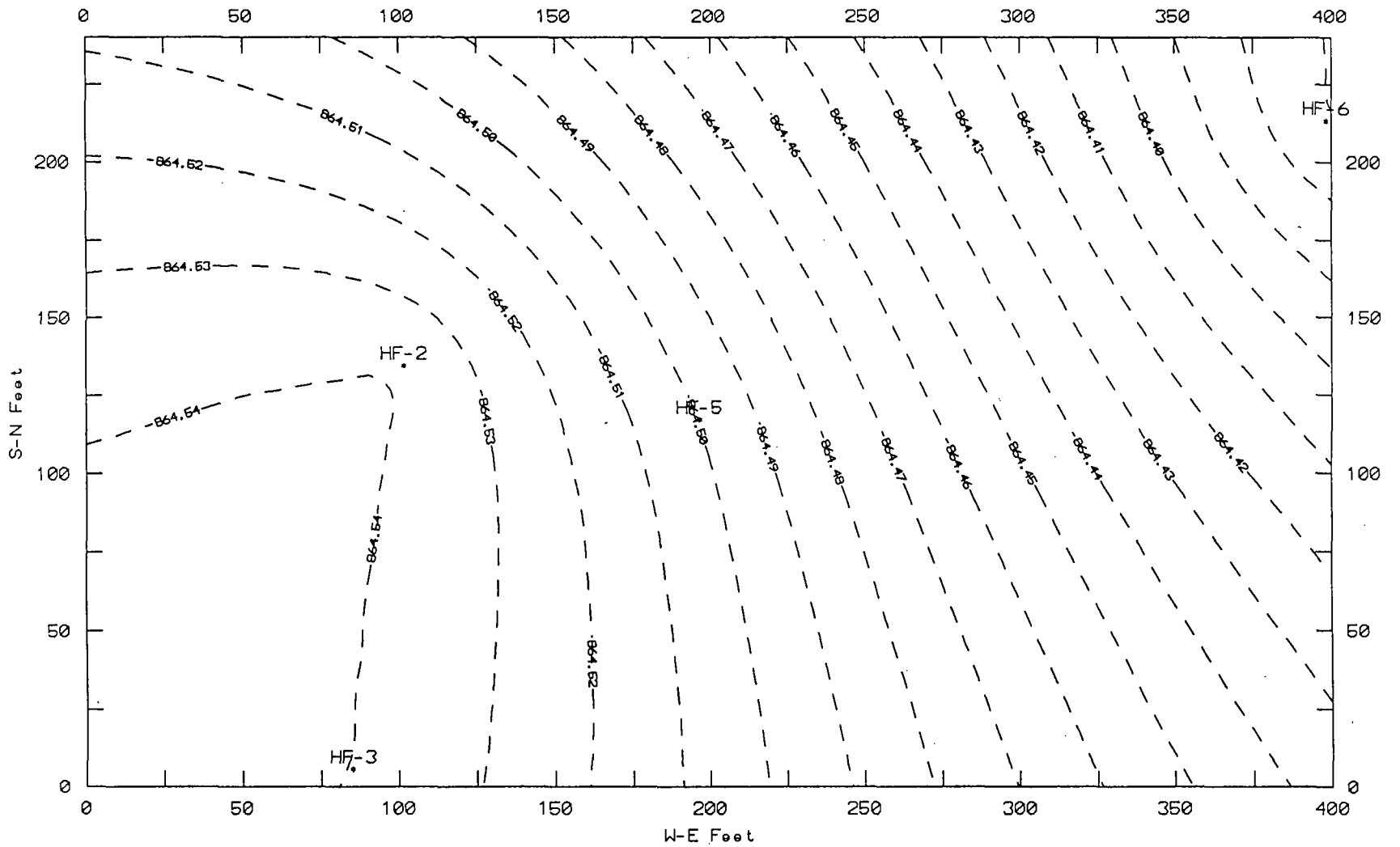

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FIGURE 8. WATER ELEVATION CONTOURS – MARCH 18–22, 1991

HYDRO–FLEX
2101 N.W. BRICKYARD ROAD
TOPEKA, KANSAS

Terracon

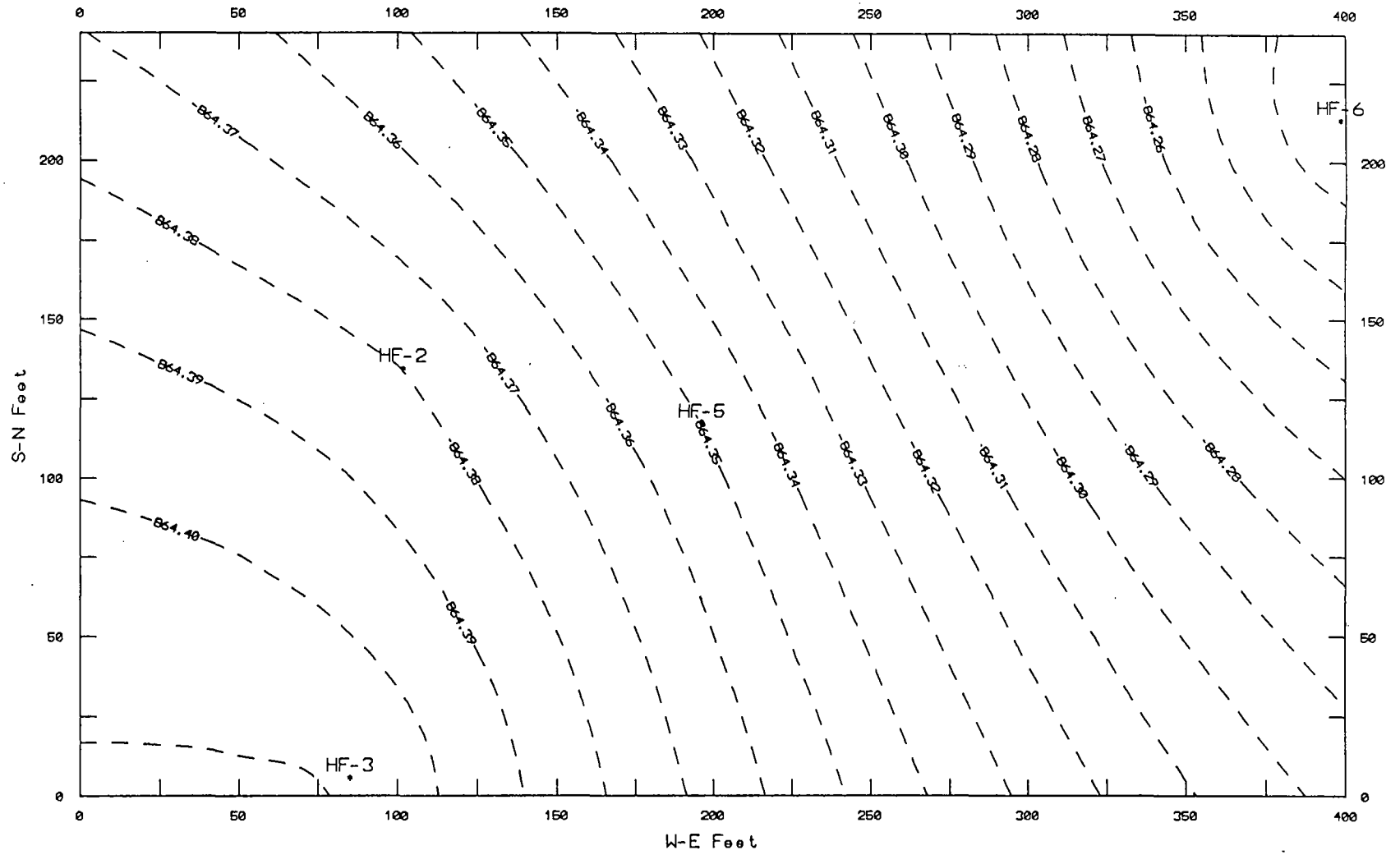

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FIGURE 9. WATER ELEVATION CONTOURS – APRIL 25, 1991

HYDRO–FLEX
2101 N.W. BRICKYARD ROAD
TOPEKA, KANSAS

Terracon

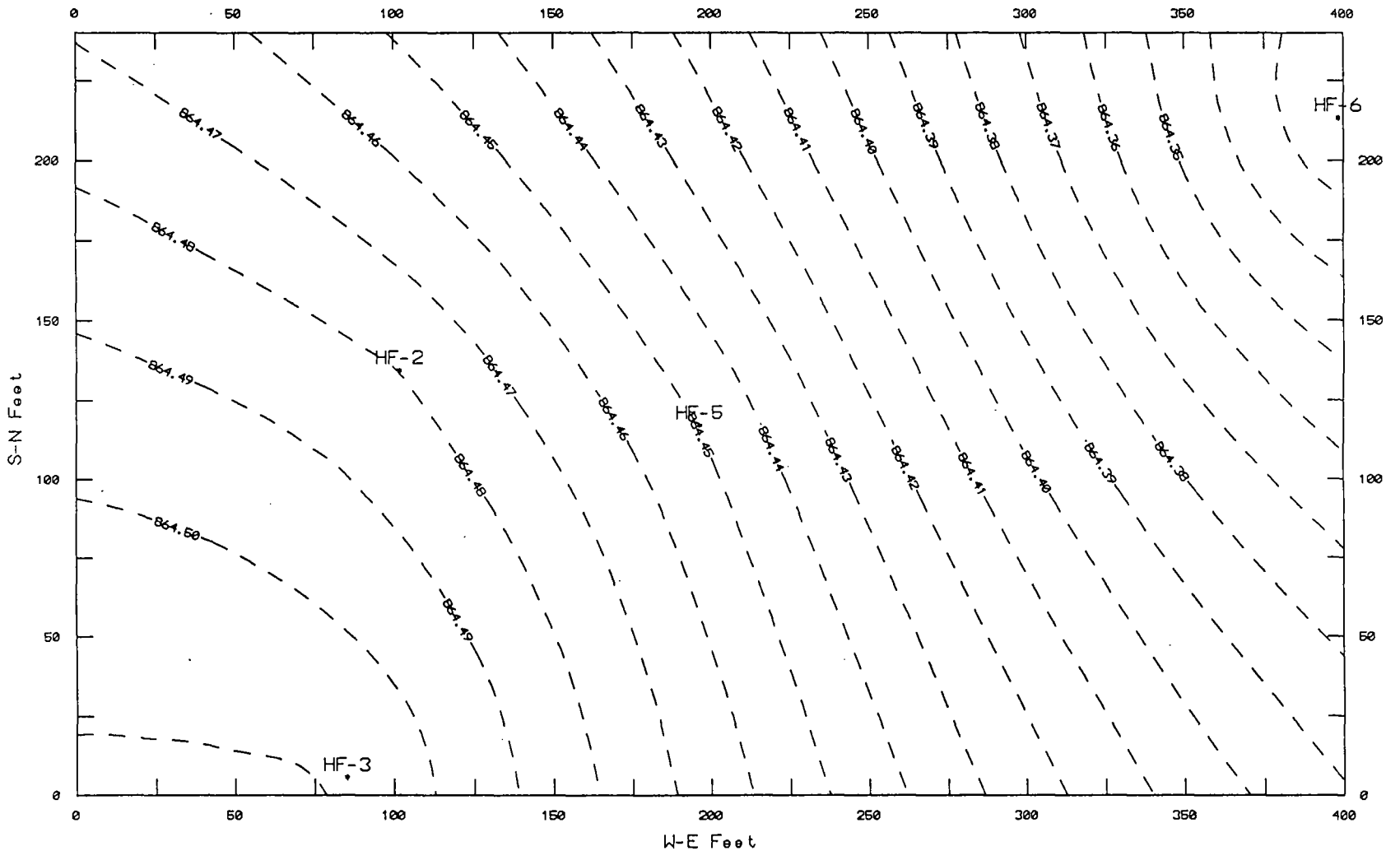

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FIGURE 10. WATER ELEVATION CONTOURS – MAY 10, 1991

HYDRO–FLEX
2101 N.W. BRICKYARD ROAD
TOPEKA, KANSAS

Terracon

Table 2: Water Level Measurements[1,2,3]						
	Monitoring Well					
Data/Date	HF-1	HF-2	HF-3	HF-4	HF-5	HF-6
TOSC	897.10	889.86	889.69	890.01	891.47	890.00
TOSC-GL	2.51	1.94	1.72	1.51	2.52	2.18
TOSC-TOWC	0.24	1.37	0.21	0	0.15	0.07
TOWC	896.86	888.49	889.48	890.01	891.32	889.93
05 Mar 90:						
Below TOWC	32.57	23.93	24.90	25.47	-	-
MSL	864.29	864.56	864.58	864.54	-	-
01 Oct 90						
Below TOWC	31.52	22.84	23.81	24.42	-	-
MSL	865.34	865.65	865.67	865.59	-	-
18 Mar 91						
Below TOWC	32.59	23.95	24.94	25.51	26.84	25.56
MSL	864.27	864.54	864.54	864.50	864.48	864.37
25 Apr 91						
Below TOWC	32.74	24.11	25.07	25.66	26.97	25.70
MSL	864.12	864.38	864.41	864.35	864.35	864.23
10 May 91						
Below TOWC	32.59	24.01	24.97	25.56	26.87	25.61
MSL	864.27	864.48	864.51	864.45	864.45	864.32

NOTES FOR TABLE 2:

1. Top of surface casing (TOSC), ground level (GL), and top of well casing (TOWC) in feet mean sea level (MSL) determined by surveys conducted 9 March 1990 by EBH and 22 April 1991 by Kramer. EBH reported elevations are approximately 0.1 feet higher than Kramer reported elevations. Values shown here are Kramer's. TOSC-GL is height of surface casing above ground level (AGL) in feet and TOSC-TOWC is difference in feet between top of surface and well casings.

2. Water levels for each well on each date reported as measured feet below TOWC and calculated feet MSL. Dash for HF-5 and Hf-6 on first two dates indicates wells did not exist.

3. Water levels for HF-5 and HF-6 on 18 March 1991 actually measured 22 March 1991. Water level measurements for HF-4 on both dates were identical.

wells HF-1 through HF-4. The contours in these figures show the direction of ground water flow as being to the northeast at a gradient of approximately 0.0003 to 0.0004 feet/foot. Wells HF-5 and HF-6 were subsequently installed. Figures 8 through 10 include data from them, with the data from HF-4 being replaced by data from HF-5. The contours in Figures 8 through 10 show the direction of ground water flow as being to the east-northeast at a gradient of approximately 0.0005 feet/foot. This direction and gradient probably more accurately represent actual conditions. It is noteworthy that the direction of flow from the soil adsorption field area and HF-4 would be nearly directly towards HF-6.

Laboratory data sheets presenting grain size distribution and porosity data for samples from three depth ranges are provided as Item B-2 in Appendix B to this report. The three depth ranges are: (1) 28.3 to 29.4 feet BGL; (2) 29.4 to 30.3 feet BGL; and (3) 34.0 to 39.0 feet BGL (nominally 35 feet BGL). Percent finer than grain sizes picked off of distribution curves for the d_{60}, d_{50} or median, and d_{10} or effective sizes of each depth range are listed in Table 3. Calculated uniformity coefficients (U_c) and the mean porosity for each depth range are also listed in Table 3. Based on grain size, material in these three depth ranges was characterized as being: (1) sand with trace clay and gravel (mean porosity of 30.9 percent); (2) sand with clay (mean porosity of 33.2 percent); and (3) gravelly sand with trace clay (mean porosity of 22.3 percent), respectively. Porosity in the six samples from the first two depth ranges was reported to vary from 29.2 to 36.7 percent. The mean and standard deviation for this data would be 32.0 and 2.69 percent, respectively.

Table 3: Grain Size Distribution Data			
	Depth Range (Feet BGL)		
Item	28.3-29.4	29.4-30.3	34.0-39.0
Grain Sizes[1]:			
d_{95}	1.2	0.43	6.5
d_{84}	0.39	0.34	4.1
d_{60}	0.28	0.21	2.1
d_{50}	0.24	0.14	1.6
d_{16}	0.090	0.019	0.31
d_{10}	0.076	0.0030	0.20
d_5	0.053	0.00020	0.10
U_c	3.7	70	10.5
Mean Porosity[2]	30.9	33.2	22.3
Calculated K[3]:			
Hazen	3.5×10^{-3}	3.6×10^{-6}	6.0×10^{-2}
Kozeny-Carmen	1.0×10^{-2}	2.5×10^{-3}	1.1×10^{-1}
Bedinger	5.4×10^{-3}	1.9×10^{-3}	2.4×10^{-1}

NOTES FOR TABLE 3:

1. Grain sizes in mm. U_c equals d_{60} divided by d_{10}.

2. Porosity expressed in percent.

3. Hydraulic conductivity (K) calculated based on grain size using Hazen, Kozeny-Carmen, and Bedinger equations. The Hazen equation is based on d_{10} in cm and a coefficient appropriate for the material involved. Coefficients of 0.6, 0.4, and 1.5 were selected for the depth ranges indicated, respectively. The Kozeny-Carmen equation is based on fluid density and dynamic viscosity, porosity, and representative or geometric mean (based on d_{84} and d_{16}) grain size. The density and dynamic viscosity of water at 15 °C and mean porosity were used. The Bedinger equation uses a coefficient of 0.0944 and median grain size.

There are a number of equations available in the literature that can be used to estimate hydraulic conductivity based on such variables as grain size and porosity. Results based on three such equations are listed in Table 3. They probably provide a reasonably precise range of estimates for the first and third depth ranges; however, because they were developed for sand size materials and may not appropriately account for the presence of fine-grained materials in the second depth range, the indicated spread in that range obviously lacks precision.

This information indicates that there may be considerable variation in hydraulic conductivity with depth at this site. Although hydraulic conductivity at deeper depths may be on the order of the 1.0×10^{-1} cm/sec value suggested in the work plan, based on pump tests in nearby similar locations, it may be less than that by one or more orders of magnitude within the first 10 feet below the water table.

Using the above information, average linear velocities have been calculated for two cases: (1) shallow ground water within the first 10 feet of the water table; and (2) deeper ground water. Assumptions for these cases were 1×10^{-3} and 1×10^{-1} cm/sec for hydraulic conductivity and 32 and 22 percent porosity, respectively, and a gradient of 0.0005 feet/foot in both cases. The mean linear velocities calculated for these cases are 1.6×10^{-6} and 2.3×10^{-4} cm/sec or 1.7 and 237 feet/year, respectively.

One sample was also taken from the 30 feet BGL in boring HF-6 and analyzed for organic content. The analytical data sheet showing the result of this analysis is provided in Item B-1 of Appendix B to this report. The result was 0.37 percent.

3.1.7 Demography and Land Use

Field demography and land use investigations were not a part of the approved work plan and SAP for this site. Therefore, there were no quantitative results from such work. However, observations of the site during field work verify that it is located in a rural portion of Topeka. Small farms, grain elevators to the south of the site on Brickyard Road, and a Quaker Oats pet food factory across the street on Brickyard Road dominate the immediate area. There are also several private residences to the north and south of the site on Brickyard Road.

3.1.8 Ecology

Field ecology investigations were not a part of the approved work plan and SAP for this site. Therefore, there were no results from such work.

4.0 NATURE AND EXTENT OF CONTAMINATION

4.1 Results of Site Characterization

4.1.1 Sources

Information obtained from drilling borings in the approximate center of the manholes indicates that No. 1 and No. 2 have intact bottoms but that No. 3 does not. Accumulations of water were found near and at the bottom of No. 1 and No. 2 and hard objects, assumed to be intact manhole bottoms, were encountered during the final attempt to sample each. In contrast, continuous sampling of Manhole No. 3 showed the presence of apparently naturally occurring very fine alluvial sand underlying a thin sludge layer and the overlying coarse sand that had been used to fill the manholes when they were taken out of operation in 1981.

Analytical results for source soil/sludge samples are presented in Table 4 (see Tables 4a, 4b, and 4c). These indicate that small amounts of chromium and copper contaminated sludge are

Table 4a: Source Soil/Sludge Results[1,2]

Depth/Variable	MH-1	MH-2	MH-3	HF4-S
Surface:				
Chromium				
PACE	8.49	58.9	-	-
KDHE	-	-	32.9	-
Copper				
PACE	7.42	64.9	-	-
KDHE	-	-	38.8	-
Lead				
PACE	3.10	2.60	-	-
KDHE	-	-	1.59	-
05 Feet BGL:				
Chromium	209	86.3	40.1	-
Copper	296	192	40.0	-
Lead	3.00	2.50	-	-
Bottom:				
Chromium				
PACE	16,000	278	4,440	56,200
PACE R	19,500	-	-	-
KDHE	8,930	150	862	1.29
PACE EP TOX	0.33	<0.25	2.40	44.0
PACE EP TOX R	<0.25	-	-	-
KDHE EP TOX	-	0.13	-	-
Hexavalent	<0.01	-	-	-
Hexavalent R	<0.01	-	-	-
Copper				
PACE	23,000	3.67	6,880	102,000
PACE R	27,500	-	-	-
KDHE	9,360	209	1,020	1.08
Lead				
PACE	38.3	2.00	-	-
PACE R	41.0	-	-	-
KDHE	3.39	1.70	5.30	0.001
PACE EP TOX	<0.25	<0.25	-	-
PACE EP TOX R	<0.25	-	-	-
KDHE EP TOX	-	<0.04	<0.02	-

Table 4b: Source Soil/Sludge Results[3]				
Variable	MH-1	MH-2	MH-3	HF4-S
Antimony				
PACE	<0.10	<0.10	-	-
PACE R	<0.10	-	-	-
KDHE	119	4.00	1.43	0.01
Arsenic				
PACE	<1.00	1.28	-	-
PACE R	1.57	-	-	-
KDHE	6.02	0.910	0.749	<0.021
Beryllium				
PACE	<0.10	<0.10	-	-
PACE R	0.10	-	-	-
KDHE	0.205	0.055	0.021	<0.001
Cadmium				
PACE	0.82	<0.10	-	-
PACE R	1.09	-	-	-
KDHE	0.760	0.199	0.197	<0.002
Mercury				
PACE	0.200	<0.10	-	-
PACE R	0.200	-	-	-
KDHE	-	-	-	-
Nickel				
PACE	2.12	<1.0	-	-
PACE R	3.39	-	-	-
KDHE	4.98	2.64	2.273	0.013
Selenium				
PACE	<0.10	<0.10	-	-
PACE R	<0.10	-	-	-
KDHE	<0.30	<0.30	<3.00	<0.001
Silver				
PACE	1.50	<0.100	-	-
PACE R	1.50	-	-	-
KDHE	<0.050	<0.050	0.351	<0.004
Thallium				
PACE	9.40	<1.0	-	-
PACE R	9.40	-	-	-
KDHE	5.91	0.92	0.75	<0.015
Zinc				
PACE	98.8	5.62	-	-
PACE R	98.8	-	-	-
KDHE	68.5	9.97	11.3	0.069

Table 4c: Source Soil/sludge Results[4]				
Variable	MH-1	MH-2	MH-3	HF4-S
VOC	<DL	NA	NA	
Benzene				0.6
Ethylbenzene				3.5
Styrene				1.9
Toluene				0.7
m-Xylene				1.7
o- or p-Xylene				1.9
B/NA	<DL	NA	NA	NA

Table 4d: Source Ground Water (HF-4) Results[5]				
	March 22, 1991		May 10, 1991	
Variable	KDHE	PACE	Filtered	Total
General:				
Alkalinity	-	-	-	354
Conductivity	-	845	-	810
Fluoride	-	-	-	0.26
Hardness	-	-	122	369
Nitrate	452	-	-	0.04
pH (Units)				
Field	-	6.91	-	7.05
KDHE Lab	-	-	-	7.3
Sulfate	-	-	-	47
Temperature	-	17.0	-	15.6
TSS	-	-	-	29
Turbidity (NTU)	51.2	-	-	143
Major Elements:				
Calcium	150	-	42.4	128
Chloride	-	-	-	39.3
Iron	0.941	-	3.34	10.9
Magnesium	19.1	-	3.94	11.9
Potassium	9.38	-	-	6.27
Sodium	57.8	-	9.46	28.7
Trace Elements:				
Antimony	20	-	80	<10
Arsenic	<21	-	11	35
Beryllium	<1	-	<1	<1
Cadmium	2	-	<2	<2
Chromium	5,810	7,380	<3	14
Copper	5,870	7,530	14	38
Manganese	451	-	309	863
Nickel	17	-	<7	7
Silver	<4	-	<4	<4
Thallium	<15	-	<15	<15
Zinc	68	-	40	48
Organics:				
VOC				-
Benzene	0.5	-	-	
Trichloromethane	0.7	-	-	
o-, p-Xylene	0.8	-	-	
B/NA				-
Benzoic Acid	11	-	-	
p-Cresol	18	-	-	

NOTES FOR TABLE 4:

1. Reported concentrations rounded off to three significant figures. All samples analyzed for elements by PACE and for organic compounds by KDHE, unless otherwise noted. Dash indicates sample not taken or sample taken but not analyzed for listed variable. "R" indicates analysis of replicate sample.

2. Concentrations of chromium, copper, and lead in manhole soil/sludge and HF-4 sludge in mg/kg, except EP TOX results and KDHE analysis of HF-4 sludge reported in mg/L.

3. USEPA priority pollutant elements.

4. USEPA priority pollutant VOC and B/NA organic compounds. "<DL" indicates less than respective detection limit. "NA" indicates not analyzed for listed variable. The only organic compounds reported at concentrations exceeding detection limits were by KDHE in the sludge sample from HF-4.

5. General variables and major elements in mg/L unless otherwise noted, except conductivity in umhos/cm at 25 °C. Trace elements and organic compounds in ug/L. Conductivity, pH, and temperature measured in the field unless otherwise noted.

present at the bottom of Manhole No. 1 and Manhole No. 3 and that a small amount of chromium and copper contaminated sludge was present in monitoring well HF-4. Concentrations of other variables appear to be at naturally occurring background levels or give no indication of significant contamination. Naturally occurring background levels are indicated in Table 5 (see Table 5a for Kansas and the United States and Table 5b for world averages). Where measured, hexavalent chromium was not reported to exceed the detection limit for it and EP TOX chromium concentrations were all less than the criterion of 5 mg/L, except in the case of sludge from HF-4. Sludge samples from Manhole No. 1 and HF-4 were analyzed for organic compounds. The only such compounds reported were small concentrations of several VOC, all but one of which are characteristic of petroleum hydrocarbon contamination. The concentrations involved are so small as to possibly be a result of minor airborne contamination from emissions of reciprocating engines operating in the vicinity of the well during sampling (e.g., the drill rig).

The amount of sludge present at the bottom of Manhole No. 1 is apparently very small. The strata containing sludge in Manhole No. 1 consisted of a 1 foot thick layer of wet, grayish brown clay with moderate blue streaks throughout. Three samples of this mixture were analyzed: replicates were analyzed by PACE and a third sample was analyzed by KDHE. The mean of all three results is 14,800 and 20,000 mg/kg for chromium and copper, respectively. Assuming these mean concentrations and a bulk density of 1.5 g/cm^3, a 1 foot layer of this mixture in a 4 foot diameter manhole would amount to 17.4 and 23.5 pounds of chromium and copper, respectively.

A smaller amount of sludge would be present at the bottom of Manhole No. 3. The sludge layer in that case consisted of

Table 5a: Background Soil Element Concentrations[1]						
	Kansas[2]			United States[3]		
Element	Min	Mean	Max	Min	Mean	Max
Sb	-	-	-	-	-	-
As	-	-	-	<0.10	5.2	97
Be	-	-	-	<1	2.38	15
Cd	-	-	-	-	-	-
Cr	7	49.0	100	1	37	2000
Cu	2	25.0	50	<1	17	700
Fe	-	-	-	100	18000	>100000
Pb	10	31.8	200	<10	16	700
Hg	-	-	-	<0.01	0.058	4.6
Ni	-	-	-	<5	13	700
Se	-	-	-	<0.1	0.26	4.3
Ag	-	-	-	-	-	-
Tl	-	-	-	-	-	-
Zn	-	-	-	<5	48	2900

Table 5b: Background Rock and Soil Element Concentrations

Element	World Mean Sedimentary Rocks[4]		World Soils and Surficial Material[5]		
	Shale	Sandstone	Min	Median	Max
Al	80000	25000	-	-	-
Sb	1.5	0.0X	0.2	1	10
As	13	1	0.1	6	40
Ba	580	X0	100	500	3000
Be	3	0.X	0.01	0.3	40
B	100	35	2	20	270
Cd	0.3	0.0X	0.01	0.35	2
Ca	22100	39100	-	-	-
Cr	90	35	5	70	1500
Co	19	0.3	0.05	8	65
Cu	45	X	2	30	250
Fe	47200	9800	-	-	-
Pb	20	7	2	35	300
Mg	15000	7000	-	-	-
Mn	850	X0	20	1000	10000
Hg	0.4	0.03	0.01	0.06	0.5
Mo	2.6	0.2	0.1	1.2	40
Ni	68	2	2	50	750
K	26600	10700	-	-	-
Se	0.6	0.05	0.01	0.4	12
Ag	0.07	0.0X	0.01	0.04	8
Na	9600	3300	-	-	-
Tl	1.4	0.82	0.1	0.2	0.8
V	130	20	3	90	500
Zn	95	16	1	90	900

NOTES FOR TABLE 5:

1. Standard chemical symbols used for elements. Concentrations in mg/kg.

2. Boerngen, Josephine G. and Hanford T. Shacklette. 1981. Chemical analysis of soils and other surficial materials of the conterminous United States. Open-File Report No. 81-197. USGS, Washington, DC, pp. 44-52 (values listed are the listed ranges and calculated means for 33 samples taken from a variety of soil types in 33 counties spread geographically throughout Kansas but not including Shawnee County).

3. Shacklette, Hanford T. and Josephine G. Boerngen. 1984. Element concentrations in soils and other surficial materials of the conterminous United States. Professional Paper No. 1270, USGS, Washington, DC, p. 6 (values listed are reported means and ranges for a large number of samples taken from counties in all 48 conterminous states and spread geographically throughout the country).

4. Turekian, Karl K. and Karl H. Wedepohl. 1961. Distribution of elements in some major units of the earth's crust. Geological Society of American Bulletin, Vol. 72, pp. 175-192 (use of "X" indicates only an order of magnitude estimate could be made).

5. From Bowen (1979) as cited in Appendix Table 1.17 by D.C. Adriano. 1986. Trace Elements in the Terrestrial Environment, Springer-Verlag, New York, p. 39.

approximately 0.1 feet of a gray clay and blue-green sludge mixture on top of blue-green fine sand. Two samples of this mixture were analyzed: one by PACE and one by KDHE. The mean of these results is 2,650 and 3,950 mg/kg for chromium and copper, respectively. Assuming these mean concentrations and a bulk density of 1.5 g/cm^3, a 0.1 foot layer of this mixture in a 4 foot diameter manhole would amount to 0.312 and 0.465 pounds of chromium and copper, respectively.

In view of the nature of the sludge sample obtained from monitoring well HF-4, the manner in which the EP TOX test is conducted, and the apparent removal of all cohesive sludge during sampling, this measurement has little meaning. When first extracted from HF-4, the sludge in the sampler appeared to be relatively cohesive but was mixed with a small amount of water containing a high concentration of sludge solids. After it was in the sample container for a short while, it became a slurry that was similar in appearance and smell to primary sludge from a wastewater treatment plant after anaerobic digestion. It was black in color and had an organic smell. In the EP TOX test run on this sample, the analysis was conducted on a combination of acidified filtrate and extracted liquid[9]. Since the filtrate itself was likely to substantially exceed the criterion, the test result may indicate more about the filtrate than the nature of the sludge. Additionally, it became apparent during sampling that all cohesive sludge present at the bottom of the well had been removed and that only relatively small amounts of sludge solids remained, dispersed in the water column. The bulk of these, if not all, were subsequently removed when the well was

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[9]Guinn, J.P. 1991. Personal communication. Coordinator, Laboratory Services, PACE, Inc., Lenexa, KS.

purged, which occurred immediately after sludge sampling took place.

Ground water was sampled from monitoring well HF-4 immediately after sludge was sampled on March 22. Analytical results are presented in Table 4d. Only total concentrations of elements were measured. Because the chromium and copper concentrations reported in those samples were on the order of 5,800 to 7,500 ug/L, KDHE requested that it be sampled again on May 10 and that both filtered and unfiltered samples be obtained. Analytical results for these samples are also presented in Table 4d. Removal of sludge from the well in conjunction with sampling on March 22 and subsequent purging apparently were apparently successful in eliminating contamination in this well. Filtered and total chromium were reported to be less than the detection limit and 14 ug/L, respectively, in those samples. Reported concentrations of 14 and 38 ug/L for filtered and total copper, respectively, were similarly low.

Other water quality variables reported in ground water samples from monitoring well HF-4 either appear to be at naturally occurring background levels or give no indication of significant contamination. Typical natural background levels of water quality variables are indicated in Table 6. Organic compounds were measured by KDHE in their March 22 sample. Small concentrations of three VOC and two B/NA compounds were reported in that sample. Four of these may be related to combustion of petroleum hydrocarbons. The fifth, trichloromethane (i.e., chloroform) is a trihalomethane.

4.1.2 Soils and Vadose Zone

Analytical results for soil samples are presented in Table 7 and descriptive statistics for chromium, copper, and lead from

Table 6: Typical Levels of Water Quality Variables*		
Variable	Surface Water	Ground Water
GENERAL (mg/L)		
Alkalinity	<200	<1000
Ammonia-N	<0.1	-
Bicarbonate	52	-
Conductivity (umhos/cm @ 25 °C)	50 - 50000	50 - 50,000
Hardness	25 - 300	25 - 300
Nitrate	-	0.2 - 20
Nitrite	<1	<1
pH (units)	6.5 - 8.5	6 - 8.5
Sulfate	8.25	3 - 150
TDS	<1000	<1000
TOC	2 - 15	<2
MAJOR ELEMENTS (mg/L)		
Calcium	13.4	1 - 150
Chloride	5.75	1 - 70
Fluoride	<1	1 - 5
Iron	0.04	0.01- 10
Magnesium	3.35	1 - 50
Phosphorous	0.01 - 0.03	0.03- 0.3
Potassium	1.3	1 - 10
Sodium	5.15	0.5 - 120
TRACE ELEMENTS (ug/L)		
Antimony	1	-
Arsenic	2	<1 - 30
Barium	50	10 - 500
Beryllium	-	<10
Boron	20	20 - 1000
Cadmium	1	<1
Chromium	1	<1 - 5
Cobalt	0.2	<10
Copper	7	<1 - 30
Lead	1	<15
Manganese	8	1 - 1000
Mercury	0.07	<1
Nickel	2	<10 - 50
Selenium	0.2	<1 - 10
Silver	0.3	<5
Thallium	-	-
Zinc	30	<10 - 2000

*Combination of data from various sources.

Table 7a: Soil Sample Results*			
Depth/Variable	S-1	S-2	S-3
Surface			
Chromium	29.3	13.3	10.4
Copper	34.9	19.2	12.3
Lead	28.7	11.8	9.13
05 Feet BGL			
Chromium	6.08	6.57	8.68
Copper	9.53	4.39	6.43
Lead	4.25	3.32	5.68
10 Feet BGL			
Chromium	-	-	-
Copper	-	-	-
Lead	-	-	-

*Concentrations rounded off to three significant figures and in mg/kg. All samples analyzed by KDHE. Dash indicates sample not analyzed for listed variable.

Table 7b: Soil Sample Results*			
Depth/Variable	S-4	S-5	S-6
Surface			
Chromium	-	24.3	-
Copper	-	27.8	-
Lead	-	9.17	-
VOC	-	<DL	-
Dichloromethane	-	7.2	-
B/NA	-	<DL	-
03 Feet BGL			
Chromium			
KDHE	-	3.50	-
PACE	13.6	-	7.53
Copper			
KDHE	-	3.46	-
PACE	11.4	-	5.84
Lead	-	0.544	-
VOC	-	<DL	-
Dichloromethane	-	6.9	-
B/NA	-	<DL	-
pH PACE	6.2	-	-
05 Feet BGL			
Chromium			
KDHE	-	13.2	-
PACE	9.42	76.4	7.39
Copper			
KDHE	-	7.39	-
PACE	4.82	5.04	5.85
Lead	-	8.28	-
VOC	-	<DL	-
Dichloromethane	-	5.6	-
B/NA	-	<DL	-
07 Feet BGL			
Chromium PACE	-	18.7	-
Copper PACE	-	10.3	-

*Concentrations rounded off to three significant figures and in mg/kg. All samples analyzed by KDHE, unless otherwise noted. Dash indicates sample not taken or taken and not analyzed by indicated laboratory for indicated variable.

Table 7c: Soil Sample Results*			
Depth/Variable	MH-3	S-7	S-8
Surface			
Chromium	-	29.1	23.4
Chromium Replicate	-	-	25.6
Copper	-	47.8	21.9
Copper Replicate	-	-	23.5
Lead	-	12.2	11.4
Lead Replicate	-	-	10.4
05 Feet BGL			
Chromium	-	10.8	28.9
Chromium EP TOX	-	-	<0.25
Copper	-	7.65	10.1
Lead	-	5.43	11.5
Lead EP TOX	-	-	<0.25
VOC	-	-	<DL
B/NA	-	-	<DL
10 Feet BGL			
Chromium	-	2.47	9.10
Copper	-	2.44	5.01
Lead	-	4.93	9.80
16 Feet BGL			
Chromium	-	-	8.42
Copper	-	-	5.41
Lead	-	-	5.70
18 Feet BGL			
Chromium	-	25.6	-
Copper	-	19.5	-
Lead	-	10.9	-
19 Feet BGL			
Chromium	5.0		
Copper	44.6		

*Concentrations rounded off to three significant figures and in mg/kg, except EP TOX in mg/L. Samples for borings MH-3 and S-7 analyzed by PACE and S-8 analyzed by KDHE. Dash indicates sample not taken or taken and not analyzed for indicated variable.

Table 7d: Soil Sample Results*			
Depth/Variable	S-9	S-10	S-11
Surface			
Chromium	9.38	23.6	6.66
Copper	13.7	31.1	10.9
Lead	5.63	11.4	4.36
05 Feet BGL			
Chromium	14.0	9.37	15.9
Copper	20.0	9.07	9.40
Lead	16.4	9.02	8.46
10 Feet BGL			
Chromium	-	-	-
Copper	-	-	-
Lead	-	-	-

*Concentrations rounded off to three significant figures and in mg/kg. All samples analyzed by KDHE. Dash indicates sample not analyzed for listed variable.

Table 7e: Soil Sample Results*		
Depth/Variable	HF-5	HF-6
Surface	-	-
10 Feet BGL		
Chromium	-	4.10
Copper	-	2.95
30 Feet BGL		
Chromium		
PACE	-	0.976
KDHE	-	2.06
Copper		
PACE	-	0.470
KDHE	-	1.00
Lead KDHE		<2
VOC	-	<DL
Dichloromethane	-	93.5
B/NA		<DL
60 Feet BGL		
Chromium		
PACE	0.708	-
KDHE	1.81	-
Copper		
PACE	0.921	-
KDHE	1.73	-
Lead KDHE	<2	-
VOC	<DL	-
Dichloromethane	4.6	-
B/NA	<DL	-

*Concentrations rounded off to three significant figures and in mg/kg. All samples analyzed by PACE unless otherwise noted. Dash indicates sample not taken or not analyed for listed variable by indicated laboratory. "<DL" indicates less than respective detection limits.

these results are presented in Table 8. Results for all variables appear to be at naturally occurring background levels or give no indication of significant contamination. Using all data points, mean chromium, copper, and lead concentrations were calculated to be 14.0, 12.7, and 8.78 mg/kg and maximum values reported for each of these elements were 76.4, 47.8, and 28.7 mg/kg, respectively. Additionally, where measured, hexavalent chromium, EP TOX chromium, and EP TOX lead were all reported to be less than their respective detection limits and soil pH was in the slightly acidic range of 6.2 to 6.6 units. Analysis was conducted for organic compounds in several samples from borings S-5, HF-5, and HF-6. Results for all organic compounds were less than detection limits in all samples except for dichloromethane (i.e., methylene chloride). Small to moderate levels of dichloromethane were reported in all of these samples. This compound is a commonly used solvent in analytical laboratories.

4.1.3 Ground Water

Analytical results for ground water samples (other than monitoring well HF-4, reported above in Section 4.1) are presented in Table 9. Results for all variables, with the exception of total chromium in monitoring well HF-5, appear to be at naturally occurring background levels or give no indication of significant contamination. The mean concentration of chromium in filtered samples was 4.25 ug/L.

The level of solids in most unfiltered ground water samples, as indicated by both total suspended solids (TSS) and turbidity values, was high. The concentrations of some elements, chromium in particular, were apparently affected by this circumstance. The mean concentration of chromium in unfiltered samples from all wells except HF-5 was 52.4 ug/L. As noted in Item A-3 of Appendix A, these concentrations of chromium were directly

Table 8: Descriptive Statistics for Soil Samples[1]			
Item	Chromium	Copper	Lead
Number of Samples	36	36	25
Minimum Concentration	0.708	0.470	<2[3]
Lower 95 % CI[2]	9.40	8.66	6.45
Mean Concentration	14.0	12.7	8.78
Upper 95 % CI[2]	18.7	16.8	11.1
Maximum Concentration	76.4	47.8	28.7
Standard Deviation	13.8	12.0	5.62

NOTES FOR TABLE 8:

1. Soil concentrations in units of mg/kg.

2. Lower and upper 95 percent confidence interval for the mean.

3. Entered at one-half the detection limit or 1 mg/kg in calculations.

Table 9a: Ground Water Sample Results*				
	HF-1		HF-2	
Variable	Filtered	Total	Filtered	Total
General:				
Alkalinity	-	374	-	399
Conductivity	-	834	-	933
Fluoride	-	0.18	-	0.32
Hardness	480	523	477	1,190
Nitrate	-	3.43	-	15.8
pH (Units)				
Field	-	6.91	-	6.90
KDHE Lab	-	7.1	-	7.2
Sulfate	-	47	-	77
Temperature (°C)	-	15.4	-	14.7
TSS	-	2,073	-	75,000
Turbidity (NTU)	-	570	-	1,340
Major Elements:				
Calcium	137	175	167	424
Chloride	-	16.9	-	5.0
Iron	0.018	50.0	0.054	34.9
Magnesium	16.2	21.0	14.5	30.8
Potassium	-	11.8	-	18.8
Sodium	13.4	12.8	15.6	16.7
Trace Elements:				
Antimony	60	10	80	20
Arsenic	<21	95	<21	79
Beryllium	<1	4	<1	5
Cadmium	<2	3	<2	12
Chromium	4	52	7	115
Copper	14	62	12	75
Manganese	5	7,570	4	1,907
Nickel	<7	69	<7	99
Silver	<4	<4	5	<4
Thallium	<15	<15	<15	<15
Zinc	35	193	19	251
VOC:	<DL	<DL	<DL	<DL
Tetrachloromethane		2.6		
Trichloromethane		0.7		

Table 9b: Ground Water Sample Results*				
	HF-3		HF-6	
Variable	Filtered	Total	Filtered	Total
General:				
Alkalinity				
Field	-	-	419	-
KDHE Lab	-	333	-	431
Conductivity	-	909	-	928
Fluoride	-	0.24	-	0.30
Hardness	354	417	431	741
Nitrate	-	0.06	-	2.88
pH (Units)				
Field	-	7.11	-	6.96
KDHE Lab	-	7.2	-	7.1
Sulfate	-	42	-	92
Temperature	-	16.3	-	15.8
TSS	-	511	-	4,330
Turbidity (NTU)	-	390	-	2,080
Major Elements:				
Calcium	121	144	152	251
Chloride	-	90.3	-	8.4
Iron	9.42	30.0	0.038	44.2
Magnesium	12.3	14.1	12.6	27.9
Potassium	-	7.10	-	18.0
Sodium	56.0	54.5	40.6	39.8
Trace Elements:				
Antimony	60	<10	70	10
Arsenic	35	32	<21	<21
Beryllium	<1	<1	<1	6
Cadmium	<2	3	<2	5
Chromium	3	26	6	55
Copper	5	88	16	109
Manganese	892	2,070	220	1,256
Nickel	<7	22	<7	160
Silver	<4	<4	5	<4
Thallium	<15	<15	<15	30
Zinc	11	94	10	265
VOC	-	<DL	-	<DL

Table 9c: Ground Water Sample Results*			
	HF-5		
Variable	Filtered	Total	Total R
General:			
Alkalinity	-	345	-
Conductivity	-	754	-
Fluoride	-	0.28	-
Hardness	375	550	539
Nitrate	-	0.04	-
pH (Units)			
Field	-	7.09	-
KDHE Lab	-	7.3	-
Sulfate	-	55	-
Temperature	-	16.3	-
TSS	-	1,330	-
Turbidity (NTU)	-	732	-
Major Elements:			
Calcium	131	192	188
Chloride	-	13.6	-
Iron	10.6	39.3	37.6
Magnesium	11.5	17.2	16.8
Potassium	-	8.78	8.81
Sodium	14.3	14.6	14.4
Trace Elements:			
Antimony	70	20	<10
Arsenic	31	26	30
Beryllium	<1	1	1
Cadmium	<2	14	15
Chromium	4	360	345
Copper	5	171	162
Manganese	1,010	1,910	1,820
Nickel	<7	48	48
Silver	<4	<4	<4
Thallium	<15	<15	<15
Zinc	11	143	97
VOC	-	<DL	<DL

NOTE FOR TABLE 9:

*General variables and major elements in mg/L unless otherwise noted, except conductivity in umohs/cm at 25 °C. Trace elements and organics in ug/L. Concentrations rounded off to three significant figures. Analysis by KDHE unless otherwise noted. Conductivity, pH, and temperature measured in field unless otherwise noted. Dash indicates sample not analyzed for indicated variable.

directly proportional to TSS concentrations (correlation coefficient of 0.90). This indicates that chromium in all wells except HF-5 probably was a result of natural background levels. In the case of the unfiltered sample from HF-5, there may be enrichment on the order of 300 ug/L due to contamination from waste disposal in HF-4. However, since the filtered chromium concentration is low, this contamination is evidently associated with suspended solids.

4.1.4 Surface Water and Sediments

As noted in Subsection 2.1.4, field surface water and sediments investigations were not a part of the approved work plan and SAP for this site. Therefore, there are no results from such work.

4.1.5 Air

Field investigations of air quality were not a part of the approved work plan and SAP for this site. Therefore, there are no results from such work.

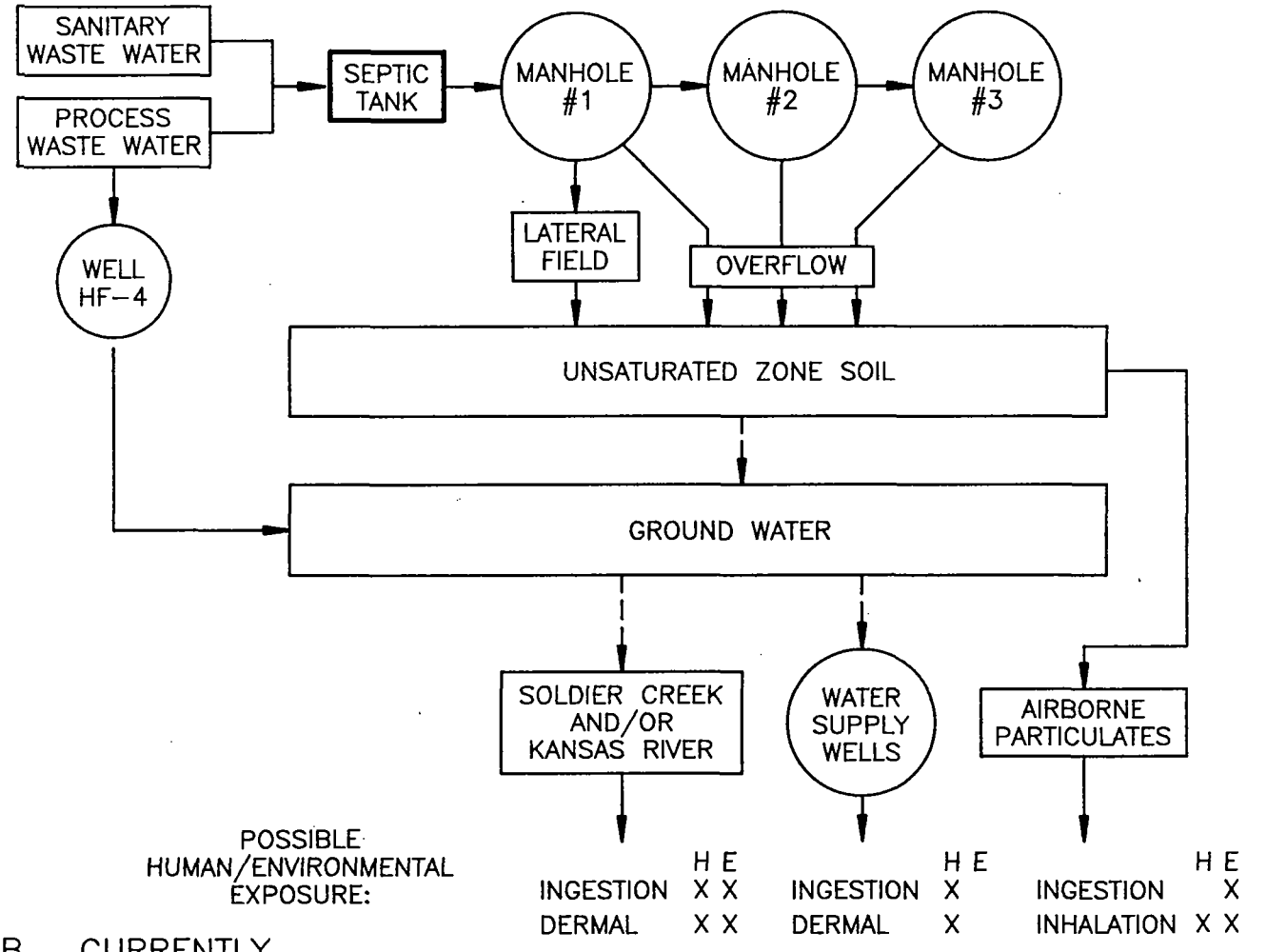
5.0 CONTAMINANT FATE AND TRANSPORT

5.1 Potential Routes of Migration

Possible routes of contaminant migration during wastewater disposal operations at this site were illustrated in Figure 5 of the work plan. Figure 11 of this report updates and extends that presentation to show both theoretical routes of contaminant migration from past operations and as a result of identified minor residual contamination remaining on site.

As indicated in Figure 11a, it was theoretically possible that contaminants could have migrated from the site via airborne particulates from surface soil contamination and could have contaminated surface streams via long-range migration through

A. DURING PAST OPERATIONS



B. CURRENTLY

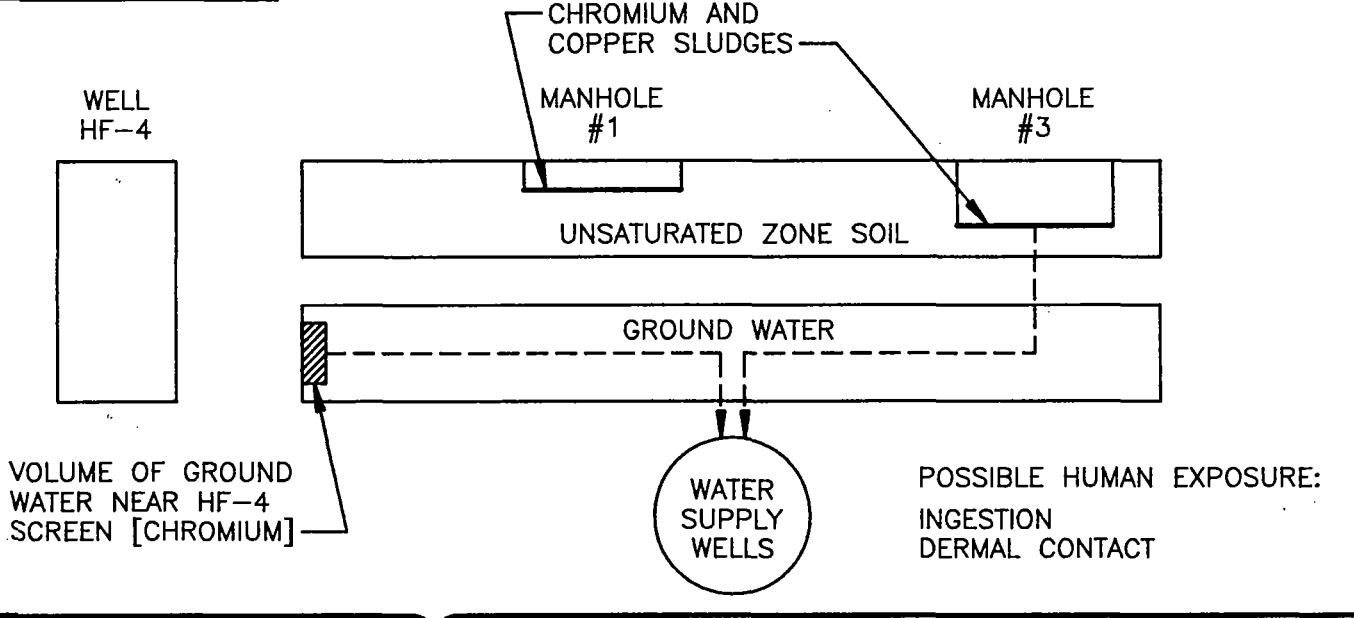


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FIGURE 11. THEORETICAL CONTAMINANT MIGRATION ROUTES

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ground water. Data from sampling during the RI indicate that these routes do not merit further consideration. Concentrations of chromium and copper in surface soil samples did not exceed levels characteristic of naturally occurring background and the small amount of chromium that may have been discharged to ground water apparently remains in close proximity to monitoring well HF-4 and has not migrated off site.

Figure 11b indicates the two theoretical routes of contaminant migration that have relevance at this time. As shown in that figure, small amounts of chromium and copper contaminated sludges remain at the bottom of Manhole No. 1 and Manhole No. 3 and ground water within a limited distance downgradient of the screen of monitoring well HF-4 is marginally enriched with chromium. Since the sludge within Manhole No. 1 is apparently structurally contained as well as adsorbed in clay and the sludge and contaminated ground water within HF-4 were removed during sampling, the only theoretical possibility of contaminant migration is from the sludge in Manhole No. 3 and the ground water outside of and immediately downgradient of the screen of HF-4. As is the case in Manhole No. 1, the sludge in Manhole No. 3 appears to be adsorbed in clay. Lines showing theoretical migration routes from these are dashed to indicate that those linkages, as will be discussed further below, are unlikely to be substantial.

5.2 Contaminant Persistence

The only contaminants of potential concern at this site are chromium and copper. Both of these contaminants are metallic elements that are solid under normal environmental conditions. Therefore, they are essentially conservative and persistent. Small amounts would be lost from any subsurface deposit over long periods of time as a function of normal biogeochemical changes.

A half life of one million years was assumed for modelling. This value was arbitrarily selected because it results in no change during the relatively short time frame encompassed by modelling results.

5.3 Contaminant Migration

5.3.1 Factors Affecting Contaminant Migration

As illustrated in Figure 11b, there are two contaminant migration routes of theoretical concern at this site. They are:

1. Migration primarily in the vertically downward direction from the sludge at the bottom of Manhole No. 3 through the underlying unsaturated zone soil to ground water; and

2. Migration primarily in the horizontal direction of ground water flow by any chromium and copper that reaches ground water from the sludge at the bottom of Manhole No. 3 and by chromium from the volume of ground water in the downgradient direction near the screen of HF-4.

The movement of chromium and copper in the unsaturated zone and ground water is discussed in detail in Appendix A of the work plan. Salient aspects of that discussion are summarized below.

Chromium and copper have limited mobility in soil, but the mobility of copper would be expected to be marginally less than that of trivalent chromium. The migration of chromium and copper in soil occurs primarily as a result of water movement; but, because of fixation and adsorption reactions, takes place at a rate significantly less than that of the water causing migration[10,11].

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[10]Tinsley, Ian J. 1979. Chemical Concepts in Pollutant Behavior, John Wiley and Sons, New York, pp. 32-35.

[11]Dragun, James. 1988. The Soil Chemistry of Hazardous Materials, Hazardous Materials Control Research Institute, Silver Spring, MD, pp. 153-193.

Although the chromium originally present in wastewater at this site was hexavalent, it would be expected to be and apparently was reduced to the trivalent form. Soil pH at this site was found to be in the slightly acidic range of 6.2 to 6.6 units. Reduction to the trivalent form would be enhanced in that pH range as compared to the situation in alkaline soils. Analysis of samples for hexavalent chromium were all less than the detection limit. Trivalent chromium is cationic and tends to be sub-stantially less mobile than hexavalent chromium. Although it may form more soluble organic complexes, many such complexes are relatively insoluble and, in any case, no substantial organics were present at this site. At the pHs involved here, chromium would be expected to be predominantly present in site sludge and/or soil in the form of the relatively insoluble chromium hydroxide [$Cr(OH)_3$][12].

Copper is a divalent cation. Like trivalent chromium, it may form soluble organic complexes; however, "only the hydroxy and carbonate complexes are expected to exist as important species in soil solutions" and these are relatively insoluble. The literature indicates that copper is one of the least mobile trace elements. In one summary of the literature, for example, it was reported that there was virtually no downward movement of copper on silty and clayey soils and only slight movement (1-3 cm) in sandy soils with a low cation exchange capacity (CEC)"[13]. There is no CEC data for soils at the Hydro-Flex site; however, the predominantly clay and silty clay soils in the unsaturated

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[12]Nieboer, E. and A.A. Jusys. 1988. Biologic chemistry of chromium. IN: Chromium in the Natural and Human Environments, Jerome O. Nriagu and Evert Nieboer, eds., John Wiley and Sons, New York, pp. 21-79.

[13]Adriano, D.C. 1986. Trace Elements in the Terrestrial Environment, Springer-Verlag, New York, pp. 183-195.

zone and similar sediments in the saturated zone would be expected to have relatively high CEC values.

The movement of conservative contaminants like chromium and copper in ground water systems is a function of four basic processes: (1) advection; (2) diffusion; (3) dispersion; and (4) retardation. These are briefly discussed below.

Advection involves the physical movement of contaminants carried by ground water as a result of its mean linear velocity. Diffusion occurs as a result of molecular motion and concentration gradients and results in limited movement of contaminants away from the volumes of highest concentration. Diffusion is normally much less than dispersion and is often mathematically incorporated into models as part of that process. Dispersion is a spreading of contaminants that occurs due to mechanical mixing and hydrodynamic forces as ground water moves through aquifers and is a function of both direction and scale. It occurs predominantly in the longitudinal direction, to a smaller degree transversely, and to a still smaller degree vertically and its magnitude increases as the distance involved increases. Retardation is essentially an adsorption phenomena. In ground water modelling, it may be expressed in terms of a unitless retardation factor or coefficient (R). R is defined as the ratio of the mean linear velocity of ground water (v_x) to the velocity of the contaminant front (v_c) and may be found empirically or computed from the following relationship[14]:

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[14]Walton, William C. 1988. Practical Aspects of Ground Water Modeling, 3rd Ed., National Water Well Association, Dublin, OH, 587 pp.

$$R = \frac{V_x}{V_c} = 1 + \frac{BK_d}{n_e} = 1 + (6.82)K_d$$

Where:
- B = Dry bulk mass density in g/cm^3 (assume 1.5 in this case).
- K_d = The contaminant's distribution coefficient in mL/g.
- n_e = Aquifer effective porosity (assume 0.22 in this case).

Chromium and copper have limited mobility in ground water systems, but the mobility of copper would be expected to be marginally less than that of trivalent chromium. As was the case in soil above, although the form of chromium originally present in wastewater at this site was hexavalent, it would be expected to be and apparently was reduced to trivalent chromium (see page 41).

The dominant trivalent species of chromium present in natural waters are $Cr(OH)_2^+$ and $Cr(OH)_3$[15]. The mobility of trivalent chromium decreases with increasing pH until it becomes relatively immobile at a pH of 4 units. In one study, a K_d value of 968 mL/g was reported at that pH (i.e., an R of approximately 6600). K_d data specific to the wastewater and soils at this site did not exist and, since Hydro-Flex is no longer in production and generating such wastewater, could not be generated during this RI. Therefore, it was necessary to examine the literature for an indication of possible values for R. A general range of R values given in the literature for "heavy metals" including

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[15]Calder, Lynn M. 1988. Chromium contamination of groundwater. IN: Chromium in the Natural and Human Environments, Jerome O. Nriagu and Evert Nieboer, eds., John Wiley and Sons, New York, pp. 215-229.

trivalent chromium is from approximately 10 to 100,000. The mid-point of this range is 1,000[16].

Unless organically complexed, copper introduced into aerobic ground waters at a pH of 7 units or above would be expected to "quickly precipitate as the hydroxide or as basic copper carbonate, $CuCO_3.Cu(OH)_2.H_2O$, to be removed by adsorption and/or sedimentation"[17]. As noted above, values of K_d and R for copper would be expected to be less than for trivalent chromium under similar conditions.

5.3.2 Contaminant Transport Modelling

As indicated in Figure 11 and noted above, there are two theoretical routes of contaminant migration at this site. From the sludge at the bottom of Manhole No. 3 and vertically downward through the underlying unsaturated zone soil to ground water and then horizontally with ground water through the aquifer or horizontally with ground water through the aquifer from ground water immediately downgradient of the screen of monitoring well HF-4.

The former route, appears to be inconsequential. This is probably because the amount of contaminated sludge is small and the chromium and copper in it are so fixed as to be essentially immobile. Although wastewater was directed to Manhole No. 3 during the mid-1970 to early-1980 time frame and sludge has apparently been in place since the system was decommissioned in

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[16]Walton, William C. 1991. Principles of Groundwater Engineering, Lewis Publishers, Chelsea, MI, p. 185.

[17]McKee, Jack Edward and Harold W. Wolf. 1963. Water Quality Criteria, 2nd Ed., Publication No. 3-A, State Water Resources Control Board, Sacramento, CA, p. 169.

1981, concentrations of chromium and copper reported in a sand sample taken directly underneath Manhole No. 3 and within a foot of the sludge layer were so low as to be within the range of naturally occurring background levels for those elements. Additionally, there was no indication of chromium or copper contamination of ground water in the sample from monitoring well HF-2, the well closest well to Manhole No. 3. Therefore, this route does not appear to be resulting in measurable effects and was not modelled.

A simple analytical ground water model was applied to the discharge of chromium from monitoring well HF-4[18]. Two different time frames were modelled: (1) the current time, approximately 18 years (6,570 days) after the discharge; and (2) an arbitrary time of 100 years (36,500 days) after the discharge. Assumptions used in this modelling effort were as follows:

1. A one time slug discharge of 0.292 pounds of chromium occurred through the screen of HF-4 (see page 34 of the workplan). The screen is located at a position of 0 feet in the downgradient or x direction and 0 feet in the transverse or y direction and has dimensions of 0.5 feet in the horizontal plane (measured well diameter slightly exceeded 6 inches) and 10 feet vertically (information regarding screen length is unavailable but it was unlikely to have been less than 10 feet in a water supply well).

2. Ground water mean linear velocity constant at 0.65 feet/day or 237 feet/year (see page 34).

3. Longitudinal and transverse dispersivities of 1 and 0.2 feet, respectively, for the scale of 18 years and 5 and 1 feet, respectively, for the scale of 100 years.

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[18]The model used was the Extended Precision Plume model JPLUME prepared for USEPA by the School of Geology, Oklanhoma State University, Stillwater, OK. It incorporates the basic processes of advection, dispersion, and retardation. Documentation for this model is provided as Item C-2 of Appendix C.

Different dispersivity values were used because of the scale dependency of that variable. Vertical dispersivity was assumed negligible. Assumptions regarding dispersivity values were based on general scale dependent and longitudinal to transverse relationships indicated in the general literature[19].

4. R of 1,000 (see page 65).

5. Effective porosity of 0.22 (see page 33).

6. Chromium is not subject to substantial biogeochemical degradation over the time frames involved (see pages 62-62).

The printout from this model, showing concentrations of chromium above background, is reproduced as Figure 12a and 12b. Concentration contours for the the 18 year output of Figure 12a are presented as Figure 12c[20]. The modelling effort indicates that only very limited chromium movement has occurred in a downgradient direction from monitoring well HF-4. The area of maximum chromium concentration after 18 years is on the order of 4 feet downgradient of the area of discharge at a concentration of 88 ug/L. Furthermore, the effect of the discharge, defined as an increase of 1 ug/L above background, goes a maximum of 13 feet downgradient. After 100 years the maxium chromium concentration has decreased to 3 ug/L, KDHE's reported analytical detection limit for chromium in this case, and the effect of the discharge goes a maximum of 50 feet downgradient.

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[19]For example, see pages 172-179 of William C. Walton's 1991 book Principles of Groundwater Engineering (Lewis Publishers, Chelsea, MI).

[20]The contours in Figure 11 were generated by Version 4 of the Surfer computer program produced by Golden Software, Inc., of Golden, Colorado. This program geostatistically interpolates between data points to estimate contour line positions. Therefore, contour lines should not be considered exact except where they coincide with data points.

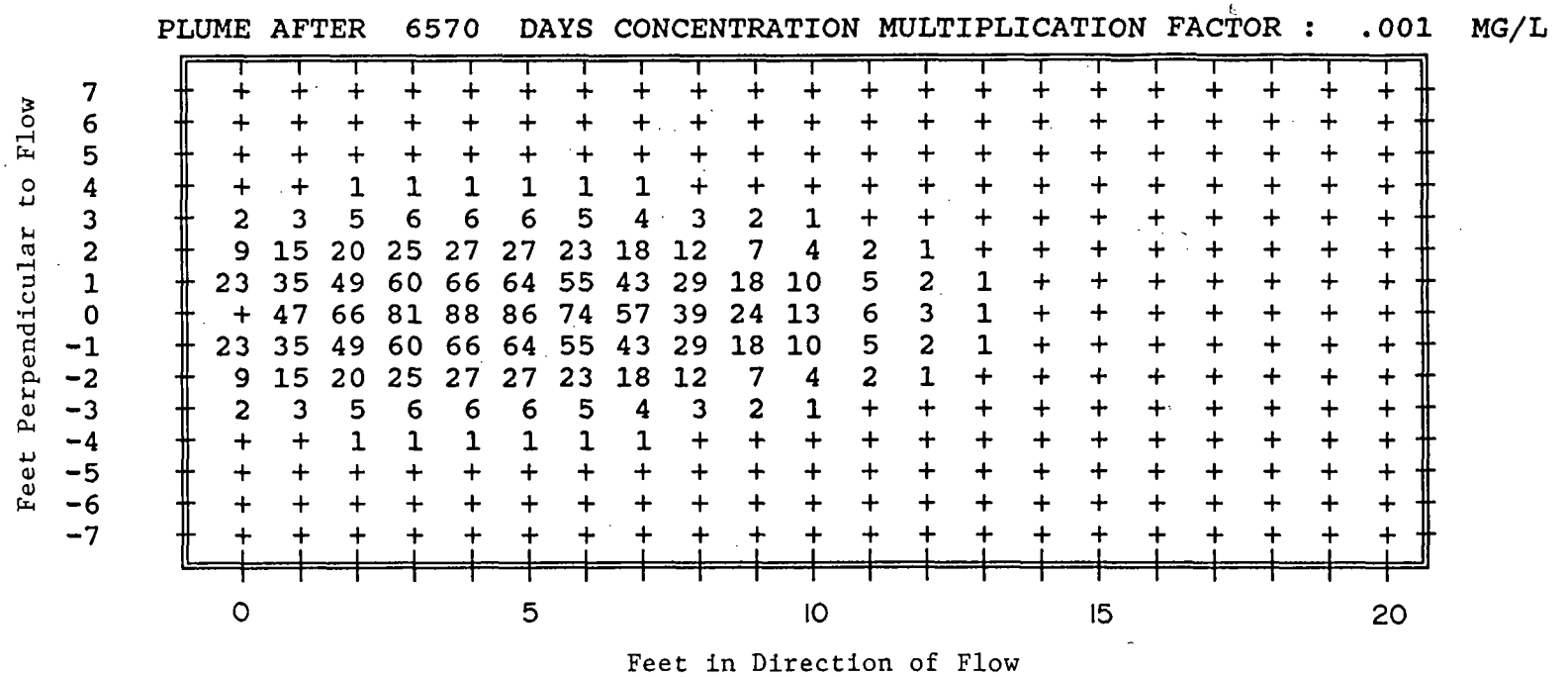

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FIGURE 12a. 6570 DAYS (18 YEARS) OUTPUT

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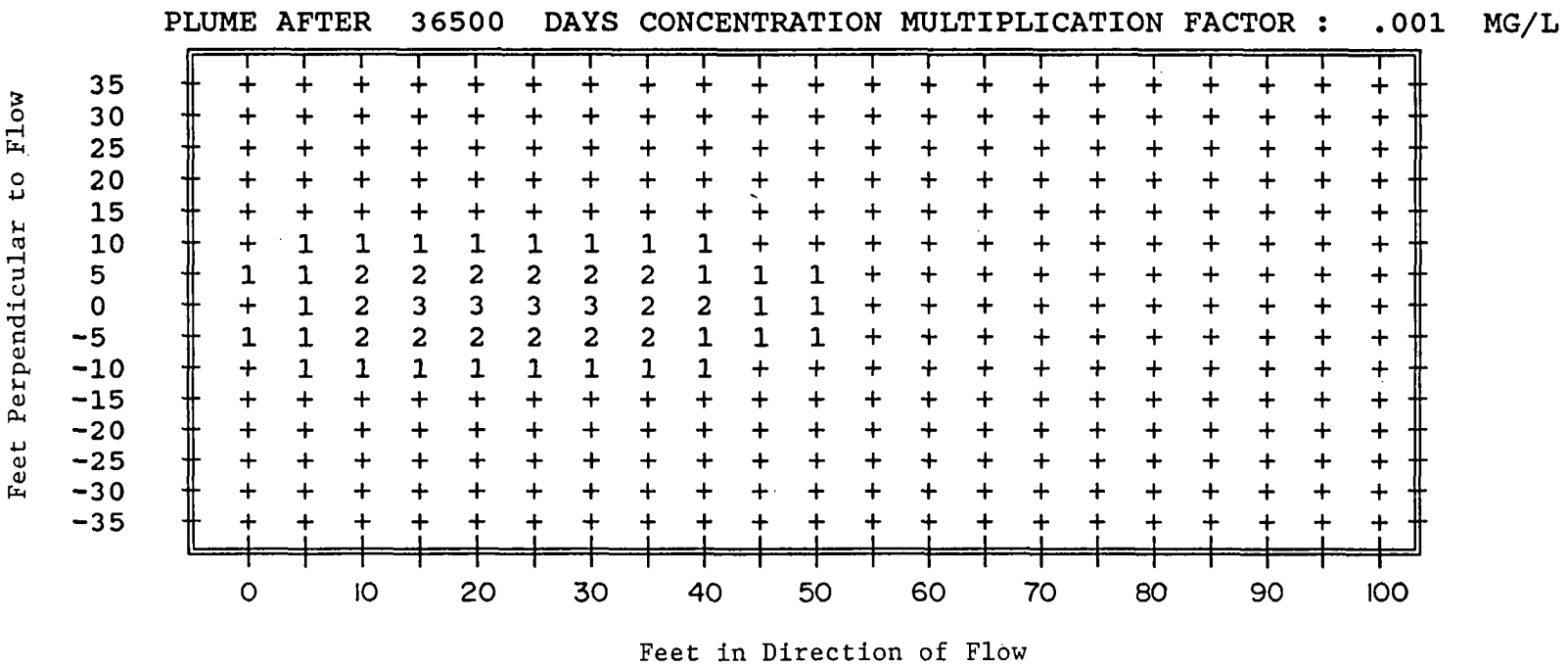

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FIGURE 12b. 36500 DAYS (100 YEARS) OUTPUT

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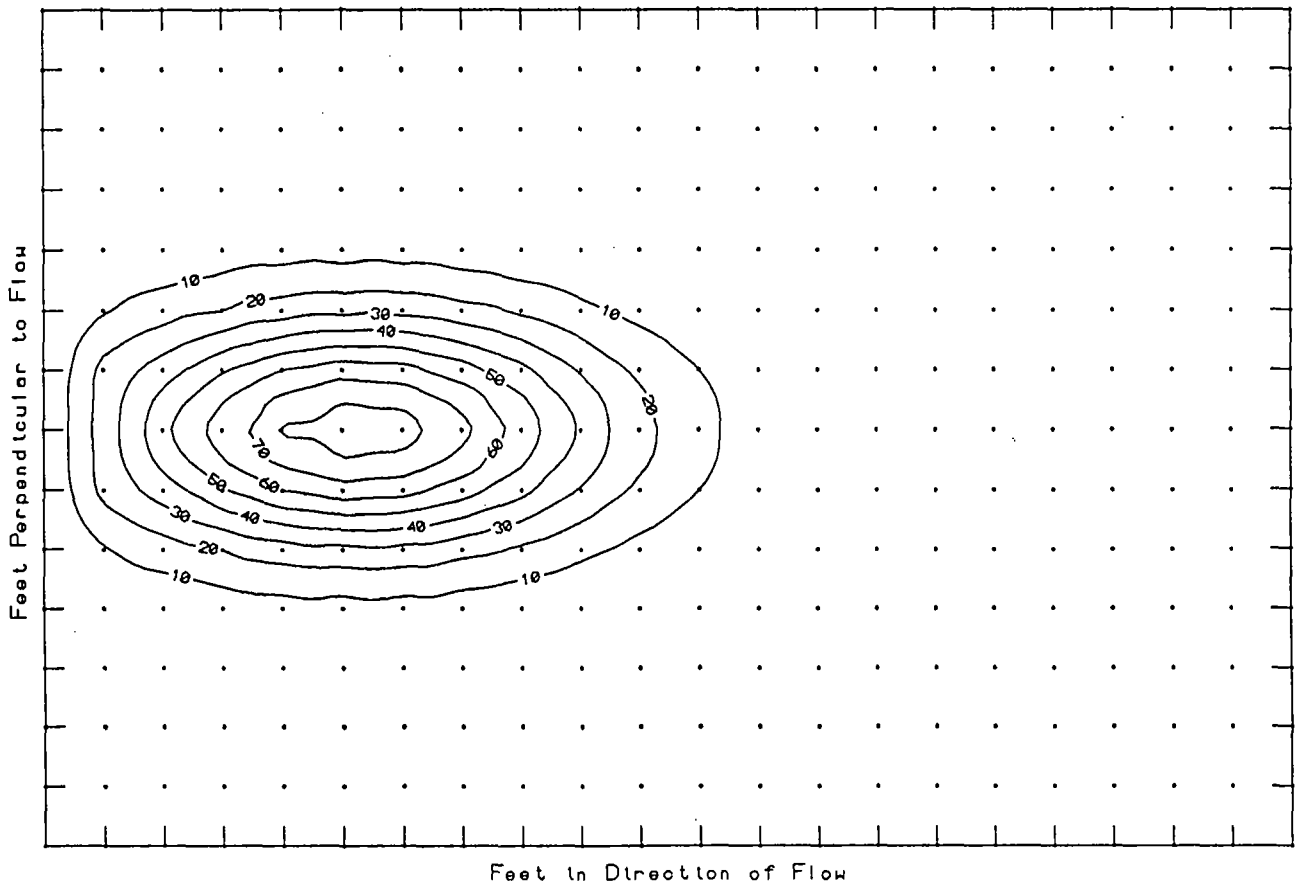

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FIGURE 12c. 6570 DAYS (18 YEARS) CONTOURS

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A limited sensitivity analysis of model results was performed by reducing R one and two orders of magnitude and changing longitudinal and transverse dispersivity values iteratively as necessary to match the resultant scale. R is probably the variable of greatest significance and uncertainty in this case. There was no need to evaluate sensitivity due to increasing R since that circumstance, although equally probable, would result in less migration occurring. Reduction of R, obviously, results in greater migration occurring than that indicated above; however, resulting maximum chromium concentrations in the downgradient contaminant plume were on the order of naturally occurring background concentrations or less. The "worst case" under these scenarios would occur with an R of 10. This would result in maximum plume concentrations on the order of 2 ug/L leaving the site after 18 years. After 100 years, maximum plume concentrations would have decreased by an order of magnitude (i.e., 0.2 ug/L) and reached a distance of approximately 2,000 feet downgradient of the site.

Given the simplicity of the model and the assumptions made in its use, model results for an R of 1,000 are reasonably consistent with the data generated during RI field work for the 18 year output. They also indicate that there will be no detectable impact of the discharge after 100 years and that during that period the chromium involved will still be within the boundaries of the site.

6.0 BASELINE RISK ASSESSMENT

6.1 Public Health Evaluation

6.1.1 Exposure Assessment

Exposure assessment requires identification of chemical sources, delineation of the physical environment, definition of exposure pathways, identification of exposure points and

potentially exposed populations, quantification of potential exposure, and evaluation of the uncertainty underlying the assessment as a whole. Information on sources and the physical environment from preceding sections of the RI report is used in combination with contaminant transport modelling to quantify possible exposure concentrations.

6.1.1.1 Exposure Pathways

Theoretical exposure pathways at this site at the current time are illustrated in Figure 11b and discussed above in Section 5.0 of this report. They consist of: (1) the possible migration of chromium and copper from the sludge at the bottom of Manhole No. 3 vertically downward into ground water and then horizontally downgradient; and (2) horizontally downgradient migration of chromium from the zone of marginally enriched ground water in the vicinity of the screen of monitoring well HF-4. As noted, only migration via the latter pathway appears to be occurring to any measurable degree.

The available analytical data are adequate to identify, examine, and fully characterize exposure pathways. These data confirm that there are only two possible pathways. Additionally, they allow adequate characterization of them.

6.1.1.2. Exposure Points

The potential exposure points for this pathway would be private water supply wells located downgradient of the site. Samples were taken from the two closest such wells by KDHE on May 30, 1991. These are both located to the south of the site at properties along Brickyard Road. Over the time frame for which data exists, these wells were not downgradient of the Hydro-Flex site. Copies of KDHE analytical data sheets for these samples and a location map are provided as Item B-5 in Appendix B. The

chromium concentrations reported for these samples were 6 and 4 ug/L, respectively, and the copper concentrations were 45 and 11 ug/L, respectively. These results appear to be at naturally occurring background levels and, in combination with other results, indicate that there has not been any detectable migration of contaminants from the site. Therefore, this information indicates there would be no exposure points.

6.1.1.3 Quantification of Exposure

Quantification of exposure to chemicals in drinking water involves calculation of the intake rate resulting from exposure concentrations and ingestion rates over the duration of the exposure. The general equation for this calculation is as follows[21]:

$$\text{Intake (mg/kg-day)} = \frac{CW \times IR \times EF \times ED}{BW \times AT}$$

Where:

CW	=	Site-specific chemical concentration in water based on unfiltered sample data (mg/L).
IR	=	Ingestion rate (2 L/day is assumed as the 90th percentile level for adults).
EF	=	Exposure frequency (assumed to be 365 days per year for residents).
ED	=	Exposure duration (assumed to be 30 years as the 90th percentile level at one residence).
BW	=	Body weight (assumed to be 70 kg for the average adult).
AT	=	Activity time (assumed pathway-specific exposure period for noncarcinogenic effects or ED x 365 days/year and 70 years x 365 days/year for carcinogenic effects).

[21]Office of Emergency and Remedial Response. 1989. Risk assessment guidance for Superfund, Vol. I: human health evaluation manual (Part A). USEPA, Washington, DC, p. 6-35.

The appropriate site-specific concentration value for chromium in this case is assumed to be 4.25 ug/L or 0.00425. This concentration is the mean of filtered samples from all six monitoring wells and is close to the total value from nearby private water supply wells. The total value obtained from monitoring wells and, in particular, HF-5 was considerably higher due to the presence of high levels of solids. From a practical standpoint, a source of water would be rejected if such levels of solids were present. Therefore, applying the above equation, the calculated intake would be approximately 0.00012 mg/kg-day for noncarcinogenic and 0.000052 mg/kg-day for carcinogenic effects. This intake is totally a result of naturally occurring background levels of chromium in ground water and is not due to contaminant migration from the Hydro-Flex site. Modelling results discussed above in Section 5.0 of this report indicate measurable migration of chromium will not occur from the Hydro-Flex site.

6.1.1.4 Exposure Uncertainty

There are always substantial uncertainties involved in estimates of chemical exposure due to environmental contamination. These uncertainties may be characterized as being related to sampling and analysis, contaminant transport modelling, and exposure parameter estimation (e.g., body weight, ingestion rate, and exposure duration). The potential magnitude for overestimation of exposure due to general exposure parameters as a whole is intentionally in the moderate to high category.

In this case, there is uncertainty regarding sampling and analysis simply because the number of ground water samples taken was relatively small and, therefore, did not statistically characterize ground water quality with a high degree of precision. There is also moderate to high uncertainty regarding the contaminant transport modelling that was done. However, this

uncertainty is not such that it is likely to result in any substantial change to the exposure estimate. The modelling that was done appears to support field data indicating that contamination did not leave the site and that contaminant concentrations are at or near natural background levels in all monitoring wells with the exception of HF-5, approximately 6 feet downgradient from the only source that reached ground water.

6.1.2 Toxicity Assessment[22]

Toxicity assessment involves identification of the hazard associated with identified chemicals to which populations may be exposed and determination of the dose-response relationship. This assessment is conducted without regard to any possible site-related exposure.

6.1.2.1 Hazard Identification

Chromium exposure may occur via oral ingestion, inhalation, or dermal contact. However, inhalation and dermal contact are potential problems primarily with respect to occupational exposures involving relatively high concentrations of hexavalent chromium. From a public health standpoint, oral ingestion and absorption via the gastrointestinal (GI) tract is the primary exposure route. As is the case for most metals, GI tract absorption of chromium is believed to be low. Furthermore, hexavalent chromium is more readily absorbed than the trivalent form.

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[22]Unless otherwise noted, the toxicological data on chromium presented in this subsection has been summarized from the profile prepared by Syracuse Research Corporation under contract with the Agency for Toxic Substances and Disease Registry of the U.S. Public Health Service, in collaboration with USEPA, and published by Oak Ridge National Laboratory.

The toxicity of chromium depends on its chemical form. Hexavalent chromium is more acutely toxic than the trivalent form and, when exposure is via the inhalation route, is considered a known human carcinogen (USEPA Category A). However, there is no evidence at the current time that hexavalent chromium is carcinogenic when orally ingested. In contrast, trivalent chromium is considered a micronutrient and has not been conclusively classified with regard to carcinogenicity due to lack of data (USEPA Category D).

There is considerable information regarding the acute effects of both hexavalent and trivalent chromium on both humans and animals; however, the literature is particularly rich with respect to the hexavalent form. Symptoms of acute hexavalent chromium toxicity include GI tract bleeding, massive fluids loss, cardiovascular shock, and death. Renal and liver damage have been documented at lower doses, as have immune system effects. Hexavalent chromium is a powerful skin irritant and can result in increased sensitivity and allergic dermatitis. Such reactions have also been documented to a lessor degree with trivalent chromium.

Although there have been several long term exposure studies in rodents and the ability of hexavalent chromium to cause cancer and genotoxic effects is well-documented, other chronic chromium health effects have not been well studied. For example, no human or animal studies of chromium developmental or reproductive toxicity were found in the literature when it was surveyed as of the late-1980s.

6.1.2.2 Dose-Response Quantification

Reference doses (RfDs) for oral noncarcinogenic effects have been established by USEPA for hexavalent and trivalent chromium.

The RfD is a level of exposure, based on the available toxicological data, below which it is believed to be unlikely that even sensitive populations will experience adverse health effects. These are identified in Table 10. In addition, the National Research Council has estimated that an adequate and safe daily dietary intake range for trivalent chromium is 50 to 200 ug/day. This range is based on the absence of deficiency symptoms in individuals consuming an average of 50 ug/day and an absence of adverse effects in individuals consuming 200 ug/day. The upper end of this range was taken into consideration by USEPA when it recently relaxed the national primary drinking water standard or maximum contaminant level (MCL) for total chromium from 50 to 100 ug/L[23].

USEPA has also established a unit cancer risk of 1.2×10^{-2} for lifetime inhalation exposure to 1 ug/m^3 of hexavalent chromium compounds. This translates to a 10^{-6} (i.e., one in a million) risk level at a concentration of 8×10^{-5} ug/m^3. The primary site involved with human cancer related to occupation hexavalent chromium inhalation is the lungs; however, other increased cancer rates have also been found for other sites (e.g., the stomach and liver).

6.1.3 Risk Characterization

Risk characterization is the final step in the risk assessment process. In it, exposure and toxicity assessments are integrated into quantitative and qualitative expressions of risk. Both exposure and toxicity must be significant in order for risk to exist.

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[23]USEPA. 1991. National primary drinking water regulations--synthetic organic and inorganic chemicals. Federal Register, Vol. 56, No. 20, pp. 3536-3537 (January 30).

Table 10: Chromium Noncarcinogenic Toxicity Values				
Form	RfD[1]	Critical Effect	Basis	Uncertainty Factors
Trivalent	1	None[2]	Water/IRIS	100 for inter- and intraspecies variability. 10 for general uncertainty around the NOAEL.
Hexavalent	0.005	None[3]	Water/IRIS	100 for inter- and intra species variability. 5 for less-than-lifetime exposure duration.

NOTES FOR TABLE 10:

1. RfD expressed in mg/kg-day in drinking water with assumed 1.0 GI tract absorption fraction.

2. No adverse effects noted in 2 year feeding study involving rats.

3. No adverse effects noted in 1 year drinking water study involving rats.

In this case, the exposure is related to oral ingestion of trivalent chromium. There is no quantitative information indicating the hazard of trivalent chromium from dermal contact and it is clear that no hazard exists at the concentration of concern. Therefore, the relevant exposure or intake level is 0.00012 mg/kg-day level for noncarcinogenic effects and the relevant RfD is 1 mg/kg-day for that form of chromium. This yields a noncancer hazard quotient of 0.001 (i.e., Intake divided by RfD). This quotient is substantially less than the effect threshold of one and is due entirely to naturally occurring background concentrations of chromium in ambient ground water in the vicinity of the Hydro-Flex site, not to any release of contaminants at the site.

6.2 Environmental Assessment

Since the impact of this discharge is limited to ground water within a short distance of the screen of monitoring well HF-4, an assessment of environmental effects, as indicated in Figure 12, is inapplicable in this case and has not been conducted.

7.0 SUMMARY AND CONCLUSIONS

7.1 Summary

7.1.1 Nature and Extent of Contamination

The contamination at this site is the result of batch disposal of relatively small volumes of wastewater containing substantial concentrations of chromium and copper during the early-1971 through mid-1981 period. Most of the wastewater was discharged through a septic tank and manholes that were used as settling basins to a soil adsorption system. It appears that the bulk of the chromium and copper discharged were subsequently removed when the sludge from the septic tank and manholes was periodically pumped out for off site disposal. Additionally, a

one time attempt to discharge a batch of wastewater to an unused water supply well on site resulted in contamination of that well (designated monitoring well HF-4).

The contamination that remains on site at this time is highly localized within three small areas. It consists of minor volumes of sludge containing substantial concentrations of chromium and copper at the bottom of Manhole No. 1 (estimated at 17.4 and 23.5 pounds of chromium and copper, respectively) and Manhole No. 2 (estimated at 0.312 and 0.465 pounds of chromium and copper, respectively) and a small volume of water in the vicinity of and immediately downgradient from the screen of monitoring well HF-4 marginally enriched with chromium above the current drinking water standard for that metal (i.e., on the order of a maximum of 300 ug/L). It appears that the contaminated sludge and water that was formerly in HF-4 was removed as a result of sampling activities during the initial site investigation in 1987 and the RI.

7.1.2 Fate and Transport

Chromium and copper in the sludge at the bottom of the manholes appear to be tightly adsorbed within a clay matrix. EP TOX chromium measurements were less than the criterion of 5 mg/L and no hexavalent chromium was detected. Additionally, the bottom of Manhole No. 1 appears to be intact, thereby isolating the sludge at that location from the environment. Although no bottom was found on Manhole No. 3, the small amounts of chromium and copper in the sludge at the bottom of that manhole appear to be essentially immobile. There is no indication that this sludge has served as a source of contamination of underlying materials or ground water. Concentrations of chromium and copper in the underlying material within 1 foot of the sludge were low, in the range of naturally occurring background, and there was no

indication of chromium or copper contamination of ground water sampled from the closest monitoring well (i.e., HF-2).

The chromium in the ground water in the vicinity of monitoring well HF-4 appears to be nearly completely associated with suspended solids in the water and appears to have moved only a short distance. Although this chromium has migrated approximately 6 feet to the east of HF-4, there is no indication that chromium from this source has migrated off site or that chromium or copper from any source on site have contaminated ground water at all. Ground water modelling results indicate that chromium released from HF-4 is unlikely to migrate off site at a significant concentration even after a long period of time (i.e., 100 years after release the edge of the plume, as defined by the 1 ug/L concentration level, had travelled approximately 50 feet and enrichment behind the contaminant from was a maximum of only 3 ug/L).

7.1.3 Risk Assessment

There appears to be essentially no risk to public health attributable to this site. There are two theoretically possible exposure routes related to sources at this site: (1) airborne exposure due to erosion of contaminated surficial materials; and (2) contaminant migration with ground water. RI data clearly show that chromium and copper concentrations in surficial materials at this site are low, in the range of naturally occurring background. Therefore, this route is ruled out.

With regard to ground water, only marginal enrichment by chromium of a small volume of ground water was found during the RI. Chromium is a toxic pollutant which, when ingested at sufficiently high doses, can cause adverse human health effects. However, it is not believed to be carcinogenic via ingestion of

water and at least small doses of trivalent chromium are considered necessary for human nutrition. In this case, field data indicate that chromium has not migrated off site via ground water to date. Furthermore, ground water modelling results indicate that chromium from the marginally enriched volume of ground water in the immediate vicinity of monitoring well HF-4 is unlikely to do so in the future. Therefore, quantitative risk characterization in this report was based on naturally occurring background concentrations of chromium. These pose no risk.

7.2 Conclusions

7.2.1 Data Limitations and Future Work

All data sets have limitations. In this case, for example, some samples were taken but not analyzed and analysis of some samples for certain variables that had been planned was not conducted. All changes from the approved work plan and SAP were approved KDHE, as a result of field findings, or were a result of samples being analyzed by KDHE's laboratory.

Those samples taken but not analyzed were soil samples from 10 feet BGL at stations S-1, S-2, S-3, S-9, S-10, and S-11 and surface soil samples from stations S-4 and S-6, Manhole No. 3, and boring HF-6. The first six of these were the responsibility of KDHE. They were not analyzed because there was no indication of contamination in samples from shallower depths at those stations. The last four of these were the responsibility of Hydro-Flex. KDHE approved not analyzing these samples because surface soil samples analyzed during Phase IA showed no contamination, a circumstance that was repeated with regard to surface soil samples later analyzed by KDHE. Variables for which analysis was planned but did not occur were previously delineated on page 9.

Quality assurance/quality control (QA/QC) data for this site indicate the data that were developed are generally of acceptable quality. The one exception to this case was with regard to the analysis of the May 10 ground water sample from monitoring well HF-4. The ion balance for this sample is not within normal limits for such data (see Item B-6 in Appendix B). This discrepancy appears to be related to an inappropriately low concentration of calcium reported in the filtered sample results.

The approved work plan and SAP were tailored to suit the circumstances of this site. In particular, the number and location of soil borings and samples and the number and location of monitoring wells were limited and one complete round of ground water sampling occurred only once. Therefore, the data developed are inadequate for rigorous geostatistical characterization of soil strata with a high degree of precision or statistical characterization of ground water quality or trends in ground water quality over time. Additional samples in all media for all variables, additional ground water samples on a quarterly basis over time, and additional quality assurance/quality control measures would be necessary to marginally improve confidence in the data, to establish trends, or to achieve high statistical significance. Statistically-based sampling and characterization are not appropriate for the circumstances of this site and were not required by regulatory agencies.

Given the circumstances of this site and the results of field work to date, none of the limitations noted above have a significant bearing on the conclusions of this RI. The physical size of this site is relatively small (less than 3 acres). The volume of wastewater discharged at this site when it was in operation was relatively small (estimated to have averaged 90 gpd). Difficulties were encountered in attempting to discharge

this wastewater to the soil adsorption system and much of the chromium and copper contaminants were ultimately removed from the site when sludge was pumped from the manholes and septic tank. Sampling during the RI indicates that only small amounts of sludge remain in the bottom of two manholes. In one of these the bottom is apparently intact and the sludge is contained. In the other, there is no bottom but the sludge is apparently immobile. Sampling during the RI indicates no detectable enrichment of these contaminants in soil near any part of the system, including directly underneath the manhole having no bottom. The only indication that contaminants at this site reached ground water is with regard to the one time small volume direct discharge to HF-4. Site investigation sampling activities apparently removed the remaining contamination in HF-4. The only remaining evidence of this discharge appears to be minor enrichment of chromium a small distance (i.e., 6 feet) immediately downgradient in HF-5. Concentrations of chromium and copper in all other wells appear to be at naturally occurring background levels. Ground water modelling results support field data from the RI. They indicate very limited potential for contaminant transport at this site with concentrations having reached levels marginally above naturally occurring background after moving on the order of a 50 feet downgradient after 100 years. For the same reasons, no further site investigation work is recommended for this site. Furthermore, in the event that subsequent ground water monitoring is required at this site, it is recommended that it consist solely of water level measurements and analysis of samples for chromium, copper, and TSS concentrations.

7.2.2 Recommended Remedial Action Objectives

Remedial action objectives will be dealt with in detail in the FS portion of this project. In accordance with the Consent Settlement and Consent Order between Hydro-Flex and KDHE, the FS

report will include an adequately detailed analysis of at least four remedial alternatives including the "no action" alternative and all alternatives will be evaluated according to the criteria presented in USEPA guidance. The nature of the contaminants of concern at this site and site circumstances limit remedial alternatives that should be considered. On the basis of preliminary scoping and data collection, it is intended to consider the following five remedial alternatives in the FS report:

1. No action (with or without monitoring).
2. Excavation of Manhole No. 1 and Manhole No. 3 with associated sludge.
3. Capping the tops of Manhole No. 1 and Manhole No. 3 with low permeability material.
4. Extraction and disposal of marginally contaminated ground water.

In accordance with the Consent Settlement and Consent Order, a draft FS report will be submitted to KDHE within 60 days of approval of the RI report and it will be finalized and submitted to KDHE within 30 days of receiving written KDHE comments on the draft FS report.

8.0 GENERAL COMMENTS

The analysis, evaluation, and conclusions presented in this report are based on: (1) data obtained from soil borings and monitoring wells installed at the indicated locations and sampled at the indicated times; (2) analytical data received from two separate laboratories; and (3) review of the available historic information pertaining to this site. This report does not reflect variations in subsurface lithology or conditions which may occur between borings across the site or over time. Actual subsurface conditions may vary and the extent of such variation

may not become evident without further investigation. If variations become evident or new information is developed, it will become necessary to re-evaluate the conclusions presented in this report.

This report has been prepared for the exclusive use of our client. It has been prepared in accordance with generally accepted geoenvironmental engineering and science practices. No warranties, either express of implied are intended or made.

APPENDIX A: TECHNICAL MEMORANDA ON FIELD ACTIVITIES

Item A-1: Boring Logs

LOG OF BORING NO. HF-5

OWNER	ARCHITECT/ENGINEER
Hydro-Flex Corporation	Terracon Environmental
SITE: 2101 N.W. Brickyard Road, Topeka, Kansas	PROJECT: Remedial Investigation

TOP OF CASING: 891.32 ft
GROUND SURFACE ELEV.: 888.95 ft

DESCRIPTION			WELL DETAIL	DEPTH (FT.)	SAMPLES: USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	TESTS: BLOWS / FT.	TESTS: FIELD VAPOR TESTS (ppm)	TESTS: COMMENTS OR FIELD NOTES
SILTY CLAY, with gravel, brown Becoming light brown silty clay at 1.5 feet				5							
	10.0	899.0		10							
FINE SAND, brown				15							
				20							

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 10 in
WELL DIA.: 2 in

WATER LEVEL OBSERVATIONS				
WL	▽24.10	WD	▼24.44	AD
WL				
WL				

Terracon

BORING STARTED	3-20-91		
BORING COMPLETED	3-20-91		
RIG	C.M.E. 75	FOREMAN	G.M.Z.
APPROVED	G.M.Z.	JOB #	50905072

LOG OF BORING NO. HF-5

OWNER: Hydro-Flex Corporation

ARCHITECT/ENGINEER: Terracon Environmental

SITE: 2101 N.W. Brickyard Road, Topeka, Kansas

PROJECT: Remedial Investigation

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH (FT.)	SAMPLES: USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	TESTS: BLOWS / FT.	TESTS: FIELD VAPOR TESTS (ppm)	COMMENTS OR FIELD NOTES
	23.0 912.0									
	SILTY FINE SAND, gray, moist ▽		25							
	26.0 915.0									
	FINE-MEDIUM SAND, brown		30							
			35							
			40							

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WATER LEVEL OBSERVATIONS				
WL	▽24.10	WD	▽24.44	AD
WL				
WL				

Terracon

BORING STARTED	3-20-91		
BORING COMPLETED	3-20-91		
RIG	C.M.E. 75	FOREMAN	G.M.Z.
APPROVED	G.M.Z.	JOB #	50905072

LOG OF BORING NO. HF-5

OWNER: Hydro-Flex Corporation

ARCHITECT/ENGINEER: Terracon Environmental

SITE: 2101 N.W. Brickyard Road, Topeka, Kansas

PROJECT: Remedial Investigation

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH (FT.)	SAMPLES: USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	TESTS: BLOWS / FT.	TESTS: FIELD VAPOR TESTS (ppm)	TESTS: COMMENTS OR FIELD NOTES
	52.0 941.0		45							
	MEDIUM-COARSE SAND AND GRAVEL, brown		50							
			55							
			60							
			65		1	AF	N/A			

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WATER LEVEL OBSERVATIONS				
WL	▽24.10	WD	▼24.44	AD
WL				
WL				

Terracon

BORING STARTED	3-20-91		
BORING COMPLETED	3-20-91		
RIG	C.M.E. 75	FOREMAN	G.M.Z.
APPROVED	G.M.Z.	JOB #	50905072

LOG OF BORING NO. HF-5

OWNER: Hydro-Flex Corporation

ARCHITECT/ENGINEER: Terracon Environmental

SITE: 2101 N.W. Brickyard Road, Topeka, Kansas

PROJECT: Remedial Investigation

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH (FT.)	SAMPLES: USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	TESTS: BLOWS / FT.	TESTS: FIELD VAPOR TESTS (ppm)	COMMENTS OR FIELD NOTES
	Becoming gray at 65.0 feet		70							
	74.3 963.3									
	75.0 964.0 **SHALE**, gray		75							
	Bottom of boring.									
	Soil classificaton based on ASTM Standard D-2488-84.									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WATER LEVEL OBSERVATIONS				
WL	▽24.10	WD	▼24.44	AD
WL				
WL				

Terracon

BORING STARTED	3-20-91
BORING COMPLETED	3-20-91
RIG C.M.E. 75	FOREMAN G.M.Z.
APPROVED G.M.Z.	JOB # 50905072

LOG OF BORING NO. HF-6

OWNER: Hydro-Flex Corporation

ARCHITECT/ENGINEER: Terracon Environmental

SITE: 2101 N.W. Brickyard Road, Topeka, Kansas

PROJECT: Remedial Investigation

TOP OF CASING: 889.93 ft
GROUND SURFACE ELEV.: 887.92 ft

DEPTH (FT.)	DESCRIPTION	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	TESTS BLOWS / FT.	TESTS FIELD VAPOR TESTS (ppm)	COMMENTS OR FIELD NOTES
	SILTY CLAY, dark brown		1	H	N/A			
	Becoming brown at 1.0 foot							
			2	SS	24"			
4.5	883.4							
	SILT, light brown							
6.5	881.4							
	SILTY CLAY, brownish gray		3	SS	24"			
9.0	878.9							
	FINE-MEDIUM SAND, light brown							
			4	SS	20"			
			5	SS	18"			

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 10 in
WELL DIA.: 2 in

WATER LEVEL OBSERVATIONS				
WL	▽ 23.5	W.S.	▼23.44	A.B.
WL				
WL				

Terracon

BORING STARTED	3-19-91
BORING COMPLETED	3-19-91
RIG C.M.E. 75	FOREMAN G.M.Z.
APPROVED G.M.Z.	JOB # 50905072

LOG OF BORING NO. HF-6

OWNER: Hydro-Flex Corporation

ARCHITECT/ENGINEER: Terracon Environmental

SITE: 2101 N.W. Brickyard Road, Topeka, Kansas

PROJECT: Remedial Investigation

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH (FT.)	SAMPLES: USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	TESTS: BLOWS / FT.	TESTS: FIELD VAPOR TESTS (ppm)	COMMENTS OR FIELD NOTES
	+ ▼ 1 inch layer of dark brown silt at 24.0 feet		25		6	SS	24"			
	28.3 — 859.6									
	29.4 — 858.5 **MEDIUM SAND**, light brown (with traces of clay and gravel)				7	SS	24"			
	30.3 — 857.6 **MEDIUM SAND**, light brown (with dark brown clay)		30		8	SS	24"			
	FINE-MEDIUM SAND, light brown (with trace of dark brown clay)									
	35.0 — 852.9 **GRAVELLY SAND**, brown (with trace of dark brown clay)		35		9	AF	N/A			
	39.0 — 848.9									
	Bottom of boring									
	Soil classification based on ASTM Standard D-2488-84									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WATER LEVEL OBSERVATIONS				
WL	▽ 23.5	W.S.	▽23.44	A.B.
WL				
WL				

Terracon

BORING STARTED	3-19-91		
BORING COMPLETED	3-19-91		
RIG	C.M.E. 75	FOREMAN	G.M.Z.
APPROVED	G.M.Z.	JOB #	50905072

LOG OF BORING NO. S-1

OWNER: Hydro-Flex Corporation

ARCHITECT/ENGINEER: Terracon Environmental

SITE: 2101 N.W. Brickyard Road, Topeka, Kansas

PROJECT: Remedial Investigation

TOP OF CASING: ft

GROUND SURFACE ELEV.: 888.00 ft

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH (FT.)	SAMPLES: USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	TESTS: BLOWS / FT.	TESTS: FIELD VAPOR TESTS (ppm)	COMMENTS OR FIELD NOTES
	1.0 **SILTY CLAY**, dark brown — 887.0				1	H	N/A			
	SILT, with trace of fine sand, light brown									
	4.5 — 883.5				2	SS	24"			
	SILTY CLAY, dark brown		5							
	8.0 — 880.0									
	FINE SAND, brown				3	SS	16"			
	11.0 — 877.0		10							
	Bottom of boring.									
	Soil classification based on ASTM Standard D-2488-84.									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 7 in

WELL DIA.: in

WATER LEVEL OBSERVATIONS		
WL	▽	▼
WL		
WL		

Terracon

BORING STARTED	3-19-91
BORING COMPLETED	3-19-91
RIG C.M.E. 75	FOREMAN G.M.Z.
APPROVED G.M.Z.	JOB # 50905072

LOG OF BORING NO. S-2

OWNER: Hydro-Flex Corporation

ARCHITECT/ENGINEER: Terracon Environmental

SITE: 2101 N.W. Brickyard Road, Topeka, Kansas

PROJECT: Remedial Investigation

TOP OF CASING: ft

GROUND SURFACE ELEV.: 888.20 ft

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH (FT.)	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	TESTS BLOWS / FT.	TESTS FIELD VAPOR TESTS (ppm)	COMMENTS OR FIELD NOTES
	SILTY CLAY, dark brown				1	H	N/A			
	3.0 — 885.2									
	SANDY SILT, light brown		5		2	SS	24"			
	5.5 — 882.7									
	SILTY CLAY, dark brown									
	8.0 — 880.2									
	SANDY SILT, brown		10		3	SS	19"			
	11.0 — 877.2									
	Bottom of boring.									
	Soil classification based on ASTM Standard D-2488-84.									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 7 in

WELL DIA.: in

WATER LEVEL OBSERVATIONS

WL	▽	▼
WL		
WL		

Terracon

BORING STARTED 3-21-91

BORING COMPLETED 3-21-91

RIG C.M.E. 75 FOREMAN G.M.Z.

APPROVED G.M.Z. JOB # 50905072

LOG OF BORING NO. S-3

OWNER: **Hydro-Flex Corporation**

ARCHITECT/ENGINEER: **Terracon Environmental**

SITE: **2101 N.W. Brickyard Road, Topeka, Kansas**

PROJECT: **Remedial Investigation**

TOP OF CASING: ft
GROUND SURFACE ELEV.: 888.30 ft

GRAPHIC LOG	DESCRIPTION		WELL DETAIL	DEPTH (FT.)	SAMPLES: USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	TESTS: BLOWS / FT.	TESTS: FIELD VAPOR TESTS (ppm)	COMMENTS OR FIELD NOTES
	1.0 **GRAVEL**	887.3				1	H	N/A			
	2.0 **SILTY CLAY**, dark brown	886.3									
	SANDY SILT, light brown					2	SS	24"			
	5.5	882.8		5							
	SILTY CLAY, dark brown										
	8.5	879.8									
	SANDY SILT, light brown					3	SS	16"			
	11.0	877.3		10							
	Bottom of boring.										
	Soil classification based on ASTM Standard D-2488-84.										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 7 in
WELL DIA.: in

WATER LEVEL OBSERVATIONS		
WL	▽	▼
WL		
WL		

Terracon

BORING STARTED	3-21-91
BORING COMPLETED	3-21-91
RIG C.M.E. 75	FOREMAN G.M.Z.
APPROVED G.M.Z.	JOB # 50905072

LOG OF BORING NO. S-4

OWNER: **Hydro-Flex Corporation**

ARCHITECT/ENGINEER: **Terracon Environmental**

SITE: **2101 N.W. Brickyard Road, Topeka, Kansas**

PROJECT: **Remedial Investigation**

TOP OF CASING: ft

GROUND SURFACE ELEV.: **887.90 ft**

GRAPHIC LOG	DESCRIPTION		WELL DETAIL	DEPTH (FT.)	SAMPLES: USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	TESTS: BLOWS / FT.	TESTS: FIELD VAPOR TESTS (ppm)	COMMENTS OR FIELD NOTES
	SILT, gray-brown With a trace of fine sand at 1.1 feet					1	H	N/A			
	3.0	884.9									
						2	SS	10"			
	FINE SAND, brown										
	5.0	882.9		5		3	SS	14"			
	6.0 **SILTY CLAY**, dark gray-brown	881.9									
	Bottom of boring										
	Soil classification based on ASTM Standard D-2488-84										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 7 in

WELL DIA.: in

WATER LEVEL OBSERVATIONS		
WL	▽	▼
WL		
WL		

Terracon

BORING STARTED	3-18-91		
BORING COMPLETED	3-18-91		
RIG	C.M.E. 75	FOREMAN	G.M.Z.
APPROVED	G.M.Z.	JOB #	50905072

LOG OF BORING NO. S-5

OWNER: Hydro-Flex Corporation

ARCHITECT/ENGINEER: Terracon Environmental

SITE: 2101 N.W. Brickyard Road, Topeka, Kansas

PROJECT: Remedial Investigation

TOP OF CASING: ft

GROUND SURFACE ELEV.: 888.10 ft

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH (FT.)	SAMPLES: USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	TESTS: BLOWS / FT.	TESTS: FIELD VAPOR TESTS (ppm)	COMMENTS OR FIELD NOTES
	SILTY CLAY, dark gray-brown				1	H	N/A			
	3.0 — 885.1				2	AF	N/A			
	4.0 — 884.1									
	GRAVEL		5		3	SS	24"			
	SILTY CLAY, gray Becoming dark brown at 5.0 feet Becoming gray at 7.0 feet				4	SS	24"			
	8.0 — 880.1									
	Bottom of boring									
	Soil classification based on ASTM Standard D-2488-84									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 7 in

WELL DIA.: in

WATER LEVEL OBSERVATIONS		
WL	▽	▼
WL		
WL		

Terracon

BORING STARTED	3-21-91
BORING COMPLETED	3-21-91
RIG C.M.E. 75	FOREMAN G.M.Z.
APPROVED G.M.Z.	JOB # 50905072

LOG OF BORING NO. S-6

OWNER: Hydro-Flex Corporation

ARCHITECT/ENGINEER: Terracon Environmental

SITE: 2101 N.W. Brickyard Road, Topeka, Kansas

PROJECT: Remedial Investigation

TOP OF CASING: ft

GROUND SURFACE ELEV.: 888.20 ft

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH (FT.)	SAMPLES: USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	TESTS: BLOWS / FT.	TESTS: FIELD VAPOR TESTS (ppm)	COMMENTS OR FIELD NOTES
	SILTY CLAY, dark brown				1	H	N/A			
	Becoming gray at 2.5 feet				2	HA	N/A			
	3.5 884.7									
	4.5 **GRAVEL** 883.7				3	HA	N/A			
	Bottom of boring									
	Soil classification based on ASTM Standard D-2488-84									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 3 in

WELL DIA.: in

WATER LEVEL OBSERVATIONS		
WL	▽	▼
WL		
WL		

Terracon

BORING STARTED	3-18-91
BORING COMPLETED	3-18-91
RIG HA	FOREMAN G.M.Z.
APPROVED G.M.Z.	JOB # 50905072

LOG OF BORING NO. S-7

OWNER: Hydro-Flex Corporation

ARCHITECT/ENGINEER: Terracon Environmental

SITE: 2101 N.W. Brickyard Road, Topeka, Kansas

PROJECT: Remedial Investigation

TOP OF CASING: ft

GROUND SURFACE ELEV.: 888.10 ft

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH (FT.)	SAMPLES: USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	TESTS: BLOWS / FT.	TESTS: FIELD VAPOR TESTS (ppm)	COMMENTS OR FIELD NOTES
	0.8 — 887.3 SILT, brown				1	H	N/A			
	SILTY CLAY, gray-brown									
			5		2	SS	14"			
	5.7 — 882.4 6.0 — 882.1 FINE SANDY CLAY, brown									
	SILT, brown									
	9.5 — 878.6 SILTY FINE SAND, light brown				3	SS	16"			
			10							
	14.0 — 874.1 SILT, light brown, moist									
			15							
	16.8 — 871.3 CLAY, gray-brown				4	SS	24"			
	19.0 Becoming light gray at 18.7 feet — 869.1									
	Bottom of boring									
	Soil classification based on ASTM Standard D-2488-84									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 7 in

WELL DIA.: in

WATER LEVEL OBSERVATIONS		
WL	▽	▼
WL		
WL		

Terracon

BORING STARTED	3-18-91
BORING COMPLETED	3-18-91
RIG C.M.E. 75	FOREMAN G.M.Z.
APPROVED G.M.Z.	JOB # 50905072

LOG OF BORING NO. S-8

OWNER: Hydro-Flex Corporation

ARCHITECT/ENGINEER: Terracon Environmental

SITE: 2101 N.W. Brickyard Road, Topeka, Kansas

PROJECT: Remedial Investigation

TOP OF CASING: ft

GROUND SURFACE ELEV.: 888.10 ft

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH (FT.)	SAMPLES: USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	TESTS: BLOWS / FT.	TESTS: FIELD VAPOR TESTS (ppm)	COMMENTS OR FIELD NOTES
	SILT, light brown Becoming dark brown with a trace of clay at 1.0 feet				1	H	N/A			
	Becoming light brown with a trace of clay at 4.0 feet		5		2	SS	24"			
5.5										
	CLAY, dark brown									
7.5										
	SILT, light brown with a trace of clay				3	SS	24"			
10.8			10							
	CLAY, light brown with a trace of sand									
15.2			15		4	SS	24"			
17.0	**FINE SAND**, light olive gray, well sorted									
	Bottom of boring									
	Soil classification based on ASTM Standard D-2488-84									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 7 in

WELL DIA.: in

WATER LEVEL OBSERVATIONS				
WL	▽ DRY	W.S.	▼ DRY	A.B.
WL				
WL				

Terracon

BORING STARTED	10-1-90		
BORING COMPLETED	10-1-90		
RIG	C.M.E. 850	FOREMAN	G.M.Z.
APPROVED	G.M.Z.	JOB #	50905072

LOG OF BORING NO. S-9

OWNER: Hydro-Flex Corporation

ARCHITECT/ENGINEER: Terracon Environmental

SITE: 2101 N.W. Brickyard Road, Topeka, Kansas

PROJECT: Remedial Investigation

TOP OF CASING: ft

GROUND SURFACE ELEV.: 888.00 ft

GRAPHIC LOG	DESCRIPTION		WELL DETAIL	DEPTH (FT.)	SAMPLES: USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	TESTS: BLOWS / FT.	TESTS: FIELD VAPOR TESTS (ppm)	TESTS: COMMENTS OR FIELD NOTES
	SILTY CLAY, dark brown					1	H	N/A			
	3.5	884.5									
	CLAY, light gray-brown			5		2	SS	19"			
	7.5	880.5									
	8.8 **SILTY CLAY**, light gray-brown	879.2									
	11.0 **SILT**, light brown	877.0		10		3	SS	16"			
	Bottom of boring.										
	Soil classification based on ASTM Standard D-2488-84.										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 7 in

WELL DIA.: in

WATER LEVEL OBSERVATIONS		
WL	▽	▼
WL		
WL		

Terracon

BORING STARTED	3-19-91
BORING COMPLETED	3-19-91
RIG C.M.E. 75	FOREMAN G.M.Z.
APPROVED G.M.Z.	JOB # 50905072

LOG OF BORING NO. S-10

OWNER: Hydro-Flex Corporation

ARCHITECT/ENGINEER: Terracon Environmental

SITE: 2101 N.W. Brickyard Road, Topeka, Kansas

PROJECT: Remedial Investigation

TOP OF CASING: ft

GROUND SURFACE ELEV.: 888.10 ft

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH (FT.)	SAMPLES: USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	TESTS: BLOWS / FT.	TESTS: FIELD VAPOR TESTS (ppm)	COMMENTS OR FIELD NOTES
	1.0 **SILTY CLAY**, dark brown — 887.1				1	H	N/A			
	FINE SANDY SILT, gray-brown — 3.5 — 884.6									
	SILT, dark brown		5		2	SS	23"			
	8.5 — 879.6									
	8.8 — 879.3 **FINE SANDY SILT**, brown				3	SS	16"			
	11.0 **SILT**, light brown — 877.1		10							
	Bottom of boring.									
	Soil classification based on ASTM Standard D-2488-84.									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 7 in

WELL DIA.: in

WATER LEVEL OBSERVATIONS		
WL	▽	▼
WL		
WL		

Terracon

BORING STARTED	3-20-91
BORING COMPLETED	3-20-91
RIG C.M.E. 75	FOREMAN G.M.Z.
APPROVED G.M.Z.	JOB # 50905072

LOG OF BORING NO. S-11

OWNER: Hydro-Flex Corporation

ARCHITECT/ENGINEER: Terracon Environmental

SITE: 2101 N.W. Brickyard Road, Topeka, Kansas

PROJECT: Remedial Investigation

TOP OF CASING: ft

GROUND SURFACE ELEV.: 888.20 ft

GRAPHIC LOG	DESCRIPTION		WELL DETAIL	DEPTH (FT.)	SAMPLES: USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	TESTS: BLOWS / FT.	TESTS: FIELD VAPOR TESTS (ppm)	TESTS: COMMENTS OR FIELD NOTES
	1.0 SILTY CLAY, dark brown	887.2				1	H	N/A			
	FINE SANDY SILT, light brown										
	5.0	883.2				2	SS	24"			
	SILTY CLAY, dark brown			5							
	9.5	878.7				3	SS	24"			
	11.0 FINE SANDY SILTY CLAY, gray-brown	877.2		10							
	Bottom of boring.										
	Soil classification based on ASTM Standard D-2488-84.										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 7 in

WELL DIA.: in

WATER LEVEL OBSERVATIONS		
WL	▽	▼
WL		
WL		

Terracon

BORING STARTED	3-20-91
BORING COMPLETED	3-20-91
RIG C.M.E. 75	FOREMAN G.M.Z.
APPROVED G.M.Z.	JOB # 50905072

LOG OF BORING NO. MH-1

OWNER: Hydro-Flex Corporation

ARCHITECT/ENGINEER: Terracon Environmental

SITE: 2101 N.W. Brickyard Road, Topeka, Kansas

PROJECT: Remedial Investigation

TOP OF CASING: ft

GROUND SURFACE ELEV.: 888.10 ft

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH (FT.)	SAMPLES: USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	TESTS: BLOWS / FT.	TESTS: FIELD VAPOR TESTS (ppm)	COMMENTS OR FIELD NOTES
	0.3 — 887.8				1	H	N/A			
	SILT, light brown									
	SAND, light brown, poorly sorted									
	Hard object encountered and penetrated at 4.0 feet				2	SS	24"			
			5							
			10							
	11.5 — 876.6				3	SS	18"			
	12.5 — 875.6									
	WET SLUDGE, grayish brown clay with moderate blue streaks									
	Bottom of boring (hard object at 12.5 feet)									
	Soil classification based on ASTM Standard D-2488-84									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 7 in

WELL DIA.: in

WATER LEVEL OBSERVATIONS		
WL	▽	▼
WL		
WL		

Terracon

BORING STARTED	10-1-90
BORING COMPLETED	10-1-90
RIG C.M.E. 850	FOREMAN G.M.Z.
APPROVED G.M.Z.	JOB # 50905072

LOG OF BORING NO. MH-2

OWNER: Hydro-Flex Corporation	ARCHITECT/ENGINEER: Terracon Environmental
SITE: 2101 N.W. Brickyard Road, Topeka, Kansas	PROJECT: Remedial Investigation

TOP OF CASING: ft
GROUND SURFACE ELEV.: 888.00 ft

DEPTH (FT.)	DESCRIPTION	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY	TESTS BLOWS / FT.	TESTS FIELD VAPOR TESTS (ppm)	TESTS COMMENTS OR FIELD NOTES
	COARSE SAND, brown, poorly sorted		1	H	N/A			
5			2	SS	24"			
10	Becoming wet at 14.0 feet ▼		3	SS	24"			
15	Traces of green grains from 16.0-17.5 feet		4	SS	24"			
17.5	870.5		5	SS	18"			
	Bottom of boring (hard object at 17.5 feet)							
	Soil classification based on ASTM Standard D-2488-84							

WELL DETAIL

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 7 in
WELL DIA.: in

WATER LEVEL OBSERVATIONS		
WL	▽	▼
WL		
WL		

Terracon

BORING STARTED	10-1-90
BORING COMPLETED	10-1-90
RIG C.M.E. 850	FOREMAN G.M.Z.
APPROVED G.M.Z.	JOB # 50905072

LOG OF BORING NO. MH-3

OWNER: Hydro-Flex Corporation

ARCHITECT/ENGINEER: Terracon Environmental

SITE: 2101 N.W. Brickyard Road, Topeka, Kansas

PROJECT: Remedial Investigation

TOP OF CASING: ft

GROUND SURFACE ELEV.: 887.90 ft

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH (FT.)	SAMPLES: USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	TESTS: BLOWS / FT.	TESTS: FIELD VAPOR TESTS (ppm)	COMMENTS OR FIELD NOTES
	MEDIUM SAND, brown, poorly sorted				1	H	N/A			
	Becoming gray at 1.0 feet									
	Becoming brown at 1.4 feet									
			5		2	SS	16"			
	Becoming moist at 6.7 feet									
			10		3	SS	17"			
					4	SS	16"			
	15.4 — 872.5		15							
	15.7 — 872.2 **SILTY CLAY**, gray				5	SS	13"			
	17.6 — 870.3									
	17.9 — 870.0 **MEDIUM SAND**, brown, moist				6	SS	16"			
	19.5 — 868.4									
	SILTY CLAY AND SLUDGE, gray and green-blue (0.1 feet)									

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

BOREHOLE DIA.: 7 in

WELL DIA.: in

WATER LEVEL OBSERVATIONS		
WL	▽	▼
WL		
WL		

Terracon

BORING STARTED	3-18-91
BORING COMPLETED	3-18-91
RIG C.M.E. 75	FOREMAN G.M.Z.
APPROVED G.M.Z.	JOB # 50905072

LOG OF BORING NO. MH-3

OWNER	ARCHITECT/ENGINEER
Hydro-Flex Corporation	Terracon Environmental
SITE: 2101 N.W. Brickyard Road, Topeka, Kansas	PROJECT: Remedial Investigation

GRAPHIC LOG	DESCRIPTION	WELL DETAIL	DEPTH (FT.)	SAMPLES: USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY	TESTS: BLOWS / FT.	TESTS: FIELD VAPOR TESTS (ppm)	TESTS: COMMENTS OR FIELD NOTES
	VERY FINE SAND, light gray, well sorted									
	Bottom of boring									
	Soil classification based on ASTM Standard D-2488-84									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WATER LEVEL OBSERVATIONS		
WL	▽	▼
WL		
WL		

Terracon

BORING STARTED	3-18-91
BORING COMPLETED	3-18-91
RIG C.M.E. 75	FOREMAN G.M.Z.
APPROVED G.M.Z.	JOB # 50905072

Item A-2: Water Well Records

WATER WELL RECORD Form WWC-5 KSA 82a-1212

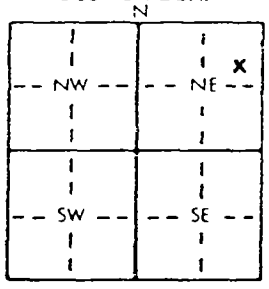
LOCATION OF WATER WELL:	Fraction	Section Number	Township Number	Range Number
County: SHAWNEE	NE ¼ NE ¼ NE ¼	22	T 11 S	R 15 (E) W

Distance and direction from nearest town or city street address of well if located within city?
4101 N.W. BRICKYARD RD., TOPEKA, KS 66618

WATER WELL OWNER: HYDRO-FLEX CORP.
RR#, Street Address, Box #: } SAME AS ABOVE
City, State, ZIP Code:

Board of Agriculture, Division of Water Resources
Application Number:

LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:



4 DEPTH OF COMPLETED WELL 75.Ø ft. ELEVATION:
Depth(s) Groundwater Encountered 1. 24.Ø ft. 2. ft. 3. ft.
WELL'S STATIC WATER LEVEL ft. below land surface measured on mo/day/yr
Pump test data: Well water was ft. after hours pumping gpm
Est. Yield gpm: Well water was ft. after hours pumping gpm
Bore Hole Diameter in. to ft., and in. to ft.

WELL WATER TO BE USED AS: 5 Public water supply 8 Air conditioning 11 Injection well
1 Domestic 3 Feedlot 6 Oil field water supply 9 Dewatering 12 Other (Specify below)
2 Irrigation 4 Industrial 7 Lawn and garden only [10 Monitoring well] HF-5

Was a chemical/bacteriological sample submitted to Department? Yes ..... No X ; If yes, mo/day/yr sample was submitted
Water Well Disinfected? Yes No

TYPE OF BLANK CASING USED: 5 Wrought iron 8 Concrete tile CASING JOINTS: Glued Clamped
1 Steel 3 RMP (SR) 6 Asbestos-Cement 9 Other (specify below) Welded
[PVC] 4 ABS 7 Fiberglass Threaded X

Blank casing diameter 2 in. to 62.75 ft., Dia in. to ft., Dia in. to ft.
Casing height above land surface ~ 24 in., weight lbs./ft. Wall thickness or gauge No. SCH. 40

TYPE OF SCREEN OR PERFORATION MATERIAL: [7 PVC] 10 Asbestos-cement
1 Steel 3 Stainless steel 5 Fiberglass 8 RMP (SR) 11 Other (specify)
2 Brass 4 Galvanized steel 6 Concrete tile 9 ABS 12 None used (open hole)

SCREEN OR PERFORATION OPENINGS ARE: 5 Gauzed wrapped 8 Saw cut 11 None (open hole)
[Continuous slot] [3 Mill slot] Ø.ØIØ IN 6 Wire wrapped 9 Drilled holes
2 Louvered shutter 4 Key punched 7 Torch cut 10 Other (specify)

SCREEN-PERFORATED INTERVALS: From 62.75 ft. to 66.75 ft., From > MILL SLOT ft. to ft.
From 67.75 ft. to 71.75 ft., From > CONTINUOUS SLOT ft. to ft.

GRAVEL PACK INTERVALS: From 27.Ø ft. to 54.Ø ft., From > NATURAL ft. to ft.
From 54.Ø ft. to 75.Ø ft., From > 45/55 SAND ft. to ft.

GROUT MATERIAL: 1 Neat cement 2 Cement grout [3 Bentonite] 4 Other
Grout Intervals: From 2.Ø ft. to 24.Ø ft., From 24.Ø ft. to 27.Ø ft., From ft. to ft.

What is the nearest source of possible contamination: GROUT PELLETS
1 Septic tank 4 Lateral lines 7 Pit privy 10 Livestock pens [14 Abandoned water well] HF-4
2 Sewer lines 5 Cess pool 8 Sewage lagoon 11 Fuel storage 15 Oil well/Gas well
3 Watertight sewer lines 6 Seepage pit 9 Feedyard 12 Fertilizer storage 16 Other (specify below)
13 Insecticide storage

Direction from well? WEST How many feet? ~6 FEET

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
Ø	Ø1.5	SILTY CLAY WITH GRAVEL, BROWN			
1.5	1Ø.Ø	SILTY CLAY, LIGHT BROWN			
Ø	23.Ø	FINE SAND, BROWN			
3	26.Ø	SILTY SAND, BROWN			
6.Ø	52.Ø	FINE TO MEDIUM SAND, BROWN			
2.Ø	65.Ø	GRAVELLY MEDIUM TO COARSE SAND, BROWN			
Ø	74.3	GRAVELLY MEDIUM TO COARSE SAND, GRAY			
3	75.Ø	SHALE, GRAY			

CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was [(1) constructed,] (2) reconstructed, or (3) plugged under my jurisdiction and was completed on (mo/day/year) MARCH 21, 1991 and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 416 This Water Well Record was completed on (mo/day/yr) APRIL 10, 1991
under the business name of TERRACON ENV., INC. by (signature) Stephen T. Goodbar

INSTRUCTIONS: Use typewriter or ball point pen. PLEASE PRESS FIRMLY and PRINT clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Bureau of Water, Topeka, Kansas 66620-7320. Telephone: 913-296-5545. Send one to WATER WELL OWNER and retain one for your records.

WATER WELL RECORD Form WWC-5 KSA 82a-1212

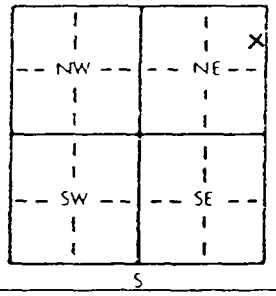
LOCATION OF WATER WELL:	Fraction	Section Number	Township Number	Range Number
County: SHAWNEE	NE ¼ NE ¼ NE ¼	22	T 11 S	R 15 (E)W

Distance and direction from nearest town or city street address of well if located within city?
1Ø1 N.W. BRICKYARD ROAD, TOPEKA, KS 66618

WATER WELL OWNER: HYDRO-FLEX CORP.
RR#, Address, Box # : } SAME AS ABOVE
City, State, ZIP Code :

Board of Agriculture, Division of Water Resources
Application Number:

LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:



4 DEPTH OF COMPLETED WELL 39.Ø ft. ELEVATION:
Depth(s) Groundwater Encountered 1. 23.7 ft. 2. ft. 3. ft.
WELL'S STATIC WATER LEVEL ft. below land surface measured on mo/day/yr
Pump test data: Well water was ft. after hours pumping gpm
Est. Yield gpm: Well water was ft. after hours pumping gpm
Bore Hole Diameter in. to ft., and in. to ft.

WELL WATER TO BE USED AS: 5 Public water supply 8 Air conditioning 11 Injection well
1 Domestic 3 Feedlot 6 Oil field water supply 9 Dewatering 12 Other (Specify below)
2 Irrigation 4 Industrial 7 Lawn and garden only [10 Monitoring well] HF-6

Was a chemical/bacteriological sample submitted to Department? Yes ..... No X ; If yes, mo/day/yr sample was submitted
Water Well Disinfected? Yes No

TYPE OF BLANK CASING USED: 5 Wrought iron 8 Concrete tile CASING JOINTS: Glued Clamped
1 Steel 3 RMP (SR) 6 Asbestos-Cement 9 Other (specify below) Welded
[2 PVC] 4 ABS 7 Fiberglass Threaded X

Blank casing diameter 2 in. to 29.Ø ft., Dia in. to ft., Dia in. to ft.
Casing height above land surface ~24 in., weight lbs./ft. Wall thickness or gauge No. SCH. 4Ø

TYPE OF SCREEN OR PERFORATION MATERIAL: [7 PVC]
1 Steel 3 Stainless steel 5 Fiberglass 8 RMP (SR) 10 Asbestos-cement
2 Brass 4 Galvanized steel 6 Concrete tile 9 ABS 11 Other (specify)
12 None used (open hole)

SCREEN OR PERFORATION OPENINGS ARE: 5 Gauzed wrapped 8 Saw cut 11 None (open hole)
[1 Continuous slot] Ø.Ø1Ø IN 3 Mill slot 6 Wire wrapped 9 Drilled holes
2 Louvered shutter 4 Key punched 7 Torch cut 10 Other (specify)

SCREEN-PERFORATED INTERVALS: From 29.Ø ft. to 38.3 ft., From ft. to ft.
From ft. to ft., From ft. to ft.

GRAVEL PACK INTERVALS: From 26.4 ft. to 39.Ø ft., From > 45/55 SAND ft. to ft.
From ft. to ft., From ft. to ft.

GROUT MATERIAL: 1 Neat cement 2 Cement grout [3 Bentonite] 4 Other
Grout Intervals: From 2.Ø ft. to 23.7 ft., From 23.7 PELLETS ft. to 26.4 ft., From ft. to ft.

What is the nearest source of possible contamination: GROUT
[1 Septic tank] [4 Lateral lines] 7 Pit privy 10 Livestock pens 14 Abandoned water well
2 Sewer lines 5 Cess pool 8 Sewage lagoon 11 Fuel storage 15 Oil well/Gas well
3 Watertight sewer lines 6 Seepage pit 9 Feedyard 12 Fertilizer storage 16 Other (specify below)
13 Insecticide storage

Direction from well? WEST How many feet? ~25Ø FEET

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
Ø	Ø1.Ø	SILTY CLAY, DARK BROWN			
Ø1.Ø	Ø4.5	SILTY CLAY, BROWN			
Ø4.5	Ø6.5	SILT, LIGHT BROWN			
Ø6.5	Ø9.Ø	SILTY CLAY, BROWNISH GRAY			
Ø9.Ø	28.3	FINE TO MEDIUM SAND, LIGHT BROWN			
28.3	29.4	FINE TO MEDIUM SAND, LIGHT BROWN			
29.4	3Ø.3	SILTY SAND, LIGHT BROWN			
3Ø.3	35.Ø	FINE TO MEDIUM SAND, LIGHT BROWN			
35.Ø	39.Ø	GRAVELLY SAND, BROWN			

CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on (mo/day/year) MARCH 19, 1991 and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 416 This Water Well Record was completed on (mo/day/year) APRIL 19, 1991
under the business name of TERRACON ENV., INC. by (signature) Stephen J. Goodbrod

INSTRUCTIONS: Use typewriter or ball point pen. *PLEASE PRESS FIRMLY* and *PRINT* clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Bureau of Water, Topeka, Kansas 66620-7320. Telephone: 913-296-5545. Send one to WATER WELL OWNER and retain one for your records.

Item A-3: Correspondence With KDHE

June 18, 1991

Terracon
ENVIRONMENTAL, INC.
7810 N. W. 100th
P.O. Box 901541
Kansas City, Missouri 64190-1541
(816) 891-7717

James A. Cunningham, P.E.
John F. Hartwell, P.E.
Robert L. Sholar
Stephen F. Loosbrock, C.P.G.
Robert L. Fine II, E.I.T.
Michael S. Kukuk, C.P.G.
David M. Beem, CIH
Julie H. Pflugradt

Rachel Miller
Environmental Geologist
Bureau of Environmental Remediation
Kansas Department of Health and Environment
Building 740, Forbes Field
Topeka, Kansas 66620-0001

RE: Hydro-Flex Corporation
2101 N.W. Brickyard Road
Topeka, Kansas 66618
Project No. 50905072

Dear Rachel:

Thank you for your letter of May 28, with enclosed KDHE analytical results for ground water samples taken from the 6 wells associated with the Hydro-Flex Corporation site in Topeka.

With regard to analytical results, as you know, we took soil, sludge, and ground water samples in March and ground water samples in May. Analytical results for all samples taken in March that were turned into the laboratory for analysis are enclosed. As approved by KDHE, we held 4 of the surface soil samples taken in March pending receipt of initial analytical results. After receipt of those results, you agreed that it would not be necessary to submit those 4 samples for analysis. We continue to hold those samples but will discard them when their 6 month holding time runs out (i.e., in September). Similarly, we continue to hold the ground water samples that were taken in May but will discard them when their 6 month holding time runs out (i.e., in November).

We have now completed both Parts A and B of the Phase I investigation, as agreed upon in the Amended Consent Settlement and Consent Order. As you know, Part A included the drilling and sampling of 3 boreholes (in Manhole No. 1 and adjacent to it and in Manhole No. 2) while Part B included the remainder of the Phase 1 work, as described in the workplan and sampling and

analysis plan approved by KDHE and the U.S. Environmental Protection Agency (USEPA).

We have reviewed all of the field data collected to date and discussed them with you. As you know, with the minor exception of several ground water samples, this data indicates that environmental conditions at this site are essentially uncontaminated. For example, concentrations of chromium, copper, and lead in soil samples were generally at levels lower than those characteristically occurring naturally in Kansas or elsewhere. With respect to ground water, several of the samples were reported to contain total chromium concentrations exceeding the Kansas Action Level (KAL) of 50 ug/L; however, as more fully discussed below, we believe that these exceedances are minor and due largely to naturally occurring chromium in sediments. Therefore, we believe that the existing data is adequate for completion of the remedial investigation/feasibility study (RI/FS) process with a "no further action" alternative. It is also our understanding that KDHE is essentially in agreement with this evaluation.

As you know, monitoring wells HF-1 through HF-4 were installed prior to the RI/FS. HF-1 is the "background" well, HF-2 is near the soil adsorption field, HF-3 is south of the soil adsorption field and actually upgradient, and HF-4 is the former water supply well that was contaminated with Hydro-Flex wastewater. HF-1 and HF-2 were screened near the top of the aquifer and HF-3 was screened near its bottom. It is unknown where HF-4 was screened but assumed it was screened near the bottom. HF-5 and HF-6 are new monitoring wells installed in March in a generally downgradient direction from HF-4 and the soil adsorption system. HF-5 is approximately 6 feet from HF-4 and HF-6 is further away on the eastern border of the site. HF-5

is screened near the bottom and HF-6 is screened near the top of the aquifer.

Pertinent ground water results from the May sampling event were as follows:

Monitoring Well	TSS (mg/L)	Chromium (ug/L) Filtered	Chromium (ug/L) Total
HF-1	2,073	4	52
HF-2	74,991	7	115
HF-3	511	3	26
HF-4	29	<3	14
HF-5	1,334	4	360
HF-6	4,333	6	55

It can be seen that filtered chromium concentrations are very low in all wells and that total chromium concentrations in all wells except HF-5 are directly proportional to total suspended solids (TSS) concentrations (correlation coefficient of 0.90).

The presence of high concentrations of sediments in the 2 inch monitoring wells is understandable. A significant fraction of the aquifer material that could be near well screens may be in the silt and clay size range. Particle size distribution analysis results for 2 samples obtained during installation of HF-6 showed that the silt and clay size range constituted approximately 5 and 35 percent of the total material. During development, ground water being pumped from HF-5 and HF-6 was initially highly turbid. Turbidity was significantly reduced during development, but not eliminated, and the turbidity of water purged prior to sampling was higher than at the end of development.

Total chromium concentrations in 4 wells (HF-1, HF-2, HF-5, and HF-6) exceeded the existing KAL. However, with the exception

of the sample from HF-5, there is a strong correlation between TSS and chromium concentrations in these samples. The effect of that correlation is, with the exception of HF-5, that the chromium concentrations in these samples appear to be a result of naturally occurring chromium in the sediments. Chromium in sediments in a sample may be dissolved during sample digestion and measured as part of the total. Since sediment concentrations are typically higher than water concentrations, this can be significant even if only a small fraction of the chromium in the sediments is dissolved in this manner. Furthermore, for 3 of the 4 wells (excluding well HF-5) the exceedances are small compared to existing or likely criteria. For example, 2 of these reported exceedances were for wells HF-1 (the "background" well) and HF-6. They were within 10 percent of the existing KAL and would not exceed the recently adopted federal drinking water standard for chromium of 100 ug/L.

With regard to HF-5, it is possible that minor enrichment of chromium in sediments in the immediate vicinity of HF-4 (including those that could be drawn into HF-5 during sampling) may have occurred as a result of waste disposal and that this enrichment may be a factor in the concentration of total chromium found in the sample from that well. However, even if that is the case, the enrichment attributable to waste disposal would seem to be minor in both magnitude and extent. Analysis of samples of aquifer materials obtained during installation of both HF-5 and HF-6 indicated low concentrations of chromium (i.e., less than 1 mg/kg). It should also be considered that the ground water sample from HF-4, containing only a small amount of sediments, had a low total chromium concentration. In view of the extensive purging of well HF-4 and its proximity to HF-5, some of the water sampled probably passed HF-5 on the way to HF-4.

If additional sampling of HF-5 was to be required, we would recommend that it be extensively re-developed and purged. We expect that doing so would result in low total chromium concentrations if the sediment concentration could be reduced. However, considering the variability in aquifer materials, the probability that the fraction of silt and clay in the material around the screen is high, and the fact that HF-5 is a 2 inch well, it is uncertain whether this extraordinary effort would be effective in reducing the concentration of sediment in samples from this well and, therefore, whether this effort would be worthwhile or should be undertaken.

In conclusion, we believe that the existing data are adequate for completion of the RI/FS process with a "no further action" alternative. Your formal concurrence in that evaluation at this time is necessary, so that we can complete the RI/FS process without further delay.

Thank you for your consideration. We'll look forward to hearing from you in the near future in this matter.

Sincerely,
TERRACON ENVIRONMENTAL, INC.

GMZ

G.M. Zemansky, Ph.D.
Senior Hydrogeologist

Enclosure

State of Kansas
[redacted]
Governor Joan Finney
Department of Health and Environment
Division of Environment
Forbes Field, Bldg. 740, Topeka, KS 66620-0002

Acting
Stanley C. Grant, Ph.D., Secretary

Respond to: (913) 296-1673
FAX (913) 296-6247
BER FAX (913) 296-1686

June 26, 1991

G.M. Zemansky
Senior Water Quality Engineer
Terracon Environmental, Inc.
7810 N.W. 100th
P.O. Box 901541
Kansas City, Missouri 64100-1541

RE: Hydro-Flex Site, Topeka

Dear Gil:

We received your letter of June 18, 1991 and would like to reply to your request for concurrence. First, we agree that the existing field data is adequate for completion of the RI/FS, and that the Phase II investigation described in the RI/FS Workplan is not necessary. However, there may have been some misunderstanding during our phone conversation concerning the "no further action" issue discussed in your letter.

Although according to current investigative information, there appears to be little or no groundwater contamination and only a small area of soil contamination, it is not possible for KDHE to approve a remedial alternative at this time. The EPA guidance for completion of the RI/FS must be followed in the selection of an appropriate remedial alternative for the site. The small amount of contaminated soil/sludge present at the site should be addressed in the FS.

Again, we agree that the Phase II investigation is not necessary for the reasons stated in your letter, but we do not concur with the "no action alternative" at this time. A number of limited remedial action alternatives (including the no action alternative) should be evaluated during the FS. Please contact me if you have any questions concerning this matter.

Sincerely,

Rachel M. Miller

Rachel Miller
Environmental Geologist
Remedial Section
Bureau of Environmental Remediation

C. Larry Knoche --> Marvin Glotzbach
Cathy Barrett - EPA
Jeff Campbell - Hydro-Flex
Sharad Bhatia - Blackwell Sanders

Charles Konigsberg, Jr., M.D., M.P.H., Director of Health (913) 296-1343
[redacted] Director of Environment (913) 296-1535
Lorne Phillips, Ph.D., Director of Information Systems (913) 296-1415
Roger Carlson, Ph.D., Director of the Kansas Health and Environmental Laboratory (913) 296-1619

APPENDIX B: ANALYTICAL DATA AND QA/QC EVALUATION RESULTS

Item B-1: PACE Analytical Results

pace
INCORPORATED
THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

April 23, 1991

RECEIVED APR 29 1991

Mr. Gil Zemansky
Terracon Consultants EC, Inc.
7810 N.W. 100th St.
Kansas City, MO 64153

RE: PACE Project No. 510325.503
Project # 5090-5072

Dear Mr. Zemansky:

Enclosed is the report of laboratory analyses for samples received March 25, 1991.

If you have any questions concerning this report, please feel free to contact us.

Sincerely,

Duane R. Boline, Ph.D.
Director, Sampling and Analytical Services

Enclosures

9608 Loiret Boulevard
Lenexa, KS 66219
TEL: 913-599-5665
FAX: 913-599-1759

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THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

Terracon Consultants EC, Inc.
7810 N.W. 100th St.
Kansas City, MO 64153

April 23, 1991
PACE Project Number: 510325503

Attn: Mr. Gil Zemansky

Project # 5090-5072

PACE Sample Number:			60 0031932	
Date Collected:			03/22/91	
Date Received:			03/25/91	
Parameter	Units	MDL	HF4-W-1	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Chromium	mg/L	0.020	7.38	04/11/91
Copper	mg/L	0.010	7.53	04/11/91

PACE Sample Number:			60 0031959	
Date Collected:			03/22/91	
Date Received:			03/25/91	
			HF4-S-1	
Parameter	Units	MDL	Leachate	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Chromium, Leachate	mg/L	0.25	44.0	04/11/91
Copper, Leachate	mg/L	0.25	212	04/11/91

MDL Method Detection Limit

9608 Loiret Boulevard
Lenexa, KS 66219
TEL: 913-599-5665
FAX. 913-599 1759

Offices Serving: Minneapolis, Minnesota; Tampa, Florida; Iowa City, Iowa; San Francisco, California; Kansas City, Missouri; Charlotte, North Carolina; Asheville, North Carolina; New York, New York; Pittsburgh, Pennsylvania; Denver, Colorado

REPORT OF LABORATORY ANALYSIS

April 23, 1991
PACE Project Number: 510325503

Project # 5090-5072

Parameter	Units	MDL	60 0032017 Leachate	DATE ANALYZED
PACE Sample Number:			60 0032017	
Date Collected:			03/19/91	
Date Received:			03/25/91	
			SB-MH3-11	
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Chromium, Leachate	mg/L	0.25	2.40	04/11/91
Copper, Leachate	mg/L	0.25	174	04/11/91

Parameter	Units	MDL	60 0032262 HF4-W-1 Duplicate % RPD	DATE ANALYZED
PACE Sample Number:			60 0032262	
Date Collected:			03/22/91	
Date Received:			03/25/91	
			HF4-W-1	
			Duplicate	
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Chromium	%		3	04/11/91
Copper	%		4	04/11/91

MDL Method Detection Limit

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Lenexa, KS 66219
TEL: 913-599-5665
FAX: 913-599-1759

REPORT OF LABORATORY ANALYSIS

April 23, 1991
PACE Project Number: 510325503

Project # 5090-5072

PACE Sample Number:			60 0032270	
Date Collected:			03/22/91	
Date Received:			03/25/91	
			HF4-W-1	
			MS	
Parameter	Units	MDL	% Recovery	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Chromium	%		97	04/11/91
Copper	%		98	04/11/91

PACE Sample Number:			60 0031940	
Date Collected:			03/22/91	
Date Received:			03/25/91	
Parameter	Units	MDL	HF4-S-1	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Chromium	mg/kg	0.50	56200	04/22/91
Copper	mg/kg	0.50	102000	04/22/91
EP TOXICITY LEACHATE PREP DATE			0031959	04/01/91
Totals, Extract Date-Metals (Soils+)			04/15/91	

MDL Method Detection Limit

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TEL: 913-599-5665
FAX: 913-599-1759

Project # 5090-5072

PACE Sample Number:			60 0031967	
Date Collected:			03/20/91	
Date Received:			03/25/91	
Parameter	Units	MDL	SB-HF5-60	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Chromium	mg/kg	0.112	0.708	04/11/91
Copper	mg/kg	0.112	0.921	04/11/91
Totals, Extract Date-Metals (Soils+)			03/29/91	

PACE Sample Number:			60 0031975	
Date Collected:			03/19/91	
Date Received:			03/25/91	
Parameter	Units	MDL	SB-HF6-10	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Chromium	mg/kg	0.108	4.10	04/11/91
Copper	mg/kg	0.108	2.95	04/11/91
Totals, Extract Date-Metals (Soils+)			03/29/91	

PACE Sample Number:			60 0031983	
Date Collected:			03/19/91	
Date Received:			03/25/91	
Parameter	Units	MDL	SB-HF6-30	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
% Ash	%		85.19	04/01/91
Chromium	mg/kg	0.120	0.976	04/11/91
Copper	mg/kg	0.120	0.470	04/11/91
Totals, Extract Date-Metals (Soils+)			03/29/91	

MDL Method Detection Limit

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THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

April 23, 1991
PACE Project Number: 510325503

Project # 5090-5072

PACE Sample Number:			60 0031991	
Date Collected:			03/19/91	
Date Received:			03/25/91	
Parameter	Units	MDL	SB-MH3-05	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Chromium	mg/kg	0.103	40.1	04/11/91
Copper	mg/kg	0.103	40.0	04/11/91
Totals, Extract Date-Metals (Soils+)			03/29/91	

PACE Sample Number:			60 0032009	
Date Collected:			03/19/91	
Date Received:			03/25/91	
Parameter	Units	MDL	SB-MH3-11	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
hromium	mg/kg	0.50	4440	04/22/91
opper	mg/kg	0.50	6880	04/22/91
EP TOXICITY LEACHATE PREP DATE			0032017	04/01/91
Totals, Extract Date-Metals (Soils+)			04/15/91	

MDL Method Detection Limit

9608 Loiret Boulevard
Lenexa, KS 66219
TEL: 913-599-5665
FAX: 913-599-1759

Project # 5090-5072

PACE Sample Number:			60 0032025	
Date Collected:			03/19/91	
Date Received:			03/25/91	
Parameter	Units	MDL	SB-MH3-19	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Chromium	mg/kg	0.110	5.00	04/11/91
Copper	mg/kg	0.110	44.6	04/11/91
Totals, Extract Date-Metals (Soils+)			03/29/91	

PACE Sample Number:			60 0032033	
Date Collected:			03/18/91	
Date Received:			03/25/91	
Parameter	Units	MDL	SB-050-40W -03 S4	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
% Ash	%		84.71	04/01/91
Chromium	mg/kg	0.115	13.6	04/11/91
Copper	mg/kg	0.115	11.4	04/11/91
Totals, Extract Date-Metals (Soils+)			03/29/91	
pH			6.2	03/27/91

MDL Method Detection Limit

REPORT OF LABORATORY ANALYSIS

April 23, 1991
PACE Project Number: 510325503

Project # 5090-5072

PACE Sample Number:			60 0032041	
Date Collected:			03/18/91	
Date Received:			03/25/91	
			SB-050-40W	
Parameter	Units	MDL	-05 S4	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Chromium	mg/kg	0.119	9.42	04/11/91
Copper	mg/kg	0.119	4.82	04/11/91
Totals, Extract Date-Metals (Soils+)			03/29/91	

PACE Sample Number:			60 0032050	
Date Collected:			03/20/91	
Date Received:			03/25/91	
			SB-050-00C	
Parameter	Units	MDL	-05 S5	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Chromium	mg/kg	0.122	76.4	04/11/91
Copper	mg/kg	0.122	5.04	04/11/91
Totals, Extract Date-Metals (Soils+)			03/29/91	

MDL Method Detection Limit

9608 Loiret Boulevard
Lenexa, KS 66219
TEL: 913-599-5665
FAX: 913-599-1759

REPORT OF LABORATORY ANALYSIS

April 23, 1991
PACE Project Number: 510325503

Project # 5090-5072

Parameter	Units	MDL	60 0032068 SB-050-00C -07 S5	DATE ANALYZED
PACE Sample Number:			60 0032068	
Date Collected:			03/20/91	
Date Received:			03/25/91	
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Chromium	mg/kg	0.125	18.7	04/11/91
Copper	mg/kg	0.125	10.3	04/11/91
Totals, Extract Date-Metals (Soils+)			03/29/91	

Parameter	Units	MDL	60 0032076 SB-050-30E -03 S6	DATE ANALYZED
PACE Sample Number:			60 0032076	
Date Collected:			03/19/91	
Date Received:			03/25/91	
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
% Ash	%		78.70	04/01/91
Chromium	mg/kg	0.123	7.53	04/11/91
Copper	mg/kg	0.123	5.84	04/11/91
Totals, Extract Date-Metals (Soils+)			03/29/91	
pH			6.6	03/27/91

MDL Method Detection Limit

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TEL: 913-599-5665
FAX: 913 599-1759

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REPORT OF LABORATORY ANALYSIS

Mr. Gil Zemansky
Page 9

April 23, 1991
PACE Project Number: 510325503

Project # 5090-5072

PACE Sample Number:			60 0032084	
Date Collected:			03/19/91	
Date Received:			03/25/91	
			SB-050-30E	
Parameter	Units	MDL	-05 S6	DATE ANALYZED
INORGANIC ANALYSIS				
INDIVIDUAL PARAMETERS				
Chromium	mg/kg	0.119	7.39	04/11/91
Copper	mg/kg	0.119	5.85	04/11/91
Totals, Extract Date-Metals (Soils+)			03/29/91	

MDL Method Detection Limit

These data have been reviewed and are approved for release.

Brian J. Smith
Manager, Inorganic Chemistry

9608 Loiret Boulevard
Lenexa, KS 66219
TEL: 913-599-5665
FAX: 913-599-1759

REPORT OF LABORATORY ANALYSIS

QUALITY CONTROL DATA

April 23, 1991
PACE Project Number: 510325503

Project # 5090-5072

% Ash
Batch: 60 03142
Samples: 60 0031983, 60 0032033, 60 0032076

SAMPLE DUPLICATE:

Parameter	Units	MDL	60 0032033 SB-050-40W -03 S4	Duplicate of Sample 60 0032033	RPD
% Ash	%		84.71	85.56	1%

MDL Method Detection Limit
RPD Relative Percent Difference

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REPORT OF LABORATORY ANALYSIS

RECEIVED MAY 13 1991

May 09, 1991

Mr. Gil Zemansky
Terracon Consultants EC, Inc.
7810 N.W. 100th St.
Kansas City, MO 64153

RE: PACE Project No. 510426.505
Total Solids Testing

Dear Mr. Zemansky:

Enclosed is the report of laboratory analyses for samples received April 26, 1991.

If you have any questions concerning this report, please feel free to contact us.

Sincerely,

D.R. Boline

Duane R. Boline, Ph.D.
Director, Sampling and Analytical Services

Enclosures

9608 Loiret Boulevard
Lenexa, KS 66219
TEL: 913-599-5665
FAX: 913-599-1759

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REPORT OF LABORATORY ANALYSIS

Terracon Consultants EC, Inc.
7810 N.W. 100th St.
Kansas City, MO 64153

May 09, 1991
PACE Project Number: 510426505

Attn: Mr. Gil Zemansky

Total Solids Testing

PACE Sample Number:			60 0048703	
Date Collected:			03/19/91	
Date Received:			04/26/91	
			SB-HF6-30	
Parameter	Units	MDL	-003198.3	DATE ANALYZED
INORGANIC ANALYSIS				
ANALYSIS FOR SOLIDS CONTENT				
% Total Solids	%	0.01	84.64	05/07/91
% Total Fixed Solids	%	0.01	84.27	05/07/91
% Volatile Solids	%	0.01	0.37	05/07/91

MDL Method Detection Limit

9608 Loiret Boulevard
Lenexa, KS 66219
TEL: 913-599-5665
FAX: 913-599-1759

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REPORT OF LABORATORY ANALYSIS

May 09, 1991
PACE Project Number: 510426505

Total Solids Testing

PACE Sample Number:			60 0048711	
Date Collected:			03/18/91	
Date Received:			04/26/91	
			SB-050-40W -03 S4	
Parameter	Units	MDL	-003203.3	DATE ANALYZED
INORGANIC ANALYSIS				
ANALYSIS FOR SOLIDS CONTENT				
% Total Solids	%	0.01	85.19	05/07/91
% Total Fixed Solids	%	0.01	83.34	05/07/91
% Volatile Solids	%	0.01	1.85	05/07/91

PACE Sample Number:			60 0048720	
Date Collected:			03/19/91	
Date Received:			04/26/91	
			SB-050-30E -03 S6	
Parameter	Units	MDL	-003207.6	DATE ANALYZED
INORGANIC ANALYSIS				
ANALYSIS FOR SOLIDS CONTENT				
% Total Solids	%	0.01	81.60	05/07/91
% Total Fixed Solids	%	0.01	77.76	05/07/91
% Volatile Solids	%	0.01	3.84	05/07/91

MDL Method Detection Limit

These data have been reviewed and are approved for release.

Brian J. Smith
Manager, Inorganic Chemistry

9608 Loiret Boulevard
Lenexa, KS 66219
TEL: 913-599-5665
FAX: 913-599-1759

pace INCORPORATED
THE ASSURANCE OF QUALITY

CHAIN-OF-CUSTODY RECORD
Analytical Request

Client: TERRACON ENVIRONMENTAL, INC.
Address: P.O. BOX 901541
KANSAS CITY, MO 64190-1541
Phone: 816-891-7717

Report To: G.M. ZEMANSKY
Bill To: "
P.O. # / Billing Reference
Project Name / No.: 5090 5072

Pace Client No.
Pace Project Manager
Pace Project No.
*Requested Due Date: 15 DAYS

Sampled By (PRINT): G.M. ZEMANSKY
Sampler Signature: GM Zemansky
Date Sampled: 18-22 MAR. 91

ITEM NO.	SAMPLE DESCRIPTION	TIME	MATRIX	PACE NO.	NO. OF CONTAINERS	PRESERVATIVES: UNPRESERVED	H_2SO_4	HNO_3	VOA	ANALYSES REQUEST: TOTAL CHROMIUM USEPA 6010	TOTAL COPPER USEPA 6010	EP TOX CHROMIUM	% ORGANIC MATTER ASTM D 2974-87	pH	REMARKS
1	HF4-W-1	22/3 1345	H_2O		1			✓		✓	✓				
2	HF4-S-1	22/3 1000	SLUDGE			✓				✓	✓	✓			
3	SB-HF5-60	20/3 1000	SOIL							✓	✓				
4	SB-HF6-10	19/3 0855								✓	✓				
5	SB-HF6-30	19/3 0945								✓	✓		✓		
6	SB-MH3-05	19/3 1400								✓	✓				
7	SB-MH3-11	19/3 1420								✓	✓	✓			
8	SB-MH3-19	19/3 1430								✓	✓				

COOLER NOS.	BAILERS	SHIPMENT METHOD OUT / DATE	SHIPMENT METHOD RETURNED / DATE

Additional Comments

ITEM NUMBER	RELINQUISHED BY / AFFILIATION	ACCEPTED BY / AFFILIATION	DATE	TIME
	GM Zemansley / TERRACON	Connie L. Sanders	25 MAR. 91	0730

ORIGINAL

SEE REVERSE SIDE FOR INSTRUCTIONS

pace INCORPORATED
THE ASSURANCE OF QUALITY

36348

CHAIN-OF-CUSTODY RECORD
Analytical Request

Client: TERRACON ENVIRONMENTAL, INC.
Address: P.O. BOX 901541
KANSAS CITY, MO 64190-1541
Phone: 816-891-7717

Report To: G.M. ZEMANSKY
Bill To: "
P.O. # / Billing Reference
Project Name / No.: 5090 5072

Pace Client No.
Pace Project Manager
Pace Project No.
*Requested Due Date:

Sampled By (PRINT): G.M. ZEMANSKY
Sampler Signature: GMZemansky
Date Sampled: 18-22 MAR. 91

ITEM NO.	SAMPLE DESCRIPTION		TIME	MATRIX	PACE NO.	NO. OF CONTAINERS	PRESERVATIVES: UNPRESERVED	H_2SO_4	HNO_3	VOA			ANALYSES REQUEST: TOTAL CHROMIUM USEPA 6010	TOTAL LEAD USEPA 6010	TOTAL COPPER USEPA 6010	% ORGANIC MATTER ASTM D 2974-87	pH	REMARKS
✓ 1	SB-05Ø-1ØW-Ø3	S4		SOIL	18/3 1350	1	✓						✓	✓	✓	✓		
✓ 2	SB-05Ø-1ØW-Ø5				18/3 1400								✓	✓				
✓ 3	SB-05Ø-ØØC-Ø5	S5			2Ø/3 1535								✓	✓				
✓ 4	SB-05Ø-ØØC-Ø7				2Ø/3 1545								✓	✓				
✓ 5	SB-05Ø-3ØE-Ø3	S6			19/3 ØØØØ								✓	✓	✓	✓		
✓ 6	SB-05Ø-3ØE-Ø5				19/3 1540								✓	✓				
7																		
8																		

COOLER NOS.	BAILERS	SHIPMENT METHOD: OUT / DATE	SHIPMENT METHOD: RETURNED / DATE

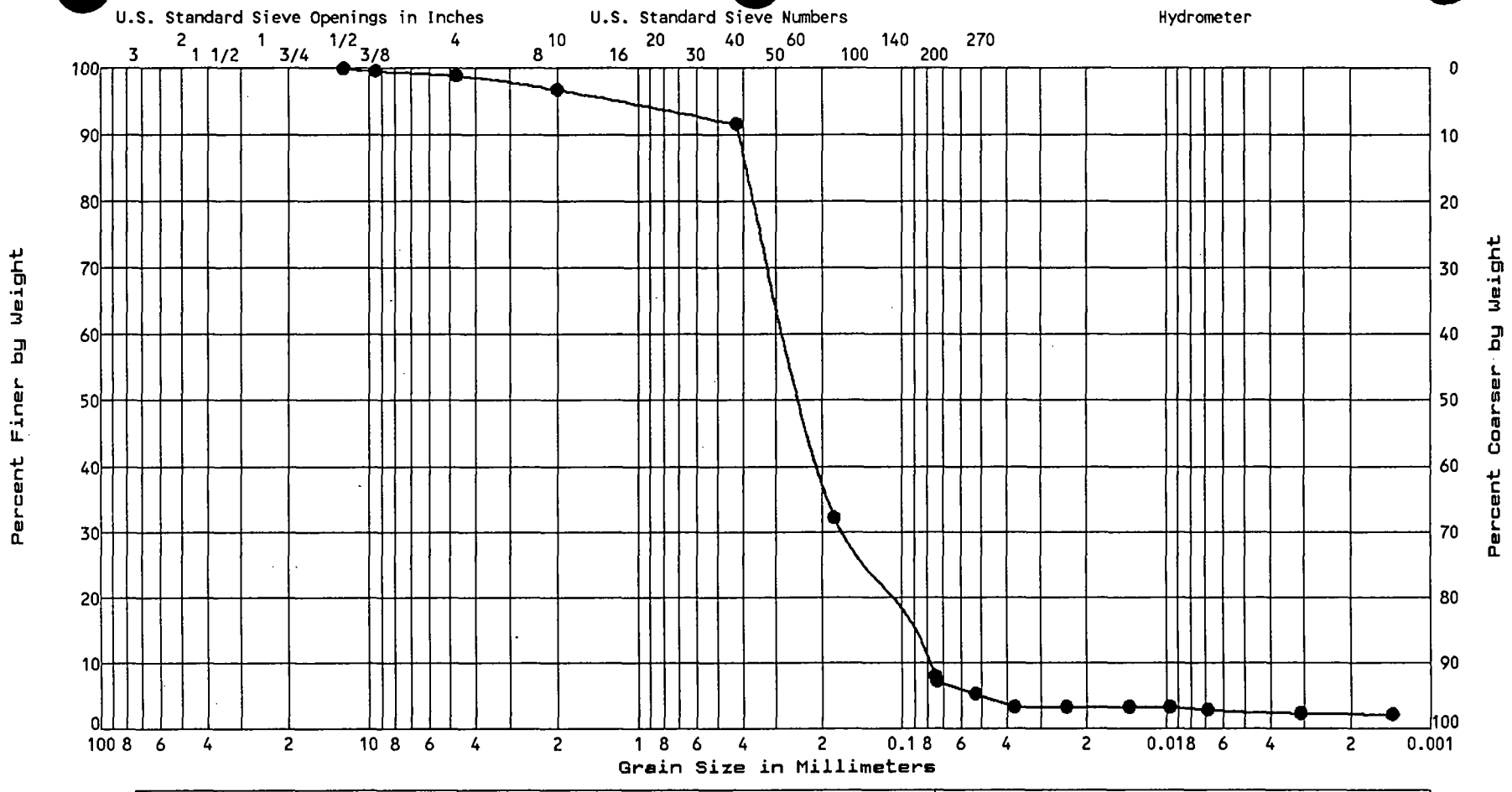
Additional Comments

ITEM NUMBER	RELINQUISHED BY / AFFILIATION	ACCEPTED BY / AFFILIATION	DATE	TIME
	GMZemansky / TERRACON	Connie L. Sadler	25 MAR. 91	Ø73Ø

ORIGINAL

SEE REVERSE SIDE FOR INSTRUCTIONS

Item B-2: Terracon Geotechnical Laboratory Results



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

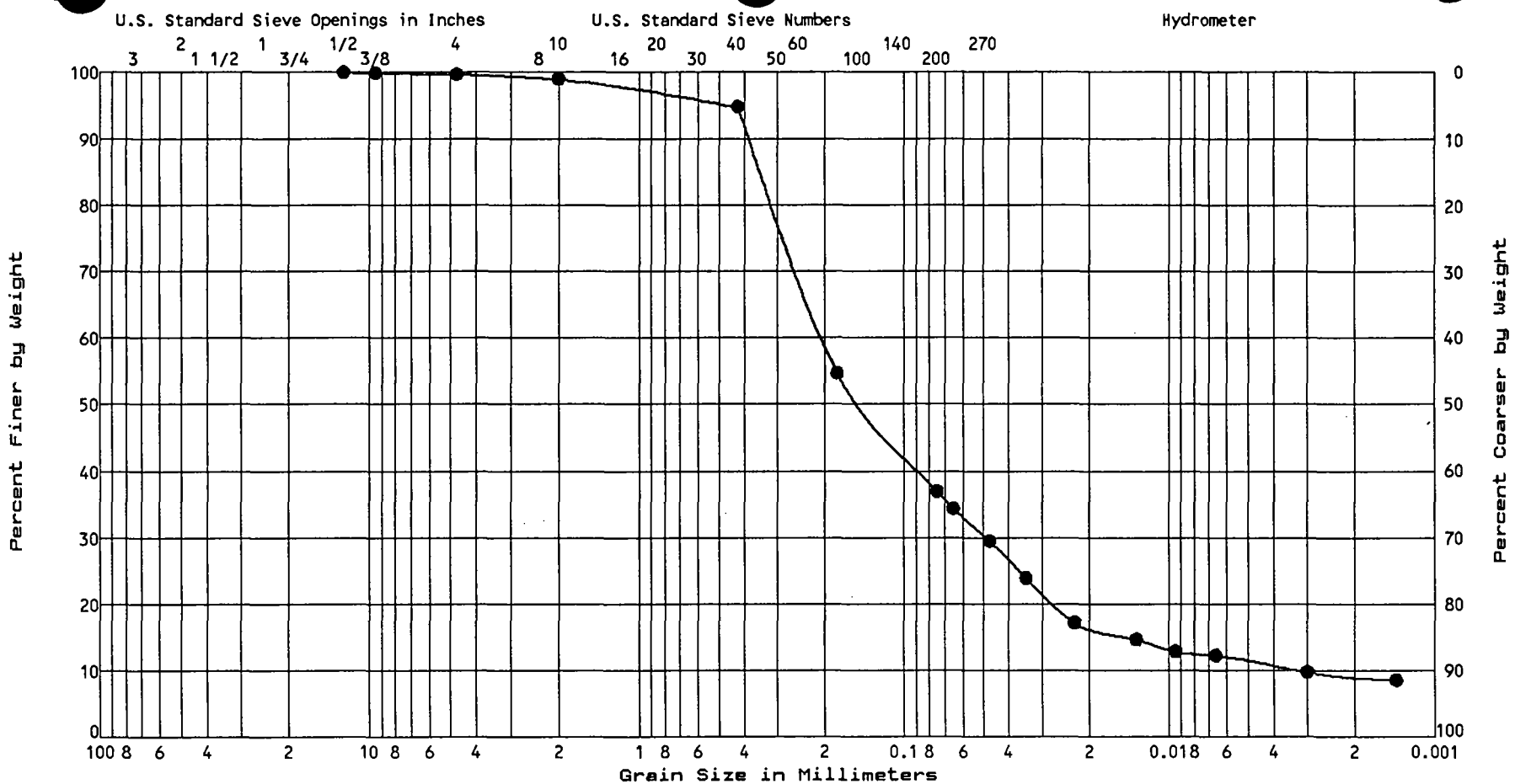
GRAIN SIZE DISTRIBUTION CURVE

Boring No.	Sample No.	Depth	Description	Unified Symbol	Natural WC	LL	PL	PI
●	1	28.3-29.4	SAND TRACE CLAY & GRAVEL, LIGHT BROWN					

Project HYDROFLEX -

Job No. 50905072 Date 3/29/91

Terracon



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

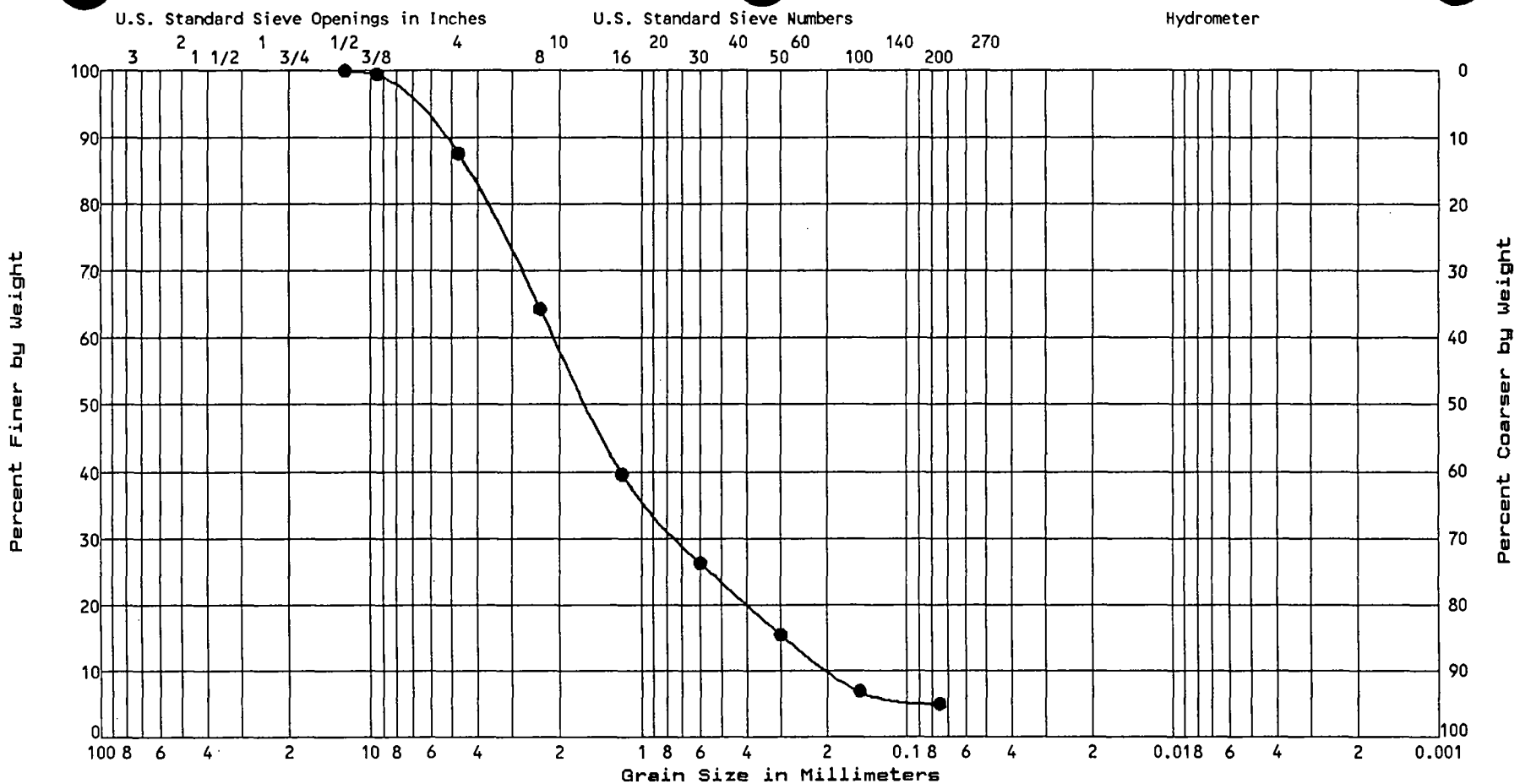
GRAIN SIZE DISTRIBUTION CURVE

Boring No.	Sample No.	Depth	Description	Unified Symbol	Natural WC	LL	PL	PI
●	2	29.4-30.3	SAND WITH CLAY, LIGHT BROWN & DARK BROWN					

Project HYDROFLEX -

Job No. 50905072 Date 3/29/91

Terracon



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

Boring No.	Sample No.	Depth	Description	Unified Symbol	Natural WC	LL	PL	PI
●	3	34.0-39.0	GRAVELY SAND TRACE CLAY, BROWN & DARK BROWN					

Project **HYDROFLEX -**

Job No. **50905072** Date **3/29/91**

Terracon

HYDROFLEX

JOB NO. 50905072

3/29/91

POROSITY RESULTS

SAMPLE ID	DRY DENSITY, PCF	SPECIFIC GRAVITY	POROSITY, %
28.3' TO 28.7'	117.0	2.650	29.2
28.7' TO 29.1'	114.0	2.650	31.1
29.1' TO 29.4'	111.8	2.650	32.4
29.4' TO 29.7'	110.9	2.648	32.9
29.7' TO 30.0'	104.6	2.648	36.7
30.0' TO 30.3'	115.8	2.648	29.9
34' TO 39'	127.5	2.630	22.3

Terracon

Item B-3: KDHE Analytical Results (March 1991 Samples)

State of Kansas
[redacted]
Governor Joan Finney
Department of Health and Environment
Division of Environment
Forbes Field, Bldg. 740, Topeka, KS 66620-0001

Stanley C. Grant, Ph.D., Acting Secretary

Respond to: (913) 296-1673
FAX (913) 296-6247
BER FAX (913) 296-1686

April 24, 1991

G.M. Zemansky
Senior Water Quality Engineer
Terracon Environmental, Inc.
7810 N.W. 100th
P.O. Box 901541
Kansas City, Missouri 64100-1541

RE: Hydro-Flex Site, Topeka

Dear Gil:

Enclosed is a copy of the sample analyses from the Hydro-Flex site in Topeka taken during March 1991. This should be a complete collection of the analyses results. As we discussed over the phone, we recommend that HF-4 be re-sampled for both field-filtered and unfiltered analyses for heavy metals. We also recommend that all remaining groundwater samples be taken for both field-filtered and unfiltered analyses for heavy metals. Although we agree to perform all the analyses, we request that you provide the filtering apparatus.

Please let me know when your next sampling episode will occur or if you have any questions concerning this data.

Sincerely,

Rachel Miller

Rachel Miller
Environmental Geologist
Remedial Section
Bureau of Environmental Remediation

C. Larry Knoche --> Marvin Glotzbach
Jeff Campbell - Hydro-Flex
Sharad Bhatia - Blackwell Sanders

KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102041PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 0815 Depth: ****

Site ID: Matrix: Soil

Date Collected: 3-18-91
Date Received: 3-20-91
Date Reported: 3-29-91

Comments: SB-125-25W-00(S1) SURFACE 2" DOWN
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		5778.82
Calcium	2632.156	Turbidity (NTU)	NA	Antimony		1.34
Magnesium	1472.203	Spec. Conductance (micromhos/cm)	NA	Arsenic		2.999
Sodium	77.265	T. Dissolved Solids	NA	Barium		91.857
Potassium	1294.16	Total Phosphorus (P)	NA	Beryllium		0.354
		Silica (SiO2)	5655.518	Cadmium		0.320
Total Alk. (CaCO3)	NA	Boron	2.924	Chromium		29.275
Chloride	NA	Dissolved Oxygen	NA	Cobalt		3.633
Sulfate	NA	BOD	NA	Copper		34.885
Nitrate (N)	NA	COD	NA	Iron		5561.932
Nitrite	NA	CBOD	NA	Lead		28.730
Fluoride	NA	Ammonia (N)	NA	Manganese		176.764
		T. Sus. Solids	NA	Mercury		NA
		Corrosivity (LI)	NA	Molybdenum	LT	0.10
Cyanide	NA	Kjeldahl Nitrogen	NA	Nickel		6.210
Oil/Grease	NA	Chromium (+6)	NA	Selenium	LT	3.00
Phenols	NA	Tin	NA	Silver	LT	0.40
TDP	NA	MBAS	NA	Thallium	LT	1.50
Sulfide	NA	Flash Pt (Celsius)	NA	Vanadium		10.628
				Zinc		32.250
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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M. GLOTZBACH-BER

KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102047PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1545 Depth: 5

Site ID: Matrix: Soil

Date Collected: 3-19-91
Date Received: 3-20-91
Date Reported: 3-29-91

Comments: SB-125-25W-05(S1) BORING SAMPLE
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum	6042.81
Calcium	3281.705	Turbidity (NTU)	NA	Antimony	LT 1.00
Magnesium	1779.653	Spec. Conductance (micromhos/cm)	NA	Arsenic	0.267
Sodium	84.847	T. Dissolved Solids	NA	Barium	171.501
Potassium	1552.31	Total Phosphorus (P)	NA	Beryllium	0.488
		Silica (SiO2)	4547.830	Cadmium	0.337
Total Alk. (CaCO3)	NA	Boron	4.169	Chromium	6.078
Chloride	NA	Dissolved Oxygen	NA	Cobalt	4.766
Sulfate	NA	BOD	NA	Copper	9.528
Nitrate (N)	NA	COD	NA	Iron	6197.737
Nitrite	NA	CBOD	NA	Lead	4.247
Fluoride	NA	Ammonia (N)	NA	Manganese	440.225
		T. Sus. Solids	NA	Mercury	NA
		Corrosivity (LI)	NA	Molybdenum	0.206
Cyanide	NA	Kjeldahl Nitrogen	NA	Nickel	10.929
Oil/Grease	NA	Chromium (+6)	NA	Selenium	1.635
Phenols	NA	Tin	NA	Silver	LT 0.40
TDP	NA	MBAS	NA	Thallium	0.54
Sulfide	NA	Flash Pt (Celsius)	NA	Vanadium	10.519
				Zinc	31.153
Total Coliform	NA				
Fecal Coliform	NA				
Fecal Strep	NA				

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
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RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102044PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 0930 Depth: ****

Site ID: Matrix: Soil

Date Collected: 3-18-91
Date Received: 3-20-91
Date Reported: 3-29-91

Comments: SB-125-00C-00(S2) SURFACE 2" DOWN
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		6131.92
Calcium	2816.175	Turbidity (NTU)	NA	Antimony		1.41
Magnesium	1642.116	Spec. Conductance (micromhos/cm)	NA	Arsenic		1.950
Sodium	78.185	T. Dissolved Solids	NA	Barium		92.828
Potassium	1402.85	Total Phosphorus (P)	NA	Beryllium		0.383
		Silica (SiO2)	6441.010	Cadmium		0.259
Total Alk. (CaCO3)	NA	Boron	3.169	Chromium		13.226
Chloride	NA	Dissolved Oxygen	NA	Cobalt		4.173
Sulfate	NA	BOD	NA	Copper		19.190
Nitrate (N)	NA	COD	NA	Iron		5906.733
Nitrite	NA	CBOD	NA	Lead		11.802
Fluoride	NA	Ammonia (N)	NA	Manganese		189.562
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		0.258
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel		7.884
Phenols	NA	Chromium (+6)	NA	Selenium	LT	3.00
TDP	NA	Tin	NA	Silver	LT	0.40
Sulfide	NA	MBAS	NA	Thallium	LT	1.50
		Flash Pt (Celsius)	NA	Vanadium		11.462
Total Coliform	NA			Zinc		26.778
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102068PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1545 Depth: 5

Site ID: Matrix: Soil

Date Collected: 3-20-91
Date Received: 3-21-91
Date Reported: 4- 1-91

Comments: SB-125-00C-05(S2-05) BORING SAMPLE
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		5858.06
Calcium	4827.984	Turbidity (NTU)	NA	Antimony		0.82
Magnesium	1953.242	Spec. Conductance (micromhos/cm)	NA	Arsenic	LT	2.100
Sodium	169.668	T. Dissolved Solids	NA	Barium		87.583
Potassium	1338.88	Total Phosphorus (P)	NA	Beryllium		0.265
		Silica (SiO2)	4420.697	Cadmium		0.003
Total Alk. (CaCO3)	NA	Boron	3.661	Chromium		5.673
Chloride	NA	Dissolved Oxygen	NA	Cobalt		3.177
Sulfate	NA	BOD	NA	Copper		4.386
Nitrate (N)	NA	COD	NA	Iron		5268.792
Nitrite	NA	CBOD	NA	Lead		3.324
Fluoride	NA	Ammonia (N)	NA	Manganese		102.936
		T. Sus. Solids	NA	Mercury		NA
		Corrosivity (LI)	NA	Molybdenum		0.102
Cyanide	NA	Kjeldahl Nitrogen	NA	Nickel		5.366
Oil/Grease	NA	Chromium (+6)	NA	Selenium	LT	3.00
Phenols	NA	Tin	NA	Silver	LT	0.40
TDP	NA	MBAS	NA	Thallium	LT	1.50
Sulfide	NA	Flash Pt (Celsius)	NA	Vanadium		11.234
				Zinc		17.926
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102046PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1630 Depth: ****

Site ID: Matrix: Soil

Date Collected: 3-19-91
Date Received: 3-20-91
Date Reported: 3-29-91

Comments: SB-125-25E-00(S3)
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		6223.73
Calcium	60255.656	Turbidity (NTU)	NA	Antimony		1.88
Magnesium	6463.696	Spec. Conductance (micromhos/cm)	NA	Arsenic		1.173
Sodium	132.296	T. Dissolved Solids	NA	Barium		118.581
Potassium	1161.68	Total Phosphorus (P)	NA	Beryllium		0.385
		Silica (SiO2)	4223.387	Cadmium		0.192
Total Alk. (CaCO3)	NA	Boron	3.445	Chromium		10.412
Chloride	NA	Dissolved Oxygen	NA	Cobalt		4.284
Sulfate	NA	BOD	NA	Copper		12.327
Nitrate (N)	NA	COD	NA	Iron		9300.908
Nitrite	NA	CBOD	NA	Lead		9.132
Fluoride	NA	Ammonia (N)	NA	Manganese		384.349
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		0.826
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel		7.911
Phenols	NA	Chromium (+6)	NA	Selenium	LT	3.00
TDP	NA	Tin	NA	Silver	LT	0.40
Sulfide	NA	MBAS	NA	Thallium	LT	1.50
		Flash Pt (Celsius)	NA	Vanadium		12.581
				Zinc		24.844
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
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RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102071PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1445 Depth: 5

Site ID: Matrix: Soil

Date Collected: 3-21-91
Date Received: 3-21-91
Date Reported: 4- 1-91

Comments: SB-125-25E-05(S3-05) BORING SAMPLE
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		7867.97
Calcium	7964.184	Turbidity (NTU)	NA	Antimony		2.33
Magnesium	2559.841	Spec. Conductance (micromhos/cm)	NA	Arsenic	LT	2.100
Sodium	237.582	T. Dissolved Solids	NA	Barium		122.217
Potassium	1703.09	Total Phosphorus (P)	NA	Beryllium		0.388
		Silica (SiO2)	4899.176	Cadmium		0.295
Total Alk. (CaCO3)	NA	Boron	4.497	Chromium		8.675
Chloride	NA	Dissolved Oxygen	NA	Cobalt		4.212
Sulfate	NA	BOD	NA	Copper		6.430
Nitrate (N)	NA	COD	NA	Iron		7095.827
Nitrite	NA	CBOD	NA	Lead		5.683
Fluoride	NA	Ammonia (N)	NA	Manganese		147.812
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		0.254
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel		7.404
Phenols	NA	Chromium (+6)	NA	Selenium	LT	3.00
TDP	NA	Tin	NA	Silver	LT	0.40
Sulfide	NA	MBAS	NA	Thallium	LT	1.50
		Flash Pt (Celsius)	NA	Vanadium		15.445
				Zinc		22.811
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

[redacted]t To: RACHEL MILLER-BER
[redacted]ess:

Lab Number: 102042PT
Lab Acct Code: BER
Env Acct Code: ER

[redacted]ity: NE22-1115E 04089026 HYDRO-FLEX

[redacted]lected By: RACHEL MILLER Time: 0830 Depth: ****

[redacted] ID: Matrix: Soil

Date Collected: 3-18-91
Date Received: 3-20-91
Date Reported: 3-29-91

[redacted]ments: SB-050-00C-00(S5) SURFACE 2" DOWN
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

[redacted]al Hard.		pH (Units)	NA	Aluminum		7212.83
[redacted]CO3)	NA	Turbidity (NTU)	NA	Antimony		1.26
[redacted]ium	2662.669	Spec. Conductance		Arsenic		0.490
[redacted]nesium	1653.158	(micromhos/cm)	NA	Barium		93.800
[redacted]m	93.866	T. Dissolved Solids	NA	Beryllium		0.396
[redacted]um	1345.11	Total Phosphorus (P)	NA	Cadmium		0.125
		Silica (SiO2)	3495.012	Chromium		24.338
[redacted]al Alk.		Boron	3.480	Cobalt		4.294
[redacted]CO3)	NA	Dissolved Oxygen	NA	Copper		27.753
[redacted]ride	NA	BOD	NA	Iron		7028.465
[redacted]fate	NA	COD	NA	Lead		9.173
[redacted]rate (N)	NA	CBOD	NA	Manganese		158.789
[redacted]te	NA	Ammonia (N)	NA	Mercury		NA
[redacted]oride	NA	T. Sus. Solids	NA	Molybdenum		0.568
		Corrosivity (LI)	NA	Nickel		7.399
[redacted]ide	NA	Kjeldahl Nitrogen	NA	Selenium	LT	3.00
[redacted]Grease	NA	Chromium (+6)	NA	Silver	LT	0.40
[redacted]nols	NA	Tin	NA	Thallium	LT	1.50
[redacted]	NA	MBAS	NA	Vanadium		13.722
[redacted]ide	NA	Flash Pt (Celsius)	NA	Zinc		30.851

[redacted]al Coliform NA
[redacted] Coliform NA
[redacted] Strep NA

[redacted]mist: FD NA - Not Analyzed LT - Less Than

* *

[redacted]y To: File
M. GLOTZBACH-BER

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 102780OC
Report Date: 4- 5-91

SAMPLE COLLECTION INFORMATION

Site ID No.: Program Code: ER Sample Type: SOIL
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX SB-050-00C-00 (S5)
Collected By: RACHEL MILLER-BER Date: 3-19-91 Time: 1430

RESULTS OF ANALYSIS

PRIORITY POLLUTANT ACID EXTRACTABLES	Concentration (MG/KG)	Reporting Limit (MG/KG)
ORTHO-CHLOROPHENOL	NOT DETECTED	1.0
2-NITROPHENOL	NOT DETECTED	1.0
PHENOL	NOT DETECTED	1.0
2,4-DIMETHYLPHENOL	NOT DETECTED	1.0
2,4-DICHLOROPHENOL	NOT DETECTED	1.0
2,4,6-TRICHLOROPHENOL	NOT DETECTED	1.0
P-CHLORO-M-CRESOL	NOT DETECTED	1.0
2,4-DINITROPHENOL	NOT DETECTED	25.0
4,6-DINITRO-O-CRESOL	NOT DETECTED	5.0
PENTACHLOROPHENOL	NOT DETECTED	5.0
4-NITROPHENOL	NOT DETECTED	5.0

Note: 2,6-Dichlorophenol if present, is calculated as 2,4-Dichlorophenol.

Comment: THE ABOVE RESULTS AND DETECTION LEVELS ARE ON A DRY WEIGHT BASIS.

Analyst: DENNIS L. DOBSON

Roger H. Carlson, Ph.D., Director

Copy To: M. GLOTZBACH-BER

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 102743OC
Report Date: 4- 5-91

SAMPLE COLLECTION INFORMATION

Site ID No.: Program Code: ER Sample Type: SOIL
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX SB-050-00C-00 (S5)
Collected By: RACHEL MILLER-BER Date: 3-19-91 Time: 1430

RESULTS OF ANALYSIS

PRIORITY POLLUTANT BASE NEUTRAL EXTRACTABLES	Concentration (MG/KG)	Reporting Limit (MG/KG)
HEXACHLOROETHANE	NOT DETECTED	1.0
BIS(2-CHLOROETHYL)ETHER	NOT DETECTED	1.0
BIS(2-CHLOROISOPROPYL)ETHER	NOT DETECTED	1.0
HEXACHLOROBUTADIENE	NOT DETECTED	1.0
1,2,4-TRICHLOROBENZENE	NOT DETECTED	1.0
NAPHTHALENE	NOT DETECTED	1.0
BIS(2-CHLOROETHOXY)METHANE	NOT DETECTED	1.0
2-CHLORONAPHTHALENE	NOT DETECTED	1.0
ACENAPHTHYLENE	NOT DETECTED	1.0
ACENAPHTHENE	NOT DETECTED	1.0
DIMETHYL PHTHALATE	NOT DETECTED	1.0
2,6-DINITROTOLUENE	NOT DETECTED	1.0
FLUORENE	NOT DETECTED	1.0
[illegible]HLOROPHENYL PHENYL ETHER	NOT DETECTED	1.0
[illegible]-DINITROTOLUENE	NOT DETECTED	1.0
DIETHYL PHTHALATE	NOT DETECTED	1.0
HEXACHLOROBENZENE	NOT DETECTED	1.0
4-BROMOPHENYL PHENYL ETHER	NOT DETECTED	1.0
PHENANTHRENE &/OR ANTHRACENE	NOT DETECTED	1.0
DI-N-BUTYL PHTHALATE	NOT DETECTED	1.0
FLUORANTHENE	NOT DETECTED	1.0
PYRENE	NOT DETECTED	1.0
BUTYL BENZYL PHTHALATE	NOT DETECTED	1.0
BIS(2-ETHYLHEXYL) PHTHALATE	NOT DETECTED	5.0
CHRYSENE &/OR BENZO(A)ANTHRACENE	NOT DETECTED	1.0
DI-N-OCTYL PHTHALATE	NOT DETECTED	5.0
BENZO<(B) &/OR (K)>FLUORANTHENE	NOT DETECTED	1.0
BENZO(A)PYRENE	NOT DETECTED	1.0
INDENO(1,2,3-C,D)PYRENE	NOT DETECTED	1.0
DIBENZO(A,H)ANTHRACENE	NOT DETECTED	1.0
BENZO(G,H,I)PERYLENE	NOT DETECTED	1.0

Comment: THE ABOVE RESULTS AND DETECTION LEVELS ARE ON A DRY WEIGHT BASIS.

Analyst: DENNIS L. DOBSON

Roger H. Carlson, Ph.D., Director

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 1027480C
Report Date: 3-27-91

SAMPLE COLLECTION INFORMATION

Site ID No.: Program Code: ER Sample Type: SOIL
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX SB-050-00C-00(S5)
Collected By: RACHEL MILLER-BER Date: 3-18-91 Time: 1045

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (MG/KG)	Reporting Limit (MG/KG)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	7.2	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROPROPANE	NOT DETECTED	0.5
TRANS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE RLP

Roger H. Carlson, Ph.D., Director

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KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102048PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1500 Depth: 3

Site ID: Matrix: Soil

Date Collected: 3-19-91
Date Received: 3-20-91
Date Reported: 3-29-91

Comments: SB-050-00C-03-(S5-03)
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		4443.18
Calcium	1641.706	Turbidity (NTU)	NA	Antimony	LT	1.00
Magnesium	1306.493	Spec. Conductance (micromhos/cm)	NA	Arsenic		1.222
Sodium	176.063	T. Dissolved Solids	NA	Barium		57.171
Potassium	930.71	Total Phosphorus (P)	NA	Beryllium		0.263
		Silica (SiO2)	4322.684	Cadmium		0.009
Total Alk. (CaCO3)	NA	Boron	2.654	Chromium		3.501
Chloride	NA	Dissolved Oxygen	NA	Cobalt		2.031
Sulfate	NA	BOD	NA	Copper		3.465
Nitrate (N)	NA	COD	NA	Iron		4020.608
Nitrite	NA	CBOD	NA	Lead		0.544
Fluoride	NA	Ammonia (N)	NA	Manganese		85.573
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum	LT	0.10
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel		3.968
Phenols	NA	Chromium (+6)	NA	Selenium		2.554
TDP	NA	Tin	NA	Silver	LT	0.40
Sulfide	NA	MBAS	NA	Thallium	LT	1.50
		Flash Pt (Celsius)	NA	Vanadium		7.151
Total Coliform	NA			Zinc		12.946
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 1027470C
Report Date: 3-27-91

SAMPLE COLLECTION INFORMATION

Site ID No.: Program Code: ER Sample Type: SOIL
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX SB-050-00C-03(S5)
Collected By: RACHEL MILLER-BER Date: 3-20-91 Time: 0730

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (MG/KG)	Reporting Limit (MG/KG)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	6.9	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROPROPANE	NOT DETECTED	0.5
TRANS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE RLP

Roger H. Carlson, Ph.D., Director

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: [redacted] Lab Number: 102781OC
Address: FORBES BLDG. 740, TOPEKA, KS. 66620 Report Date: 4- 5-91

SAMPLE COLLECTION INFORMATION

Site ID No.: Program Code: ER Sample Type: SOIL
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX SB-050-OOC-03(S5)
Collected By: RACHEL MILLER-BER Date: 3-19-91 Time: 1500

RESULTS OF ANALYSIS

PRIORITY POLLUTANT ACID EXTRACTABLES	Concentration (MG/KG)	Reporting Limit (MG/KG)
ORTHO-CHLOROPHENOL	NOT DETECTED	1.0
2-NITROPHENOL	NOT DETECTED	1.0
PHENOL	NOT DETECTED	1.0
2,4-DIMETHYLPHENOL	NOT DETECTED	1.0
2,4-DICHLOROPHENOL	NOT DETECTED	1.0
2,4,6-TRICHLOROPHENOL	NOT DETECTED	1.0
4-CHLORO-M-CRESOL	NOT DETECTED	1.0
2,4-DINITROPHENOL	NOT DETECTED	25.0
4,6-DINITRO-O-CRESOL	NOT DETECTED	5.0
PENTACHLOROPHENOL	NOT DETECTED	5.0
4-NITROPHENOL	NOT DETECTED	5.0

Note: 2,6-Dichlorophenol if present, is calculated as 2,4-Dichlorophenol.

Comment: THE ABOVE RESULTS AND DETECTION LEVELS ARE ON A DRY WEIGHT BASIS.

Analyst: DENNIS L. DOBSON Roger H. Carlson, Ph.D., Director

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Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 102744OC
Report Date: 4- 5-91

SAMPLE COLLECTION INFORMATION

Site ID No.: Program Code: ER Sample Type: SOIL
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX SB-050-OOC-03(S5)
Collected By: RACHEL MILLER-BER Date: 3-19-91 Time: 1500

RESULTS OF ANALYSIS

PRIORITY POLLUTANT BASE NEUTRAL EXTRACTABLES	Concentration (MG/KG)	Reporting Limit (MG/KG)
HEXACHLOROETHANE	NOT DETECTED	1.0
BIS(2-CHLOROETHYL)ETHER	NOT DETECTED	1.0
BIS(2-CHLOROISOPROPYL)ETHER	NOT DETECTED	1.0
HEXACHLOROBUTADIENE	NOT DETECTED	1.0
1,2,4-TRICHLOROBENZENE	NOT DETECTED	1.0
NAPHTHALENE	NOT DETECTED	1.0
BIS(2-CHLOROETHOXY)METHANE	NOT DETECTED	1.0
2-CHLORONAPHTHALENE	NOT DETECTED	1.0
ACENAPHTHYLENE	NOT DETECTED	1.0
ACENAPHTHENE	NOT DETECTED	1.0
DIMETHYL PHTHALATE	NOT DETECTED	1.0
2,6-DINITROTOLUENE	NOT DETECTED	1.0
FLUORENE	NOT DETECTED	1.0
[illegible]HLOROPHENYL PHENYL ETHER	NOT DETECTED	1.0
[illegible]-DINITROTOLUENE	NOT DETECTED	1.0
DIETHYL PHTHALATE	NOT DETECTED	1.0
HEXACHLOROBENZENE	NOT DETECTED	1.0
4-BROMOPHENYL PHENYL ETHER	NOT DETECTED	1.0
PHENANTHRENE &/OR ANTHRACENE	NOT DETECTED	1.0
DI-N-BUTYL PHTHALATE	NOT DETECTED	1.0
FLUORANTHENE	NOT DETECTED	1.0
PYRENE	NOT DETECTED	1.0
BUTYL BENZYL PHTHALATE	NOT DETECTED	1.0
BIS(2-ETHYLHEXYL) PHTHALATE	NOT DETECTED	5.0
CHRYSENE &/OR BENZO(A)ANTHRACENE	NOT DETECTED	1.0
DI-N-OCTYL PHTHALATE	NOT DETECTED	5.0
BENZO<(B) &/OR (K)>FLUORANTHENE	NOT DETECTED	1.0
BENZO(A)PYRENE	NOT DETECTED	1.0
INDENO(1,2,3-C,D)PYRENE	NOT DETECTED	1.0
DIBENZO(A,H)ANTHRACENE	NOT DETECTED	1.0
BENZO(G,H,I)PERYLENE	NOT DETECTED	1.0

Comment: THE ABOVE RESULTS AND DETECTION LEVELS ARE ON A DRY WEIGHT BASIS.

Analyst: DENNIS L. DOBSON

Roger H. Carlson, Ph.D., Director

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KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102067PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1600 Depth: 5

Site ID: Matrix: Soil

Date Collected: 3-20-91
Date Received: 3-21-91
Date Reported: 4- 1-91

Comments: SB-050-00C-05(S5-05) BORING SAMPLE
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		8972.33
Calcium	4709.542	Turbidity (NTU)	NA	Antimony		0.62
Magnesium	2281.585	Spec. Conductance (micromhos/cm)	NA	Arsenic	LT	2.100
Sodium	720.665	T. Dissolved Solids	NA	Barium		83.422
Potassium	1952.83	Total Phosphorus (P)	NA	Beryllium		0.472
		Silica (SiO2)	3491.172	Cadmium		0.301
Total Alk. (CaCO3)	NA	Boron	8.162	Chromium		13.232
Chloride	NA	Dissolved Oxygen	NA	Cobalt		5.362
Sulfate	NA	BOD	NA	Copper		7.386
Nitrate (N)	NA	COD	NA	Iron		8077.002
Nitrite	NA	CBOD	NA	Lead		8.284
Fluoride	NA	Ammonia (N)	NA	Manganese		313.831
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		0.458
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel		10.602
Phenols	NA	Chromium (+6)	NA	Selenium	LT	3.00
TDP	NA	Tin	NA	Silver	LT	0.40
Sulfide	NA	MBAS	NA	Thallium	LT	1.50
		Flash Pt (Celsius)	NA	Vanadium		15.820
Total Coliform	NA			Zinc		35.280
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 102841OC
Report Date: 3-27-91

SAMPLE COLLECTION INFORMATION

Site ID No.: Program Code: ER Sample Type: SOIL
Collection Site: 000000NE221115E, 04089026 HYDRO-FLEX SB-050-00C-05
Collected By: RACHEL MILLER-BER Date: 3-20-91 Time: 1535

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (MG/KG)	Reporting Limit (MG/KG)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	5.6	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
[illegible]-DICHLOROPROPANE	NOT DETECTED	0.5
[illegible]NS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE RLP

Roger H. Carlson, Ph.D., Director

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 102837OC
Report Date: 4- 9-91

SAMPLE COLLECTION INFORMATION

Site ID No.: Program Code: ER Sample Type: SOIL
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX SB-050-00C-05
Collected By: RACHEL MILLER-BER Date: 3-20-91 Time: 1535

RESULTS OF ANALYSIS

PRIORITY POLLUTANT ACID EXTRACTABLES	Concentration (MG/KG)	Reporting Limit (MG/KG)
ORTHO-CHLOROPHENOL	NOT DETECTED	1.0
2-NITROPHENOL	NOT DETECTED	1.0
PHENOL	NOT DETECTED	1.0
2,4-DIMETHYLPHENOL	NOT DETECTED	1.0
2,4-DICHLOROPHENOL	NOT DETECTED	1.0
2,4,6-TRICHLOROPHENOL	NOT DETECTED	1.0
4-CHLORO-M-CRESOL	NOT DETECTED	1.0
2,4-DINITROPHENOL	NOT DETECTED	25.0
4,6-DINITRO-O-CRESOL	NOT DETECTED	5.0
PENTACHLOROPHENOL	NOT DETECTED	5.0
4-NITROPHENOL	NOT DETECTED	5.0

Note: 2,6-Dichlorophenol if present, is calculated as 2,4-Dichlorophenol.

Comment: THE ABOVE RESULTS AND DETECTION LEVELS ARE ON A DRY WEIGHT BASIS.

Analyst: DENNIS L. DOBSON

Roger H. Carlson, Ph.D., Director

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 1028360C
Report Date: 4- 9-91

SAMPLE COLLECTION INFORMATION

Site ID No.: Program Code: ER Sample Type: SOIL
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX SB-050-00C-05
Collected By: RACHEL MILLER-BER Date: 3-20-91 Time: 1535

RESULTS OF ANALYSIS

PRIORITY POLLUTANT BASE NEUTRAL EXTRACTABLES	Concentration (MG/KG)	Reporting Limit (MG/KG)
HEXACHLOROETHANE	NOT DETECTED	1.0
BIS(2-CHLOROETHYL)ETHER	NOT DETECTED	1.0
BIS(2-CHLOROISOPROPYL)ETHER	NOT DETECTED	1.0
HEXACHLOROBUTADIENE	NOT DETECTED	1.0
1,2,4-TRICHLOROBENZENE	NOT DETECTED	1.0
NAPHTHALENE	NOT DETECTED	1.0
BIS(2-CHLOROETHOXY)METHANE	NOT DETECTED	1.0
2-CHLORONAPHTHALENE	NOT DETECTED	1.0
ACENAPHTHYLENE	NOT DETECTED	1.0
ACENAPHTHENE	NOT DETECTED	1.0
DIMETHYL PHTHALATE	NOT DETECTED	1.0
2,6-DINITROTOLUENE	NOT DETECTED	1.0
FLUORENE	NOT DETECTED	1.0
[illegible]HLOROPHENYL PHENYL ETHER	NOT DETECTED	1.0
[illegible]-DINITROTOLUENE	NOT DETECTED	1.0
DIETHYL PHTHALATE	NOT DETECTED	1.0
HEXACHLOROBENZENE	NOT DETECTED	1.0
4-BROMOPHENYL PHENYL ETHER	NOT DETECTED	1.0
PHENANTHRENE &/OR ANTHRACENE	NOT DETECTED	1.0
DI-N-BUTYL PHTHALATE	NOT DETECTED	1.0
FLUORANTHENE	NOT DETECTED	1.0
PYRENE	NOT DETECTED	1.0
BUTYL BENZYL PHTHALATE	NOT DETECTED	1.0
BIS(2-ETHYLHEXYL) PHTHALATE	NOT DETECTED	5.0
CHRYSENE &/OR BENZO(A)ANTHRACENE	NOT DETECTED	1.0
DI-N-OCTYL PHTHALATE	NOT DETECTED	5.0
BENZO<(B) &/OR (K)>FLUORANTHENE	NOT DETECTED	1.0
BENZO(A)PYRENE	NOT DETECTED	1.0
INDENO(1,2,3-C,D)PYRENE	NOT DETECTED	1.0
DIBENZO(A,H)ANTHRACENE	NOT DETECTED	1.0
BENZO(G,H,I)PERYLENE	NOT DETECTED	1.0

Comment: THE ABOVE RESULTS AND DETECTION LEVELS ARE ON A DRY WEIGHT BASIS.

Analyst: DENNIS L. DOBSON

Roger H. Carlson, Ph.D., Director

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KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102063PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 0730 Depth: ****

Site ID: Matrix: Soil

Date Collected: 3-18-91
Date Received: 3-21-91
Date Reported: 3-29-91

Comments: SB-020-35W-00(S7) SURFACE 2" DOWN
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		8188.42
		Turbidity (NTU)	NA	Antimony	LT	1.00
Calcium	2521.396	Spec. Conductance		Arsenic	LT	2.100
Magnesium	1840.826	(micromhos/cm)	NA	Barium		97.034
Sodium	99.863	T. Dissolved Solids	NA	Beryllium		0.399
Potassium	1675.34	Total Phosphorus (P)	NA	Cadmium		0.300
		Silica (SiO2)	1797.752	Chromium		29.134
Total Alk. (CaCO3)	NA	Boron	3.800	Cobalt		4.101
		Dissolved Oxygen	NA	Copper		47.780
Chloride	NA	BOD	NA	Iron		7227.745
Sulfate	NA	COD	NA	Lead		12.226
Nitrate (N)	NA	CBOD	NA	Manganese		174.607
Nitrite	NA	Ammonia (N)	NA	Mercury		NA
Fluoride	NA	T. Sus. Solids	NA	Molybdenum		0.661
		Corrosivity (LI)	NA	Nickel		7.482
Cyanide	NA	Kjeldahl Nitrogen	NA	Selenium	LT	3.00
Oil/Grease	NA	Chromium (+6)	NA	Silver	LT	0.40
Phenols	NA	Tin	NA	Thallium	LT	1.50
TDP	NA	MBAS	NA	Vanadium		14.990
Sulfide	NA	Flash Pt (Celsius)	NA	Zinc		28.116
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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Department of Health and Environment
Biochemical Analysis Laboratory
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(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102065PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1100 Depth: 5

Site ID: Matrix: Soil

Date Collected: 3-18-91
Date Received: 3-18-91
Date Reported: 3-29-91

Comments: SB-020-35W-05 BORING SAMPLE
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		6324.14
Calcium	2153.338	Turbidity (NTU)	NA	Antimony	LT	1.00
Magnesium	1520.717	Spec. Conductance (micromhos/cm)	NA	Arsenic	LT	2.100
Sodium	188.813	T. Dissolved Solids	NA	Barium		79.903
Potassium	1293.79	Total Phosphorus (P)	NA	Beryllium		0.320
		Silica (SiO2)	3906.681	Cadmium		0.123
Total Alk. (CaCO3)	NA	Boron	3.346	Chromium		10.774
Chloride	NA	Dissolved Oxygen	NA	Cobalt		3.427
Sulfate	NA	BOD	NA	Copper		7.650
Nitrate (N)	NA	COD	NA	Iron		5945.101
Nitrite	NA	CBOD	NA	Lead		5.429
Fluoride	NA	Ammonia (N)	NA	Manganese		137.264
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		0.254
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel		6.810
Phenols	NA	Chromium (+6)	NA	Selenium	LT	3.00
TDP	NA	Tin	NA	Silver	LT	0.40
Sulfide	NA	MBAS	NA	Thallium	LT	1.50
		Flash Pt (Celsius)	NA	Vanadium		12.234
				Zinc		19.425
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102060PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1110 Depth: 10

Site ID: Matrix: Soil

Date Collected: 3-18-91
Date Received: 3-21-91
Date Reported: 3-29-91

Comments: SB-020-35W-10(S7) BORING SAMPLE
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		1713.30
Calcium	776.590	Turbidity (NTU)	NA	Antimony		1.66
Magnesium	433.566	Spec. Conductance (micromhos/cm)	NA	Arsenic	LT	2.100
Sodium	87.335	T. Dissolved Solids	NA	Barium		20.221
Potassium	457.86	Total Phosphorus (P)	NA	Beryllium		0.024
		Silica (SiO2)	4565.984	Cadmium		0.164
Total Alk. (CaCO3)	NA	Boron	1.952	Chromium		2.471
Chloride	NA	Dissolved Oxygen	NA	Cobalt		1.813
Sulfate	NA	BOD	NA	Copper		2.440
Nitrate (N)	NA	COD	NA	Iron		2187.801
Nitrite	NA	CBOD	NA	Lead		4.930
Fluoride	NA	Ammonia (N)	NA	Manganese		45.072
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		0.203
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel		2.786
Phenols	NA	Chromium (+6)	NA	Selenium	LT	3.00
TDP	NA	Tin	NA	Silver		0.224
Sulfide	NA	MBAS	NA	Thallium	LT	1.50
		Flash Pt (Celsius)	NA	Vanadium		5.150
				Zinc		6.643
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102064PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1115 Depth: 16

Site ID: Matrix: Soil

Date Collected: 3-18-91
Date Received: 3-21-91
Date Reported: 3-29-91

Comments: SB-020-35W-16(S7) BORING SAMPLE
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		25522.42
Calcium	21985.996	Turbidity (NTU)	NA	Antimony		2.83
Magnesium	6796.841	Spec. Conductance (micromhos/cm)	NA	Arsenic	LT	2.100
Sodium	1373.927	T. Dissolved Solids	NA	Barium		194.045
Potassium	5081.51	Total Phosphorus (P)	NA	Beryllium		1.131
		Silica (SiO2)	1779.421	Cadmium		0.857
Total Alk. (CaCO3)	NA	Boron	13.640	Chromium		25.640
Chloride	NA	Dissolved Oxygen	NA	Cobalt		7.438
Sulfate	NA	BOD	NA	Copper		19.521
Nitrate (N)	NA	COD	NA	Iron		19433.813
Nitrite	NA	CBOD	NA	Lead		10.903
Fluoride	NA	Ammonia (N)	NA	Manganese		221.543
		T. Sus. Solids	NA	Mercury		NA
		Corrosivity (LI)	NA	Molybdenum		0.407
Cyanide	NA	Kjeldahl Nitrogen	NA	Nickel		17.207
Oil/Grease	NA	Chromium (+6)	NA	Selenium	LT	3.00
Phenols	NA	Tin	NA	Silver	LT	0.40
TDP	NA	MBAS	NA	Thallium	LT	1.50
Sulfide	NA	Flash Pt (Celsius)	NA	Vanadium		38.100
				Zinc		71.851
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102049PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 0830 Depth: ****

Site ID: Matrix: Soil

Date Collected: 3-19-91
Date Received: 3-20-91
Date Reported: 3-29-91

Comments: SB-25N-25W-00(S9)
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		5093.23
Calcium	2722.458	Turbidity (NTU)	NA	Antimony	LT	1.00
Magnesium	1471.555	Spec. Conductance (micromhos/cm)	NA	Arsenic		1.373
Sodium	64.896	T. Dissolved Solids	NA	Barium		92.680
Potassium	1613.45	Total Phosphorus (P)	NA	Beryllium		0.374
		Silica (SiO2)	7290.544	Cadmium		0.163
Total Alk. (CaCO3)	NA	Boron	3.724	Chromium		9.381
Chloride	NA	Dissolved Oxygen	NA	Cobalt		2.672
Sulfate	NA	BOD	NA	Copper		13.660
Nitrate (N)	NA	COD	NA	Iron		4885.394
Nitrite	NA	CBOD	NA	Lead		5.633
Fluoride	NA	Ammonia (N)	NA	Manganese		133.401
		T. Sus. Solids	NA	Mercury		NA
		Corrosivity (LI)	NA	Molybdenum		0.103
Cyanide	NA	Kjeldahl Nitrogen	NA	Nickel		5.888
Oil/Grease	NA	Chromium (+6)	NA	Selenium		1.449
Phenols	NA	Tin	NA	Silver	LT	0.40
TDP	NA	MBAS	NA	Thallium		0.38
Sulfide	NA	Flash Pt (Celsius)	NA	Vanadium		9.830
				Zinc		19.620
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102045PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1415 Depth: 5

Site ID: Matrix: Soil

Date Collected: 3-19-91
Date Received: 3-20-91
Date Reported: 3-29-91

Comments: SB-25N-25W-05(S9-05) BORING SAMPLE
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		16705.21
Calcium	19330.256	Turbidity (NTU)	NA	Antimony		3.79
Magnesium	4857.267	Spec. Conductance (micromhos/cm)	NA	Arsenic		0.772
Sodium	161.670	T. Dissolved Solids	NA	Barium		157.174
Potassium	3328.80	Total Phosphorus (P)	NA	Beryllium		1.070
		Silica (SiO2)	4554.100	Cadmium		1.062
Total Alk. (CaCO3)	NA	Boron	4.915	Chromium		13.953
Chloride	NA	Dissolved Oxygen	NA	Cobalt		12.771
Sulfate	NA	BOD	NA	Copper		19.957
Nitrate (N)	NA	COD	NA	Iron		16138.743
Nitrite	NA	CBOD	NA	Lead		16.445
Fluoride	NA	Ammonia (N)	NA	Manganese		803.440
		T. Sus. Solids	NA	Mercury		NA
		Corrosivity (LI)	NA	Molybdenum		0.206
Cyanide	NA	Kjeldahl Nitrogen	NA	Nickel		30.380
Oil/Grease	NA	Chromium (+6)	NA	Selenium	LT	3.00
Phenols	NA	Tin	NA	Silver	LT	0.40
TDP	NA	MBAS	NA	Thallium	LT	1.50
Sulfide	NA	Flash Pt (Celsius)	NA	Vanadium		28.509
				Zinc		58.641
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102043PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 0900 Depth: ****

Site ID: Matrix: Soil

Date Collected: 3-18-91
Date Received: 3-20-91
Date Reported: 3-29-91

Comments: SB-25N-00C-00(S10)
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		5779.38
Calcium	3012.579	Turbidity (NTU)	NA	Antimony		2.40
Magnesium	1532.485	Spec. Conductance (micromhos/cm)	NA	Arsenic		1.175
Sodium	97.694	T. Dissolved Solids	NA	Barium		89.664
Potassium	1413.04	Total Phosphorus (P)	NA	Beryllium		0.345
		Silica (SiO2)	6888.971	Cadmium		0.400
Total Alk. (CaCO3)	NA	Boron	4.412	Chromium		23.637
Chloride	NA	Dissolved Oxygen	NA	Cobalt		4.124
Sulfate	NA	BOD	NA	Copper		31.084
Nitrate (N)	NA	COD	NA	Iron		5963.746
Nitrite	NA	CBOD	NA	Lead		11.357
Fluoride	NA	Ammonia (N)	NA	Manganese		169.247
		T. Sus. Solids	NA	Mercury		NA
		Corrosivity (LI)	NA	Molybdenum		0.361
Cyanide	NA	Kjeldahl Nitrogen	NA	Nickel		6.784
Oil/Grease	NA	Chromium (+6)	NA	Selenium	LT	3.00
Phenols	NA	Tin	NA	Silver	LT	0.40
TDP	NA	MBAS	NA	Thallium	LT	1.50
Sulfide	NA	Flash Pt (Celsius)	NA	Vanadium		10.691
				Zinc		45.676
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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RESULTS OF LABORATORY ANALYSES

eport To: RACHEL MILLER-BER
ddress:

Lab Number: 102069PT
Lab Acct Code: BER
Env Acct Code: ER

ocality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1500 Depth: 5

ite ID: Matrix: Soil

Date Collected: 3-20-91
Date Received: 3-21-91
Date Reported: 4- 1-91

Comments: SB-25N-00C-05(S10-05)
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard.		pH (Units)	NA	Aluminum		9551.07
(CaCO3)	NA	Turbidity (NTU)	NA	Antimony		2.38
alcium	2787.790	Spec. Conductance		Arsenic	LT	2.100
Magnesium	2237.505	(micromhos/cm)	NA	Barium		106.823
Sodium	91.393	T. Dissolved Solids	NA	Beryllium		0.494
assium	2095.04	Total Phosphorus (P)	NA	Cadmium		0.305
		Silica (SiO2)	2905.381	Chromium		9.366
Total Alk.		Boron	4.111	Cobalt		5.891
(CaCO3)	NA	Dissolved Oxygen	NA	Copper		9.068
hloride	NA	BOD	NA	Iron		8544.544
Sulfate	NA	COD	NA	Lead		9.024
Nitrate (N)	NA	CBOD	NA	Manganese		244.729
itrite	NA	Ammonia (N)	NA	Mercury		NA
luoride	NA	T. Sus. Solids	NA	Molybdenum		0.356
		Corrosivity (LI)	NA	Nickel		9.571
yanide	NA	Kjeldahl Nitrogen	NA	Selenium	LT	3.00
il/Grease	NA	Chromium (+6)	NA	Silver	LT	0.40
Phenols	NA	Tin	NA	Thallium	LT	1.50
TDP	NA	MBAS	NA	Vanadium		18.030
ulfide	NA	Flash Pt (Celsius)	NA	Zinc		30.633

Total Coliform	NA
ecal Coliform	NA
ecal Strep	NA

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-~~BER~~
Address:

Lab Number: 102052PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 0730 Depth: ****

Site ID: Matrix: Soil

Date Collected: 3-20-91
Date Received: 3-20-91
Date Reported: 3-29-91

Comments: SB-25N-25E-00(S11) SURFACE-2"
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		5341.02
Calcium	2382.937	Turbidity (NTU)	NA	Antimony	LT	1.00
Magnesium	1390.739	Spec. Conductance (micromhos/cm)	NA	Arsenic		2.425
Sodium	66.479	T. Dissolved Solids	NA	Barium		93.560
Potassium	1243.21	Total Phosphorus (P)	NA	Beryllium		0.366
		Silica (SiO2)	7641.745	Cadmium	LT	0.20
Total Alk. (CaCO3)	NA	Boron	6.347	Chromium		6.659
Chloride	NA	Dissolved Oxygen	NA	Cobalt		2.864
Sulfate	NA	BOD	NA	Copper		10.894
Nitrate (N)	NA	COD	NA	Iron		5011.170
Nitrite	NA	CBOD	NA	Lead		4.364
Fluoride	NA	Ammonia (N)	NA	Manganese		167.600
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		0.206
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel		5.606
Phenols	NA	Chromium (+6)	NA	Selenium		1.986
TDP	NA	Tin	NA	Silver	LT	0.40
Sulfide	NA	MBAS	NA	Thallium		1.38
		Flash Pt (Celsius)	NA	Vanadium		9.840
				Zinc		21.890
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102070PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1515 Depth: 5

Site ID: Matrix: Soil

Date Collected: 3-20-91
Date Received: 3-21-91
Date Reported: 4- 1-91

Comments: SB-25N-25E-05(S11-05) BORING SAMPLE
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		9760.05
Calcium	3533.509	Turbidity (NTU)	NA	Antimony		0.12
Magnesium	2653.256	Spec. Conductance (micromhos/cm)	NA	Arsenic	LT	2.100
Sodium	157.692	T. Dissolved Solids	NA	Barium		155.002
Potassium	1990.98	Total Phosphorus (P)	NA	Beryllium		0.561
		Silica (SiO2)	4812.890	Cadmium		0.406
Total Alk. (CaCO3)	NA	Boron	4.459	Chromium		15.902
Chloride	NA	Dissolved Oxygen	NA	Cobalt		6.115
Sulfate	NA	BOD	NA	Copper		9.398
Nitrate (N)	NA	COD	NA	Iron		9433.914
Nitrite	NA	CBOD	NA	Lead		8.462
Fluoride	NA	Ammonia (N)	NA	Manganese		330.211
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum	LT	0.10
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel		11.606
Phenols	NA	Chromium (+6)	NA	Selenium	LT	3.00
TDP	NA	Tin	NA	Silver	LT	0.40
Sulfide	NA	MBAS	NA	Thallium	LT	1.50
		Flash Pt (Celsius)	NA	Vanadium		16.660
				Zinc		37.368
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

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RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102040PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 0800 Depth: ****

Site ID: Matrix: Soil

Date Collected: 3-18-91
Date Received: 3-20-91
Date Reported: 3-29-91

Comments: SB-MH3-00 SURFACE 2" DOWN
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		951.63
Calcium	847.297	Turbidity (NTU)	NA	Antimony		0.63
Magnesium	269.227	Spec. Conductance (micromhos/cm)	NA	Arsenic	LT	2.100
Sodium	24.957	T. Dissolved Solids	NA	Barium		26.163
Potassium	247.96	Total Phosphorus (P)	NA	Beryllium		0.087
		Silica (SiO2)	3280.095	Cadmium		0.087
Total Alk. (CaCO3)	NA	Boron	1.548	Chromium		32.895
Chloride	NA	Dissolved Oxygen	NA	Cobalt		1.210
Sulfate	NA	BOD	NA	Copper		38.849
Nitrate (N)	NA	COD	NA	Iron		1506.018
Nitrite	NA	CBOD	NA	Lead		1.591
Fluoride	NA	Ammonia (N)	NA	Manganese		65.644
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum	LT	0.10
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel		2.601
Phenols	NA	Chromium (+6)	NA	Selenium	LT	3.00
TDP	NA	Tin	NA	Silver	LT	0.40
Sulfide	NA	MBAS	NA	Thallium		1.44
		Flash Pt (Celsius)	NA	Vanadium		2.429
				Zinc		6.972
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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M. GLOTZBACH-BER

KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102066PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1000 Depth: 11

Site ID: Matrix: Soil

Date Collected: 3-18-91
Date Received: 3-21-91
Date Reported: 3-29-91

Comments: SB-MH3-11 BORING SAMPLE
ACID LEACH; EP TOXICITY PENDING

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		937.62
Calcium	870.600	Turbidity (NTU)	NA	Antimony		1.43
Magnesium	215.690	Spec. Conductance (micromhos/cm)	NA	Arsenic		0.749
Sodium	49.675	T. Dissolved Solids	NA	Barium		45.145
Potassium	274.02	Total Phosphorus (P)	NA	Beryllium		0.021
		Silica (SiO2)	1970.532	Cadmium		0.197
Total Alk. (CaCO3)	NA	Boron	1.744	Chromium		862.411
Chloride	NA	Dissolved Oxygen	NA	Cobalt		1.925
Sulfate	NA	BOD	NA	Copper		1017.014
Nitrate (N)	NA	COD	NA	Iron		1855.979
Nitrite	NA	CBOD	NA	Lead		5.302
Fluoride	NA	Ammonia (N)	NA	Manganese		33.235
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		1.424
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel		2.273
Phenols	NA	Chromium (+6)	NA	Selenium	LT	3.00
TDP	NA	Tin	NA	Silver		0.351
Sulfide	NA	MBAS	NA	Thallium		0.75
		Flash Pt (Celsius)	NA	Vanadium		4.184
				Zinc		11.333
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102093PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-11-15E 04089026 HYDRO-FLEX SB-MH3-11 BORING SAMPLE

Collected By: RACHEL MILLER Time: 1000 Depth: 11

Site ID: Matrix: Soil

Date Collected: 3-18-91
Date Received: 3-21-91
Date Reported: 4- 4-91

Comments: EP TOX ON 102066PT

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		0.05
		Turbidity (NTU)	NA	Antimony	LT	0.01
Calcium	41.808	Spec. Conductance		Arsenic	LT	0.021
Magnesium	0.994	(micromhos/cm)	NA	Barium		0.666
Sodium	0.373	T. Dissolved Solids	NA	Beryllium	LT	0.001
Potassium	1.81	Total Phosphorus (P)	NA	Cadmium		0.009
		Silica (SiO2)	2.873	Chromium		0.621
Total Alk. (CaCO3)	NA	Boron	0.011	Cobalt	LT	0.004
		Dissolved Oxygen	NA	Copper		50.038
Chloride	NA	BOD	NA	Iron		0.054
Sulfate	NA	COD	NA	Lead	LT	0.02
Nitrate (N)	NA	CBOD	NA	Manganese		0.520
Nitrite	NA	Ammonia (N)	NA	Mercury		NA
Fluoride	NA	T. Sus. Solids	NA	Molybdenum	LT	0.001
		Corrosivity (LI)	NA	Nickel		0.018
Cyanide	NA	Kjeldahl Nitrogen	NA	Selenium	LT	0.03
Oil/Grease	NA	Chromium (+6)	NA	Silver	LT	0.004
Phenols	NA	Tin	NA	Thallium	LT	0.015
TDP	NA	MBAS	NA	Vanadium	LT	0.003
Sulfide	NA	Flash Pt (Celsius)	NA	Zinc		0.434

Total Coliform	NA
Fecal Coliform	NA
Fecal Strep	NA

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102093PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-11-15E 04089026 HYDRO-FLEX SB-MH3-11 BORING SAMPLE

Collected By: RACHEL MILLER Time: 1000 Depth: 11

Site ID: Matrix: Soil

Date Collected: 3-18-91
Date Received: 3-21-91
Date Reported: 4- 4-91

Comments: EP TOX ON 102066PT

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		0.05
		Turbidity (NTU)	NA	Antimony	LT	0.01
Calcium	41.808	Spec. Conductance		Arsenic	LT	0.021
Magnesium	0.994	(micromhos/cm)	NA	Barium		0.666
Sodium	0.373	T. Dissolved Solids	NA	Beryllium	LT	0.001
Potassium	1.81	Total Phosphorus (P)	NA	Cadmium		0.009
		Silica (SiO2)	2.873	Chromium		0.621
Total Alk. (CaCO3)	NA	Boron	0.011	Cobalt	LT	0.004
		Dissolved Oxygen	NA	Copper		50.038
Chloride	NA	BOD	NA	Iron		0.054
Sulfate	NA	COD	NA	Lead	LT	0.02
Nitrate (N)	NA	CBOD	NA	Manganese		0.520
Nitrite	NA	Ammonia (N)	NA	Mercury		NA
Fluoride	NA	T. Sus. Solids	NA	Molybdenum	LT	0.001
		Corrosivity (LI)	NA	Nickel		0.018
Cyanide	NA	Kjeldahl Nitrogen	NA	Selenium	LT	0.03
Oil/Grease	NA	Chromium (+6)	NA	Silver	LT	0.004
Phenols	NA	Tin	NA	Thallium	LT	0.015
TDP	NA	MBAS	NA	Vanadium	LT	0.003
Sulfide	NA	Flash Pt (Celsius)	NA	Zinc		0.434

Total Coliform	NA
Fecal Coliform	NA
Fecal Strep	NA

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102051PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1000 Depth: 60

Site ID: Matrix: Soil

Date Collected: 3-20-91
Date Received: 3-20-91
Date Reported: 3-29-91

Comments: SB-HF5-60 BORING SAMPLE
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum	399.97
Calcium	15722.397	Turbidity (NTU)	NA	Antimony	0.43
Magnesium	223.876	Spec. Conductance (micromhos/cm)	NA	Arsenic	1.902
Sodium	45.645	T. Dissolved Solids	NA	Barium	15.721
Potassium	149.46	Total Phosphorus (P)	NA	Beryllium	0.088
		Silica (SiO2)	1378.497	Cadmium	0.024
Total Alk. (CaCO3)	NA	Boron	2.242	Chromium	1.810
Chloride	NA	Dissolved Oxygen	NA	Cobalt	0.890
Sulfate	NA	BOD	NA	Copper	1.732
Nitrate (N)	NA	COD	NA	Iron	1581.157
Nitrite	NA	CBOD	NA	Lead	LT 2.00
Fluoride	NA	Ammonia (N)	NA	Manganese	49.989
		T. Sus. Solids	NA	Mercury	NA
		Corrosivity (LI)	NA	Molybdenum	0.103
Cyanide	NA	Kjeldahl Nitrogen	NA	Nickel	2.432
Oil/Grease	NA	Chromium (+6)	NA	Selenium	4.419
Phenols	NA	Tin	NA	Silver	0.021
TDP	NA	MBAS	NA	Thallium	2.50
Sulfide	NA	Flash Pt (Celsius)	NA	Vanadium	3.928
				Zinc	4.413
Total Coliform	NA				
Fecal Coliform	NA				
Fecal Strep	NA				

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER Lab Number: 102745OC
Address: FORBES BLDG. 740, TOPEKA, KS. 66620 Report Date: 3-27-91

SAMPLE COLLECTION INFORMATION

Site ID No.: Program Code: ER Sample Type: SOIL
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX SB-HF5-60
Collected By: RACHEL MILLER-BER Date: 3-20-91 Time: 1000

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (MG/KG)	Reporting Limit (MG/KG)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	4.6	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
[illegible]-DICHLOROPROPANE	NOT DETECTED	0.5
[illegible]NS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE RLP Roger H. Carlson, Ph.D., Director

Copy To: MARVIN GLOTZBACH-BER

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 102741OC
Report Date: 4- 5-91

SAMPLE COLLECTION INFORMATION

Site ID No.: Program Code: ER Sample Type: SOIL
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX SB-HF5-60
Collected By: RACHEL MILLER-BER Date: 3-20-91 Time: 1000

RESULTS OF ANALYSIS

PRIORITY POLLUTANT BASE NEUTRAL EXTRACTABLES	Concentration (MG/KG)	Reporting Limit (MG/KG)
HEXACHLOROETHANE	NOT DETECTED	1.0
BIS(2-CHLOROETHYL)ETHER	NOT DETECTED	1.0
BIS(2-CHLOROISOPROPYL)ETHER	NOT DETECTED	1.0
HEXACHLOROBUTADIENE	NOT DETECTED	1.0
1,2,4-TRICHLOROBENZENE	NOT DETECTED	1.0
NAPHTHALENE	NOT DETECTED	1.0
BIS(2-CHLOROETHOXY)METHANE	NOT DETECTED	1.0
2-CHLORONAPHTHALENE	NOT DETECTED	1.0
ACENAPHTHYLENE	NOT DETECTED	1.0
ACENAPHTHENE	NOT DETECTED	1.0
DIMETHYL PHTHALATE	NOT DETECTED	1.0
2,6-DINITROTOLUENE	NOT DETECTED	1.0
FLUORENE	NOT DETECTED	1.0
[illegible]HLOROPHENYL PHENYL ETHER	NOT DETECTED	1.0
[illegible]-DINITROTOLUENE	NOT DETECTED	1.0
DIETHYL PHTHALATE	NOT DETECTED	1.0
HEXACHLOROBENZENE	NOT DETECTED	1.0
4-BROMOPHENYL PHENYL ETHER	NOT DETECTED	1.0
PHENANTHRENE &/OR ANTHRACENE	NOT DETECTED	1.0
DI-N-BUTYL PHTHALATE	NOT DETECTED	1.0
FLUORANTHENE	NOT DETECTED	1.0
PYRENE	NOT DETECTED	1.0
BUTYL BENZYL PHTHALATE	NOT DETECTED	1.0
BIS(2-ETHYLHEXYL) PHTHALATE	NOT DETECTED	5.0
CHRYSENE &/OR BENZO(A)ANTHRACENE	NOT DETECTED	1.0
DI-N-OCTYL PHTHALATE	NOT DETECTED	5.0
BENZO<(B) &/OR (K)>FLUORANTHENE	NOT DETECTED	1.0
BENZO(A)PYRENE	NOT DETECTED	1.0
INDENO(1,2,3-C,D)PYRENE	NOT DETECTED	1.0
DIBENZO(A,H)ANTHRACENE	NOT DETECTED	1.0
BENZO(G,H,I)PERYLENE	NOT DETECTED	1.0

Comment: THE ABOVE RESULTS AND DETECTION LEVELS ARE ON A DRY WEIGHT BASIS.

Analyst: DENNIS L. DOBSON Q2 RECEIVED Roger H. Carlson, Ph.D., Director

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APR 8 1991

BUREAU OF ENVIRONMENTAL REMEDIATION

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 1027780C
Report Date: 4- 5-91

SAMPLE COLLECTION INFORMATION

Site ID No.: Program Code: ER Sample Type: SOIL
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX SB-HF5-60
Collected By: RACHEL MILLER-BER Date: 3-20-91 Time: 1000

RESULTS OF ANALYSIS

PRIORITY POLLUTANT ACID EXTRACTABLES	Concentration (MG/KG)	Reporting Limit (MG/KG)
ORTHO-CHLOROPHENOL	NOT DETECTED	1.0
2-NITROPHENOL	NOT DETECTED	1.0
PHENOL	NOT DETECTED	1.0
2,4-DIMETHYLPHENOL	NOT DETECTED	1.0
2,4-DICHLOROPHENOL	NOT DETECTED	1.0
2,4,6-TRICHLOROPHENOL	NOT DETECTED	1.0
4-CHLORO-M-CRESOL	NOT DETECTED	1.0
2,4-DINITROPHENOL	NOT DETECTED	25.0
4,6-DINITRO-O-CRESOL	NOT DETECTED	5.0
PENTACHLOROPHENOL	NOT DETECTED	5.0
4-NITROPHENOL	NOT DETECTED	5.0

Note: 2,6-Dichlorophenol if present, is calculated as 2,4-Dichlorophenol.

Comment: THE ABOVE RESULTS AND DETECTION LEVELS ARE ON A DRY WEIGHT BASIS.

Analyst: DENNIS L. DOBSON

Roger H. Carlson, Ph.D., Director

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KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102050PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1000 Depth: 30

Site ID: Matrix: Soil

Date Collected: 3-19-91
Date Received: 3-20-91
Date Reported: 3-29-91

Comments: SB-HF6-30 BORING SAMPLE
ACID LEACH; ANALYSIS COMPLETE

* *

Results Expressed in Milligrams/Kilogram

Total Hard. (CaCO3)	NA	pH (Units)	NA	Aluminum		529.70
		Turbidity (NTU)	NA	Antimony	LT	1.00
Calcium	2887.806	Spec. Conductance		Arsenic		0.348
Magnesium	162.989	(micromhos/cm)	NA	Barium		20.622
Sodium	49.841	T. Dissolved Solids	NA	Beryllium		0.083
Potassium	200.41	Total Phosphorus (P)	NA	Cadmium	LT	0.20
		Silica (SiO2)	2003.470	Chromium		2.061
Total Alk. (CaCO3)	NA	Boron	3.279	Cobalt		0.064
		Dissolved Oxygen	NA	Copper		1.000
Chloride	NA	BOD	NA	Iron		789.214
Sulfate	NA	COD	NA	Lead	LT	2.00
Nitrate (N)	NA	CBOD	NA	Manganese		8.158
Nitrite	NA	Ammonia (N)	NA	Mercury		NA
Fluoride	NA	T. Sus. Solids	NA	Molybdenum	LT	0.10
		Corrosivity (LI)	NA	Nickel		1.024
Cyanide	NA	Kjeldahl Nitrogen	NA	Selenium		2.719
Oil/Grease	NA	Chromium (+6)	NA	Silver	LT	0.40
Phenols	NA	Tin	NA	Thallium		0.57
TDP	NA	MBAS	NA	Vanadium		1.754
Sulfide	NA	Flash Pt (Celsius)	NA	Zinc		3.080

Total Coliform	NA
Fecal Coliform	NA
Fecal Strep	NA

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 1027460C
Report Date: 3-27-91

SAMPLE COLLECTION INFORMATION

Site ID No.: Program Code: ER Sample Type: SOIL
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX SB-HF6-30
Collected By: RACHEL MILLER-BER Date: 3-19-91 Time: 0955

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (MG/KG)	Reporting Limit (MG/KG)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	93.5	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROPROPANE	NOT DETECTED	0.5
TRANS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE RLP

Roger H. Carlson, Ph.D., Director

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER Lab Number: 102742OC
Address: FORBES BLDG. 740, TOPEKA, KS. 66620 Report Date: 4- 5-91

SAMPLE COLLECTION INFORMATION

Site ID No.: Program Code: ER Sample Type: SOIL
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX SB-HF6-30
Collected By: RACHEL MILLER-BER Date: 3-19-91 Time: 1000

RESULTS OF ANALYSIS

PRIORITY POLLUTANT BASE NEUTRAL EXTRACTABLES	Concentration (MG/KG)	Reporting Limit (MG/KG)
HEXACHLOROETHANE	NOT DETECTED	1.0
BIS(2-CHLOROETHYL)ETHER	NOT DETECTED	1.0
BIS(2-CHLOROISOPROPYL)ETHER	NOT DETECTED	1.0
HEXACHLOROBUTADIENE	NOT DETECTED	1.0
1,2,4-TRICHLOROBENZENE	NOT DETECTED	1.0
NAPHTHALENE	NOT DETECTED	1.0
BIS(2-CHLOROETHOXY)METHANE	NOT DETECTED	1.0
2-CHLORONAPHTHALENE	NOT DETECTED	1.0
ACENAPHTHYLENE	NOT DETECTED	1.0
ACENAPHTHENE	NOT DETECTED	1.0
DIMETHYL PHTHALATE	NOT DETECTED	1.0
2,6-DINITROTOLUENE	NOT DETECTED	1.0
FLUORENE	NOT DETECTED	1.0
[illegible]HLOROPHENYL PHENYL ETHER	NOT DETECTED	1.0
[illegible]-DINITROTOLUENE	NOT DETECTED	1.0
DIETHYL PHTHALATE	NOT DETECTED	1.0
HEXACHLOROBENZENE	NOT DETECTED	1.0
4-BROMOPHENYL PHENYL ETHER	NOT DETECTED	1.0
PHENANTHRENE &/OR ANTHRACENE	NOT DETECTED	1.0
DI-N-BUTYL PHTHALATE	NOT DETECTED	1.0
FLUORANTHENE	NOT DETECTED	1.0
PYRENE	NOT DETECTED	1.0
BUTYL BENZYL PHTHALATE	NOT DETECTED	1.0
BIS(2-ETHYLHEXYL) PHTHALATE	NOT DETECTED	5.0
CHRYSENE &/OR BENZO(A)ANTHRACENE	NOT DETECTED	1.0
DI-N-OCTYL PHTHALATE	NOT DETECTED	5.0
BENZO<(B) &/OR (K)>FLUORANTHENE	NOT DETECTED	1.0
BENZO(A)PYRENE	NOT DETECTED	1.0
INDENO(1,2,3-C,D)PYRENE	NOT DETECTED	1.0
DIBENZO(A,H)ANTHRACENE	NOT DETECTED	1.0
BENZO(G,H,I)PERYLENE	NOT DETECTED	1.0

Comment: THE ABOVE RESULTS AND DETECTION LEVELS ARE ON A DRY WEIGHT BASIS.

RECEIVED

Analyst: DENNIS L. DOBSON Roger H. Carlson, Ph.D., Director

Copy To: M. GLOTZBACH-BER

APR 8 1991

BUREAU OF
ENVIRONMENTAL
REMEDIATION

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 1027790C
Report Date: 4- 5-91

SAMPLE COLLECTION INFORMATION

Site ID No.: Program Code: ER Sample Type: SOIL
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX SB-HF6-30
Collected By: RACHEL MILLER-BER Date: 3-19-91 Time: 1000

RESULTS OF ANALYSIS

PRIORITY POLLUTANT ACID EXTRACTABLES	Concentration (MG/KG)	Reporting Limit (MG/KG)
ORTHO-CHLOROPHENOL	NOT DETECTED	1.0
2-NITROPHENOL	NOT DETECTED	1.0
PHENOL	NOT DETECTED	1.0
2,4-DIMETHYLPHENOL	NOT DETECTED	1.0
2,4-DICHLOROPHENOL	NOT DETECTED	1.0
2,4,6-TRICHLOROPHENOL	NOT DETECTED	1.0
4-CHLORO-M-CRESOL	NOT DETECTED	1.0
2,4-DINITROPHENOL	NOT DETECTED	25.0
4,6-DINITRO-O-CRESOL	NOT DETECTED	5.0
PENTACHLOROPHENOL	NOT DETECTED	5.0
4-NITROPHENOL	NOT DETECTED	5.0

Note: 2,6-Dichlorophenol if present, is calculated as 2,4-Dichlorophenol.

Comment: THE ABOVE RESULTS AND DETECTION LEVELS ARE ON A DRY WEIGHT BASIS.

Analyst: DENNIS L. DOBSON

Roger H. Carlson, Ph.D., Director

Copy To: M. GLOTZBACH-BER

RECEIVED
APR 8 1991
BUREAU OF ENVIRONMENTAL REMEDIATION

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 102842OC
Report Date: 4- 1-91

SAMPLE COLLECTION INFORMATION

Site ID No.: Program Code: ER Sample Type: SLUDGE
Collection Site: 000000NE221115E, 04089026 HYDRO-FLEX HF4-S-1
Collected By: RACHEL MILLER-BER Date: - - Time: 0930

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (UG/L)	Reporting Limit (UG/L)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	NOT DETECTED	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROPROPANE	NOT DETECTED	0.5
TRANS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	0.6	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	0.7	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	3.5	0.7
META-XYLENE	1.7	0.6
ORTHO &/OR PARA-XYLENE	1.9	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0
STYRENE	1.9	

Analyst: RICHARD L. PIERCE RLP

Roger H. Carlson, Ph.D., Director

Copy To: M. GLOTZBACH-BER

KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102078PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX HF4-S1

Collected By: RACHEL MILLER Time: 0930 Depth: 70

Site ID: Matrix: Liquid

Date Collected: 3-22-91
Date Received: 3-25-91
Date Reported: 4- 5-91

Comments:

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	2163	pH (Units)	NA	Aluminum		0.08
		Turbidity (NTU)	NA	Antimony		0.01
Calcium	814.248	Spec. Conductance		Arsenic	LT	0.021
Magnesium	31.915	(micromhos/cm)	NA	Barium		0.236
Sodium	74.778	T. Dissolved Solids	NA	Beryllium	LT	0.001
Potassium	13.41	Total Phosphorus (P)	NA	Cadmium	LT	0.002
		Silica (SiO2)	7.750	Chromium		1.286
Total Alk. (CaCO3)	NA	Boron	0.493	Cobalt		0.007
		Dissolved Oxygen	NA	Copper		1.076
Chloride	NA	BOD	NA	Iron		0.093
Sulfate	NA	COD	NA	Lead		0.001
Nitrate (N)	NA	CBOD	NA	Manganese		1.470
Nitrite	NA	Ammonia (N)	NA	Mercury		NA
Fluoride	NA	T. Sus. Solids	NA	Molybdenum		0.004
		Corrosivity (LI)	NA	Nickel		0.013
Cyanide	NA	Kjeldahl Nitrogen	NA	Selenium	LT	0.001
Oil/Grease	NA	Chromium (+6)	NA	Silver	LT	0.004
Phenols	NA	Tin	NA	Thallium	LT	0.015
TDP	NA	MBAS	NA	Vanadium	LT	0.003
Sulfide	NA	Flash Pt (Celsius)	NA	Zinc		0.069

Total Coliform	NA
Fecal Coliform	NA
Fecal Strep	NA

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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M. GLOTZBACH-BER

KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102077PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX HF4-W1

Collected By: RACHEL MILLER Time: 1400 Depth: 70

Site ID: 00000987 Matrix: Water

Date Collected: 3-22-91
Date Received: 3-25-91
Date Reported: 4- 2-91

Comments: INDUSTRIAL WELL

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	452	pH (Units)	NA	Aluminum		0.19
Calcium	149.667	Turbidity (NTU)	51.2	Antimony		0.02
Magnesium	19.103	Spec. Conductance (micromhos/cm)	NA	Arsenic	LT	0.021
Sodium	57.838	T. Dissolved Solids	NA	Barium		0.051
Potassium	9.38	Total Phosphorus (P)	NA	Beryllium	LT	0.001
		Silica (SiO2)	24.863	Cadmium		0.002
Total Alk. (CaCO3)	NA	Boron	0.297	Chromium		5.806
Chloride	NA	Dissolved Oxygen	NA	Cobalt		0.007
Sulfate	NA	BOD	NA	Copper		5.870
Nitrate (N)	NA	COD	NA	Iron		0.941
Nitrite	NA	CBOD	NA	Lead		NA
Fluoride	NA	Ammonia (N)	NA	Manganese		0.451
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		0.125
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel		0.017
Phenols	NA	Chromium (+6)	NA	Selenium		NA
TDP	NA	Tin	NA	Silver	LT	0.004
Sulfide	NA	MBAS	NA	Thallium	LT	0.015
		Flash Pt (Celsius)	NA	Vanadium		0.003
				Zinc		0.068

Total Coliform	NA
Fecal Coliform	NA
Fecal Strep	NA

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER Lab Number: 102840OC
Address: FORBES BLDG. 740, TOPEKA, KS. 66620 Report Date: 4- 1-91

SAMPLE COLLECTION INFORMATION

Site ID No.: 00000987 Program Code: ER Sample Type: WATER
Collection Site: 000000NE221115E, 04089026 HYDRO-FLEX HF4-W-L
Collected By: RACHEL MILLER-BER Date: 3-22-91 Time: 1400

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (UG/L)	Reporting Limit (UG/L)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	NOT DETECTED	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	0.7	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROPROPANE	NOT DETECTED	0.5
TRANS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	0.5	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	0.8	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Comment: TRACES OF SEVERAL PETROLEUM TYPE HYDROCARBONS WERE DETECTED.

Analyst: RICHARD L. PIERCE RLP Roger H. Carlson, Ph.D., Director

Copy To: M. GLOTZBACH-BER

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 102838OC
Report Date: 4-19-91

SAMPLE COLLECTION INFORMATION

Site ID No.: 00000987 Program Code: ER Sample Type: WATER
Collection Site: 000000NE221115E, 04089026 HYDRO-FLEX HF4-W-1
Collected By: RACHEL MILLER-BER Date: 3-22-91 Time: 1400

RESULTS OF ANALYSIS

PRIORITY POLLUTANT BASE NEUTRAL EXTRACTABLES	Concentration (UG/L)	Reporting Limit (UG/L)
HEXACHLOROETHANE	NOT DETECTED	4.0
BIS(2-CHLOROETHYL)ETHER	NOT DETECTED	4.0
BIS(2-CHLOROISOPROPYL)ETHER	NOT DETECTED	4.0
HEXACHLOROBUTADIENE	NOT DETECTED	4.0
1,2,4-TRICHLOROBENZENE	NOT DETECTED	4.0
NAPHTHALENE	NOT DETECTED	4.0
BIS(2-CHLOROETHOXY)METHANE	NOT DETECTED	4.0
2-CHLORONAPHTHALENE	NOT DETECTED	4.0
ACENAPHTHYLENE	NOT DETECTED	4.0
ACENAPHTHENE	NOT DETECTED	4.0
DIMETHYL PHTHALATE	NOT DETECTED	4.0
2,6-DINITROTOLUENE	NOT DETECTED	4.0
FLUORENE	NOT DETECTED	4.0
[illegible]HLOROPHENYL PHENYL ETHER	NOT DETECTED	4.0
[illegible]-DINITROTOLUENE	NOT DETECTED	4.0
DIETHYL PHTHALATE	NOT DETECTED	4.0
HEXACHLOROBENZENE	NOT DETECTED	4.0
4-BROMOPHENYL PHENYL ETHER	NOT DETECTED	4.0
PHENANTHRENE &/OR ANTHRACENE	NOT DETECTED	4.0
DI-N-BUTYL PHTHALATE	NOT DETECTED	4.0
FLUORANTHENE	NOT DETECTED	4.0
PYRENE	NOT DETECTED	4.0
BUTYL BENZYL PHTHALATE	NOT DETECTED	4.0
BIS(2-ETHYLHEXYL) PHTHALATE	NOT DETECTED	20.0
CHRYSENE &/OR BENZO(A)ANTHRACENE	NOT DETECTED	4.0
DI-N-OCTYL PHTHALATE	NOT DETECTED	20.0
BENZO<(B) &/OR (K)>FLUORANTHENE	NOT DETECTED	4.0
BENZO(A)PYRENE	NOT DETECTED	4.0
INDENO(1,2,3-C,D)PYRENE	NOT DETECTED	4.0
DIBENZO(A,H)ANTHRACENE	NOT DETECTED	4.0
BENZO(G,H,I)PERYLENE	NOT DETECTED	4.0

Comment: NUMEROUS PETROLEUM TYPE HYDROCARBONS ARE INDICATED AS PRESENT.

Analyst: DENNIS L. DOBSON

Roger H. Carlson, Ph.D., Director

Copy To: M. GLOTZBACH-BER

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 102839OC
Report Date: 4-19-91

SAMPLE COLLECTION INFORMATION

Site ID No.: 00000987 Program Code: ER Sample Type: WATER
Collection Site: 000000NE221115E, 04089026 HYDRO-FLEX HF4-W-1
Collected By: RACHEL MILLER-BER Date: 3-22-91 Time: 1400

RESULTS OF ANALYSIS

PRIORITY POLLUTANT ACID EXTRACTABLES	Concentration (UG/L)	Reporting Limit (UG/L)
ORTHO-CHLOROPHENOL	NOT DETECTED	4.0
2-NITROPHENOL	NOT DETECTED	4.0
PHENOL	NOT DETECTED	4.0
2,4-DIMETHYLPHENOL	NOT DETECTED	4.0
2,4-DICHLOROPHENOL	NOT DETECTED	4.0
2,4,6-TRICHLOROPHENOL	NOT DETECTED	4.0
4-CHLORO-M-CRESOL	NOT DETECTED	4.0
2,4-DINITROPHENOL	NOT DETECTED	100
4,6-DINITRO-O-CRESOL	NOT DETECTED	20.0
PENTACHLOROPHENOL	NOT DETECTED	100
4-NITROPHENOL	NOT DETECTED	20.0
BENZOIC ACID	11	
PARA-CRESOL	18	

Note: 2,6-Dichlorophenol if present, is calculated as 2,4-Dichlorophenol.

Comment: NUMEROUS PETROLEUM TYPE HYDROCARBONS ARE INDICATED AS PRESENT. BENZOIC ACID AND PARA-CRESOL ARE NOT PRIORITY POLLUTANT ACIDS.

Analyst: DENNIS L. DOBSON DLD

Roger H. Carlson, Ph.D., Director

Copy To: M. GLOTZBACH-BER

Item B-4: KDHE Analytical Results (May 1991 Samples)

State of Kansas
[redacted]r
Governor Joan Finney
Department of Health and Environment
Division of Environment
Forbes Field, Bldg. 740, Topeka, KS 66620-0001

Acting
Stanley C. Grant, Ph.D., Secretary

Respond to: (913) 296-1673
FAX (913) 296-6247
BER FAX (913) 296-1686

May 28, 1991

G.M. Zemansky
Senior Water Quality Engineer
Terracon Environmental, Inc.
7810 N.W. 100th
P.O. Box 901541
Kansas City, Missouri 64100-1541

RE: Hydro-Flex Site, Topeka

Dear Gil:

Enclosed is a copy of the sample analyses from the Hydro-Flex site in Topeka taken during May 10, 1991. This should be a complete set of the groundwater analyses results.

Please send me your analyses results and let me know if we can be of any assistance as the RI/FS continues. Also, inform me of your recommendation regarding the need or absence of a need for another phase of investigation.

Sincerely,

Rachel M. Miller

Rachel Miller
Environmental Geologist
Remedial Section
Bureau of Environmental Remediation

C. Larry Knoche --> Marvin Glotzbach
Cathy Barrett - EPA
Jeff Campbell - Hydro-Flex
Sharad Bhatia - Blackwell Sanders

Charles Konigsberg, Jr., M.D., M.P.H.,
Director of Health
(913) 296-1343

[redacted]
Director of Environment
(913) 296-1535

Lorne Phillips, Ph.D.,
Director of Information Systems
(913) 296-1415

Roger Carlson, Ph.D.,
Director of the Kansas Health and Environmental Laboratory
(913) 296-1620

KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102576PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE-22-11-15E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1010 Depth: 30

Site ID: 00000956 Matrix: Water

Date Collected: 5-10-91
Date Received: 5-13-91
Date Reported: 5-15-91

Comments: HF-1 BACKGROUND WELL-FILTERED SAMPLE

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	408	pH (Units)	NA	Aluminum		0.03
Calcium	136.829	Turbidity (NTU)	NA	Antimony		0.06
Magnesium	16.167	Spec. Conductance (micromhos/cm)	NA	Arsenic	LT	0.021
Sodium	13.374	T. Dissolved Solids	NA	Barium		0.359
Potassium	NA	Total Phosphorus (P)	NA	Beryllium	LT	0.001
		Silica (SiO2)	42.647	Cadmium	LT	0.002
Total Alk. (CaCO3)	NA	Boron	0.042	Chromium		0.004
Chloride	NA	Dissolved Oxygen	NA	Cobalt	LT	0.004
Sulfate	NA	BOD	NA	Copper		0.014
Nitrate (N)	NA	COD	NA	Iron		0.018
Nitrite	NA	CBOD	NA	Lead		NA
Fluoride	NA	Ammonia (N)	NA	Manganese		0.005
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum	LT	0.001
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel	LT	0.007
Phenols	NA	Chromium (+6)	NA	Selenium		NA
TDP	NA	Tin	NA	Silver	LT	0.004
Sulfide	NA	MBAS	NA	Thallium	LT	0.015
		Flash Pt (Celsius)	NA	Vanadium		0.005
				Zinc		0.035
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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M. GLOTZBACH-BER

KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102575PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE-22-11-15E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1010 Depth: 30

Site ID: 00000956 Matrix: Water

Date Collected: 5-10-91
Date Received: 5-13-91
Date Reported: 5-23-91

Comments: HF-1

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	523	pH (Units)	7.1	Aluminum		13.45
Calcium	175.010	Turbidity (NTU)	570.0	Antimony		0.01
Magnesium	21.007	Spec. Conductance (micromhos/cm)	NA	Arsenic		0.095
Sodium	12.888	T. Dissolved Solids	NA	Barium		2.766
Potassium	11.78	Total Phosphorus (P)	NA	Beryllium		0.004
		Silica (SiO2)	123.614	Cadmium		0.003
Total Alk. (CaCO3)	374	Boron	0.126	Chromium		0.052
Chloride	16.9	Dissolved Oxygen	NA	Cobalt		0.066
Sulfate	47	BOD	NA	Copper		0.062
Nitrate (N)	3.43	COD	NA	Iron		50.024
Nitrite	NA	CBOD	NA	Lead		NA
Fluoride	0.18	Ammonia (N)	NA	Manganese		7.572
		T. Sus. Solids	2073	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum	LT	0.001
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel		0.069
Phenols	NA	Chromium (+6)	NA	Selenium		NA
TDP	NA	Tin	NA	Silver	LT	0.004
Sulfide	NA	MBAS	NA	Thallium	LT	0.015
		Flash Pt (Celsius)	NA	Vanadium		0.133
				Zinc		0.193
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD

NA - Not Analyzed

LT - Less Than

* *

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M. GLOTZBACH-BER

KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102578PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE-22-11-15E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1320 Depth: 30

Site ID: 00000949 Matrix: Water

Date Collected: 5-10-91
Date Received: 5-13-91
Date Reported: 5-15-91

Comments: HF-2 FILTERED SAMPLE

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	477	pH (Units)	NA	Aluminum		0.09
Calcium	167.307	Turbidity (NTU)	NA	Antimony		0.08
Magnesium	14.464	Spec. Conductance (micromhos/cm)	NA	Arsenic	LT	0.021
Sodium	15.603	T. Dissolved Solids	NA	Barium		0.200
Potassium	NA	Total Phosphorus (P)	NA	Beryllium	LT	0.001
		Silica (SiO2)	42.955	Cadmium	LT	0.002
Total Alk. (CaCO3)	NA	Boron	0.129	Chromium		0.007
Chloride	NA	Dissolved Oxygen	NA	Cobalt		0.004
Sulfate	NA	BOD	NA	Copper		0.012
Nitrate (N)	NA	COD	NA	Iron		0.054
Nitrite	NA	CBOD	NA	Lead		NA
Fluoride	NA	Ammonia (N)	NA	Manganese		0.004
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		0.004
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel	LT	0.007
Phenols	NA	Chromium (+6)	NA	Selenium		NA
TDP	NA	Tin	NA	Silver		0.005
Sulfide	NA	MBAS	NA	Thallium	LT	0.015
		Flash Pt (Celsius)	NA	Vanadium		0.020
				Zinc		0.019
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102577PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE-22-11-15E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1320 Depth: 30

Site ID: 00000949 Matrix: Water

Date Collected: 5-10-91
Date Received: 5-13-91
Date Reported: 5-23-91

Comments: HF-2

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	1186	pH (Units)	7.2	Aluminum		34.96
Calcium	424.497	Turbidity (NTU)	1340.0	Antimony		0.02
Magnesium	30.751	Spec. Conductance (micromhos/cm)	NA	Arsenic		0.079
Sodium	16.673	T. Dissolved Solids	NA	Barium		1.600
Potassium	18.81	Total Phosphorus (P)	NA	Beryllium		0.005
		Silica (SiO2)	191.537	Cadmium		0.012
Total Alk. (CaCO3)	399	Boron	0.184	Chromium		0.115
Chloride	5.0	Dissolved Oxygen	NA	Cobalt		0.056
Sulfate	77	BOD	NA	Copper		0.075
Nitrate (N)	15.80	COD	NA	Iron		34.886
Nitrite	NA	CBOD	NA	Lead		NA
Fluoride	0.32	Ammonia (N)	NA	Manganese		1.907
		T. Sus. Solids	74991	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		0.004
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel		0.099
Phenols	NA	Chromium (+6)	NA	Selenium		NA
TDP	NA	Tin	NA	Silver	LT	0.004
Sulfide	NA	MBAS	NA	Thallium	LT	0.015
		Flash Pt (Celsius)	NA	Vanadium		0.175
				Zinc		0.251
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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Department of Health and Environment
Biochemical Analysis Laboratory
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(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102580PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE-22-11-15E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1410 Depth: 65

Site ID: 00000871 Matrix: Water

Date Collected: 5-10-91
Date Received: 5-13-91
Date Reported: 5-20-91

Comments: HF-3 FILTERED SAMPLE

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	354	pH (Units)	NA	Aluminum	LT	0.026
Calcium	121.668	Turbidity (NTU)	NA	Antimony		0.06
Magnesium	12.299	Spec. Conductance (micromhos/cm)	NA	Arsenic		0.035
Sodium	56.022	T. Dissolved Solids	NA	Barium		0.712
Potassium	NA	Total Phosphorus (P)	NA	Beryllium	LT	0.001
		Silica (SiO2)	35.901	Cadmium	LT	0.002
Total Alk. (CaCO3)	NA	Boron	0.037	Chromium		0.003
Chloride	NA	Dissolved Oxygen	NA	Cobalt		0.007
Sulfate	NA	BOD	NA	Copper		0.005
Nitrate (N)	NA	COD	NA	Iron		9.418
Nitrite	NA	CBOD	NA	Lead		NA
Fluoride	NA	Ammonia (N)	NA	Manganese		0.892
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		0.004
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel	LT	0.007
Phenols	NA	Chromium (+6)	NA	Selenium		NA
TDP	NA	Tin	NA	Silver	LT	0.004
Sulfide	NA	MBAS	NA	Thallium	LT	0.015
		Flash Pt (Celsius)	NA	Vanadium	LT	0.003
				Zinc		0.011
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102579PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE-22-11-15E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1410 Depth: 65

Site ID: 00000871 Matrix: Water

Date Collected: 5-10-91
Date Received: 5-13-91
Date Reported: 5-23-91

Comments: HF-3

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	417	pH (Units)	7.2	Aluminum		5.82
Calcium	143.888	Turbidity (NTU)	390.0	Antimony	LT	0.01
Magnesium	14.130	Spec. Conductance (micromhos/cm)	NA	Arsenic		0.032
Sodium	54.453	T. Dissolved Solids	NA	Barium		1.023
Potassium	7.10	Total Phosphorus (P)	NA	Beryllium	LT	0.001
		Silica (SiO2)	56.198	Cadmium		0.003
Total Alk. (CaCO3)	333	Boron	0.130	Chromium		0.026
Chloride	90.3	Dissolved Oxygen	NA	Cobalt		0.024
Sulfate	42	BOD	NA	Copper		0.088
Nitrate (N)	0.06	COD	NA	Iron		30.003
Nitrite	NA	CBOD	NA	Lead		NA
Fluoride	0.24	Ammonia (N)	NA	Manganese		2.066
		T. Sus. Solids	511	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		0.001
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel		0.022
Phenols	NA	Chromium (+6)	NA	Selenium		NA
TDP	NA	Tin	NA	Silver	LT	0.004
Sulfide	NA	MBAS	NA	Thallium	LT	0.015
		Flash Pt (Celsius)	NA	Vanadium		0.042
				Zinc		0.094
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

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RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102582PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE-22-11-15E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1215 Depth: 70

Site ID: 00000987 Matrix: Water

Date Collected: 5-10-91
Date Received: 5-13-91
Date Reported: 5-20-91

Comments: HF-4 FILTERED SAMPLE

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	122	pH (Units)	NA	Aluminum	LT	0.026
Calcium	42.405	Turbidity (NTU)	NA	Antimony		0.08
Magnesium	3.939	Spec. Conductance (micromhos/cm)	NA	Arsenic		0.011
Sodium	9.465	T. Dissolved Solids	NA	Barium		0.238
Potassium	NA	Total Phosphorus (P)	NA	Beryllium	LT	0.001
		Silica (SiO2)	11.694	Cadmium	LT	0.002
Total Alk. (CaCO3)	NA	Boron	0.024	Chromium	LT	0.003
Chloride	NA	Dissolved Oxygen	NA	Cobalt		0.004
Sulfate	NA	BOD	NA	Copper		0.014
Nitrate (N)	NA	COD	NA	Iron		3.337
Nitrite	NA	CBOD	NA	Lead		NA
Fluoride	NA	Ammonia (N)	NA	Manganese		0.309
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum	LT	0.001
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel	LT	0.007
Phenols	NA	Chromium (+6)	NA	Selenium		NA
TDP	NA	Tin	NA	Silver	LT	0.004
Sulfide	NA	MBAS	NA	Thallium	LT	0.015
		Flash Pt (Celsius)	NA	Vanadium	LT	0.003
Total Coliform	NA			Zinc		0.040
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102581PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE-22-11-15E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1215 Depth: 70

Site ID: 00000987 Matrix: Water

Date Collected: 5-10-91
Date Received: 5-13-91
Date Reported: 5-23-91

Comments: HF-4

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	369	pH (Units)	7.3	Aluminum		0.15
Calcium	128.211	Turbidity (NTU)	143.0	Antimony	LT	0.01
Magnesium	11.934	Spec. Conductance (micromhos/cm)	NA	Arsenic		0.035
Sodium	28.662	T. Dissolved Solids	NA	Barium		0.773
Potassium	6.27	Total Phosphorus (P)	NA	Beryllium	LT	0.001
		Silica (SiO2)	36.570	Cadmium	LT	0.002
Total Alk. (CaCO3)	354	Boron	0.153	Chromium		0.014
Chloride	39.3	Dissolved Oxygen	NA	Cobalt	LT	0.004
Sulfate	47	BOD	NA	Copper		0.038
Nitrate (N)	0.04	COD	NA	Iron		10.867
Nitrite	NA	CBOD	NA	Lead		NA
Fluoride	0.26	Ammonia (N)	NA	Manganese		0.863
		T. Sus. Solids	29	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		0.002
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel	LT	0.007
Phenols	NA	Chromium (+6)	NA	Selenium		NA
TDP	NA	Tin	NA	Silver	LT	0.004
Sulfide	NA	MBAS	NA	Thallium	LT	0.015
		Flash Pt (Celsius)	NA	Vanadium	LT	0.003
				Zinc		0.048
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

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Biochemical Analysis Laboratory
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RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102584PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE-22-11-15E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1530 Depth: 70

Site ID: 00027944 Matrix: Water

Date Collected: 5-10-91
Date Received: 5-13-91
Date Reported: 5-20-91

Comments: HF-5 FILTERED SAMPLE

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	375	pH (Units)	NA	Aluminum		0.05
Calcium	131.330	Turbidity (NTU)	NA	Antimony		0.07
Magnesium	11.522	Spec. Conductance (micromhos/cm)	NA	Arsenic		0.031
Sodium	14.336	T. Dissolved Solids	NA	Barium		0.836
Potassium	NA	Total Phosphorus (P)	NA	Beryllium	LT	0.001
		Silica (SiO2)	35.529	Cadmium	LT	0.002
Total Alk. (CaCO3)	NA	Boron	0.066	Chromium		0.004
Chloride	NA	Dissolved Oxygen	NA	Cobalt		0.009
Sulfate	NA	BOD	NA	Copper		0.005
Nitrate (N)	NA	COD	NA	Iron		10.554
Nitrite	NA	CBOD	NA	Lead		NA
Fluoride	NA	Ammonia (N)	NA	Manganese		1.008
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		0.004
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel	LT	0.007
Phenols	NA	Chromium (+6)	NA	Selenium		NA
TDP	NA	Tin	NA	Silver	LT	0.004
Sulfide	NA	MBAS	NA	Thallium	LT	0.015
		Flash Pt (Celsius)	NA	Vanadium		0.003
				Zinc		0.011
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

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Department of Health and Environment
Biochemical Analysis Laboratory
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(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102583PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE-22-11-15E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1530 Depth: 70

Site ID: 00027944 Matrix: Water

Date Collected: 5-10-91
Date Received: 5-13-91
Date Reported: 5-23-91

Comments: HF-5

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	550	pH (Units)	7.3	Aluminum		15.92
Calcium	192.082	Turbidity (NTU)	732.0	Antimony		0.02
Magnesium	17.162	Spec. Conductance (micromhos/cm)	NA	Arsenic		0.026
Sodium	14.633	T. Dissolved Solids	NA	Barium		1.655
Potassium	8.78	Total Phosphorus (P)	NA	Beryllium		0.001
		Silica (SiO2)	96.270	Cadmium		0.014
Total Alk. (CaCO3)	345	Boron	0.101	Chromium		0.360
Chloride	13.6	Dissolved Oxygen	NA	Cobalt		0.030
Sulfate	55	BOD	NA	Copper		0.171
Nitrate (N)	0.04	COD	NA	Iron		39.294
Nitrite	NA	CBOD	NA	Lead		NA
Fluoride	0.28	Ammonia (N)	NA	Manganese		1.910
		T. Sus. Solids	1334	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum	LT	0.001
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel		0.048
Phenols	NA	Chromium (+6)	NA	Selenium		NA
TDP	NA	Tin	NA	Silver	LT	0.004
Sulfide	NA	MBAS	NA	Thallium	LT	0.015
		Flash Pt (Celsius)	NA	Vanadium		0.039
				Zinc		0.143
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

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Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102585PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE-22-11-15E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1530 Depth: 70

Site ID: 00027944 Matrix: Water

Date Collected: 5-10-91
Date Received: 5-13-91
Date Reported: 5-16-91

Comments: HF-5-R

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	539	pH (Units)	NA	Aluminum		14.70
Calcium	188.249	Turbidity (NTU)	NA	Antimony	LT	0.01
Magnesium	16.777	Spec. Conductance (micromhos/cm)	NA	Arsenic		0.030
Sodium	14.446	T. Dissolved Solids	NA	Barium		1.579
Potassium	8.81	Total Phosphorus (P)	NA	Beryllium		0.001
		Silica (SiO2)	92.193	Cadmium		0.015
Total Alk. (CaCO3)	NA	Boron	0.115	Chromium		0.345
Chloride	NA	Dissolved Oxygen	NA	Cobalt		0.031
Sulfate	NA	BOD	NA	Copper		0.162
Nitrate (N)	NA	COD	NA	Iron		37.632
Nitrite	NA	CBOD	NA	Lead		NA
Fluoride	NA	Ammonia (N)	NA	Manganese		1.825
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum	LT	0.001
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel		0.048
Phenols	NA	Chromium (+6)	NA	Selenium		NA
TDP	NA	Tin	NA	Silver	LT	0.004
Sulfide	NA	MBAS	NA	Thallium	LT	0.015
		Flash Pt (Celsius)	NA	Vanadium		0.039
Total Coliform	NA			Zinc		0.097
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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Department of Health and Environment
Biochemical Analysis Laboratory
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(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102587PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE-22-11-15E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1110 Depth: 30

Site ID: 00002099 Matrix: Water

Date Collected: 5-10-91
Date Received: 5-13-91
Date Reported: 5-15-91

Comments: HF-6 FILTERED SAMPLE

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	431	pH (Units)	NA	Aluminum		0.09
Calcium	152.059	Turbidity (NTU)	NA	Antimony		0.07
Magnesium	12.634	Spec. Conductance (micromhos/cm)	NA	Arsenic	LT	0.021
Sodium	40.626	T. Dissolved Solids	NA	Barium		0.211
Potassium	NA	Total Phosphorus (P)	NA	Beryllium	LT	0.001
		Silica (SiO2)	33.158	Cadmium	LT	0.002
Total Alk. (CaCO3)	NA	Boron	0.292	Chromium		0.006
Chloride	NA	Dissolved Oxygen	NA	Cobalt		0.007
Sulfate	NA	BOD	NA	Copper		0.016
Nitrate (N)	NA	COD	NA	Iron		0.038
Nitrite	NA	CBOD	NA	Lead		NA
Fluoride	NA	Ammonia (N)	NA	Manganese		0.220
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		0.016
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel	LT	0.007
Phenols	NA	Chromium (+6)	NA	Selenium		NA
TDP	NA	Tin	NA	Silver		0.005
Sulfide	NA	MBAS	NA	Thallium	LT	0.015
		Flash Pt (Celsius)	NA	Vanadium		0.006
				Zinc		0.010
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

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Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102586PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE-22-11-15E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1110 Depth: 30

Site ID: 00002099 Matrix: Water

Date Collected: 5-10-91
Date Received: 5-13-91
Date Reported: 5-23-91

Comments: HF-6

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	741	pH (Units)	7.1	Aluminum		47.55
Calcium	250.991	Turbidity (NTU)	2080.0	Antimony		0.01
Magnesium	27.855	Spec. Conductance (micromhos/cm)	NA	Arsenic	LT	0.021
Sodium	39.774	T. Dissolved Solids	NA	Barium		1.376
Potassium	17.97	Total Phosphorus (P)	NA	Beryllium		0.006
		Silica (SiO2)	238.334	Cadmium		0.005
Total Alk. (CaCO3)	431	Boron	0.363	Chromium		0.055
Chloride	8.4	Dissolved Oxygen	NA	Cobalt		0.180
Sulfate	92	BOD	NA	Copper		0.109
Nitrate (N)	2.88	COD	NA	Iron		44.202
Nitrite	NA	CBOD	NA	Lead		NA
Fluoride	0.30	Ammonia (N)	NA	Manganese		1.256
		T. Sus. Solids	4333	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum	LT	0.001
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel		0.160
Phenols	NA	Chromium (+6)	NA	Selenium		NA
TDP	NA	Tin	NA	Silver	LT	0.004
Sulfide	NA	MBAS	NA	Thallium		0.03
		Flash Pt (Celsius)	NA	Vanadium		0.097
				Zinc		0.265

Total Coliform	NA
Fecal Coliform	NA
Fecal Strep	NA

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER Lab Number: 1036050C
Address: FORBES BLDG. 740, TOPEKA, KS. 66620 Report Date: 5-14-91

SAMPLE COLLECTION INFORMATION

Site ID No.: 00000956 Program Code: ER Sample Type: WATER
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX HF-1
Collected By: RACHEL MILLER-BER Date: 5-10-91 Time: 1010

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (UG/L)	Reporting Limit (UG/L)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	NOT DETECTED	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	0.7	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	2.6	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROPROPANE	NOT DETECTED	0.5
TRANS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE RLP Roger H. Carlson, Ph.D., Director

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Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 1036050C
Report Date: 5-14-91

SAMPLE COLLECTION INFORMATION

Site ID No.: 00000956 Program Code: ER Sample Type: WATER
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX HF-1
Collected By: RACHEL MILLER-BER Date: 5-10-91 Time: 1010

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (UG/L)	Reporting Limit (UG/L)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	NOT DETECTED	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	0.7	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	2.6	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROPROPANE	NOT DETECTED	0.5
TRANS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE RLP

Roger H. Carlson, Ph.D., Director

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 103607OC
Report Date: 5-14-91

SAMPLE COLLECTION INFORMATION

Site ID No.: 00000949 Program Code: ER Sample Type: WATER
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX HF-2
Collected By: RACHEL MILLER-BER Date: 5-10-91 Time: 1320

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (UG/L)	Reporting Limit (UG/L)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	NOT DETECTED	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
[illegible]-DICHLOROPROPANE	NOT DETECTED	0.5
[illegible]NS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE RLP

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Kansas Health & Environmental Laboratory
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Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER Lab Number: 103607OC
Address: FORBES BLDG. 740, TOPEKA, KS. 66620 Report Date: 5-14-91

SAMPLE COLLECTION INFORMATION

Site ID No.: 00000949 Program Code: ER Sample Type: WATER
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX HF-2
Collected By: RACHEL MILLER-BER Date: 5-10-91 Time: 1320

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (UG/L)	Reporting Limit (UG/L)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	NOT DETECTED	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROPROPANE	NOT DETECTED	0.5
TRANS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE RLP Roger H. Carlson, Ph.D., Director

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GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 103603OC
Report Date: 5-14-91

SAMPLE COLLECTION INFORMATION

Site ID No.: 00000871 Program Code: ER Sample Type: WATER
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX HF-3
Collected By: RACHEL MILLER-BER Date: 5-13-91 Time: 1410

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (UG/L)	Reporting Limit (UG/L)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	NOT DETECTED	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
[illegible]-DICHLOROPROPANE	NOT DETECTED	0.5
[illegible]NS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE

Roger H. Carlson, Ph.D., Director

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Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 103603OC
Report Date: 5-14-91

SAMPLE COLLECTION INFORMATION

Site ID No.: 00000871 Program Code: ER Sample Type: WATER
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX HF-3
Collected By: RACHEL MILLER-BER Date: 5-13-91 Time: 1410

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (UG/L)	Reporting Limit (UG/L)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	NOT DETECTED	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
[illegible]-DICHLOROPROPANE	NOT DETECTED	0.5
[illegible]NS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE RLP

Roger H. Carlson, Ph.D., Director

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 103604OC
Report Date: 5-14-91

SAMPLE COLLECTION INFORMATION

Site ID No.: 00027944 Program Code: ER Sample Type: WATER
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX HF-5
Collected By: RACHEL MILLER-BER Date: 5-10-91 Time: 1530

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (UG/L)	Reporting Limit (UG/L)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	NOT DETECTED	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROPROPANE	NOT DETECTED	0.5
TRANS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE

Roger H. Carlson, Ph.D., Director

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Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 1036040C
Report Date: 5-14-91

SAMPLE COLLECTION INFORMATION

Site ID No.: 00027944 Program Code: ER Sample Type: WATER
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX HF-5
Collected By: RACHEL MILLER-BER Date: 5-10-91 Time: 1530

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (UG/L)	Reporting Limit (UG/L)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	NOT DETECTED	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
[illegible]-DICHLOROPROPANE	NOT DETECTED	0.5
[illegible]NS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE

Roger H. Carlson, Ph.D., Director

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Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 1036060C
Report Date: 5-14-91

SAMPLE COLLECTION INFORMATION

Site ID No.: 00002099 Program Code: ER Sample Type: WATER
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX HF-6
Collected By: RACHEL MILLER-BER Date: 5-10-91 Time: 1110

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (UG/L)	Reporting Limit (UG/L)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	NOT DETECTED	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROPROPANE	NOT DETECTED	0.5
TRANS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE RLP

Roger H. Carlson, Ph.D., Director

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 1036060C
Report Date: 5-14-91

SAMPLE COLLECTION INFORMATION

Site ID No.: 00002099 Program Code: ER Sample Type: WATER
Collection Site: 000000NE221115E, 04089026, HYDRO-FLEX HF-6
Collected By: RACHEL MILLER-BER Date: 5-10-91 Time: 1110

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (UG/L)	Reporting Limit (UG/L)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	NOT DETECTED	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
[illegible]-DICHLOROPROPANE	NOT DETECTED	0.5
[illegible]NS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE

Roger H. Carlson, Ph.D., Director

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KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102588PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE-22-11-15E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1215 Depth: ****

Site ID: Matrix: Water

Date Collected: 5-10-91
Date Received: 5-13-91
Date Reported: 5-16-91

Comments: E-B QC SAMPLE

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	2	pH (Units)	NA	Aluminum		0.09
Calcium	0.657	Turbidity (NTU)	NA	Antimony		0.06
Magnesium	0.137	Spec. Conductance (micromhos/cm)	NA	Arsenic	LT	0.021
Sodium	0.491	T. Dissolved Solids	NA	Barium		0.005
Potassium	LT 0.6	Total Phosphorus (P)	NA	Beryllium	LT	0.001
		Silica (SiO2)	1.191	Cadmium		0.003
Total Alk. (CaCO3)	NA	Boron	0.079	Chromium	LT	0.003
Chloride	NA	Dissolved Oxygen	NA	Cobalt	LT	0.004
Sulfate	NA	BOD	NA	Copper		0.006
Nitrate (N)	NA	COD	NA	Iron		0.122
Nitrite	NA	CBOD	NA	Lead		NA
Fluoride	NA	Ammonia (N)	NA	Manganese		0.007
		T. Sus. Solids	NA	Mercury		NA
		Corrosivity (LI)	NA	Molybdenum	LT	0.001
Cyanide	NA	Kjeldahl Nitrogen	NA	Nickel	LT	0.007
Oil/Grease	NA	Chromium (+6)	NA	Selenium		NA
Phenols	NA	Tin	NA	Silver	LT	0.004
TDP	NA	MBAS	NA	Thallium	LT	0.015
Sulfide	NA	Flash Pt (Celsius)	NA	Vanadium	LT	0.003
				Zinc		0.032
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102061PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1530 Depth: ****

Site ID: Matrix: Water

Date Collected: 3-19-91
Date Received: 3-21-91
Date Reported: 3-29-91

Comments: HF6-W2 QC SAMPLE

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	8	pH (Units)	NA	Aluminum		0.34
Calcium	2.036	Turbidity (NTU)	NA	Antimony	LT	0.01
Magnesium	0.605	Spec. Conductance (micromhos/cm)	NA	Arsenic	LT	0.021
Sodium	2.178	T. Dissolved Solids	NA	Barium		0.007
Potassium	0.69	Total Phosphorus (P)	NA	Beryllium	LT	0.001
		Silica (SiO2)	3.213	Cadmium	LT	0.002
Total Alk. (CaCO3)	NA	Boron	0.085	Chromium	LT	0.003
Chloride	NA	Dissolved Oxygen	NA	Cobalt	LT	0.004
Sulfate	NA	BOD	NA	Copper		0.020
Nitrate (N)	NA	COD	NA	Iron		1.582
Nitrite	NA	CBOD	NA	Lead		NA
Fluoride	NA	Ammonia (N)	NA	Manganese		0.014
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		0.006
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel	LT	0.007
Phenols	NA	Chromium (+6)	NA	Selenium		NA
TDP	NA	Tin	NA	Silver	LT	0.004
Sulfide	NA	MBAS	NA	Thallium	LT	0.015
		Flash Pt (Celsius)	NA	Vanadium	LT	0.003
Total Coliform	NA			Zinc		0.021
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102062PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: NE22-1115E 04089026 HYDRO-FLEX

Collected By: RACHEL MILLER Time: 1500 Depth: ****

Site ID: Matrix: Water

Date Collected: 3-18-91
Date Received: 3-21-91
Date Reported: 3-29-91

Comments: HF7-W1 QC SAMPLE

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)		3	pH (Units)	NA	Aluminum		0.23
			Turbidity (NTU)	NA	Antimony	LT	0.01
Calcium		0.770	Spec. Conductance		Arsenic	LT	0.021
Magnesium		0.350	(micromhos/cm)	NA	Barium		0.003
Sodium		1.204	T. Dissolved Solids	NA	Beryllium	LT	0.001
Potassium	LT	0.6	Total Phosphorus (P)	NA	Cadmium	LT	0.002
			Silica (SiO2)	2.437	Chromium	LT	0.003
Total Alk. (CaCO3)		NA	Boron	0.074	Cobalt	LT	0.004
			Dissolved Oxygen	NA	Copper		0.011
Chloride		NA	BOD	NA	Iron		0.157
Sulfate		NA	COD	NA	Lead		NA
Nitrate (N)		NA	CBOD	NA	Manganese		0.003
Nitrite		NA	Ammonia (N)	NA	Mercury		NA
Fluoride		NA	T. Sus. Solids	NA	Molybdenum		0.004
			Corrosivity (LI)	NA	Nickel	LT	0.007
Cyanide		NA	Kjeldahl Nitrogen	NA	Selenium		NA
Oil/Grease		NA	Chromium (+6)	NA	Silver	LT	0.004
Phenols		NA	Tin	NA	Thallium		0.02
TDP		NA	MBAS	NA	Vanadium	LT	0.003
Sulfide		NA	Flash Pt (Celsius)	NA	Zinc		0.010
Total Coliform		NA					
Fecal Coliform		NA					
Fecal Strep		NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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Item B-5: KDHE Analytical Results (Private Water Wells)

KANSAS DEPARTMENT OF HEALTH & ENVIRONMENT
Topeka, Kansas 66620-0001 (913) 296-1500

7-26-91

GIL :

HERE ARE THE PRIVATE WELL ANALYSES YOU REQUESTED ALONG WITH A LOCATION MAP

- RACHEL

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

eport To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 1038890
Report Date: 6- 6-9

SAMPLE COLLECTION INFORMATION

→ SAMPLE 2

Site ID No.: 00001041 Program Code: ER Sample Type: WATER
Collection Site: 0000SENE221115E, 04089026, [redacted] PRIVATE WELL
Collected By: BER-R. MILLER Date: 5-30-91 Time: 134

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (UG/L)	Reporting Limit (UG/L)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	NOT DETECTED	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROPROPANE	NOT DETECTED	0.5
TRANS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE Richard L. Pierce Roger H. Carlson, Ph.D., Director

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See Case No. 3888
for Analysis Data

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
Kansas Health & Environmental Laboratory
Organic Chemistry Laboratory
Topeka, Kansas 66620

GC/MS ANALYSIS REPORT

Report To: RACHEL MILLER-BER
Address: FORBES BLDG. 740, TOPEKA, KS. 66620

Lab Number: 1038880
Report Date: 6- 6-91

SAMPLE COLLECTION INFORMATION SAMPLE 1

Site ID No.: 00001034 Program Code: ER Sample Type: WATER
Collection Site: 0000SENE221115E, 04089026, [redacted] PRIVATE WELL
Collected By: BER-R. MILLER Date: 5-30-91 Time: 1510

RESULTS OF ANALYSIS

PURGABLE ORGANICS	Concentration (UG/L)	Reporting Limit (UG/L)
CHLOROMETHANE	NOT DETECTED	5.0
BROMOMETHANE	NOT DETECTED	1.2
VINYL CHLORIDE	NOT DETECTED	0.8
CHLOROETHANE	NOT DETECTED	3.7
DICHLOROMETHANE	NOT DETECTED	0.9
1,1-DICHLOROETHYLENE	NOT DETECTED	0.6
1,1-DICHLOROETHANE	NOT DETECTED	0.5
TRANS &/OR CIS 1,2-DICHLOROETHYLENE	NOT DETECTED	0.5
TRICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROETHANE	NOT DETECTED	0.6
1,1,1-TRICHLOROETHANE	NOT DETECTED	0.7
TETRACHLOROMETHANE	NOT DETECTED	0.7
BROMODICHLOROMETHANE (THM)	NOT DETECTED	0.5
1,2-DICHLOROPROPANE	NOT DETECTED	0.5
TRANS 1,3-DICHLOROPROPENE	NOT DETECTED	0.8
TRICHLOROETHYLENE	NOT DETECTED	0.6
BENZENE	NOT DETECTED	0.5
DIBROMOCHLOROMETHANE (THM)	NOT DETECTED	0.7
CIS 1,3-DICHLOROPROPENE	NOT DETECTED	0.9
1,1,2-TRICHLOROETHANE	NOT DETECTED	0.6
BROMOFORM (THM)	NOT DETECTED	1.5
1,1,2,2-TETRACHLOROETHANE	NOT DETECTED	0.6
TETRACHLOROETHYLENE	NOT DETECTED	1.1
TOLUENE	NOT DETECTED	0.5
CHLOROBENZENE	NOT DETECTED	0.5
ETHYLBENZENE	NOT DETECTED	0.7
META-XYLENE	NOT DETECTED	0.6
ORTHO &/OR PARA-XYLENE	NOT DETECTED	0.6
1,3-DICHLOROBENZENE	NOT DETECTED	1.0
1,2-DICHLOROBENZENE	NOT DETECTED	1.0
1,4-DICHLOROBENZENE	NOT DETECTED	1.0

Analyst: RICHARD L. PIERCE Richard L. Pierce Roger H. Carlson, Ph.D., Director

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KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

SAMPLE 1

Lab Number: 102687PT
Lab Acct Code: BER
Env Acct Code: ER

Locality: SENE-22-11-15E [redacted] PRIVATE WELL

Collected By: R. MILLER Time: 1510 Depth: 30

Site ID: 00001034 Matrix: Water

Date Collected: 5-30-91
Date Received: 5-31-91
Date Reported: 6- 7-91

Comments:

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	437	pH (Units)	NA	Aluminum		0.08
Calcium	149.547	Turbidity (NTU)	NA	Antimony	LT	0.01
Magnesium	15.609	Spec. Conductance (micromhos/cm)	NA	Arsenic	LT	0.021
Sodium	36.233	T. Dissolved Solids	NA	Barium		0.374
Potassium	9.77	Total Phosphorus (P)	NA	Beryllium	LT	0.001
		Silica (SiO2)	29.989	Cadmium	LT	0.002
Total Alk. (CaCO3)	NA	Boron	0.221	Chromium		0.006
Chloride	NA	Dissolved Oxygen	NA	Cobalt	LT	0.004
Sulfate	NA	BOD	NA	Copper		0.045
Nitrate (N)	NA	COD	NA	Iron		0.027
Nitrite	NA	CBOD	NA	Lead		NA
Fluoride	NA	Ammonia (N)	NA	Manganese		0.021
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		0.005
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel	LT	0.007
Phenols	NA	Chromium (+6)	NA	Selenium		NA
TDP	NA	Tin	NA	Silver	LT	0.004
Sulfide	NA	MBAS	NA	Thallium	LT	0.015
		Flash Pt (Celsius)	NA	Vanadium		0.007
				Zinc		0.033
Total Coliform	NA					
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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KANSAS HEALTH AND ENVIRONMENTAL LABORATORY
Department of Health and Environment
Biochemical Analysis Laboratory
Bldg. 740, Forbes Field, Topeka, KS 66620-8420
(913) 296-1657

RESULTS OF LABORATORY ANALYSES

Report To: RACHEL MILLER-BER
Address:

Lab Number: 102686PT
Lab Acct Code: BER
Env Acct Code: ER

SAMPLE 2

Locality: SENE-22-11-15E 04089026 [redacted] PRIVATE WELL

Collected By: R. MILLER Time: 1340 Depth: 30

Site ID: 00001041 Matrix: Water

Date Collected: 5-30-91
Date Received: 5-31-91
Date Reported: 6- 7-91

Comments:

* *

Results Expressed In Milligrams/Liter

Total Hard. (CaCO3)	438	pH (Units)	NA	Aluminum		0.10
Calcium	152.534	Turbidity (NTU)	NA	Antimony	LT	0.01
Magnesium	13.983	Spec. Conductance (micromhos/cm)	NA	Arsenic	LT	0.021
Sodium	14.130	T. Dissolved Solids	NA	Barium		0.343
Potassium	9.50	Total Phosphorus (P)	NA	Beryllium	LT	0.001
		Silica (SiO2)	30.261	Cadmium	LT	0.002
Total Alk. (CaCO3)	NA	Boron	0.401	Chromium		0.004
Chloride	NA	Dissolved Oxygen	NA	Cobalt	LT	0.004
Sulfate	NA	BOD	NA	Copper		0.011
Nitrate (N)	NA	COD	NA	Iron		0.060
Nitrite	NA	CBOD	NA	Lead		NA
Fluoride	NA	Ammonia (N)	NA	Manganese		0.064
		T. Sus. Solids	NA	Mercury		NA
Cyanide	NA	Corrosivity (LI)	NA	Molybdenum		0.003
Oil/Grease	NA	Kjeldahl Nitrogen	NA	Nickel	LT	0.007
Phenols	NA	Chromium (+6)	NA	Selenium		NA
TDP	NA	Tin	NA	Silver	LT	0.004
Sulfide	NA	MBAS	NA	Thallium	LT	0.015
		Flash Pt (Celsius)	NA	Vanadium	LT	0.003
Total Coliform	NA			Zinc		0.048
Fecal Coliform	NA					
Fecal Strep	NA					

Chemist: FD NA - Not Analyzed LT - Less Than

* *

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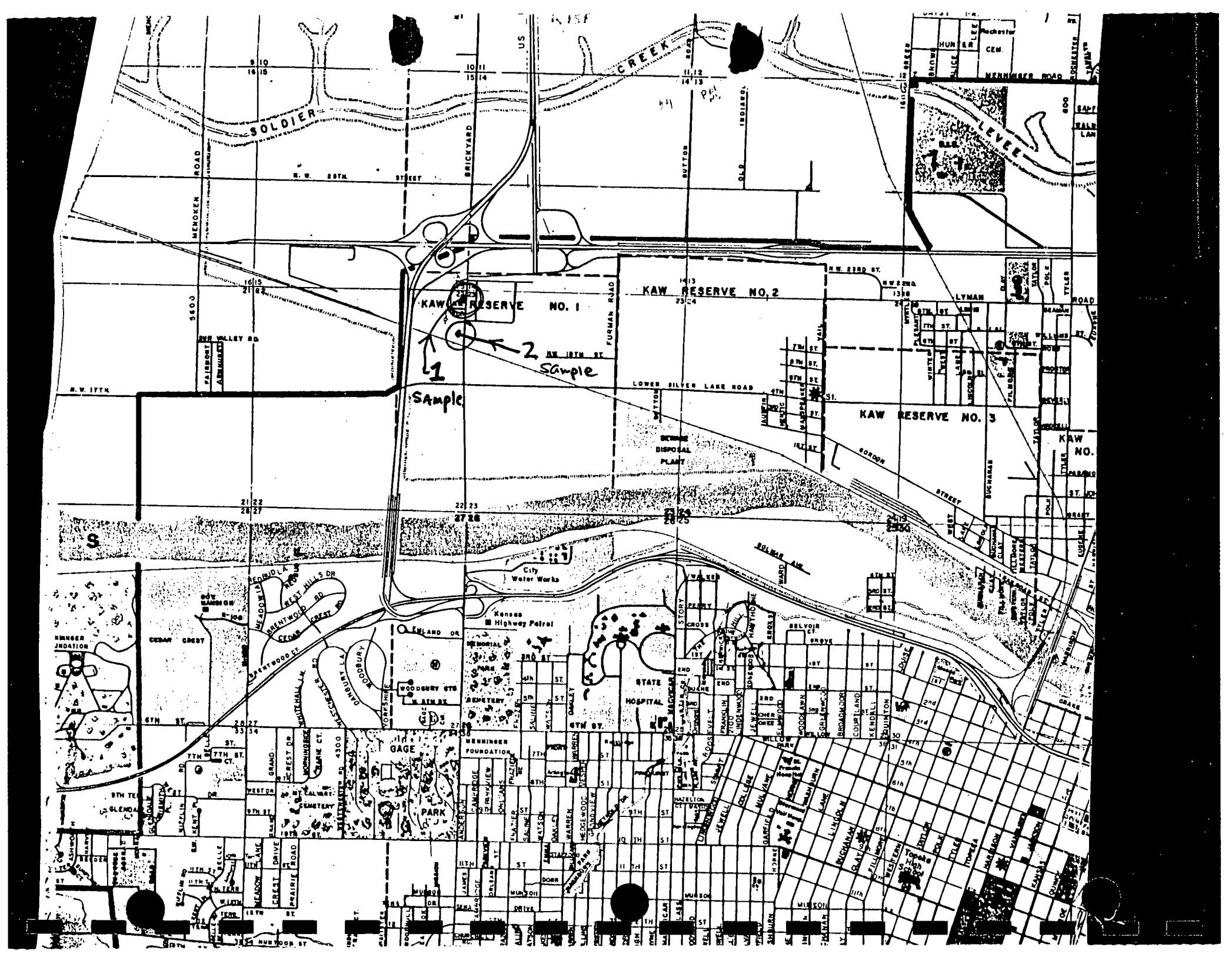
SOLDIER CREEK
LEVEE
KAW RESERVE NO. 1
KAW RESERVE NO. 2
KAW RESERVE NO. 3
1 Sample
2 Sample
MENOKEN ROAD
BRICKYARD
FURMAN ROAD
SUTTON
OLD INDIANOLA
LOWER SILVER LAKE ROAD
GORDON STREET
SEWAGE DISPOSAL PLANT
City Water Works
Kansas Highway Patrol
STATE HOSPITAL
MENNINGER FOUNDATION
MEMORIAL PARK CEMETERY
GAGE PARK
CEDAR CREST
WOODBURY PL
WOODBURY CT
ENGLAND DR
MENNINGER ROAD
LYMAN ROAD
HUNTOOR ST
SOLDIER CREEK

Item B-6: QA/QC Evaluation Results

QA/QC EVALUATION RESULTS

QA/QC data generated during the RI consisted of: (1) field replicate samples sent to the same analytical laboratory; (2) interlaboratory replicate samples; (3) equipment blank samples; (4) ion balances for water samples where the data to do so were available; and (5) internal laboratory QA/QC procedures.

Field replicate samples were taken of soil, sludge, and ground water. In general, results for these samples indicated satisfactory analytical laboratory quality with relative percent differences (RPDs) less than 50 percent in soil and sludge and less than 10 percent in water. A greater degree of variation in soil and sludge samples than in water samples is normal. For example, the RPD for chromium in replicate sludge samples from the bottom of Manhole No. 1 was 20 percent and the RPD for unfiltered chromium in the replicate water sample from monitoring well HF-5 was 4 percent.

Somewhat greater variation was evident in interlaboratory replicate sample results. However, these consisted of such samples as sludge from the bottom of manholes or monitoring well HF-4. Because of the limited amount of sludge available to be sampled, the nature of these samples was not uniform and it was expected that substantial differences in analytical results would occur. Nevertheless, the same relative order of magnitude was indicated by results.

Three equipment blanks were taken during field work. The results of these are presented in Table B1. Two of these blanks were associated with soil sampling equipment and one with ground water sampling equipment. Although relatively small concentrations of copper and some other elements were reported to be present above detection limits, chromium was less than its detection limit of 3 ug/L in all three samples. These results indicate an acceptable level of equipment cleanliness for the contaminants, types of samples, and other circumstances of this site.

Ion balances were conducted for samples from all six monitoring wells. The results of these calculations are presented in Table B2. Ion balance differences were generally good, being substantially less than 10 percent of the total except in the case of HF-4. For example, the difference for the sample from HF-2 was 4 percent. In the case of HF-4, the ion balance difference was excessive. Examination of the data indicates that this is a result of the filtered calcium concentration, reported at 42 mg/L, being low in comparison to the unfiltered calcium concentration, reported at 128 mg/L. This difference, which is far greater than is the case for other samples, would be sufficient to make the ion balance results satisfactory if the higher value was used. Therefore, the result

Table B1: Equipment Blank Results*			
Variable	HF1-W-2	HF6-W-2	HF7-W-1
General:			
Hardness	2,000	8,000	3,000
Major Elements:			
Calcium	657	2,040	770
Iron	122	1,580	157
Magnesium	137	605	350
Potassium	<600	690	<600
Sodium	491	2,180	1,200
Trace Elements:			
Antimony	60	<10	<10
Arsenic	<21	<21	<21
Beryllium	<1	<1	<1
Cadmium	3	<2	<2
Chromium	<3	<3	<3
Copper	6	20	11
Manganese	7	14	3
Nickel	<7	<7	<7
Silver	<4	<4	<4
Thallium	<15	<15	20
Zinc	32	21	10

*Concentrations rounded off to three significant figures and in ug/L. Analysis by KDHE. Samples identified as follows:

1. HF1-W-2 - Ground water sampling equipment blank involving distilled water, HDPE tubing, and Waterra pump foot valve.
2. HF6-W-2 - Soil sampling equipment blank of distilled water rinsate off split-barrel sampler after decontamination before obtaining the 30 foot BGL sample from boring HF-6.
3. HF7-W-1 - Soil sampling equipment blank of distilled water rinsate off hand tools after decontamination before obtaining the surface sample from boring S-7.

Table B2: Ground Water Ion Balances*

Ion	MW	EW	Monitoring Well HF-1	HF-2	HF-3	HF-4	HF-5	HF-6
CATIONS								
Ca^{+2}	40	20	6.85	8.35	6.05	2.12	6.55	7.60
Fe^{+2}	55.8	27.9	0.00	0.00	0.34	0.12	0.38	0.00
Mg^{+2}	24.3	12.2	1.33	1.19	1.01	0.32	0.94	1.03
Mn^{+2}	54.9	27.4	0.00	0.00	0.03	0.01	0.04	0.01
K^{+}	39.1	39.1	0.30	0.48	0.18	0.16	0.22	0.46
Na^{+}	23	23	0.58	0.68	2.43	0.41	0.62	1.77
Total			9.06	10.70	10.04	3.14	8.75	10.87
ANIONS								
HCO_3^{-}	100	50	7.48	7.98	6.66	7.08	6.90	8.38
Cl^{-}	35.5	35.5	0.48	0.14	2.54	1.11	0.39	0.24
NO_3^{-}	62	62	0.06	0.25	0.00	0.00	0.00	0.05
SO_4^{-2}	96	48	0.98	1.60	0.88	0.98	1.15	1.92
Total			9.00	9.97	10.08	9.17	8.44	10.59

*Sandard chemical symbols used. Gram molecular weight (MW) and equivalent weight (EW) for each species in first column listed in second and third columns, respectively. Calcium carbonate weights used for bicarbonate since bicarbonate analytical results are expressed in terms of calcium carbonate. Monitoring well concentrations and totals in units of milliequivalents/liter (meq/L). Concentrations of all cations except potassium converted from analytical results for filtered samples. Only total results were available for potassium and all anions, except alkalinity in HF-6. Alakalinity in HF-6 based on field determination in a filtered sample.

for filtered calcium appears to be questionably low. Results for other ions appear to be reasonable.

Internal laboratory QA/QC procedure information for KDHE's laboratory is not available to Terracon. PACE reportedly followed its laboratory quality assurance plan as documented in the Quality Assurance Project Plan (QAPP) for the RI. This included standard calibration measures and the use of method blanks, matrix spikes, and analytical duplicate or replicate samples. Matrix spikes provide an indication of accuracy and replicates provide an indication of precision. The PACE QC data summary provided for analysis of samples taken in March 1991 is included as the following pages of this evaluation. As indicated therein, recovery of calibration standards was in the 97 percent or better range, method blank results were acceptably low and near zero, matrix spikes indicated recoveries in the range of 70 to 80 percent (a range that is good for soil samples), and calculated RPDs for replicate samples were 4.2 percent or less. Replicate results for the water sample from monitoring well HF-4 were 3 and 4 percent for chromium and copper, respectively.

Based on QA/QC results, as discussed above, data quality is evaluated as being satisfactory for the purposes of the RI at this site. This conclusion is reached without having had access to information on internal KDHE laboratory QA/QC procedures and results. Lack of such access limits this evaluation to that degree; however, the other information that is available does not indicate significant data quality problems.

pace laboratories, inc.

REPORT OF LABORATORY ANALYSIS

Offices:
Minneapolis, Minnesota
Tampa, Florida
Coralville, Iowa
Novato, California
Leawood, Kansas
Irvine, California
Asheville, North Carolina
Charlotte, North Carolina

QC DATA SUMMARY FOR METALS

PACE Laboratories, Inc.

Initial calibration source ERA

% RECOVERIES OF CALIBRATION STANDARDS

PROJECT#	5103255				
DATE ANAL.	4/11/91				
PARAMETER					
Cu	97.0%				
Cr	98.9%				

METHOD BLANK RESULTS (MG/L)

DATE PREP	3/29				
DATE ANAL.	4/11/91				
Cu	0.013				
Cr	-0.003				

MATRIX SPIKE RESULTS (MG/L)

DATE ANAL.	DATE PREP	SAMPLE ID	PARAMETER	AMOUNT IN SAMPLE	SAMPLE + SPIKE	SPIKE REC. ADDED	% REC
4/11/91	3/29/91	3199.1 3198.2	Cu	3.879	4.575	1.000	69.6%
		3199.1	Cr	3.890	4.727	1.000	83.7%
4/11/91	3/29/91	3201.7	Cu			N/A	
		3201.7	Cr	8.146	8.949	1.000	80.3%

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pace INCORPORATED
THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

DUPLICATE DATA

DATE ANALYZED 4/29/91 SAMPLE # _____

DATE PREPPED 3/29/91

	PARAMETER	VALUE 1	VALUE 2	% RPD
3199.1	Cu	3.879	3.863	0.4 %
	Cr	3.890	3.741	3.9 %
3201.7	Cu	142.35	148.45	4.2 %
	Cr	8.146	8.422	3.3 %

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APPENDIX C: RISK ASSESSMENT METHODS

Item C-1: Risk Assessment Methods

RISK ASSESSMENT METHODS

The risk assessment portion of the RI report is contained in Section 6.0 of the report. The methods used in generating that section are delineated within it. Reliance was primarily placed on USEPA guidance, as delineated in "Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)", EPA/54-/1-89/002, December 1989, Office of Emergency and Remedial Response, Washington, DC.

Item C-2: Ground Water Model Documentation

FUNDAMENTALS OF GROUND-WATER POLLUTION

In any ground-water pollution study it is essential to obtain the background concentration of a wide variety of chemical constituents, particularly those that might be common both to the local ground water and a leachate. The water in shallow or surficial aquifers can undergo substantial fluctuations in chemical quality and, therefore, it is not always a simple and easy task to determine background concentrations, particularly of the more conservative constitutents, such as chloride or nitrate. In general, samples should be collected during dry periods and not during or within a week or so following a period of rain. Throughout much of North America the major periods of ground-water recharge occur in wetter periods of the year (generally in the spring and fall), while minor recharge occurs during or immediately after a rain. These recharge events flush water soluble compounds from the unsaturated zone to the water table and may substantially change the chemical quality of the ground water. Since the quality of shallow ground water may fluctuate within fairly wide limits during short intervals, it is essential to determine background concentrations statistically by collecting several samples at different times and from different depths.

The severity of ground-water pollution is partly dependent on the characteristics of the waste or leachate, that is, its volume, composition, concentration of the various constituents, time rate of release of the contaminant, the size of the area from which the contaminants are derived, and the density of the leachate, among others. Data describing these parameters are difficult to obtain and are lumped together into the term "mass flow rate". which is the product of the contaminant concentration and its volume, recharge rate, or leakage rate.

Once the leachate is formed it begins to migrate slowly downward through the unsaturated zone where several physical, chemical and biological forces act upon it. Eventually, however, the leachate may reach saturated strata where it will then flow primarily in a horizontal direction as defined by the hydraulic gradient. From this point on, the leachate will become diluted due to a number of phenonmena, including filtration, sorption, chemical processes, microbial degradation, dispersion, time and distance of travel.

Filtration removes suspended particles from the water mass, including particles of iron and manganese or other precipitates that may have been formed by chemical reaction. Dilution brought about by oxides and hydroxides, and organic matter, all of which function as sorptive material. The amount of sorption depends on the type of pollutant and the physical and chemical properties of the solution and the subsurface material.

Chemical processes are important when precipitation occurs

as a result of excess quantities of ions in solution. Chemical processes also include volatilization as well as radioactive decay. In many situations, particularly in the case of organic compounds, microbiological degradation effects are not well known. It does appear, however, that a great deal of degradation can occur if the system is not overloaded and appropriate nutrients are available.

Dispersion of a leachate in an aquifer causes the concentration of the contaminants to decrease with increasing length of flow. It is caused by a combination of molecular diffusion, which is important only at very low velocities, and dispersion (hydrodynamic mixing), which occurs at higher velocities in laminar flow through porous media. In porous media, different macroscopic velocities and flow paths that have various lengths are to be expected. Leachate moving along a shorter flow path or at a higher velocity would arrive at an end point sooner than that part following a longer path or a lower velocity, thus resulting in hydrodynamic dispersion. Dispersion can be both longitudinal and transverse and the net result is a conic form downgradient from a continous pollution source. The concentration of the leachate is less at the margins of the cone and increases toward the source (Figure 1). Because dispersion is directly related to ground-water velocity, a plume or slug will tend to increase in size and decrease in concentration with more rapid flow within the same period of time (Figure 1).

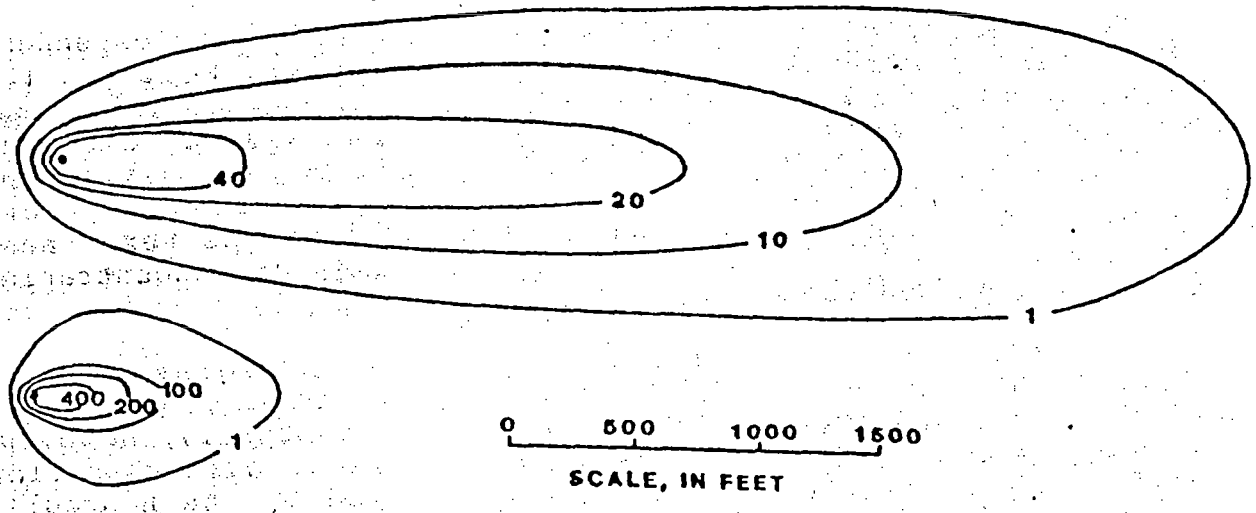


Figure 1. Ground-water Velocity Exerts a Major Control on Plume Shape. Upper Plume V = 1.5 ft/day and Lower Plume V =0.5.

Since dispersion is affected by velocity and the configuration of the aquifer pore spaces, coefficients must be determined experimentally of empirically for a given aquifer. There is considerable confusion regarding the quantification of the dispersion coefficient and many of the published values are fitted values that cannot be transferred.

Selection of dispersion coefficients that adequately reflect conditions that exist in an aquifer is a problem that can not be readily solved and herein lies one of the major stumbling blocks of chemical transport models.

Often confused with the term dispersion (D_x=longitudinal dispersion and D_y=transverse dispersion) is dispersivity (a_x, a_y). The former includes velocity: to transform from one to another requires either division or multiplication by velocity.

The rate of advance of a contaminant plume can be retarded if there is a reaction between its components and ground-water constituents or if sorption occurs. This is called retardation (R_d). The plume in which sorption and chemical reactions occur, generally will expand more slowly and the concentration will be lower than those of an equivalent nonreactive leachate.

Hydrodynamic dispersion affects all solutes equally while sorption and chemical reactions can affect various constituents at different rates. Thus, a leachate source that contains a number of different solutes can have several solutes moving at different rates due to the attenuation processes.

The areal extent of plumes may range within wide extremes depending on the local geologic conditions, influences on the hydraulic gradient, such as pumping, changes in ground-water velocity, and differences in the time rate of release of contaminants.

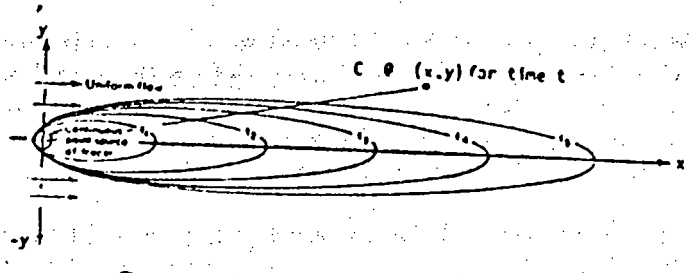
The many complex factors that control the movement of leachate and the overall behavior of contaminant plumes are difficult to assess in that the final effect represents several factors integrated collectively. Likewise, concentrations for each consitutent in a complex waste are difficult to obtain. Therefore, predictions of conentration and plume geometry, at best, can only be used as estimates, principally to identify whether or not a plume might develop at a site and, if so, to what extent. Models can also be used as an aid in determining potential locations for monitoring wells and to test various renovation or restoration schemes.

PLUME

The mapping of movement of contaminated ground water is an important aspect of the design of any landfill, holding on disposal pond, or reclamation project. As leachate may be generated from the above mentioned operations, there is a need for predicting its movement down gradient of the points of injection. Since the resulting contaminant plume may contain chemical, bacterial, or radioactive constituents, there is also an interest in mapping the concentration distribution of such materials as they disperse, react chemically or mechanically with resident aquifer materials, or decay. This program code allows such concentration mapping. The theory upon which the code is based comes basically from Wilson and Miller (1978). The theory was extended herein to also include time varying leachate release rates as well as multiple and areally extensive point sources of contamination.

Program Theory

The configuration of the plume mapping situation is basically as follows. The principal of superposition is used to evaluate the impacts of multiple point sources of varying strength.



Concentration distributions
at various times

Wilson and Miller give the equations for mapping the time-varying concentration distribution of the above configuration. Their equations, converted to the units of this paper are:

$$C = \left(\frac{16019}{m}\right)\left[\frac{f'_m \exp\left(\frac{x}{\beta}\right)}{4\pi n (D_x D_y)^{1/2}} W\left(u, \frac{r}{\beta}\right)\right]$$

in which:

$$D_x = \alpha_x V$$

$$D_y = \alpha_y V$$

$$\beta = 2D'_x/V$$

$$\gamma = 1 + (2\beta\lambda/V')$$

$$u = r^2/4\gamma D'_x t$$

$$r = \left[\left(x^2 + \frac{D'_x}{D'_y}\right)\gamma\right]^{1/2}$$

$$W(u, \frac{r}{B}) = \int_u^\infty \frac{1}{\theta} \exp-(\theta + \frac{r^2}{4B^2\theta})d\theta = (\frac{\pi B}{2r})^{1/2} \exp(-\frac{r}{B}) \operatorname{erfc}[-\frac{\frac{r}{B} - 2u}{2u^{1/2}}]$$

$$D'_x = D_x/R_t$$

$$D'_y = D_y/R_t$$

$$V' = V/R_t$$

$$\operatorname{erfc}(x) = 1 - \operatorname{erf}(x)$$

$$\operatorname{erf}(x) = 1 - \frac{1}{[1 + a_1x + a_2x^2 + \cdots + a_6x^6]^{16}}$$

$$a_1 = 0.0705$$

$$a_2 = 0.0423$$

$$a_3 = 0.00927$$

$$a_4 = 0.00015$$

$$a_5 = 0.000277$$

$$a_6 = 0.000043$$

and where:

C = concentration of the substance in solution (mass of solute per unit volume of solution), in parts per million (ppm)

m = aquifer thickness, in feet (ft)

f'_m = mass injection rate of pollutant, in pounds per day (lbs/day)

x = distance between point source x coordinate and observation point x coordinate, in ft

α_x = longitudinal dispersivity in x direction of flow, in ft

α_y = transverse dispersivity in y direction, in feet

R_t = retardation factor due to ion exchange or adsorption, a factor equal to or greater than 1, no dimensions

λ = radioactive decay constant, in $days^{-1}$. This equals to ln2/365L where L equals half life of species, in years

V = uniform groundwater flow rate in x direction, in ft/day. This is calculated from field data according to the equation V = KI/7.48n where K is the aquifer hydraulic conductivity, I is the hydraulic gradient, and n is the porosity.

n = aquifer porosity, a decimal

16019 = conversion factor to produce concentrations in parts per million. The units of this constant are ppm/lb/ft^3.

The Wilson and Miller (1978) analytical model was chosen because it is a simpler model with fewer parameters than other equations examined. The simpler solution better lent itself to developing user-oriented microcomputer programs. The equation and methods, however, do have some significant drawbacks, perhaps two of the most serious being the inability to predict movement through the unsaturated zone and to input natural recharge between source and sink into the techniques. Recharge can be introduced by means of the more advanced models.

The assumptions on which the analytical solutionis based are as follows:

1. The ground-water flow regime is saturated.

2. The aquifer is infinite in areal extent.

3. All aquifer properties are homogeneous and isotropic.

4. Ground-water flow is continous and uniform in direction and velocity.

5. There is no dilution of the plume by recharge outside the source area.

6. The leachate is evenly distributed over the vertical dimension of the saturated zone.

7. The leachate source is a point in a plan view.

8. The leachate source supplies a constant mass flow rate.

PLUME is menu-driven interactive program. A map of concentration distribution can be viewed on the monitor or a hard copy can be generated on command by a printer. The concentrations shown reflect the <u>average</u> concentration in the plume at a particular point. The concentration, of course, is a function of the thickness of the zone of contaminant mixing.