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PROJECT EVALUATION REPORT NEAT ENHANCED HEAVY FUEL OIL RECOVERY PILOT TEST VOLUME 1 OF 2 APPENDICES A TO D NWS YORKTOWN VA
3/1/1994
GROUNDWATER TECHNOLOGY GOVERNMENT SERVICES

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PROJECT EVALUATION REPORT
NAVAL SUPPLY CENTER YORKTOWN
HEAT-ENHANCED HEAVY FUEL OIL RECOVERY
PILOT TEST

VOLUME 1 OF 2

(APPENDICES A-D)

RAC N47408-92-D-3044
Delivery Order 11

PREPARED FOR:

ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
6500 HAMPTON BLVD.
BUILDING A/LAFAYETTE ANNEX
NORFOLK, VIRGINIA 23511-6287

MARCH 1994

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John Conway
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1.0 EXECUTIVE SUMMARY

1.1 Introduction

This Evaluation Report has been prepared to discuss the results of an enhanced liquid-petroleum hydrocarbon remediation pilot-scale test program conducted at the Naval Supply Center (NSC) Yorktown Fuel Annex. The test was conducted to determine the feasibility of using steam injection or hot water injection to heat the soil and liquid petroleum hydrocarbon to facilitate the recovery of separate-phase hydrocarbons (SPH) at the tank farm site. The results of the pilot-scale test program include recommendations and a listing of design parameters.

Environmental Investigations have been on-going at the site since 1989 to assess subsurface impact associated with the historical operations at the facility. In a report prepared by O'Brien and Gere Engineers entitled "Corrective Action Plan, Yorktown Fuel Annex, Yorktown, Virginia, 1990", it was determined that recovery of SPH would constitute the first stage of remediation. Due to the viscosity of the SPH in the subsurface, it was concluded that SPH mobility may be enhanced by heat application, steam or hot water injection, or by the addition of surfactants and/or solvents.

Steam injection and hot water injection were selected by the government as the preferred alternative for enhancing the mobility of the SPH at the Yorktown Fuel Annex site and are the remediation techniques evaluated during the pilot test.

1.2 Objectives

The overall objective of conducting the pilot-scale study was to achieve zones of heated soil and to subsequently measure the effects of the heating methods to enhance SPH and groundwater removal in the pumping well capture areas.

Specific Objectives

- Obtain field data to evaluate the feasibility of steam and/or hot water injection to enhance SPH recovery;
- Define trends in SPH recovery versus soil temperature variations and evaluate the viability of steam or hot water injection for achieving targeted clean-up criteria; and,
- Determine conceptual operating parameters (i.e. steam flow rates, optimum soil temperature, operation requirements,...) for future full-scale remediation facility construction and operation.

1.3 Activities

In order to achieve these objectives, it was necessary to heat the soil using steam and hot water and recover SPH in a consistent and comparable manner. There were both primary and subordinate activities, which are listed below.

Primary Activities

- Inject steam at varying flow rates to assess its effect on the mobility of the SPH;

- Inject hot water at varying flow rates to assess its effect on the mobility of the SPH;
- Pump SPH without heat at a third location to assess the mobility of the SPH without heat influence;
- Extract groundwater at three locations to establish cones of depression for SPH collection and subsequent recovery.

Subordinate Activities

- Derive soil temperature gradients which would allow for an approximation of the thermodynamic properties of the SPH saturated soil;
- Average directional soil heat capacities at various injection flows;
- Compare data for heat-enhanced and un-enhanced recovery systems;
- Determine the effects of heat-enhanced recovery on the soil vapor concentrations of hydrocarbons in the study area;
- Obtain additional groundwater and hydrocarbon pumping data in the fuel annex area which would allow further assessment of the hydraulic conditions at the site.
- Measure and remove SPH accumulations during pseudo-steady-state conditions and during cool-down period after ceasing steam injection;
- Measure the horizontal soil temperature gradient across the study area at various depths;
- Determine injection rates for steam and hot water necessary to obtain steady-state conditions;
- Analyze soil samples collected before and after the operation of the heating and recovery systems for changes in contaminant concentrations.

1.4 Selection of Preferred Recovery Methods

This pilot study was performed to evaluate the alternatives of groundwater and SPH recovery without heat enhancement; groundwater and SPH recovery with hot water injection (heat) enhancement; and groundwater and SPH recovery with steam injection (heat) enhancement. Due to SPH emulsification, product/water inversions, and equipment operations which occurred during pilot testing, it was concluded that total fluids recovery will be more effective than separate dual pump recovery systems for groundwater and SPH. The following evaluations, therefore, include total fluids recovery.

1.4.1 Product Recovery Only (Unheated System)

No significant fuel oil recovery occurred from the unheated pilot test area. This is attributed to the low kinematic viscosity and greater affinity for Naval Special Fuel Oil (NSFO) to remain immobile within a soil matrix. This alternative was, therefore, not considered further as a stand-alone technology; it would not promote the removal/remediation of NSFO. The pilot study confirmed that unheated recovery, in comparison to a heat-enhanced system is of limited benefit.

1.4.2 Hot Water Enhanced Recovery (Hot Water Heated System)

Hot water enhanced extraction did provide some enhancement of separate-phase hydrocarbon (SPH) recovery; however, it also appeared to promote the inversion of the NSFO product which, in turn, would make significant recovery difficult. The mass of water required to provide the required BTU input to the subsurface is many times more than that required using steam. Also, the specific gravity of the NSFO is approximately equal to water. Therefore, water was found above the product on occasion and anticipated separation did not occur. In addition, maintaining hydraulic control to the extent necessary to promote significant product recovery would require a large number of monitoring wells and an associated intensive maintenance program. Hot water injection was eliminated from further consideration due to potential problems with product inversion and difficulties of maintaining hydraulic control.

1.4.3 Steam Enhanced Recovery (Steam Injection System)

Steam enhanced recovery provided the greatest promise for remediation of NSFO at the subject site. This determination was based on several factors. Those factors were the flexibility to achieve higher temperatures; the low mass injection rate needed; the propensity for SPH to rise with the steam injected below the product layer and water table; and the overall success in removing free product. The rapid recovery of soil temperatures after a shut-down period indicates that steam injection could be applied alternately to separate areas. This could reduce recovery costs. Other factors in this determination are the flexibility for process augmentation to bio-venting technologies after removal of most of the product. This augmentation may meet removal threshold criteria and ultimately result in site closure.

1.5 Summary

The cost of remediation for this site will be heavily influenced by the size of the area to be treated, the definition of variations within the SPH plume, and the remediation process technology selected.

Additional plume definition, to address the horizontal and vertical extent of the SPH plume, will provide significant information for the recovery system design, construction, and operation. Refining the plume definition, with respect to the existing reservoirs and other structures, will allow optimum placement of injection and recovery wells. It can also be used as a baseline for comparison between pre- and post-remediation data and it may be used to estimate the total mass of hydrocarbons present in site soils.

Steam enhanced SPH recovery is the recommended technology for removing the bulk of the NSFO present in the subsurface at this site. This approach remains feasible whereas other technologies are rejected. Reasons for rejecting of the other tested technologies tested are summarized below.

> Un-enhanced SPH recovery was rejected due to the negligible recovery of the highly viscous NSFO at ambient ground temperatures (about 59°F).
>
> Hot water enhanced SPH recovery, while more promising than un-enhanced recovery, was also eliminated as a viable option. SPH recovery was only slightly greater than un-enhanced recovery. It is also expected that it would be very difficult to maintain hydraulic control within the treatment cells, given the possibility for SPH/water inversion and the mass of water required.

As the subsurface temperature is increased from 59°F (15°C) to 212°F (100°C), the residual saturation concentration for NSFO will decrease from about 31,000 ppm to about 7,400 ppm. This

is close to the level of 4,800 ppm which would be expected for No. 2 fuel oil at 50°F (10°C). Remaining traces of free product, with a higher constituent percentage of lower volatility NSFO components, will become reabsorbed and essentially immobilized during cooling of the soil formation.

With the injection of steam at a temperature which heats the subsurface to 212°F, it would take only abut 2.75 times longer to recover NSFO than it would to provide a similar level of recovery if the contaminant were No. 2 fuel oil. There is a decrease in NSFO viscosity from about 30 centistokes at 150°F (hot water) to about 11 centistokes at 212°F (steam), this indicated that there would be a 63% reduction in recovery time for a system using steam as compared to one using hot water.

Heating may become unevenly focused along pathways connecting the recovery and injection wells, resulting in incomplete removal treatment. This issue can be addressed during the design and construction phases to improve the efficiency of the full-site remediation system.

Heating with steam will provide a more uniform temperature influence on the surrounding soils than hot water. This is due to the expanding isothermal zone of influence created by the large amount of energy transferred during the change in phase from steam to water. Movement of the steam front is expected to be influenced less by subsurface heterogeneities than by the movement of hot water. Heating with steam also provides better hydraulic control within each treatment cell due to the minimal amount of dilution water to be removed.

The pilot-test data evaluation process determined a temperature threshold at which the recovery of NSFO is effective and at which the residual saturation value is minimized. This temperature value was found to be approximately 140°F. This is less than the injection steam temperature of 212°F and significantly higher than the natural ground temperature of 59°F, but it is a temperature which was found to be readily attainable across the pilot test area.

Considering the pilot test data available, it is reasonable that an upper temperature threshold could also be established in conjunction with the cool-down rate which would provide the temperature bounds and time frame for pulsed heating of the subsurface. Pulsed heating of the subsurface, i.e., applications of alternative heating and non-heating of the soil during planned cycles, will allow for the system to be efficiently designed and operated. It will allow remediation of partial site areas and offer flexibility, by pipe manifolding, to inject heat to specific site areas in a variable manner. This will maintain soil temperatures within the range that effectively mobilizes the NSFO. Further, this design will optimize capital expenditures for a cost-effective full-scale system.

It was noted that the higher temperature in the steam injection system appeared to relate to increased concentrations of volatile constituents in the recovery well. It was also noted that dissolved hydrocarbon, even in small concentrations, will need to be addressed in a full-scale system.

Other technologies may be applicable to specific areas or conditions which may be found on the Yorktown site with further investigation. But, steam enhanced SPH recovery, operated as a pulsed steam delivery system, in conjunction with total fluids extraction, is considered to be the most viable application of the technologies evaluated during this pilot program.

2.0 SITE INFORMATION

2.1 Site Description

Naval Supply Center (NSC) Yorktown, located in central York County, Virginia, is a Naval Fuel Depot which stores and distributes fuel to a number of commands in the area.

The facility is bounded by Virginia Route 238 to the north, the West Branch of Wormley Creek to the south, the Colonial National Historical Park to the west, and the U.S. Coast Guard Reserve Training Center to the east (see Figure 2-1). The 110-acre site lies between 25 and 50 feet above mean low water (MLW) with gently rolling terrain that slopes toward Wormley Creek. The facility is predominately open field areas with a few buildings and paved roads. A security fence surrounds the facility, and access is controlled by a manned security gate (see Figure 2-2).

NSC Yorktown was activated in 1918 with the construction of eight 90,000-barrel reinforced concrete underground tanks for Naval Special Fuel Oil (NSFO). The NSFO tank area lies at the northern edge of NSC Yorktown along Route 238 near the main entrance to the facility and covers about thirteen acres. Due to the vintage construction of the NSFO tanks, they have neither secondary containment nor leak detection systems.

According to a corrective action plan prepared by O'Brien & Gere in October 1990, inventory loss of NSFO was first detected in the NSFO tank area in the 1950s and continued to be noted while the tanks were in service. Groundwater was detected in Tank 4 of Group A in 1980. Later, NSFO was discovered seeping from the ground in a low-lying area east of the NSFO tanks. This area is adjacent to a pond and an area which drains to the West Branch of Wormley Creek.

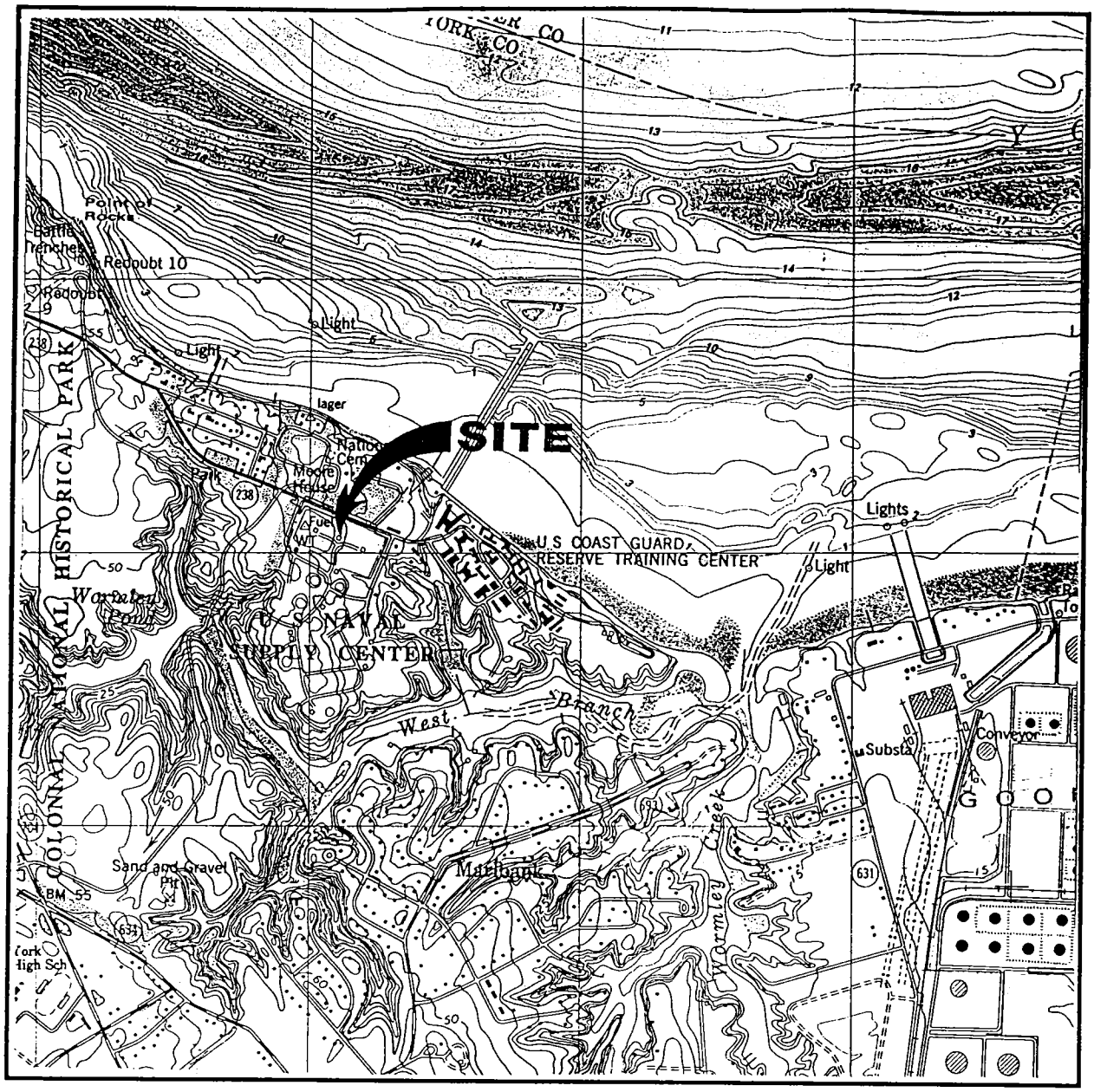
Analysis of a free product sample, and review of a Material Safety Data Sheet (MSDS) from ARCO Petroleum Products Company for Fuel Oil 535, indicates the product consists of No. 5 heavy fuel oil. The product is also referred to as bunker oil, Fuel Oil - Navy Special Grade or Navy Special Fuel Oil (NSFO). Therefore, physical contaminant properties for No. 5 fuel oil will be used in this report for evaluation of recovery methods, residual concentrations, etc. The material has a specific gravity between .94 and .99 and a viscosity of about 500 centistokes at 15 degrees Celsius (59°F), the approximate normal subsurface temperature.

2.2 Site Hydrogeology

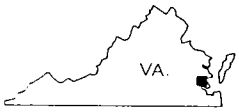
The following discussion is adapted from the Corrective Action Plan (CAP), Yorktown Fuel Annex, by O'Brien & Gere, October 1990. Discussion of the site geology is limited to the uppermost 27 feet of the unconsolidated overburden material.

The predominant sediment type encountered during the investigation was a tan to red-brown sand with grain size that ranged from coarse to fine with traces of silt (Yorktown Formation). This material extends downward to approximately 20 feet below grade. Below this is a layer of green-blue-gray fine-grained fossiliferous sand.

During the drilling portion of the pilot study (1993), subsurface lithology remained fairly consistent from the surface to approximately 20 feet below grade. The soil consisted of reworked yellowish to orange, light brown to brown and green-gray, fine-to coarse-grained sands. Dependent upon specific location across the study site below 20 feet, the lithology became more varied with inter-bedded sands and clays *(see Appendix A - Drilling Logs)*. These findings are consistent with the work performed in 1990.



SOURCE: U.S.G.S. TOPOGRAPHIC QUADRANGLE
POQUOSON WEST, VA.
7.5 MINUTE SERIES
37076-B4-TB-024
1983



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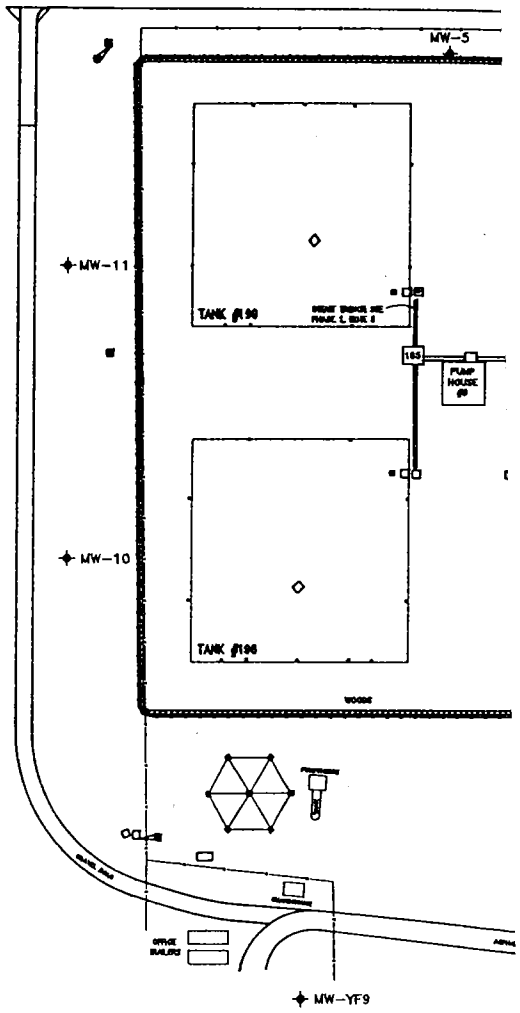
Site Location Map

Figure 2-1

Groundwater Technology



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FEET

NO.	DATE	BY	REVISION

SIGNATURE	DATE
REVIEW ENGR:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

GROUNDWATER TECHNOLOGY

NSC YORKTOWN FUEL ANNEX

NSFO REMEDIATION PILOT TEST
YORKTOWN, VIRGINIA

SITE LAYOUT

DESIGNED BY:	DETAILED BY: PJC	CHECKED BY:
DRAWING DATE: 1/6/94	ACAD FILE: YORKSVY	
PROJECT NO.: 830011008.210691	CONTRACT:	

DRAWING:
FIGURE 2-2

The water table generally occurs at a depth of approximately 13 to 24 feet below grade across the site. Water table elevation is 9 to 13 feet above mean sea level. Predominant groundwater flow is to the southeast from the NSFO tank area towards the West Branch of Wormley Creek at a moderate hydraulic gradient of 0.03 ft./ft.

Numerous drilling logs indicated the presence of significant and varied amounts of separate-phase hydrocarbons (SPH) bound within the soil matrix below the water table. This is indicative of releases from the concrete tanks below the water table elevation.

3.0 DESIGN BASIS AND ASSUMPTIONS

3.1 Remediation Strategy

The primary focus of the heat-enhanced remediation strategy was the recovery of SPH from the subsurface using steam injection and/or hot water injection to enhance SPH mobility. The application of heat from either of these sources was intended to reduce the viscosity of the SPH, making the SPH more mobile within the soil matrix.

Separate test sites were provided in the pilot test area for both the steam and the hot water injection systems. Each of these sites contained specific pumping/recovery, injection, and monitoring wells and associated monitoring systems. A third test site, with recovery and monitoring wells, was provided to serve as a benchmark for conventional recovery (un-enhanced by heat) and to allow for comparison to the heat-enhanced sites.

At each test location, the recovery well was pumped for a period of time to create a cone of depression and to establish baseline information with respect to groundwater levels and SPH influx. During pilot-test pumping operations, either steam or hot water was injected into the ground at four injection points installed around the recovery well. Steam and hot water were injected continuously for several days, while experiencing operational and system difficulties, in an attempt to maintain steady-state conditions at the monitoring wells and within the subsurface. A network of thermocouples was used to monitor the rate and radius of soil heating and to establish the location of the heat front relative to the injection wells.

After operating the heat-enhancement and recovery systems for approximately 45 days under pseudo steady-state conditions (but with operational difficulties), heat enhancement was shut down. Following shutdown, the network of thermocouples was used to monitor the rate and radius of soil cooling, thus providing useful pilot-test information.

3.2 Remediation Objectives

The overall objectives of the pilot-scale study were to achieve zones of heated soil, recover SPH and groundwater and, subsequently, measure the effects of the heating methods used.

Specific objectives of the pilot scale test were:

- Obtain field data to evaluate the feasibility and cost effectiveness of steam and hot water injection to enhance SPH recovery.
- Define trends in SPH recovery versus soil temperature variations.
- Evaluate the feasibility of steam or hot water injection for achieving targeted clean-up criteria.
- Determine relevant design parameters (i.e. steam flow rates, physical system layout, operational requirements, etc.) for extrapolation to a full-site remediation operation.

Pilot test operational activities were designed to:

- Determine soil temperature gradients which would permit an approximation of the thermodynamic properties of the SPH-saturated soil;
- Determine average directional soil-heat capacities at various injection rates;
- Compare recovery data for heat-enhanced and un-enhanced systems;
- Determine the effects of heat-enhanced recovery on the soil vapor concentrations of hydrocarbons in the study area;
- Obtain additional groundwater and hydrocarbon recovery data in the Fuel Annex area which would allow further assessment of the hydraulic conditions at the site; and
- Obtain preliminary information on the operation of steam and hot-water injection equipment, pumping equipment, control systems and data collection system to ensure efficiency of the full-scale system.

3.3 Pilot Study Focus

The kinematic viscosity of hydrocarbons decreases with increasing temperature as shown in Table 3.1

Table 3.1
Kinematic Viscosity of Selected Petroleum Products and Water at 15°C and 100°C[a]

	Avg. Kinematic Viscosity @ 15°C (centistokes)	Avg. Kinematic Viscosity @ 100°C (centistokes)
Gasoline	0.68	.35
Water	1.15	.27
JP-4	1.3	0.55
No. 1 Fuel Oil	2.5	0.82
No. 2 Fuel Oil	4.1	1.05
No. 4 Fuel Oil	40	3.5
No. 5 Light Fuel Oil	170	7.0
No. 5 Heavy Fuel Oil	500	11.0
No. 6 Fuel Oil	4,000	25.0

[a]R.H. Perry and C.H. Chilton, Chemical Engineers' Handbook, Sixth Edition, McGraw-Hill, New York, NY, 1984, p. 9-13.

At 212°F (100°C), the kinematic viscosity of No. 5 heavy fuel oil is about 11 centistokes, approximately 2.75 times that of No. 2 fuel oil at natural ground temperatures 59°F (15°C). No. 2 fuel oil at this temperature is routinely and effectively recovered by pumping. Therefore, it is reasonable to expect that traditional methods will also be effective for the recovery of NSFO at approximately 212°F (100°C).

Subsurface heating, often accomplished by injection of steam and/or hot water, has been applied in several environmental cleanups to enhance *in-situ* recovery of viscous petroleum products from saturated and vadose zone soils. Studies[1,2,3] have shown that the feasibility of steam or hot water enhanced *in-situ* recovery requires medium to high permeability soil and physical soil homogeneity; these soil conditions exist at the NSC Yorktown site.

The average concentration of petroleum hydrocarbon which remains adsorbed to soil after free product removal (i.e., residual saturation) also decreases with decreasing viscosity as shown in Table 3.2.

Table 3.2
Residual Saturation for Petroleum Products in Soil

	Gasoline[a]	No. 2 Fuel Oil[b]	Lube Oil[b]	No. 6 Fuel Oil[c]
Coarse gravel	-	800	1,600	-
Gravel to coarse sand	-	1,600	3,200	-
Coarse to medium sand	-	2,800	5,600	-
Medium to fine sand	2,000	4,800	9,600	60,000
Fine sand to silt	-	8,000	16,000	-

- = no data available

[a]R.A. Brown, "Oxygen Sources for Biotechnological Applications," presentation at the Biotechnology Work Group sponsored by the US Navy Civil Engineering Laboratory and the US Army Construction Engineering Laboratory, Monterey, CA, February 1989.

[b]Hazardous Waste Consultant, March/April, 1992, pp. 1/19-20.

[c]S. Fogel, M.C. Leahy, R. Butts, and M. Jones, "Bioremediation of a No. 6 Fuel Oil Spill: Comparison of Laboratory Treatability Data with Field Remediation Data, "5th Petroleum Contaminated Soil Conference, Amherst, MA, September 1990.

1. "Hot Water Enhanced Recovery of Phase Separated Lubricating Oil", Fulton, Reuter & Buscheck, Handex of N.J. 11/20/91 AGWS&E and API Conference.

2. "Combined Steam Injection and Vacuum Extraction for Insitu Remediation", Kent S. Udell, U.C. Berkley.

3. "Steam Injection/Vacuum Extraction Phase II, McClellan Air Force Base," CH_2M Hill, December 1991.

3.4 Heat Balance Calculations

A number of design steps were necessary to ensure success during the pilot study. Heat related issues were the most critical.

Heat balance calculations were used to identify the boiler size, steam injection rate, hot water injection rate, and injection well spacing necessary to produce measurable results in the required time. Heat balances were performed for initial startup of the pilot test, steady state operation of the system with groundwater pumping, and cooldown of the subsurface following completion of the test. The following assumptions are employed in performing these calculations:

- Conditions within the test area:
  - Average SPH thickness is five feet;
  - Depth to top of groundwater/hydrocarbon is about 15 feet;
  - Aquifer thickness is about 20 feet (15 to 35 feet below grade);
  - Soil porosity is 0.3%;
  - Hydraulic conductivity is 16 gpd/ft^2;
  - The groundwater gradient is 0.03 ft/ft;
  - Soil bulk density is 110 lb/ft^3; and
  - Ambient groundwater and ground surface temperatures are 50°F. (50°F was assumed for the design of the test. Field measurement of groundwater temperature indicated 57°F to 58°F. Material data are determined at 59°F (15°C) as indicated in Section 1.)

- Steam/hot water injection will heat the NSFO-contaminated zone, plus three feet above and five feet below, to temperatures of 212°F and 160°F, respectively.

- The movement of injected steam will be radially away from each injection well and will not be affected by other steam injection wells. The injected hot water will move preferentially from the injection wells toward the centrally located collection well.

- The recovery wells pump from 15 feet below the top of static groundwater, with a recovery rate of two gpm per well.

- The design time to achieve steady state operation in the pilot test is 10 days.

3.4.1 Heat Capacities

Key to the design of the pilot test is an estimation of the heat required to raise the temperature of the subsurface over the desired distance. The heat content of the steam must be balanced against the heat capacity of the soil to perform this estimation.

The soil contains weight fractions of moisture (x_{water}) and adsorbed petroleum (x_{oil}). The heat capacity (C_p) of the soil is then

$$C_{p,soil} = C_{p,dry\ soil} + x_{water}C_{p,water} + x_{oil}C_{p,oil} \qquad (1)$$

The heat capacities of oil, water, and representative soil materials is given in Table 3.3. The heat capacity of dry soil is assumed to be about 0.2 Btu/lb·°F (midway between the heat capacities for sand and clay). The heat capacities for water and oil are 1.0 Btu/lb·°F, and 0.47 Btu/lb·°F, respectively. The water content of the soil is assumed to be 15% in the vadose zone and 30% in

the saturated zone. The oil content in the petroleum-saturated vadose zone soil is assumed to be 30%. Equation (1) predicts soil heat capacities of:

- 0.35 Btu/lb·°F for the Vadose Zone;
- 0.50 Btu/lb·°F for the Saturated Zone, and
- 0.49 Btu/lb·°F for the Petroleum-Saturated Vadose Zone

Table 3.3
Heat Capacities for Relevant Materials

Material	Heat Capacity (Btu/lb·°F)
Petroleum, ρ = 0.93 g/cc[a]	0.47
Water	1.00
Sand[b]	0.19
Clay[b]	0.22

[a]D.M. Himmelblau, Basic Principals and Calculations in Chemical Engineering, Third Edition, Prentice-Hall, Englewood Cliffs, NJ, 1974, p.519.

[b]R.H. Perry and C.H. Chilton, Chemical Engineers' Handbook, Fifth Edition, McGraw-Hill, New York, NY, 1973, p. 3-136.

3.4.2 Initial Heat Requirement for Steam Injection

As steam is injected, it will heat the soil adjacent to each injection well until the condensation temperature of the steam is reached. Condensation fronts will move radially away from the injection wells, each creating a cylinder of heated soil. Ultimately, the cylinders merge in the vicinity of the recovery well. Where the cylinders do not intersect, an annulus in which soil temperature decreases from 212°F to ambient temperature surrounds the cylinder. For purposes of sizing the system, the heat content of these annuli is neglected (a reasonable assumption once the condensation front has moved a substantial distance from the injection well).

If steam is applied to the four injection wells at a total rate of m lb/hr for t hours until the heated cylinders merge, the heat balance is described by equation (2)

$$mt\Delta H_v = (2\pi+4)r^2 x \rho_b C_{p,soil}\Delta T, \qquad (2)$$

where ΔH_v is the heat of vaporization for water (about 970 Btu/lb), r is the distance from the injection wells to the recovery well in feet, x is the thickness of the heated zone in feet, ρ_b is the soil bulk density (typically 110 lb/ft^3), ΔT is the temperature rise (162°F, from an ambient temperature of 50°F to a steam temperature of 212°F). If the steam is superheated, any sensible heat can be neglected, as it generally represents only a few percent of the heat content of the steam. Any heat losses transporting the steam to the injection point are also neglected. Adopting these typical values and assuming that multiple strata of varying heat capacities are heated, equation (2) can be rearranged to

$$r = 0.073\{mt/\Sigma(x_i C_{pi})\}^{0.5} \qquad (3)$$

where r is expressed in feet and x_i and C_{pi} refer to the depth and heat capacities of various soil strata.

Equation (3) is useful in designing the pilot test. For example, using the predicted heat capacities from Section 3.4.1, assume that injecting steam into the oil-saturated zone ($x=5$ ft, $C_p=0.49$ Btu/lb·°F) also heats a portion of the overlying unsaturated zone ($x=3$ ft, $C_p=0.35$ Btu/lb·°F) and a portion of the underlying saturated zone ($x=5$ ft, $C_p=0.50$ Btu/lb·°F). Equation (3) becomes

$$r = 0.030(mt)^{0.5}. \tag{4}$$

In this example, complete heating of the test area in 10 days (240 hours) can be achieved by injecting steam at a rate of 600 lb/hr with a well spacing of 11 feet. The total area heated would be 1,200 ft^2.

3.4.3 Initial Heat Requirement for Hot Water Injection

The injected hot water will move preferentially from the injection wells toward the centrally located collection well, since the rate of water collection will equal or exceed the rate of injection. If r is the distance from the injection wells to the collection well, the volume of soil heated is approximately a rectangular solid of thickness x with a square footprint of area $2r^2$. The heat requirement is described by equation (5)

$$\text{Heat requirement} = 2r^2\rho_b\Delta T\Sigma(x_iC_{pi}) \tag{5}$$

where ΔT is the temperature difference between the hot water (160°F) and ambient soil temperature (50°F), or about 110°F. To determine the quantity of water injection at 160°F required to supply this quantity of heat, consider first the limiting case of perfect and complete heat transfer between soil and water. If water is injected at a constant rate m lb/hr for t hours, then the heat supplied is

$$\text{Heat supplied} = mtC_{p,water}\Delta T. \tag{6}$$

Equating equations (5) and (6) yields

$$2r^2\rho_b\Sigma(x_iC_{pi}) = mtc_{p,water}. \tag{7}$$

Again, assume a soil bulk density (ρ_b) of 110 lb/ft^3 and that water injected into the oil-saturated zone ($x=5$ ft, $C_p=0.49$ Btu/lb·°F) also heats some soil above and below the zone. ($x=8$ ft, $C_p=0.35$ Btu/lb·°F). Then equation (7) becomes

$$r = 0.030(mt)^{0.5}. \tag{8}$$

In this example, complete heating of the test area in 10 days (240 hours) can be achieved by injecting hot water at a rate of 3,300 lb/hr (6.6 gpm) with a well spacing of about 25 feet. The total area heated would be 1,200 ft^2. Since heat transfer from the injected water will not be perfect, it is recommended that the design incorporate a 50% safety margin. The hot water injection rate then becomes 5,000 lb/hr (10 gpm).

3.4.4 Steady State Heat Requirements

Heat will be lost upward by conduction through the unsaturated soil to the ground surface. The thermal conductivity of soil (k_s) is approximately 0.3 Btu/hr·ft·°F.[1] The heat transfer coefficient for a solid to air (h_{sa}) is generally about 2 Btu/hr·ft^2·°F.[2] Steady state heat loss upward, therefore, will be

$$Q_u = A\Delta T/(x/k_s + 1/h_{sa}). \tag{9}$$

The area (A) for both steam injection and hot water injection is 1,200 square feet. ΔT is 162°F for steam injection and 100°F for hot water injection, and x is about 15 feet (approximate distance from ground surface to the top of the separate-phase hydrocarbon). The upward heat loss is then calculated by equation (9) as 3850 Btu/hr and 2400 Btu/hr for steam injection and hot water injection, respectively.

In order to provide a direct comparison between steam and hot water injection technologies in these heat requirement calculations, the heat amounts are reduced to equivalent pounds per hour of steam. The upward heat loss is calculated to be 3850 Btu/hr for steam injection. This is equivalent to 3.75 lb/hr of steam injection. The upward heat loss is calculated to be 2,400 Btu/hr for hot water injection. This is equivalent to 2.25 lb/hr steam injection.

Heat also will be lost to the saturated soil and groundwater, both by convection and diffusion. If groundwater is directly heated by the steam or hot water, then energy will be required to heat the water that replaces the hot water removed by forced convection (pumping or natural groundwater movement). Assuming that the top 5 to 10 feet of the saturated zone is heated directly, then the convective heat loss is

$$q = C_{p,water}Q_t(T_h - T_a) \tag{10}$$

where T_h is the temperature (°F) to which the oil-saturated subsurface is heated, T_a is the ambient groundwater temperature (°F), and Q_t is the excess groundwater removal rate (lb/hr) from the portion of the saturated zone which is heated directly. Under pumping conditions, Q_t is related to the total pumping rate (Q) and the water or steam injection rate (Q_i). Since the recovery well is screened to 15 feet, the steam injection well to 10 feet, and the hot water injection well to five feet below the top of static groundwater, only a fraction of the recovered water will be directly heated. This may be shown as

$$Q_t = y(Q - Q_i) \tag{11}$$

where y is about 2/3 for steam injection and 1/3 for hot water injection. Q_t will, therefore, be 1.3 and 0.7 gpm (670 and 335 lb/hr) for steam injection and hot water injection, respectively. From equation (10), the heat loss would be 109,000 Btu/hr for steam injection and 33,500 Btu/hr for hot water injection (corresponding to 112 lb/hr and 34 lb/hr of steam, respectively).

Heat is also conducted into the cooler portion of the saturated zone which is not heated directly, and this heat leaves the saturated zone through the replacement of hot water (which is removed by

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[1]R.H. Perry and C.H. Chilton, Chemical Engineers' Handbook, Sixth Edition, McGraw-Hill, New York, NY, 1984, p. 3-263.

[2]C.O. Bennett and J.E. Myers, Momentum, Heat, and Mass Transfer, Third Edition, McGraw-Hill, New York, NY, 1982, p. 317.

pumping or natural groundwater movement) with water from the surrounding aquifer. At steady state, the heat diffusing into the saturated zone equals the heat physically removed by groundwater removal,

$$q = (k_s A/x)(T_h - T) = C_{p,water} Q_b (T - T_a), \tag{12}$$

where T is the average saturated zone temperature (°F) below the heated zone, and Q_b is the excess groundwater removal rate (lb/hr) from the portion of the saturated zone which is not directly heated. Under pumping conditions,

$$Q_b = (1 - y)(Q - Q_i) \tag{13}$$

or about 0.7 gpm and 1.3 gpm (335 lb/hr and 670 lb/hr) for steam injection and hot water injection respectively. Eliminating T from equation (12) yields

$$q = (T_h - T_a)/[(1/C_{p,water} Q_b) + (x/k_s A)] \tag{14}$$

The difference between the bottom of the heated zone and the bottom of the pumping well (5 feet and 10 feet for steam injection and hot water injection, respectively) is assumed for x, and k_s is assumed to be 0.3 Btu/hr·ft·°F. Equation (14) yields heat loss rates for steam injection and hot water injection of 9600 Btu/hr and 3416 Btu/hr, respectively, (which correspond to a steam flows of 10 lb/hr and 4 lb/hr).

Some heat will also be conducted laterally at the edge of the heated areas. The area across which this heat transfer occurs is roughly the perimeter times the depth of the heated zone, or about 1400 square feet and 700 square feet for steam injection and hot water injection, respectively. If the soil temperature is assumed to be nearly ambient at approximately 10 feet from the heated zone, then the heat loss by this mechanism is

$$q = k_s A(T_h - T_a)/x, \tag{15}$$

or 7100 Btu/hr and 2100 Btu/hr (7.3 and 2.2 lb steam/hr) for steam and hot water injection, respectively.

The total amount of steam required for steady state operation of the steam injection and hot water injection systems is, therefore, calculated to be about 133 lb/hr and 42 lb/hr, respectively.

3.4.5 Cooldown Rate

Rigorous modeling of the non-steady state heat conduction during cooldown of the heated zone would require substantial effort and would yield reliable results only if a detailed characterization of the test location were available. Instead, an order-of-magnitude approach was adopted. Hence, the total heat removal required to return from heated to ambient conditions is

$$q = A\rho_b(\Sigma x_i C_{pi})\Delta T \tag{16}$$

or 1.3×10^8 Btu for steam injection, 7.9×10^7 Btu for hot water injection. The initial cooldown rate is

equal to the steady-state heat loss rate under non-pumping conditions. The upward and radial conductive heat losses are calculated by equation (9) as 11,000 Btu/hr (3900 + 7100) and 4500 (2400 + 2100) Btu/hr for steam injection and hot water injection, respectively, as discussed above.

Downward conductive loss is found from equation (14), where Q_b is the flow of groundwater beneath the heated area. The hydraulic conductivity at the site has been estimated to be 16 gpd/ft^2, the groundwater gradient is 0.03 ft/ft, the total aquifer depth beneath the heated zone is approximately 10 feet and 15 feet for hot water injection and steam injection, respectively. The width of the heated zone is expected to be about 40 feet. Q_b is then 67 lb/hr for steam injection and 100 lb/hr for hot water injection. Inserting these values into equation (14) results in a downward conductive heat loss of 3800 Btu/hr and 1900 Btu/hr for steam injection and hot water injection, respectively.

Convective heat loss comes from the displacement of higher temperature groundwater with water from the surrounding aquifer. Heat loss from natural groundwater flow is

$$q = (T_h - T_a)C_{p,water}Q_m \tag{17}$$

or 10,800 Btu/hr for steam injection and 3300 Btu/hr for hot water injection. Total heat loss is therefore 25,500 Btu/hr and 9800 Btu/hr, respectively, for the steam injection and the hot water injection areas. At these rates, cooldown of the heated area would be complete after 5000 to 8000 hours (7 to 11 months). Of course, the heat loss rate will slow as the soil cools, and it would not be unreasonable to expect measurably higher soil temperatures at the test site for an even longer period after completion of the test.

4.0 PILOT-TEST WELL INSTALLATION

4.1 Introduction

Four steam injection wells, four hot water injection wells, three recovery wells, and ten monitoring wells were installed at the Yorktown pilot-test site. Five monitoring wells were installed in each of the two heat-enhanced pilot test areas. Wells were installed using a truck-mounted drilling rig with 12-inch diameter hollow stem augers. Hollow stem auger drilling was utilized for ease of installation; access to subsurface soils for sampling; control over well installation; and for the accurate placement of each of the installed wells. The casing for each well was installed according to the design specifications for the specific type of well. Figure 4-1 depicts the site layout and the location of each of the installed wells.

After each borehole was drilled, all downhole drilling equipment was steam cleaned to prevent cross-contamination between well locations. In addition, split-spoon sampling equipment was decontaminated between each sampling event by washing in an Alconox® and water solution, followed by a water rinse and a final rinse with distilled water.

During well installation, soil samples were collected by a field geologist and a log was prepared describing the soil lithology. The descriptions are in accordance with the Unified Soil Classification System. *Appendix A contains the drilling logs for each of the wells installed.*

4.2 Recovery Well Installation

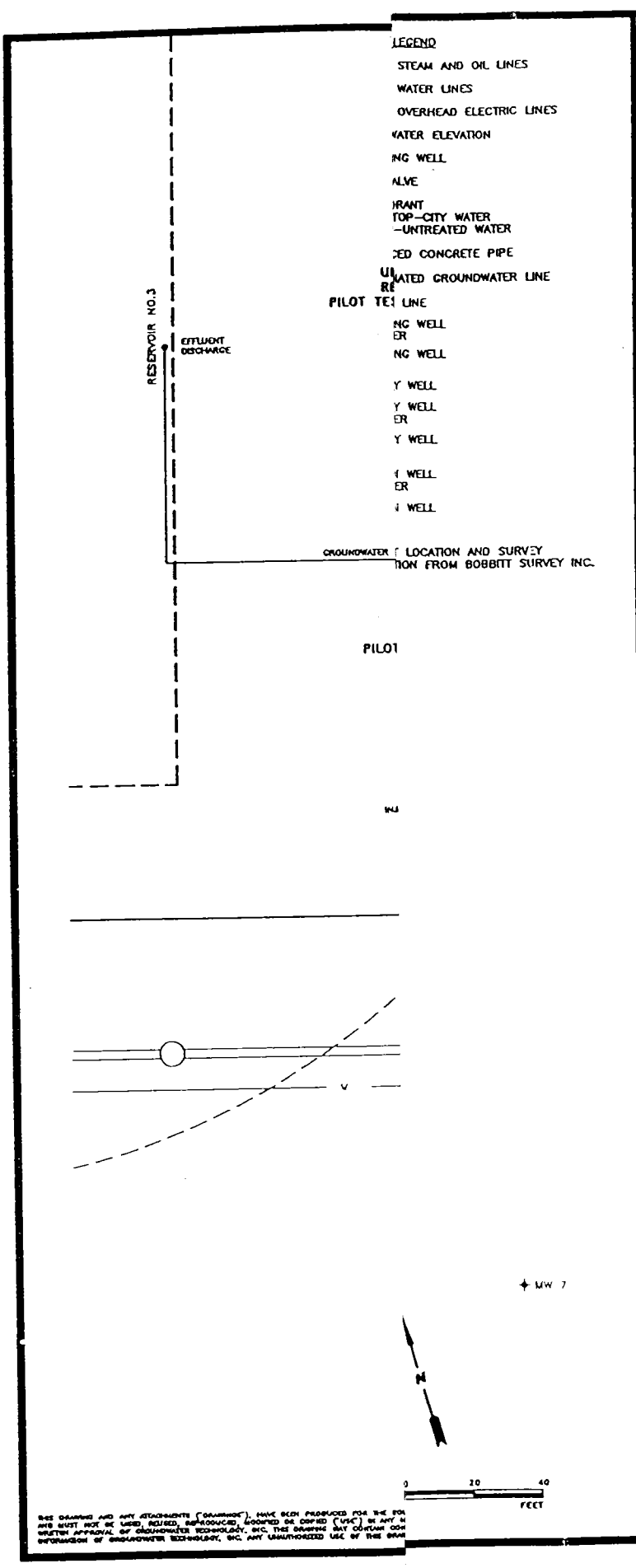
For each of the three groundwater extraction and SPH recovery systems a recovery well was constructed (see Figure 4-2). Table 4.1 depicts the recovery well nomenclature and applicable recovery system.

Table 4.1
Recovery Well Nomenclature
NSC Yorktown, Fuel Annex
Installed April, 1993

Well Designation	Applicable Recovery System
RW-1S	Recovery Well Number 1 - Steam, Steam Injection Enhanced Recovery System
RW-2H	Recovery Well Number 2 - Hot Water, Hot Water Injection Enhanced Recovery System
RW-3X	Recovery Well Number 3 - Standard Dual Pump Recovery Well (Unenhanced)

30

4500



NO.	DATE	BY	REVISION
1	7/14/93	EWH	AS BUILT

SIGNATURE	DATE
REVIEW ENGR:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

GROUNDWATER TECHNOLOGY

NSC YORKTOWN FUEL ANNEX

NSFO REMEDIATION PILOT TEST
YORKTOWN, VIRGINIA

AS BUILT SITE PLAN AND PIPING DETAILS

DESIGNED BY:	DETAILED BY:	CHECKED BY:
PF	NLW	

DRAWING DATE: 7-14-93	ACAD FILE: 1098-Y2
PROJECT NO.: 85001-1098	CONTRACT: RAC #47408-92-D-3044 D.O. 0911

DRAWING: REVISION:

FIGURE 4-1

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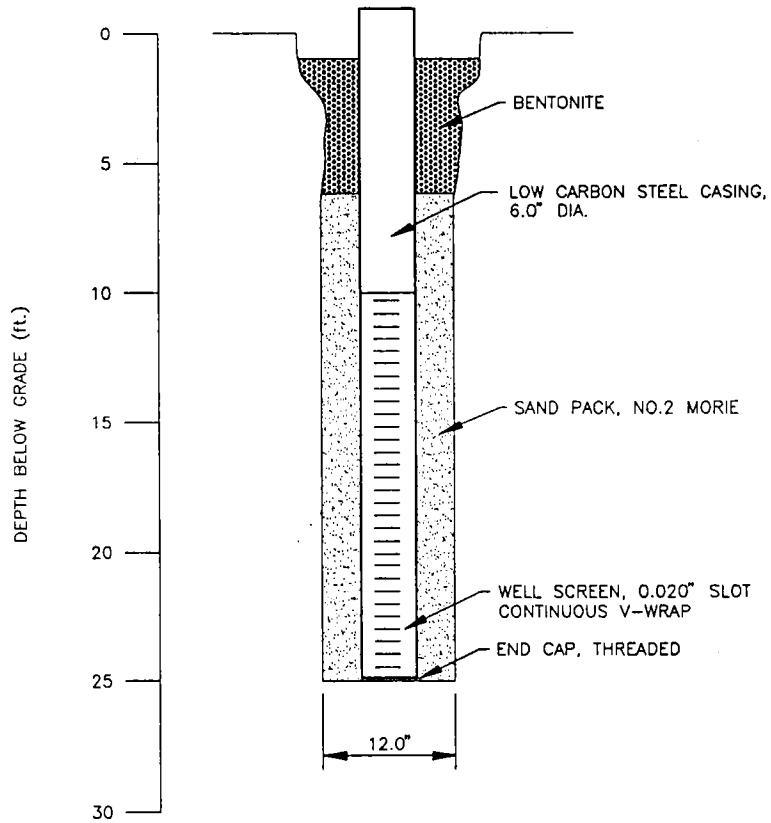


SOURCE: GEOLOGIST SKETCH

FIGURE 4-2

GROUNDWATER TECHNOLOGY

REV. NO.:	DRAWING DATE: 9/7/93	ACAD FILE: RECWELL

TYPICAL CONSTRUCTION RECOVERY WELL

CLIENT: U.S. NAVY/FISC YORKTOWN			PM:
LOCATION: YORKTOWN, VIRGINIA			PE/RG:
DESIGNED: PTS	DETAILED: PJC	PROJECT NO.: 830011098.210691	

The recovery wells were drilled to a depth of 30 feet below the ground surface. Construction of the wells consisted of low carbon steel, 6-inch diameter, Schedule 40 blank casing from the surface to 10 feet below the surface and 6-inch diameter, low carbon steel, continuous v-wire wrapped, 0.020-inch slotted screen from 10 to 30 feet (Figure 4-2).

4.3 Steam Injection Well Installation

Four steam injection wells were installed in a square configuration centered on recovery well RW-1S. (Figure 4-1).

The steam injection wells (SI) were drilled to a depth of 25 feet below the ground surface. Construction of the wells consisted of 4-inch diameter low carbon steel Schedule 40 blank casing from the surface to 20 feet below the surface and 0.040-inch slotted screen from 20 to 25 feet (Figure 4-3).

4.4 Hot Water Injection Well Installation

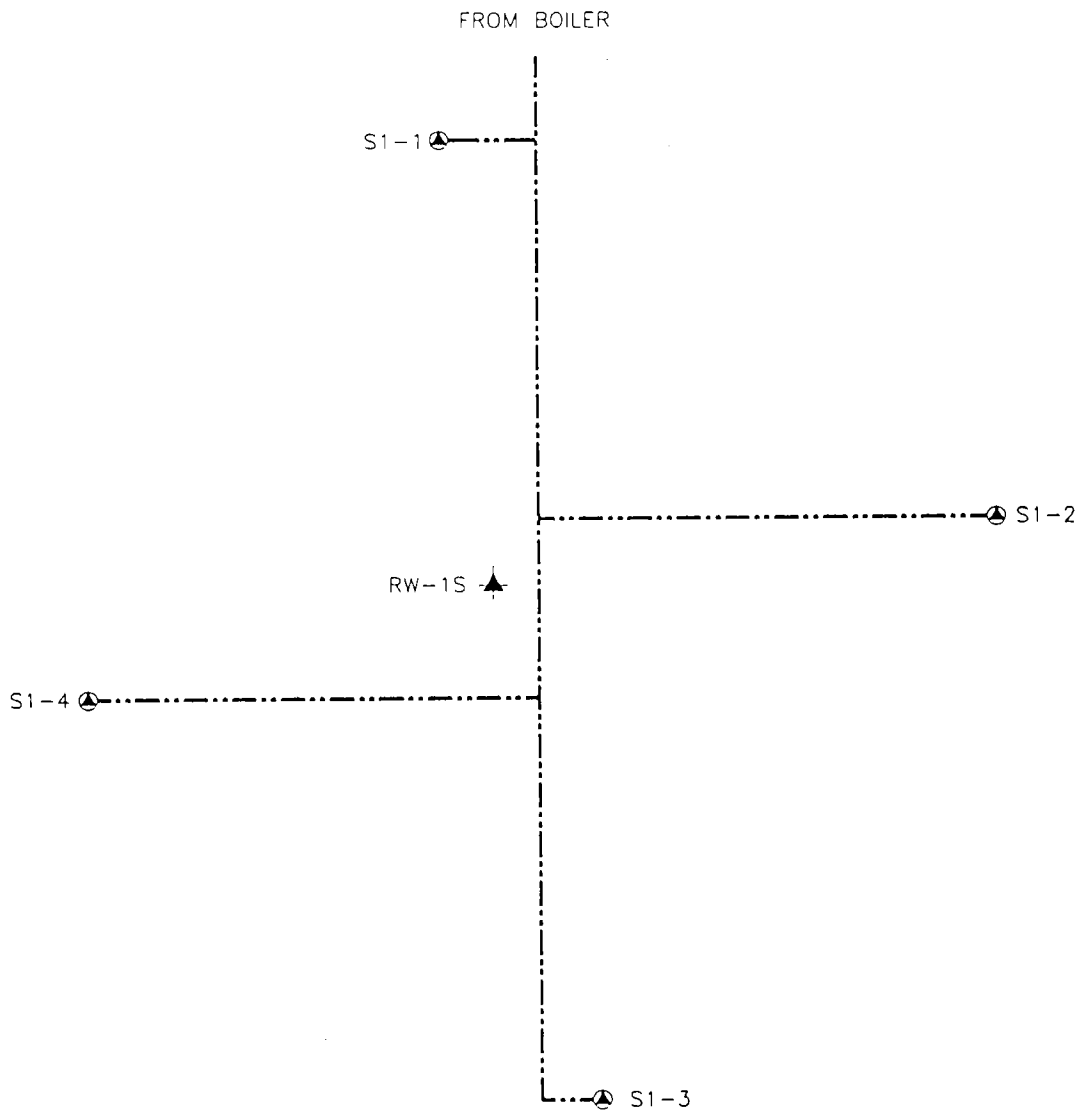
Four hot water injection wells were installed in a square configuration centered on recovery well RW-2H. This arrangement is depicted on Figure 4-1.

The hot water injection wells (HWI) were drilled to a depth of 20 feet below the ground surface. Construction of the wells consisted of 4-inch diameter low carbon steel Schedule 40 blank casing from the surface to 10 feet below the surface and 0.040 slotted screen from 10 to 20 feet (Figure 4-4).

4.5 Monitoring Well Installation

Five monitoring wells (MW) were installed around each of the recovery wells (RW-1S, RW-2H) in the two heat-enhanced remediation pilot test systems. The monitoring wells were installed at varying distances from the injection and recovery wells to allow collection of data across the heat-enhanced systems.

The monitoring wells were drilled to a depth of 25 feet below the ground surface. Construction of the monitoring wells consisted of 2-inch diameter low carbon steel Schedule 40 blank casing from the ground surface to 10 feet below the surface and 0.020-inch slotted screen from 10 to 25 feet (Figure 4-5).



LEGEND

STEAM INJECTION WELL

RECOVERY WELL

STEAM INJECTION PIPING

NOTE: RECOVERY WELL IS 6" STEEL CASED.
STEAM INJECTION WELL IS 4" STEEL CASED.

N

0 3 6
SCALE FEET

SOURCE: GEOLOGIST SKETCH

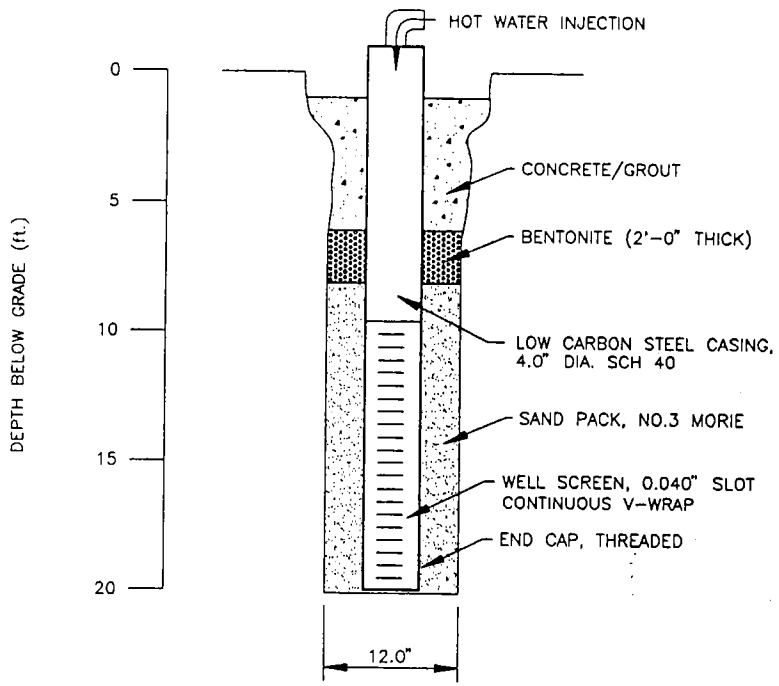
FIGURE 4-3

GROUNDWATER TECHNOLOGY

REV. NO.:	DRAWING DATE: 9/20/93	ACAD FILE: YORK-SIS

CONFIGURATION OF STEAM INJECTION SYSTEM

CLIENT: U.S. NAVY/FISC YORKTOWN			PM:
LOCATION: YORKTOWN, VIRGINIA			PE/RG:
DESIGNED: PTS	DETAILED: PJC	PROJECT NO.: 830011098.020691	



SOURCE: GEOLOGIST SKETCH

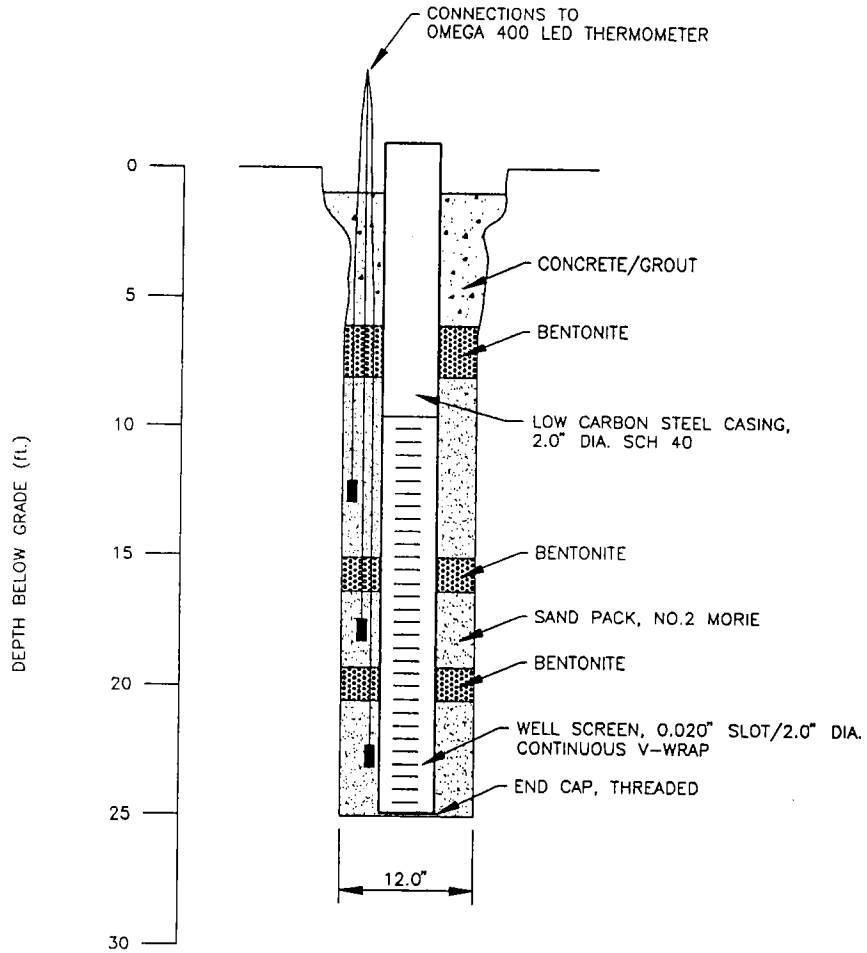
FIGURE 4-4

GROUNDWATER TECHNOLOGY

REV. NO.:	DRAWING DATE: 9/7/93	ACAD FILE: HWWELL

TYPICAL HOT WATER INJECTION WELL

CLIENT: U.S. NAVY/FISC YORKTOWN		PM:
LOCATION: YORKTOWN, VIRGINIA		PE/RG:
DESIGNED: PTS	DETAILED: PJC	PROJECT NO.: 830011098.210691



SOURCE: GEOLOGIST SKETCH

FIGURE 4-5

GROUNDWATER TECHNOLOGY

REV. NO.:	DRAWING DATE: 9/7/93	ACAD FILE: TYPWELL

TYPICAL MONITORING WELL CONSTRUCTION

CLIENT: U.S. NAVY/FISC YORKTOWN		PM:
LOCATION: YORKTOWN, VIRGINIA		PE/RG:
DESIGNED: PTS	DETAILED: PJC	PROJECT NO.: 830011098.210691

4.6 Temperature Probe Installation

Three thermistor temperature probes were installed in each of the five monitoring wells associated with the two heat-enhanced pilot systems. Each thermistor consisted of a heat sensitive probe on the end of a heat resistant cable. A 0.25-inch jack, compatible with the Omega Model 400 LED thermometer with which the temperature readings were taken, was located at the above-ground end of each thermistor cable.

Thermistors were placed within the annulus of each monitoring well at 23 feet, 18 feet and 13 feet below grade. Bentonite seals between each thermistor allowed for thermal separation between the soil horizons in which the temperature probes were set (Figure 4-5).

The placement depths for the thermistors were based on the following information provided from the site before installation:

- Depth to water was approximately 14 to 15 feet below grade and the NSFO-saturated zone was approximately 13 to 20 feet below grade. Therefore, thermistors placed at 23 feet would reflect conditions in the saturated zone below the NSFO saturated area.

- NSFO was reported at 13 feet and potentially to 9 feet below grade. Placement of the thermistor at 13 feet allowed for temperature readings of soils within the vadose zone, just above the groundwater table, whether NSFO was present or not.

- Placement of the thermistor at 18 feet provided for a second temperature reading in the saturated zone. It also provided for collection of data across a 15-foot span, to document any stratification of temperature influence. Depending upon the location of the monitoring wells, the placement of this thermistor may or may not have been within a saturated interval of NSFO or high concentration of adsorbed NSFO.

- Placement of three thermistors per well at 13, 18, and 23 feet allowed for comparison between the heat-enhanced systems at three specific intervals over a 15-foot vertical section.

5.0 PILOT TEST EQUIPMENT

5.1 Introduction

Four steam injection wells, four hot water injection wells, three recovery wells, 10 monitoring wells, a boiler trailer, water treatment system, and associated piping networks, electrical systems and controls were included in the pilot-test facilities (see Figure 5-1, As-Built Site Plan). This section describes the installation of those facilities.

5.2 Pumps

A dual pump groundwater extraction and NSFO recovery system was installed in each of the three recovery wells (RW-1S, RW-2H and RW-3X). The dual pump system consisted of two separate pumping units with interconnected controls for coordination of operation. A groundwater pump and a product pump was provided. Arrangement and operation of the pumps is presented in the Process and Instrumentation Diagram (Figure 5-2[1] P&ID).

The groundwater extraction pumps are referred to as water table depression pumps (WTDPs) in this application as they depress the water table at the well to improve SPH recovery. The WTDPs were installed in the bottom of the well to eliminate the possibility of extracting SPH from the subsurface through the water system. The WTDPs were connected to an oil/water separator to remove oil which might be mixed with the water. Each of the WTDPs was selected to pump up to 10 gallons per min (gpm) at 90 feet of hydrostatic head.

The WTDP in RW-1S was a Grunfos pump, Type 16 E4 (4-stage), Model B, No. 9117 with 1-inch discharge and a Franklin 1/2 Hp, 60 Hz, 3-phase, 460-volt submersible electric motor. The pump was place at 29 feet below grade in the recovery well and the associated water level probe was placed at 21 feet below grade.

The WTDP in RW-2H was a Grunfos pump, Type 16 E7 (7-stage), Model B No. 9249 with 1-inch discharge and a Franklin submersible 3/4 Hp, 60 Hz, 3-phase, 460-volt electric motor. The pump was placed at a depth of 29 feet below grade in the recovery well and the associated water level probe was placed at a depth of 21 feet.

The WTDP installed in RW-3X was a Grunfos pump, Type 16 E4 (4-stage), Model B, No. 9041 with 1-inch discharge and a Franklin submersible 1/2 Hp, 60 Hz, 3-phase, 460-volt electric motor. The pump was placed at a depth of 28 feet and the associated water level probe was placed at a depth of 22 feet.

A liquid petroleum hydrocarbon recovery pump was installed in each recovery well above the WTDP. Each of the recovery pumps was installed in RW-1S, RW-2H and RW-3X so that the intake was at or just below the level of NSFO at the time of installation. The product recovery pumps were GRS (Groundwater Recovery Systems, Exton, PA) Model SG-40525-G00 Viking gear pumps with Franklin submersible electrical motors.

Each product recovery pump included adjacent float probes controlling the operation of the pump. As groundwater drawdown occurred, the SPH recovery pumps were adjusted to remain at or just above the oil/water interface. Vertical adjustment of the pumps within the well occurred frequently during the first week of operation and, less often, during the pilot test as steady-state groundwater levels were established.

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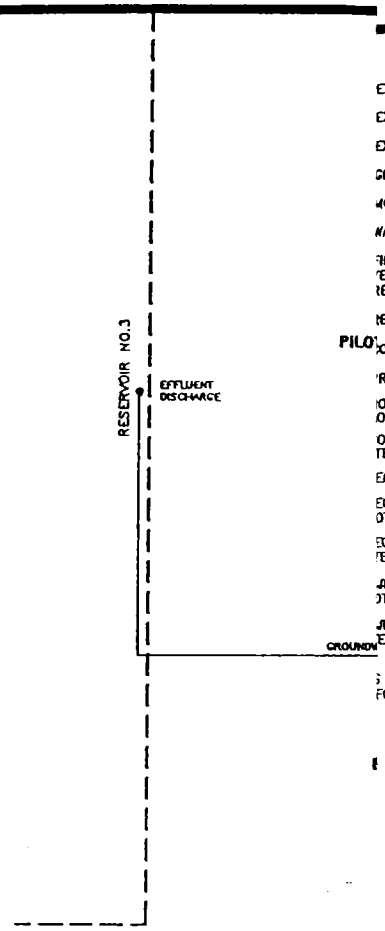
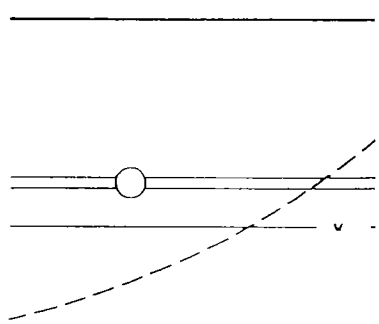
[1]Figure 5-2A is P&ID Legend, Figure 5-2B is P&ID.





LEGEND

EXISTING STEAM AND OIL LINES

EXISTING WATER LINES

EXISTING OVERHEAD ELECTRIC LINES

GROUNDWATER ELEVATION

MONITORING WELL

WATER VALVE

FIRE HYDRANT
YELLOW TOP—CITY WATER
RED TOP—UNTREATED WATER

REINFORCED CONCRETE PIPE

PILOT CONTAMINATED GROUNDWATER LINE

PRODUCT LINE

MONITORING WELL
HOT WATER

MONITORING WELL
STEAM

RECOVERY WELL

RECOVERY WELL
HOT WATER

RECOVERY WELL
STEAM

INJECTION WELL
HOT WATER

INJECTION WELL
STEAM

AS BUILT LOCATION AND SURVEY
INFORMATION FROM BOBBITT SURVEY INC.

MW.7

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FEET

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GROUNDWATER TECHNOLOGY

NSC YORKTOWN FUEL ANNEX

NSFO REMEDIATION PILOT TEST
YORKTOWN, VIRGINIA

AS BUILT SITE PLAN AND PIPING DETAILS

DESIGNED BY:	DETAILED BY:	CHECKED BY:
PF	NLW	

DRAWING DATE: 7-14-93	ACAD FILE: 1098-Y2
PROJECT NO.: 83001-1098	CONTRACT: RAC N47408-92-D-3044 D.O. 0911
DRAWING: 5-1	REVISION:

VALVE AND PIPIN EVIATIONS

- GLOBE VALVE
- GATE VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- PLUG VALVE
- 3-WAY VALVE
- ANGLE VALVE
- RELIEF OR SAFETY VALVE
- DIAPHRAGM VALVE
- BALL VALVE
- GLOBE VALVE
- SELF-CONTAINED PRESSURE REGULATING VALVE W/RELIEF
- KNIFE GATE VALVE
- BACKFLOW PREVENTER
- NO NORMALLY OPEN
- NC NORMALLY CLOSED
- SP SAMPLE PORT
- FLEXIBLE HOSE

RIC PRESSURE
JR
GROUNDWATER
WATER
TIFICATION
OLYVINYL CHLORIDE PIPE
ETAL PIPE
IPE
EL PIPE
PIPE
PIPE
RIDE PIPE
NCRETE PIPE
L PIPE
PIPE

VALVE OPERATOI

- SOLENOID
- MOTOR, ELECTRIC
- DIAPHRAGM

TIFICATION

PRIMARY ELEMENT SYI

- ORIFICE PLATE
- PITOT TUBE
- AVERAGING PITOT TUBE
- VENTURI OR FLOW TUBE
- TOTALIZING FLOWMETER

LASS
BLE NUMBER
IATION
CATION

EQUIPMENT SYM NORMALLY USED)

- SUBMERSIBLE PUMP
- PUMP
- PNEUMATIC DIAPHRAGM PUMP

S
IONS
PEN-CLOSE
N-OFF (MAINTAINED)
IDATION REDUCTION POTENTIAL
PEN-STOP-CLOSE (MOMENTARY)
TART-STOP (MOMENTARY)
IGH SELECT
OW SELECT
QUARE ROOT
DD OR TOTALIZE

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GROUNDWATER TECHNOLOGY

NSC YORKTOWN FUEL ANNEX

NSFO REMEDIATION PILOT TEST
YORKTOWN, VIRGINIA

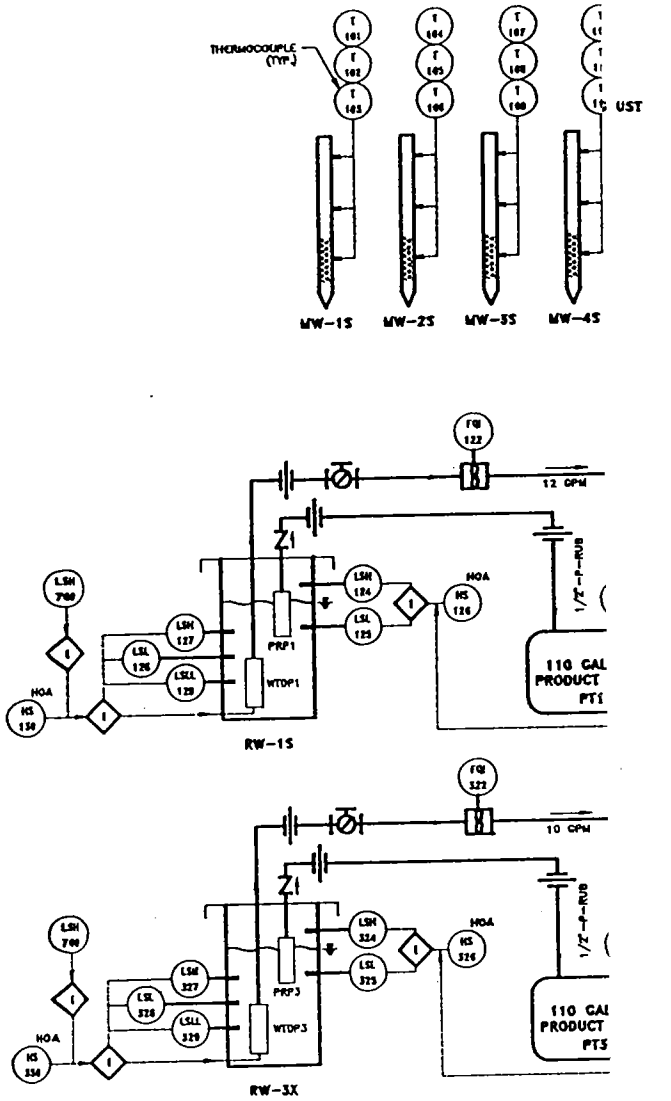
PROCESS & INSTRUMENTATION DIAGRAM LEGEND

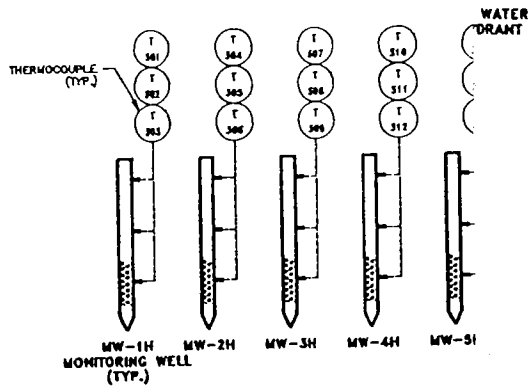
DESIGNED BY:	DETAILED BY:	CHECKED BY:
PF	MLW	

DRAWING DATE:	ACAD FILE:
1-8-93	1098-P1

PROJECT NO.:	CONTRACT:
83001-1098	RAC M47408-87-D-3044 D.O. 0011

DRAWING: 5-2A
REVISION:





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PROJECT MGR:	
CLIENT:	

GROUNDWATER TECHNOLOGY

NSC YORKTOWN FUEL ANNEX

NSFO REMEDIATION PILOT TEST
YORKTOWN, VIRGINIA

PROCESS AND INSTRUMENTATION DIAGRAM

DESIGNED BY:	DETAILED BY:	CHECKED BY:
PF	NLW	

DRAWING DATE:	ACAD FILE:
7-14-93	1098-P2

PROJECT NO.:	CONTRACT:
83001-1098	RAC N47408-92-D-3044 D.O. 0011

DRAWING: 5-2B

REVISION:

Each product recovery pump was connected to a separate, surface-mounted double-walled recovery tank. The separate tanks permitted collection of data on the volume of SPH recovered by each pilot-test system. The pump discharge hose continued out of the well and was connected to the surface-mounted recovery tank. The recovery tank included a 2-inch diameter bung hole with a tank-full float switch. The switch was connected to the pump control panel. If the tank became full, the float switch would shut off the SPH recovery pump. This mechanism was provided to enable the system to operate while unattended while preventing the recovery tank from overfilling and spilling recovered SPH on the surface.

5.3 Control Panels

Each SPH recovery system (RW-1S, RW-2H, and RW-3X) was equipped with a control panel for the pumping components of the recovery system. The panel was installed adjacent to the recovery well. Groundwater Recovery Systems of Exton, PA, designed, assembled and installed the control panels based on performance specifications by Groundwater Technology Government Services, Inc.

Automatic operation of the WTDPs from the control panel permitted continuous operation of the pumps. The controlling mechanism was the float switch deployed within the well. The float switch was set at a designated depth within each well, as indicated in Section 5.2. When the groundwater level was above the probe, a float would rise to the top of its travel within the probe, activate a magnetic switch, and signal the WTDP to run. When the float fell to the bottom of its travel, indicating groundwater level decreasing, the switch would deactivate and turn the WTDP off. The groundwater within the well was thus maintained at a relatively constant level by the float switch contained within the probe.

There were two operational override conditions to shut down the WTDP:

- The water table level in the well had dropped below the lower level of the float switch contained in the water level probe or,
- The NSFO within the well had reached the water level probe and had activated a second float switch. The second switch operated (floated) on the density of the fluid in which it was submerged. This arrangement was specified to preclude the WTDP from pumping NSFO or other hydrocarbons through the water discharge system.

The control system was not designed to automatically reset. Manual resetting of the system permitted system diagnosis.

There were two status lights associated with the SPH recovery pump controls:

- A red "recovery tank full" light and,
- A green "run" light.

The "tank full" light, when illuminated, signified that the SPH recovery tank was full. This light was activated by the "tank full" float switch installed in the recovery tank. When the red light was illuminated the SPH product recovery pump would not run to overfill the recovery tank. In order to deactivate the "tank full" light and reactivate the SPH pump, the recovery tank had to be emptied.

5.4 Steam System

Steam for the operation of the pilot test was generated from a vendor-supplied semi-trailer with an enclosed boiler. The trailer was located on a crushed gravel pad in the pilot test area. The 80HP, oil-fired boiler was sized to deliver 600 pounds of steam per hour to the steam injection system. It also provided steam to a heat exchanger for hot water production.

Two 500-gallon fuel-oil tanks were installed outside the boiler trailer. These additional fuel tanks allowed continuous operation of the boiler for two to three days and minimized the number of fuel deliveries to the site.

The NSC Yorktown provided electrical power to a temporary sub-panel located adjacent to the boiler trailer. The electrical supply consisted of a 40-ampere, 460-volt, 3-phase service. This service fed the boiler system sub-panel for boiler controls and monitoring equipment, lights, burner blower, and steam flow computer.

Makeup water for the boiler was provided from a hydrant located adjacent to the pilot test area. A flow meter and totalizer were located in the trailer to record the amount of water consumed by the boiler system.

The steam supply for the pilot test was delivered to the individual steam injection wells via an insulated above-ground piping system. Pressure gauges and valving at each of the injection wells allowed steam pressures to be adjusted to balance and control the steam injection.

The steam flow rate to the test area was continuously monitored by a flow computer using measurement of the pressure drop across an orifice plate in the steam piping. The computer provided an instantaneous readout of steam delivered in pounds per hour and the total pounds of steam delivered to the pilot test area. Flow was controlled by a regulator valve installed in the delivery pipe. A pressure gauge (steam pressure delivered) was installed in the piping train downstream from the regulator valve.

The P&ID provides the instrumentation and control arrangement for the steam delivery system (Figure 5-2).

5.5 Hot Water System

The trailer-mounted boiler unit contained a heat exchanger which used steam from the boiler to heat water to 160°F. Water was supplied with boiler makeup water from an adjacent hydrant. The 160°F hot water passed through a flow regulator and a hot water meter and was delivered to the hot water injection wells in an insulated delivery pipe system.

The hot water injection wellheads included a valve to control the rate at which water would be injected into the subsurface. The wellheads also had pressure gauges to monitor hot water injection pressure. Individual flow meters were not provided at each injection well.

Measurement and adjustment of the total hot water injection rate was necessary to maintain a balanced drawdown in the recovery well. Total flow from the hot water meter was compared with the recovery well WTDP flow data. Injection and extraction were balanced by making minor adjustments to the individual flow control valves. Total flow remained relatively constant throughout the testing period at approximately 11 to 12 gallons per minute total.

The P&ID provides the instrumentation and control arrangements for the hot water delivery system (Figure 5-2).

5.6 Water Treatment

Groundwater was extracted from each of the recovery wells during the operation of the pilot test using the WTDP. The water first passed a temperature probe installed in the piping which permitted the collection of water-temperature data for the individual recovery wells. Water then passed through a flow control valve and a flow meter which provided the flow rate and total volume of water extracted. A sample port was located after the water meter in the piping train for the collection of water samples.

The recovered groundwater from the individual recovery wells was piped to a common manifold and then through an oil/water separator to remove SPH. Recovered groundwater was then discharged into one of the existing (empty) on-site 90,000 barrel underground storage tanks.

6.0 PILOT TEST DATA COLLECTION

6.1 Introduction

Consistent with standard pilot-scale studies, baseline data collection was accomplished as part of the pre-startup process activities. The baseline parameters included flow rates, liquid levels, SPH thicknesses, BTEX concentrations in soils, soil temperature readings from all of the thermistors, background ambient photoionization detector readings, and start-up pumping rates.

The baseline data was collected from a variety of sources. Flow rates for steam injection were recorded from the steam "flow computer", which monitored steam flow to the injection wells. Flow rates for injection of hot water were collected from the hot water meter on the hot water line to the system. Flow rate data collected from the groundwater extraction systems were read from the water meters installed at each recovery well. Liquid levels were collected from individual monitoring wells, by lowering a steel tape which was coated with a water-indicator paste down the well.

Benzene, toluene, ethyl benzene, xylenes (BTEX) concentration data was obtained by analysis of soil samples collected during the installation of the monitoring, recovery, and injection wells. Soil samples were collected with split-spoon samplers at discrete depths below grade. The depth at which the sample was collected was determined by measuring the drill rods and sampler.

Hydrocarbon screen and extractable organic halide data were obtained from laboratory analysis of soil samples collected specifically for that purpose during the installation of the monitoring, recovery and injection wells. While these analyses were performed to establish baseline conditions, unforeseen contaminant(s) or biproducts of biodegradation would also be identified using these methods.

Photoionization detector (PID) measurements of total volatiles in air were recorded by field personnel during several different on-site project events. PID readings were obtained and recorded for health and safety reasons and for field headspace analysis of soils. The PID data for field analysis of soil samples were recorded as baseline data.

6.2 Baseline Monitoring

Depth to water and depth to SPH were measured in each of the monitoring and recovery wells equipment before operation of the pilot test. Depth to water and SPH were measured using a tape measure and recorded to the nearest hundredth of a foot. Measurement through liquid petroleum to water were made using water-paste spread on the measuring tape. Liquid level baseline data for the recovery and monitoring wells are presented in Table 6.1.

Table 6.1
Initial Liquid Level Measurements
May 4, 1993

Well	DTP (ft.)	DTW (ft.)	Notes	PT (ft.)
RW-1S	13.70	14.50	Initial Readings	0.80
RW-2H	16.50	16.50	Trace of product	0
RW-3X	17.00	17.00	Trace of product	0
MW-1S	ND	12.60		0
MW-2S	13.00	13.40		0.40
MW-3S	13.50	13.70		0.20
MW-4S	12.70	12.80		0.10
MW-5S	13.60	13.60	Trace of product	0
MW-1H	14.50	ND	Product to bottom of well	
MW-2H	14.40	14.40	Trace of product	0
MW-3H	ND	14.55	No product	0
MW-4H	14.40	14.40	Trace of product	0
MW-5H	15.00	15.20		0.20

DTP = Depth to liquid petroleum hydrocarbons
DTW = Depth to water
PT = Liquid petroleum hydrocarbon thickness
ND = Not detected

Soil temperature data in the area of the heat-enhanced systems were recorded from the thermistors installed within the bores of the monitoring wells. A digital thermometer was connected to each thermometer jack. Thermistor placement depth and a corresponding temperature reading were recorded.

Baseline temperature data from each of the temperature probes are presented in Table 6.2. This information was subsequently compared to data collected during the operational period of the pilot study.

Table 6.2
Initial Temperature Data
May 4, 1993

Well	Probe	Depth, in ft.	Temperature Reading, °F
MW-1S	T1	13	60.5
	T2	18	60.8
	T3	23	63.7
MW-2S	T1	13	56.7
	T2	18	57.5
	T3	23	59.7
MW-3S	T1	13	58.5
	T2	18	57.9
	T3	23	58.3
MW-4S	T1	13	57.3
	T2	18	57.5
	T3	23	59.9
MW-5S	T1	13	56.3
	T2	18	57.4
	T3	23	57.9
MW-1H	T1	13	58.2
	T2	18	58.0
	T3	23	59.2
MW-2H	T1	13	56.3
	T2	18	56.9
	T3	23	58.1
MW-3H	T1	13	56.2
	T2	18	57.1
	T3	23	58.3
MW-4H	T1	13	56.4
	T2	18	56.7
	T3	23	58.0
MW-5H	T1	13	56.2
	T2	18	57.0
	T3	23	58.6

6.2.1 Collection of Water Pumping Rate Data

Initial water pumping rates were collected directly from the water meters located at each of the recovery systems (RW-1S, RW-2H and RW-3X). The initial pump rates were established from previous investigations at the site and adjusted during the pilot testing period. Table 6.3 depicts the initial settings.

Table 6.3
Initial Groundwater Pump Settings
(May 4, 1993)

Well	Pumping Rate, GPM	Total Meter Reading, Gal*
RW-1S	2	20
RW-2H	1.5	30
RW-3X	1	35

* Total meter readings initially are not zero - due to factory testing and calibration.

Initial pumping rates were established on four factors:

- According to the O'Brien and Gere corrective action plan (CAP) for the site and its aquifer analysis, recovery wells were anticipated to yield between 1.0 gpm and 5.0 gpm.

- Review of the drilling log descriptions, both from the O'Brien and Gere work and from the installation of the monitoring wells and recovery wells for this pilot test, indicated a transmissivity of approximately 600 gallons-per-day-per-foot (gpd/ft). This would allow a small diameter well with a saturated interval of approximately 20 feet to pump at approximately 3 gpm.

- GSI's geologic evaluation, experience, and review of groundwater pumping systems in a similar aquifer also indicated that a recovery well would only yield between 1 and 5 gpm without creating a steep cone of depression, agreeing with O'Brien and Gere. This scenario is typical of Tidewater area groundwater pumping systems in the surficial aquifer.

- During the installation of the groundwater extraction pumps, prime tests were conducted along with brief drawdown tests. The results of the tests indicated that pumping at a rate of 5 gpm created a steep cone of depression (drawdown in excess of five feet) and did not achieve steady-state conditions. After manipulating the discharge rates for the pumps, it was found that the optimum rates for the groundwater extraction pumps were between 1 and 3 gpm. There was no evidence from the pumping tests that the aquifer would be able to sustain the higher (3 to 5 gpm) flow rates anticipated by O'Brien & Gere and GSI. A potential existed for burning- out a pump by pumping a pilot-test-well dry at a higher rate.

6.2.2 Collection of Samples

During the installation of the monitoring wells, split-spoon core samples were collected at 4 and 6 feet below grade and continuously in 2-foot intervals from 9 feet to a depth of 25 feet. A portion of the sample was taken from each 2-foot core sample and the field headspace screened using a PID. Readings from the PID, reported in ppm, allowed the field geologist to compare volatile components, if present, and select the "worst case" samples to be submitted to the laboratory. Results from the field headspace screen using a PID, for the borings at the specific lithologic horizons, are presented in Table 6.4.

Table 6.4
PID Readings
April 7 to 14, 1993

Well	Depth, ft.	PID Reading, ppm	Well	Depth, ft.	PID Reading, ppm
MW-1S	4.0 - 6.0	6824	MW-2S	4.0 - 6.0	231
	9.0 - 11.0	25		9.0 - 11.0	675
	11.0 - 13.0	12.5		11.0 - 13.0	768
	13.0 - 15.0	185		13.0 - 15.0	390
	15.0 - 17.0	109		15.0 - 17.0	328
	17.0 - 19.0	134		17.0 - 19.0	86
	19.0 - 21.0	68		19.0 - 21.0	77
	21.0 - 23.0	16.6		21.0 - 23.0	85
	23.0 - 25.0	34.2		23.0 - 25.0	58
MW-3S	4.0 - 6.0	265	MW-4S	4.0 - 6.0	386
	9.0 - 11.0	578		9.0 -11.0	506
	11.0 - 13.0	358		11.0 - 13.0	842
	13.0 - 15.0	91		13.0 - 15.0	561
	15.0 - 17.0	446		15.0 - 17.0	276
	17.0 - 19.0	7.4		17.0 - 19.0	895
	19.0 - 21.0	47		19.0 - 21.0	89
	21.0 - 23.0	74.6		21.0 - 23.0	164
	23.0 - 25.0	42.6		23.0 - 25.0	154
MW-5S	4.0 - 6.0	0	MW-1H	4.0 - 6.0	0
	9.0 - 11.0	35.1		9.0 - 11.0	0
	11.0 - 13.0	7.9		11.0 - 13.0	11
	13.0 - 15.0	0		13.0 - 15.0	4
	15.0 - 17.0	0		15.0 - 17.0	27
	17.0 - 19.0	0		17.0 - 19.0	87
	19.0 - 21.0	0		19.0 - 21.0	132
	21.0 - 23.0	0		21.0 - 23.0	74.4
	23.0 - 25.0	0		23.0 - 25.0	115
MW-2H	4.0 - 6.0	6.8	MW-3H	4.0 - 6.0	0
	9.0 - 11.0	382		9.0 - 11.0	540
	11.0 - 13.0	137		11.0 - 13.0	13.3
	13.0 - 15.0	98.9		13.0 - 15.0	31.1
	15.0 - 17.0	163		15.0 - 17.0	16.2
	17.0 - 19.0	88.3		17.0 - 19.0	35.4
	19.0 - 21.0	93.7		19.0 - 21.0	5.1
	21.0 - 23.0	114		21.0 - 23.0	11.9
	23.0 - 25.0	59		23.0 - 25.0	24.9
MW-4H	4.0 - 6.0	19.2	MW-5H	4.0 - 6.0	0
	9.0 - 11.0	32		9.0 - 11.0	0
	11.0 - 13.0	12.6		11.0 - 13.0	0
	13.0 - 15.0	16		13.0 - 15.0	0
	15.0 - 17.0	91		15.0 - 17.0	0
	17.0 - 19.0	24		17.0 - 19.0	19.3
	19.0 - 21.0	161		19.0 - 21.0	129
	21.0 - 23.0	105		21.0 - 23.0	100
	23.0 - 25.0	74.7		23.0 - 25.0	132

A sample was then selected, based on the field headspace data and the field geologist's determination of which sample interval would yield representative assessment analytical results. Table 6.5 presents a summary of soil samples submitted to the laboratory for analysis.

Table 6.5
Soil Samples Submitted to Laboratory for Analysis

Well	Soil Sample Interval Submitted for Analysis by Laboratory, ft.	Well	Soil Sample Interval Submitted for Analysis by Laboratory, ft.
MW-1S	4 - 6	MW-1H	19 - 21
MW-2S	11 - 13	NW-2H	9 - 11
MW-3S	9 - 11	MW-3H	9 - 11
MW-4S	17 - 19	MW-4H	19 - 21
MW-5S	9 - 11	MW-5H	19 - 21

The soil samples were submitted to an analytical laboratory. Each soil sample was analyzed for the presence of:

- Benzene, toluene, ethyl benzene, and xylenes by modified EPA method 8020;
- Petroleum hydrocarbons by a gas chromatograph, flame ionization detector (GC-FID) by EPA method 3550/8015. This is an analysis that subdivides the hydrocarbon spectrum into gasoline, mineral spirits, kerosene, diesel and lubricating oil as per California State Water Resources Control Board LUFT Manual protocols;
- Extractable organic halides by EPA method 600/4-84-008; and
- Total Petroleum Hydrocarbons (TPH) by infrared spectrometry, modified EPA method 418.1.

The soil samples collected from the monitoring wells for baseline BTEX data indicated detectable concentrations of BTEX components in MW-2S, MW-4S, MW-1H, MW-4H, and MW-5H. Monitoring well MW-1H, installed in the area of the hot water injection pilot-test area, had the highest concentrations of BTEX analytes, 7.9 ppm for total BTEX, at 19 to 21 feet below grade. Table 6.6 is a summary of the BTEX concentrations for the initial soil samples collected. The initial soil analytical reports for BTEX analyses are summarized in *Appendix B*.

Table 6.6
BTEX Concentration in Soil, mg/kg (ppm)

Sample Location	Depth, ft.	Benzene, ppm	Toluene, ppm	Ethyl Benzene, ppm	Xylenes (total), ppm	BTEX (total), ppm
MW-1S	4 - 6	<0.05	<0.05	<0.10	<0.20	<MDL
MW-2S	11 - 13	<0.05	0.34	0.73	3.5	4.6
MW-3S	9 - 11	<0.05	<0.05	<0.10	<0.20	<MDL
MW-4S	17 - 19	<0.05	0.35	0.49	2.0	2.8
MW-5S	9 - 11	<0.0022	<0.0038	<0.0022	<0.0045	<MDL
MW-1H	19 - 21	0.35	0.15	4.0	3.4	7.9
MW-2H	9 - 11	<0.0011	<0.0019	<0.0011	<0.0023	<MDL
MW-3H	9 - 11	<0.05	<0.05	<0.10	<0.20	<MDL
MW-4H	19 - 21	0.18	0.14	0.47	0.70	1.5
MW-5H	19 - 21	0.08	0.21	0.61	0.87	1.8

< MDL = Less than Method Detection Limit

Petroleum hydrocarbon analysis by EPA method 3550/8015 is based on the response of the detector to the specific fuel identified in the sample. Detector response is determined by summing individual peak areas in the retention time window for a specific fuel. Fuel Oil No. 5 consists of the carbon chain range of C^{12} to C^{32} and is not quantified by this method.

Soil sample analytical results indicate that petroleum hydrocarbons within the kerosene, diesel and lubricating oil ranges of the hydrocarbon spectrum were detected in the samples collected. Within the diesel range of the hydrocarbon spectrum, the diesel concentration ranged from 410 ppm to 16,000 ppm. The kerosene concentration ranged from 160 ppm to 3,200 ppm. The lubricating oil concentration ranged from 630 ppm to 22,000 ppm.

Table 6.7 summarizes the soil sample analyses. A complete copy of the analytical results is presented in *Appendix B*.

Table 6.7
Summary of Hydrocarbon Screen Soil Analysis by GC FID in mg/kg
Baseline (Initial) Data

ANALYTE	STEAM INJECTION SYSTEM				
	MW-1S 4 - 6 ft.	MW-2S 11 - 13 ft.	MW-3S 9 - 11 ft.	MW-4S 17 - 19 ft.	MW-5S 9 - 11 ft.
Gasoline	<12	<11	<9.9	<13	<11
Mineral Spirits	<12	<11	<9.9	<13	<11
Kerosene	160[a]	670[a]	240[a]	3200[ad]	<11
Diesel	<12	<11	<9.9	<13	<11
Fuel Oil No. 6	<12	<11	<9.9	<13	<11
Lubric. Oil	<12	<11	<9.9	<13	<11
TPH	<39	500	130	720	<35
TOX	<77	<66	<65	<79	<71
ANALYTE	HOT WATER INJECTION SYSTEM				
	MW-1H 19 - 21 ft.	MW-2H 9 - 11 ft.	MW-3H 9 - 11 ft.	MW-4H 19 - 21 ft.	MW-5H 19 - 21 ft.
Gasoline	<12	<10	<12	<12	<14
Mineral Spirits	<12	<10	<12	<12	<14
Kerosene	<12	<10	<12	<12	<14
Diesel	16000[ab]	<10	<12	410[ab]	12000[ab]
Fuel Oil No. 6	<12	<10	<12	<12	<14
Lubric. Oil	22000[b]	<10[c]	<12[c]	630[b]	17000[b]
TPH	31000	<35	49	4900	28000
TOX	<74	<68	<72	<74	<85

[a] The sample chromatogram showed a loss of n-alkanes consistent with models of a degraded kerosene.

[b] The sample chromatogram showed the presence of more than one hydrocarbon pattern, diesel and lubricating oil. Some component peaks from each pattern were present in the quantitation window for the others. The reported value represents a maximum concentration found in the sample.

[c] The sample chromatogram showed the presence of trace level hydrocarbon peaks in the boiling point range of lubricating oil. The hydrocarbons appeared to be petroleum in nature but did not match instrument standards. Identification of these compounds was beyond the scope of this analysis.

[d] The sample chromatogram showed the presence of more than one hydrocarbon pattern, kerosene and non-target hydrocarbon peaks. Some component peaks from the non-target hydrocarbons were present in the quantitation window for kerosene. The reported value represents a maximum concentration found in the sample.

The analytical results for the Hydrocarbon Screen in Soil indicated concentrations of kerosene, diesel and lubricating oil contaminants. Kerosene-type contaminants were found in soils from monitoring wells MW-1S, MW-2S, MW-3S, and MW-4S at depths rangings from 4 to 19 feet. The highest concentration reported from the samples collected was 3200 mg/kg in MW-4S at 17 to 19 feet. The analysis indicated a contaminant consistent with degraded kerosene in the sample from MW-4S.

The presence of diesel contamination was reported in monitoring wells MW-1H, MW-4H, and MW-5H at depths ranging from 19 to 21 feet. The highest reported concentration of diesel by these analyses was 16,000 mg/kg in the 19 to 21 foot sample from monitoring well MW-1H.

Lubricating oil concentrations were reported in samples from MW-1H, MW-4H and MW-5H. The analytical results for lubricating oil indicated concentrations ranging from 630 mg/kg (MW-4H) at 19 to 21 feet to 22,000 mg/kg (MW-1H) at 19 to 21 feet.

The presence of kerosene, diesel, and lubricating oil type contamination found in the soils was somewhat unexpected when the focus of the contaminant type to date has been NSFO, or a No. 5 fuel oil. The presence of these types of contamination may be attrituable to other sources at the fuel annex. The fuel annex is known to handle JP-4, JP-5 and other products. It was beyond the scope of the pilot test to assess the potential of contributions from other sources. The presence of lighter petroleum products, while minimal, must be considered in the development of a product recovery system for the site to avoid discharge excursions and to avoid excessive initial operating costs.

Total petroleum hydrocarbon (TPH) concentrations by EPA method 418.1 ranged from 49 ppm in the soil sample collected at 9 to 11 feet below grade in monitoring well MW-3H to 31,000 ppm at 19 to 20 feet in monitoring well MW-1H.

Soil samples collected for hydrocarbon analysis by EPA method 418.1 and EPA 3550/8015 were collected from the same core. The difference in TPH concentrations in the samples may be attributed to differences between discrete soil samples extracted from the same sampling interval. The measurement of petroleum hydrocarbons by method 418.1 is susceptible to a significant degree of interferences. An attempt is made to eliminate polar hydrocarbon interference such as complex aromatic compounds and hydrocarbon derivatives of chlorine, sulfur and nitrogen through silica gel adsorption. The materials not eliminated by gel adsorption are designated hydrocarbons by EPA method 418.1.

All of the soil samples submitted to the laboratory were analyzed for the presence of extractable organic halides (TOX) as specified in the scope of work. This analysis was performed as a screen of the soil samples collected to potentially identify other organic halides which may or may not have been present in the soil as a contaminant. Additionally, post pilot test analysis for extractable organic halides would provide a secondary check and verify/deny thermal alteration or liberation of any potential organic halides. Concentrations of extractable organic halides in all of the soil samples collected during the installation of the monitoring wells were less than the laboratory's method detection limit.

6.3 Phase One -- Start-Up Activities

All three groundwater extraction and SPH recovery systems were started concurrently as part of the pilot-test start-up. Data were collected during start-up for comparison with operating and post-pilot test data. Data collected during start-up included:

- Liquid level data from monitoring, and recovery wells;
- Thermistor temperatures;
- Boiler operational data;
- SPH recovery volumes;

- Groundwater extraction rates, and totals;
- Steam injection rates, pressures and total pounds; and
- Hot water injection rates, totals and temperatures.

6.3.1 Collection of Water Pumping Data

Liquid level data (*Appendix C*) was collected prior to start-up and during the initial operations using an electronic data collection unit coupled to pressure transducers placed in monitoring wells MW-1S, MW-2S, MW-3S, MW-4S, MW-5S, and recovery well RW-1S. Each of the transducers were calibrated and checked prior to deployment in the wells. The data collector was programmed to collect data during the initial start-up operations and for a 24-hour period thereafter.

The transducers were set at known depths from the surface. This was as measured from the top of the well casing and as listed in Table 6.8. Also included in Table 6.8 are the corresponding measurements for depth to water (as measured from the top of the well casing), depth to SPH, if applicable, and the depth of measurable liquid (water and SPH) above the transducer.

Table 6.8
Pump Test Transducer Settings

Well	Depth of Transducer, ft.	Initial Depth to Water, ft.	Initial Depth to Liquid Petroleum Hydrocarbons, ft.	Depth of Transducer Below Liquid, ft.
MW-1S	18	12.6	N/A	5.4
MW-2S	18	13.4	13.0	5.0
MW-3S	18	13.7	13.5	4.5
MW-4S	18	12.8	12.7	5.3
MW-5S	18	13.6	N/A	4.4
RW-1S	21	14.5	13.7	7.3

N/A = not applicable

Data from the wells were collected using a total of six transducers deployed in the six wells. Only data from three wells were utilized (MW-3S, MW-5S and RW-1S) due to discrepancies in the data. The discrepancies in data from the other wells (MW-1S, MW-2S and MW-4S) included negative transducer readings, off-scale readings, and generally unreliable data from the transducers. These unreliable readings can be attributed to dirt in the transducer heads, and product density differences. Both conditions affected the electronics of the transducers, which were calibrated prior to deployment.

Transducer pressure readings were converted into feet of head for each of the wells and the changes in groundwater elevations for the individual wells were monitored and recorded by the logging unit. During a constant discharge pump test, decreases in groundwater table elevation (drawdown) were recorded for separate time intervals. The length of the pump test was approximately 24 hours. Actual pump test length was 1400 minutes, 40 minutes short of a complete 24-hour pump test.

6.3.2 Radius of Influence Determination

The data retrieved from the logging unit was transferred to a PC-based system for conversion and analysis. Conversion amounted to correction of transducer readings in psi to feet of water and correction factors for the sensitivity of the transducers. The usable data was input into Graphical Well

Analysis Package (GWAP), a PC-based aquifer analysis software package, for determination of specific aquifer characteristics associated with the steam injection system test area. From this data, drawdown vs. time curves were analyzed using the GWAP program.

Three separate analyses of the data were performed during computer modelling and curve matching by the GWAP program. The three separate curve matching techniques were:

- Elastic Response, Unconfined Aquifer
- Delayed Response, Unconfined Aquifer
- Leaky, Confined Aquifer

Review of the aquifer data and literature on the geologic units in the Yorktown vicinity, indicated that the best fit would be the Elastic Response and Unconfined Aquifer curves. All three types of curves were evaluated due to the nature of the site conditions and the construction activates which may have altered the surficial aquifer conditions when the underground storage tanks were constructed. Neither cut and fill conditions surrounding the USTs nor the potential effect of compaction under the tanks or surrounding the tanks was evaluated. This may have had some effect on the aquifer properties, but it was beyond the scope of the pilot test.

The surifical aquifer (Columbia) at the Yorktown site is considered to be an unconfined aquifer. Most of the area in which this pump test took place consists of a lithology representative of reworked earthen materials. This is typical of the construction activities associated with the eight underground storage tanks. Native (un-reworked) sediments were typically not encountered at less than 20 to 23 feet below grade during drilling. Groundwater was encountered at approximately 15 feet below grade. Therefore, while the aquifer analysis may be skewed and not necessarily representative of the native Columbia surifical aquifer, the aquifer properties calculated are representative of the tank area.

Using the pump test data and GWAP modeling, soil transmissivity in the test area was calculated to range between 400 and 1300 gallons per day per foot (gpd/ft). This is consistent with silty sand, the primary lithology observed during the drilling phase of the pilot test. Therefore, it was concluded that the values of the data collected and calculated by the analysis were consistent with the lithology observed at the site.

Hydraulic conductivity was calculated to range between 42 and 110 gpd/ft^2. Analytical results are summarized in Table 6.9.

Table 6.9
Results of Pump Test Analysis
May 4, 1993

Analysis Run	Well	Transmissivity, gpd	Hydraulic Conductivity, gpd/ft^2
Unconfined Aquifer, Elastic Response	MW-5S	489	42.9
Unconfined Aquifer, Elastic Response	MW-3S	871	77
Unconfined Aquifer, Delayed Response	MW-5S	1259	110.5
Unconfined Aquifer, Delayed Response	MW-3S	977	86.5
Leaky Confined Aquifer	MW-5S	631	55.3
Leaky Confined Aquifer	MW-3S	3632	321

Appendix D contains the matched curves for the aquifer analysis. A check was run using the combined curves of MW-3S and MW-5S. It confirmed the analysis and calculations by comparing results of the combined analysis with the singular and by verifying that the differences were not greater than two orders of magnitude for transmissivity.

Radius of influence (ROI) was observed at 29 feet (0.48 ft - MW-5S @ 1440 min). ROI was also calculated to range between 11 and 111 feet based on the hydrogeologic information for the site from both the O'Brien and Gere report and data collected during this pilot test. The equation for ROI or the distance to the stagnation point from a groundwater extraction well can be used to calculate the approximate radial influence. In this instance we used:

[1]

$$R = \frac{Q}{2\Pi h \phi v_n}$$ [1]

where:

R = radius/stagnation point, down-gradient
h = height of aquifer in feet (thickness)
Q = pumping rate in ft^3/day
ϕ = porosity (0.30)
v_n = velocity of groundwater in ft/day

$$v_n = \frac{KI}{\phi_e}$$

where:

K = hydraulic conductivity in gpd/ft^2
I = gradient in ft/ft
ϕ_e = porosity

From these equations and data collected during the pilot test, the following matrix (Table 6.10) was constructed for the possible stagnation points at the Yorktown site.

Table 6.10
Summary of Stagnation Point Calculations

Flow Rate, gpm [Q]	Hydraulic Conductivity (K), gpd/ft^2	$V_{natural}$ = (V_n) ft/day	Arc Width at stagnation point cross gradient from recovery well, ft	Distance down gradient to stagnation point, ft [R]
2	42	.57	187.5	29.87
2	110	1.47	72.79	11.59
4	42	.57	375.1	59.7
4	110	1.47	145.7	23.1

The calculation is limited in that it assumes steady state conditions have been reached. However, this basic model provides a suitable basis for estimating capture areas for recovery wells.

[1] Reference: (1983) Keely, Joseph, F., and Tsang, Chin Fu. "Velocity Plots and Capture Zones of Pumping Centers for Groundwater Investigations".

Based on this information, the ROI at the Yorktown site will range from 11.5 feet to 59.7 feet. The average ROI would be 35.6 feet in the down gradient direction.

Capture zone width varies from 72 feet to 375 feet across the gradient direction. Average width is 223 ft. This equates to a ROI perpendicular to the gradient of 111.5 feet. Averaging the perpendicular and parallel radius, an overall average ROI of approximately 90 ft is calculated. This would allow for 180 feet on-center construction of recovery wells (*see Appendix D - Aquifer analysis data*). Figure 6-1 schematically represents this.

As can be seen from Figure 6-1, the stagnation point becomes significantly wider further down-gradient from RW-1 towards RW-3 . This relationship is further depicted in the hydrogeologic model constructed for the site which will be discussed later. *Appendix I* contains the iterations of the model for the Yorktown site.

6.3.3 Testing of Treated Effluent

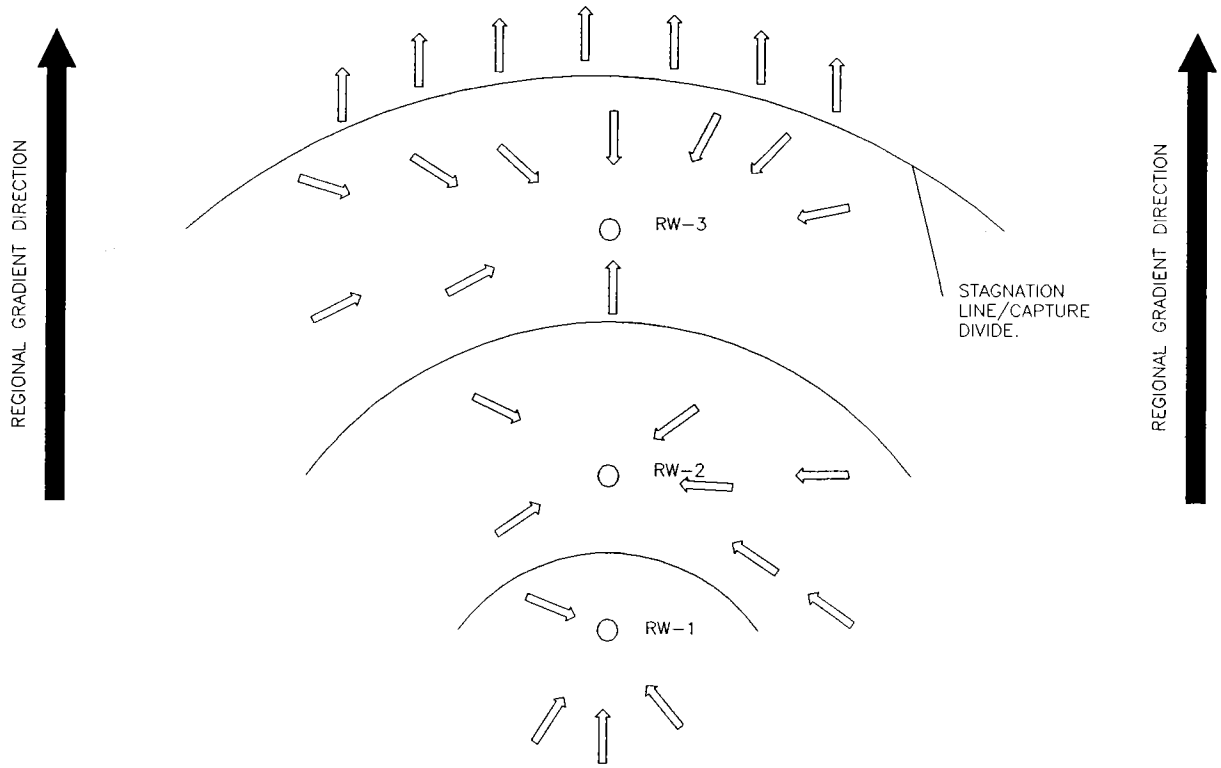
Recovered groundwater was passed through an oil/water separator and discharged to an existing underground storage tank for final disposition. Recovered groundwater was not passed through an activated carbon process train prior to surface discharge as had been originally planned. Therefore, the effluent was not tested during the operational phase of the pilot test. This modification to the pilot system treatment train was made at the request of the government and is reflected in the As-Built site plan and the Process and Instrumentation Diagram (see Section 5.0)

6.4 Phase Two/Three - Operational Activities

6.4.1 Steam System

Throughout the operational phase of the pilot test, detailed chronological data and comments were collected to permit data correlation to system performance. In addition, detailed operational data highlights and potential design and O&M issues were recorded so that they could be addressed during the design and construction of the full-scale program.

Detailed chronological operational notes are in *Appendix E.* As noted in this appendix, several operational problems were encountered during the pilot test. A broken water main supplying the boiler, failure of the recovery equipment and multiple electrical component failures occurred over the course of the pilot test. These events, although not anticipated, allowed for the collection of data during adverse operating conditions. Since the time of operation for the pilot test was limited by the above events, steady-state continuous operation was difficult to maintain and was only achieved for a short time.



⇦ Groundwater Flow Direction Arrow (Groundwater Flow Towards Recovery Well, within Stagnation Line/Capture Divide)

Stagnation/Capture Zone Schematic

Figure 6-1

Groundwater Technology, Inc.

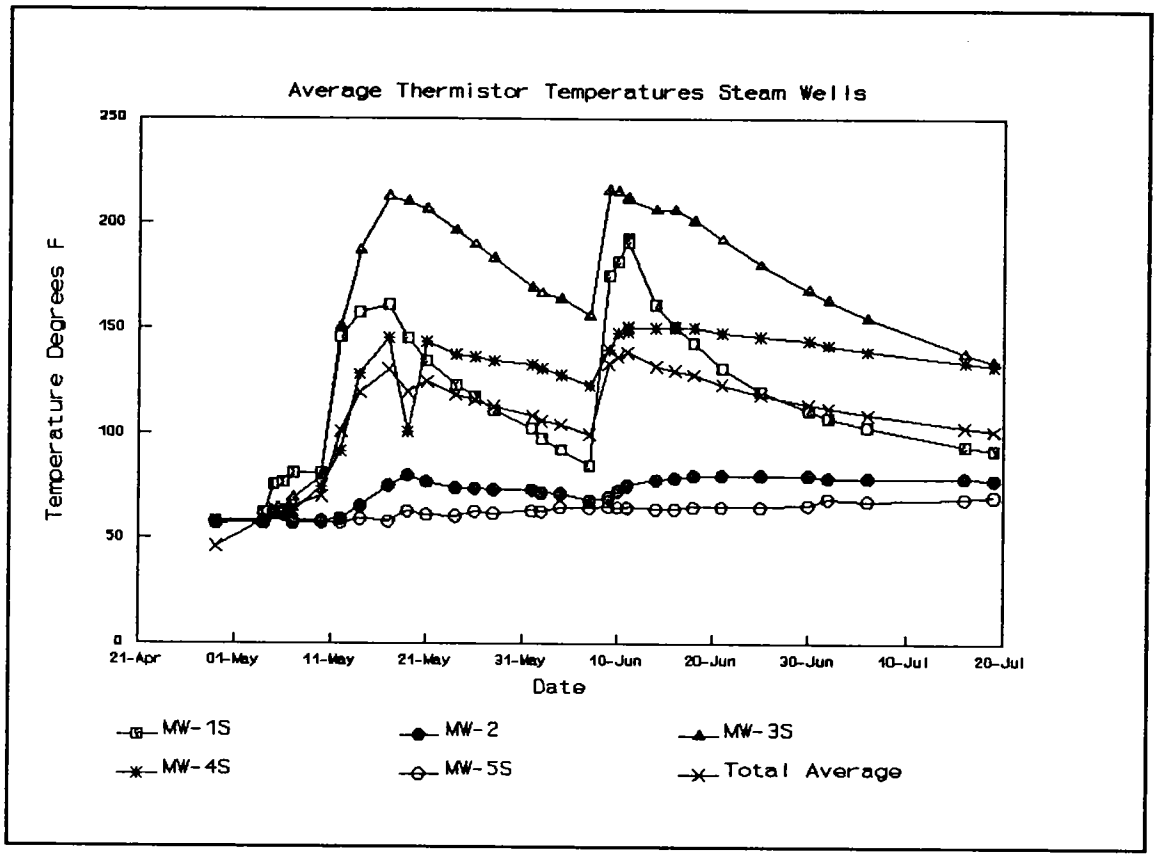
The initial ambient temperature of the soils within the steam-enhanced system varied between 55 and 60°F, dependent on depth. As steam was applied to the subsurface, the soil temperature increased. The increase was variable dependent upon depth and distance from a steam injection point. Within 10 days of the steam injection start-up, overall average soil temperature increased 50°F. Figure 6-2 and Table 6.11 present average probe (thermistor) temperatures for groups of thermistors in the steam system over the duration of the pilot test. Between May 4 and May 14, 1993, overall average soil temperatures increased approximately 50°F (Figure 6-2).

Average temperatures expressed in Table 6.11 and Figure 6-2 were calculated for the entire well by adding the three thermistor temperature recordings and computing the average. Overall averages were calculated in the same fashion for all the wells on the same date to arrive at an overall average temperature for the system.

Table 6.11
Average Temperature from Thermistors T1-T2-T3
in each Steam System Monitoring Wells
Degrees F.

	MONITORING WELLS					
DATE	MW-1S	MW-2S	MW-3S	MW-4S	MW-5S	Overall Avg.
29-Apr-93	0.0	58.0	57.1	57.9	57.2	46.0
04-May-93	61.7	58.0	58.2	58.2	57.2	58.7
04-May-93	61.9	58.2	58.5	58.4	57.4	58.9
04-May-93	62.2	58.1	58.5	58.3	57.4	58.9
05-May-93	75.9	62.6	62.1	60.9	61.3	64.6
06-May-93	76.6	61.5	63.3	61.3	61.2	64.8
07-May-93	81.2	58.2	69.2	62.8	57.3	65.7
10-May-93	81.2	58.4	79.4	74.5	57.3	70.2
12-May-93	145.7	59.2	150.7	91.4	57.3	100.9
14-May-93	157.7	65.7	187.0	128.1	59.2	119.5
17-May-93	161.1	75.0	212.3	145.4	58.0	130.4
19-May-93	145.2	80.1	210.0	100.6	62.8	119.8
21-May-93	134.3	77.0	206.3	143.3	61.3	124.5
24-May-93	122.8	74.0	196.3	137.4	60.6	118.2
26-May-93	117.4	73.8	189.7	136.0	62.9	115.9
28-May-93	110.9	73.2	183.3	134.5	61.8	112.7
01-Jun-93	102.2	73.2	169.5	132.8	63.2	108.2
02-Jun-93	97.5	71.8	166.6	130.7	62.9	105.9
04-Jun-93	92.3	71.5	163.9	127.8	64.9	104.1
07-Jun-93	84.7	68.3	156.2	122.8	64.5	99.3
09-Jun-93	175.2	69.6	215.3	139.9	65.1	133.0
10-Jun-93	181.9	72.7	214.7	148.0	64.9	136.4
11-Jun-93	192.7	75.0	212.0	148.7	64.7	138.6
11-Jun-93	191.7	75.3	211.7	150.7	64.7	138.8
11-Jun-93	191.0	75.7	211.0	150.3	65.0	138.6
14-Jun-93	161	78	206	150	64	131.8
16-Jun-93	151	79	206	150	64	130.0
18-Jun-93	143	80	201	150	65	127.8
21-Jun-93	131	80	192	148	65	123.2
25-Jun-93	120	80	180	146	65	118.2
30-Jun-93	111	80	168	144	66	113.8
02-Jul-93	107	79	163	142	69	112.0
06-Jul-93	103	79	155	139	68	108.8
16-Jul-93	94	79	138	134	69	102.8
19-Jul-93	92	78	134	132	70	101.2

Figure 6-2



Due to the operational difficulties during days 10 to 25, the overall average soil temperature declined approximately 25°F. As steam was re-injected on a regular basis, the overall average temperatures increased to approximately 140°F in a short period of time (2 to 3 days). Specific monitoring well temperature averages over the three select horizons (13 feet, 18 feet, and 23 feet) were either significantly higher (e.g. MW-3S @ avg. temp of 150 - 200°F) or significantly lower (e.g. MW-5S @ avg. temp. of 60 - 77°F). These differences are primarily due to the data collection point (thermistor) being closer to or further away from a steam injection point.

Appendix F contains the specific temperature data and associated graphs for each of the steam system monitoring wells and thermistors.

Appendix G contains a series of figures illustrating the areal extent of heating as measured by the thermistors in the monitoring wells associated with the steam injection system. The figures outline the gradual changes of the temperatures across the steam injection site within the three select horizons and are representative of how areal distribution occurred in the subsurface.

The configuration of the soil heating effect followed a cloverleaf pattern. However, over time, preferential heat pathways were observed. Subtle changes between the Figures in Appendix G support this observation.

Late in the pilot test period, steam breakout occurred at RW-1S. Steam injection wells were shut off to identify the steam injection well contributing to the breakout. It was thought that the procedure would identify a preferential steam flow path from a specific injection well. Each open/closed test was run for approximately 20 minutes. These observations indicated more than one injection well contributed to the breakout condition at RW-1S and that there may not have been a preferential pathway. The sequence of open and closed wellhead valves and the observed results are presented in Table 6.12.

Table 6.12
Summary of Wellhead Valve Closing Test

TEST	WELLHEAD VALVE STATUS	INJECTION WELL NO.	FINDINGS
(A)	CLOSED	SI-1	STILL STEAM BREAK-OUT AT RW-1S
	OPEN	SI-2	
	OPEN	SI-3	
	OPEN	SI-4	
(B)	OPEN	SI-1	STILL STEAM BREAK-OUT AT RW-1S
	CLOSED	SI-2	
	OPEN	SI-3	
	OPEN	SI-4	
(C)	OPEN	SI-1	STILL STEAM BREAK-OUT AT RW-1S
	OPEN	SI-2	
	CLOSED	SI-3	
	OPEN	SI-4	
(D)	OPEN	SI-1	STILL STEAM BREAK-OUT AT RW-1S
	OPEN	SI-2	
	OPEN	SI-3	
	CLOSED	SI-4	
(E)	OPEN	SI-1	STILL STEAM BREAK-OUT AT RW-1S
	CLOSED	SI-2	
	CLOSED	SI-3	
	CLOSED	SI-4	
(F)	CLOSED	SI-1	STILL STEAM BREAK-OUT AT RW-1S
	OPEN	SI-2	
	CLOSED	SI-3	
	CLOSED	SI-4	
(G)	CLOSED	SI-1	STILL STEAM BREAK-OUT AT RW-1S
	CLOSED	SI-2	
	OPEN	SI-3	
	CLOSED	SI-4	
(H)	CLOSED	SI-1	STILL STEAM BREAK-OUT AT RW-1S
	CLOSED	SI-2	
	CLOSED	SI-3	
	OPEN	SI-4	

6.4.2 Hot Water System

Hot water at approximately 160°F was injected at the four injection wells starting May 4, 1993. Temperature measurements were obtained from thermistors in each monitoring well as described above. The temperature in the surrounding soils increased an average of 8°F after approximately four hours of injection. Overall average soil temperature increased to a high of 80.8°F during May 12 to 14, 1993. The highest average temperature recorded at a single monitoring well in the hot water system was recorded at monitoring well MW-1H, 160.9°F, (average of three thermistors) on May 12, 1993. Table 6.13 presents the average temperatures for each of the monitoring wells associated with the hot water system. The temperatures presented are the average of the three individual thermistor readings for that well.

Table 6.13
Average Temperatures
From Thermistors T1, T2, T3
in Each Hot Water System Monitoring Well

DATE	MW-1H	MW-2H	MW-3H	MW-4H	MW-5H	OVERALL AVERAGE
04-May-93	58.5	57.1	57.2	57.0	57.3	57.4
05-May-93	106.2	59.6	60.4	60.8	60.3	69.4
06-May-93	98.5	60.4	58.8	59.3	61.1	67.6
07-May-93	77.2	57.5	57.3	57.1	63.0	62.4
10-May-93	80.5	57.6	57.3	57.1	63.8	63.2
12-May-93	160.9	57.6	57.2	57.2	71.4	80.8
14-May-93	133.9	62.1	59.9	63.7	84.7	80.8
17-May-93	84.3	62.0	57.3	67.7	96.0	73.4
19-May-93	100.3	62.7	58.3	68.3	90.0	75.9
21-May-93	100.0	63.0	58.3	67.3	86.7	75.0
24-May-93	96.6	62.1	62.5	66.9	81.1	73.8
26-May-93	95.2	62.7	60.4	67.2	79.7	73.0
28-May-93	62.2	62.2	59.7	67.6	78.1	65.9
01-Jun-93	90.6	62.5	61.0	69.6	76.0	71.9
02-Jun-93	90.2	62.4	60.9	69.3	75.6	71.6
04-Jun-93	89.9	64.7	63.3	71.2	77.0	73.2
07-Jun-93	87.2	62.4	61.3	70.4	73.5	70.9
09-Jun-93	87.5	63.1	63.1	70.0	73.7	71.4
11-Jun-93	86.1	61.8	69.1	62.6	n/a*	69.9

* n/a = data not available

Figure 6-3 presents average probe (thermistor) temperatures for the hot water system over the duration of the pilot test. Figure 6.4 presents and expands the overall average of the probe temperature for the test area. From the graph in Figure 6-4, overall average soil temperatures can be seen to have increased approximately 20°F to 30°F.

Figure 6-3

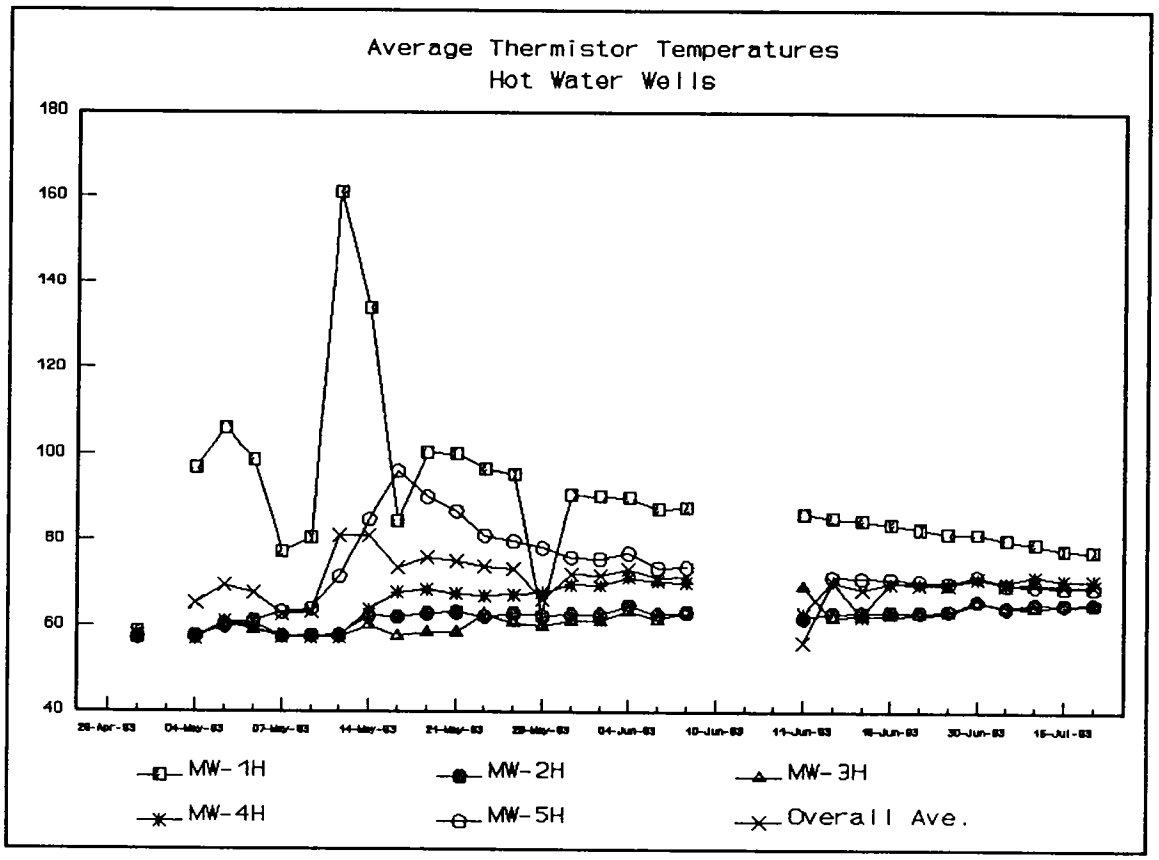
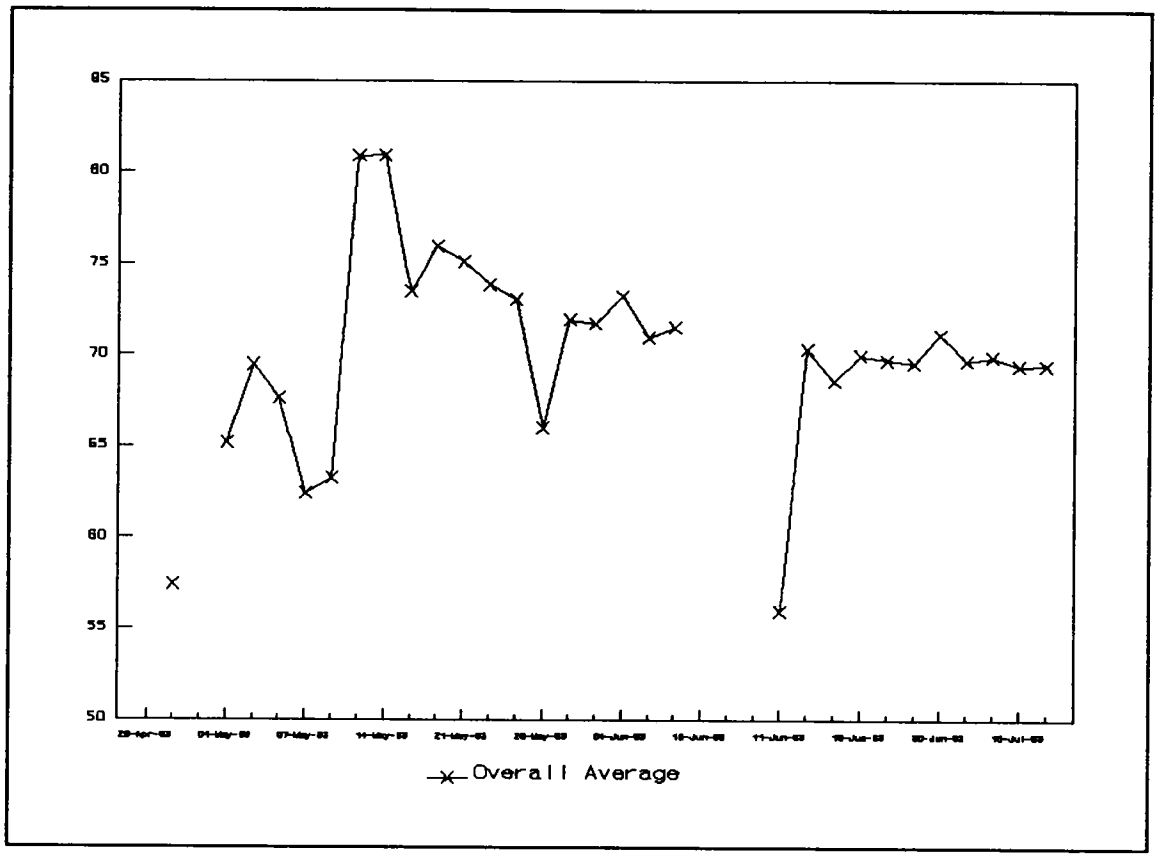


Figure 6-4
Overall Average Hot Water Temperature
All Hot Water Wells



Appendix H contains the specific temperature data and associated graphs for each of the hot water monitoring wells.

No well discharge temperature data was collected on a regular basis from which any inferences or evaluations could be drawn with respect to the hot water injection system.

Heating of the soils in the hot water injection system area to the planned temperature was not accomplished during the pilot-testing period. Several situations were encountered which demonstrated the limited applicability of hot water injection. Due to lack of natural mobility, the NSFO within the soil matrix became trapped below the water table as hot water was injected. Further, the NSFO already trapped below the water table (evidenced by the drilling logs) was limited in its exposure to the hot water. The transfer of heat from the hot water to the soils and to the adsorbed-phase NSFO did not occur as anticipated.

Another interesting situation was that increases in the groundwater table elevation during injection occurred faster than the groundwater could be recovered. This occurred even though the recovery system was sized to handle more water than was being injected it contributed to an inversion of NSFO below the water table. Water above the NSFO was unable to flow through the NSFO choked soil matrix to the recovery well and the NSFO was not heated enough to flow out of the matrix or float to the water surface.

The condition of NSFO being trapped below the water was labelled an inversion since oil usually floats on water.

Data indicating the potential for inversion and NSFO existing below the water table was obtained during well installations. During the drilling of the monitoring wells, soil samples retrieved from below the water table contained a considerable amount of NSFO. A natural inversion was also noted with the unheated system at RW-3X and created difficulties for recovery of NSFO at RW-3X. This is not an uncommon phenomena related to underground storage tanks. It has been observed adjacent to tanks with leaks below the surrounding groundwater table and product storage levels above the groundwater elevation.

Several attempts were made by stopping the hot water injection during the pilot testing period, to allow the separation of the NSFO and water to occur. This did not correct the condition in the timeframe of the pilot test. Therefore, it is concluded that the inversion situation created adverse recovery conditions for the hot water system.

The physical properties of the NSFO and the subsurface environment did not permit effective separation and mobilization of the NSFO in the vicinity of the hot water injection system. In addition to not meeting the primary objective of NSFO recovery, heating of the subsurface environment as originally anticipated was never achieved. This is discussed further in Section 7.2.

6.4.3 Soil Vapor Concentration Response

During the latter part of the pilot test, after injection of steam or hot water ceased, the wellheads of the monitoring and recovery wells were opened and the air in the wells was analyzed for volatiles using a portable Photo-ionization Detector (PID) with a 10.0eV lamp. This was done to provide data on the presence of volatile releases from the soils after the heating period. The site contaminant, NSFO, is a heavy distillate and typically does not yield lighter-end hydrocarbon volatiles. The data collected indicated that volatilization was occurring in the vicinity of the heated area of the pilot test. Table 6.14 presents the concentrations detected by the PID.

Table 6.14
PID Monitoring of Well Heads
July 13, 1993 (Day No. 71)

Well	Photo-ionization Detector Reading, ppm	Notes
MW-1S	340	After opening sealed well
MW-2S	180	After opening sealed well
MW-3S	389	After opening sealed well
MW-4S	871	After opening sealed well
MW-5S	N/D*	After opening sealed well
MW-1H	13.0	Well open to atmosphere
MW-2H	12.4	Well open to atmosphere
MW-3H	12.7	Well open to atmosphere
MW-4H	12.6	Well open to atmosphere
MW-5H	12.9	Well open to atmosphere
RW-1S	32	Well open to atmosphere
RW-2H	12.9	Well open to atmosphere
RW-3X	12.9	Well open to atmosphere

No air samples were taken to quantify and qualify the volatiles detected by the PID.

The higher PID readings from the monitoring wells associated with the steam system were possibly due to the wells being sealed with an airtight well cap. The sealing of the well may have allowed for build-up of volatiles. They may also be a result of the higher temperature achieved in the steam test area. The information indicates that volatile constituents exist in the subsurface even though they may not be directly related to the NSFO. The heating of the subsurface has the potential to create hazards, including increases in measurable volatile concentration, which must be considered in future designs, construction and operations.

7.0 DATA EVALUATION

7.1 Introduction

The amount of product recovered in each test area is perhaps the most important indicator in assessing the feasibility of applying one or more of the tested remedial methods over a larger area of the site. This section discusses the different systems piloted and the success or failure of each. The data collected is compared and evaluated with respect to performance objectives.

7.2 Separate Phase Hydrocarbon (SPH) Recovery

A small-diameter submersible SPH recovery pump was deployed in each of the three recovery wells to remove accumulated product. Over the duration of the pilot test, the recovery tanks were gauged to determine the volume of liquid hydrocarbons recovered by each system. Approximately 7, 10, and 163 gallons of SPH were collected over the period of the pilot test by the un-enhanced, hot water enhanced, and steam-enhanced recovery systems, respectively. Recovery data is presented in Table 7.1. As indicated by the product recovery volumes, steam injection provided a significantly higher recovery rate. The recovery volume for the hot water enhanced and the un-enhanced systems showed minimal differences (see Figure 7-1).

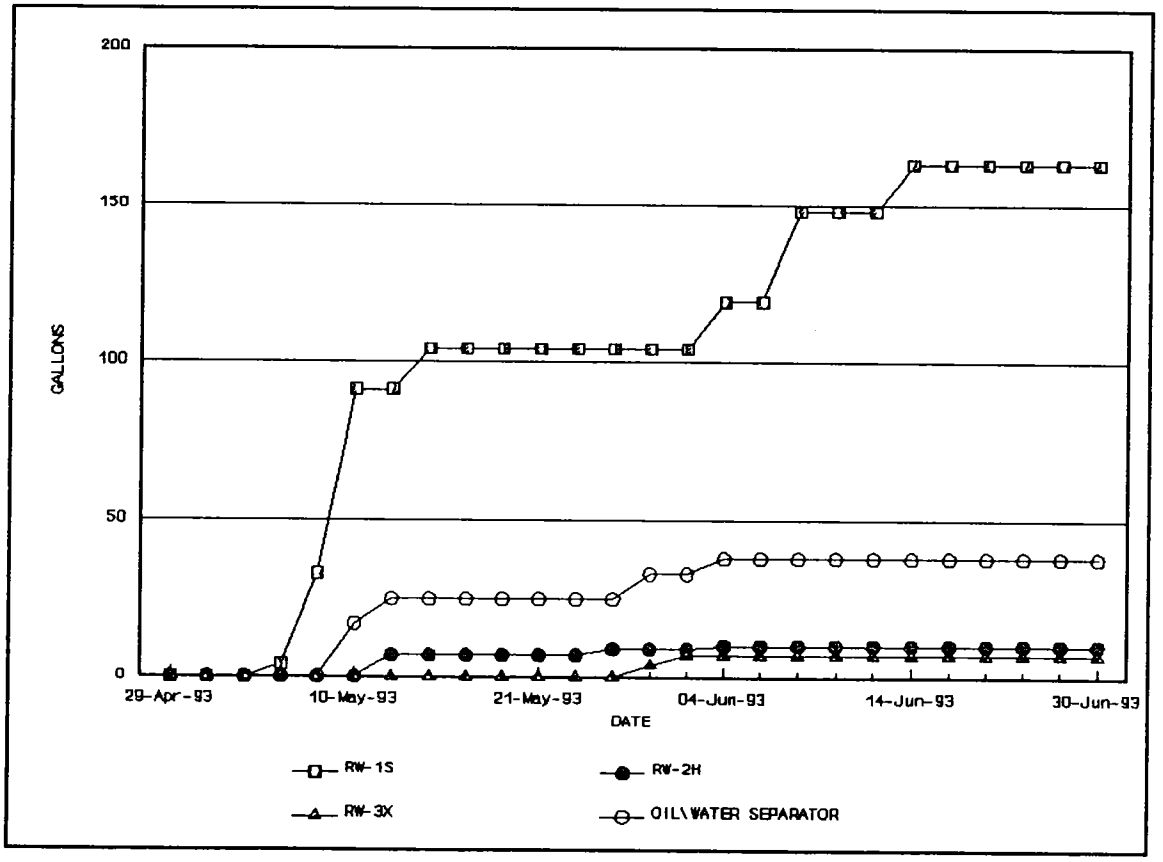
Table 7.1
Liquid Hydrocarbon Recovery Volumes

DATE	RW-1S CUMULATIVE GALLONS	RW-2H CUMULATIVE GALLONS	RW-3X CUMULATIVE GALLONS
29-Apr-93	0	0	0
04-May-93	0	0	0
05-May-93	0	0	0
06-May-93	4	0	0
07-May-93	33	0	0
10-May-93	91	0	0
12-May-93	91	7	0
14-May-93	104	7	0
17-May-93	104	7	0
19-May-93	104	7	0
21-May-93	104	7	0
24-May-93	104	7	0
26-May-93	104	9	0
01-Jun-93	104	9	4
02-Jun-93	104	9	7
04-Jun-93	119	10	7
07-Jun-93	119	10	7
09-Jun-93	148	10	7
10-Jun-93	148	10	7

Table 7.1 (Cont.)
Liquid Hydrocarbon Recovery Volumes

DATE	RW-1S CUMULATIVE GALLONS	RW-2H CUMULATIVE GALLONS	RW-3X CUMULATIVE GALLONS
11-Jun-93	148	10	7
14-Jun-93	163	10	7
16-Jun-93	163	10	7
18-Jun-93	163	10	7
21-Jun-93	163	10	7
25-Jun-93	163	10	7
30-Jun-93	163	10	7

Figure 7-1
Liquid Hydrocarbon Recovery



Rapid accumulation of free product from the pilot-scale system was first observed starting May 10, 1993 and again on June 9, 1993. The first period of rapid recovery correlates to the initial increase in soil temperature by approximately 10°F to 20°F and continuous pumping of groundwater and SPH. The second period correlates to the restart of pumping after equipment problems were rectified. It also correlates to subsurface temperatures of 120°F to 140°F, and continual system operation for a 3 to 5 day period.

The pilot-test data evaluation process determined a temperature threshold at which the recovery of NSFO is effective and at which the residual saturation value is minimized. This temperature value was found to be approximately 140°F. This is less than the steam injection temperature of 212°F and significantly higher than the natural ground temperature of 59°F, but it is a temperature which was found to be readily attainable across the pilot test area.

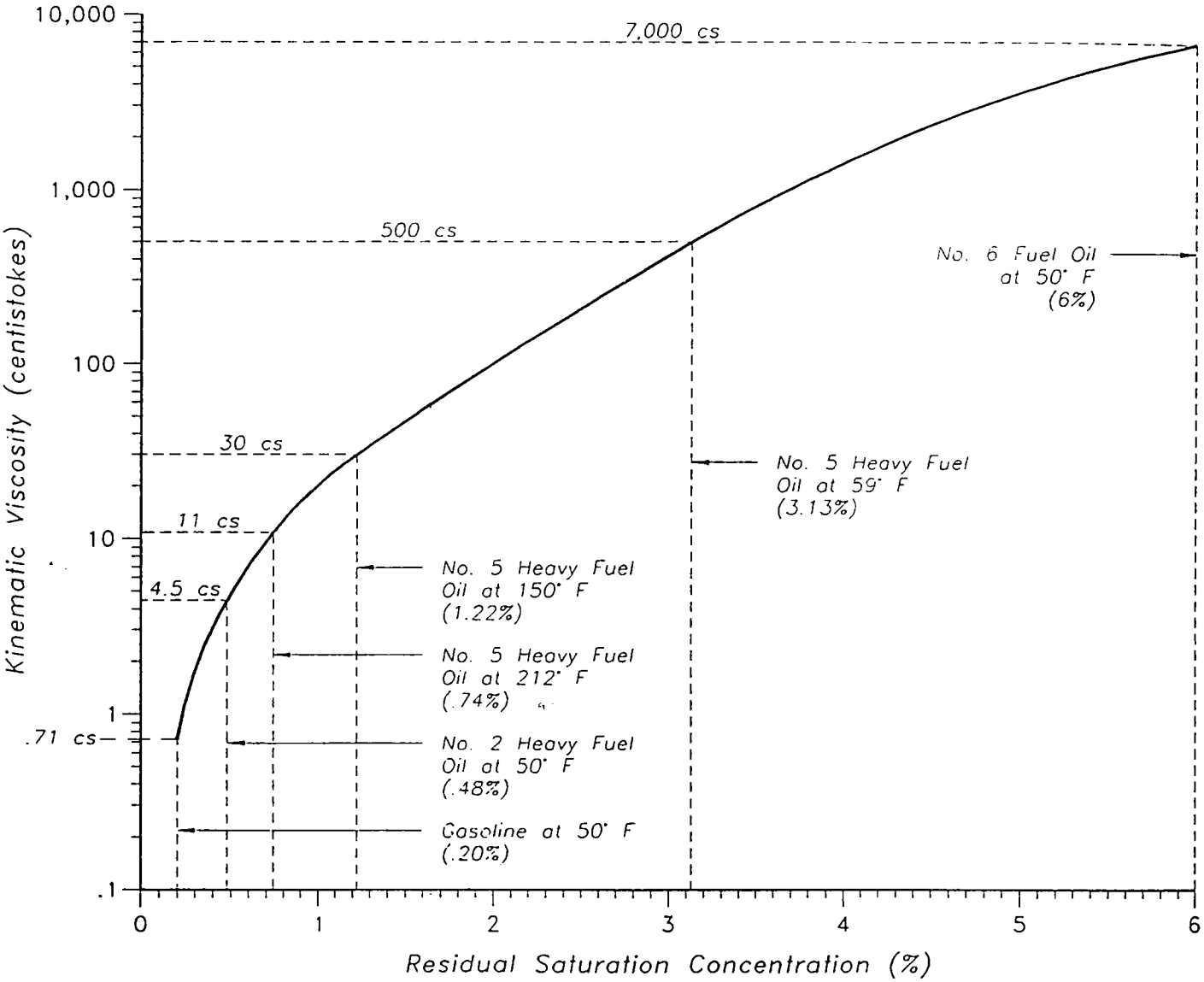
SPH was often present as a separate phase below a layer of water in the hot water enhanced system recovery well RW-2H. This may be extrapolated to reflect conditions throughout the formation resulting from the relatively high specific gravity of NSFO, (0.94-0.99 g/ml as compared to 1.00 g/ml for water) and the downward force of the injected water overcoming weak buoyant forces. The injection of steam requires lower mass flow rates through the soil than hot water injection and reduces the undesirable possibility of increased water circulation in the vadose zone.

Smearing of SPH into lower areas of the saturated zone is a result of lowering the groundwater level. Liquid level data collected in the hot water injection test area indicates that the use of hot water injection points would make it very difficult to control treatment area hydraulics. In particular, it would be difficult to control the subsurface water in a manner which would promote efficient product recovery while minimizing the potential for smearing of the product.

The radius of influence for SPH recovery was approximately the same as that for groundwater. Evaluation of recent hydrogeologic test data indicated that an estimated radius of influence of 90 feet for a recovery well will be accomplished by pumping 2 to 3 gpm. This will also create a maximum desirable initial drawdown level of 2 to 3 feet at the recovery well. Over time, the drawdown would become greater in a network of wells due to the overlapping of radii of influence between wells. This increased drawdown may locally increase smearing of the SPH, but it allows for more timely recovery of the SPH.

Evaluation of the steam injection treatment parameters requires review of the relations between temperature, viscosity, residual concentration and hydraulic conductivity. Most importantly the soil hydraulic conductivity is inversely proportional to kinematic viscosity. Figure 7-2 depicts the relationship of residual saturation concentration in percent versus kinematic viscosity in centistokes. For example, for a given network of pumping wells, a No.5 heavy fuel oil plume with an average ground temperature viscosity of 500 centistokes would require greater than 16 times the duration to remediate as a No. 5 fuel oil plume which at 150°F has a viscosity of 30 centistokes. In addition, the residual saturation concentration falls from 3.13% @ 59°F to 1.22% when the No. 5 heavy fuel oil is heated to 150°F.

The single steam injection pilot test cell demonstrated an SPH recovery rate of about 6 gpd. This is based on 163 gallons of SPH being collected over approximately 25 days of SPH recovery. This product recovery rate was attained while pumping between 2 and 3 gpm (2880 to 4320 gpd) of groundwater and while only attaining a 130°F soil temperature over the test area for about eight days.



Source: Compilation and Graphing of Previously Published and Unpublished Information

Residual Saturation Concentration vs. Kinematic Viscosity

Figure 7-2

GROUNDWATER TECHNOLOGY

7.3 Dissolved Phase Hydrocarbon Recovery

Observations indicated that thermal and mixing effects of heat-enhanced recovery of NSFO caused significant mixing or emulsification of the SPH and water. The similarity in specific gravity between the oil and water may have exacerbated this condition. Recovered product contained as much as 30% water by volume, and the hot water enhanced system often exhibited inversion of the SPH and water layers. Emulsified and mixed hydrocarbon recovery would be effectively accomplished using total fluids extraction pumps.

The potential for emulsified product and the low solubility of No. 5 heavy fuel oil reduces the value of the calculation of product mass expected to be removed in the dissolved state. Mass removal in the dissolved phase for more soluble petroleum products, such as gasoline, represent only about 1% of the total mass present at a site. The dissolved fraction of No. 5 fuel oil's total mass is most likely less than 1%. The calculation of recoverable dissolved hydrocarbon is beyond the scope of this report.

As noted in Section 6.2.2, Table 6.7, Summary of Hydrocarbon Screen Soil Analysis by GC FID, soils exhibited concentrations of kerosene, diesel, and lubricating oil. The emulsification of product (No. 5 fuel oil) is not expected to significantly contribute to the dissolved fraction of contaminant in the groundwater. However, soil analytical results indicate the presence of other soluble contaminants. If the site-wide system is to incorporate groundwater extraction as a means to help capture SPH, some of the groundwater extracted will contain a fraction of dissolved hydrocarbons. The purpose of this pilot test was not to evaluate dissolved contaminant loading or impact. However, it should be noted that, for a site-wide system, dissolved hydrocarbons in any discharge to surface water may have to be addressed. The extent to which it must be addressed is dependent on the regulatory climate.

7.4 Hydrocarbon Recovery Equipment

Concerns with the control system developed during operation of the groundwater recovery and SPH recovery pumping equipment. An undetermined power surge apparently damaged pump controls and shut down the recovery system for two weeks. In addition, the small difference between the specific gravity of the SPH (0.94 - 0.99) and the specific gravity of water (1.0) apparently caused float switches to fail. The failure occurred as the SPH/groundwater interface dropped past the float switches while the groundwater pump was operating. The groundwater pump then began to pump SPH. This was exacerbated by the coating of probes with heavy oil during deployment and with emulsified oil during operation. The failure to stop the groundwater recovery pump allowed SPH to be pumped to the oil/water separator which, in turn, affected water treatment.

Power surge controls should be installed in any electrical service for the full scale system. The use of a total-fluids recovery system would reduce problems resulting from down-well controls which function on liquid-density differences or conductivity.

7.5 Radial Temperature Influence

While steam was being injected on a regular basis, the overall average subsurface temperature increased to approximately 130°F in a short period of time (2 to 3 days). Monitoring well temperature averages over the three select horizons (13 feet, 18 feet and 23 feet) were either significantly higher (e.g. MW-3S @ avg. temp. of 150 to 200°F) or significantly lower (e.g. MW-5S @ avg. temp. 60 to 70°F). This can be seen in *Appendix F*. These differences are primarily due to the distances of the data collection points (thermistors) from a steam injection point. The concern, therefore, is the correlation of the average soil temperature ranges and the rate of accumulation of product in the recovery tank.

Significant accumulation of SPH was first observed starting May 10, 1993 as the soil began to warm. On June 10, 1993, significant accumulation was also observed. The second observation correlates to the subsurface temperature of 130°F - 140°F and continual system operation for a 3 to 5 day period.

Given the limited pilot test data available for periods of system operation at 130°F to 140°F, it is reasonable that an upper temperature threshold could be established corresponding to this increase in product recovery. The cool-down rate for the site was conceptually developed as discussed in Section 3.2.5. A full-scale system can utilize the data on temperature range and cooling rate for minimizing operational costs while maximizing efficiency. This will permit a relationship to be formalized, during operation, for pulsed injection of heat into the subsurface to maintain the temperature necessary for continuous recovery. Pulsed heating of the subsurface will allow the system to be efficiently operated. It also offers flexibility, by pipe manifolding and valving, to inject heat into specific site areas to maintain soil temperatures within the required range without excessive heating or without heating more area than necessary.

7.6 Heat Loss Rate Estimate

As outlined in the Work Plan, heat loss through the unsaturated soil to the groundsurface is expected to be negligible compared to that loss through fluids recovery. A survey of surface temperatures at a depth of 4 to 5 inches (Figure 7-3) confirmed that the unsaturated zone soils provided adequate insulation between the isothermal steam zone and the surface. Surface temperatures were generally only 6°F to 20°F above the ambient air temperature in the steam injection test area, with the exception of small areas within two feet of the injection points. Even within the latter areas, surface temperatures did not exceed 28°F over ambient for any measurement taken more than seven inches from a steam injection point.

Increasing the injection point spacing, or raising the screened interval of the injection wells, will increase the possibility of steam breakthrough to the surface prior to thorough heating of the area between the injection and extraction points. The potential for breakthrough may be reduced by utilizing soil vapor extraction (SVE) to direct vadose zone steam towards recovery wells, or by the injection of steam at a slightly deeper interval (25 to 30 feet). The use of SVE is discussed in Section 8.4.1.

Scale Bar

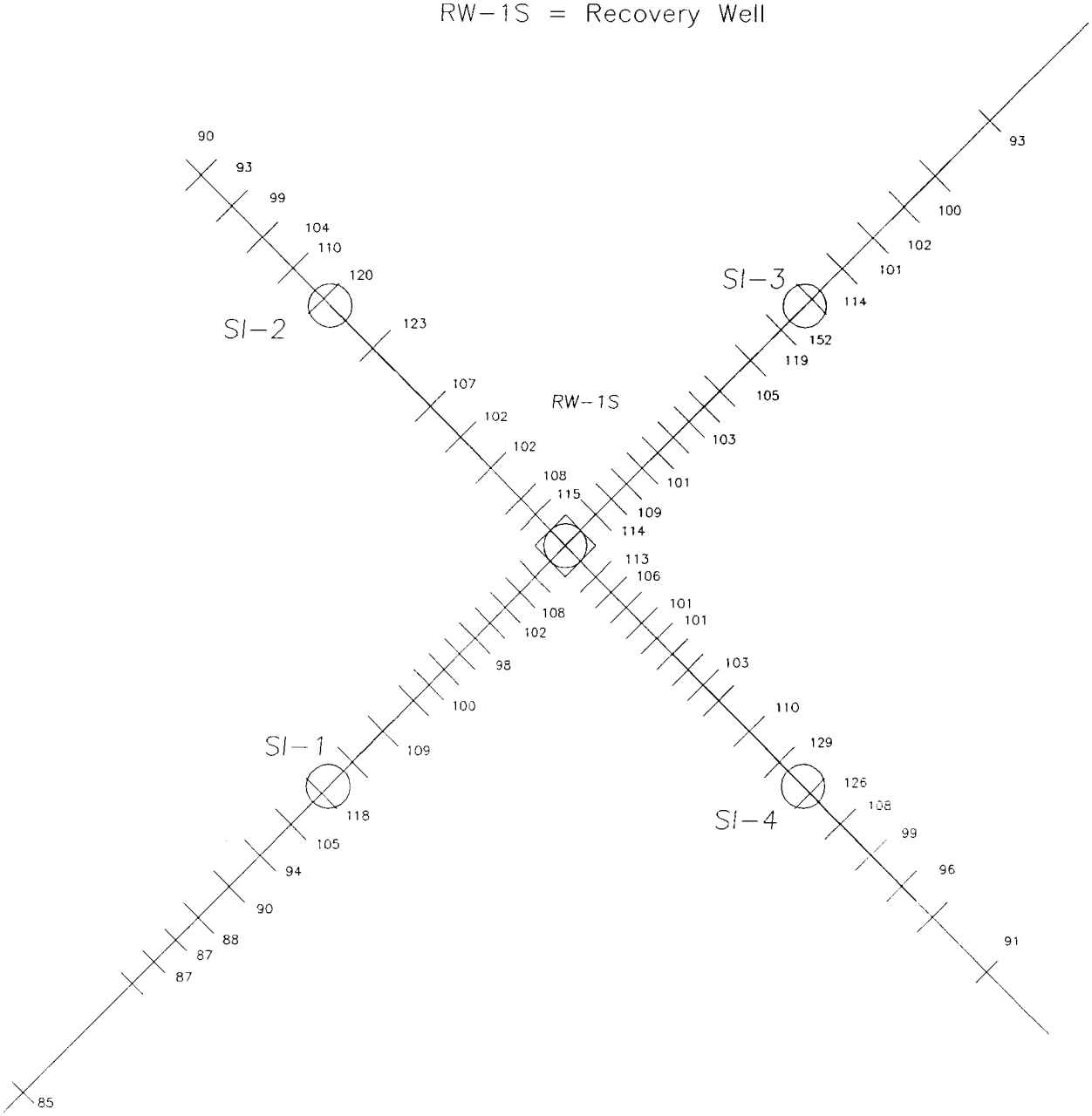
0 10 Feet

Temperature Readings in Degrees F.

Soil Temperature Data Taken with a Thermistor Probe.

SI-1 = Steam Injection Well

RW-1S = Recovery Well



Surface Temperature Readings
4 to 5 Inches
Below Grade

Figure 7-3

Groundwater Technology

A total of about 115,200 lb of steam was injected at approximately 600 lb/hr for about 192 hours (8 days) between May 6 and 15, 1993. The average subsurface temperature within the steam injection study area rose from 57.6°F to 148.5°F, a difference of 90.9°F. The heat losses during this period can be estimated as shown in Section 3.4. Using an average soil temperature of 103°F, the heat loss from the steam injection study area was approximately 7 MMBtu.

The volume of saturated soil that was heated (with a heat capacity of 0.5 Btu/lb • °F) is 1200 ft^2 times a thickness of 10 feet. It is assumed that the unsaturated zone soil that was heated (with a heat capacity of 0.35 Btu/lb • °F) is 1200 ft^2 times a thickness of 3 feet. If an average soil bulk density of 120 is assumed, as in Section 3.4, the expected temperature rise from the input of steam would be

$$\Delta T = (q_{steam} - q_{losses})/A\rho_b(\Sigma x_i C_{pi}) \quad (18)$$

or 120°F. This is about 32% greater than the observed average temperature rise of 90.90°F. This is considered to be acceptable agreement considering the detail of the calculations, the potential for unknown soil characteristic and their extent, and the relatively short actual running time for the test.

After stopping steam injection, decay of the average temperature was observed during cooling-off periods following May 15 and June 10. The average temperature of monitoring locations within the affected area, originally 57.6°F, fell from 148.5°F to 108.0°F between May 15 and June 7, a period of 21 days. Average temperature fell from 157.3°F to 119.9°F between June 11 and July 6, a period of 25 days. Assuming exponential decay, this corresponds to temperature decay-rate time constants of 36 days and 53 days. This is less than the predicted values (7 to 11 months) by a factor of about 6. The source of this difference is unknown. Although the cause of this difference is unknown, the effectiveness of steam injection for NSFO recovery is not diminished. During large-scale operations, where a wide variety of soil and operating conditions are encountered for a long period of time, sufficient empirical data may permit development of a better predictive model or may demonstrate a closer correspondence to the predicted values.

7.7 Soil Quality

Soil samples were collected in the steam injection test area before and after pilot testing to assess the impact on hydrocarbon concentrations. The TPH concentrations in the soil from wells 2S and 3S before the pilot test were 500 mg/kg and 720 mg/kg, respectively. The TPH concentration after testing for the same area and vertical interval were 16 mg/kg and 13 mg/kg, respectively. This reflects a decrease in residual saturation concentrations. The result is attributable to the reduction of SPH viscosity and the removal of SPH during the pilot test.

A less pronounced, but similar, effect occurred in the hot water injection area.

See Table 7.2 present the pre- vs. post-pilot test analytical data for Total Petroleum Hydrocarbon (TPH). Table 7.3 presents pre- and post-pilot test Total Organic Halide analytical values.

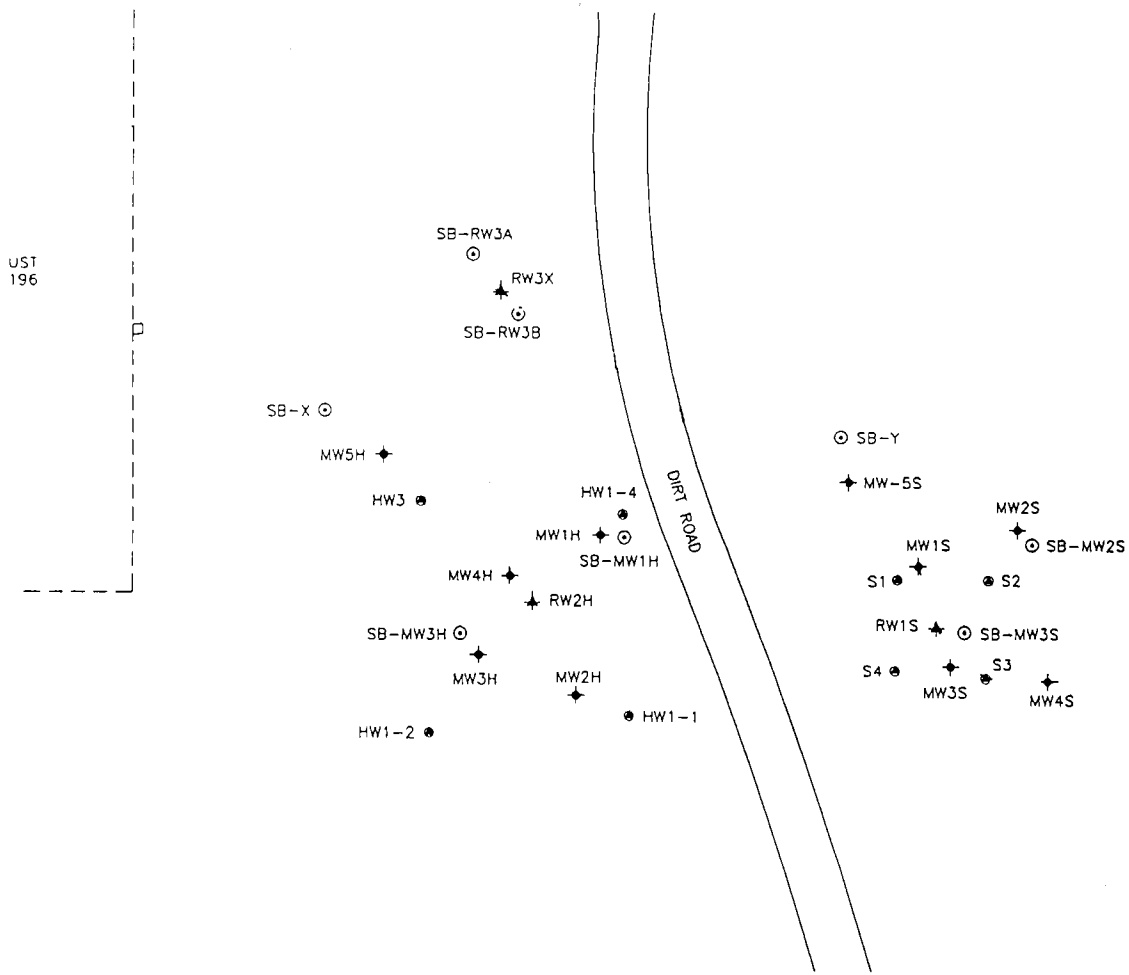
Table 7.2
Comparison of TPH Pre- vs. Post-Test Soil Analysis Data in mg/kg

Pre-Test Results				Post-Test Results			
Well	Depth of Sample	Concentration	Notes	Boring	Depth of Sample	Concentration	Notes
MW-1S	4-6	<39					
MW-2S	11-13	500		SBMW2S	12-14	16.3	
MW-3S	9-11	130		SBMW3S	9-10	13.1	
MW-4S	17-19	720					
MW-5S	9-11	<35	Run at low level in µg/kg				
MW-1H	19-21	31000		SBMW1H	11-12	BRL*	
MW-2H	9-11	<34	*Run at low level in µg/kg				
MW-3H	9-11	49		SBMW3H	4-6	61.2	
MW-4H	19-21	4900					
MW-5H	19-21	28000					
				SBRW3A	4-6	11	Adjacent to RW-3X
				SBRW3B	9-10	BRL	
				SB-Y	12-14	BRL	Away from Pilot Test Area
				SB-X	12-14	BRL	Away from Pilot Test Area

*BRL = Below reportable limit

As noted in Table 7.2, blank spaces exist where directly correlatable data was not collected. The data that is correlatable does exhibit a significant relationship, i.e., soil contamination (TPH) levels did decrease in the area of the steam pilot test.

Figure 7-4 depicts the locations of the post pilot test soil borings from which the samples were obtained.



Well and Soil Boring Locations

Figure 7-4

GROUNDWATER TECHNOLOGY

NSC YORKTOWN FUEL ANNEX

NAPO REMEDIATION PILOT TEST
YORKTOWN, VIRGINIA

DESIGNED BY: BM	DETAILED BY: PJC	CHECKED BY:
DRAWING DATE: 1/10/94		ACAD FILE: YORKXLOC
PROJECT NO: 830011008.210691		CONTRACT:
DRAWING:		REVISION:

Table 7.3
Comparison of Pre- and Post-Test Total Organic Halides in Soil Samples

Initial Well Location	Soil Sample Depth	Concentration in mg/kg	Post-Comparison Soil Boring No.	Depth of Sample	Concentration mg/kg
MW-1S	4-6	<77			
MW-2S	11-13	<66	S8MW2S	12-14	50
MW-3S	9-11	<65	S8MW3S	9-10	88
MW-4S	17-19	<79			
MW-5S	9-11	<71			
MW-1H	19-21	<74	S8MW1H	11-12	18
MW-2H	9-11	<68			
MW-3H	9-11	<72	S8MW3H	4-6	21
MW-4H	19-21	<74	S8RW3A	4-6	18
MW-5H	19-21	<85	S8RW3B	9-10	20
			S8-Y	12-14	17
			S8-X	12-14	15
			DISCOMP	n/a	18

n/a = not available (disposal composition sample)
Blank cells in Table 7.3 represent that data is not available, therefore the horizontal row comparability is not possible.

8.0 RECOMMENDATIONS

8.1 Introduction

The cost of remediation for NSC Yorktown will be heavily influenced by the size of the area to be treated and the remediation process technology application. The use of steam to heat the subsurface can be utilized to enhance the flow characteristics of the NSFO, thereby allowing for a program of enhanced separate phase recovery. Heat-enhanced recovery of NSFO will help reduce the SPH at the Yorktown site; however, it will not, by itself, fully remediate the entire site.

The 1993 pilot test was not performed to demonstrate complete remediation. It did demonstrate that steam injection assisted product recovery will provide a means of removing the bulk of the NFSO contaminant from the subsurface. However, review of alternate technologies for NSFO recovery in specific areas of the site or under specific conditions, should not be ruled out as a result of this investigation.

The following subsections discuss recommendations developed from the pilot test. These subsections discuss information needs, technology application, full-scale system development criteria and cost information.

8.2 Vertical and Horizontal Plume Definition

The application of steam injection to the subsurface contamination at the Yorktown site is based on the assessment work and plume definitions provided with the O'Brien and Gere, Inc., Corrective Action Plan (CAP). The limits of the SPH plume are outlined in the CAP. For this report, the volume of impacted soil was determined using the SPH thicknesses presented in the CAP. Approximately 135,000 cubic yards (yd^3) of soil are saturated with SPH, based on the data provided in the CAP. It was assumed that 20% of the soil porosity is filled with NSFO and that soil porosite is 30% of the soil volume. Based on these data there is approximately 1,600,000 gallons of NSFO in the soil at the site.

The quantity and distribution of data from the CAP used in the calculations are insufficient for an accurate estimate of the volume of impacted soil. For example, the distances between some of the monitoring wells on the west side of the site are up to 500 feet and information is lacking on the vertical dimension (depth) of the plume across the site. In particular, depth information is needed with respect to the soils saturated with NSFO below the water table. Before the application of steam enhanced recovery to the entire site, it is recommended that all dimensions of the plume be better defined. Additional information on the extent of the plume is necessary before a cost-effective full-scale recovery system design can be implemented.

The use of vertical induction profiling, using long wavelength electro-magnetic fields to measure resistivity in the soil to indicate the location of product in the subsurface, is recommended. Vertical induction profiling requires the temporary installation of transmitters and receivers in wells or structures at a number of locations across the site. The method may permit the use of existing wells and tanks for installation of transmitters and receivers.

The subcontractor performing the vertical induction profiling of the area would provide geophysical interpretive services with respect to the vertical induction profiling, thereby clarifying the horizontal and vertical extent of the NSFO plume. The resulting information, when applied to the steam injection system layout design, boiler system selection and pumping system design, would help to minimize capital and operating costs.

8.3 Technology Selection

The process of technology selection within the limitations of this report only encompasses those technologies utilized during the pilot study. The technologies included a standard dual-pump recovery system, with heat enhancement by the use of hot water injection, and recovery by a dual-pump recovery system with heat enhancement by the use of steam injection.

8.3.1 Soil Heating Technology

Based on the pilot-testing of these technologies, steam enhanced SPH recovery is recommended. Reasons for rejection of the other technologies tested are presented:

Un-enhanced SPH recovery was rejected due to the negligible recovery of the highly viscous NSFO at ambient ground temperatures (about 59°F).

Hot water enhanced SPH recovery, while more promising than un-enhanced recovery, was also eliminated as a viable option. Using hot water injection to heat the subsurface to 140°-150°F was predicted to take about 2.5 times longer than it would to provide a similar level of recovery of NSFO at 212°F. While the steam injection pilot system did not heat the soil to 212°F, the concerns with water/NSFO inversion and recovery of the injected hot water make hot water injection not viable.

As the subsurface temperature is increased from 59°F to 212°F with steam injection, the residual saturation concentration for NSFO was predicted to decrease from about 3.13% to about 0.74%. This is shown in Figure 8-1. Remaining traces of free product, with a higher constituent percentage of lower volatility NSFO components, become reabsorbed and essentially immobilized during cooling of the formation.

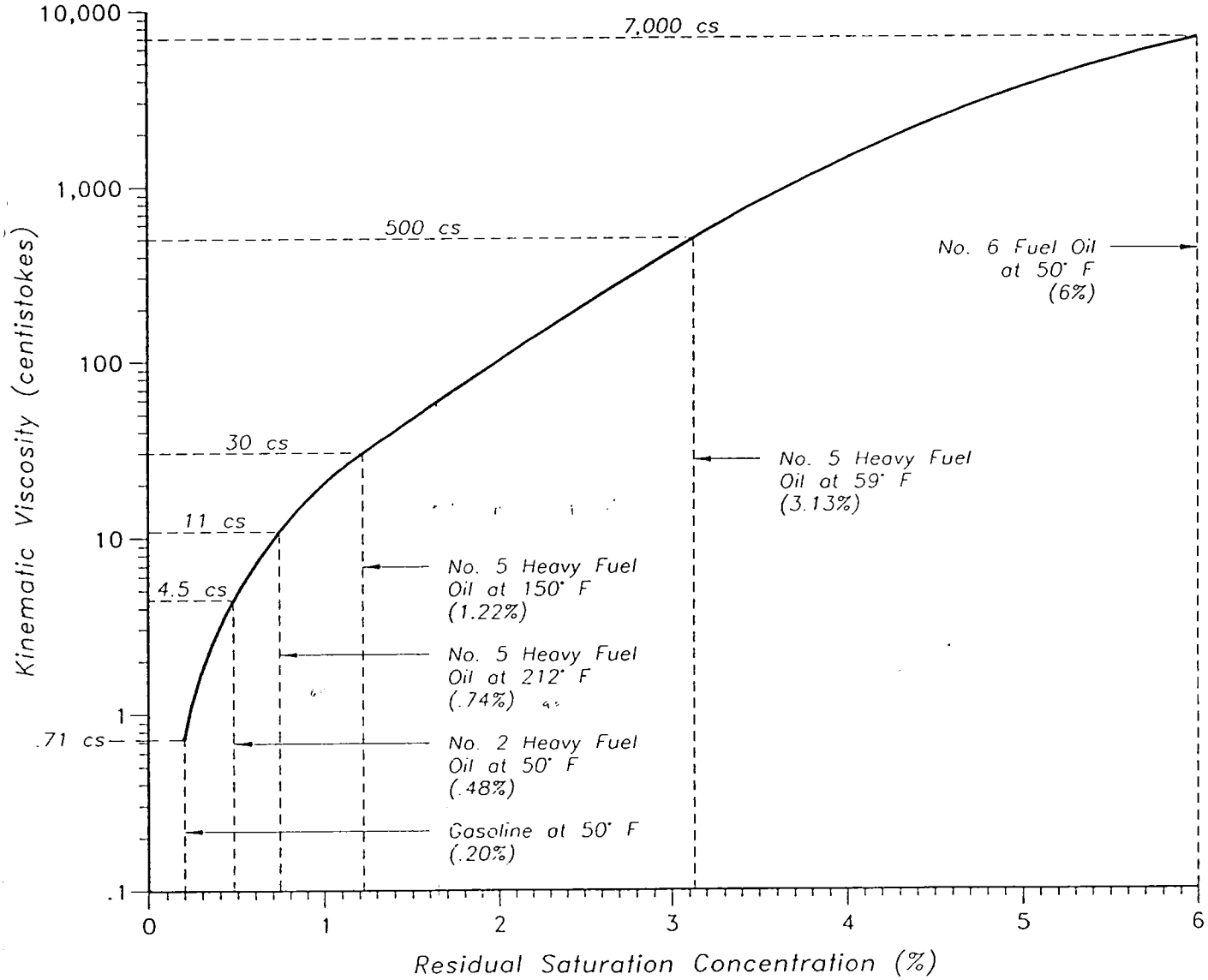
The steam injection pilot-test system did not heat the soil and the test area to 212°F for an extended period of time as intended. However, significant portions of the soil in the test area were heated to over 200°F for several days at a time. Also, the average temperature of the soil in the area was raised to over 130°F for at least eight days during the test. At 130°F, the residual saturation concentration for NSFO would be about 1.7%. From the pilot test operations, it may be concluded that steam injection will raise the soil temperature to at least 130°F and potentially reduce the residual concentration to about 1.7%. Temperatures of 200°F are very likely to occur over much of the site during full-scale remediation considering the number of cells that would be involved and limited number of cells at the unheated perimeter (no adjacent heated cell).

Steam injection wells were conservatively placed on approximately 30-foot centers for the pilot test although heat balance calculations implied that a 40-foot spacing would be adequate. This was done, in part, to compensate for heat loss to the soil surrounding the heated area. During the test, 212°steam reached the recovery well verifying that the spacing was conservative. With multiple cells and fewer unheated cell sides, the steam injection well spacing for the full-scale system can be set at 40-feet or less.

8.3.2 Pumping Technology Selection

As depicted in *Appendices G and H,* temperature gradient maps for the steam system and the hot water system exhibit preferential flow directions for heating at the Yorktown site. Additionally, groundwater which has become heated and which escapes beyond the capture radius of the pumping wells must be assumed to preferentially heat in the down-gradient direction. The limits of this down-gradient heat potential are beyond the scope of this pilot test, but this should be a consideration for

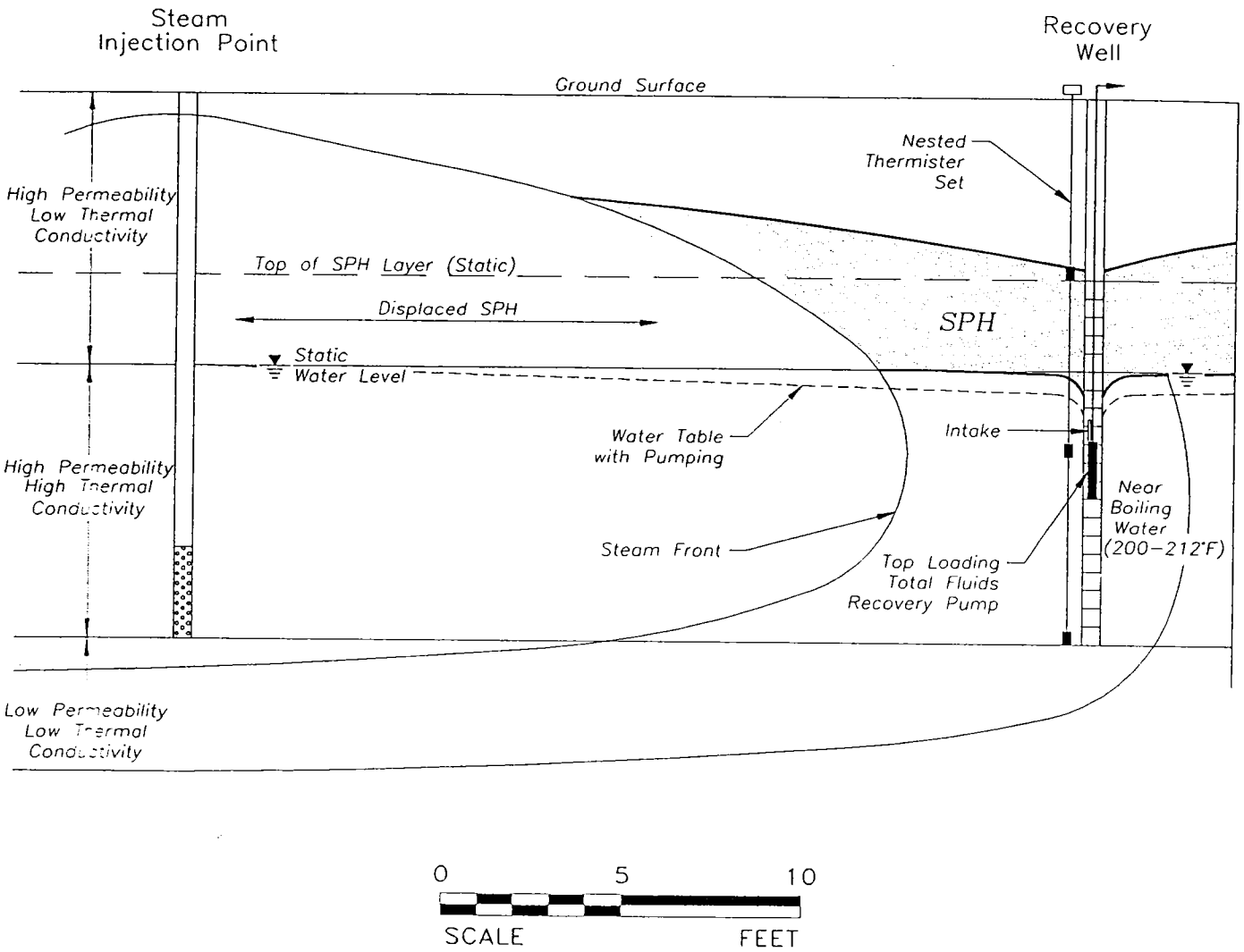
the full-scale system. This would best be accomplished by monitoring temperature variations in different directions once the system is in operation. Then, adjustments in the amount of heat injected could be made to achieve balanced heating. Figure 8-2 depicts the conditions expected in the subsurface due to steam injection.



RESIDUAL SATURATION CONCENTRATION
VS.
KINEMATIC VISCOSITY

FIGURE 8-1

GROUNDWATER TECHNOLOGY



SCHEMATIC OF STEAM INJECTION SYSTEM AND SPACIAL RELATIONSHIP WITH TOTAL FLUIDS RECOVERY WELL

FIGURE 8-2

GROUNDWATER TECHNOLOGY

Balancing of soil heating will have to be coordinated with the balancing of hydraulic control. Movement of the steam front is expected to be influenced less by subsurface heterogeneities than the movement of groundwater. Gradient direction, and its manipulation by pumping will, potentially, greatly influence the heat balance.

The product recovery system in the steam test area was shown to recover about six gallons per day over the test period. It recovered as much as twenty-nine gallons over a one-day period. During the system operation, however, the product recovery pump extracted water mixed with the product. The water table depression pump (WTDP) was noted pumping SPH when the controls failed to detect the interface between water and SPH. The WTDP was not stopped due to fouling of the control probe by the thick NSFO or due to the small difference in specific gravity between the SPH and groundwater not being detected by the float switch in the probe. A combination of these causes may have occurred, resulting in unpredictable and inconsistent product recovery.

Pumping total fluids, water and SPH, to maintain a set drawdown level, would alleviate the pump control concerns. It is therefore recommended that a total fluids pumping system be installed in the full-scale recovery system for the site. The following preliminary site layouts and cost estimate are based on total fluids pumping with steam heat-enhancement.

It is possible that, if areas of significant thickness of SPH are clearly located and improved controls can be obtained, SPH recovery remediation technologies should be re-evaluated. The decisions on specific areas of SPH and acceptable controls leading to reconsideration of SPH recovery would have to made during preliminary design of the site-wide recovery system and after the plume definition.

Total fluid pumps would pump between two and three gpm. This is equivalent to 2880 to 4320 gallons of fluid per day per well. Assuming that one-percent of the fluid recovered is SPH, at least 28 gallons per day of SPH would be recovered per well. This is within the range of the product recovery rates seen during the pilot test. The recovery rates would vary, with time and the location of the recovery well on the site. For the purpose of recommendations in this report, a 20 gallon-per-day per well product recovery rate is used.

8.4 Selected Technology Application

With the selection of steam injection and total fluids pumping for the recovery of NSFO at the Yorktown site, the characteristics for a full-scale application can be addressed in the following manner:

8.4.1 Steam Injection

Due to the extent of the area to be treated with steam injection, a discussion of the entire site is best handled if the site is subdivided into smaller components. Quarters are used in this discussion. Each quarter is approximately the same size and includes approximately the same number of steam injection wells. This may be adjusted in the preliminary design, depending on plume definition.

Based on the heat balance calculation in Section 3.0 and the observed conditions during the pilot test, the steam injection wells can be placed on 40-foot centers in a grid pattern superimposed over the plume area. This area will also be covered by the recovery well capture limits.

The size of the site is approximately 577,500 sq ft (13 acres), including the surface area of the tanks. From that and the grid pattern, the total number of steam injection points will be approximately 280. To efficiently apply steam to all of the steam injection points, the number of boilers would be minimized by:

(1) Sizing large boilers to run many steam injection points at once.

To encompass the entire site with a steam injection rate of 150 lb/hr per injection well, for a total of 280 injection wells, approximately 1000 steam horsepower will be needed.

This would be best addressed by using four 280 Horse Power (HP) boiler units. If the boilers are larger than 290 HP, an EPA permit will be required. The use of four smaller units allows for flexibility in moving the units and, if one boiler goes down, the whole system does not necessarily go down. The 280 HP boilers should incorporate rotary burners to allow for burning of recovered fuel oil to help offset fuel cost.

Each boiler should have the capability to run approximately 70 steam injection points, or one quarter of the system.

(2) Arranging the manifolding of the steam injection points and the distribution system so that the number of boilers can be minimized and their use can be maximized.

Cross-manifolding between steam injection quarters would allow for flexibility in the use of the boilers during maintenance periods or down-time. This would also allow for pulsed heating over a large area by a single boiler.

Figure 8-3 illustrates the grid pattern locating the 280 injection points on the site. Figure 8-4 illustrates the quartering of the site and the layout of the steam injection system.

As noted in Section 7.6, the increased injection point spacing may increase the possibility of steam breakthrough to the surface prior to thorough heating of the area between the injection and extraction points. The potential for breakthrough may be reduced by utilizing soil vapor extraction (SVE) to direct vadose zone steam towards recovery wells, or by the injection of steam at a slightly deeper interval (25 to 30 feet).

There are two benefits to soil vapor extraction from recovery wells. First is the greater control over the movement of steam in the vadose zone. Second is the more effective removal of any volatile compounds present in the soil gas.

The drawbacks of using SVE are as follows:

- An increase in the complexity of the systems;
- The costs of the vapor recovery, associated condensate removal equipment, emission control (if required),
- Increased maintenance and monitoring,
- The need to perform additional SVE pilot studies to derive the data on which to base the SVE design.

Benefits of lowering the screened interval of steam injection points include the ability to effectively heat product at greater depths (i.e. 20 to 25 feet); thorough heating and greater radius of steam influence prior to surface breakthrough; and minimal additional installation costs. The main drawback is the expected increase in the initial fuel costs to heat an additional five feet of soil in the saturated zone.

Neither SVE or a lower steam injection level is recommended at this time.

8.4.2 Groundwater/Total Fluids Extraction

Each recovery well (groundwater extraction well) will be treated as a system including a recovery well, a total fluids extraction pump and ancillatory surface-support equipment at the wellhead.

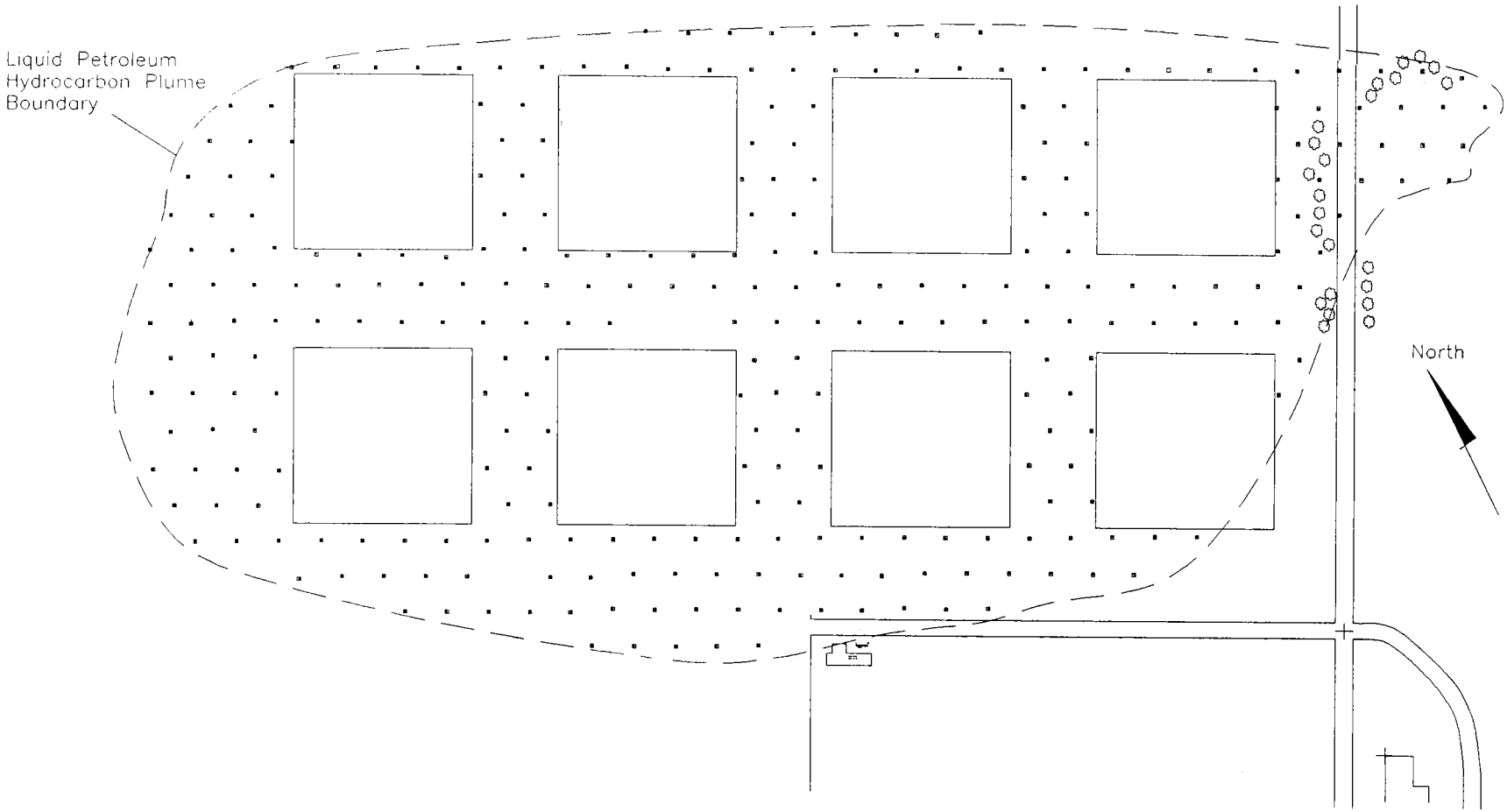
The number of recovery wells needed was determined by use of a simple hydrologic model analysis using Flowpath. The model assumed a steady state condition across the site (actually achieved after a period of time). It also assumed a constant discharge rate of three gpm per well. It did not account for porosity voids filled with NSFO, thus skewing porosity and permeability.

The area to be treated will be encompassed by a number of recovery wells as determined by the modeling. The flowpaths to the recovery wells depict the areal extent of the groundwater and hydrocarbons to be captured by the recovery wells. Modelling multiple well locations provides a means of designating the number of recovery wells required.

8.4.3 Recovery Well Location

Based on the hydrogeologic information for the site from both the O'Brien and Gere report and data collected during this pilot test, the equation for radius of influence or stagnation point from a groundwater extraction well can be utilized. In this instance...

NSC YORKTOWN
NSFO TANK AREA



Approximate Scaled Layout
for location of individual steam injection
points to encompass LPH plume as
designated by O'Brien & Gere CAP.

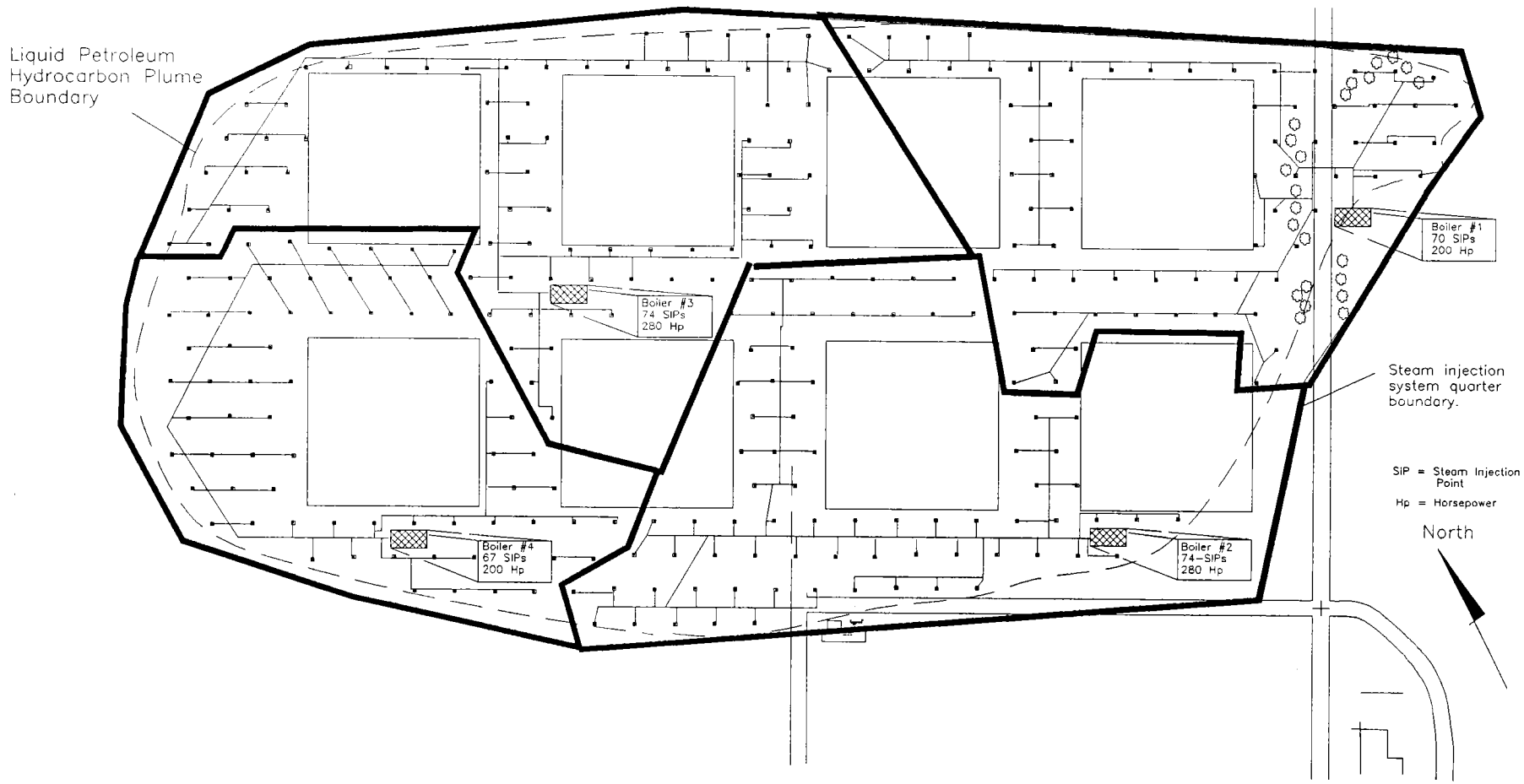
As shown here. 287 steam
injection points.

LAYOUT- STEAM INJECTION WELL LOCATIONS

FIGURE 8-3

Groundwater Technology

NSC YORKTOWN
NSFO TANK AREA



Approximate Scaled Layout for location of individual steam injection points to encompass LPH plume as designated by O'Brien & Gere CAP.

As shown here: 287 steam injection points.

STEAM INJECTION SYSTEM LAYOUT

FIGURE 8-4

Groundwater Technology

[1] $$R = \frac{Q}{2\pi h \phi v_n}$$ [1]

where:

R = Radius/stagnation point down gradient in feet
h = height of aquifer in feet (thickness)
Q = pumping rate in ft^3/day
ϕ = porosity (0.30)
v_n = velocity of groundwater in ft/day

$$v_n = \frac{KI}{\phi_e}$$

where:

K = Hydraulic conductivity in gpd/ft^2
I = gradient in ft/ft
ϕ_e = porosity

From these equations, the following matrix (Table 8.1) is constructed for the possible stagnation line or capture zone limits at the Yorktown site.

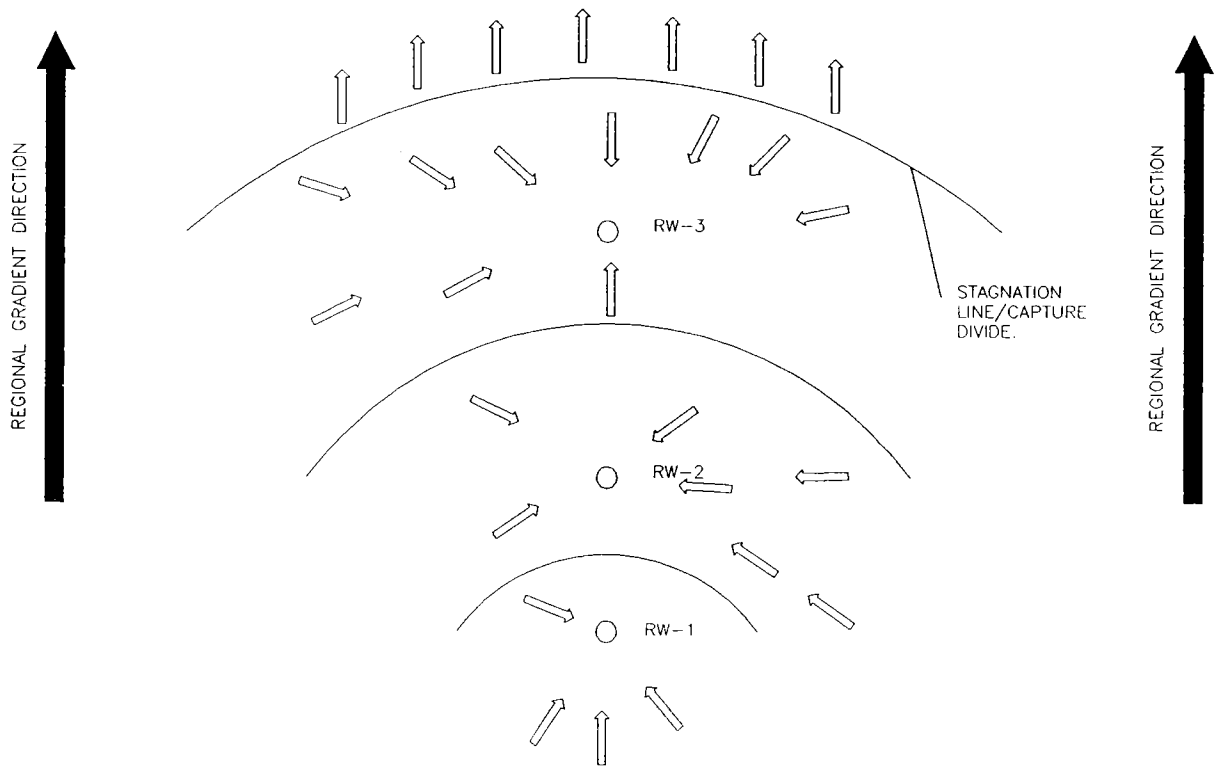
Table 8.1
Summary of Stagnation Point Calculations

Flow Rate GPM [Q]	Hydraulic Conductivity (K), gpd/ft^2	$V_{natural}$ = (V_n), ft/day	Arc Width at stagnation point cross gradient from recovery well, ft	Distance down gradient to stagnation point, ft
2	42	.57	187.5	29.87
2	110	1.47	72.79	11.59
4	42	.57	375.1	59.7
4	110	1.47	145.7	23.1

Based on this information the radius of influence will range from 11.5 ft to 59.7 ft and average 35.6 ft in the down-gradient direction. This would allow for 70-foot on-center construction of the groundwater extraction wells. However, taking into account the width of capture zones, the capture zone will vary from 72 ft to 375 ft perpendicular to gradient direction, and average 223 ft wide. This equates to a radius perpendicular-to-gradient of 111.5 ft. Averaging the perpendicular and the parallel radii yields an overall radius of influence of approximately 90 ft . This would allow for a 180-ft on-center spacing for construction of the recovery wells.

If recovery wells are configured in a line parallel with the overall gradient direction, the well placed furthest down-gradient will have a width of capture zone enhanced by the next up-gradient well. This is subject to well placement, pumping rate, and construction of the well. Figure 8-5 schematically represents this.

[1] Reference: (1983) Keely, Joseph, F., and Tsang, Chin Fu. "Velocity Plots and Capture Zones of Pumping Centers for Groundwater Investigations".



Groundwater Flow Direction Arrow (Groundwater Flow Towards Recovery Well, within Stagnation Line/Capture Divide)

STAGNATION/CAPTURE ZONE SCHEMATIC

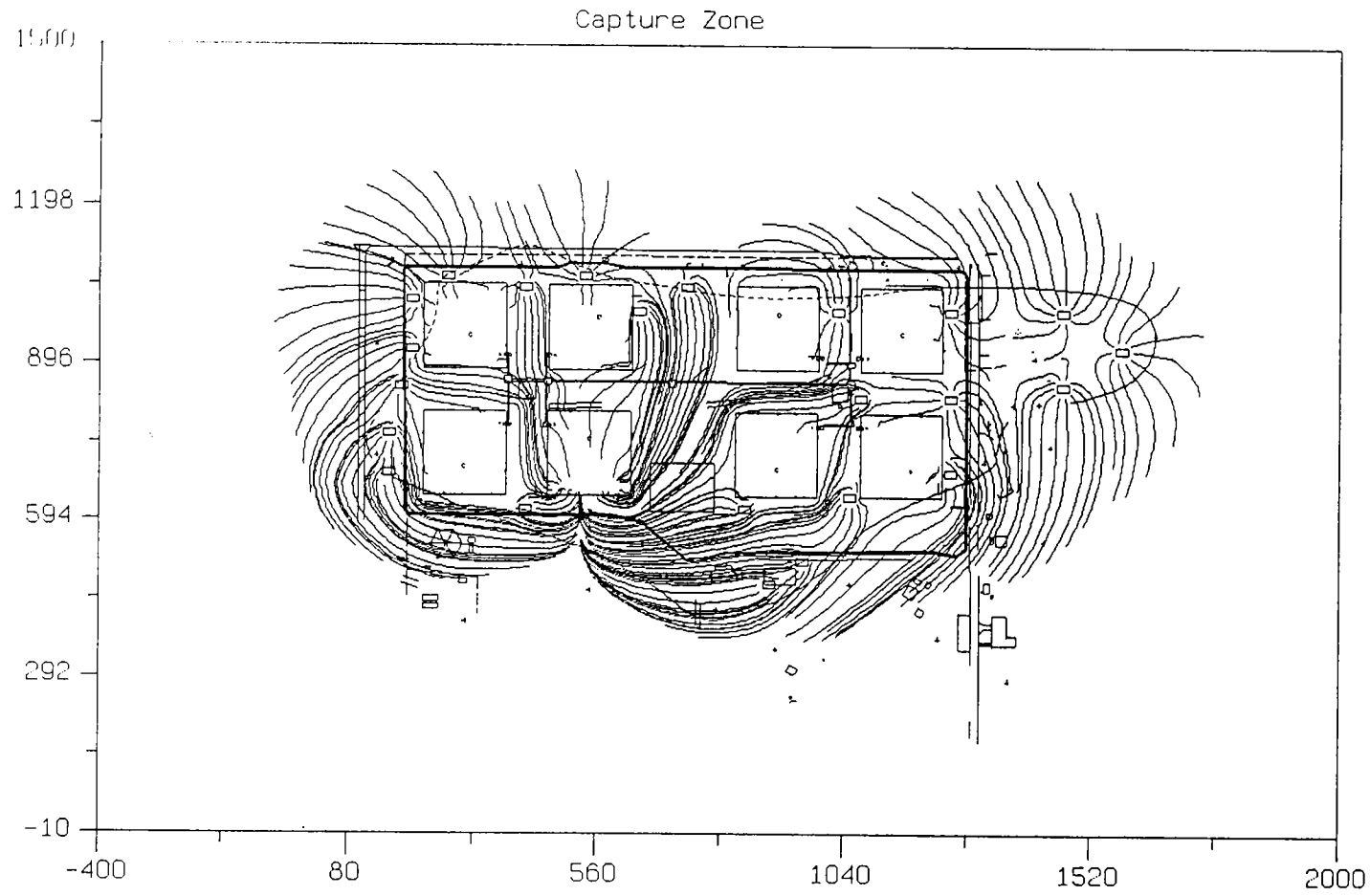
FIGURE 8-5

Groundwater Technology

As can be seen from Figure 8-5, the width of the stagnation line or capture divide becomes significantly wider further down-gradient from RW-1 towards RW-3 . This relationship is further depicted in the models constructed for the site using Flowpath. *Appendix I* contains the iterations of the model for the Yorktown site.

The models used herein are somewhat simplistic and are limited by the basic data used for calculation. Due to complexities of the site and the nature of the construction of the USTs, this model only represents a single layout scenario for defining basic SPH recovery.

As can be seen from the groundwater extraction model (Figure 8-6), the site will require approximately 23 recovery wells. The final configuration of the recovery wells can be further enhanced by removing the wells depicted on the east side (toe of the plume) and moving them to the central area of the plume or to the thicker areas of the plume. It is possible to further enhance capture and recovery with additional recovery wells. The model depicts a minimum of 23 recovery wells. A maximum number of 30 recovery wells is assumed. The most cost-effective placement of recovery wells should be determine after additional plume definition is complete and alternative well locations are modelled.



FLOWPATH

Copyright 1989-1992 by WHS

Steady State Flow

Time : 3.65E+02

Retard : 1.00E+00

Units : [ft]

File : AABPYRK

RECOVERY WELL LOCATIONS

FIGURE 8-6

8.4.4 Groundwater Treatment

Groundwater and extracted/total fluids will flow to common treatment/separation areas to limit the duplication of treatment equipment. Each groundwater separation/treatment unit will consist of the following:

- One oil/water separator
- One air stripper
- One granular activated carbon unit
- One transfer pump
- Ancillatory piping, valving, gauges, sample ports
- One SPH recovery tank

The groundwater treatment units are assumed to have the capability to handle a maximum flow rate of 18 gpm. The maximum flow rate (18 gpm) per groundwater treatment unit was determined by the sizing of an air stripper. Standard air strippers are readily available which can handle up to 20 gpm. The 18 gpm limit allows for a two gpm (10%) design factor. As each groundwater extraction/total fluids pump was also assumed to discharge of three gpm, six recovery wells can be served per groundwater separation/treatment unit. Four or five treatment units would be needed to serve the 23 to 30 recovery wells.

In conjunction with the groundwater treatment unit, a total of six total fluid extraction systems can be supplied with compressed air by one compressor, if a pneumatic pumping system is applied. The compressor would be located adjacent to the groundwater separation/treatment unit to limit electrical distribution costs. With the anticipated number of recovery wells between 23 and 30, four or five compressors would be needed.

9.0 COST ESTIMATE INFORMATION

With the configuration of the steam injection system and recovery system as stated herein, the following represents an estimate of the cost associated with capital purchases, and the cost for yearly operation of the system. It is very likely that significant changes can be made during the engineering/design refinement phase (beyond the scope of this report) that can reduce some of the costs. Table 9-1 contains an itemized list of major items required to implement a steam-enhanced NSFO recovery system for the Yorktown site with estimates for their costs. Further definition of the NSFO plume, additional modelling of the recovery and more detailed design of the components may reduce the cost of the system.

Table 9.1
Estimated Capital Cost & First Year Operating Costs

NSC Yorktown
Steam Enhanced
NSFO Recovery System

Installed Item	Quantity	Unit	Unit Price	Cost	Notes
CAPITAL ITEMS					
Steam Fitters Labor					
Installation	4000	man/hr	$50	$200,000	
Recovery Wells 6.0" Dia.	30	ea	$12,000	$360,000	Includes: well screen, casing, sand pack, install.
Monitoring Wells with Thermistors	24	ea	$2,100	$50,400	
Pneumatic Pumps	30	ea	$2,000	$60,000	Includes individual well controller
Oil/Water Separators	5	ea	$6,500	$32,500	
Well Controllers	5	ea	$3,000	$15,000	
Compressors	5	ea	$4,000	$20,000	
Product Recovery Tanks	5	ea	$1,200	$6,000	
Air Strippers	5	ea	$8,000	$40,000	
GAC Units 1500 Pound	5	ea	$2,000	$10,000	
Steam Piping: 2"	12000	ln ft.	$2.00	$24,000	
Steam Piping Insulation:	12000	ln ft.	$1.00	$12,000	
Steam Injection Wells	280	ea	$2,000	$560,000	
Steam Injection Valves	280	ea	$35	$9,800	
Steam Pressure Gauges	280	ea	$15	$4,200	
Steam Piping Elbows 90's 2" (estimate #)	861	ea	$27	$23,247	
Steam Piping Elbows 45's 2" (estimate #)	500	ea	$33	$16,500	
Steam Piping 2" Cross's (estimate #)	90	ea	$92	$8,280	
Steam Piping 't's 2" (estimate #)	300	ea	$12	$3,600	
Backflow preventers 2"(estimate #)	24	ea	$1,000	$24,000	
Other Parts (Contingency)	1	ea	$10,000	$10,000	
Transfer Pumps (1HP) & controller	6	ea	$2,800	$16,800	
Water transfer piping (Linear ft.) 2"	2200	ln ft.	$4	$8,800	
Water transfer piping (Linear ft.) 4"	600	ln ft.	$8	$4,800	
Trenching (estimate#)	10500	ln ft.	$4	$42,000	
Gravel	1500	yd.	$15	$22,500	
Landscaping replacement	1	ea	$5,000	$5,000	
Safety Equipment	6	ea	$500	$3,000	
Solids Disposal	1	ea	$18,000	$18,000	
Soils Disposal	1	ea	$46,800	$46,800	
Laboratory Initial	1	ea	$40,000	$40,000	
Laboratory Post Installation	1	ea	$30,000	$30,000	
TOTAL CAPITAL COSTS				$1,727,227	
ANNUAL COST					
Boilers (rental) for 1 year.	12	ea/mo	$24,000	$288,000	
Miscellaneous:	1	ea	$5,000	$5,000	
Fuel	12	ea/mo	$65,000	$780,000	per year (estimate)**
Electricity	12	ea/mo	$8,500	$102,000	
Laboratory yearly ops	12	ea/mo	$3,200	$38,400	
Operations & Maintenance					
Labor	12	ea/mo.	$21,000	$252,000	
Materials	12	ea	$3,000	$36,000	
FIRST YEAR OPERATION COST				$1,501,400	

** Fuel estimate is based on a consumption rate of approximately 2000 gallons per day of diesel No. 2. This quantity will vary with actual boiler fuel consumption rates, actual overall heat capacity of the soil, water and oil and use of recovered NSFO as an auxiliary/co-fuel source. As the soil is heated, it is anticipated the fuel consumption rate will decrease significantly over time.

The estimated annual cost, presented in Table 9.2, can be significantly affected by annual fuel cost. Fuel cost is the single most costly item over a 7-year period. Future price changes or fuel shortages can have a significant effect. Pulsed heating and efficient design of the system will reduce costs related to the fuel use.

Table 9.2
Estimated Annual Cost
NSC Yorktown
Steam-Enhanced NSFO Recovery System

Item	No.	Units	Cost/Unit	Total Cost	Notes:
Operations and Maintenance					
Boilers (rental) for 1 year.	12	ea/mo	$24,000	$288,000.00	
Miscellaneous:	1	ea	$5,000	$5,000.00	
Fuel	12	ea/mo	$65,000	$780,000.00	per year (estimate)**
Electricity	12	ea/mo	$8,500	$102,000.00	
Laboratory yearly ops	12	ea/mo	$3,200	$38,400.00	
Operations & Maintenance					
Labor	12	ea/mo.	$21,000	$252,000	
Materials	12	ea	$3,000	$36,000	
TOTAL ESTIMATED ANNUAL COST				$1,501,400	

To determine an operating cost for the life of the SPH recovery program, it is assumed that the system would, as described, recover 80% of the 1.6 million gallons of SPH assumed to be in the subsurface. The total volume of SPH to be recovered would be approximately 1.28 million gallons. Eighty percent recovery was used as a conservative recovery total. This was used in place of 98% recovery which could be used, based on the 1.7% residual demonstrated in section 8.3.1 It was used to provide a more conservative approach to the recovery potential. If the system recovers 500 gallons of product per day (20 gallons per recovery well per day, if 25 wells are installed), the 1.28 million gallons of SPH would be recovered in approximately 2560 days or 7.1 years. Table 9-3 presents an estimated annual cost and cumulative cost schedule for seven years of operation.

Table 9.3
Estimated Cumulative Cost
For Remediation
NSC Yorktown
Steam Enhanced NSFO Recovery System

Year Number	Annual Cost	Cumulative Cost
1	$3,228,627	$3,228,627
2	$1,501,400	$4,730,027
3	$1,501,400	$6,231,427
4	$1,501,400	$7,732,827
5	$1,501,400	$9,234,227
6	$1,501,400	$10,735,627
7	$1,501,400	$12,237,027

Without more definitive information on the mass of liquid petroleum hydrocarbons to be recovered from the Yorktown site and the actual recovery rate for an entire system, a more accurate estimate cannot be made of the cost of operations over the remediation period.

APPENDIX A

DRILLING LOGS, SOIL BORING LOGS

UNIFIED SOIL CLASSIFICATION SYSTEM

CLASSIFICATION CHART

MAJOR DIVISIONS		SYMBOLS	TYPICAL NAMES	GTGS FILL PATTERN
COARSE GRAINED SOILS OVER 50%>No.200 SIEVE SIZE	GRAVELS MORE THAN 1/2 OF COARSE FRACTION> NO.4 SIEVE SIZE	GW	Well graded gravels or gravel-sand mixtures, little or no fines	26
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines	25
		GM	Silty gravels, gravel-sand mixtures	26=11
		GC	Clayey gravels, gravel-sand-clay mixtures	26=14
	SANDS MORE THAN 1/2 OF COARSE FRACTION< NO.4 SIEVE SIZE	SW	Well graded sands or gravelly sands, little or no fines	8
		SP	Poorly graded sands or gravelly sands, little or no fines	6
		SM	Silty sands, sand-silt mixtures	9
		SC	Clayey sands, sand-clay mixtures	10
FINE GRAINED SOILS OVER 50%<No.200 SIEVE SIZE	SILTS & CLAYS LL<50	ML	Inorganic siltys and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	11
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	14
		OL	Organic silts andorganic silty clays of low plasticity	18
	SILTS & CLAYS LL>50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	12
		CH	Inorganic clays of high plasticity, fat clays	15
		OH	Organic clays of medium to high plasticity, organic silty clays, organic silts	35
HIGHLY ORGANIC SOILS		Pt	Peat and other hightly organic soils	20

GRAIN SIZE CHART

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL COARSE FINE	3" to No.4 3" to 3/4" 3/4" to No.4	76.2 to 4.75 76.2 to 19.1 10.1 to 4.75
SAND COARSE MEDIUM FINE	No.4 to No.200 No.4 to No.10 No.10 to No.40 No.40 to No.200	4.75 to 0.074 4.76 to 2.00 2.00 to 0.420 0.420 to 0.074
SILT & CLAY	Below No.200	Below No.0.074

WELL CONSTRUCTION MATERIALS

- Asphalt (68)
- Concrete (55)
- Neat Cement (54)
- Base Course (30)
- Sluff (64)
- Bentonite (21)
- Filter Pack (7)
- Pea Gravel (2)
- Liner (33)
- Geocloth (36)

SCREENS

- Solid (1s)
- Slotted PVC (3w)
- Slot. PVC High Flow (8w)
- Wire Wound PVC (16w)
- Wire Wound Steel (15w)
- Saw Cut (12w)

SAMPLE TYPES

SS - Split Spoon
CC - Continuous Core
CG - Cuttings Grab

SYMBOLS

Initial Water Level
Static Water Level

GROUNDWATER TECHNOLOGY

GROUNDWATER TECHNOLOGY

Drilling Log

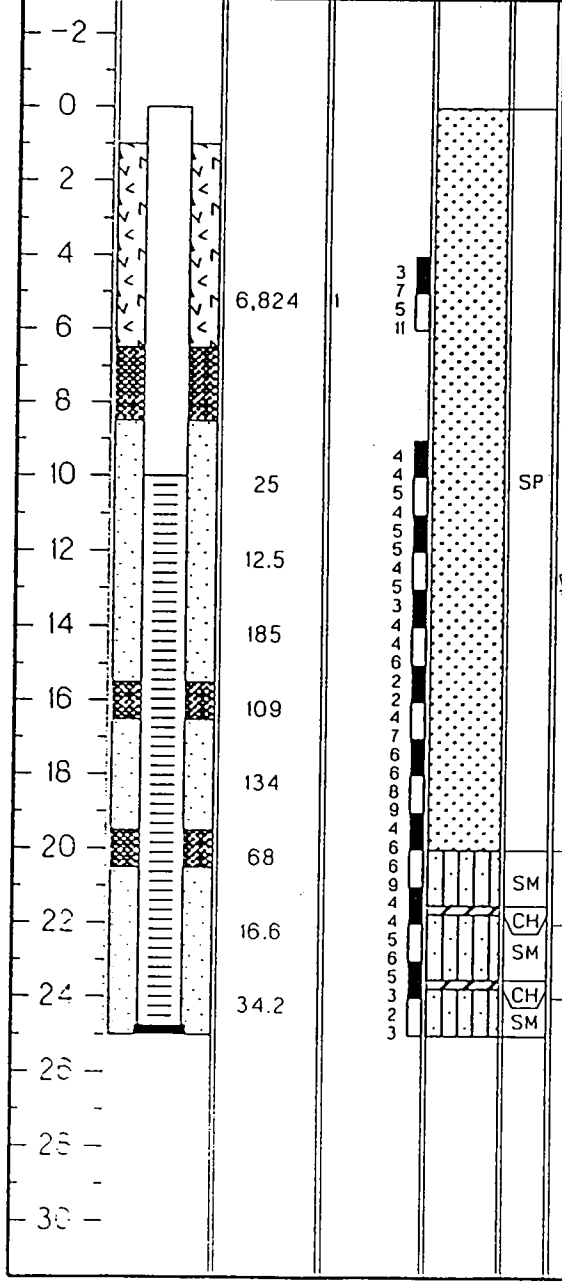
Monitoring Well MW-1S

Project NSC FUEL ANNEX Owner U.S. NAVY
Location YORKTOWN, VIRGINIA Project No. 830011098 Date drilled 7 APR 1993
Surface Elev. _____ Total Hole Depth 25 ft. Diameter 12 in.
Top of Casing _____ Water Level Initial 13.0 ft. Static _____
Screen: Dia 2 in. Length 15 ft. Type/Size 0.020 in.
Casing: Dia 2 in. Length 10.0 ft. Type LOW CARBON STEEL
Filter Pack Material #2 SAND Rig/Core Type CME-75HD
Drilling Company FISHBURNE DRILLING Method HOLLOW STEM AUGER Permit # _____
Driller G. WILHELM Log By R. PACIORKA
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector
I=laboratory sample.



Description

(Color, Texture, Structure)

Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%

Light brown, yellowish-orange, poorly sorted SAND, loose, moist.

Light gray, yellowish-orange, fine to coarse SAND, loose, moist.

Light gray, fine to coarse SAND, loose, very moist.

Light gray, fine to coarse SAND, loose, saturated; Product staining at 14 feet. Saturated at 14 feet.

Light gray, fine to coarse SAND, very loose to loose, saturated; Product staining throughout sample

Light gray, fine to coarse SAND, loose, saturated, to 18.5 feet then, grayish-green, silty fine to medium SAND, loose, saturated, below. Product staining throughout sample.

Light gray, brown, fine to coarse SAND, loose, saturated, to 20 feet then, light brown, gray, CLAY, soft, saturated, below. Product saturates clay.

Greenish-gray, CLAY, soft, saturated, to 22 feet then, light gray green, fine to medium SAND, loose, saturated, fossiliferous below. Product throughout sample.

Light brown, gray, fine to coarse SAND, loose, saturated to 24.5 then three inches of greenish-gray, CLAY, soft; then greenish-gray fine to medium SAND, loose, saturated below. Lesser amount of product in sample.

Drilling Log

GROUNDWATER TECHNOLOGY

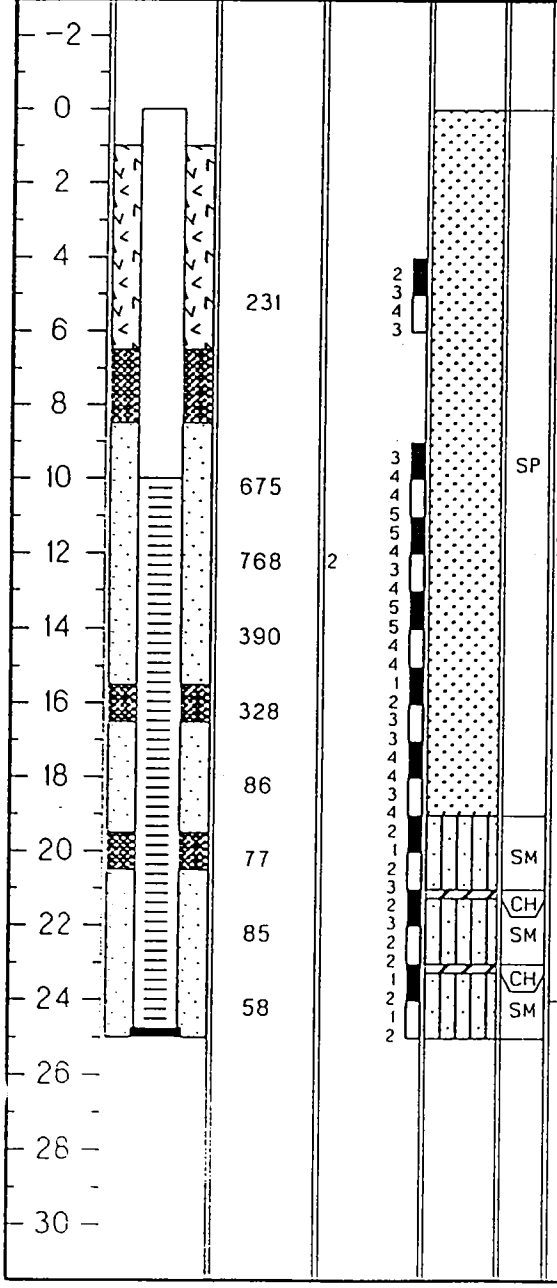
Monitoring Well **MW-2S**

Project NSC FUEL ANNEX Owner U.S. NAVY
Location YORKTOWN, VIRGINIA Project No. 830011098 Date drilled 7 APR 1993
Surface Elev. _____ Total Hole Depth 25 ft. Diameter 12 in.
Top of Casing _____ Water Level Initial 12.0 ft. Static _____
Screen: Dia 2 in. Length 15 ft. Type/Size 0.020 in.
Casing: Dia 2 in. Length 10.0 ft. Type LOW CARBON STEEL
Filter Pack Material #2 SAND Rig/Core Type CME-75HD
Drilling Company FISHBURNE DRILLING Method HOLLOW STEM AUGER Permit # _____
Driller G. WILHELM Log By R. PACIORKA
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector
2=laboratory sample.



Description

(Color, Texture, Structure)
Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%

Light brown, yellowish-orange, fine to coarse SAND, loose, very moist.

Light gray, fine to coarse SAND, loose, moist, HC odor

Light gray, fine to coarse SAND, loose, saturated at 12', HC odor

Light gray, fine to coarse SAND, loose, saturated, HC odor

Light gray to brown, fine to coarse SAND, loose, saturated

Light gray, fine to coarse SAND, finning downward to fine greenish SAND; LPH at 19'

Greenish-gray, brown, fine to medium SAND, very loose, saturated; 3" CLAY at 21'; LPH throughout

Greenish-gray, fine to medium SAND, fossiliferous, very loose, saturated,3" CLAY near 23 feet; LPH throughout Product throughout sample.

Light gray, fine to coarse SAND, very loose, saturated; LPH throughout

Drilling Log

GROUNDWATER TECHNOLOGY

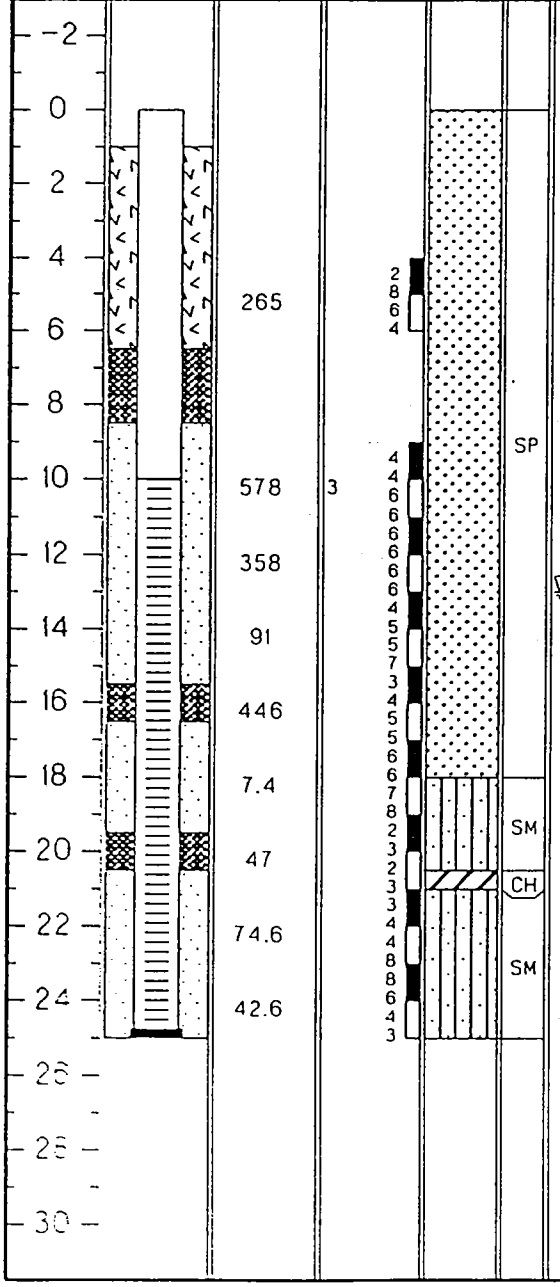
Monitoring Well **MW-3S**

Project NSC FUEL ANNEX Owner U.S. NAVY
Location YORKTOWN, VIRGINIA Project No. 830011098 Date drilled 7 APR 1993
Surface Elev. _____ Total Hole Depth 25 ft. Diameter 12 in.
Top of Casing _____ Water Level Initial 13.0 ft. Static _____
Screen: Dia 2 in. Length 15 ft. Type/Size 0.020 in.
Casing: Dia 2 in. Length 10.0 ft. Type LOW CARBON STEEL
Filter Pack Material #2 SAND Rig/Core Type CME-75HD
Drilling Company FISHBURNE DRILLING Method HOLLOW STEM AUGER Permit # _____
Driller G. WILHELM Log By R. PACIORKA
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector
3=laboratory sample.



Description

(Color, Texture, Structure)
Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%

Light gray, yellowish-orange, fine SAND, loose, very moist

Light gray to light brown, fine to medium SAND, loose, moist

Light gray to light brown, fine to coarse SAND, loose, moist to saturated at 12.5

Light gray to light brown, fine to coarse SAND, loose, saturated LPH staain at 15'

Same as above to 16.5', then greenish gray fine SAND, no LPH

Light brown to light gray, fine to coarse SAND, grading downward to fine to medium SAND at 18'; no LPH

Light gray, fine to coarse SAND to 20.5', then 6 " of greenish gray CLAY to 21'; LPH present

Gray-brown, fine to coarse SAND, grading to greenish gray fine SAND at 22.5', saturated, LPH throughout

Greenish-gray, fossiliferous, fine SAND, loose, saturated, LPH stops at 24.5'

Drilling Log

GROUNDWATER TECHNOLOGY

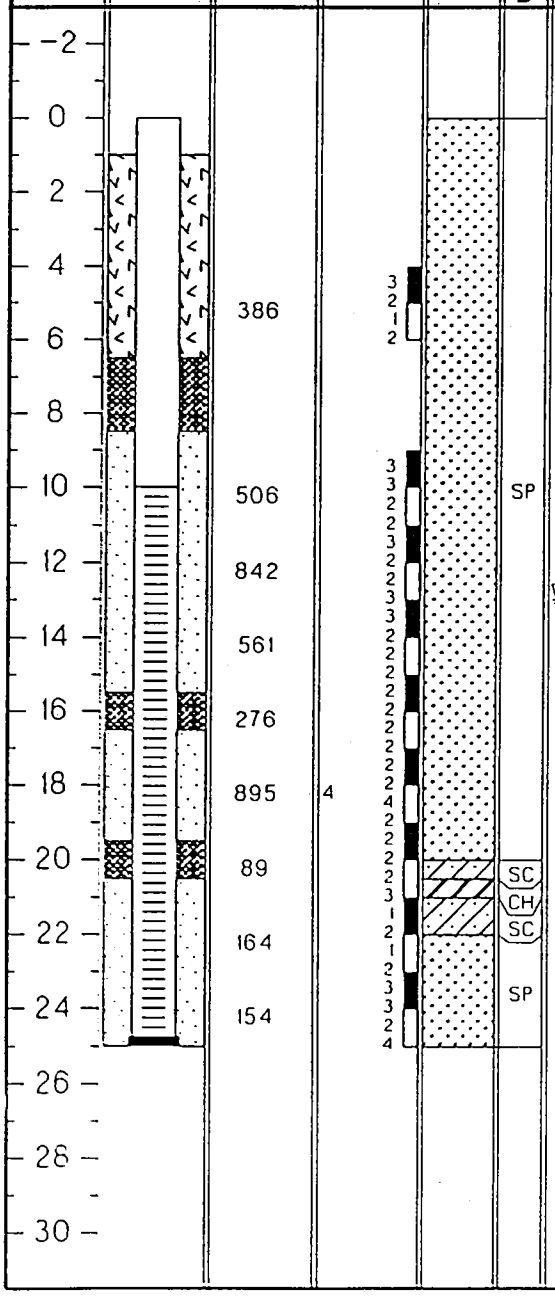
Monitoring Well **MW-4S**

Project *FISC FUEL ANNEX* Owner *U.S. NAVY*
Location *YORKTOWN, VIRGINIA* Project No. *830011098* Date drilled *14 APR 1993*
Surface Elev. _____ Total Hole Depth *25 ft.* Diameter *12 in.*
Top of Casing _____ Water Level Initial *13.0 ft.* Static _____
Screen: Dia *2 in.* Length *15 ft.* Type/Size *0.020 in.*
Casing: Dia *2 in.* Length *10.0 ft.* Type *LOW CARBON STEEL*
Filter Pack Material *#2 SAND* Rig/Core Type *CME-75HD*
Drilling Company *FISHBURNE DRILLING* Method *HOLLOW STEM AUGER* Permit # _____
Driller *G. WILHELM* Log By *R. PACIORKA*
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector
4=laboratory sample.



Depth (ft.)	PID (ppm)	Sample ID Blow Count/ % Recovery	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
4–6	386	3 2 1 2		Light gray, yellowish-orange, fine SAND, very loose, moist.
10	506	3 3 2 2	SP	Light gray, fine to medium SAND, very loose, moist.
12	842	3 2 2 3		Light gray, fine to coarse SAND, very loose, moist to saturated. Saturated at 12.5.
14	561	3 3 2 2		Light gray, fine to coarse SAND, very loose, saturated.
16	276	2 2 2 2		Light gray, fine to coarse SAND, very loose, saturated; fining downwards to a greenish-gray, fine SAND.
18	895	2 2 4 2	4	Greenish-gray, fine SAND, very loose, saturated; becoming brown at 19'
20	89	2 2 3	SC CH	Brownish-olive green, fine SAND, grading to a clayey fine SAND at 20 feet then to a olive green CLAY to 21 feet. LPH throughout.
22	164	1 2 1 2	SC	Olive green, clayey fine SAND to 22 feet grading to a light greenish- gray, fossiliferous, fine SAND to 23 feet. LPH throughout.
24	154	3 3 2 4	SP	Greenish-gray, fossiliferous, fine SAND, very loose, saturated. No LPH.

GROUNDWATER TECHNOLOGY

Drilling Log

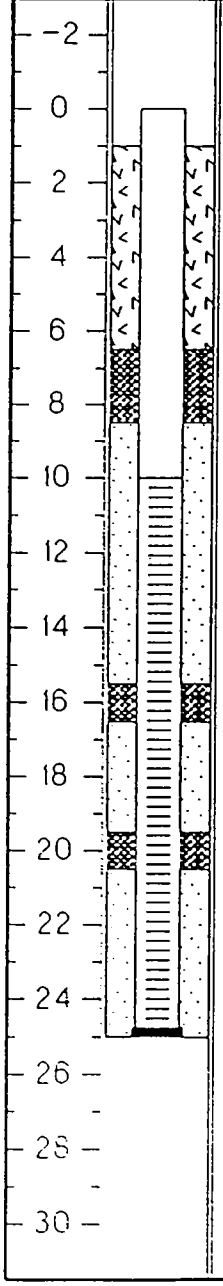
Monitoring Well MW-5S

Project FISC FUEL ANNEX Owner U.S. NAVY
Location YORKTOWN, VIRGINIA Project No. 830011098 Date drilled 14 APR 1993
Surface Elev. _____ Total Hole Depth 25 ft. Diameter 12 in.
Top of Casing _____ Water Level Initial 14.0 ft. Static _____
Screen: Dia 2 in. Length 15 ft. Type/Size 0.020 in.
Casing: Dia 2 in. Length 10.0 ft. Type LOW CARBON STEEL
Filter Pack Material #2 SAND Rig/Core Type CME-75HD
Drilling Company FISHBURNE DRILLING Method HOLLOW STEM AUGER Permit # _____
Driller G. WILHELM Log By R. PACIORKA
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector
5=laboratory sample.



Depth (ft.)	PID (ppm)	Sample ID	Blow Count/ % Recovery	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2					
0					
2					
4			3 4 4 7		
6	0				Yellowish-orange, fine to medium SAND, loose, moist.
8					
10	35.1	5	2 3 3 6 6		Light gray, fine SAND, very loose, moist.
12	7.9		7 6 5 4	SP	Light gray, fine SAND, loose, very moist.
14	0		4 3 4 3		▽ Light gray, fine SAND, loose, very moist to 14'; then gray, medium to coarse SAND, loose, saturated. Saturated at 14 foot.
16	0		3 5 4 6		Light gray, fine to coarse SAND, very loose to loose, saturated.
18	0		6 7 5 2		Greenish-gray, fine to coarse SAND, loose, saturated.
20	0		2 3 4 3		Green, fine SAND, very loose, to 20 feet; then brown fine SAND below. No LPH.
22	0		3 3 3 6		Brown, fine SAND, very loose, saturated. No LPH.
24	0		5 6 5		Green, fine SAND, loose, saturated. No LPH. No LPH.
26					
28					
30					

GROUNDWATER TECHNOLOGY

Drilling Log

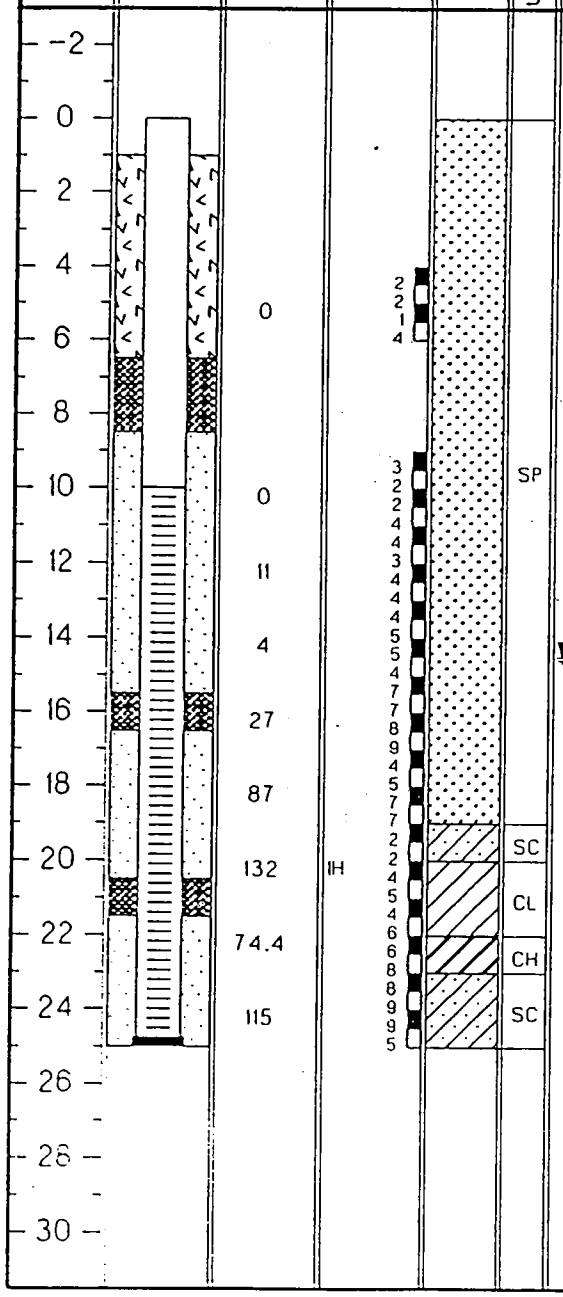
Monitoring Well MW-1H

Project FISC FUEL ANNEX Owner U.S. NAVY
Location YORKTOWN, VIRGINIA Project No. 830011098 Date drilled 13 APR 1993
Surface Elev. _____ Total Hole Depth 25 ft. Diameter 12 in.
Top of Casing _____ Water Level Initial 14.5 ft. Static 14.5 ft.
Screen: Dia 2 in. Length 15 ft. Type/Size 0.020 in.
Casing: Dia 2 in. Length 10.0 ft. Type LOW CARBON STEEL
Filter Pack Material #2 SAND Rig/Core Type CME-75HD
Drilling Company FISHBURNE DRILLING Method HOLLOW STEM AUGER Permit # _____
Driller G. WILHELM Log By R. PACIORKA
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector
IH=laboratory sample.



Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
Light brown, gray, fine to medium SAND, very loose, moist.
Light brown, greenish-gray, fine to medium SAND, very loose to loose, moist.
Greenish-gray, fine to medium SAND, loose, moist.
Light brown, gray, fine to coarse SAND, loose, moist to saturated. Saturated at 14.5 feet.
Green, light brown, fine to coarse SAND, loose, saturated.
Green, light brown, fine to coarse SAND, loose, saturated, grading to a green, fine SAND at 18 feet. LPH at 18 feet.
Green, clayey SAND, loose, to 20 feet; then green, sandy CLAY, soft, saturated below. LPH throughout sample.
Green, sandy CLAY, to 22 feet; then, green, CLAY to 23 feet. LPH throughout sample.
Green, clayey fine SAND, loose, saturated, fossiliferous. LPH present.

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well **MW-2H**

Project *FISC FUEL ANNEX* Owner *U.S. NAVY*
Location *YORKTOWN, VIRGINIA* Project No. *830011098* Date drilled *14 APR 1993*
Surface Elev. _____ Total Hole Depth *25 ft.* Diameter *12 in.*
Top of Casing _____ Water Level Initial *14.5 ft.* Static *14.5 ft.*
Screen: Dia *2 in.* Length *15 ft.* Type/Size *0.020 in.*
Casing: Dia *2 in.* Length *10.0 ft.* Type *LOW CARBON STEEL*
Filter Pack Material *#2 SAND* Rig/Core Type *CME-75HD*
Drilling Company *FISHBURNE DRILLING* Method *HOLLOW STEM AUGER* Permit # _____
Driller *G. WILHELM* Log By *R. PACIORKA*
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector
2H=laboratory sample.

Depth (ft.)	Well Completion	PID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2						
0						
2						
4			4 5 4 5			
6		6.8				Yellowish-orange, fine to medium SAND, loose, moist to 6 feet; then, gray, fine SAND, loose, moist.
8						
10		382	2H 3 4 5 5 5		SP	Light brown, light gray, fine to medium SAND, loose, moist.
12		137	4 6 7 7			Light gray, fine to coarse SAND, loose, moist.
14		98.9	6 7 7			Greenish-gray, fine to coarse SAND, loose, saturated. Saturated at 14.5 feet.
16		163	4 4 5 4 5			Greenish-gray, fine to coarse SAND, loose, saturated, becoming light brown, coarse SAND at 16.5 feet.
18		88.3	4 7 6 7			Light brown, coarse SAND, loose, saturated, fining downwards to a fine sand at 18 feet. LPH at 18.5.
20		93.7	8 12 15		SC CH	Green, fine to coarse SAND, loose, saturated grades tp a greem fine clayey SAND. Three inch CLAY layer at 20.5. LPH throughout sample.
22		114	5 8 7 9		SC CH	Olive green, fine clayey SAND, loose, saturated, grades to a olive green, CLAY at 21.5 feet. LPH throughout sample.
24		59	4 5 6 5		SC	Olive green, fine clayey SAND, loose, saturated. LPH throughout sample
26						
28						
30						

Drilling Log

GROUNDWATER TECHNOLOGY

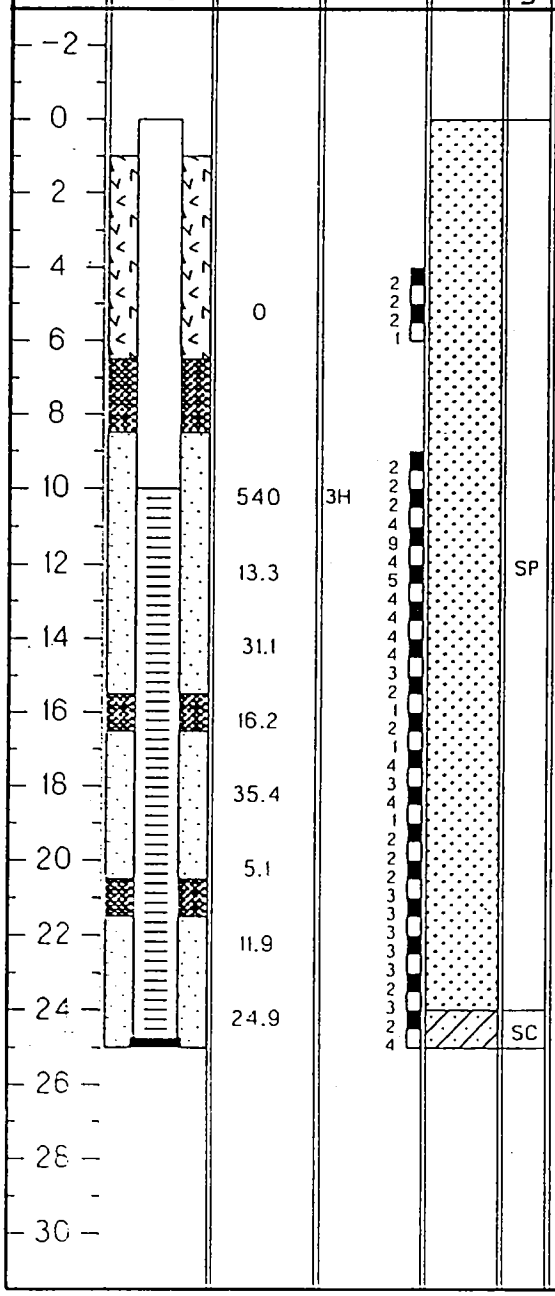
Monitoring Well **MW-3H**

Project *FISC FUEL ANNEX* Owner *U.S. NAVY*
Location *YORKTOWN, VIRGINIA* Project No. *830011098* Date drilled *14 APR 1993*
Surface Elev. _____ Total Hole Depth *25 ft.* Diameter *12 in.*
Top of Casing _____ Water Level Initial *14.5 ft.* Static *14.5 ft.*
Screen: Dia *2 in.* Length *15 ft.* Type/Size *0.020 in.*
Casing: Dia *2 in.* Length *10.0 ft.* Type *LOW CARBON STEEL*
Filter Pack Material *#2 SAND* Rig/Core Type *CME-75HD*
Drilling Company *FISHBURNE DRILLING* Method *HOLLOW STEM AUGER* Permit # _____
Driller *G. WILHELM* Log By *R. PACIORKA*
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector
3H=laboratory sample.



Depth (ft.)	PID (ppm)	Sample ID	Blow Count/ % Recovery	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
6	0		2 2 2 1		Yellowish-orange, fine to coarse SAND, loose, moist to 6 feet; then, gray, fine SAND, loose, moist.
10	540	3H	2 2 2 4 9		Light brown, fine to medium SAND, loose, moist, grades to a clayey SAND at 10 feet.
12	13.3		4 5 4 4	SP	Light brown, light gray, fine SAND, loose, moist.
14	31.1		4 4 3 2		Light gray, fine to coarse SAND, very loose, moist to saturated. Saturated at 14.5 feet. No LPH.
16	16.2		1 2 1 4		Light gray, fine to coarse SAND, very loose, saturated. No LPH.
18	35.4		3 4 1 2		Greenish-gray, fine to coarse SAND, very loose, saturated. No LPH.
20	5.1		2 2 3 3		Light brown, fine to coarse SAND, very loose, saturated. No LPH.
22	11.9		3 3 3 2		Light brown, light gray, fine to coarse SAND, very loose, saturated; grades to a brown, fine SAND at 23 feet.
24	24.9		3 2 4	SC	Brown, fine SAND, very loose, saturated, grades to a green, clayey fine SAND at 24 feet. Becoming increasingly clayey towards 25 feet. LPH stain at 24.75 feet.

Drilling Log

GROUNDWATER TECHNOLOGY

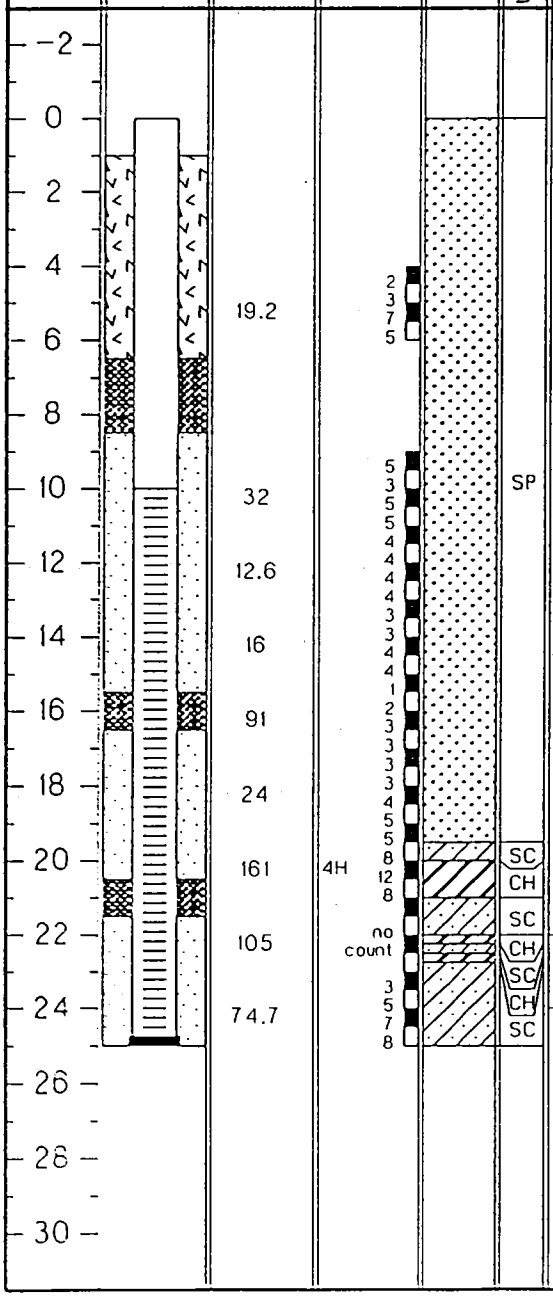
Monitoring Well **MW-4H**

Project *FISC FUEL ANNEX* Owner *U.S. NAVY*
Location *YORKTOWN, VIRGINIA* Project No. *830011098* Date drilled *14 APR 1993*
Surface Elev. _____ Total Hole Depth *25 ft.* Diameter *12 in.*
Top of Casing _____ Water Level Initial *14.5 ft.* Static *14.5 ft.*
Screen: Dia *2 in.* Length *15 ft.* Type/Size *0.020 in.*
Casing: Dia *2 in.* Length *10.0 ft.* Type *LOW CARBON STEEL*
Filter Pack Material *#2 SAND* Rig/Core Type *CME-75HD*
Drilling Company *FISHBURNE DRILLING* Method *HOLLOW STEM AUGER* Permit # _____
Driller *G. WILHELM* Log By *R. PACIORKA*
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector
4H=laboratory sample.



Description

(Color, Texture, Structure)
Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%

Yellowish-orange, greenish-gray, fine to coarse SAND, loose, moist.

Light brown, fine to medium SAND, loose, moist.

Light brown, light gray, fine to coarse SAND, loose, moist.

Greenish-gray, fine to coarse SAND, very loose, moist to saturated. Saturated at 14.5 feet. LPH at 15 feet.

Light brown, olive green, fine to coarse SAND, very loose, saturated.

Light brown, olive green, fine to coarse SAND, loose, saturated. LPH at 19 feet.

Green, fine to coarse SAND grading to a green fine clayey SAND at 19.5 feet. Green clayey SAND grades to a green CLAY at 20 feet. LPH throughout sample.

Olive green, fine clayey SAND to 22 feet; then, three inches green CLAY followed by green clayey SAND to 22.5 feet; three inches green CLAY again, followed by green clayey SAND to 23 feet. LPH throughout sample.

Olive green, fine clayey SAND, loose, saturated. LPH present.

GROUNDWATER TECHNOLOGY

Drilling Log

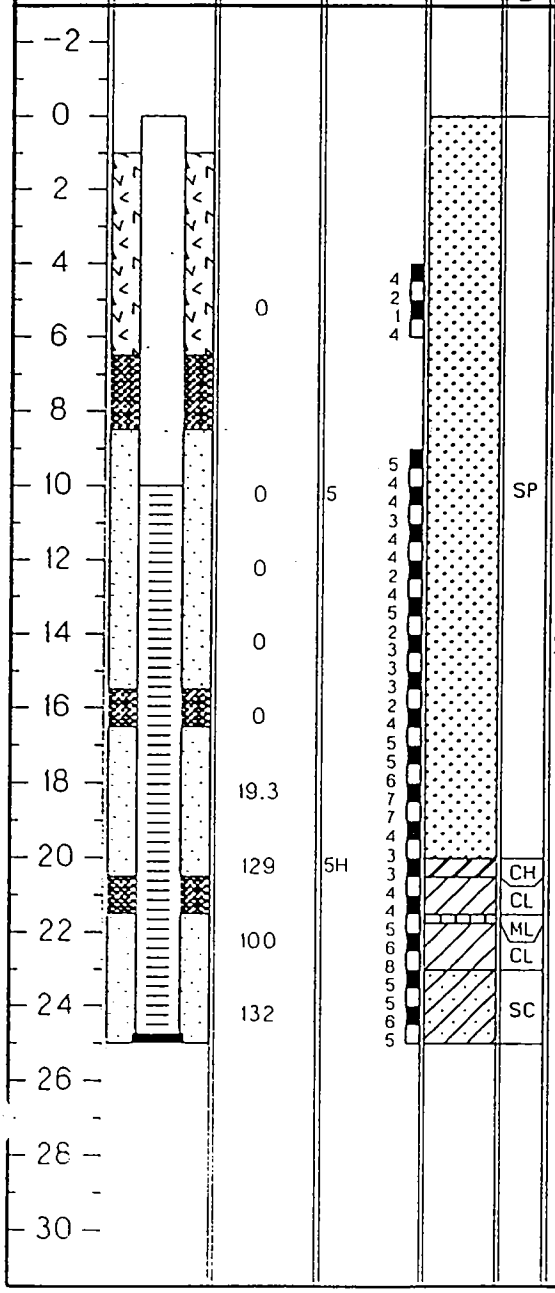
Monitoring Well MW-5H

Project FISC FUEL ANNEX Owner U.S. NAVY
Location YORKTOWN, VIRGINIA Project No. 830011098 Date drilled 13 APR 1993
Surface Elev. _____ Total Hole Depth 25 ft. Diameter 12 in.
Top of Casing _____ Water Level Initial 14.5 ft. Static 14.5 ft.
Screen: Dia 2 in. Length 15 ft. Type/Size 0.020 in.
Casing: Dia 2 in. Length 10.0 ft. Type LOW CARBON STEEL
Filter Pack Material #2 SAND Rig/Core Type CME-75HD
Drilling Company FISHBURNE DRILLING Method HOLLOW STEM AUGER Permit # _____
Driller G. WILHELM Log By R. PACIORKA
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector
5H=laboratory sample.



Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
Yellowish-orange, fine to medium SAND, loose, moist to 4.5 feet, then light gray, fine to coarse SAND below.
Light gray, fine to coarse SAND, loose, moist.
Greenish-gray, fine to coarse SAND, loose, very moist.
Greenish-gray, fine to coarse SAND, very loose, moist to saturated. Saturated at 14.5 feet.
Greenish-gray, fine to coarse SAND, very loose, saturated, then light brown, fine to coarse SAND, loose, saturated.
Olive green, brown, alternating layers of fine to coarse SAND, loose, saturated. LPH beads.
Green, fine SAND, loose, to 20 feet; then green, CLAY grading to sandy CLAY below. LPH throughout sample.
Green, sandy CLAY, to 21.5; then, three inches of gray, fine SAND; then, green, sandy CLAY, soft, below. LPH throughout sample.
Green, clayey fine SAND, loose, saturated, fossiliferous. LPH present.

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well **SI-1**

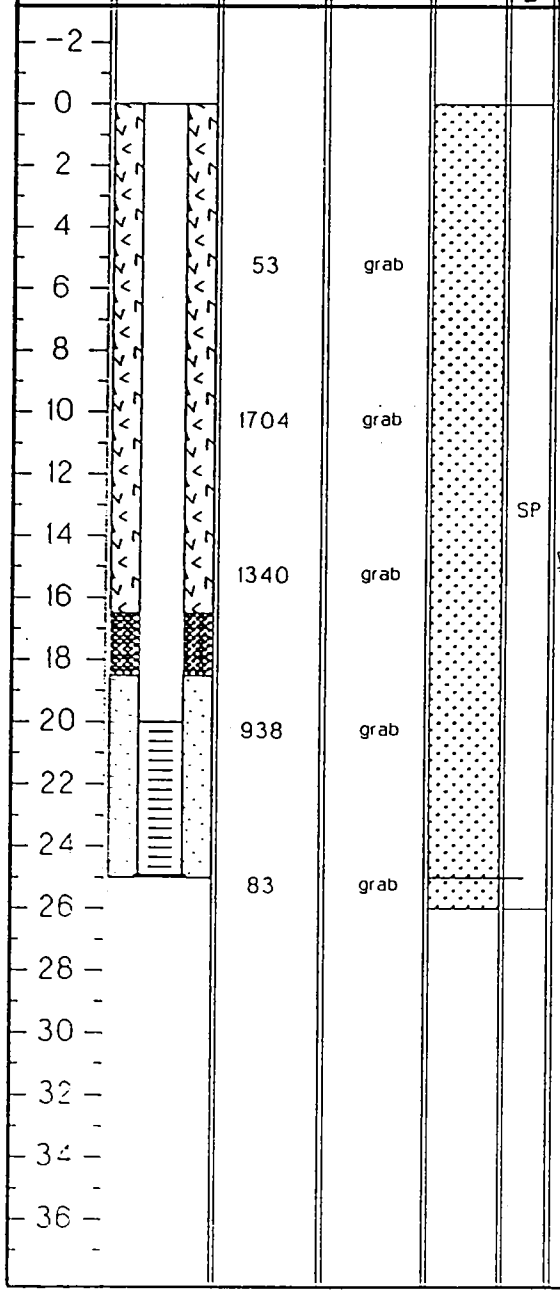
Project *NSC FUEL ANNEX* Owner *U.S. NAVY*
Location *YORKTOWN, VIRGINIA* Project No. *830011098* Date drilled *9 APR 1993*
Surface Elev. _____ Total Hole Depth *25 ft.* Diameter *12 in.*
Top of Casing _____ Water Level Initial *15.0 ft.* Static _____
Screen: Dia *4 in.* Length *5 ft.* Type/Size *0.040 in.*
Casing: Dia *6 in.* Length *20 ft.* Type *LOW CARBON STEEL*
Filter Pack Material *#3 SAND* Rig/Core Type *CME-75HD*
Drilling Company *FISHBURNE DRILLING* Method *HOLLOW STEM AUGER* Permit # _____
Driller *G. WILHELM* Log By *R. PACIORKA*
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector

Grab samples were collected in place of split-spoon samples



Depth (ft.)	PID (ppm)	Sample ID Blow Count/ % Recovery	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
6	53	grab		Yellowish-orange fine to medium SAND, loose, moist
8				Medium gray fine to medium SAND at 7'
10	1704	grab		Light gray fine to medium SAND, loose, very moist, heavy HC odor saturated at 13'
14			SP	
16	1340	grab		∇ Light gray to light brown, fine to coarse SAND, loose, saturated HC odor
20	938	grab		Greenish-gray fine to coarse SAND, loose, saturated, HC odor
26	83	grab		Olive-green, fine to coarse SAND, very loose, saturated, running slight HC odor

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well **SI-2**

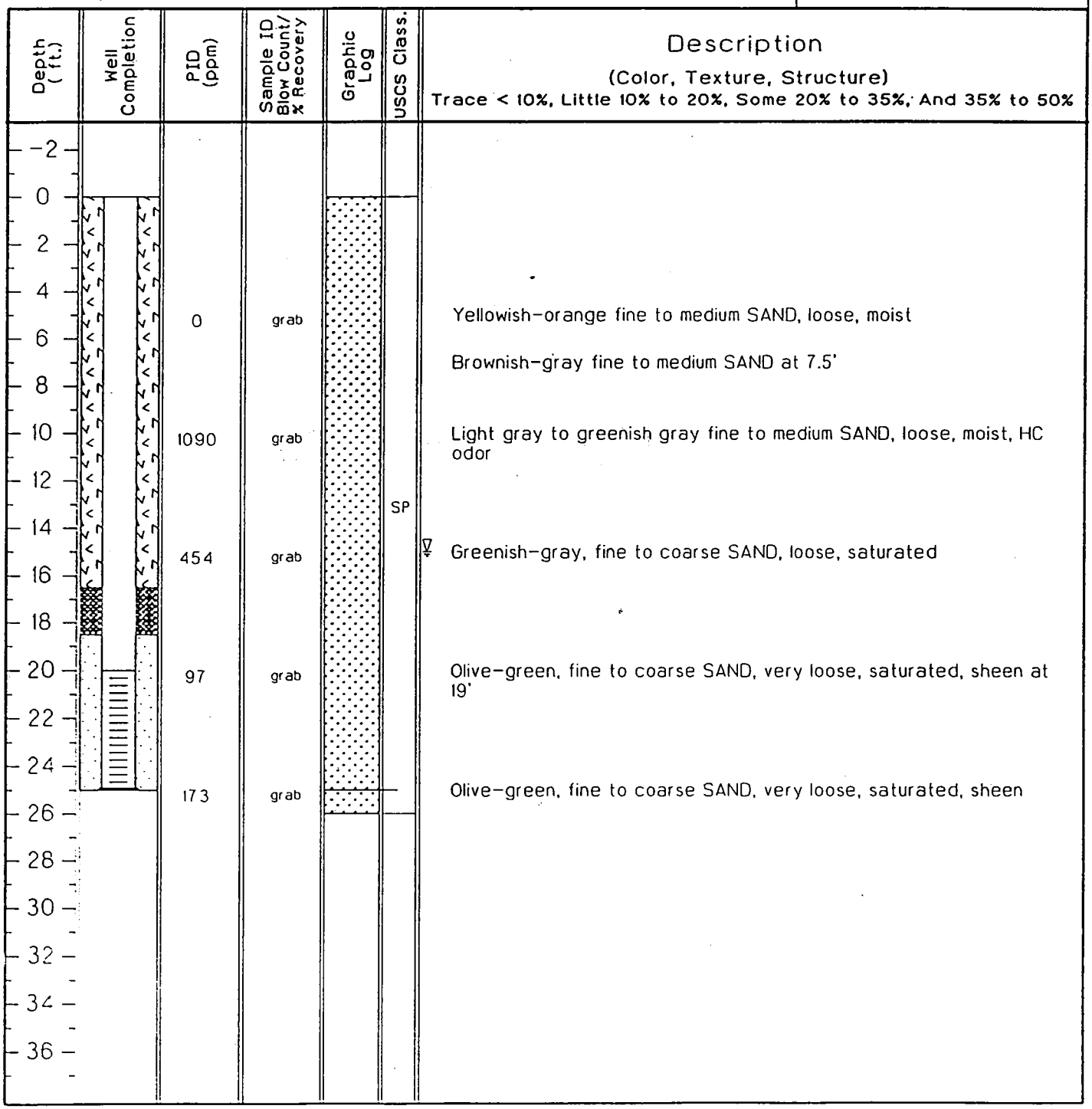
Project NSC FUEL ANNEX Owner U.S. NAVY
Location YORKTOWN, VIRGINIA Project No. 830011098 Date drilled 9 APR 1993
Surface Elev. _____ Total Hole Depth 25 ft. Diameter 12 in.
Top of Casing _____ Water Level Initial 15.0 ft. Static _____
Screen: Dia 4 in. Length 5 ft. Type/Size 0.040 in.
Casing: Dia 6 in. Length 20 ft. Type LOW CARBON STEEL
Filter Pack Material #3 SAND Rig/Core Type CME-75HD
Drilling Company FISHBURNE DRILLING Method HOLLOW STEM AUGER Permit # _____
Driller G. WILHELM Log By R. PACIORKA
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector

Grab samples were collected in place of split-spoon samples



Depth (ft.)	PID (ppm)	Sample ID Blow Count/ % Recovery	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
6	0	grab		Yellowish-orange fine to medium SAND, loose, moist
8				Brownish-gray fine to medium SAND at 7.5'
10	1090	grab		Light gray to greenish gray fine to medium SAND, loose, moist, HC odor
14			SP	
16	454	grab		∇ Greenish-gray, fine to coarse SAND, loose, saturated
20	97	grab		Olive-green, fine to coarse SAND, very loose, saturated, sheen at 19'
26	173	grab		Olive-green, fine to coarse SAND, very loose, saturated, sheen

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well SI-3

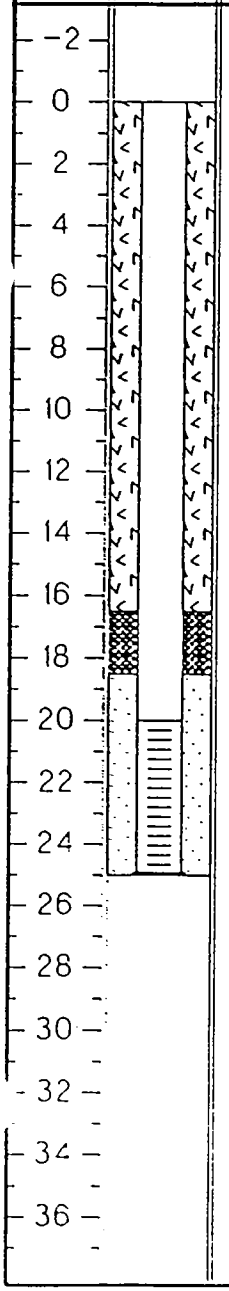
Project NSC FUEL ANNEX Owner U.S. NAVY
Location YORKTOWN, VIRGINIA Project No. 830011098 Date drilled 9 APR 1993
Surface Elev. _____ Total Hole Depth 25 ft. Diameter 12 in.
Top of Casing _____ Water Level Initial 15.0 ft. Static _____
Screen: Dia 4 in. Length 5 ft. Type/Size 0.040 in.
Casing: Dia 6 in. Length 20 ft. Type LOW CARBON STEEL
Filter Pack Material #3 SAND Rig/Core Type CME-75HD
Drilling Company FISHBURNE DRILLING Method HOLLOW STEM AUGER Permit # _____
Driller G. WILHELM Log By R. PACIORKA
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector

Grab samples were collected in place of split-spoon samples



Depth (ft.)	PID (ppm)	Sample ID Blow Count/ % Recovery	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2				
0				
2				
4				
6	0	grab		Yellowish-orange fine to medium SAND, loose
				Brownish-gray fine to medium SAND at 7'
8				
10	28	grab		Light gray fine to medium SAND, loose, moist
12				
14			SP	
	3	grab		∇ Greenish-gray, fine to coarse SAND, loose, saturated at 14'
16				
18				
20	33	grab		Greenish-gray, fine to coarse SAND, loose, saturated at 14', HC odor turning grayish-green at 23'
22				
24				
26	14	grab		Olive-green, fine to coarse SAND, very loose, running, saturated Hc odor and sheen, fossiliferous
28				
30				
32				
34				
36				

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well SI-4

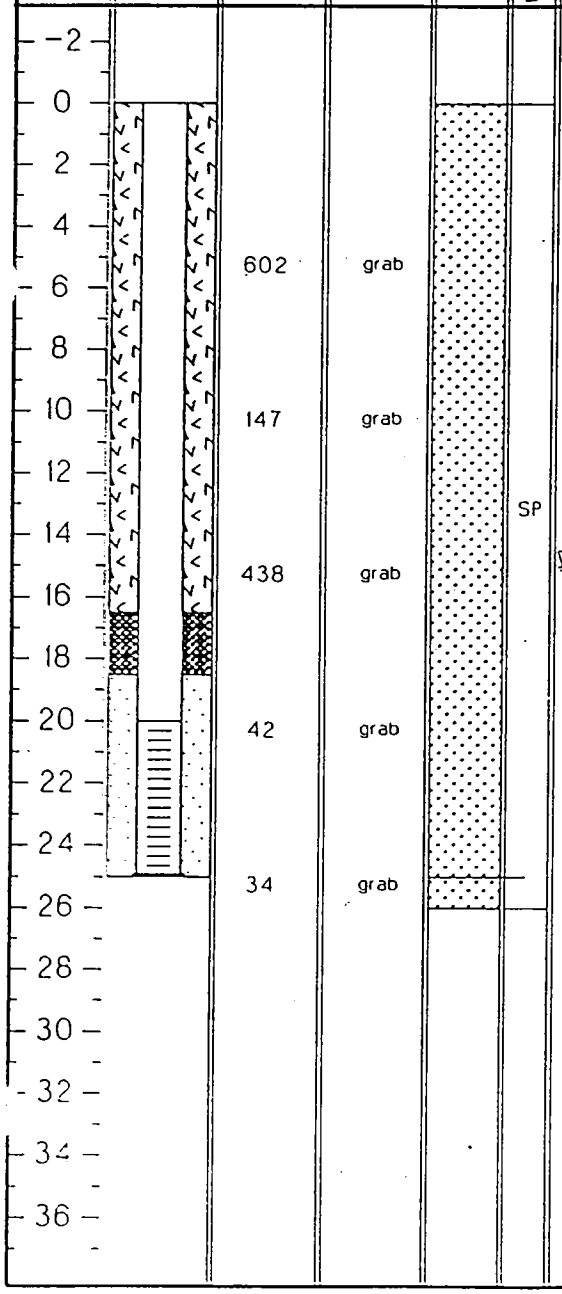
Project NSC FUEL ANNEX Owner U.S. NAVY
Location YORKTOWN, VIRGINIA Project No. 830011098 Date drilled 9 APR 1993
Surface Elev. _____ Total Hole Depth 25 ft. Diameter 12 in.
Top of Casing _____ Water Level Initial 15.0 ft. Static _____
Screen: Dia 4 in. Length 5 ft. Type/Size 0.040 in.
Casing: Dia 6 in. Length 20 ft. Type LOW CARBON STEEL
Filter Pack Material #3 SAND Rig/Core Type CME-75HD
Drilling Company FISHBURNE DRILLING Method HOLLOW STEM AUGER Permit # _____
Driller G. WILHELM Log By R. PACIORKA
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector

Grab samples were collected in place of split-spoon samples



Depth (ft.)	PID (ppm)	Sample ID Blow Count/ % Recovery	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
6	602	grab		Yellowish-orange fine SAND, to 4', then light to dark brown, clayey fine to medium SAND, loose, moist
10	147	grab		Tan fine to medium SAND, loose, moist, greenish gray at 13'
14	438	grab	SP	Light gray, fine to coarse SAND, loose, moist to saturated at 15'
20	42	grab		Olive-gray, fine to coarse SAND, loose, saturated, sheen, HC odor
26	34	grab		Olive-gray, fine to coarse SAND, loose, saturated, sheen, HC odor fossiliferous

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well **RW-1S**

Project *NSC FUEL ANNEX* Owner *U.S. NAVY*
Location *YORKTOWN, VIRGINIA* Project No. *830011098* Date drilled *8 APR 1993*
Surface Elev. _____ Total Hole Depth *30 ft.* Diameter *12 in.*
Top of Casing _____ Water Level Initial *15.0 ft.* Static _____
Screen: Dia *6 in.* Length *20 ft.* Type/Size *0.020 in.*
Casing: Dia *6 in.* Length *10.0 ft.* Type *LOW CARBON STEEL*
Filter Pack Material *#2 SAND* Rig/Core Type *CME-75HD*
Drilling Company *FISHBURNE DRILLING* Method *HOLLOW STEM AUGER* Permit # _____
Driller *G. WILHELM* Log By *R. PACIORKA*
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector
I=laboratory sample.

Depth (ft.)	Well Completion	PID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2						
0						
2						
4						
6		0				Yellowish-orange, fine SAND, loose, moist
8						
10		341	I			Light gray to light brown, fine to medium SAND, loose, moist
12						
14						
16		303			SP	Light brown to greenish gray, fine to coarse SAND, loose, very moist to saturated
18						
20		171				Greenish-gray, fine to coarse SAND, saturated, some LPH present
22						
24						
26		62				Grreenish-gray fine to coarse SAND, loose, saturated, some LPH present
28						
30		54				Grreenish-gray fine to coarse SAND, loose, saturated, no LPH present
32						
34						
36						

Drilling Log

GROUNDWATER TECHNOLOGY

Monitoring Well RW-2H

Project NSC FUEL ANNEX Owner U.S. NAVY
Location YORKTOWN, VIRGINIA Project No. 830011098 Date drilled 8 APR 1993
Surface Elev. _____ Total Hole Depth 30 ft. Diameter 12 in.
Top of Casing _____ Water Level Initial 15.0 ft. Static _____
Screen: Dia 6 in. Length 20 ft. Type/Size 0.020 in.
Casing: Dia 6 in. Length 10.0 ft. Type LOW CARBON STEEL
Filter Pack Material #2 SAND Rig/Core Type CME-75HD
Drilling Company FISHBURNE DRILLING Method HOLLOW STEM AUGER Permit # _____
Driller G. WILHELM Log By R. PACIORKA
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector

Grab samples were collected in place of split-spoon samples

Depth (ft.)	Well Completion	PID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2						
0						
2						Yellowish-orange, fine to medium SAND, loose, dry
4						
6		0	grab			Light brown fine to medium SAND, loose, moist
8						
10		0	grab			
12						
14						
16		0	grab		SP	
18						
20		30	grab			
22						
24						
26		16	grab			
28						
30		18	grab			
32						
34						
36						

GROUNDWATER TECHNOLOGY

Drilling Log

Monitoring Well RW-3X

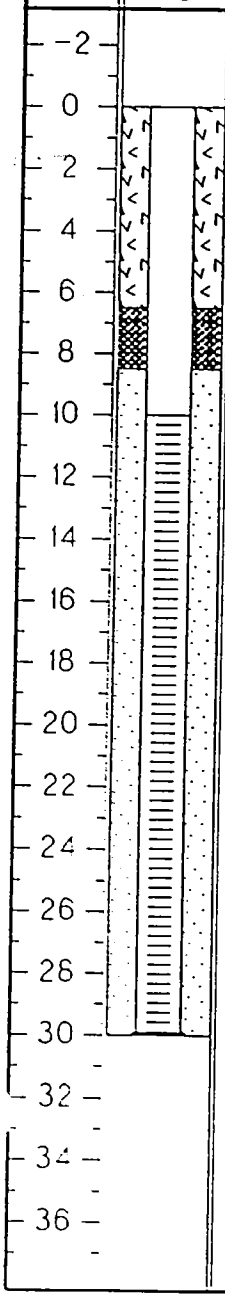
Project NSC FUEL ANNEX Owner U.S. NAVY
Location YORKTOWN, VIRGINIA Project No. 830011098 Date drilled 8 APR 1993
Surface Elev. _____ Total Hole Depth 30 ft. Diameter 12 in.
Top of Casing _____ Water Level Initial 15.0 ft. Static _____
Screen: Dia 6 in. Length 20 ft. Type/Size 0.020 in.
Casing: Dia 6 in. Length 10.0 ft. Type LOW CARBON STEEL
Filter Pack Material #2 SAND Rig/Core Type CME-75HD
Drilling Company FISHBURNE DRILLING Method HOLLOW STEM AUGER Permit # _____
Driller G. WILHELM Log By R. PACIORKA
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector

Grab samples were collected in place of split-spoon samples



Depth (ft.)	PID (ppm)	Sample ID Blow Count/ % Recovery	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2				
0				
2				
4				
6	0	grab		Yellowish-orange to light brown, fine to coarse SAND, loose, moist
8				
10	0	grab		Light gray to light brown, fine to medium SAND, loose, moist
12				
14				
16	14	grab	SP	Light gray to light brown, fine to coarse SAND, loose, moist saturated at 14' to 14.5'
18				
20	0	grab		Greenish-gray, fine to coarse SAND, loose, saturated, no LPH present
22				
24				
26	4	grab		Grayish-green, fine to medium SAND, loose, saturated, slight HC odor at 24', sheen
28				
30	5.6	grab		Olive green fine to medium SAND, loose, saturated, no LPH present
32				
34				
36				

GROUNDWATER TECHNOLOGY

Drilling Log

Monitoring Well **HWI-1**

Project *NSC FUEL ANNEX* Owner *U.S. NAVY*
Location *YORKTOWN, VIRGINIA* Project No. *830011098* Date drilled *13 APR 1993*
Surface Elev. _____ Total Hole Depth *20 ft.* Diameter *12 in.*
Top of Casing _____ Water Level Initial *15 ft.* Static _____
Screen: Dia *4 in.* Length *10 ft.* Type/Size *0.040 in.*
Casing: Dia *4 in.* Length *10 ft.* Type *LOW CARBON STEEL*
Filter Pack Material *#3 SAND* Rig/Core Type *CME-75HD*
Drilling Company *FISHBURNE DRILLING* Method *HOLLOW STEM AUGER* Permit # _____
Driller *G. WILHELM* Log By *R. PACIORKA*
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector

Grab samples were collected in place of split-spoon samples

Depth (ft.)	Well Completion	PID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2						
0						
2						
4						
6		0	grab			Light brown fine to medium SAND, loose, moist
8						
10		0	grab		SP	Light brown to gray, silty, fine to medium SAND, loose, moist
12						
14						
16		0	grab			Greenish-gray, fine to coarse SAND, loose, saturated at 15
18						
20		0	grab			Olive-green, fine to coarse SAND, very loose, saturated, HC odor
22						
24						
26						
28						
30						
32						
34						
36						

GROUNDWATER TECHNOLOGY

Drilling Log

Monitoring Well HWI-2

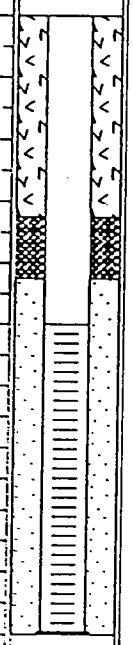
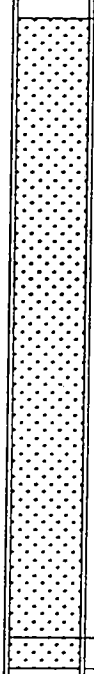
Project NSC FUEL ANNEX Owner U.S. NAVY
Location YORKTOWN, VIRGINIA Project No. 830011098 Date drilled 13 APR 1993
Surface Elev. _____ Total Hole Depth 20 ft. Diameter 12 in.
Top of Casing _____ Water Level Initial 16 ft. Static _____
Screen: Dia 4 in. Length 10 ft. Type/Size 0.040 in.
Casing: Dia 4 in. Length 10 ft. Type LOW CARBON STEEL
Filter Pack Material #3 SAND Rig/Core Type CME-75HD
Drilling Company FISHBURNE DRILLING Method HOLLOW STEM AUGER Permit # _____
Driller G. WILHELM Log By R. PACIORKA
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector

Grab samples were collected in place of split-spoon samples

Depth (ft.)	Well Completion	PID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2, 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36		0	grab			Yellowish-orange fine to medium SAND, loose, moist
		0	grab		SP	Light gray to brown, slightly silty, fine to medium SAND, loose, moist
		0	grab			Light gray, fine to medium SAND, loose, saturated at 16'
		0	grab			Olive-green, fine to coarse SAND, very loose, saturated

GROUNDWATER TECHNOLOGY

Drilling Log

Monitoring Well **HWI-3**

Project *NSC FUEL ANNEX* Owner *U.S. NAVY*
Location *YORKTOWN, VIRGINIA* Project No. *830011098* Date drilled *13 APR 1993*
Surface Elev. _____ Total Hole Depth *20 ft.* Diameter *12 in.*
Top of Casing _____ Water Level Initial *15 ft.* Static _____
Screen: Dia *4 in.* Length *10 ft.* Type/Size *0.040 in.*
Casing: Dia *4 in.* Length *10 ft.* Type *LOW CARBON STEEL*
Filter Pack Material *#3 SAND* Rig/Core Type *CME-75HD*
Drilling Company *FISHBURNE DRILLING* Method *HOLLOW STEM AUGER* Permit # _____
Driller *G. WILHELM* Log By *R. PACIORKA*
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector

Grab samples were collected in place of split-spoon samples

Depth (ft.)	Well Completion	PID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2						
0						
2						
4						
6		0	grab			Yellowish-orange fine to medium SAND, loose, moist, gray at 8'
8						
10		0	grab		SP	Light gray, fine to medium SAND, loose, moist
12						
14						
16		0	grab			Light gray, fine to medium SAND, loose, saturated at 15'
18						
20		2.4	grab			Olive-green, fine to coarse SAND, very loose, saturated
22						
24						
26						
28						
30						
32						
34						
36						

GROUNDWATER TECHNOLOGY

Drilling Log

Monitoring Well HWI-4

Project NSC FUEL ANNEX Owner U.S. NAVY
Location YORKTOWN, VIRGINIA Project No. 830011098 Date drilled 13 APR 1993
Surface Elev. _____ Total Hole Depth 20 ft. Diameter 12 in.
Top of Casing _____ Water Level Initial 14.5 ft. Static _____
Screen: Dia 4 in. Length 10 ft. Type/Size 0.040 in.
Casing: Dia 4 in. Length 10 ft. Type LOW CARBON STEEL
Filter Pack Material #3 SAND Rig/Core Type CME-75HD
Drilling Company FISHBURNE DRILLING Method HOLLOW STEM AUGER Permit # _____
Driller G. WILHELM Log By R. PACIORKA
Checked By _____ License No. _____

See Site Map For Boring Location

COMMENTS:

Printed using Unified Soil Classification System (USCS)
PID=Photo-Ionization Detector

Grab samples were collected in place of split-spoon samples

Depth (ft.)	Well Completion	PID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2						
0						
2						
4						
6		3.7	grab			Yellowish-orange fine to medium SAND, loose, moist Gray fine to medium SAND, loose, moist
8						
10		0	grab		SP	Light brown to gray fine to medium SAND, few pebbles, loose, moist
12						
14						
16		0	grab			Greenish-gray, fine to coarse SAND, loose, saturated at 14.5
18						
20		53	grab			Olive-green, fine to coarse SAND, very loose, saturated, HC odor
22						
24						
26						
28						
30						
32						
34						
36						

UNIFIED SOIL CLASSIFICATION SYSTEM

CLASSIFICATION CHART

MAJOR DIVISIONS		SYMBOLS	TYPICAL NAMES	GTGS FILL PATTERN
COARSE GRAINED SOILS OVER 50%>No.200 SIEVE SIZE	GRAVELS MORE THAN 1/2 OF COARSE FRACTION> NO.4 SIEVE SIZE	GW	Well graded gravels or gravel-sand mixtures, little or no fines	26
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines	25
		GM	Silty gravels, gravel-sand mixtures	26=11
		GC	Clayey gravels, gravel-sand-clay mixtures	26=14
	SANDS MORE THAN 1/2 OF COARSE FRACTION< NO.4 SIEVE SIZE	SW	Well graded sands or gravelly sands, little or no fines	8
		SP	Poorly graded sands or gravelly sands, little or no fines	6
		SM	Silty sands, sand-silt mixtures	9
		SC	Clayey sands, sand-clay mixtures	10
FINE GRAINED SOILS OVER 50%<No.200 SIEVE SIZE	SILTS & CLAYS LL<50	ML	Inorganic siltys and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	11
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	14
		OL	Organic silts andorganic silty clays of low plasticity	18
	SILTS & CLAYS LL>50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	12
		CH	Inorganic clays of high plasticity, fat clays	15
		OH	Organic clays of medium to high plasticity, organic silty clays, organic silts	35
HIGHLY ORGANIC SOILS		Pt	Peat and other hightly organic soils	20

GRAIN SIZE CHART

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL COARSE FINE	3" to No.4 3" to 3/4" 3/4" to No.4	76.2 to 4.75 76.2 to 19.1 10.1 to 4.75
SAND COARSE MEDIUM FINE	No.4 to No.200 No.4 to No.10 No.10 to No.40 No.40 to No.200	4.75 to 0.074 4.76 to 2.00 2.00 to 0.420 0.420 to 0.074
SILT & CLAY	Below No.200	Below No.0.074

WELL CONSTRUCTION MATERIALS

- Asphalt (68)
- Concrete (55)
- Neat Cement (54)
- Base Course (30)
- Sluff (64)
- Bentonite (21)
- Filter Pack (7)
- Pea Gravel (2)
- Liner (33)
- Geocloth (36)

SCREENS

- Solid (1s)
- Slotted PVC (3w)
- Slot. PVC High Flow (8w)
- Wire Wound PVC (16w)
- Wire Wound Steel (15w)
- Saw Cut (12w)

SAMPLE TYPES

SS - Split Spoon
CC - Continuous Core
CG - Cuttings Grab

SYMBOLS

Initial Water Level
Static Water Level

GROUNDWATER TECHNOLOGY

GROUNDWATER TECHNOLOGY GOVERNMENT SERVICES

Drilling Log

Soil Boring SB-MW2S

Project *Yorktown Pilot Study* Owner *US NAVY*
Location *NCS Yorktown, Virginia* Project No. *830011098.020602* Date drilled *7/12/93*
Surface Elev. _____ Total Hole Depth *20 ft.* Diameter *10 in.*
Top of Casing _____ Water Level Initial *17 ft.* Static _____
Screen: Dia *NA in.* Length *NA ft.* Type/Size *NA in.*
Casing: Dia *NA in.* Length *NA ft.* Type *NA*
Filter Pack Material *NA* Rig/Core Type *Mobile B-47/Spit Spoon*
Drilling Company *Fishburne Drilling* Method *Hollow Stem Auger* Permit # _____
Driller *Joe* Log By *Bill Hughes and Lori Reuther*
Checked By *Taylor Sword* License No. *CPG APIG #8334*

See Site Map For Boring Location

COMMENTS:

The soil borings were drilled in the vicinity of the remedial pilot test compound at the Yorktown Naval Fueling Facility, Yorktown, Virginia.

Depth (ft.)	PID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2					
0					Ground surface
2					Reddish brown color, dry to damp, well sorted, fine to medium SAND, some silt
4		SS-1 GRAB			
6	195	SS-2 7,8,2,3/ 100			Gray color, damp, well sorted, fine SAND, some silt
8	302	SS-3 3,4/ 100			Reddish brown color, dry to damp, well sorted, medium to fine SAND, some silt
10				SP	
12	113	SS-4 5,3,5,5/ 100			Light olive green color, damp, well sorted, coarse to medium SAND
14	40	SS-5 5,4,4,4/ 100			Light olive green color, damp, well sorted, coarse to medium SAND Brown, moist, medium to fine SAND
16	21	SS-6 4,4,4,4/ 100			Reddish brown to gray, wet, SILTY SAND *Encountered water*
18	22	SS-7 1,1,1,1/ 100			Reddish brown to gray, wet, SILTY SAND
20					Bottom of Exploration
22					
24					

GROUNDWATER TECHNOLOGY GOVERNMENT SERVICES

Drilling Log

Soil Boring SB-MW3H

Project *Yorktown Pilot Study* Owner *US NAVY*
Location *NCS Yorktown* Project No. *830011098.020602* Date drilled *7/13/93*
Surface Elev. _____ Total Hole Depth *20 ft.* Diameter *10 in.*
Top of Casing _____ Water Level Initial *14 ft.* Static _____
Screen: Dia *NA in.* Length *NA ft.* Type/Size *NA in.*
Casing: Dia *NA in.* Length *NA ft.* Type *NA*
Filter Pack Material *NA* Rig/Core Type *Mobile B-47/Spit Spoon*
Drilling Company *Fishburne Drilling* Method *Hollow Stem Auger* Permit # _____
Driller *Joe* Log By *Bill Hughes and Lori Reuther*
Checked By *Taylor Sword* License No. *CPG APIG #8334*

See Site Map For Boring Location

COMMENTS:

The soil borings were drilled in the vicinity of the remedial pilot test compound at the Yorktown Naval Fueling Facility, Yorktown, Virginia.

Depth (ft.)	PID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2					
0					Ground surface
2					
4	82	SS-1 5,5,5,3/ 100			Reddish Brown to dark gray color, dry, well sorted, medium to fine SAND, some silt and clay, petroleum staining and odor
6					
8					
	46	SS-2 4,3/ 100		SP	Brown color, damp, well sorted, loose, medium to fine SAND, some clay and silt, little mottling
10	44	SS-3 3,4,5,5/ 70			Reddish brown to gray color, damp, well sorted, coarse to fine SAND, some mottling
12	31	SS-4 3,3,4,4/ 70			Dark brown color, damp, fine SAND, some silt and clay
14					*Encountered water*
	25	SS-5 2,1,2,2/ 100			Red brown color, damp to wet, well sorted, loose, coarse to fine SAND,
16	20	SS-6 3,2,1,2/ 100			Greenish gray, wet, well sorted, medium to fine SAND, trace coarse sand, petroleum staining and odor
18	29	SS-7 3,3,3,4/ 100			Greenish gray, wet, well sorted, loose, coarse to fine SAND, petroleum staining and odor
20					Bottom of Exploration
22					
24					

GROUNDWATER TECHNOLOGY GOVERNMENT SERVICES

Drilling Log

Soil Boring SB-MW3S

Project *Yorktown Pilot Study* Owner *US NAVY*
Location *NCS Yorktown, Virginia* Project No. *830011098.020602* Date drilled *7/12/93*
Surface Elev. _____ Total Hole Depth *20 ft.* Diameter *10 in.*
Top of Casing _____ Water Level Initial *14 ft.* Static _____
Screen: Dia *NA in.* Length *NA ft.* Type/Size *NA in.*
Casing: Dia *NA in.* Length *NA ft.* Type *NA*
Filter Pack Material *NA* Rig/Core Type *Mobile B-47/Spit Spoon*
Drilling Company *Fishburne Drilling* Method *Hollow Stem Auger* Permit # _____
Driller *Joe* Log By *Bill Hughes and Lori Reuther*
Checked By *Taylor Sword* License No. *CPG APIG #8334*

See Site Map For Boring Location

COMMENTS:

The soil borings were drilled in the vicinity of the remedial pilot test compound at the Yorktown Naval Fueling Facility, Yorktown, Virginia.

Depth (ft.)	PID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2					
0					Ground surface
2					
4	110	SS-1 5,6,7,4/ 100			Reddish brown color, dry to damp, well sorted, fine SAND, some silt, trace organic material
6					
8					
10	142	SS-2 4,4/ 100		SP	Reddish brown to brown color, dry to damp, well sorted, medium to fine SAND, some silt
	139	SS-3 4,4,5,6/ 100			Reddish brown to brown color, dry to damp, well sorted, medium to fine SAND, some silt
12	60	SS-4 4,4,5,4/ 100			Reddish brown to gray color, moist to damp, well sorted medium to fine SAND, some silt
14					*Encountered water*
	41	SS-5 2,4,5,5/ 100			Reddish brown to gray to green, wet, well sorted, coarse to fine SAND, some silt
16	20	SS-6 4,5,6,5/ 100			Reddish brown to brown to gray, wet, well sorted, course to fine SAND
18	47	SS-7 6,7,8,5/ 100			Brown to dark gray, wet, well sorted, coarse to fine SAND, some silt
20					Bottom of Exploration
22					
24					

Drilling Log

GROUNDWATER TECHNOLOGY GOVERNMENT SERVICES

Soil Boring SB-RW3A

Project *Yorktown Pilot Study* Owner *US NAVY*
Location *Yorktown Coast Guard Station* Project No. *830011098.020602* Date drilled *7/12/93*
Surface Elev. _____ Total Hole Depth *20 ft.* Diameter *10 in.*
Top of Casing _____ Water Level Initial _____ Static _____
Screen: Dia *NA in.* Length *NA ft.* Type/Size *NA in.*
Casing: Dia *NA in.* Length *NA ft.* Type *NA*
Filter Pack Material *NA* Rig/Core Type *Mobile B-47/Spit Spoon*
Drilling Company *Fishburne Drilling* Method *Hollow Stem Auger* Permit # _____
Driller *Joe* Log By *Bill Hughes and Lori Reuther*
Checked By *Taylor Sword* License No. *CPG APIG #8334*

See Site Map For Boring Location

COMMENTS:

The soil borings were drilled in the vicinity of the remedial pilot test compound at the Yorktown Naval Fueling Facility, Yorktown, Virginia.

Depth (ft.)	PID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2					
0					Ground surface
2				SP	
4	23	SS-1 2,2,4,3/ 100			Reddish brown to light brown color, damp to moist, well sorted, fine SAND, some silt
6				SP SM	
8	19	SS-2 4,3/ 100			Reddish brown to gray color, dry to damp, well sorted, fine SAND, some silt and clay
10	21	SS-3 3,3,3,3/ 100			Light reddish brown color, dry to damp, well sorted, fine SAND, some silt
12	21	SS-4 4,4,4,4/ 100			Reddish brown color, damp, well sorted, medium to fine SAND, some silt and clay
14	15	SS-5 6,5,6,7/ 100		SP	Reddish brown to gray, wet, well sorted, coarse to fine SAND, some clay and silt
16	10	SS-6 7,8,9,9/ 100			Reddish brown to gray, wet, well sorted, coarse to fine SAND, some clay and silt
18	14	SS-7 6,7,5,6/ 100			Reddish brown to greenish-gray, wet, well sorted, coarse to fine SAND, some clay and silt
20					Bottom of Exploration
22					
24					

GROUNDWATER TECHNOLOGY GOVERNMENT SERVICES

Drilling Log

Soil Boring SB-RW3B

Project *Yorktown Pilot Study* Owner *US NAVY*
Location *NSC Yorktown, Virginia* Project No. *830011098.020602* Date drilled *7/12/93*
Surface Elev. _____ Total Hole Depth *20 ft.* Diameter *10 in.*
Top of Casing _____ Water Level Initial _____ Static _____
Screen: Dia *NA in.* Length *NA ft.* Type/Size *NA in.*
Casing: Dia *NA in.* Length *NA ft.* Type *NA*
Filter Pack Material *NA* Rig/Core Type *Mobile B-47/Spit Spoon*
Drilling Company *Fishburne Drilling* Method *Hollow Stem Auger* Permit # _____
Driller *Joe* Log By *Bill Hughes and Lori Reuther*
Checked By *Taylor Sword* License No. *CPG APIG #8334*

See Site Map For Boring Location

COMMENTS:

The soil borings were drilled in the vicinity of the remedial pilot test compound at the Yorktown Naval Fueling Facility, Yorktown, Virginia.

Depth (ft.)	PID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2					
0					Ground surface
2					
4	18	SS-1 1,2,1,1/ 100			Reddish brown to brown, dry to damp, well sorted, medium to fine SAND, some clay and silt
6				SP	
8	72	SS-2 4,3/ 100			Light reddish brown to brown color, dry to damp, poorly sorted, medium to fine SAND, some clay and silt
10	48	SS-3 4,5,4,6/ 100			Reddish brown color, damp, well sorted, medium to fine SAND, some silt and clay
12	45	SS-4 4,5,4,7/ 100			Light reddish brown color, damp, poorly sorted medium to fine SAND, some silt and clay
14	44	SS-5 4,3,3,2/ 100			Reddish brown to gray, wet, well sorted, coarse to fine SAND, some clay and silt
16	23	SS-6 4,5,5,7/ 100		SM	Reddish brown to green gray, wet, well sorted, coarse to fine SAND, some clay and silt
18	197	SS-7 4,3,2,1/ 100		SP	Gray, wet, well sorted, medium to fine SAND, some silt, petroleum staining and odor
20					Bottom of Exploration
22					
24					

GROUNDWATER TECHNOLOGY GOVERNMENT SERVICES

Drilling Log

Soil Boring **SB-X**

Project *Yorktown Pilot Study* Owner *US NAVY*
Location *NCS Yorktown* Project No. *830011098.020602* Date drilled *7/13/93*
Surface Elev. _____ Total Hole Depth *20 ft.* Diameter *10 in.*
Top of Casing _____ Water Level Initial _____ Static _____
Screen: Dia *NA in.* Length *NA ft.* Type/Size *NA in.*
Casing: Dia *NA in.* Length *NA ft.* Type *NA*
Filter Pack Material *NA* Rig/Core Type *Mobile B-47/Spit Spoon*
Drilling Company *Fishburne Drilling* Method *Hollow Stem Auger* Permit # _____
Driller *Joe* Log By *Bill Hughes and Lori Reuther*
Checked By *Taylor Sword* License No. *CPG APIG #8334*

See Site Map For Boring Location

COMMENTS:

The soil borings were drilled in the vicinity of the remedial pilot test compound at the Yorktown Naval Fueling Facility, Yorktown, Virginia.

Depth (ft.)	PID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2					
0					Ground surface
2					
4	15	SS-1 11,8,7,8/ 100			Reddish brown color, damp, poorly sorted, coarse to very fine SAND
6					
8	15	SS-2 4,5/ 100			Light to dark brown color, damp, poorly sorted, loose, very fine SAND
10	17	ss-3 5,5,6,7/ 100		SP	Light to dark brown color w/black striations, damp, poorly sorted, fine SAND
12	17	SS-4 6,5,5,5/ 100			Reddish brown color, damp, loose, medium to fine SAND, some coarse sand
14	15	SS-5 5,4,4,4/ 90			Reddish brown to greenish gray, wet, well sorted, coarse to fine SAND
16	15	SS-6 4,2,4,4/ 75			Light gray to green gray color, wet, well sorted, loose, coarse to fine SAND
18	156	SS-7 7,5,7,6/ 100			Reddish brown to greenish gray color, wet, well sorted, coarse to fine SAND, petroleum staining and oder
20					Bottom of Exploration
22					
24					

GROUNDWATER TECHNOLOGY GOVERNMENT SERVICES

Drilling Log

Soil Boring SB-Y

Project *Yorktown Pilot Study* Owner *US NAVY*
Location *NSC Yorktown, Virginia* Project No. *830011098.020602* Date drilled *7/13/93*
Surface Elev. _____ Total Hole Depth *20 ft.* Diameter *10 in.*
Top of Casing _____ Water Level Initial _____ Static _____
Screen: Dia *NA in.* Length *NA ft.* Type/Size *NA in.*
Casing: Dia *NA in.* Length *NA ft.* Type *NA*
Filter Pack Material *NA* Rig/Core Type *Mobile B-47/Spit Spoon*
Drilling Company *Fishburne Drilling* Method *Hollow Stem Auger* Permit # _____
Driller *Joe* Log By *Bill Hughes and Lori Reuther*
Checked By *Taylor Sword* License No. *CPG APIG #8334*

See Site Map For Boring Location

COMMENTS:

The soil borings were drilled in the vicinity of the remedial pilot test compound at the Yorktown Naval Fueling Facility, Yorktown, Virginia.

Depth (ft.)	PID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2					
0					Ground surface
2					
4	13	SS-1 2,1,4,4/ 100		SP	Reddish brown to brown color, damp to moist, well graded, coarse to fine SAND
6					
8	16	SS-2 3,4/ 40			Reddish brown to gray color, damp, well sorted, medium to fine SAND, some silt
10	21	SS-3 3,4,3,3/ 100			Reddish brown to gray color, damp, well sorted, fine SAND, some clay and silt
12	23	SS-4 2,1,2,1/ 100		SM	Reddish brown color, moist to wet, loose, coarse to very fine SAND, some silt and clay
14	16	SS-5 2,1,1,2/ 100			Reddish brown to greenish gray, wet, well sorted, loose, coarse to fine SAND, some clay and silt
16	20	SS-6 1,1,1,1/ 100		SP	Light green to gray, wet, well sorted, loose, coarse to fine SAND,
18	19	SS-7 1,1,1,1/ 100			Light green to gray, wet, well sorted, loose, coarse to fine SAND,
20					Bottom of Exploration
22					
24					

Drilling Log

GROUNDWATER TECHNOLOGY GOVERNMENT SERVICES

Soil Boring SB-MW1H

Project *Yorktown Pilot Study* Owner *US NAVY*
Location *NSC Yorktown, Virginia* Project No. *830011098.020602* Date drilled *7/13/93*
Surface Elev. _____ Total Hole Depth *20 ft.* Diameter *10 in.*
Top of Casing _____ Water Level Initial _____ Static _____
Screen: Dia *NA in.* Length *NA ft.* Type/Size *NA in.*
Casing: Dia *NA in.* Length *NA ft.* Type *NA*
Filter Pack Material *NA* Rig/Core Type *Mobile B-47/Spit Spoon*
Drilling Company *Fishburne Drilling* Method *Hollow Stem Auger* Permit # _____
Driller *Joe* Log By *Bill Hughes and Lori Reuther*
Checked By *Taylor Sword* License No. *CPG APIG #8334*

See Site Map For Boring Location

COMMENTS:

The soil borings were drilled in the vicinity of the remedial pilot test compound at the Yorktown Naval Fueling Facility, Yorktown, Virginia.

Depth (ft.)	PID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-2					
0					Ground Surface
2					
4	37	SS-1 1,1,2,1/ 100			Brown to gray color, dry to damp, medium to fine SAND, some silt
6					
8	29	SS-2 3,1,3,2/ 100			Light brown to light gray color, damp, well sorted, medium to fine SAND
10				SP	Light reddish orange, coarse to fine SAND
	55	SS-3 4,4/ 100			Light gray to light brown color, damp, coarse SAND, little medium sand, trace fine sand and silt.
12	20	SS-4 5,6,6,7/ 60			Brown to light green, wet, loose, coarse to fine SAND
14		SS-5 2,1,3,6/ 100			Light brown to green gray, wet, well sorted, loose, coarse to fine SAND, some silt
16					Red brown, wet, fine to very fine SAND,
	290	SS-6 6,7,8,8/ 100			Red brown to brown, wet, well sorted, loose, medium to fine SAND, petroleum staining and odor
18	223	SS-7 4,4,4,4/ 100			Brown to dark brown, wet, loose, coarse to fine SAND, petroleum staining and odor
20					Bottom of Exploration
22					
24					

APPENDIX B

ANALYTICAL RESULTS

Pre-Pilot Test
Analytical Results

GTEL
ENVIRONMENTAL
LABORATORIES, INC.
Northeast Region
Meadowbrook Industrial Park
Milford, NH 03055
(603) 672-4835
(603) 673-8105 (FAX)

Client Number: 830011098
Project ID: NSC/Yorktown
Login Number: M3-04-0205

April 26, 1993

Taylor Sword
Government Services, Inc.
1244-B Executive Blvd.
Chesapeake, VA 23320

Dear Mr. Sword:

Enclosed please find the analytical results for the samples received by GTEL Environmental Laboratories, Inc. on 04/08/93 under chain-of-custody record 54875.

A formal Quality Assurance / Quality Control (QA/QC) program is maintained by GTEL, which is designed to meet or exceed the EPA requirements. Analytical work for this project met QA/QC criteria unless otherwise stated in the footnotes.

GTEL is certified (approved) by the State of Virginia under certificate number 00155.

If you have any questions regarding this analysis, or if we can be of further assistance, please call our Customer Service Representative.

Sincerely,

GTEL Environmental Laboratories, Inc.

Susan C. Uhler
Laboratory Director

Client Number: 830011098
Project ID: NSC/Yorktown
Login Number: M3-04-0205

ANALYTICAL RESULTS

Aromatic Volatile Organics in Soil
Modified EPA Method 8020[a]

GTEL Sample Number		040205-01	040205-02	040205-03	--
Client Identification		MW-1S	MW-2S	MW-3S	--
Date Sampled		04/07/93	04/07/93	04/07/93	--
Date Analyzed		04/10/93	04/10/93	04/10/93	--
Analyte	Reporting Limit, mg/kg	Concentration, mg/kg (dry)			
Benzene	0.05	< 0.05	< 0.05	< 0.05	--
Toluene	0.05	< 0.05	**0.34**	< 0.05	--
Ethylbenzene	0.10	< 0.10	**0.73**	< 0.10	--
Xylenes (total)	0.20	< 0.20	**3.5**	< 0.20	--
BTEX (total)	--	--	**4.6**	--	--
Sample Dilution Factor[b]		1.29[c]	1.09	1.08[c]	--
Percent Solids		79.1	92.0	94.3	--

a Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Revision 0, US EPA November 1986; Methanolic extraction by EPA Method 5030 (purge and trap). Method modified to include additional compounds.

b The sample dilution factor indicates the adjustments made to the data and detection limits as a result of dilutions and percent solids.

c Sample was not analyzed low level due to the interference of non-target compounds.

GTEL ENVIRONMENTAL LABORATORIES, INC.

Client Number: 830011098
Project ID: NSC/Yorktown
Login Number: M3-04-0205

ANALYTICAL RESULTS

Hydrocarbon Screen in Soil
by GC FID[a]

GTEL Sample Number		040205-01	040205-02	040205-03	--
Client Identification		MW-1S	MW-2S	MW-3S	--
Date Sampled		04/07/93	04/07/93	04/07/93	--
Date Extracted		04/09/93	04/09/93	04/09/93	--
Date Analyzed		04/15/93	04/15/93	04/15/93	--
Analyte	Detection Limit, mg/kg	Concentration, mg/kg			
Gasoline	10	< 12	< 11	< 9.9	--
Mineral Spirits	10	< 12	< 11	< 9.9	--
Kerosine	10	**160**[b]	**670**[b]	**240**[b]	--
Diesel	10	< 12	< 11	< 9.9	--
Fuel Oil #6	10	< 12	< 11	< 9.9	--
Lubricating Oil	10	< 12	< 11	< 9.9	--
Detection Limit Multiplier		1.25	1.06	0.991	--
Percent Solids, %		79.1	92.0	94.3	--

a Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Revision 0, US EPA November 1986; Methylene chloride extraction by modified EPA Method 3550; modification as per California State Water Resources Control Board LUFT Manual protocols. Concentration calculated on a dry weight basis.

b The sample chromatogram shows a loss of n-alkanes consistent with models of a degraded kerosine.

GTEL ENVIRONMENTAL LABORATORIES, INC.

Client Number: 830011098
Project ID: NSC/Yorktown
Login Number: M3-04-0205

ANALYTICAL RESULTS

Extractable Organic Halides in Soil[a]

Sample Identification		Date Sampled	Date Analyzed	Percent Solids, %	Detection Limit, mg/kg	Concentration, mg/kg
GTEL No.	Client ID	--	--	--	--	--
040205-01	MW-1S	04/07/93	04/13/93	79.1	77	< 77
040205-02	MW-2S	04/07/93	04/13/93	92.0	66	< 66
040205-03	MW-3S	04/07/93	04/13/93	94.3	65	< 65

a EPA 600/4-84-008, Appendix D, Method for Extractable Organic Halides in Soil, US EPA, June, 1983. Concentration is calculated on a dry weight basis.

GTEL ENVIRONMENTAL LABORATORIES, INC.

Client Number: 830011098
Project ID: NSC/Yorktown
Login Number: M3-04-0205

ANALYTICAL RESULTS

Total Recoverable Petroleum Hydrocarbons in Soil
by Infrared Spectrometry
Modified EPA Method 418.1[a]

Sample Identification		Date Sampled	Date Extracted	Date Analyzed	Percent Solids, %	Detection Limit, mg/kg	Concentration, mg/kg
GTEL No.	Client ID	--	--	--	--	--	--
040205-01	MW-1S	04/07/93	04/08/93	04/09/93	79.1	39	< 39
040205-02	MW-2S	04/07/93	04/08/93	04/09/93	92.1	170	**500**
040205-03	MW-3S	04/07/93	04/08/93	04/09/93	94.3	33	**130**

a EPA 600/4-79-020, March 1983 revision. Extraction modified for soils (Soxhlet). Concentration calculated on a dry weight basis.

GTEL ENVIRONMENTAL LABORATORIES, INC.

GTEL ENVIRONMENTAL LABORATORIES, INC.

MEADOWBROOK INDUSTRIAL PARK
MILFORD, NH 03055
(603) 672-4835
(800) LAB-GTEL

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

54875

Company Name: [illegible]

Phone #: 804 436 7881

FAX #: 804 [illegible]

Company Address: [illegible]

Site location: NSC YORKTOWN YORKTOWN, VA

Project Manager: [illegible]

Client Project ID: (#) 23001 1098-020402

(NAME) NSC/YORKTOWN

I attest that the proper field sampling procedures were used during the collection of these samples.

Sampler Name (Print): RICHARD J PACIORKA

Field Sample ID	GTEL Lab # (Lab use only)	# Containers	Matrix: WATER	SOIL	AIR	SLUDGE	PRODUCT	OTHER	Method Preserved: HCl	HNO_3	H_2SO_4	ICE	UNPRESERVED	OTHER (SPECIFY)	Sampling: DATE	TIME	BTEX/602 ☐ 8020 ☒ with MTBE ☐	BTEX/Gas Hydrocarbons PID/FID ☐ with MTBE ☐	Hydrocarbons GC/FID Gas ☐ Diesel ☐ Screen ☒	Hydrocarbon Profile (SIMDIS) ☐	Oil and Grease 413.1 ☐ 413.2 ☐ SM 503 ☐	TPH/IR 418.1 ☒ SM 503 ☐	EDB by 504 ☐ DBCP by 504 ☐	EPA 503.1 ☐ EPA 502.2 ☐	EPA 601 ☐ EPA 8010 ☐	EPA 602 ☐ EPA 8020 ☐	EPA 608 ☐ 8080 ☐ PCB only ☐	EPA 624/PPL ☐ 8240/TAL ☐ NBS (+15) ☐	EPA 625/PPL ☐ 8270/TAL ☐ NBS (+25) ☐	EPA 610 ☐ 8310 ☐	EP TOX Metals ☐ Pesticides ☐ Herbicides ☐	TCLP Metals ☐ VOA ☐ Semi-VOA ☐ Pest ☐ Herb ☐	EPA Metals - Priority Pollutant ☐ TAL ☐ RCRA ☐	CAM Metals TTLC ☐ STLC ☐	Lead 239.2 ☐ 200.7 ☐ 7420 ☐ 7421 ☐ 6010 ☐	Organic Lead ☐	Corrosivity ☐ Flash Point ☐ Reactivity ☐	TOX		
MW-1S	1	6		X								X			4/7	1230	X		X			X														X		
MW-2S	2	6		X								X			4/7	1400	X		X			X														X		
MW-3S	3	6		X								X			4/7	1505	X		X			X														X		

TAT
- Priority (24 hr) ☐
- Expedited (48 hr) ☐
- 7 Business Days ☐
- Other 5 DAY Business Days ☐

Special Handling
- GTEL Contact
- Quote/Contract #
- Confirmation #
- PO #

QA / QC LEVEL
BLUE ☐ CLP ☐ OTHER

SPECIAL DETECTION LIMITS

SPECIAL REPORTING REQUIREMENTS
FAX ☒

REMARKS
PROJECT ID: NSC/YORKTOWN

Lab Use Only Lot #

Storage Location: 23LA

Work Order #

CUSTODY RECORD

Relinquished by Sampler:	Date	Time	Received by:
Relinquished by:	Date	Time	Received by:
Relinquished by:	Date 4-8-93	Time 10:40	Received by Laboratory:

Waybill # 2584000926

Rev. 7/91

GTEL
ENVIRONMENTAL
LABORATORIES, INC.
Northeast Region
Meadowbrook Industrial Park
Milford, NH 03055
(603) 672-4835
(603) 673-8105 (FAX)

Client Number: 830011098
Project ID: NYSC/Yorktown
Login Number: M3-04-0472

April 29, 1993

Taylor Sword
Government Services, Inc.
1244-B Executive Blvd
Chesapeake, VA 23320

Dear Mr. Sword:

Enclosed please find the analytical results for the samples received by GTEL Environmental Laboratories, Inc. on 04/16/93 under chain-of-custody record 54874.

A formal Quality Assurance / Quality Control (QA/QC) program is maintained by GTEL, which is designed to meet or exceed the EPA requirements. Analytical work for this project met QA/QC criteria unless otherwise stated in the footnotes.

GTEL is certified (approved) by the State of Virginia under certificate number 00155.

If you have any questions regarding this analysis, or if we can be of further assistance, please call our Customer Service Representative.

Sincerely,

GTEL Environmental Laboratories, Inc.

Susan C. Uhler
Laboratory Director

Client Number: 830011098
Project ID: NYSC/Yorktown
Login Number: M3-04-0472

ANALYTICAL RESULTS

Aromatic Volatile Organics in Soil
Modified EPA Method 8020[a]

GTEL Sample Number		040472-01	040472-02	040472-03	040472-04[c]
Client Identification		MW-5H	MW-1H	MW-4H	MW-3H
Date Sampled		04/13/93	04/13/93	04/14/93	04/14/93
Date Analyzed		04/21/93	04/21/93	04/21/93	04/21/93
Analyte	Reporting Limit, mg/kg	Concentration, mg/kg (dry)			
Benzene	0.05	**0.08**	**0.35**	**0.18**	< 0.05
Toluene	0.05	**0.21**	**0.15**	**0.14**	< 0.05
Ethylbenzene	0.10	**0.61**	**4.0**	**0.47**	< 0.10
Xylenes (total)	0.20	**0.87**	**3.4**	**0.70**	< 0.20
BTEX (total)	--	**1.8**	**7.9**	**1.5**	--
Sample Dilution Factor[b]		1.38	1.19	1.19	1.17
Percent Solids		71.6	82.3	82.5	84.5

a Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Revision 0, US EPA November 1986; Methanolic extraction by EPA Method 5030 (purge and trap). Method modified to include additional compounds.

b The sample dilution factor indicates the adjustments made to the data and detection limits as a result of dilutions and percent solids.

c Sample was not analyzed low level due to the interference of non-target compounds.

GTEL ENVIRONMENTAL LABORATORIES, INC.

Client Number: 830011098
Project ID: NYSC/Yorktown
Login Number: M3-04-0472

ANALYTICAL RESULTS

Aromatic Volatile Organics in Soil
Modified EPA Method 8020[a]

GTEL Sample Number		040472-06	--	--	--
Client Identification		MW-4S	--	--	--
Date Sampled		04/14/93	--	--	--
Date Analyzed		04/21/93	--	--	--
Analyte	Reporting Limit, mg/kg	Concentration, mg/kg (dry)			
Benzene	0.05	< 0.05	--	--	--
Toluene	0.05	**0.35**	--	--	--
Ethylbenzene	0.10	**0.49**	--	--	--
Xylenes (total)	0.20	**2.0**	--	--	--
BTEX (total)	--	**2.8**	--	--	--
Sample Dilution Factor[b]		1.31	--	--	--
Percent Solids		77.0	--	--	--

a Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Revision 0, US EPA November 1986; Methanolic extraction by EPA Method 5030 (purge and trap). Method modified to include additional compounds.

b The sample dilution factor indicates the adjustments made to the data and detection limits as a result of dilutions and percent solids.

GTEL ENVIRONMENTAL LABORATORIES, INC.

Client Number: 830011098
Project ID: NYSC/Yorktown
Login Number: M3-04-0472

ANALYTICAL RESULTS

Aromatic Volatile Organics in Soil - Low Level
Modified EPA Method 8020[a]

GTEL Sample Number		040472-05	040472-07	--	--
Client Identification		MW-2H	MW-5S	--	--
Date Sampled		04/14/93	04/14/93	--	--
Date Analyzed		04/22/93	04/22/93	--	--
Analyte	Detection Limit, ug/kg	Concentration, ug/kg (dry)			
Benzene	1.0	< 1.1	< 2.2	--	--
Toluene	1.7	< 1.9	< 3.8	--	--
Ethylbenzene	1.0	< 1.1	< 2.2	--	--
Xylenes (total)	2.0	< 2.3	< 4.5	--	--
BTEX (total)	--	--	--	--	--
Detection Limit Multiplier[b]		1.13	2.25	--	--
Percent Solids		89.1	86.1	--	--

a Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Revision 0, Table 2, US EPA November 1986; sample prepared by EPA Method 5030. Method modified to include additional compounds. Results are reported on a dry weight basis.

b The detection limit multiplier indicates the adjustments made to the data and detection limits as a result of dilutions and percent solids.

GTEL ENVIRONMENTAL LABORATORIES, INC.

Client Number: 830011098
Project ID: NYSC/Yorktown
Login Number: M3-04-0472

ANALYTICAL RESULTS

Hydrocarbon Screen in Soil
by GC FID[a]

GTEL Sample Number		040472-01	040472-02	040472-03	040472-04
Client Identification		MW-5H	MW-1H	MW-4H	MW-3H
Date Sampled		04/13/93	04/13/93	04/14/93	04/14/93
Date Extracted		04/19/93	04/19/93	04/19/93	04/19/93
Date Analyzed		04/20/93	04/20/93	04/21/93	04/21/93
Analyte	Detection Limit, mg/kg	Concentration, mg/kg			
Gasoline	10	< 14	< 12	< 12	< 12
Mineral Spirits	10	< 14	< 12	< 12	< 12
Kerosine	10	< 14	< 12	< 12	< 12
Diesel	10	**12000**[bc]	**16000**[bc]	**410**[bc]	< 12
Fuel Oil #6	10	< 14	< 12	< 12	< 12
Lubricating Oil	10	**17000**[c]	**22000**[c]	**630**[c]	< 12[d]
Detection Limit Multiplier		1.39	1.18	1.17	1.18
Percent Solids, %		71.6	82.3	82.5	84.5

a Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Revision 0, US EPA November 1986; Methylene chloride extraction by modified EPA Method 3550; modification as per California State Water Resources Control Board LUFT Manual protocols. Concentration calculated on a dry weight basis.

b The sample chromatogram shows a loss of n-alkanes consistent with models of a degraded diesel.

c The sample chromatogram shows the presence of more than one hydrocarbon pattern, diesel and lubricating oil. Some component peaks from each pattern are present in the quantitation window for the others. The reported value represents a maximum concentration found in the sample.

d The sample chromatogram shows the presence of trace level hydrocarbon peaks in the boiling point range of lubricating oil that appear to be petroleum in nature but do not match instrument standards. Identification of these compounds is beyond the scope of this analysis.

GTEL ENVIRONMENTAL LABORATORIES, INC.

Client Number: 830011098
Project ID: NYSC/Yorktown
Login Number: M3-04-0472

ANALYTICAL RESULTS

Hydrocarbon Screen In Soil
by GC FID[a]

GTEL Sample Number		040472-05	040472-06	040472-07	--
Client Identification		MW-2H	MW-4S	MW-5S	--
Date Sampled		04/14/93	04/14/93	04/14/93	--
Date Extracted		04/19/93	04/19/93	04/19/93	--
Date Analyzed		04/21/93	04/21/93	04/21/93	--
Analyte	Detection Limit, mg/kg	Concentration, mg/kg			
Gasoline	10	< 10	< 13[e]	< 11	--
Mineral Spirits	10	< 10	< 13	< 11	--
Kerosine	10	< 10	**3200**[fg]	< 11	--
Diesel	10	< 10	< 13	< 11	--
Fuel Oil #6	10	< 10	< 13	< 11	--
Lubricating Oil	10	< 10[d]	< 13	< 11	--
Detection Limit Multiplier		1.04	1.26	1.07	--
Percent Solids, %		89.1	77.0	86.1	--

a Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Revision 0, US EPA November 1986; Methylene chloride extraction by modified EPA Method 3550; modification as per California State Water Resources Control Board LUFT Manual protocols. Concentration calculated on a dry weight basis.

d The sample chromatogram shows the presence of trace level hydrocarbon peaks in the boiling point range of lubricating oil that appear to be petroleum in nature but do not match instrument standards. Identification of these compounds is beyond the scope of this analysis.

e The sample chromatogram shows the presence of a significant quantity of hydrocarbon peaks in the boiling point range of gasoline that appear to be petroleum in nature but do not match instrument standards. Identification of these compounds is beyond the scope of this analysis.

f The sample chromatogram shows the presence of more than one hydrocarbon pattern, kerosine and non-target hydrocarbon peaks. Some component peaks from the non-target hydrocarbons are present in the quantitation window for kerosine. The reported value represents a maximum concentration found in the sample.

g The sample chromatogram shows a loss of n-alkanes consistent with models of a degraded kerosine.

GTEL ENVIRONMENTAL LABORATORIES, INC.

Client Number: 830011098
Project ID: NYSC/Yorktown
Login Number: M3-04-0472

ANALYTICAL RESULTS

Extractable Organic Halides in Soil[a]

Sample Identification		Date Sampled	Date Analyzed	Percent Solids, %	Detection Limit, mg/kg	Concentration, mg/kg
GTEL No.	Client ID	--	--	--	--	--
040472-01	MW-5H	04/13/93	04/22/93	71.6	85	< 85
040472-02	MW-1H	04/13/93	04/22/93	82.3	74	< 74
040472-03	MW-4H	04/14/93	04/22/93	82.5	74	< 74
040472-04	MW-3H	04/14/93	04/22/93	84.5	72	< 72
040472-05	MW-2H	04/14/93	04/22/93	89.1	68	< 68
040472-06	MW-4S	04/14/93	04/22/93	77.0	79	< 79
040472-07	MW-5S	04/14/93	04/22/93	86.1	71	< 71

a EPA 600/4-84-008, Appendix D, Method for Extractable Organic Halides in Soil, US EPA, June, 1983. Concentration is calculated on a dry weight basis.

GTEL ENVIRONMENTAL LABORATORIES, INC.

Client Number: 830011098
Project ID: NYSC/Yorktown
Login Number: M3-04-0472

ANALYTICAL RESULTS

Total Recoverable Petroleum Hydrocarbons in Soil
by Infrared Spectrometry
Modified EPA Method 418.1[a]

Sample Identification		Date Sampled	Date Extracted	Date Analyzed	Percent Solids, %	Detection Limit, mg/kg	Concentration, mg/kg
GTEL No.	Client ID	--	--	--	--	--	--
040472-01	MW-5H	04/13/93	04/21/93	04/22/93	71.6	2100	**28000**
040472-02	MW-1H	04/13/93	04/21/93	04/22/93	82.3	2000	**31000**
040472-03	MW-4H	04/14/93	04/21/93	04/22/93	82.5	940	**4900**
040472-04	MW-3H	04/14/93	04/21/93	04/22/93	84.5	39	**49**
040472-05	MW-2H	04/14/93	04/21/93	04/22/93	89.1	34	< 34
040472-06	MW-4S	04/14/93	04/21/93	04/22/93	77.0	200	**720**
040472-07	MW-5S	04/14/93	04/21/93	04/22/93	86.1	35	< 35

a EPA 600/4-79-020, March 1983 revision. Extraction modified for soils (Soxhlet). Concentration calculated on a dry weight basis.

GTEL ENVIRONMENTAL LABORATORIES, INC.

GTEL ENVIRONMENTAL LABORATORIES, INC.

MEADOWBROOK INDUSTRIAL PARK
MILFORD, NH 03055
(603) 672-4835
(800) LAB-GTEL

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST 54874

ompany Name: STI/OSI

Phone #: 804 436 7881

FAX #: 804 436 2312

ompany Address: 144-B EXECUTIVE ROAD SUITE 100 [illegible] 23320

Site location: NSC/YORKTOWN FUEL ANNEX YORKTOWN, VA

roject Manager: TAYLOR SWORD

Client Project ID: (#) 830011098-020402

(NAME) NSC/YORKTOWN

attest that the proper field sampling rocedures were used during the collection f these samples. RJP

Sampler Name (Print): RICHARD J PACIORKA

ANALYSIS REQUEST

Field Sample ID	GTEL Lab # (Lab use only)	# Containers	Matrix: WATER	SOIL	AIR	SLUDGE	PRODUCT	OTHER	Method Preserved: HCl	HNO_3	H_2SO_4	ICE	UNPRESERVED	OTHER (SPECIFY)	Sampling: DATE	TIME	BTEX/602 ☐ 8020 ☒ with MTBE ☐	BTEX/Gas Hydrocarbons PID/FID ☐ with MTBE ☐	Hydrocarbons GC/FID Gas ☐ Diesel ☐ Screep ☒	Hydrocarbon Profile (SIMDIS) ☐	Oil and Grease 413.1 ☐ 413.2 ☐ SM 503 ☐	TPH/IR 418.1 ☒ SM 503 ☐	EDB by 504 ☐ DBCP by 504 ☐	EPA 503.1 ☐ EPA 502.2 ☐	EPA 601 ☐ EPA 8010 ☐	EPA 602 ☐ EPA 8020 ☐	EPA 608 ☐ 8080 ☐ PCB only ☐	EPA 624/PPL ☐ 8240/TAL ☐ NBS (+15) ☐	EPA 625/PPL ☐ 8270/TAL ☐ NBS (+25) ☐	EPA 610 ☐ 8310 ☐	EP TOX Metals ☐ Pesticides ☐ Herbicides ☐	TCLP Metals ☐ VOA ☐ Semi-VOA ☐ Pest ☐ Herb ☐	EPA Metals - Priority Pollutant ☐ TAL ☐ RCRA ☐	CAM Metals TTLC ☐ STLC ☐	Lead 239.2 ☐ 200.7 ☐ 7420 ☐ 7421 ☐ 6010 ☐	Organic Lead ☐	Corrosivity ☐ Flash Point ☐ Reactivity ☐	OTHER: TOX		
MW-5H	1	5		X								X			4/13	1430	X		X			X															X		
MW-1H	2	5		X								X			4/13	1520	X		X			X															X		
MW-4H	3	6		X								X			4/14	0900	X		X			X															X		
MW-3H	4	6		X								X			4/14	0945	X		X			X															X		
MW-2H	5	5		X								X			4/14	1040	X		X			X															X		
MW-4S	6	6		X								X			4/14	1330	X		X			X															X		
MW-5S	7	5		X								X			4/14	1350	X		X			X															X		

TAT

- Priority (24 hr) ☐
- Expedited (48 hr) ☐
- 7 Business Days ☐
- Other STD
- Business Days ☐

Special Handling

- GTEL Contact
- Quote/Contract #
- Confirmation #
- PO #

QA / QC LEVEL

BLUE ☐ CLP ☐ OTHER

SPECIAL DETECTION LIMITS

SPECIAL REPORTING REQUIREMENTS

FAX ☒

REMARKS

PROJECT ID: NSC/YORKTOWN

Lab Use Only Lot #

Storage Location: [illegible] WA

Work Order #

CUSTODY RECORD

Relinquished by Sampler:	Date	Time	Received by:
[signature]	4/15/93	1705	
Relinquished by:	Date	Time	Received by:
Relinquished by:	Date	Time	Received by Laboratory:
	4/16/93	1140	2584001022 Waybill # [signature]

ev. 7/91

Post-Pilot Test Analytical Results

COMPUCHEM LABORATORIES, INC. P.O. Box 12652 3308 Chapel Hill/Nelson Highway Research Triangle Park, NC 27709 (919) 549-8263

August 13, 1993

Mr. Joseph Giandonato
GROUNDWATER TECHNOLOGY
233 Wilimington-W.Chester Pike
Suite 201
Chadds Ford, PA 19317

Dear Mr. Giandonato:

We at CompuChem Laboratories are pleased to provide our report for the analysis you requested. Data for the following sample(s) are enclosed.

Client Sample ID	Lab Sample ID	Analysis Code	Order Number	Description of Work Requested
DISCOMP	562739	1028	27539	Volatiles GC Method 8020 (Style 3)

Unless noted by Quality Assurance Notices included in this report of data, all Quality Control requirements associated with the preparation and analysis of these samples have been met.

Release of the analytical data contained in this data package has been authorized by the Technical Review Manager or his designee, as verified by the signature below.

Thank you for selecting CompuChem Laboratories for your sample analysis. If you have questions concerning this report or the analytical methods employed, please contact your Sales Representative at 800-833-5097.

We hope you will consider CompuChem Laboratories for your future analytical support and service requirements.

Sincerely,

Patricia B. Hopkins

Report Preparation
CompuChem Laboratories, Inc.

COMPUCHEM LABORATORIES, INC.
COMMERCIAL DATA PACKAGE
REPORT STYLE 3 - GC VOLATILE

I. METHOD REFERENCE

II. CHAIN OF CUSTODY

III. QUALITY CONTROL SUMMARY

IV. SAMPLE DATA

V. STANDARDS DATA

VI. RAW QUALITY CONTROL DATA

I. METHOD REFERENCE

METHOD REFERENCE

This method is for the analysis of purgeable aromatic compounds. CompuChem will employ a procedure which meets the requirements of EPA method 602 as published in the Federal Register (Vol. 49, No. 209, pp. 43272-43080) and EPA Methods 8000, 5030 and 8020 as published in the SW-846 manual, 3rd edition.

Method Summary

This is a purge and trap gas chromatographic (GC) method. Helium is bubbled through a 5ml water sample contained in a specially designed purging chamber at ambient temperature. The target analytes are efficiently transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent trap where the target analytes are trapped. After purging is completed, the trap is heated and backflushed with helium to desorb the target analytes onto a gas chromatographer column. The gas chromatographer is temperature programmed to separate the target analytes which are then detected with a photoionization detector (PID).

II. CHAIN OF CUSTODY

CHAIN-OF-CUSTODY RECORD

№ 33779

CompuChem Laboratories, Inc
3308 Chapel Hill/Nelson Highway
Research Triangle Park, NC 27709

1-800-833-5097

Ship to:

Project Name: YORKTOWN

Field Point-of-Contact: William L. Hughes

Sampler Name: Bill Hughes

Telephone No: (804) 436-7881

Sampling for project complete? (Y) or N (See Note 1.)

Carrier: AIRBORNE

Airbill No.: 5904362225

Sampler Signature: William L. Hughes

Project-specific (PS) or Batch (B) QC: ____

Box #1: 1. Surface Water 2. Ground Water 3. Leachate 4. Rinsate 5. Soil/Sediment/Sludge 6. Trip Blank 7. Oil 8. Waste 9. Other: ____

Box #2: A. HCl B. HNO_3 C. $NaHSO_4$ D. $Na_2S_2O_3$ E. Ice Only O. Other: ____ N. Not Preserved

Box #3: F. Filtered U. Unfiltered

Box #4: C. CLP 3/90 S. SW-846 W. CWA 600-series L. Low Conc. CLP R. Radiological T. TCLP O. Other

Box #5: H - High M - Medium L - Low

Sample ID (Organics: 8 characters max, Inorganics: 6 characters; see Note 2)	Date: Year: 19__	Time	Box #1 Matrix	Box #2 Preservative	Box #3 Filtered/Unfiltered	Box #4 Method	Box #5 Expect. Conc.	No. of Bottles	Use for Lab QC (MS or DUP)	Organics Analysis: VOA-GC/MS	SV-GC/MS	Pest/PCB-GC	Herb-GC	VOA-GC	Inorganics: Metals	Mercury	Cyanides	Other: Radiologicals	TOC/TOX	O&G/TPH	Phenols	Other
DISPCOMP	7/12	2:15	S	E	U	O	H	8														
	/	:																				
	/	:																				
	/	:																				
	/	:																				
	/	:																				
	/	:																				
	/	:																				
	/	:																				
	/	:																				

562729 562734
733 735
739

Remarks/Comments

~~TCL~~ BTEX by EPA 8020
TCLP Metals
% Moisture
TOX by EPA 9020
TPH by EPA 418.1
PCBs by EPA 8080

ID USED: DISCOMP

RECEIVED IN GOOD CONDITION 07/14/93

Client's Special Instructions:

Lab: Received In Good Condition? Y or N

Describe Problems, If Any:

#1 Relinquished By: (Sig.) William L Hughes	Date: 7/13/93	#2 Relinquished By: (Sig.)	Date:	#3 Relinquished By: (Sig.)	Date:	Sample storage time requested?____ (In days, see Note 3)
Company Name: GSI	Time: 4:00	Company Name:	Time:	Company Name:	Time:	
#1 Received By: (Sig.) V. Batta	Date: 7/14/93	#2 Received By (Sig.)	Date:	#3 Received By: (Sig.)	Date:	DESTROY or RETURN data after five years of archival? (Circle choice; see Note 4)
Company Name: CompuChem	Time: 0830	Company Name:	Time:	Company Name:	Time:	

Note (1): If "N" old samples to await remainder of project-maximizing batch size and minimizing QC ratio; if "Y" lab will ocessing batches now. Note (2): If CLP Inorganics diskette required, ID limited to maximum of six characte
Note (3): Sam d 60 days after date report mailed at no extra charge. Note (4): All lab copies of data destroyed after five unless client requests and pays for return of copies; annual storage fee billed in January of year six.

III. QUALITY CONTROL SUMMARY

A. Surrogate Percent Recovery Summary (Form II)

B. Matrix Spike/Matrix Spike Duplicate Comparison (Form III)

C. Analytical Sequence (Form VIII) for all applicable GC columns and instruments, in chronological order by GC column and instrument.

2F

SOIL AROMATIC VOLATILE SURROGATE RECOVERY

Lab Name: COMPUCHEM,RTP Contract:

Lab Code: COMPU Case No.: 27539 SAS No.: SDG No.: 362

GC Column (1): RTX-502.2 ID: 0.53(mm) GC Column (2): RTX-1 ID: 0.53(mm)

	SAMPLE NO.	BFB 1 %REC #	BFB 2 %REC #	%REC #	%REC #	OTHER (1)	OTHER (2)	TOT OUT
01	DISCOMP	79	78					0
02								
03								
04								
05								
06								
07								
08								
09								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

BFB = Bromofluorobenzene QC LIMITS (69-123)

Column to be used to flag recovery values.
* Values outside of QC Limits
D Surrogate diluted out.

FORM II 8020-2

IV. SAMPLE DATA

Sample data shall be arranged in packets with the Organic Analysis Data Sheet (Form I), followed by the raw data for volatile samples. These sample packets should then be placed in increasing client sample number, considering both letters and numbers in ordering samples.

A. TCL Results – Organic Analysis Data Sheet (Form I)

B. Sample Chromatogram

C. Quality Assurance Notices (if applicable)

DATA REPORTING QUALIFIERS

VALUE – If the result is a value greater than or equal to the Contract Required Quantitation Limit (CRQL), report the value.

U – Indicates compound was analyzed for but not detected. The sample Quantitation Limit must be corrected for dilution and for percent moisture. For example, 10 U for phenol in water if the sample final volume is the protocol-specified final volume. If a 1 to 10 dilution of extract is necessary, the reported limit is 100 U. For a soil sample, the value must also be adjusted for percent moisture. For example, if the sample had 24% moisture and a 1 to 10 dilution factor, the sample quantitation limit for phenol (330 U) would be corrected to:

$$\frac{(330\ U) \times df}{D} \quad \text{where } D = \frac{100 - \%\ \text{moisture}}{100}$$

and *df* = dilution factor

$$\text{At 24\% moisture, } D = \frac{100 - 24}{100} = 0.76$$

$$\frac{(330\ U) \times 10}{.76} = 4300\ U \text{ rounded to the appropriate number of significant figures}$$

For soil samples subjected to GPC clean-up procedures, the extract must be concentrated to 0.5 ml, and the sensitivity of the analysis is not compromised by the cleanup procedures. Therefore, the CRQL values will apply to all samples, regardless of cleanup. However, if a sample extract cannot be concentrated to the protocol-specified volume, this fact must be accounted for in reporting the sample quantitation limit.

J – Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed, or when the mass spectral data indicate the presence of a compound that meets the identification criteria, but the result is less than the sample quantitation limit but greater than zero. For example, if the sample quantitation limit is 10 ug/l, but a concentration of 3 ug/l is calculated, report it as 3J. The sample quantitation limit must be adjusted for dilution as dicussed for the U flag. The J flag is also applied to pesticide/Aroclor results where the pesticide/Aroclor is confirmed to be present but the concentration is less than the CRQL.

N – Indicates presumptive evidence of a compound. This flag is only used for tentatively identified compounds where the identification is based on a mass spectral library search. It is applied to all TIC results.

DATA REPORTING QUALIFIERS – PAGE 2

P – This flag is used for a pesticide/Aroclor target analyte when there is greater than 25% difference for detected concentrations between the two GC columns (see Form X). The lower of the two values is reported on Form I and flagged with a "P".

C – This flag applies to pesticide results where the identification has been confirmed by GC/MS. If GC/MS confirmation was attempted but *unsuccessful*, do *not* apply this flag; instead use a laboratory-defined flag, discussed below.

B – This flag is used when the analyte is found in the associated blank as well as in the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action. This flag must be used for a TIC as well as for a positively identified TCL compound.

E – This flag identifies compounds whose concentrations exceed the calibration range of the GC/MS instrument for that specific analysis. This flag will not apply to pesticides/PCBs analyzed by GC/EC methods. If one or more compounds have a response greater than full scale, the sample or extract must be diluted and re-analyzed according to the specifications. All such compounds with a response greater than full scale should have the concentration flagged with an "E" on the Form I for the original analysis. If the dilution of the extract causes any compounds identified in the first analysis to be below the calibration range in the second analysis, then the results of both analyses shall be reported on separate Forms I. The Form I for the diluted sample shall have the "DL" suffix appended to the sample number.

D – This flag identifies all compounds identified in an analysis at a secondary dilution factor. If a sample or extract is re-analyzed at a higher dilution factor, as in the "E" flag above, the "DL" suffix is appended to the sample number on the Form I for the diluted sample and all concentration values reported on that Form I are flagged with the "D" flag. This flag alerts data users that any discrepancies between the concentrations reported may be due to dilution of the sample or extract.

A – This flag indicates that a TIC is a suspected aldol-condensation product.

Other specific flags and footnotes may be required to properly define the results. If used, they must be fully described and such description attached to the Sample Data Summary Package and the SDG Narrative. If more than one flag is required, use "Y" and "Z" as needed. If more than five qualifiers are required for a sample result, use the "X" flag to combine several flags as needed. For instance, the "X" flag might combine the "A", "B", and "D" flags for some sample. The laboratory-defined flags are limited to the letters "X", "Y", and "Z".

1D
AROMATIC VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

DISCOMP

Lab Name: COMPUCHEM, RTP Contract:

Lab Code: COMPU Case No.: 27539 SAS No.: SDG No.: 362

Matrix: (soil/water) LO SL Lab Sample ID: 562739

Sample wt/vol: 2.50 (g/ml) G Date Received: 07/14/93

% Moisture: 17 decanted: (Y/N) N Date Analyzed: 07/21/93

Dilution Factor: 2 pH:

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
71-43-2	Benzene	0.24	JP
108-88-3	Toluene	0.75	JP
100-41-4	Ethylbenzene	3.3	JP
106-42-3	1,4-Dimethylbenzene	0.75	J
108-38-3	1,3-Dimethylbenzene	0.75	J
95-47-6	1,2-Dimethylbenzene	4.1	

Employee: 865 ANALYSIS WORKSHEET Page: 1

Name: COMPUCHEM,RTP Contract: Library: 8020TL

Lab Code: COMPU Case No.: 27539 SAS No.: SDG No.: 362

Sample ID: 562739 EPA ID: DISCOMP Matrix: LO SL

Sample Vol/Wt: 2.50 Split: 1.0 % Moisture: 17.00
Units: UG/KG Dry Wt Factor: 1.20

$$\text{conc} = \frac{\text{area} * \text{split factor} * \text{dry wt factor}}{\text{response factor} * \text{sample vol/wt}}$$

Col: RTX-1 Inst:VARIAN08 Date: 08/04/93 Time: 1735
Detection Level: 2.41 Sequence: 08V

Benzene	Std RT Window Low:	25.12	Sample RT :	25.45	PRIMARY
	Hi:	25.88	Sample Area:	1488	
	Response Factor :	2943.800	Sample Conc:	0.2436	
Toluene	Std RT Window Low:	32.77	Sample RT :	33.30	PRIMARY
	Hi:	33.77	Sample Area:	4648	
	Response Factor :	2971.000	Sample Conc:	0.7540	
Ethylbenzene	Std RT Window Low:	40.32	Sample RT :	40.94	PRIMARY
	Hi:	41.54	Sample Area:	18653	
	Response Factor :	2700.600	Sample Conc:	3.3287	
1,2-Dimethylbenzene	Std RT Window Low:	42.90	Sample RT :	43.85	CONFIRM
	Hi:	44.20	Sample Area:	24215	
	Response Factor :	2554.800	Sample Conc:	4.5679	
)omofluorobenzene	Std RT Window Low:	44.80	Sample RT :	45.47	CONFIRM
	Hi:	46.16	Sample Area:	229679	
	Response Factor :	1951.400	Sample Conc:	56.7227	78.47%
1,4-Dimethylbenzene	Std RT Window Low:	41.04	Sample RT :	41.72	CONFIRM
	Hi:	42.28	Sample Area:	5956	
	Response Factor :	3211.800	Sample Conc:	0.8937	
1,3-Dimethylbenzene	Std RT Window Low:	41.04	Sample RT :	41.72	CONFIRM
	Hi:	42.28	Sample Area:	5957	
	Response Factor :	3211.800	Sample Conc:	0.8938	

Col: RTX-502.2 Inst:VARIAN01 Date: 07/21/93 Time: 0900
Detection Level: 2.41 Sequence: 01Q

Benzene	Std RT Window Low:	25.76	Sample RT :	26.14	CONFIRM
	Hi:	26.54	Sample Area:	35894	
	Response Factor :	6396.001	Sample Conc:	1.3523	
Toluene	Std RT Window Low:	33.07	Sample RT :	33.38	CONFIRM
	Hi:	34.07	Sample Area:	166388	
	Response Factor :	5051.201	Sample Conc:	7.9374	
Ethylbenzene	Std RT Window Low:	40.60	Sample RT :	41.24	CONFIRM
	Hi:	41.84	Sample Area:	564248	
	Response Factor :	4747.401	Sample Conc:	28.6395	
1,2-Dimethylbenzene	Std RT Window Low:	43.41	Sample RT :	44.02	PRIMARY
	Hi:	44.73	Sample Area:	91867	
	Response Factor :	5428.001	Sample Conc:	4.0782	
)ofluorobenzene	Std RT Window Low:	46.86	Sample RT :	47.58	PRIMARY
	Hi:	48.28	Sample Area:	550992	
	Response Factor :	4659.201	Sample Conc:	28.4961	78.84%

Employee: 865 ANALYSIS WORKSHEET Page: 2

Name: COMPUCHEM,RTP Contract: Library: 8020TL

Lab Code: COMPU Case No.: 27539 SAS No.: SDG No.: 362

Sample ID: 562739 EPA ID: DISCOMP Matrix: LO SL

Sample Vol/Wt: 2.50 Split: 1.0 % Moisture: 17.00
Units: UG/KG Dry Wt Factor: 1.20

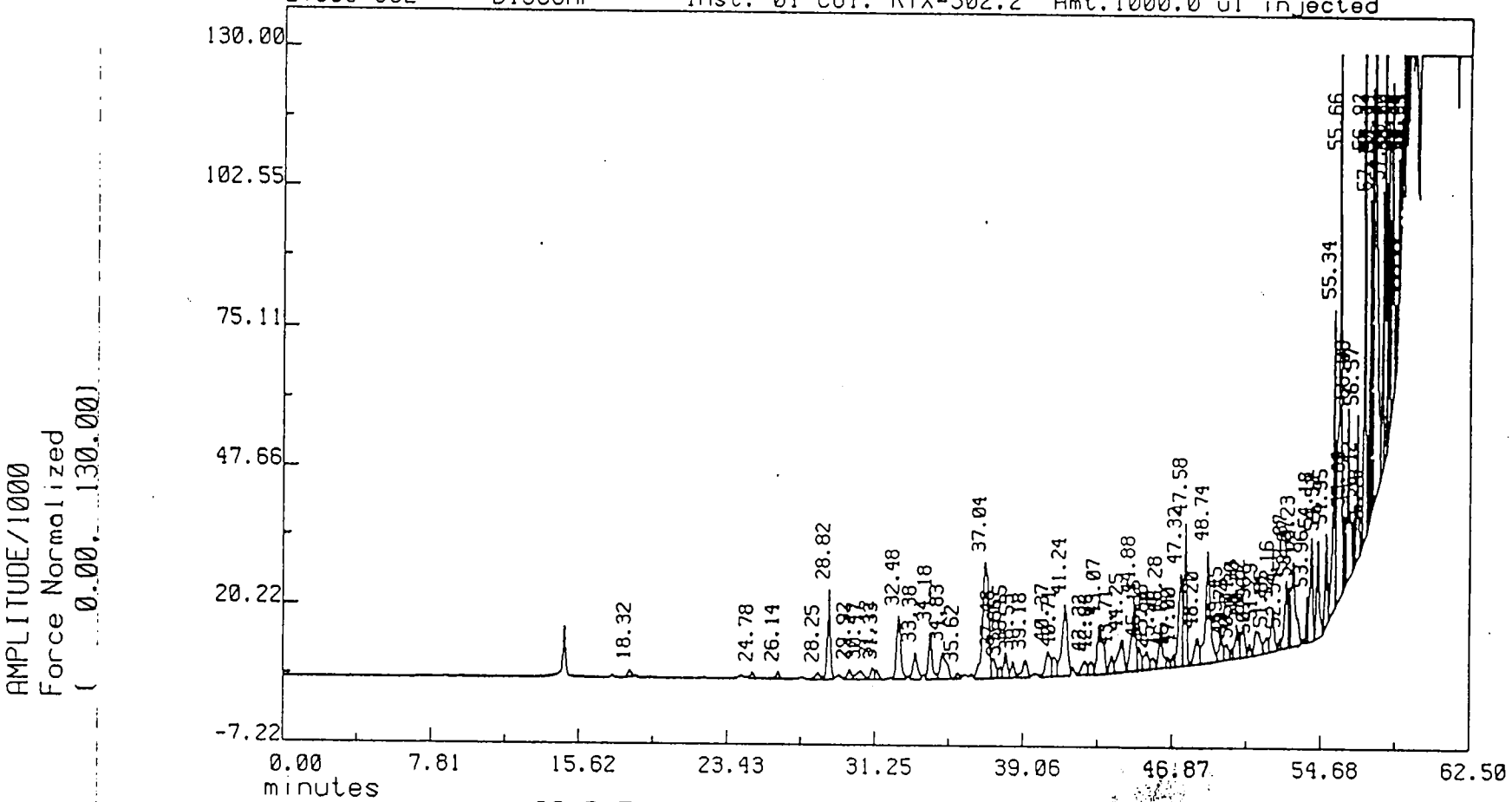
$$\text{conc} = \frac{\text{area} * \text{split factor} * \text{dry wt factor}}{\text{response factor} * \text{sample vol/wt}}$$

INJECTION CONTINUED FROM PREVIOUS PAGE

Col: RTX-502.2 Inst:VARIAN01 Date: 07/21/93 Time: 0900
Detection Level: 2.41 Sequence: 01Q

1,4-Dimethylbenzene	Std RT Window Low:	41.04	Sample RT :	41.68	PRIMARY
	Hi:	42.30	Sample Area:	17316	
	Response Factor :	5543.401	Sample Conc:	0.7527	
1,3-Dimethylbenzene	Std RT Window Low:	41.04	Sample RT :	41.68	PRIMARY
	Hi:	42.30	Sample Area:	17316	
	Response Factor :	5543.401	Sample Conc:	0.7527	

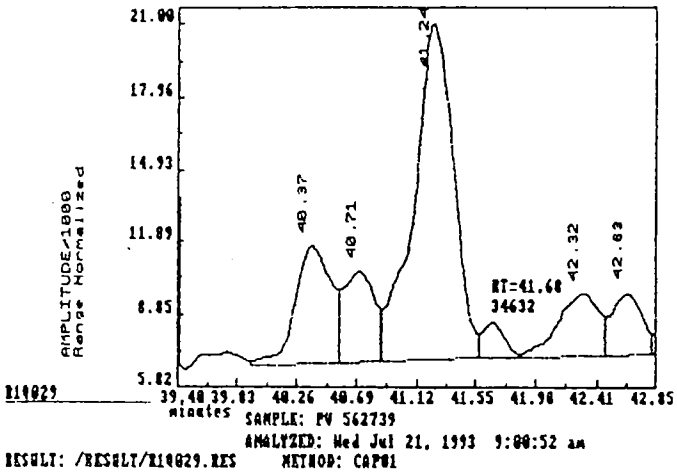
27539 362 DISCOMP Inst. 01 Col. RTX-502.2 Amt.1000.0 ul injected

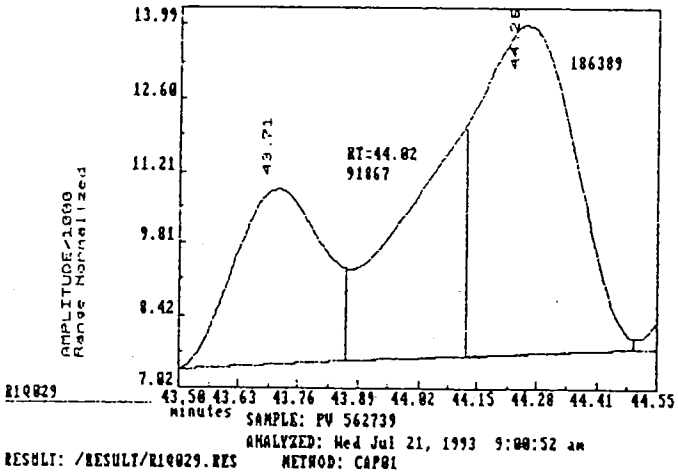


SAMPLE: PV 562739

ANALYZED: Wed Jul 21, 1993 09:00:52

RESULT: /RESULT/R1Q029.RES METHOD: CAP01

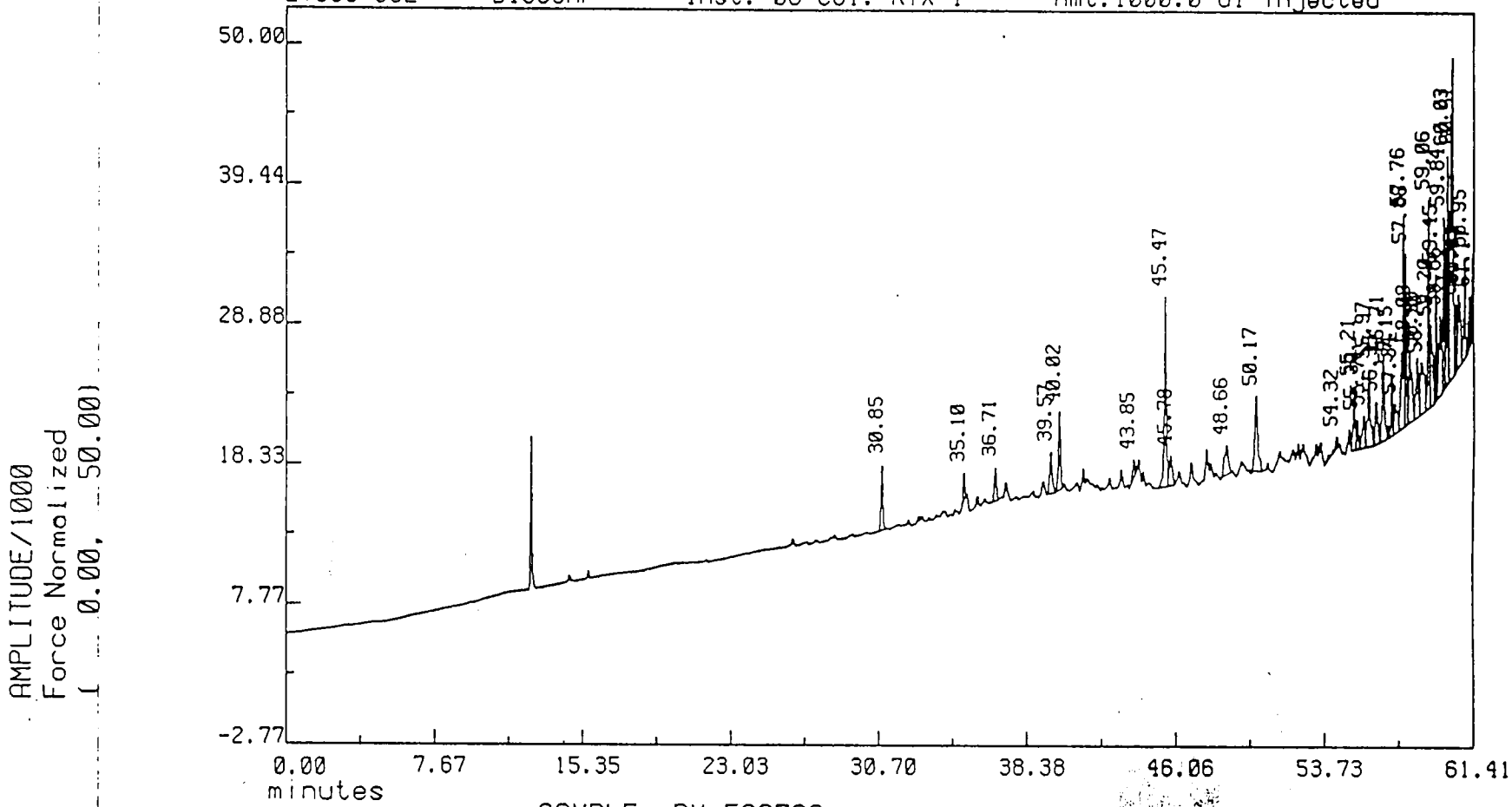

21.00
17.96
14.93
11.89
8.85
5.82
AMPLITUDE/1000
Range Normalized
40.37
40.71
41.24
RT=41.68
34632
42.32
42.63
R10029
39.48 39.83 40.26 40.69 41.12 41.55 41.98 42.41 42.85
minutes
SAMPLE: PV 562739
ANALYZED: Wed Jul 21, 1993 9:00:52 am
RESULT: /RESULT/R10029.RES METHOD: CAP01


13.99
12.60
11.21
9.81
8.42
7.02
AMPLITUDE-1000
Range Normalized
43.71
RT=44.02
91867
44.26
186389
R10829
43.50 43.63 43.76 43.89 44.02 44.15 44.28 44.41 44.55
minutes
SAMPLE: PV 562739
ANALYZED: Wed Jul 21, 1993 9:00:52 am
RESULT: /RESULT/R10029.RES METHOD: CAP01

Sample name: 562739
Instrument: 01
Injection time: 9307210900
sults file: /RESULT/R1Q029.res
ilution factor: 100.00

Peak	RT	Area	Compound
1	18.316	32383	Methyl-t-butyl ether
2	24.779	26659	
3	26.142	35894	Benzene
4	28.250	46017	
5	28.825	398832	
6	29.923	52929	
7	30.468	85921	
8	31.118	55318	
9	31.331	48599	
10	32.482	379359	
11	33.380	166388	Toluene
12	34.176	256241	
13	34.826	232084	
14	35.622	33378	
15	37.036	1033771	
16	37.481	120329	
17	37.857	51247	
18	38.145	124685	
19	38.529	78774	
	9.182	126646	
	0.369	180888	
22	40.715	116425	Chlorobenzene
23	41.237	564248	Ethylbenzene
24	42.320	106342	
25	42.632	77782	
26	43.072	402210	
27	43.710	94602	1,2-Dimethylbenzene
28	44.253	272109	Styrene
29	44.883	442832	
30	45.159	117481	
31	45.557	135423	
32	45.896	71732	
33	46.278	236768	
34	46.651	44139	
35	46.998	60832	
36	47.322	485252	
37	47.577	550992	Bromofluorobenzene
38	48.199	186284	
39	48.737	799721	
40	49.450	132818	
41	49.749	97650	
42	50.037	42624	
43	50.297	160100	
44	50.616	170010	
45	50.962	52323	
	1.291	212680	
	1.850	95256	
48	52.156	210111	
49	52.537	44160	
50	52.868	313908	
51	53.074	193377	
52	53.231	502469	
53	53.962	131946	1,3-Dichlorobenzene
54	54.180	404986	
55	54.520	359407	1,4-Dichlorobenzene
56	54.947	335732	
57	55.340	937009	
58	55.657	2055665	
59	55.892	257038	1,2-Dichlorobenzene
60	56.083	640468	
61	56.416	151284	
62	56.567	349154	
63	56.778	20642	
64	56.924	2283955	
65	57.194	618428	
66	57.339	887366	
67	57.472	2893517	
68	57.879	631580	
69	58.004	1624864	
70	58.193	615208	
71	58.394	741277	
72	58.559	114068	
73	58.702	309538	
74	58.844	237319	
75	58.951	417660	
76	41.680	17316	1,4-Dimethylbenzene
77	41.680	17316	1,3-Dimethylbenzene

27539 362 DISCOMP Inst. 08 Col. RTX-1 Amt.1000.0 ul injected



SAMPLE: PV 562739

ANALYZED: Wed Aug 4, 1993 17:35:21

RESULT: /RESULT/R8V010.RES METHOD: CAP08

Sample name: 562739

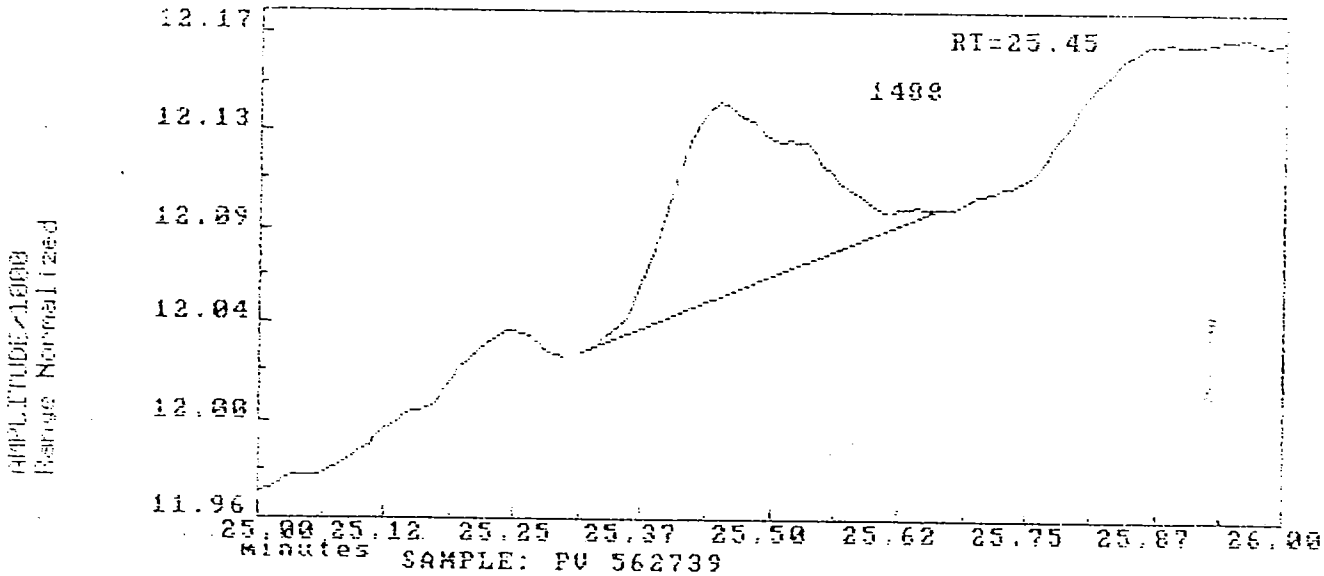
Instrument: A/D_8

Injection time: Wed Aug 4, 1993 5:35:21 pm

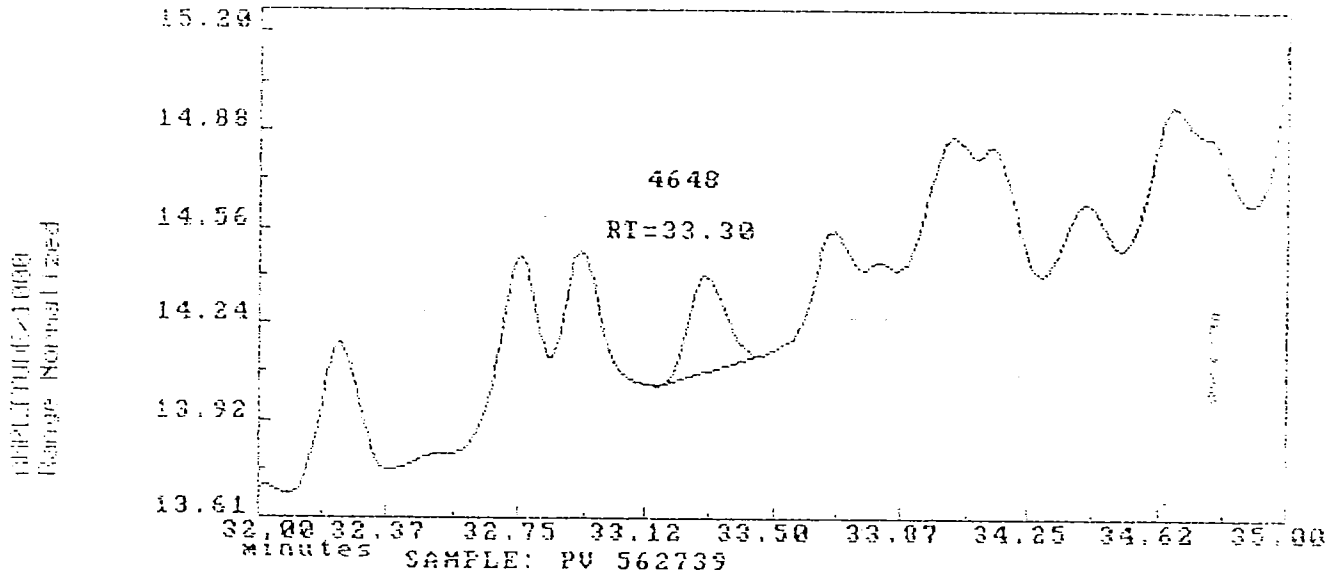
Results file; /result/R8V010.res

Dilution factor(%): 100.00

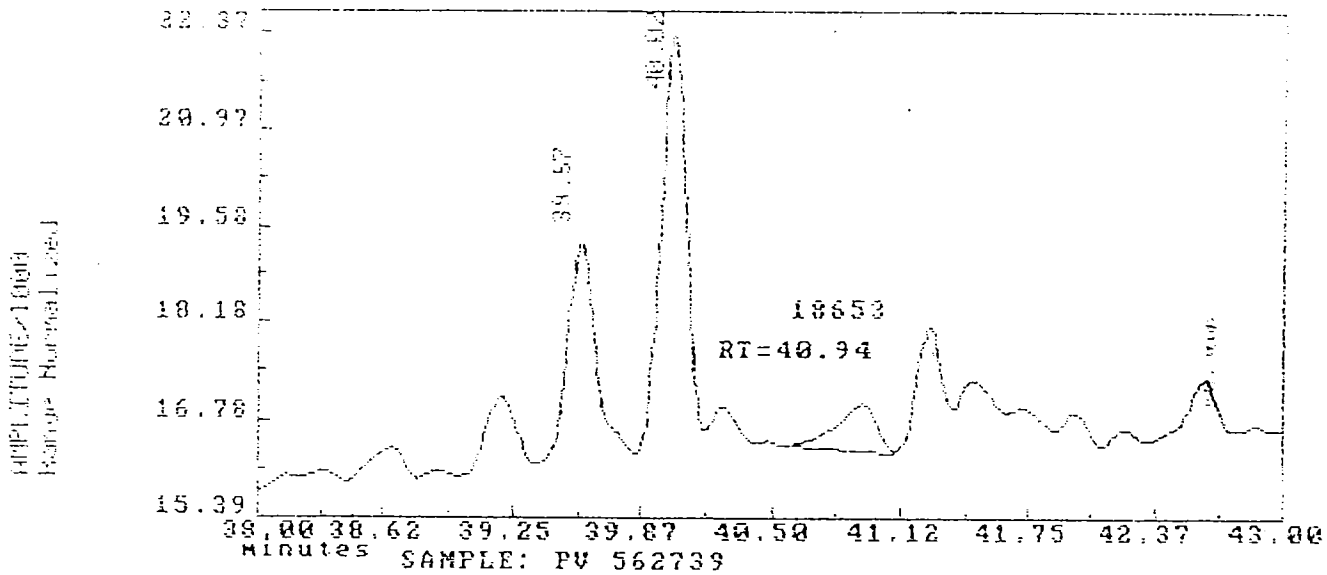
Peak	RT	Area
1	30.85	71124
2	35.10	25575
3	36.71	42109
4	39.57	56959
5	40.02	98526
6	43.85	24215
7	45.47	229679
8	45.78	45769
9	48.66	60557
10	50.17	125734
11	54.32	20824
12	55.21	64040
13	55.39	30820
14	55.71	48385
15	55.97	108151
16	56.35	56838
17	56.71	105533
18	57.15	55474
19	57.34	54404
[illegible]	57.76	218373
[illegible]	57.88	138947
22	58.08	108949
23	58.48	80472
24	58.70	107884
25	59.06	166539
26	59.20	98796
27	59.45	85884
28	59.66	109196
29	59.84	139589
30	60.03	190944
31	60.31	397762
32	60.51	76789
33	60.63	99432
34	60.95	90661
35	61.17	36394



SAMPLE: PV 562739
ANALYZED: Wed Aug 4, 1993 5:35:21 pm
RESULT: /RESULT/R8V010.RES METHOD: CAP08



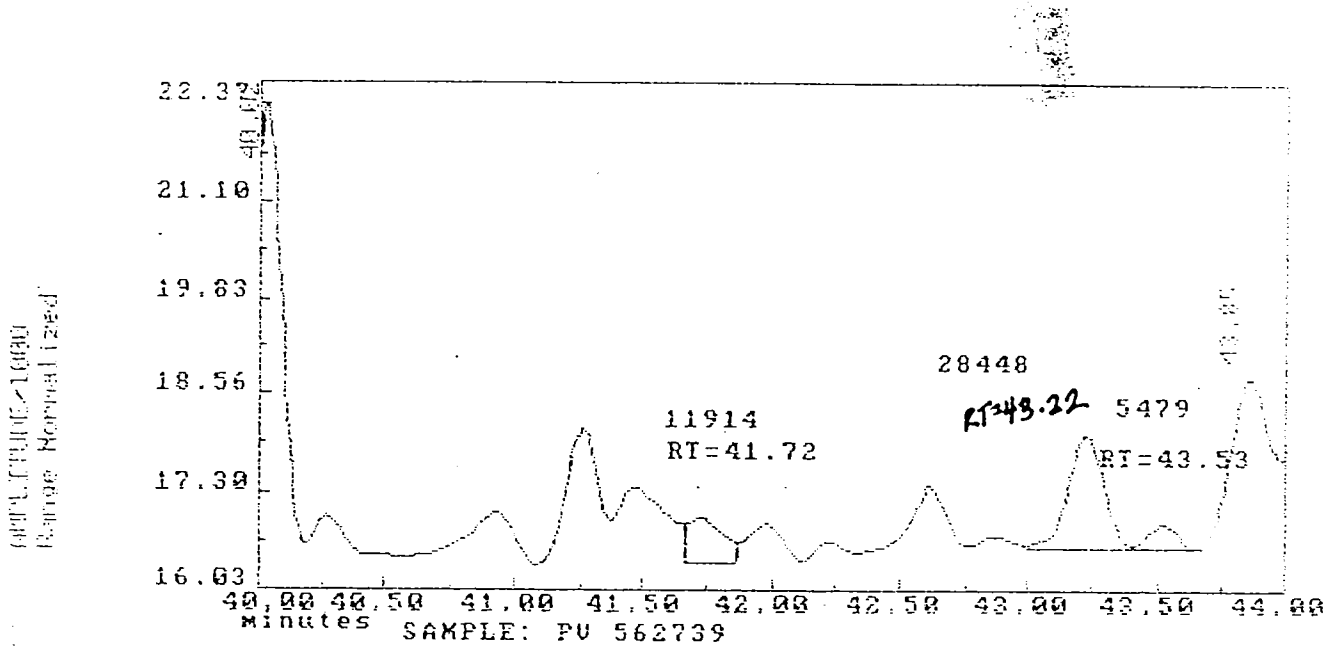
SAMPLE: PV 562739
ANALYZED: Wed Aug 4, 1993 5:35:21 pm
RESULT: /RESULT/R0U018.RES METHOD: CAP08



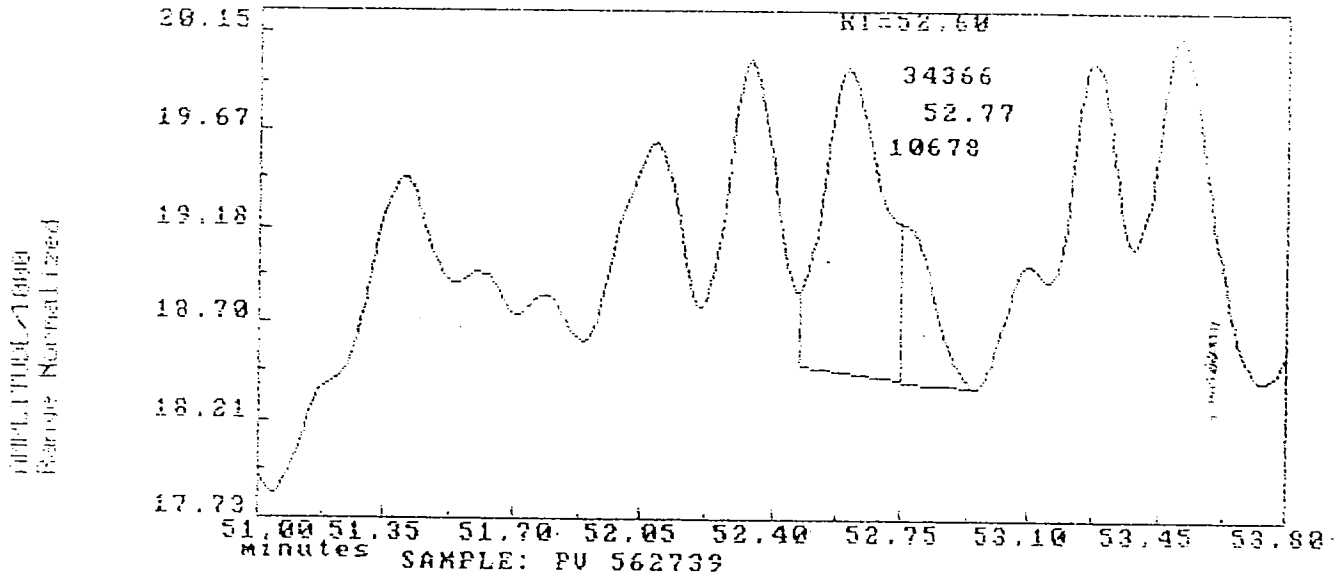
SAMPLE: PV 562739

ANALYZED: Wed Aug 4, 1993 5:35:21 pm

RESULT: /RESULT/R8V010.RES METHOD: CAP08



SAMPLE: PV 562739
ANALYZED: Wed Aug 4, 1993 5:35:21 PM
RESULT: /RESULT/R8V01G.RES METHOD: CAP08



SAMPLE: PV 562739
ANALYZED: Wed Aug 4, 1993 5:35:21 pm
RESULT: /RESULT/RSV010.RES METHOD: CAP08

LAB INSTRUCTIONS: METHOD 418.1

CASE#: 27539 DUE DATE:

B')/S-S/8020 DUAL COL
(1ETHOD 8020

GC WORKSHEET COMPUCHEM#: 562739

S/S/S

Sample Prep Code- -000
Instrument Code--- 168
Compound List------522
Surrogate Std------420
Internal Std-------000

SAMPLE ID: DISCOMP

==========

VOLUME OF SAMPLE: _____ ug

==========

ANALYSIS INFORMATION:

INSTRUMENT #	DATE	TIME	SEQUENCE	DILUTION FACTOR	REPORT
1	7/21/93	0900	1Q	1	[X]
~~28~~	8/4/93	17:35	8V	1Z	[X]
					[ ]
					[ ]

SEND TO QA [ ]
QA APPROVED [ ]
NEED GC/MS CONFIRMATION [ ]

1st ANALYST: 865 DATE: 8/10/93

2nd ANALYST: _____ DATE: _____

==========

GC REVIEW

CONDITION CODE: OK

Reviewed by: _____ Date ____/____/____
COMMENTS:

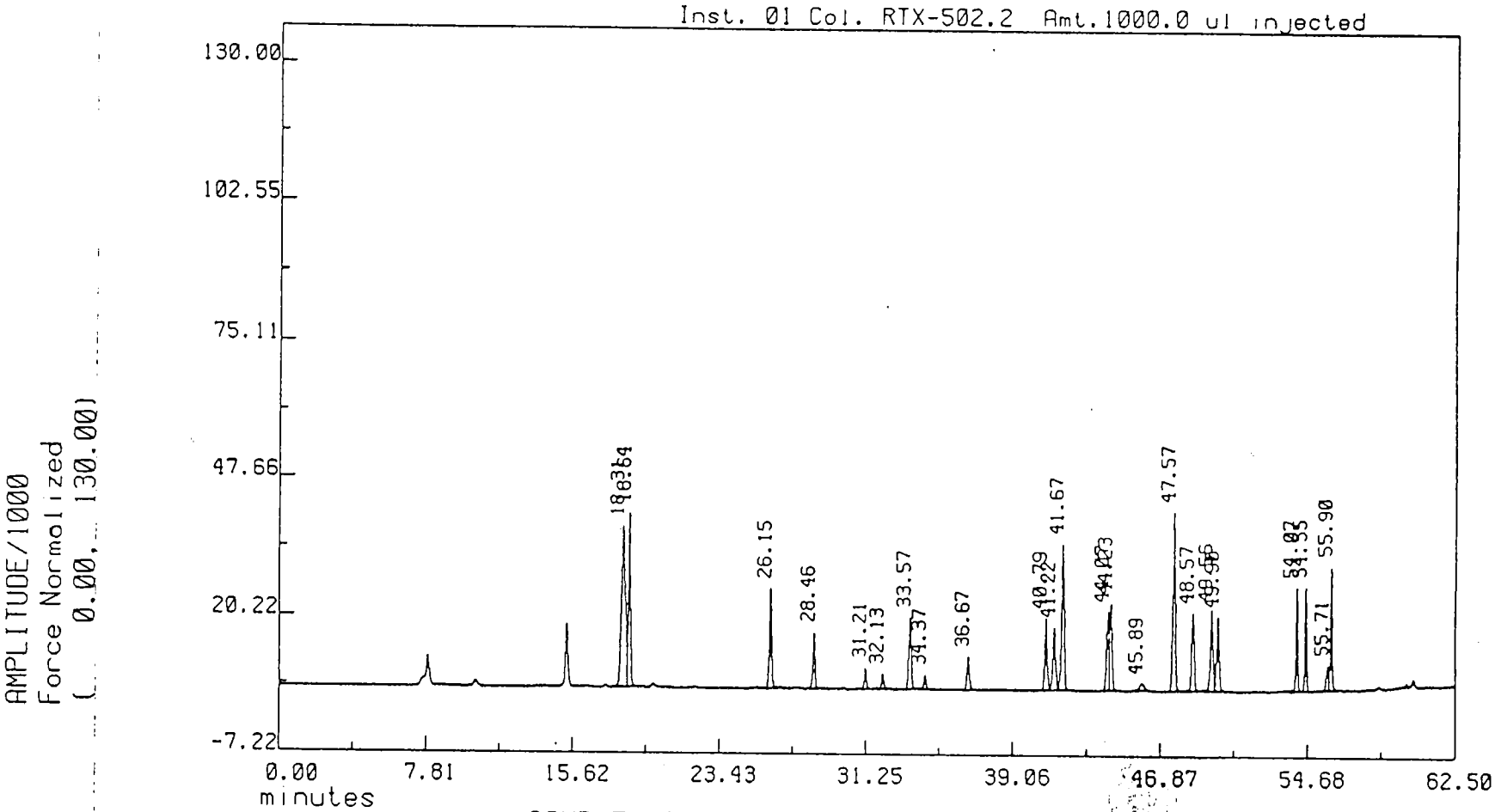
LABORATORY NOTICE
SDG 502739
CLIENT ID PDSCOMP
CASE 28539 SDG 302
METHOD BTEX

The primary analysis of the above sample was performed within the specified holding times. Due to the presence of target analytes above detection levels, a second analysis was required for confirmation. This analysis was performed at a 2:1 dilution due to high levels of non-target analytes which were saturating the detector and causing contamination of the analytical system. The confirmation was performed outside holding time specifications. The results between the two analyses were favorable. We are reporting both sets of data with reference to this notice.

Data Reviewer/ID CMC 865
Date 8/4/93

V. STANDARDS DATA

Volatile standard chromatograms for all standards associated with samples.



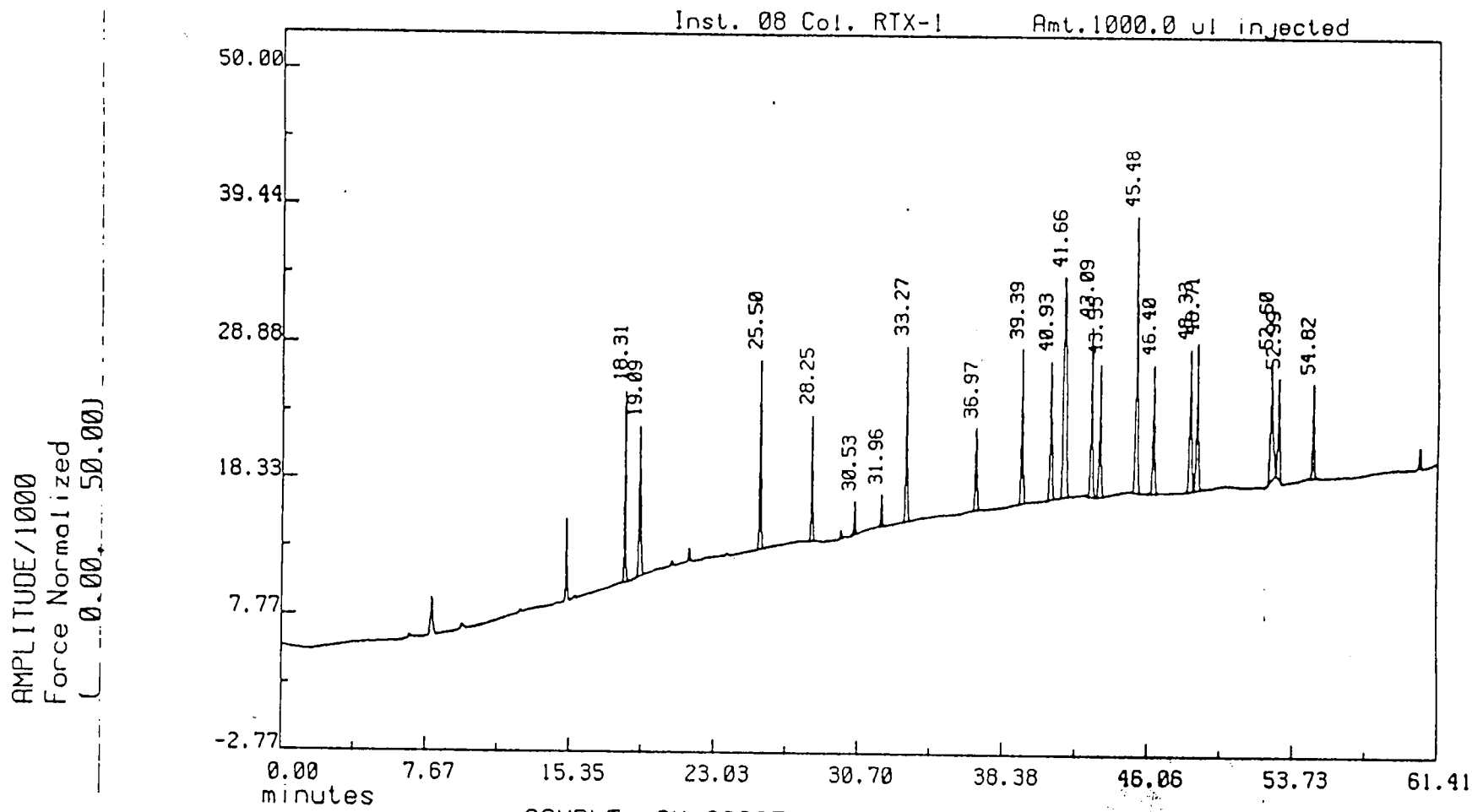
SAMPLE: CK 8020TLMED2 6G

ANALYZED: Tue Jul 20, 1993 23:17:13

RESULT: /RESULT/R1Q024.RES METHOD: CAP01

Sample name: 8020TLMED2 6G
Instrument: 01
Injection time: 9307202317
Results file: /RESULT/R1Q024.res
Dilution factor: 100.00

Peak	RT	Area	Compound	Ng
1	18.310	935386	Methyl-t-butyl ether	300.000
2	18.642	533566		
3	26.150	349928	Benzene	60.000
4	28.460	177201		
5	31.207	67750		
6	32.128	47352		
7	33.570	265925	Toluene	60.000
8	34.375	44086		
9	36.674	127993		
10	40.790	264343	Chlorobenzene	60.000
11	41.220	245888	Ethylbenzene	60.000
12	41.670	281090	1,4-Dimethylbenzene	60.000
13	44.070	294352	1,2-Dimethylbenzene	60.000
14	44.230	325812	Styrene	60.000
15	45.891	54165		
16	47.570	650867	Bromofluorobenzene	150.000
17	48.574	294869		
18	49.563	321148		
19	49.901	275156		
	4.070	280809	1,3-Dichlorobenzene	60.000
	54.550	252838	1,4-Dichlorobenzene	60.000
22	55.712	94189		
23	55.900	294337	1,2-Dichlorobenzene	60.000
24	41.670	281090	1,3-Dimethylbenzene	60.000



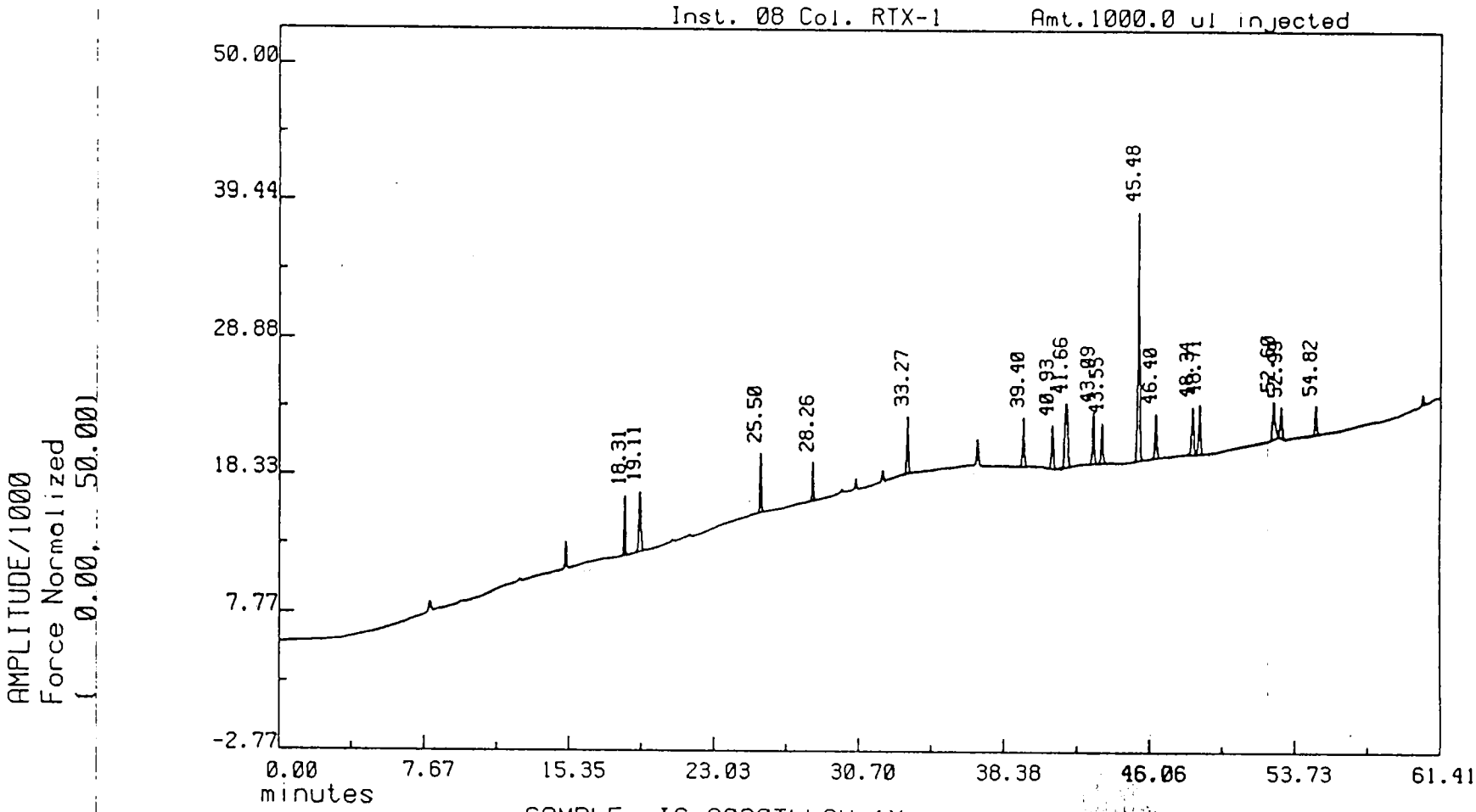
SAMPLE: CK 8020TLMED2 76

ANALYZED: Wed Aug 4, 1993 14:29:54

RESULT: /RESULT/R8V008.RES METHOD: CAP08

Sample name: 8020TLMED2 76
strument: 08 Injection time: 9308041429
esults file: /RESULT/R8V008.res
Dilution factor: 100.00

Peak	RT	Area	Compound	Ng
1	18.308	154361		
2	19.090	175889	Methyl-t-butyl ether	300.000
3	25.500	174323	Benzene	60.000
4	28.255	114975		
5	30.534	30305		
6	31.956	27261		
7	33.270	175388	Toluene	60.000
8	36.972	93175		
9	39.390	167833	Chlorobenzene	60.000
10	40.930	160195	Ethylbenzene	60.000
11	41.660	195774	1,4-Dimethylbenzene	60.000
12	43.090	190275	Styrene	60.000
13	43.550	156434	1,2-Dimethylbenzene	60.000
14	45.480	312369	Bromofluorobenzene	150.000
15	46.395	150980		
16	48.333	173125		
17	48.705	173468		
18	52.600	173882	1,3-Dichlorobenzene	60.000
[illegible]	[illegible].990	112200	1,4-Dichlorobenzene	60.000
[illegible]	[illegible].820	101733	1,2-Dichlorobenzene	60.000
21	41.660	195774	1,3-Dimethylbenzene	60.000



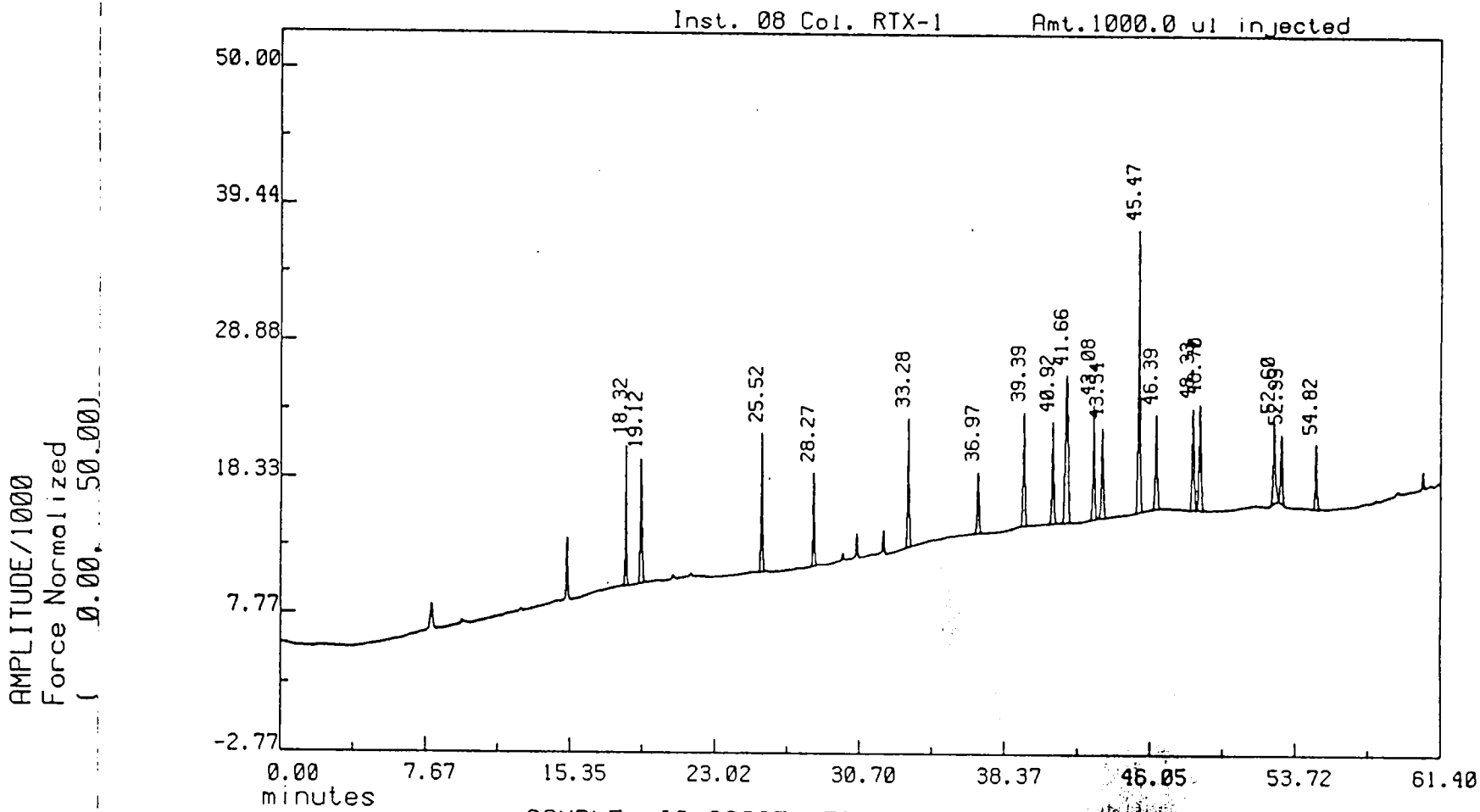
SAMPLE: IS 8020TLLOW 1Y

ANALYZED: Tue Aug 3, 1993 23:13:41

RESULT: /RESULT/R8V001.RES METHOD: CAP08

Sample name: 8020TLLOW 1Y
Instrument: 08
Injection time: 9308032313
Results file: /RESULT/R8V001.res
Dilution factor: 100.00

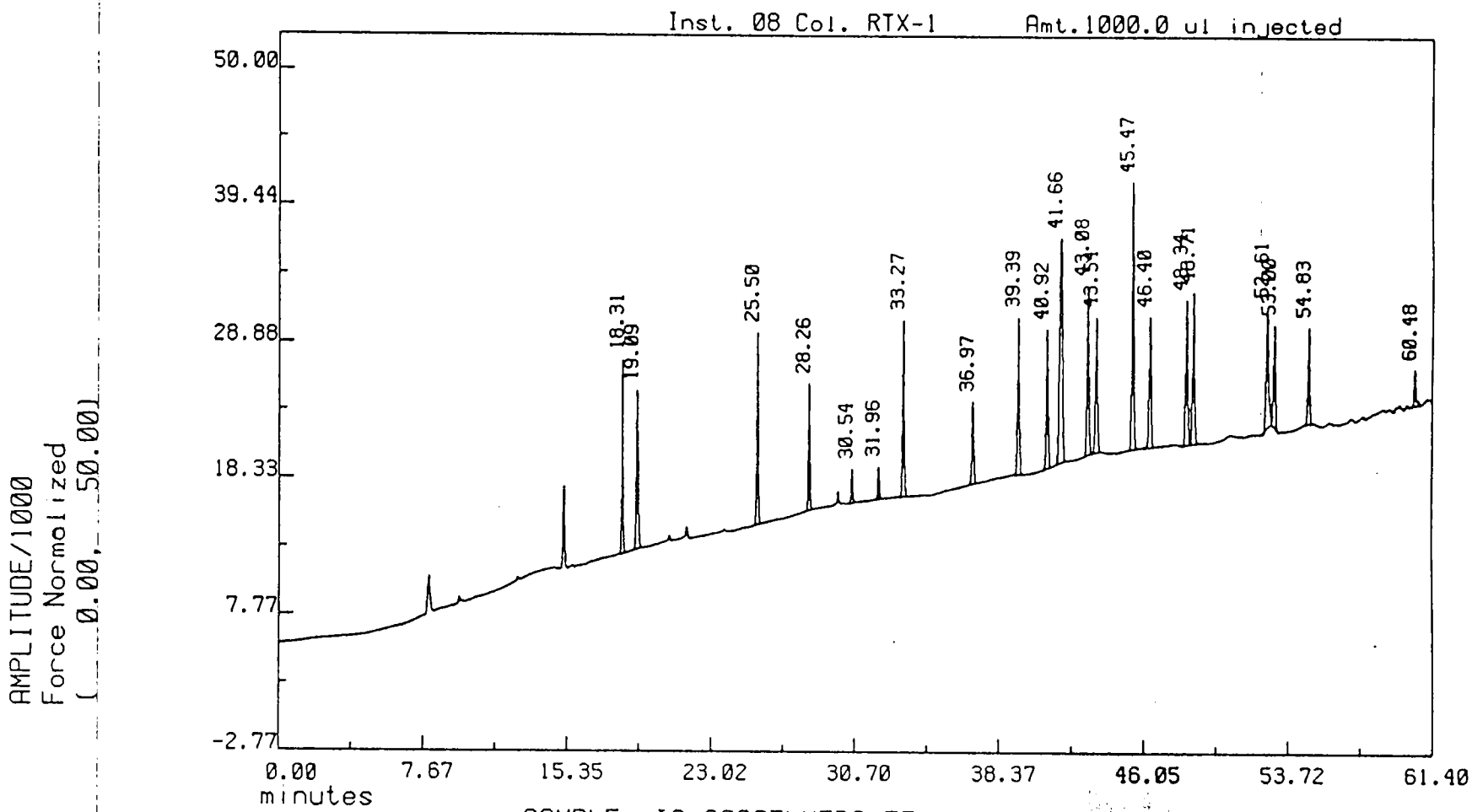
Peak	RT	Area	Compound	Ng
1	18.307	48133		
2	19.109	70432	Methyl-t-butyl ether	100.000
3	25.502	54694	Benzene	20.000
4	28.257	35840		
5	33.275	57029	Toluene	20.000
6	39.396	53249	Chlorobenzene	20.000
7	40.926	49840	Ethylbenzene	20.000
8	41.660	57581	1,4-Dimethylbenzene	20.000
9	43.090	58329	Styrene	20.000
10	43.548	47885	1,2-Dimethylbenzene	20.000
11	45.479	279782	Bromofluorobenzene	150.000
12	46.399	52205		
13	48.335	57925		
14	48.708	58045		
15	52.602	52723	1,3-Dichlorobenzene	20.000
16	52.992	34863	1,4-Dichlorobenzene	20.000
17	54.821	30685	1,2-Dichlorobenzene	20.000
18	41.660	57581	1,3-Dimethylbenzene	20.000



SAMPLE: IS 8020TLMED1 1X
ANALYZED: Wed Aug 4, 1993 00:36:00
RESULT: /RESULT/R8V002.RES METHOD: CAP08

Sample name: 8020TLMED1 1X
Instrument: 08
Injection time: 9308040036
Results file: /RESULT/R8V002.res
Dilution factor: 100.00

Peak	RT	Area	Compound	Ng
1	18.319	114184		
2	19.115	147362	Methyl-t-butyl ether	200.000
3	25.516	128277	Benzene	40.000
4	28.269	85410		
5	33.281	129120	Toluene	40.000
6	36.974	69417		
7	39.392	123556	Chlorobenzene	40.000
8	40.921	117541	Ethylbenzene	40.000
9	41.660	131797	1,4-Dimethylbenzene	40.000
10	43.082	128953	Styrene	40.000
11	43.541	105624	1,2-Dimethylbenzene	40.000
12	45.473	319494	Bromofluorobenzene	150.000
13	46.393	110412		
14	48.331	122131		
15	48.703	124039		
16	52.602	107910	1,3-Dichlorobenzene	40.000
17	52.993	77357	1,4-Dichlorobenzene	40.000
18	54.824	69153	1,2-Dichlorobenzene	40.000
19	41.660	131797	1,3-Dimethylbenzene	40.000



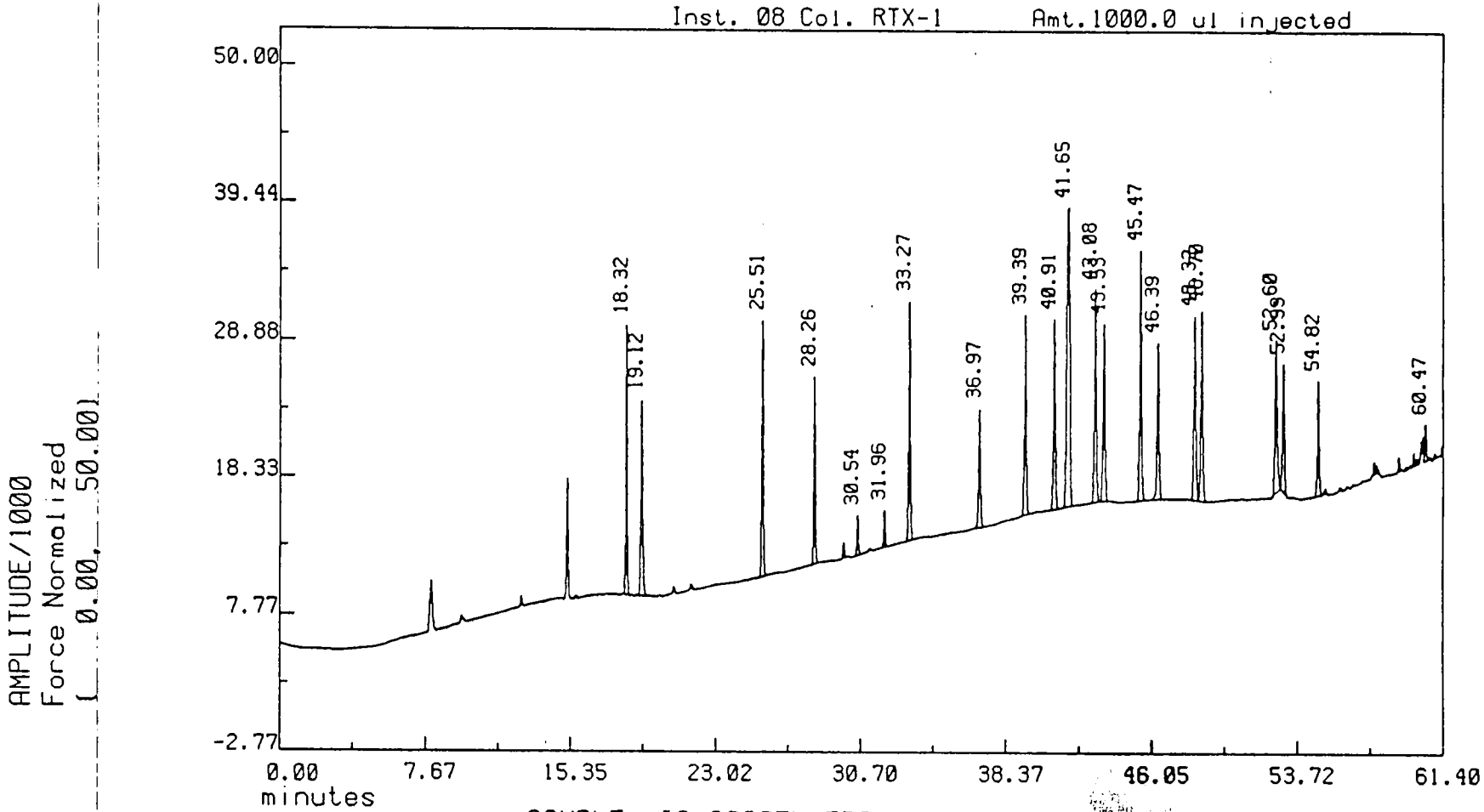
SAMPLE: IS 8020TLMED2 75

ANALYZED: Wed Aug 4, 1993 08:52:28

RESULT: /RESULT/R8V006.RES METHOD: CAP08

Sample name: 8020TLMED2 75
Instrument: 08
Injection time: 9308040852
;ults file: /RESULT/R8V006.res
.ilution factor: 100.00

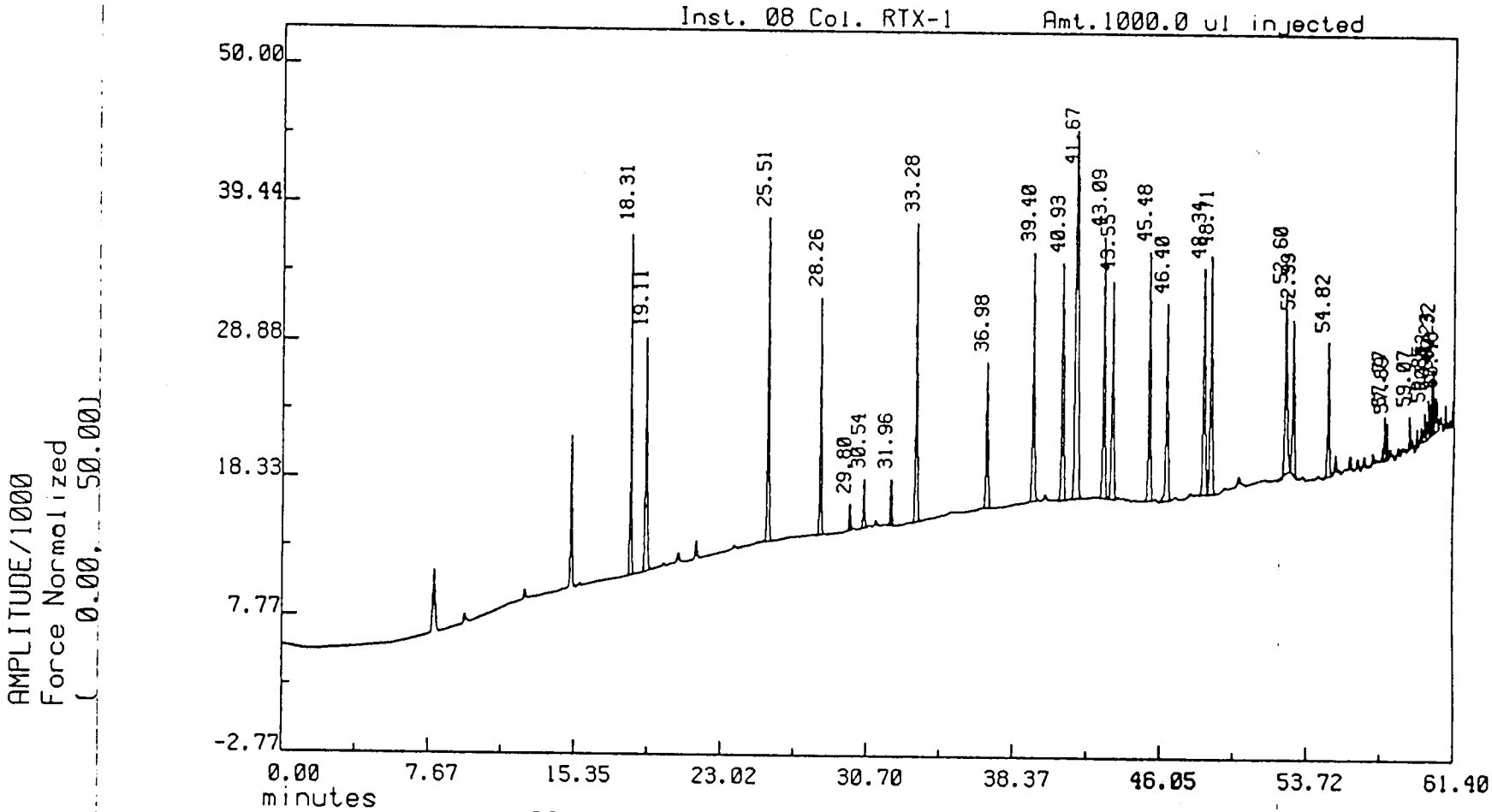
Peak	RT	Area	Compound	Ng
1	18.309	155902		
2	19.094	185186	Methyl-t-butyl ether	300.000
3	25.502	175822	Benzene	60.000
4	28.257	114368		
5	30.537	30331		
6	31.959	27336		
7	33.274	175377	Toluene	60.000
8	36.969	91127		
9	39.389	170309	Chlorobenzene	60.000
10	40.919	159828	Ethylbenzene	60.000
11	41.660	199405	1,4-Dimethylbenzene	60.000
12	43.082	189258	Styrene	60.000
13	43.541	159351	1,2-Dimethylbenzene	60.000
14	45.475	302555	Bromofluorobenzene	150.000
15	46.396	152986		
16	48.336	175350		
17	48.710	178463		
18	52.608	165016	1,3-Dichlorobenzene	60.000
19	52.999	114846	1,4-Dichlorobenzene	60.000
[illegible]	[illegible].828	105580	1,2-Dichlorobenzene	60.000
[illegible]	[illegible]0.478	39901		
22	41.660	199405	1,3-Dimethylbenzene	60.000



SAMPLE: IS 8020TLMED3 1X
ANALYZED: Wed Aug 4, 1993 03:20:13
RESULT: /RESULT/R8V004.RES METHOD: CAP08

Sample name: 8020TLMED3 1X
Instrument: 08
Injection time: 9308040320
Results file: /RESULT/R8V004.res
Dilution factor: 100.00

Peak	RT	Area	Compound	Ng
1	18.318	215370		
2	19.115	227557	Methyl-t-butyl ether	400.000
3	25.506	232812	Benzene	80.000
4	28.258	167391		
5	30.537	35865		
6	31.957	31222		
7	33.272	234326	Toluene	80.000
8	36.966	131100		
9	39.385	215907	Chlorobenzene	80.000
10	40.914	216811	Ethylbenzene	80.000
11	41.650	265256	1,4-Dimethylbenzene	80.000
12	43.075	237581	Styrene	80.000
13	43.534	205701	1,2-Dimethylbenzene	80.000
14	45.465	281076	Bromofluorobenzene	150.000
15	46.386	183729		
16	48.325	219375		
17	48.697	220804		
18	52.596	197408	1,3-Dichlorobenzene	80.000
19	52.988	145588	1,4-Dichlorobenzene	80.000
[illegible]	[illegible].820	121474	1,2-Dichlorobenzene	80.000
[illegible]	[illegible]0.469	33412		
22	41.650	265256	1,3-Dimethylbenzene	80.000



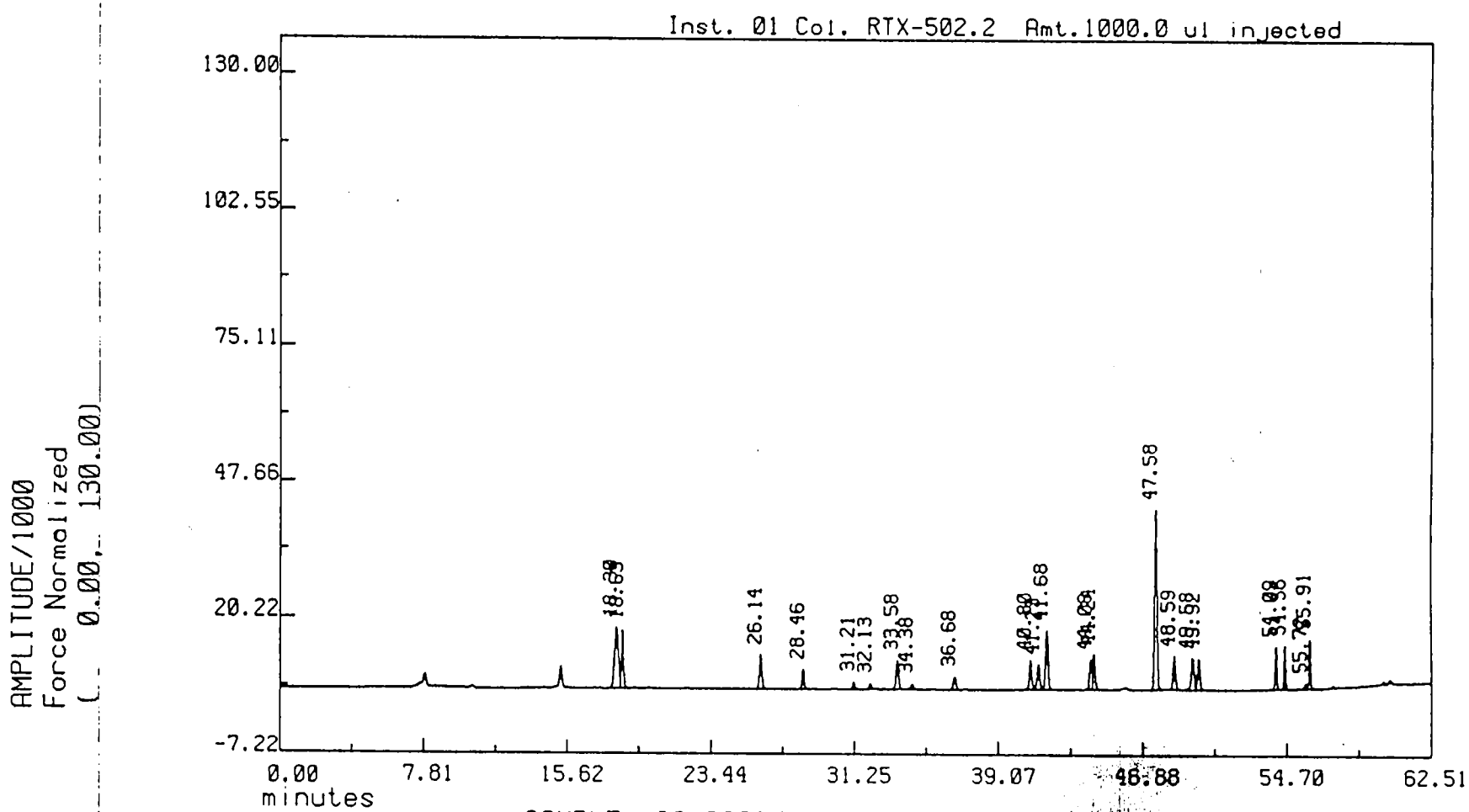
SAMPLE: IS 8020TLHIGH 1X

ANALYZED: Wed Aug 4, 1993 04:44:05

RESULT: /RESULT/R8V005.RES METHOD: CAP08

Sample name: 8020TLHIGH 1X
Instrument: 08
Injection time: 9308040444
Results file: /RESULT/R8V005.res
Dilution factor: 100.00

Peak	RT	Area	Compound	Ng
1	18.312	272144		
2	19.109	269787	Methyl-t-butyl ether	500.000
3	25.506	293735	Benzene	100.000
4	28.262	212660		
5	29.804	23076		
6	30.543	44455		
7	31.964	38149		
8	33.280	292369	Toluene	100.000
9	36.980	160082		
10	39.402	267620	Chlorobenzene	100.000
11	40.931	269841	Ethylbenzene	100.000
12	41.670	324628	1,4-Dimethylbenzene	100.000
13	43.093	290648	Styrene	100.000
14	43.551	251195	1,2-Dimethylbenzene	100.000
15	45.481	280634	Bromofluorobenzene	150.000
16	46.401	232768		
17	48.337	269312		
18	48.710	277512		
19	52.602	225990	1,3-Dichlorobenzene	100.000
[illegible]	[illegible].994	173829	1,4-Dichlorobenzene	100.000
[illegible]	[illegible]4.824	139931	1,2-Dichlorobenzene	100.000
22	57.766	32096		
23	57.888	27301		
24	59.065	23744		
25	59.849	23776		
26	60.035	30662		
27	60.226	35367		
28	60.315	42769		
29	60.480	34675		
30	41.670	324628	1,3-Dimethylbenzene	100.000



SAMPLE: IS 8020TLLOW 1Z

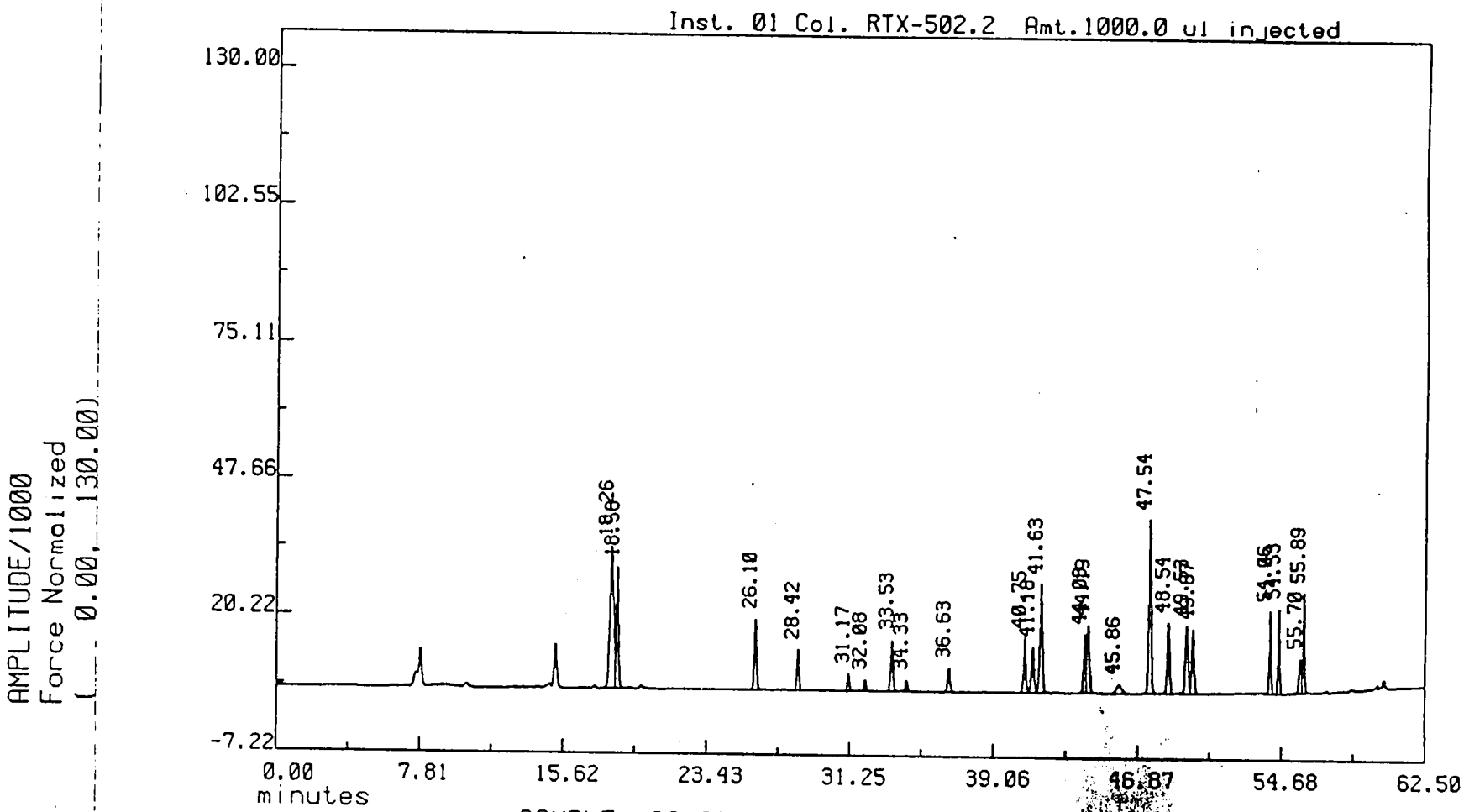
ANALYZED: Sat Jul 17, 1993 14:25:58

RESULT: /RESULT/R1Q011.RES METHOD: CAP01

Sample name: 8020TLLOW 1Z
Injection time: 9307171425

nstrument: 01
sults file: /RESULT/R1Q011.res
Dilution factor: 100.00

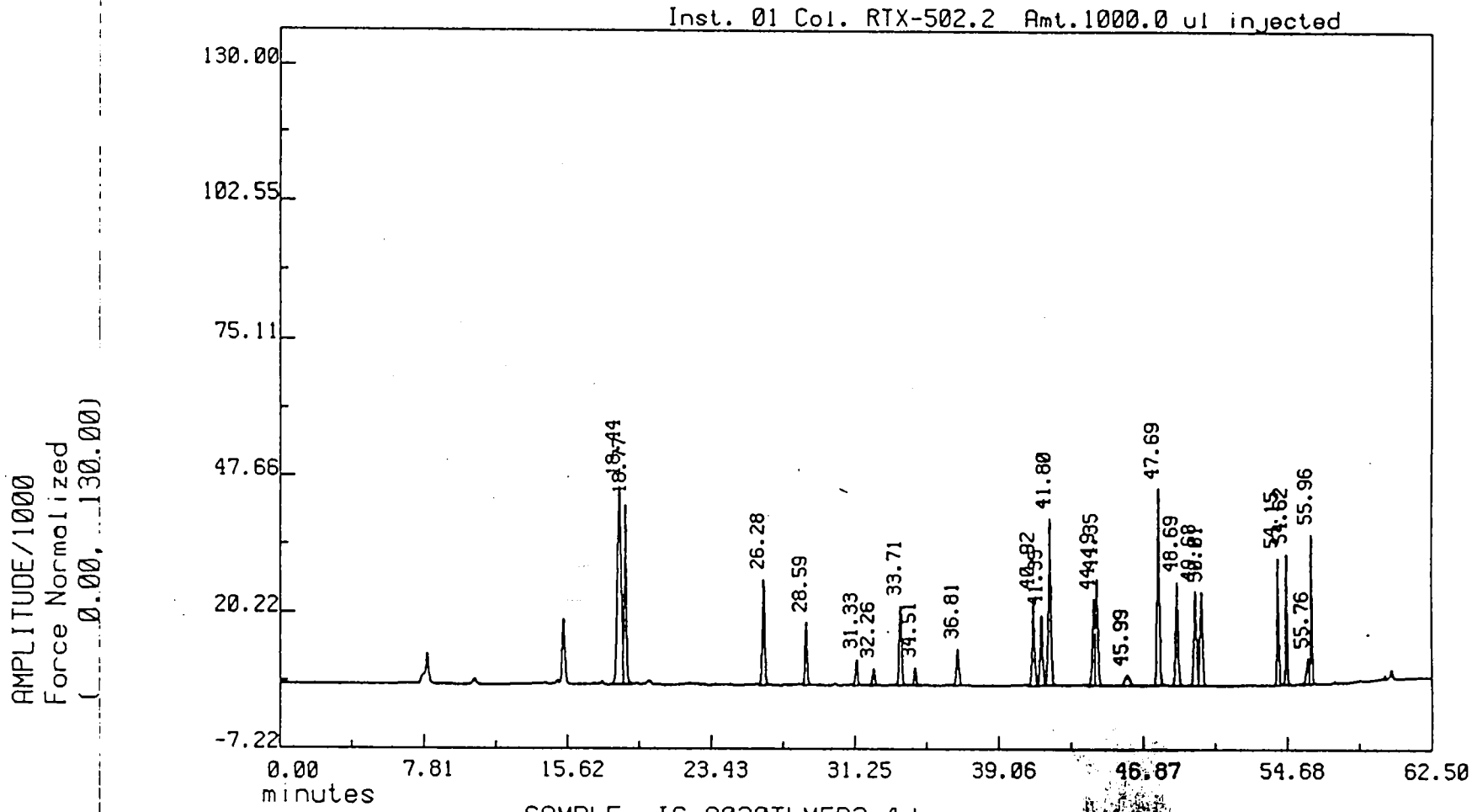
Peak	RT	Area	Compound	Ng
1	18.302	359365	Methyl-t-butyl ether	100.000
2	18.633	183486		
3	26.145	125246	Benzene	20.000
4	28.460	64486		
5	31.207	24437		
6	32.129	19438		
7	33.578	107267	Toluene	20.000
8	34.380	18061		
9	36.684	51096		
10	40.798	111325	Chlorobenzene	20.000
11	41.233	101036	Ethylbenzene	20.000
12	41.680	116044	1,4-Dimethylbenzene	20.000
13	44.078	112712	1,2-Dimethylbenzene	20.000
14	44.239	135596	Styrene	20.000
15	47.584	660341	Bromofluorobenzene	150.000
16	48.590	127275		
17	49.580	127816		
18	49.918	117277		
[illegible]	54.085	117960	1,3-Dichlorobenzene	20.000
[illegible]	[illegible].560	108161	1,4-Dichlorobenzene	20.000
21	55.721	23751		
22	55.914	112250	1,2-Dichlorobenzene	20.000
23	41.680	116044	1,3-Dimethylbenzene	20.000



SAMPLE: IS 8020TLMED1 1Y
ANALYZED: Fri Jul 16, 1993 11:23:35
RESULT: /RESULT/R1Q007.RES METHOD: CAP01

Sample name: 8020TLMED1 1Y
Instrument: 01
Injection time: 9307161123
sults file: /RESULT/R1Q007.res
Dilution factor: 100.00

Peak	RT	Area	Compound	Ng
1	18.264	819094	Methyl-t-butyl ether	200.000
2	18.584	376341		
3	26.099	248823	Benzene	40.000
4	28.419	128193		
5	31.167	52663		
6	32.085	34743		
7	33.529	186874	Toluene	40.000
8	34.332	34412		
9	36.633	88334		
10	40.747	199162	Chlorobenzene	40.000
11	41.182	177834	Ethylbenzene	40.000
12	41.630	209295	1,4-Dimethylbenzene	40.000
13	44.028	215444	1,2-Dimethylbenzene	40.000
14	44.190	251728	Styrene	40.000
15	45.859	72334		
16	47.536	636371	Bromofluorobenzene	150.000
17	48.541	262207		
18	49.531	267927		
19	49.872	235804		
[illegible]	[illegible].056	222129	1,3-Dichlorobenzene	40.000
[illegible]	54.534	205467	1,4-Dichlorobenzene	40.000
22	55.704	129945		
23	55.894	228938	1,2-Dichlorobenzene	40.000
24	41.630	209295	1,3-Dimethylbenzene	40.000



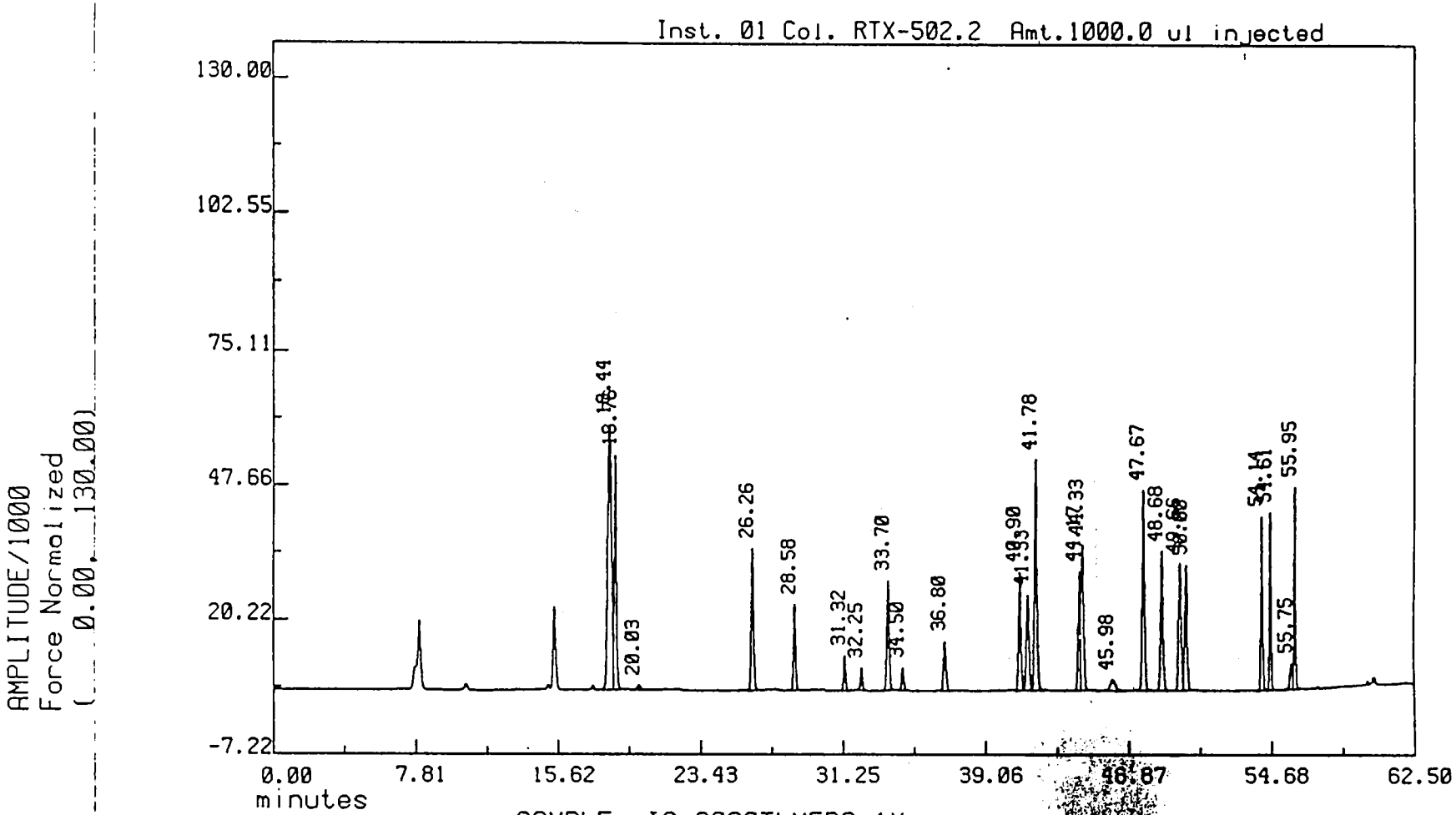
SAMPLE: IS 8020TLMED2 4J

ANALYZED: Fri Jul 16, 1993 12:40:44

RESULT: /RESULT/R1Q008.RES METHOD: CAP01

Sample name: 8020TLMED2 4J
Instrument: 01
Injection time: 9307161240
esults file: /RESULT/R1Q008.res
Dilution factor: 100.00

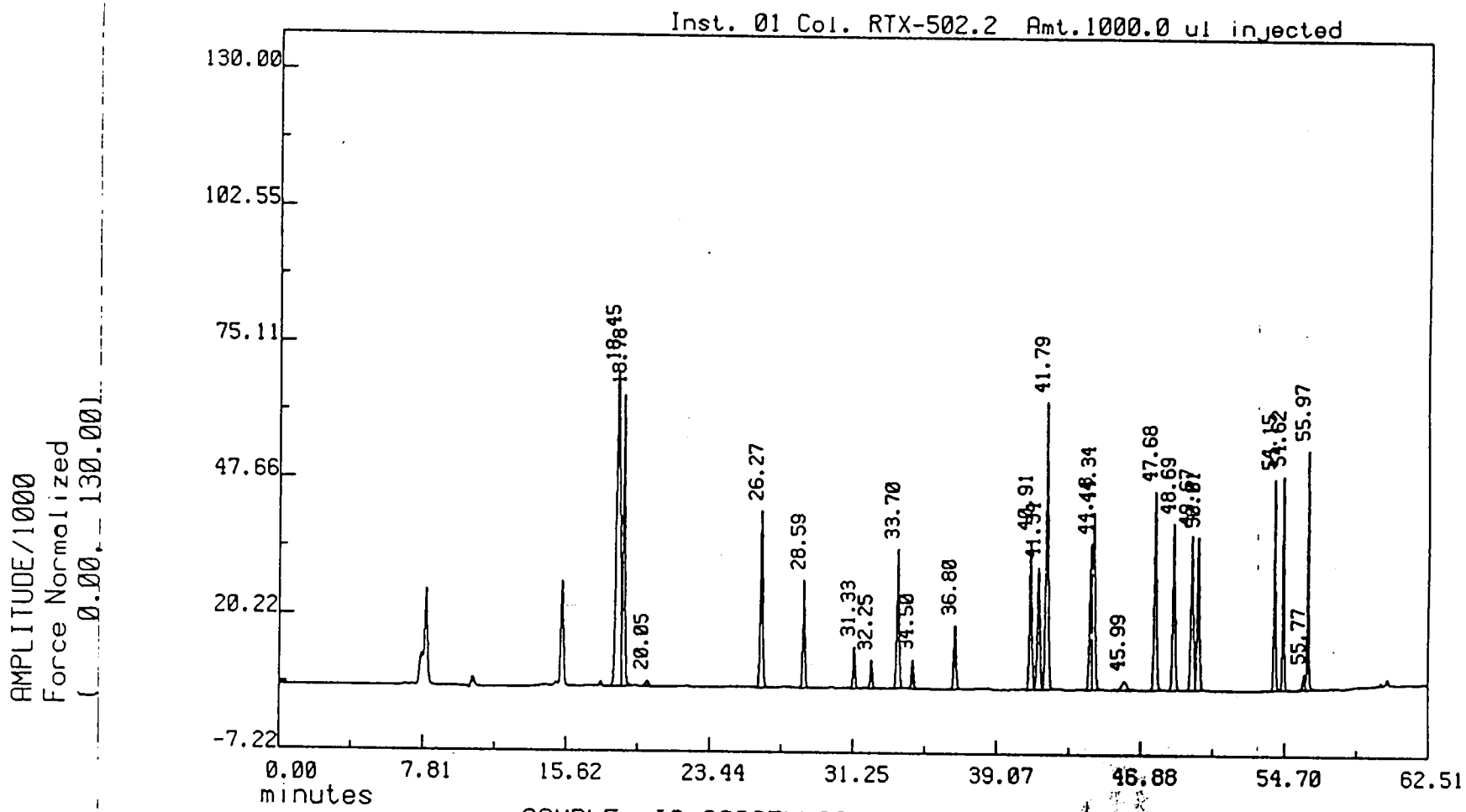
Peak	RT	Area	Compound	Ng
1	18.438	1156908	Methyl-t-butyl ether	300.000
2	18.770	561454		
3	26.279	381468	Benzene	60.000
4	28.590	201250		
5	31.333	82146		
6	32.261	55005		
7	33.709	293525	Toluene	60.000
8	34.508	54318		
9	36.813	140687		
10	40.918	319614	Chlorobenzene	60.000
11	41.351	276624	Ethylbenzene	60.000
12	41.800	324251	1,4-Dimethylbenzene	60.000
13	44.189	313921	1,2-Dimethylbenzene	60.000
14	44.350	403008	Styrene	60.000
15	45.993	73933		
16	47.686	718928	Bromofluorobenzene	150.000
17	48.690	388774		
18	49.676	374210		
19	50.014	345943		
[illegible]	54.150	341187	1,3-Dichlorobenzene	60.000
[illegible]	54.619	312890	1,4-Dichlorobenzene	60.000
22	55.762	101485		
23	55.964	333699	1,2-Dichlorobenzene	60.000
24	41.800	324251	1,3-Dimethylbenzene	60.000



SAMPLE: IS 8020TLMED3 1X
ANALYZED: Fri Jul 16, 1993 14:02:22
RESULT: /RESULT/R1Q009.RES METHOD: CAP01

Sample name: 8020TLMED3 1X
Instrument: 01
Injection time: 9307161402
Results file: /RESULT/R1Q009.res
Dilution factor: 100.00

Peak	RT	Area	Compound	Ng
1	18.438	1555928	Methyl-t-butyl ether	400.000
2	18.758	745889		
3	20.029	25666		
4	26.264	530953	Benzene	80.000
5	28.577	282526		
6	31.321	114432		
7	32.248	75155		
8	33.696	412836	Toluene	80.000
9	34.495	71496		
10	36.798	197401		
11	40.902	443881	Chlorobenzene	80.000
12	41.334	382927	Ethylbenzene	80.000
13	41.780	452779	1,4-Dimethylbenzene	80.000
14	44.174	441758	1,2-Dimethylbenzene	80.000
15	44.334	565905	Styrene	80.000
16	45.981	93559		
17	47.671	746935	Bromofluorobenzene	150.000
18	48.675	533120		
19	49.662	515411		
[illegible]	9.999	472800		
21	54.139	477829	1,3-Dichlorobenzene	80.000
22	54.609	435705	1,4-Dichlorobenzene	80.000
23	55.755	105238		
24	55.955	461458	1,2-Dichlorobenzene	80.000
25	41.780	452779	1,3-Dimethylbenzene	80.000



SAMPLE: IS 8020TLHIGH 1X
ANALYZED: Fri Jul 16, 1993 15:26:37
RESULT: /RESULT/R1Q010.RES METHOD: CAP01

Instrument: 01
Results file: /RESULT/R1Q010.res
Dilution factor: 100.00

Sample name: 8020TLHIGH 1X
Injection time: 9307161526

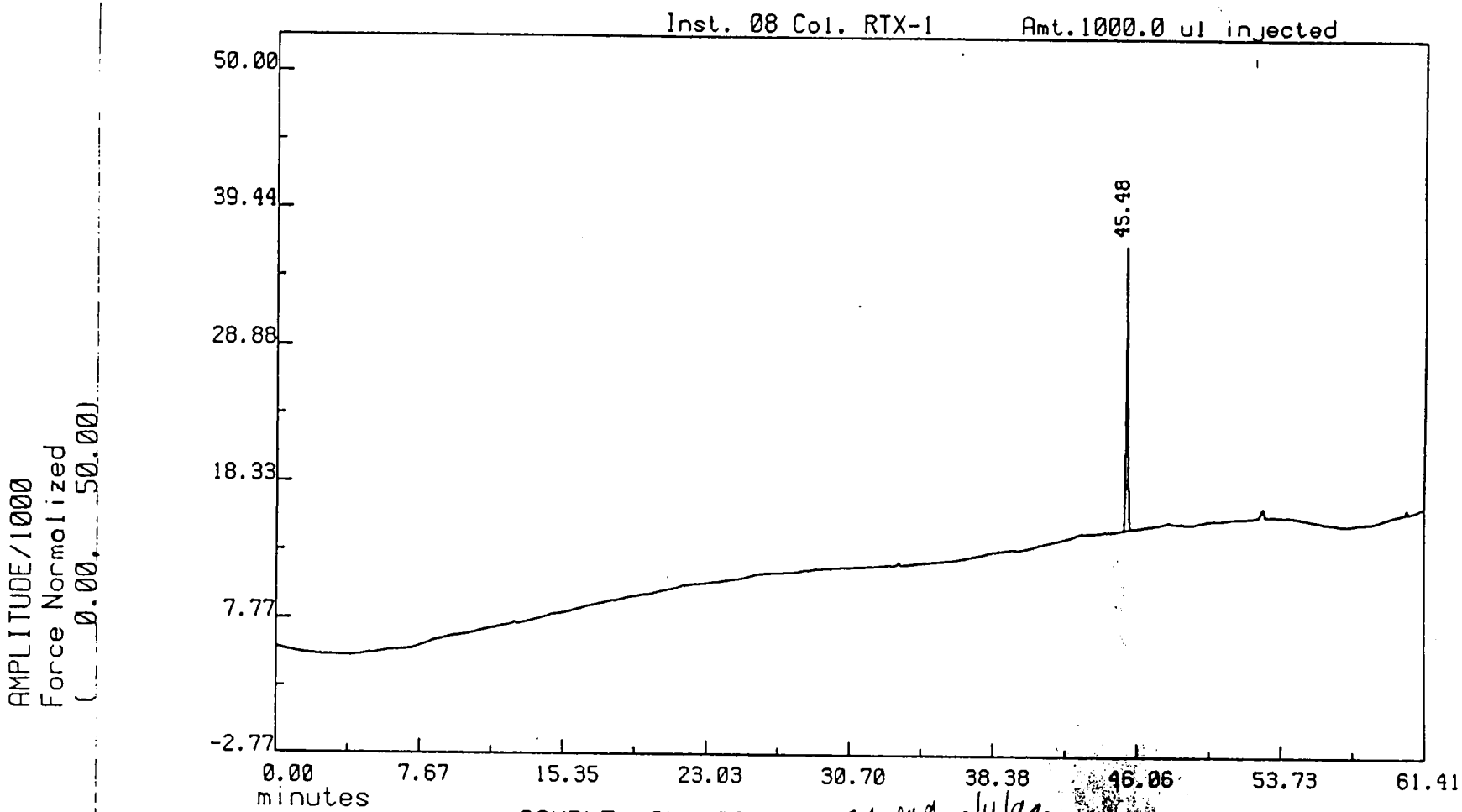
Peak	RT	Area	Compound	Ng
1	18.450	1839717	Methyl-t-butyl ether	500.000
2	18.777	913130		
3	20.047	30916		
4	26.275	650194	Benzene	100.000
5	28.585	348957		
6	31.327	132947		
7	32.254	91599		
8	33.700	516857	Toluene	100.000
9	34.500	88357		
10	36.804	247329		
11	40.910	553024	Chlorobenzene	100.000
12	41.341	484210	Ethylbenzene	100.000
13	41.790	561851	1,4-Dimethylbenzene	100.000
14	44.183	536430	1,2-Dimethylbenzene	100.000
15	44.343	675182	Styrene	100.000
16	45.990	79051		
17	47.681	731780	Bromofluorobenzene	150.000
18	48.686	629660		
19	49.672	616616		
[illegible]	[illegible]0.011	568275		
[illegible]	54.151	570450	1,3-Dichlorobenzene	100.000
22	54.621	516830	1,4-Dichlorobenzene	100.000
23	55.765	60749		
24	55.966	533572	1,2-Dichlorobenzene	100.000
25	41.790	561851	1,3-Dimethylbenzene	100.000

VI. RAW QUALITY CONTROL DATA

Blank Data

1. TCL Results – Organic Analysis Data Sheet (Form I) in chronological order

2. Blank Chromatogram



SAMPLE: CK VIBLK ~~2524~~ cwa 8/4/93

ANALYZED: Wed Aug 4, 1993 15:58:08

RESULT: /RESULT/R8V009.RES METHOD: CAP08

24 [illegible] 8/5/93

Page 1 of 1 Sample name: VIBLK ~~25~~
nstrument: 08 Injection time: 9308041558
sults file: /RESULT/R8V009.res
Dilution factor: 100.00

Peak	RT	Area	Compound	Ng
1	45.483	321759	Bromofluorobenzene	150.000

1D
AROMATIC VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

VIBLKX3

Lab Name: COMPUCHEM,RTP Contract:

Lab Code: COMPU Case No.: 27539 SAS No.: SDG No.: 362

Matrix: (soil/water) LO SL Lab Sample ID: VIBLKX3

Sample wt/vol: 5.0 (g/ml) G Date Received:

% Moisture: decanted: (Y/N) Date Analyzed: 07/21/93

Dilution Factor: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
71-43-2	Benzene	1.4	U
108-88-3	Toluene	5.3	U
100-41-4	Ethylbenzene	1.8	U
99-99-9	1,3/1,4-Dimethylbenzene	3.2	U
95-47-6	1,2-Dimethylbenzene	1.2	U

1D
AROMATIC VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

VIBLKX3

Lab Name: COMPUCHEM,RTP Contract:

Lab Code: COMPU Case No.: QC SAS No.: SDG No.: QC362

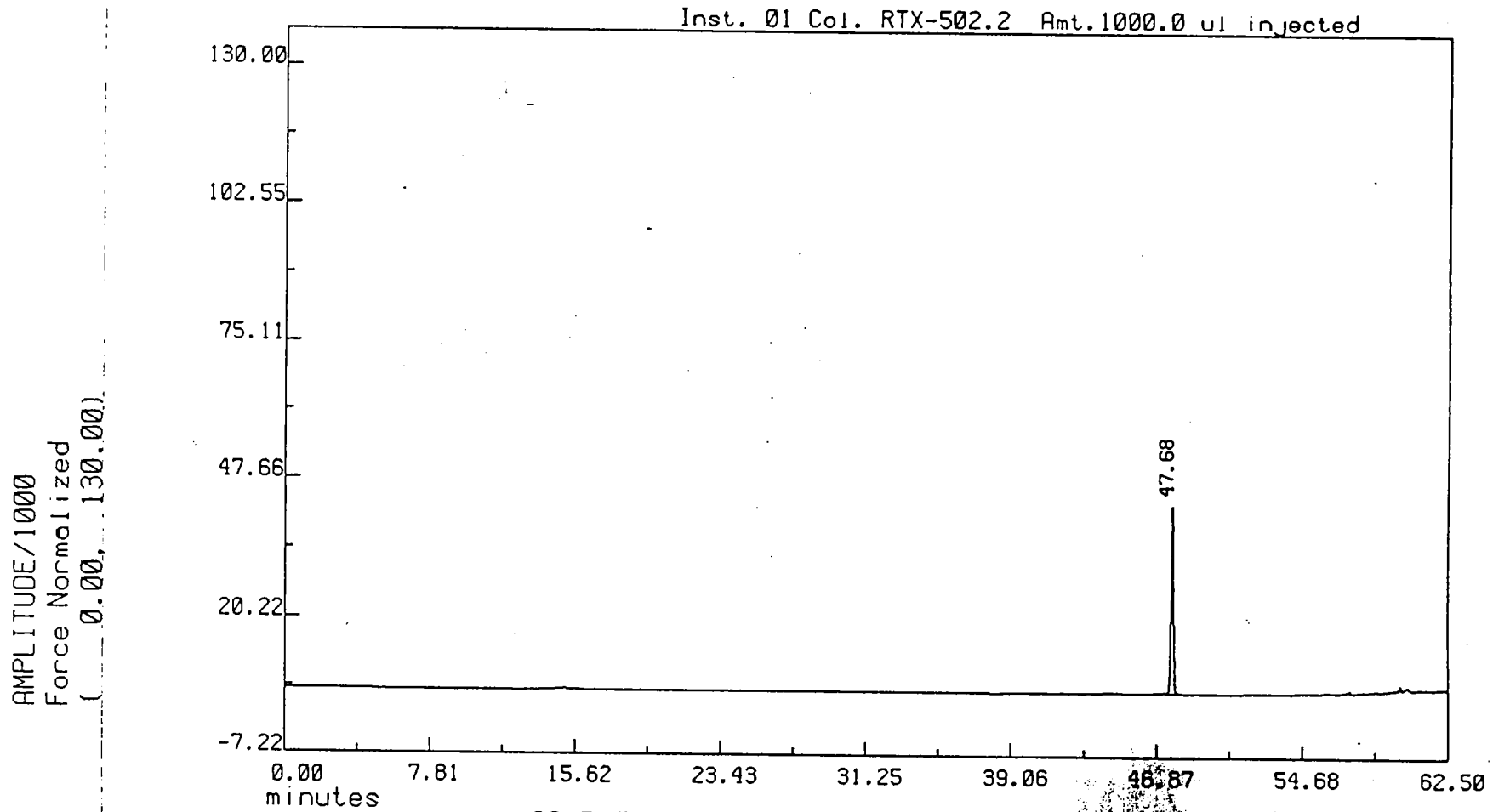
Matrix: (soil/water) LO SL Lab Sample ID: VIBLKX3

Sample wt/vol: 5.0 (g/ml) G Date Received:

% Moisture: decanted: (Y/N) Date Analyzed: 07/21/93

Dilution Factor: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
71-43-2	Benzene	1.4	U
108-88-3	Toluene	5.3	U
100-41-4	Ethylbenzene	1.8	U
99-99-9	1,3/1,4-Dimethylbenzene	3.2	U
95-47-6	1,2-Dimethylbenzene	1.2	U



SAMPLE: CK VIBLK X3

ANALYZED: Wed Jul 21, 1993 03:31:13

RESULT: /RESULT/R1Q027.RES METHOD: CAP01

Sample name: VIBLK X3
Instrument: 01
Injection time: 9307210331
Results file: /RESULT/R1Q027.res
Dilution factor: 100.00

Peak	RT	Area	Compound	Ng
1	47.678	678315	Bromofluorobenzene	150.000

COMPUCHEM LABORATORIES, INC. P.O. Box 12652 3308 Chapel Hill/Nelson Highway Research Triangle Park, NC 27709 (919) 549-8263

06/AUG/93

GROUNDWATER TECHNOLOGY
233 WILMINGTON-W.CHESTER PIKE
SUITE 201
CHADDS FORD, PA 19317

Subject: Report of Data - Account Number# 500535 Order# 27539

Enclosed are the results of analytical work performed in accordance with the referenced account number. As you are aware, these analyses were performed by an approved subcontract laboratory.

This report covers 9 sample(s) appearing on the attached list, which cross-references your sample identifiers with CompuChem's.

Thank you for selecting CompuChem Laboratories for your sample analysis. If you should have questions or require additional analytical services please contact your representative at 1-919-549-8263.

Sincerely,

Elin Cobb

Report Preparation
CompuChem Laboratories, Inc.

Attachment

COMPUCHEM LABORATORIES, INC.

06/AUG/93

GROUNDWATER TECHNOLOGY
233 WILMINGTON-W.CHESTER PIKE
SUITE 201
CHADDS FORD, PA 19317

ACCOUNT #: 500535

CC#	SAMPLE-ID	RECEIPT DATE	ANALYSIS
562734	DISPCOMP	7/14/93	SUBCONTRACT; TOTAL ORGANIC HALIDE; SO
562722	SB-MW1H	7/14/93	SUBCONTRACT; TOTAL ORGANIC HALIDE; SO
562707	SB-MW2S	7/14/93	SUBCONTRACT; TOTAL ORGANIC HALIDE; SO
562724	SB-MW3H	7/14/93	SUBCONTRACT; TOTAL ORGANIC HALIDE; SO
562711	SB-MW3S	7/14/93	SUBCONTRACT; TOTAL ORGANIC HALIDE; SO
562716	SB-RW3A	7/14/93	SUBCONTRACT; TOTAL ORGANIC HALIDE; SO
562719	SB-RW3B	7/14/93	SUBCONTRACT; TOTAL ORGANIC HALIDE; SO
562728	SB-X	7/14/93	SUBCONTRACT; TOTAL ORGANIC HALIDE; SO
562727	SB-Y	7/14/93	SUBCONTRACT; TOTAL ORGANIC HALIDE; SO

NORTHEASTERN ANALYTICAL CORPORATION

ANALYTICAL DATA PACKAGE FOR:

COMPUCHEM LABORATORIES, INC.
ENVIRONMENTAL DIVISION P.O. BOX 12652
3308 CHAPEL HILL/NELSON HWY.
RESEARCH TRIANGLE PARK, NC 27709

ATTN: MICKEY CARTEGENA

Project: # 93-47

Test Report Date: July 23, 1993

NAC Job Number: L932249

Lab Sample Number	Client Sample Designation	Collection Date
L932249-1	562707	12-JUL-93
L932249-2	562711	12-JUL-93
L932249-3	562716	12-JUL-93
L932249-4	562719	12-JUL-93
L932249-5	562722	13-JUL-93
L932249-6	562727	13-JUL-93
L932249-7	562728	13-JUL-93
L932249-8	562734	12-JUL-93
L932249-9	562724	13-JUL-93

Paul P. Painter
Laboratory Director

Signature

Certifications:

PH-0726(CT), NJ101(DE), 160(MD), NJ101(MA), 203592A+B(NH), 03117(NJ), 11022(NY), 363(NC), 68-370(PA), 00237(VA)

NORTHEASTERN ANALYTICAL CORPORATION
Test Report No. 932249
Compuchem Laboratories, Inc.

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Inorganic Results	13
Wet Chemistry Quality Control Section	16
Method Blanks	
MS/MSD	
Raw Data	

File: 28L\COMPUCHM\932249

NORTHEASTERN ANALYTICAL CORPORATION
Test Report No. 932249
Compuchem Laboratories, Inc.

NARRATIVE

The following report contains the results of sample(s) sent to Northeastern Analytical Corporation by Compuchem Laboratories, Inc. The samples were received on July 16, 1993 and were analyzed for various inorganic parameters. A laboratory chronicle follows and lists the samples associated with this project.

CHAIN-OF-CUSTODY RECORD

№ 33780

CompuChem Laboratories, Inc.
3308 Chapel Hill/Nelson Highway
Research Triangle Park, NC 27709

1-800-833-5097

Ship to: CompuChem Inc.	Project Name: Yorktown-Post Pilot Study	Field Point-of-Contact: Bill Hughes / Lori Reuther
	Sampler Name: William L. Hughes	Telephone No: (804) 436-7881
		Sampling for project complete? (Y) or N (See Note 1.)
Carrier: Airborne Airbill No.: 5904362225	Sampler Signature: William L. Hughes	Project-specific (PS) or Batch (B) QC: PS

Box #1 1. Surface Water 2. Ground Water 3. Leachate 4. Rinsate 5. Soil/Sediment/Sludge 6. Trip Blank 7. Oil 8. Waste 9. Other: _____

Box #2: A. HCl B. HNO_3 C. $NaHSO_4$ D. $Na_2S_2O_3$ E. Ice Only O. Other: _____ N. Not Preserved

Box #3: F. Filtered U. Unfiltered

Box #4: C. CLP 3/90 S. SW-846 W. CWA 600-series L. Low Conc. CLP R. Radiological T. TCLP O. Other

Box #5: H - High M - Medium L - Low U - UNKNOWN

Sample ID (Organics: 9 characters max, Inorganics: 6 characters; see Note 2)	Date: Year: 1993	Time	Box #1 Matrix	Box #2 Preservative	Box #3 Filtered/Unfiltered	Box #4 Method	Box #5 Expect. Conc.	No. of Bottles	Use for Lab QC (MS or DUP)	Organics Analysis: VOA-GC/MS	SV-GC/MS	Pest/PCB-GC	Herb-GC	VOA-GC	Inorganics: Total BTEX	Metals TCLP	Mercury	Cyanides	EPA 8080 PCBs	Radiologicals	Other: TOC/TOX	O&G/TPH	Phenols	Other	% Moisture	Remarks/Comments
SB-MW2S	7/12	10:12	S	E	U	9020 418.1	H	3													X	X				EPA 9020 for TOX
SB-MW3S	7/12	11:20	S	E	U		H	3													X	X				EPA 418.1 for TPH
SB-RW3A	7/12	1:55	S	E	U		H	3													X	X				
SB-RW3B	7/12	3:00	S	E	U		H	4													X	X				
SB-MW1H	7/13	9:45	S	E	U		H	4													X	X				
SB-MW3H	7/13	11:40	S	E	U		H	4													X	X				
SB-X	7/13	12:20	S	E	U		H	4													X	X				
SB-Y	7/13	1:15	S	E	U		H	4													X	X				
	/	:	S	E	U	SEE COMMENTS	U								X	X			X		X	X			X	
	/	:																								

562688, 562696, 562701, 707, 719, 727, 690, 697, 703, 562711, 562722, 562728, 691, 698, 716, 724, ~~729~~ JR

07/14/93

RECEIVED IN GOOD CONDITION

WLH

Client's Special Instructions:

Lab: Received in Good Condition? Y or N Describe Problems, If Any:

#1 Relinquished By: (Sig.) William L. Hughes	Date: 7/13/93	#2 Relinquished By: (Sig.)	Date:	#3 Relinquished By: (Sig.)	Date:	Sample storage time requested? _____ (In days, see Note 3)
Company Name: GSI	Time: 3:45	Company Name:	Time:	Company Name:	Time:	
#1 Received By: (Sig.) V. Batt	Date: 7/14/93	#2 Received By (Sig.)	Date:	#3 Received By: (Sig.)	Date:	DESTROY or RETURN data after five years of archival? (Circle choice; see Note 4)
Company Name: Compu CH	Time: 0830	Company Name:	Time:	Company Name:	Time:	

Note (1): If "N" lab will hold samples to await remainder of project-maximizing batch size and minimizing QC ratio; if "Y" lab will begin processing batches now. Note (2): If CLP inorganics diskette required, ID limited to maximum of six characters.
Note (3): Samples stored 60 days after date report mailed at no extra charge. Note (4): All lab copies of data destroyed after five years unless client requests and pays for return of copies; annual storage fee billed in January of year six.

CHAIN-OF-CUSTODY RECORD

№ 33779

CompuChem Laboratories, Inc.
3308 Chapel Hill/Nelson Highway
Research Triangle Park, NC 27709

1-800-833-5097

Ship to:

Project Name: YORKTOWN

Field Point-of-Contact: William L. Hughes

Sampler Name: Bill Hughes

Telephone No: (804) 436-7881

Sampling for project complete? (Y) or N (See Note 1.)

Carrier: AIRBORNE

Airbill No.: 5904362225

Sampler Signature: William L. Hughes

Project-specific (PS) or Batch (B) QC: ____

Box #1: 1. Surface Water 2. Ground Water 3. Leachate 4. Rinsate 5. Soil/Sediment/Sludge 6. Trip Blank 7. Oil 8. Waste 9. Other: ____

Box #2: A. HCl B. HNO_3 C. $NaHSO_4$ D. $Na_2S_2O_3$ E. Ice Only O. Other: ____ N. Not Preserved

Box #3: F. Filtered U. Unfiltered

Box #4: C. CLP 3/90 S. SW-846 W. CWA 600-series L. Low Conc. CLP R. Radiological T. TCLP O. Other

Box #5: H - High M - Medium L - Low

Sample ID (Organics: 9 characters max, Inorganics: 6 characters; see Note 2)	Date: Year: 19__	Time	Box #1 Matrix	Box #2 Preservative	Box #3 Filtered/Unfiltered	Box #4 Method	Box #5 Expect. Conc.	No. of Bottles	Use for Lab QC (MS or DUP)	Organics Analysis: VOA-GC/MS	SV-GC/MS	Pest/PCB-GC	Herb-GC	VOA-GC	Inorganics: Metals	Mercury	Cyanides	Other: Radiologicals	TOC/TOX	O&G/TPH	Phenols	Other	Remarks/Comments
DISPCOMP	7/12	2:15	5	E	U	O	H	8															~~TCLP~~ BTEX by EPA 8020
	/	:																					TCLP Metals
	/	:																					% Moisture
	/	:																					TOX by EPA 9020
	/	:																					TPH by EPA 418.1
	/	:																					PCBs by EPA 8080
	/	:																					
	/	:																					
	/	:																					
	/	:																					

562 729 • 562 734 •
733 • 735 •
739 •

RECEIVED IN GOOD CONDITION 7/14/93

Client's Special Instructions:

Lab: Received in Good Condition? Y or N

Describe Problems, If Any:

#1 Relinquished By: (Sig.) William L Hughes	Date: 7/13/93	#2 Relinquished By: (Sig.)	Date:	#3 Relinquished By: (Sig.)	Date:	Sample storage time requested? ____ (in days, see Note 3)
Company Name: GSI	Time: 4:00	Company Name:	Time:	Company Name:	Time:	
#1 Received By: (Sig.) V. Batta	Date: 7/14/93	#2 Received By (Sig.)	Date:	#3 Received By: (Sig.)	Date:	DESTROY or RETURN data after five years of archival? (Circle choice; see Note 4)
Company Name: CompuChem	Time: 0830	Company Name:	Time:	Company Name:	Time:	

Note (1): If "N" lab will hold samples to await remainder of project-maximizing batch size and minimizing QC ratio; if "Y" lab will begin processing batches now. Note (2): If CLP inorganics diskette required, ID limited to maximum of six characters.
Note (3): Samples stored 60 days after date report mailed at no extra charge. Note (4): All lab copies of data destroyed after five years unless client requests and pays for return of copies; annual storage fee billed in January of year six.

№ 27911

COMPUCHEM LABORATORIES

CHAIN-OF-CUSTODY RECORD

NAC 930049

PROJECT NAME: Compuchem

PROJECT NUMBER: NA#93-47

SAMPLERS (SIGNATURE) 27539

PRINTED NAME Groundwater

CLIENT ID (9 CHARACTERS) 1	2	3	4	5	6	7	8	9	# No. of Bottles/Vials	GC/MS 624-8240	625-8270	TCL-VOA	TCL-SVOA	Other:	GC 601-8010	602-8020	608-8080	8140	TCL PEST/PCB's	Herbicides	Other:	INORGANICS Metals	Cyanide	TAL Metals	Other:	OTHER TOC	TOX	Oil & Grease	Pet. Hydro.	Phenols	4003					MATRIX: Water (Soil)	SAMPLING INFO DATE	TIME	REMARKS
																																								Due Date Aug-11-1993
S	B	-	M	W	2	5			1																											1	562 707		7/12
S	B	-	M	W	3	5			1																											1		711	7/12
S	B	-	R	W	3	A			1																											1		716	7/12
S	B	-	R	W	3	B			1																											1		719	7/12
S	B	-	M	W	1	H			1																											1		722	7/13
S	B	-	Y						1																											1		727	7/13
S	B	-	X						1																											1		728	7/13
D	I	S	P	C	O	M	P		1																											1		734	7/12
S	B	-	M	W	3	A			1																											1		724	7/13

RELINQUISHED BY:	Date/Time	RELINQUISHED BY:	Date/Time	RELINQUISHED BY:	Date/Time
COMPANY NAME: Compuchem	7/15/93 6:00pm	COMPANY NAME:		COMPANY NAME:	
RECEIVED BY:	Date/Time	RECEIVED BY:	Date/Time	RECEIVED BY:	Date/Time
COMPANY NAME: NAC	7/16/93 10:30	COMPANY NAME:		COMPANY NAME:	
RELINQUISHED BY:	Date/Time	RELINQUISHED BY:	Date/Time	RELINQUISHED BY:	Date/Time
COMPANY NAME:		COMPANY NAME:		COMPANY NAME:	

SHIPPING INFORMATION

Number of Shipping Containers-

Method of Shipment

Special Handling Requirements

000004

NAC PRESERVA[illegible]E CHECKLIST

TO BE COMPLETED UPON SAMPLE RECEIPT

INSTRUCTIONS:

1. Place an X in box if okay
2. Record actual pH if outside acceptable range
3. Record temperature of cooler blank or note Y/N if samples are cooled
4. Record corrective action in remarks.

SIGNATURE: [signature]

DATE PERFORMED: 7/16/93

pH ≤ 2											>9	≥12	°C	SAMPLES	
COD	NH_3	TKN	TOX	VOA*	PHENOL	TOC	PHC/O&G	METALS	HARD	TPO_4	SO_2	CYAN	TEMP	NAC #	REMARKS
													Y	932049-1 thru 9	
															received soil
															samples

*All VOA vials received with no headspace and septum was Teflon side down, except where noted.

SPECIAL INSTRUCTIONS/NONCOMPLIANCE NOTATIONS _____

000005

NAC JOB#: L932249 000006
SHELF#: E4

INTERNAL CHAIN OF CUSTODY
SAMPLE ALIQUOT(S)

CLIENT: COMPUCHEM LABORATORIES, INC. PROJECT: GROUNDWATER

Soil: Parameters/Sample: |CLIENT S 1 |CLIENT S 1 |TOX 1 - 9 |TS 1

DATE	TIME	SAMPLE(S) RELINQUISHED BY	SAMPLE(S) RECEIVED BY	REASON FOR CHANGE OF CUSTODY
7/19/93	1000	[illegible]	[illegible]	1-9 TOX
7/19/93	1254	[illegible]	[illegible]	1-9 Return
7/20/93	0800	[illegible]	J Barnett	1-9 TS
7 20 93	0800	J Barnett	[illegible]	1-9 TS

REFER TO EXTERNAL COC FOR DESIGNATED SAMPLE INFORMATION

NORTHEASTERN ANALYTICAL CORPORATION
Test Report No. 932249
Compuchem Laboratories, Inc.

METHODOLOGY

- Total Organic Halides

  This is a method for the determination of organically bound halogen in a sample. An aliquot of sample is extracted with ethyl acetate. A portion of the solvent is administered to a total organic halogen analyzer, pyrolyzing organic halogen. Mass, as chloride, is determined by microcoulometric titration. Reference methods are Dohrmann Systems Manual and Test Methods for Evaluating Solid Waste, SW846, 3rd Edition, Method 9020.

- Total Solids, Percent

  This is a gravimetric analytical method used to determine the moisture content present in either aqueous or solid matrices. An aliquot of the sample is weighed into a tared beaker and then dried at 103°-105°C. The final weight is subtracted from the initial weight and then the percent total solids present in the sample is calculated. Reference method is Standard Methods for the Examination of Water and Wastes, 16th Edition, Method 209A.

The following is a list of symbols an/or abbreviations which may be found in NAC reports.

Symbols	Description
U	Analyte is not detected below the method detection limit
ND	Analyte is not detected below the method detection limit
>	Analyte is present in the sample at an amount greater than the reported result
MDL	Method Detection Limit
RDL	Report Detection Limit
PQL	Practical Quantitation Limit
TNTC	Coliform growth is too numerous to count (above 200)
dw	Dry Weight
B	Analyte is present in the associated method blank
MS	Matrix Spike
MSD	Matrix Spike Duplicate
DUP	Sample Duplicate
RSD	Relative % Standard Deviation
CF	Calibration Factor
MI	Matrix Interference
HA	High Analyte
J	Estimated Value
D	Standard spike or surrogate diluted out
<=	Less than or equal to
N/A	Not Applicable
>=	Greater than or equal to

LABORATORY CHRONICLE

LAB SAMPLE ID	CLIENT ID	SAMPLING DATE	MATRIX
2249-1	562707	12-JUL-93	Soil
32249-2	562711	12-JUL-93	Soil
L932249-3	562716	12-JUL-93	Soil
L932249-4	562719	12-JUL-93	Soil
L932249-5	562722	13-JUL-93	Soil
L932249-6	562727	13-JUL-93	Soil

EXTRACT DATE

PARAMETER	-1	-2	-3	-4	-5	-6
TOX						
TS						

ANALYSIS DATE

PARAMETER	-1	-2	-3	-4	-5	-6
TOX	07/19/93	07/19/93	07/19/93	07/19/93	07/19/93	07/19/93
TS	07/20/93	07/20/93	07/20/93	07/20/93	07/20/93	07/20/93

LABORATORY CHRONICLE

LAB SAMPLE ID	CLIENT ID	SAMPLING DATE	MATRIX
2249-7	562728	13-JUL-93	Soil
L932249-8	562734	12-JUL-93	Soil
L932249-9	562724	13-JUL-93	Soil

EXTRACT DATE

PARAMETER	-7	-8	-9	-10	-11	-12
TOX						
TS						

ANALYSIS DATE

PARAMETER	-7	-8	-9	-10	-11	-12
TOX	07/19/93	07/19/93	07/19/93			
TS	07/20/93	07/20/93	07/20/93			

CONFORMANCE/NON-CONFORMANCE SUMMARY CHECKLIST

LABORATORY DELIVERABLES

THIS FORM MUST BE COMPLETED BY THE LABORATORY OR ENVIRONMENTAL CONSULTANT AND ACCOMPANY ALL DATA SUBMISSIONS

The following laboratory deliverables shall be included in the data submission. All deviations from the accepted methodology and procedures, or performance values outside acceptable ranges shall be summarized in the Non-Conformance Summary. The proposed "Technical Requirements for Site Remediation" rules, which appeared in the May 4, 1992 New Jersey Register, provides further details. The document shall be bound and paginated, contain a table of contents, and all pages shall be legible. Incomplete packages will be returned or held without review until the data package is completed.

It is recommended that the analytical results summary sheets listing all targeted and non-targeted compounds with the method detection limits be included in one section of the data package and in the main body of the report.

		Check if Complete
1.	Cover Page, Title Page listing Lab Certification #, facility name & address, & date of report	✓
2.	Table of Contents	✓
3.	Summary Sheets Listing Analytical Results for all targeted and non-targeted compounds	✓
4.	Summary Table cross-referencing field ID #'s vs. Lab ID #'s	✓
5.	Document bound, paginated and legible	✓
6.	Chain of Custody	✓
7.	Methodology Summary	✓
8.	Laboratory Chronicle and Holding Time Check	✓
9.	Results submitted on a dry weight basis (if applicable)	✓
10.	Method Detection Limits	✓
11.	Lab certified by NJDEPE for parameters or appropriate category of parameters or a member of the USEPA CLP	✓
12.	Non-Conformance Summary	✓

Laboratory Director or Environmental Consultant's Signature

7/30/93
Date

INORGANIC RESULTS

NORTHEASTERN ANALYTICAL CORPORATION

REPORT OF RESULTS

Client: COMPUCHEM LABORATORIES, INC. Date Sampled: Jul 12, 1993

NAC Job Number: L932249 Date Received: Jul 16, 1993

LAB SAMPLE ID	CLIENT ID	PARAMETER	RESULT	QUAL	UNITS
L932249-1	562707	Total Organic Halide	50		mg/kg dw
L932249-2	562711	Total Organic Halide	88		mg/kg dw
L932249-3	562716	Total Organic Halide	18		mg/kg dw
L932249-4	562719	Total Organic Halide	20		mg/kg dw
L932249-5	562722	Total Organic Halide	18		mg/kg dw
L932249-6	562727	Total Organic Halide	17		mg/kg dw
L932249-7	562728	Total Organic Halide	15		mg/kg dw
L932249-8	562734	Total Organic Halide	18		mg/kg dw
L932249-9	562724	Total Organic Halide	21		mg/kg dw

U - Not detected

NORTHEASTERN ANALYTICAL CORPORATION

REPORT OF RESULTS

Client: COMPUCHEM LABORATORIES, INC. Date Sampled: Jul 12, 1993

NAC Job Number: L932249 Date Received: Jul 16, 1993

LAB SAMPLE ID	CLIENT ID	PARAMETER	RESULT	QUAL	UNITS
L932249-1	562707	Total Solids	93.27		%
L932249-2	562711	Total Solids	95.53		%
L932249-3	562716	Total Solids	94.94		%
L932249-4	562719	Total Solids	94.82		%
L932249-5	562722	Total Solids	94.72		%
L932249-6	562727	Total Solids	91.42		%
L932249-7	562728	Total Solids	97.18		%
L932249-8	562734	Total Solids	90.08		%
L932249-9	562724	Total Solids	91.69		%

U - Not detected

WET CHEMISTRY QUALITY CONTROL SECTION

NORTHEASTERN ANALYTICAL CORPORATION

METHOD BLANK RESULTS

Client: COMPUCHEM LABORATORIES, INC.

Date Analyzed: 19-JUL-93

NAC Job Number: L932249

Date Received: NA

Client ID: BLANK

Lab Sample ID: BLANK

PARAMETER	RESULT	RDL	QUAL	UNITS
Total Organic Halide	ND	10		mg/kg

Associated Samples: L932249-1 L932249-2 L932249-3 L932249-4 L932249-5 L932249-6 L932249-7 L932249-8 L932249-9 WG10521-1 WG10521-2 WG10521-3 WG10521-4

ND - Not detected at or below the MDL

NORTHEASTERN ANALYTICAL CORPORATION

REPORT OF QUALITY CONTROL RESULTS

NAC JOB #L932249

PARAMETER	MTX	LCS REC	MS REC	MSD REC	SX CONC	REPL. CONC	RPD
Total Organic Halide	S	99.3	104	99			4.9

Associated Samples: L932249-1 L932249-2 L932249-3 L932249-4 L932249-5
L932249-6 L932249-7 L932249-8 L932249-9
Sample used for Spike Analysis: L932249-1
Sample used for Duplicate Analysis: Not Applicable

NR - No Recovery
NC - Not calculated, values below RDL
HA - Interference due to high analyte
ND - Not detected below the MDL
MI - Matrix interference

~~WG10547~~, 10 7-21-93

WG 10513

000018

NAC TOTAL % SOLIDS LOG

Temp. 103-105°C Yes / No

Date In: 7-20 Out: 7 21 93

Time In: 2:00 Out: 1200

Technician: JB Technician: JK

*Constant Weight determination required for aqueous and sludge, and also for solid samples dried <12 hr.

Total Time:

SAMPLE	PAN #	PAN WT. (g)	INITIAL WT. (g)	FINAL WT. (g)	*CONSTANT WT.	% TOTAL SOLID
Blank	T	1.57		1.57		
2081-14	~~G~~ K	1.59 ~~1.58~~	10.91 ~~10.05~~	9.35		83.26
2244-1	H	1.59	5.97	3.53		44.29
2249-1	G	1.58	10.05	9.48		93.27
-2	F	1.57	10.07	9.69		95.53
-3	B	1.60	9.51	9.11		94.94
-4	E	1.60	15.31	14.60		94.82
-5	D	1.61	11.26	10.75		94.72
-6	M	1.56	7.62	7.10		91.42
-7	A	1.57	13.98	13.63		97.18
-8	C	1.60	10.67	9.77		90.08
-9	J	1.56	10.34	9.61		91.69
-9 Dup	I	1.56	7.86	7.33		91.59
2232-4	O	1.54	6.78	2.44		17.18
-4 Dup	L	1.59	6.58	2.41		16.43

Reviewed By: _____ Date: _____

PAGE:

TITLE

PROJECT NO. WG 10521

BOOK NO.

Work continued from Page

Cell check 97%

7/19/93

Sample#	Aliquot		µg Cl⁻ Reading	
BLK		.03	0.01	
STD① PZ 7/19/93	.005	.005	5.09	101%
LS STD②	.010	.01	9.94	99.8%
STD③	.025	.025	24.76	99%

Sample#	Sample Amount	Sample Aliquot	µg Cl⁻ Reading	Conc mg/Kg
2249-1	2gm	.03	0.57	46.6
2249-1MS	2gm	.03	6.81	566 PZ 7/21/93 ~~560~~ 104%
2249-1 MSD	2gm	0.03	6.49	540 99%
2249-2	2gm	0.03	1.02	84.1
2249-3	2gm	0.03	0.22	17.5
2249-4	2gm	0.03	0.24	19.2
2249-5	2gm	0.03	0.22	17.4
2249-6	2gm	0.03	0.20	15.8
2249-7	2gm	0.03	0.19	15.0
2249-8	2gm	0.03	0.20	15.8
2249-9	2gm	0.03	0.24	19.2

Cell Check 101%

7/19/93

Work continued to Page

COMPUCHEM LABORATORIES, INC. P.O. Box 12652 3308 Chapel Hill/Nelson Highway Research Triangle Park, NC 27709 (919) 549-8263

August 10, 1993

Mr. Joseph Giandonato
GROUNDWATER TECHNOLOGY
233 Wilmington-W.Chester Pike
Suite 201
Chadds Ford, PA 19317

Dear Mr. Giandonato:

We at CompuChem are pleased to provide our report for the analysis you requested. Data for the following samples are enclosed:

Client ID Number	CompuChem ID Number	Analysis Code	Order Number	Description of Work Requested
SB-MW2S	562688	4005	27539	Petroleum Hydrocarbons
SB-MW3S	562690			
SB-RW3A	562691			
SB-RW3B	562696			
SB-MW1H	562697			
SB-MW3H	562698			
SB-Y	562701			
SB-X	562703			
DISPCOMP	562733			

Thank you for selecting CompuChem Laboratories for your sample analysis. If you have any questions concerning this report or the analytical methods employed please contact your Sales Representative at 919-549-8263.

Sincerely,

Elise L. Cobb
Supervisor, Report Preparation

cc: Accounting
(Cover letter only)

COMPUCHEM LABORATORIES, INC.

NOTICE

Unless noted by Quality Assurance Notices included in this report of data, all Quality Control Requirements associated with the preparation and analyses of these samples have been met.

Release of the analytical data contained in this data package has been authorized by the Laboratory Manager or his designee, as verified by the following signature.

8/10/93
Date

Mark Ross, Manager
Inorganics Laboratory

COMPUCHEM LABORATORIES, INC.

TOTAL PETROLEUM HYDROCARBONS

To determine the concentration of total petroleum hydrocarbons (TPH) in a wide range of matrices, CompuChem employs procedures based on Method 418.1, Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Revised March 1983. By definition, TPH is any material recovered as a substance soluble in trichlorotrifluoroethane.

Method Summary

Samples are prepared for analysis by liquid/liquid extraction for water samples and soxhlet extraction for soil/sediment/sludge samples. Trichlorotrifluoroethane is the extraction solvent. The TPH extract is subjected to treatment with silica gel before infrared analysis. Results for these determinations are reported in concentration units of mg/L for water samples and mg/kg for solid samples.

COMPUCHEM LABORATORIES, INC.

ANALYTICAL REPORT OF DATA
SUBMITTED TO:

Mr. Joseph Giandonato
GROUNDWATER TECHNOLOGY
233 Wilmington-W.Chester Pike
Suite 201
Chadds Ford, PA 19317

CHRONICLE

ITEM NO.	SAMPLE IDENTIFIER	COMPUCHEM NUMBER	DATE SAMPLE RECEIVED	DATE SAMPLE EXTRACTED	DATE ANALYSIS COMPLETED
1.	SB-MW2S	562688	07/14/93	08/08/93	08/09/93
2.	SB-MW3S	562690	07/14/93	08/08/93	08/09/93
3.	SB-RW3A	562691	07/14/93	08/08/93	08/09/93
4.	SB-RW3B	562696	07/14/93	08/08/93	08/09/93
5.	SB-MW1H	562697	07/14/93	08/08/93	08/09/93
6.	SB-MW3H	562698	07/14/93	08/08/93	08/09/93
7.	SB-Y	562701	07/14/93	08/08/93	08/09/93
8.	SB-X	562703	07/14/93	08/08/93	08/09/93
9.	DISPCOMP	562733	07/14/93	08/08/93	08/09/93

COMPUCHEM LABORATORIES, INC.

TOTAL PETROLEUM HYDROCARBONS
SUMMARY REPORT

ITEM NO.	SAMPLE IDENTIFIER	COMPUCHEM NUMBER	CONCENTRATION (mg/kg)	DETECTION LIMIT (mg/kg)
1.	SB-MW2S	562688	16.3	6.3
2.	SB-MW3S	562690	13.1	6.3
3.	SB-RW3A	562691	11.0	6.3
4.	SB-RW3B	562696	BRL	6.3
5.	SB-MW1H	562697	BRL	6.3
6.	SB-MW3H	562698	61.2	6.3
7.	SB-Y	562701	BRL	6.3
8.	SB-X	562703	BRL	6.3
9.	DISPCOMP	562733	11600	6.3

BRL = BELOW REPORTABLE LIMIT

Reviewed by/ID#: [illegible] / 2037 Date: 8/10/93

Reviewed by/ID#: [illegible] / 1990 Date: 8/10/93

COMPUCHEM LABORATORIES, INC.

TPH BY FT-IR
QUALITY CONTROL REPORT

DATE EXTRACTED: 08/08/93 CASE: 27539
DATE ANALYSIS COMPLETED: 08/09/93 MATRIX: SOIL

MATRIX SPIKE COMPUCHEM#: 562641
ORIG. SAMPLE COMPUCHEM#: 562688

COMPOUND	SPIKE ADDED (mg/kg)	SAMPLE CONC. (mg/kg)	MS CONC. (mg/kg)	MS % RECOVERY
TPH	137	16.3	168	111

MATRIX SPIKE DUPLICATE COMPUCHEM#: 562642

COMPOUND	SPIKE ADDED (mg/kg)	MS CONC. (mg/kg)	MSD CONC. (mg/kg)	% RPD
TPH	137	168	159	6

BLANK SPIKE COMPUCHEM#: 562643

COMPOUND	SPIKE ADDED (mg/kg)	BS CONC. (mg/kg)	BS % RECOVERY
TPH	125	129	103

The detection limit for TPH is 6.3 mg/kg.

BRL = BELOW REPORTABLE LIMIT

Reviewed by/ID#: [illegible] / 2037 Date: 8/10/93

Reviewed by/ID#: [illegible] / 1990 Date: 8/10/93

COMPUCHEM LABORATORIES, INC.

TPH BY FT-IR

QUALITY CONTROL REPORT

DATE EXTRACTED: 08/08/93
DATE ANALYSIS COMPLETED: 08/09/93

CASE: 27539
MATRIX: SOIL

COMPUCHEM NUMBER	QC TYPE	AMOUNT DETECTED (mg/kg)
565842	METHOD BLANK	BRL

BRL = BELOW REPORTABLE LIMIT

COMPUCHEM LABORATORIES, INC.
TOTAL PETROLEUM HYDROCARBONS/OIL & GREASE
INFRARED WORKSHEET

DATE: 08/09/93
RUN#: T485

Regression Output:

Constant	-1.62171
Std Err of Y Est	1.389600
R Squared	0.995779
No. of Observations	6
Degrees of Freedom	4
X Coefficient(s)	313.4167
Std Err of Coef.	10.20188

STD. CONC.	ABSORBANCE READING	CALCULATED CONC.
0	0.00107	-1.29
2.5	0.01262	2.33
5	0.02327	5.67
10	0.03701	9.98
25	0.09140	27.02
50	0.16081	48.78

COMPUCHEM NUMBER	ABS READ	CALC'D CONC.	SAMPLE AMOUNT	FINAL VOL.(ml)	DILUTION FACTOR	CONC. IN SAMPLE (PPM)
25 C.C. *	0.08932	26.37	100	100	1	26.4
0 C.C. *	0.00106	-1.29	1000	100	1	-0.1
565842 BL	0.00241	-0.87	20	100	1	-4.3
562641 SS	0.10251	30.51	18.2	100	1	167.6
562642 SS	0.09740	28.91	18.2	100	1	158.8
562643 BS	0.08737	25.76	20	100	1	128.8
562688 OR	0.01464	2.97	18.2	100	1	16.3
562690	0.01321	2.52	19.2	100	1	13.1
562691	0.01142	1.96	17.8	100	1	11.0
562696	0.00752	0.74	19	100	1	3.9
562697	0.00761	0.76	18.8	100	1	4.1
562698	0.04032	11.02	18	100	1	61.2
25 C.C. *	0.09095	26.88	100	100	1	26.9
0 C.C. *	0.00042	-1.49	1000	100	1	-0.1
562701	0.00794	0.87	18	100	1	4.8
562703	0.00527	0.03	17.8	100	1	0.2
562733	0.12804	38.51	16.6	100	50	11598.8
25 C.C.*	0.09020	26.65	100	100	1	26.6
0 C.C.*	0.00071	-1.40	1000	100	1	-0.1

C.C. = CONTINUING CALIBRATION

Reviewed by / ID#: Grant Norris / 2037 Date: 8/10/93

FT-IR Analysis Runlog: Petroleum Hydrocarbons and Oil and Grease

Date: 4 August 1993 ID#: 6007 Run#: 1485 Page 1 of 3

Chemist: R Hardner Calib. Stds. Lot#: 6L118

Circle method reference: 418.1 413.2 503 Reviewed By: Edward Morris Date: 8-10-93

Run seq.	CompuChem number	QC type	Case number	Absorbance reading 1	Absorbance reading 2	Absorbance reading 3	Dilution factor
0000	0.0			0.00107			
0001	2.5			0.01262			
0002	5.0			0.02327			
0003	10.0			0.03701			
0004	25.0			0.09140			
0005	50.0			0.16081			
0006	25.			0.08932			
0007	0			0.00106			
0008	565842	BLK		0.00000	0.00241		
0009	562641	SS		0.10251			
0010	562642	SS		0.09740			
0011	562643	BS		0.08737			
0012	562688	OR	27539	0.01464			
0013	562690			0.01321			
0014	562691			0.01142			
0015	562696			0.00752			
0016	562697			0.00761			
0017	562698			0.04032			
0018	25			0.09095			
0019	0			0.00042			
0020	562701			0.00794			
0021	562703			0.00527			
0022	562733			0.12804			X50
0023	565841	BLK		0.00138			
0024	562611	SS		0.02633			X50
0025	562612	SS		0.02557			X50
0026	562613	BS		0.14915	0.09921		
0027	562493	OR	26990	0.02224			X50
0028	562530			0.05417			
0029	562532			0.00820			
0030	25			0.09566	0.09020		
0031	0			0.09366	0.00071		
0032	562534			0.01058	~~0.11696~~ 8/9/93		
0033	562602			0.02420			X50
0034	562614			0.01288			
0035	562616			0.11696			
0036	562619			~~0.14957~~	0.02644		X50
0037	562622			0.15204			
0038	562625			0.02445			
0039	25			0.08908			
0040	0			0.00101			
0041	565838	BLK		0.00139			

MODE:F ACTION: CompuChem Laboratory Management System 08/10/1993
EXT001S PH AND DRY WEIGHT WORKSCREEN 12:16

Which Workscreen? (P)-pH, (D)-Dry Weight, or (B)-Both
01 CompuChem Number 562688 Receive Date 7/14/93 Verified Y
Sample ID SB-MW2S

PH WORKSCREEN

02 Date Started
03 pH Amount

DRY WEIGHT WORKSCREEN

Decanted Flag (U)-Undecanted, (D)-Decanted, (B)-Both

		Undecanted		Decanted
04	Date Started	07/27/93	COLEE	09
05	Date Completed	07/28/93		10
06	Weight of Container	.99		11
07	Total Wet Weight	6.01		12
08	Total Dry Weight	5.55		13
	Factor	1.10		
	% Moist	9		
	% Solid	91		

UPDATE & UPDATE & PRINT REFRESH CN SIMPLE EXTENDED EXIT

MODE:F ACTION: CompuChem Laboratory Management System 08/10/1993
EXT001S PH AND DRY WEIGHT WORKSCREEN 12:17

Which Workscreen? (P)-pH, (D)-Dry Weight, or (B)-Both
01 CompuChem Number 562690 Receive Date 7/14/93 Verified Y
Sample ID SB-MW3S

PH WORKSCREEN

02 Date Started
03 pH Amount

DRY WEIGHT WORKSCREEN

Decanted Flag (U)-Undecanted, (D)-Decanted, (B)-Both

		Undecanted		Decanted
04	Date Started	07/27/93	COLEE	09
05	Date Completed	07/28/93		10
06	Weight of Container	.99		11
07	Total Wet Weight	6.46		12
08	Total Dry Weight	6.23		13
	Factor	1.04		
	% Moist	4		
	% Solid	96		

UPDATE & UPDATE & PRINT REFRESH CN SIMPLE EXTENDED EXIT

MODE:F ACTION: CompuChem Laboratory Management System 08/10/1993
EXT001S PH AND DRY WEIGHT WORKSCREEN 12:18

Which Workscreen? (P)-pH, (D)-Dry Weight, or (B)-Both
01 CompuChem Number 562691 Receive Date 7/14/93 Verified Y
Sample ID SB-RW3A

PH WORKSCREEN

02 Date Started
03 pH Amount

DRY WEIGHT WORKSCREEN

Decanted Flag (U)-Undecanted, (D)-Decanted, (B)-Both

		Undecanted		Decanted
04	Date Started	07/27/93	COLEE	09
05	Date Completed	07/28/93		10
06	Weight of Container	.99		11
07	Total Wet Weight	6.89		12
08	Total Dry Weight	6.26		13
	Factor	1.12		
	% Moist	11		
	% Solid	89		

UPDATE & UPDATE & PRINT REFRESH CN SIMPLE EXTENDED EXIT

MODE:F ACTION: CompuChem Laboratory Management System 08/10/1993
EXT001S PH AND DRY WEIGHT WORKSCREEN 12:18

Which Workscreen? (P)-pH, (D)-Dry Weight, or (B)-Both
01 CompuChem Number 562696 Receive Date 7/14/93 Verified Y
Sample ID SB-RW3B

PH WORKSCREEN

02 Date Started
03 pH Amount

DRY WEIGHT WORKSCREEN

Decanted Flag (U)-Undecanted, (D)-Decanted, (B)-Both

		Undecanted		Decanted
04	Date Started	07/27/93	COLEE	09
05	Date Completed	07/28/93		10
06	Weight of Container	.99		11
07	Total Wet Weight	6.26		12
08	Total Dry Weight	5.98		13
	Factor	1.06		
	% Moist	5		
	% Solid	95		

UPDATE & UPDATE & PRINT REFRESH CN SIMPLE EXTENDED EXIT

MODE:F ACTION: CompuChem Laboratory Management System 08/10/1993
EXT001S PH AND DRY WEIGHT WORKSCREEN 12:19

Which Workscreen? (P)-pH, (D)-Dry Weight, or (B)-Both
01 CompuChem Number 562697 Receive Date 7/14/93 Verified Y
Sample ID SB-MW1H

PH WORKSCREEN

02 Date Started
03 pH Amount

DRY WEIGHT WORKSCREEN

Decanted Flag (U)-Undecanted, (D)-Decanted, (B)-Both

		Undecanted		Decanted
04	Date Started	07/27/93	COLEE	09
05	Date Completed	07/28/93		10
06	Weight of Container	.99		11
07	Total Wet Weight	6.03		12
08	Total Dry Weight	5.74		13
	Factor	1.06		
	% Moist	6		
	% Solid	94		

UPDATE & UPDATE & PRINT REFRESH CN SIMPLE EXTENDED EXIT

MODE:F ACTION: CompuChem Laboratory Management System 08/10/1993
EXT001S PH AND DRY WEIGHT WORKSCREEN 12:19

Which Workscreen? (P)-pH, (D)-Dry Weight, or (B)-Both
01 CompuChem Number 562698 Receive Date 7/14/93 Verified Y
Sample ID SB-MW3H

PH WORKSCREEN

02 Date Started
03 pH Amount

DRY WEIGHT WORKSCREEN

Decanted Flag (U)-Undecanted, (D)-Decanted, (B)-Both

		Undecanted		Decanted
04	Date Started	07/27/93	COLEE	09
05	Date Completed	07/28/93		10
06	Weight of Container	.99		11
07	Total Wet Weight	6.17		12
08	Total Dry Weight	5.64		13
	Factor	1.11		
	% Moist	10		
	% Solid	90		

UPDATE & UPDATE & PRINT REFRESH CN SIMPLE EXTENDED EXIT

MODE:F ACTION: CompuChem Laboratory Management System 08/10/1993
EXT001S PH AND DRY WEIGHT WORKSCREEN 12:19

Which Workscreen? (P)-pH, (D)-Dry Weight, or (B)-Both
01 CompuChem Number 562701 Receive Date 7/14/93 Verified Y
Sample ID SB-Y

PH WORKSCREEN

02 Date Started
03 pH Amount

DRY WEIGHT WORKSCREEN

Decanted Flag (U)-Undecanted, (D)-Decanted, (B)-Both

		Undecanted		Decanted
04	Date Started	07/27/93	COLEE	09
05	Date Completed	07/28/93		10
06	Weight of Container	.99		11
07	Total Wet Weight	6.09		12
08	Total Dry Weight	5.60		13
	Factor	1.11		
	% Moist	10		
	% Solid	90		

UPDATE & UPDATE & PRINT REFRESH CN SIMPLE EXTENDED EXIT

MODE:F ACTION: CompuChem Laboratory Management System 08/10/1993
EXT001S PH AND DRY WEIGHT WORKSCREEN 12:19

Which Workscreen? (P)-pH, (D)-Dry Weight, or (B)-Both
01 CompuChem Number 562703 Receive Date 7/14/93 Verified Y
Sample ID SB-X

PH WORKSCREEN

02 Date Started
03 pH Amount

DRY WEIGHT WORKSCREEN

Decanted Flag (U)-Undecanted, (D)-Decanted, (B)-Both

		Undecanted		Decanted
04	Date Started	07/27/93	COLEE	09
05	Date Completed	07/28/93		10
06	Weight of Container	.99		11
07	Total Wet Weight	6.91		12
08	Total Dry Weight	6.28		13
	Factor	1.12		
	% Moist	11		
	% Solid	89		

UPDATE & UPDATE & PRINT REFRESH CN SIMPLE EXTENDED EXIT

MODE:F ACTION: CompuChem Laboratory Management System 08/10/1993
EXT001S PH AND DRY WEIGHT WORKSCREEN 12:20

Which Workscreen? (P)-pH, (D)-Dry Weight, or (B)-Both
01 CompuChem Number 562739 Receive Date 7/14/93 Verified Y
Sample ID DISPCOMP

PH WORKSCREEN

02 Date Started
03 pH Amount

DRY WEIGHT WORKSCREEN

Decanted Flag (U)-Undecanted, (D)-Decanted, (B)-Both

		Undecanted		Decanted
04	Date Started	07/17/93	JOEBUM	09
05	Date Completed	07/18/93		10
06	Weight of Container	1.00		11
07	Total Wet Weight	6.20		12
08	Total Dry Weight	5.30		13
	Factor	1.21		
	% Moist	17		
	% Solid	83		

UPDATE & UPDATE & PRINT REFRESH CN SIMPLE EXTENDED EXIT

CHAIN-OF-CUSTODY RECORD

№ 33780

CompuChem Laboratories, Inc.
3308 Chapel Hill/Nelson Highway
Research Triangle Park, NC 27709

1-800-833-5097

Ship to: CompuChem Inc.

Carrier: Airborne Airbill No.: 5904362225

Project Name: Yorktown-Post Pilot Study

Sampler Name: William L. Hughes

Sampler Signature: William L. Hughes

Field Point-of-Contact: Bill Hughes / Lori Reuther

Telephone No: (804) 436-7881

Sampling for project complete? Y or N (See Note 1.)

Project-specific (PS) or Batch (B) QC: PS

Box #1: 1. Surface Water 2. Ground Water 3. Leachate 4. Rinsate 5. Soil/Sediment/Sludge 6. Trip Blank 7. Oil 8. Waste 9. Other: _____

Box #2: A. HCl B. HNO_3 C. $NaHSO_4$ D. $Na_2S_2O_3$ E. Ice Only O. Other: _____ N. Not Preserved

Box #3: F. Filtered U. Unfiltered

Box #4: C. CLP 3/90 S. SW-846 W. CWA 600-series L. Low Conc. CLP R. Radiological T. TCLP O. Other

Box #5: H - High M - Medium L - Low U - UNKNOWN

Sample ID (Organics: 9 characters max, Inorganics: 6 characters; see Note 2)	Date: Year: 1993	Time	Box #1 Matrix	Box #2 Preservative	Box #3 Filtered/Unfiltered	Box #4 Method	Box #5 Expect. Conc.	No. of Bottles	Use for Lab QC (MS or DUP)	VOA-GC/MS	SV-GC/MS	Pest/PCB-GC	Herb-GC	VOA-GC	Total BTEX	Metals TCLP	Mercury	Cyanides	EPA 8080 PCBs	Radiologicals	TOC/TOX	O&G/TPH	Phenols	Other	% Moisture	Remarks/Comments
SB-MW2S	7/12	10:12	S	E	U	9020 418.1	H	3													X	X				EPA 9020 for TOX
SB-MW3S	7/12	11:20	S	E	U		H	3													X	X				EPA 418.1 for TPH
SB-RW3A	7/12	1:55	S	E	U		H	3													X	X				
SB-RW3B	7/12	3:00	S	E	U		H	4													X	X				
SB-MW1H	7/13	9:45	S	E	U		H	4													X	X				
SB-MW3H	7/13	11:40	S	E	U		H	4													X	X				
SB-X	7/13	12:20	S	E	U		H	4													X	X				
SB-Y	7/13	1:15	S	E	U		H	4													X	X				
	/	:	S	E	U	SEE COMMENTS	U								X	X			X		X	X			X	
	/	:																								

562688, 562696, 562701, 707, 719, 727, 690, 697, 703, 562711, 562722, 562728, 691, 698, 716, 724, 729

Remarks/Comments: 562688 / 562696 / 562701 / 707 / 719 / 727 / 690 / 697 / 703 / 562711 / 562722 / 562728 / 691 / 698 / 716 / 724 / 729

RECEIVED IN GOOD CONDITION 7/14/93 WLH

Client's Special Instructions:

Lab: Received in Good Condition? Y or N Describe Problems, If Any:

#1 Relinquished By: (Sig.) William L. Hughes	Date: 7/13/93	#2 Relinquished By: (Sig.)	Date:	#3 Relinquished By: (Sig.)	Date:	Sample storage time requested? _____ (In days, see Note 3)
Company Name: GSI	Time: 3:45	Company Name:	Time:	Company Name:	Time:	
#1 Received By: (Sig.) V. Batt	Date: 7/14/93	#2 Received By (Sig.)	Date:	#3 Received By: (Sig.)	Date:	DESTROY or RETURN data after five years of archival? (Circle choice; see
Company Name: Compu Chem	Time: 0830	Company Name:	Time:	Company Name:	Time:	

Note (1): If "N" lab ... samples to await remainder of project-maximizing batch size and minimizing QC ratio; if "Y" lab will be ... ssing batches now. Note (2): If CLP Inorganics diskette required, ID limited to maximum of six characters.
Note (3): Sampl... 60 days after date report mailed at no extra charge. Note (4): All lab copies of data destroyed after five y... less client requests and pays for return of copies; annual storage fee billed in January of year six.

CHAIN-OF-CUSTODY RECORD

№ 33779

CompuChem Laboratories, Inc
3308 Chapel Hill/Nelson Highway
Research Triangle Park, NC 27709

1-800-833-5097

Ship to:

Project Name: YORKTOWN

Field Point-of-Contact: William L. Hughes

Sampler Name: Bill Hughes

Telephone No: (804) 436-7881

Sampling for project complete? (Y) or N (See Note 1.)

Carrier: AIRBORNE

Airbill No.: 5904362225

Sampler Signature: William L. Hughes

Project-specific (PS) or Batch (B) QC: ____

Box #1: 1. Surface Water, 2. Ground Water, 3. Leachate, 4. Rinsate, 5. Soil/Sediment/Sludge, 6. Trip Blank, 7. Oil, 8. Waste, 9. Other: ____

Box #2: A. HCl, B. HNO_3, C. $NaHSO_4$, D. $Na_2S_2O_3$, E. Ice Only, O. Other: ____, N. Not Preserved

Box #3: F. Filtered, U. Unfiltered

Box #4: C. CLP 3/90, S. SW-846, W. CWA 600-series, L. Low Conc. CLP, R. Radiological, T. TCLP, O. Other

Box #5: H - High, M - Medium, L - Low

Sample ID (Organics: 9 characters max, Inorganics: 6 characters; see Note 2)	Date: Year: 19__	Time	Box #1 Matrix	Box #2 Preservative	Box #3 Filtered/Unfiltered	Box #4 Method	Box #5 Expect. Conc.	No. of Bottles	Use for Lab QC (MS or DUP)	Organics Analysis: VOA-GC/MS	SV-GC/MS	Pest/PCB-GC	Herb-GC	VOA-GC	Inorganics: Metals	Mercury	Cyanides	Other: Radiologicals	TOC/TOX	O&G/TPH	Phenols	Other
DISPCOMP	7/12	2:15	S	E	U	O	H	8														
	/	:																				
	/	:																				
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Remarks/Comments: 562729* 562734* 733* 735* 739*

~~TCLP~~ BTEX by EPA 8020
TCLP Metals
% Moisture
TOX by EPA 9020
TPH by EPA 418.1
PCBs by EPA 8080

RECEIVED IN GOOD CONDITION 7/14/93

Client's Special Instructions:

Lab: Received in Good Condition? Y or N Describe Problems, If Any:

#1 Relinquished By: (Sig.) William L Hughes	Date: 7/13/93	#2 Relinquished By: (Sig.)	Date:	#3 Relinquished By: (Sig.)	Date:	Sample storage time requested? ____ (in days, see Note 3)
Company Name: GSI	Time: 4:00	Company Name:	Time:	Company Name:	Time:	
#1 Received By: (Sig.) V. Batta	Date: 7/14/93	#2 Received By (Sig.)	Date:	#3 Received By: (Sig.)	Date:	DESTROY or RETURN data after five years of archival? (Circle choice; see Note 4)
Company Name: CompuChem	Time: 0830	Company Name:	Time:	Company Name:	Time:	

Note (1): If "N" la[illegible] [illegible]id samples to await remainder of project-maximizing batch size and minimizing QC ratio; if "Y" lab will b[illegible] [illegible]essing batches now. Note (2): If CLP Inorganics diskette required, ID limited to maximum of six character[illegible]
Note (3): Sam[illegible] [illegible]d 60 days after date report mailed at no extra charge. Note (4): All lab copies of data destroyed after five [illegible]nless client requests and pays for return of copies; annual storage fee billed in January of year six.

COMPUCHEM LABORATORIES, INC. P.O. Box 12652 3308 Chapel Hill/Nelson Highway Research Triangle Park, NC 27709 (919) 549-8263

August 17, 1993

Mr. Joseph Giandonato
GROUNDWATER TECHNOLOGY
233 Wilimington-W.Chester Pike
Suite 201
Chadds Ford, PA 19317

Dear Mr. Giandonato:

We at CompuChem Laboratories are pleased to provide our report for the analysis you requested. Data for the following sample(s) are enclosed.

Client Sample ID	Lab Sample ID	Analysis Code	Order Number	Description of Work Requested
DISPCOMP	562735	749	27539	PCB's Method 8080 (Style 3)

Unless noted by Quality Assurance Notices included in this report of data, all Quality Control requirements associated with the preparation and analysis of these samples have been met.

Release of the analytical data contained in this data package has been authorized by the Technical Review Manager or his designee, as verified by the signature below.

Thank you for selecting CompuChem Laboratories for your sample analysis. If you have questions concerning this report or the analytical methods employed, please contact your Sales Representative at 800-833-5097.

We hope you will consider CompuChem Laboratories for your future analytical support and service requirements.

Sincerely,

Yolanda Lee

Report Preparation
CompuChem Laboratories, Inc.

COMPUCHEM LABORATORIES, INC. P.O. Box 12652 3308 Chapel Hill/Nelson Highway Research Triangle Park, NC 27709 (919) 549-8263

Unless noted by Quality Assurance Notices included in this report of data, all Quality Control requirements associated with the preparation and analysis of this sample have been met.

Release of the analytical data contained in this data package has been authorized by the Laboratory Manager or his designee, as verified by the following signature.

Patricia B. Hopkins

Patricia B. Hopkins
Technical Reviewer

Date August 17, 1993

COMPUCHEM LABORATORIES, INC.
COMMERCIAL DATA PACKAGE
REPORT STYLE 3 - GC
PESTICIDE / HERBICDE

I. LABORATORY CHRONICLE

II. METHOD REFERENCE

III. CHAIN OF CUSTODY

IV. SAMPLE DATA

V. QUALITY CONTROL SUMMARY

I. LABORATORY CHRONICLE

COMPUCHEM LABORATORIES, INC.

CHRONICLE

ITEM NO.	CLIENT SAMPLE ID	LAB SAMPLE ID	DATE SAMPLE RECEIVED	DATE SAMPLE EXTRACTED	DATE PCB FRACTION ANALYZED
1.	DISPCOMP	562735	07/14/93	07/22/93	08/12/93

(BLANK)	564444
(SPIKE)	562736/562737
(STANDARD)	R32K012-R32K024

II. METHOD REFERENCE

METHOD REFERENCE

To determine the concentration of PCB's as required in SW-846 Method 8080, Appendix VIII and Appendix IX, CompuChem employs the methods as stated in SW-846 Method 8080 in a wide range of matrices.

Method Summary

Samples are prepared for analysis by extraction in chemical solvent(s). Aqueous samples are extracted using SW-846 Method 3510 and solids are extracted using SW-846 Method 3550.

Method 8080 provides for a "clean-up" of sample extracts to reduce interferences present in the extract which mask the target compounds. Following sample preparation, PCB's present in the sample are separated based on chromatographic conditions. Once separated, the PCB's are detected by an Electron Capture Detector. Concentration is measured relative to the response of known standards.

III. CHAIN OF CUSTODY

CHAIN-OF-CUSTODY RECORD

№ 33779

CompuChem Laboratories, Inc.
3308 Chapel Hill/Nelson Highway
Research Triangle Park, NC 27709

1-800-833-5097

Ship to:

Project Name: YORKTOWN

Field Point-of-Contact: William L. Hughes

Sampler Name: Bill Hughes

Telephone No: (804) 436-7881

Sampling for project complete? (Y) or N (See Note 1.)

Carrier: AIRBORNE

Airbill No.: 5904362225

Sampler Signature: William L. Hughes

Project-specific (PS) or Batch (B) QC: ____

Box #1: 1. Surface Water, 2. Ground Water, 3. Leachate, 4. Rinsate, 5. Soil/Sediment/Sludge, 6. Trip Blank, 7. Oil, 8. Waste, 9. Other: ____

Box #2: A. HCl, B. HNO_3, C. $NaHSO_4$, D. $Na_2S_2O_3$, E. Ice Only, O. Other: ____, N. Not Preserved

Box #3: F. Filtered, U. Unfiltered

Box #4: C. CLP 3/90, S. SW-846, W. CWA 600-series, L. Low Conc. CLP, R. Radiological, T. TCLP, O. Other

Box #5: H - High, M - Medium, L - Low

Sample ID (Organics: 9 characters max, Inorganics: 6 characters; see Note 2)	Date: Year: 19__	Time	Box #1 Matrix	Box #2 Preservative	Box #3 Filtered/Unfiltered	Box #4 Method	Box #5 Expect. Conc.	No. of Bottles	Use for Lab QC (MS or DUP)	Organics Analysis: VOA-GC/MS	SV-GC/MS	Pest/PCB-GC	Herb-GC	VOA-GC	Inorganics: Metals	Mercury	Cyanides	Other: Radiologicals	TOC/TOX	O&G/TPH	Phenols	Other	Remarks/Comments
DISPCOMP	7/12	2:15	S	E	U	O	H	8															~~TCL~~ BTEX by EPA 8020
	/	:																					TCLP Metals
	/	:																					% Moisture
	/	:																					TOX by EPA 9020
	/	:																					TPH by EPA 418.1
	/	:																					PCBs by EPA 8080
	/	:																					
	/	:																					
	/	:																					
	/	:																					
	/	:																					

562729 562734 733 735 739

RECEIVED IN GOOD CONDITION 7/14/93

Client's Special Instructions:

Lab: Received in Good Condition? Y or N

Describe Problems, If Any:

#1 Relinquished By: (Sig.) William L Hughes	Date: 7/13/93	#2 Relinquished By: (Sig.)	Date:	#3 Relinquished By: (Sig.)	Date:	Sample storage time requested? ____ (in days, see Note 3)
Company Name: GSI	Time: 4:00	Company Name:	Time:	Company Name:	Time:	
#1 Received By: (Sig.) V. Batta	Date: 7/14/93	#2 Received By (Sig.)	Date:	#3 Received By: (Sig.)	Date:	DESTROY or RETURN data after five years of archival? (Circle choice; Note 4)
Company Name: CompuChem	Time: 0830	Company Name:	Time:	Company Name:	Time:	

Note (1): If ... ll hold samples to await remainder of project-maximizing batch size and minimizing QC ratio; if "Y" lab w... ocessing batches now. Note (2): If CLP Inorganics diskette required, ID limited to maximum of six charact... Note (3): Sa... ored 60 days after date report mailed at no extra charge. Note (4): All lab copies of data destroyed after fi... unless client requests and pays for return of copies; annual storage fee billed in January of year six.

IV. SAMPLE DATA

- Compound List/Detection Limits and Surrogate Recovery Data
- Chromatogram
- Quality Assurance/Laboratory Notices following each sample (if applicable)

COMPOUND LIST
PCB'S METHOD 8080

CLIENT SAMPLE ID: DISPCOMP
LAB SAMPLE ID: 562735

	CONCENTRATION (ug/kg)	DETECTION LIMIT (ug/kg)
1. PCB-1016	BDL	20
2. PCB-1221	BDL	20
3. PCB-1232	BDL	20
4. PCB-1242	BDL	20
5. PCB-1248	BDL	20
6. PCB-1254	BDL	20
7. PCB-1260	BDL	20

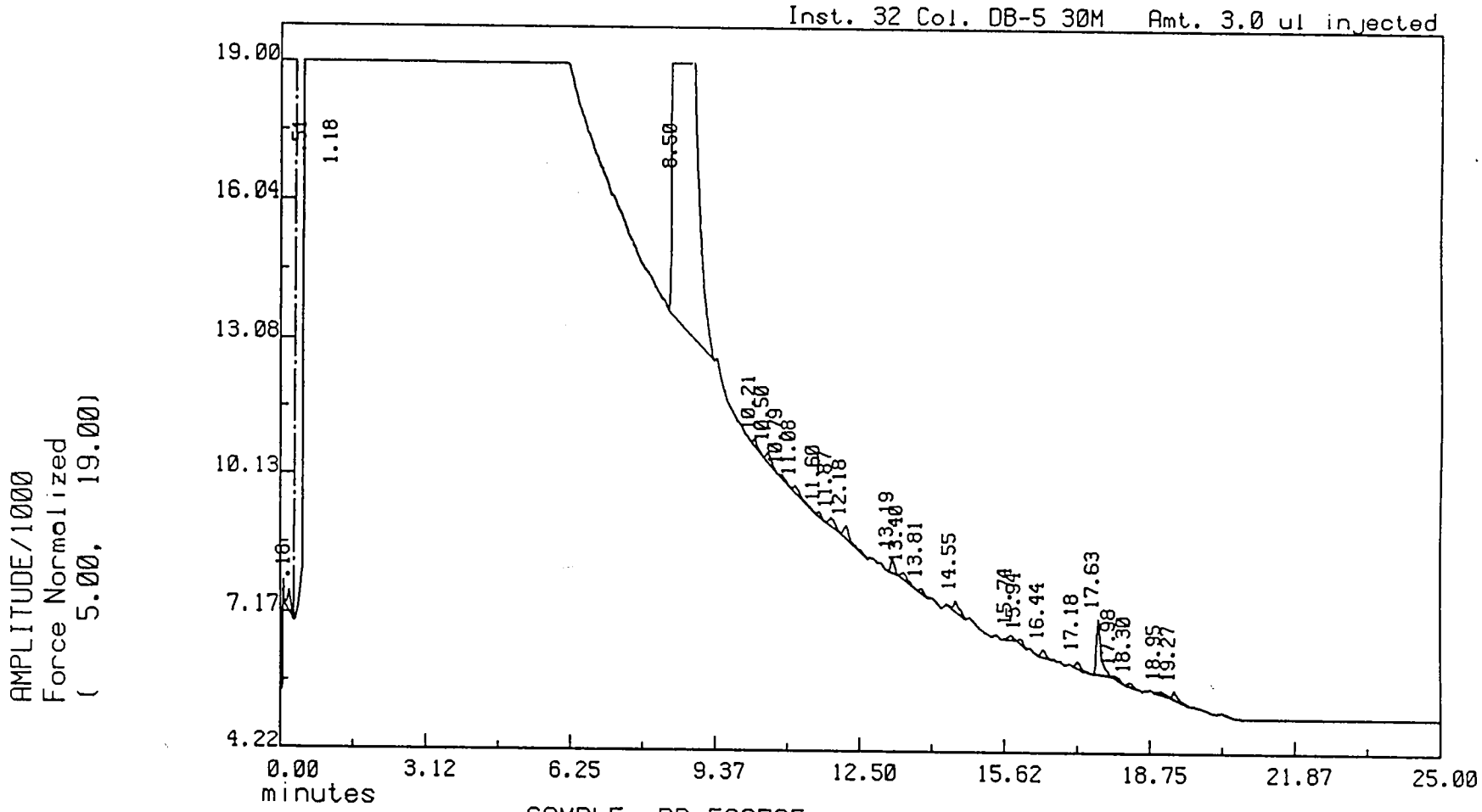
SURROGATE RECOVERY - Introduced at the beginning of the extraction, the surrogate standard is a select compound that analytically mimics the response of certain analytes. A known concentration of this surrogate is added to the sample and a percent recovery is calculated. This recovery acts as a barometer of extraction efficiency and analytical response for the individual sample.

	% Recovery	Control Range
TETRACHLORO-M-XYLENE	**	(20-150)*
DECACHLOROBIPHENYL	47	(20-150)*

*Advisory surrogate; with the exception of dilutions recovery below 20% requires action step (re-extraction and re-analysis).

BDL - BELOW DETECTION LIMIT

**See attached Quality Assurance Notice.



SAMPLE: PP 562735

ANALYZED: Tue Jul 27, 1993 15:50:10

RESULT: /RESULT/R32K043.RES METHOD: CAP32

COMPUCHEM LABORATORIES

QUALITY ASSURANCE NOTICE

CompuChem ID# 562735
Client ID# DISPCOMP
Case # 27539

Surrogate recoveries for the PCB fraction of this sample fell outside quality control limits in both the original and repeated extractions. Results were comparable between the two analyses. Since all other QC criteria associated with these analyses were met, we have attributed the out-of-control surrogate recoveries to the particular sample matrix, rather than to deficiencies in the laboratory's analytical system.

Under some circumstances, depending on the client's requirements, both sets of data will be reported. When only one report is required, the analyst considers whether or not the reextraction was completed within holding time specifications in deciding which set of data to report. If holding times were met for both extractions, the analysis that appears to be least affected by the sample matrix will be reported.

Reviewer's initials/ID IDB / 819

date 8·12·93

QAN-GC-2
901001

V. QUALITY CONTROL SUMMARY

A. Blank Data

- Compound List/Detection Limits and Surrogate Recovery Data
- Chromatogram
- Quality Assurance/Laboratory Notices (if applicable)

B. Matrix Spike/Matrix Spike Duplicate Summary

C. Standards Data

- Standard Chromatogram

COMPOUND LIST
PCB'S METHOD 8080

LAB BLANK ID: 564444

CLIENT SAMPLE ID: DISPCOMP
LAB SAMPLE ID: 562735

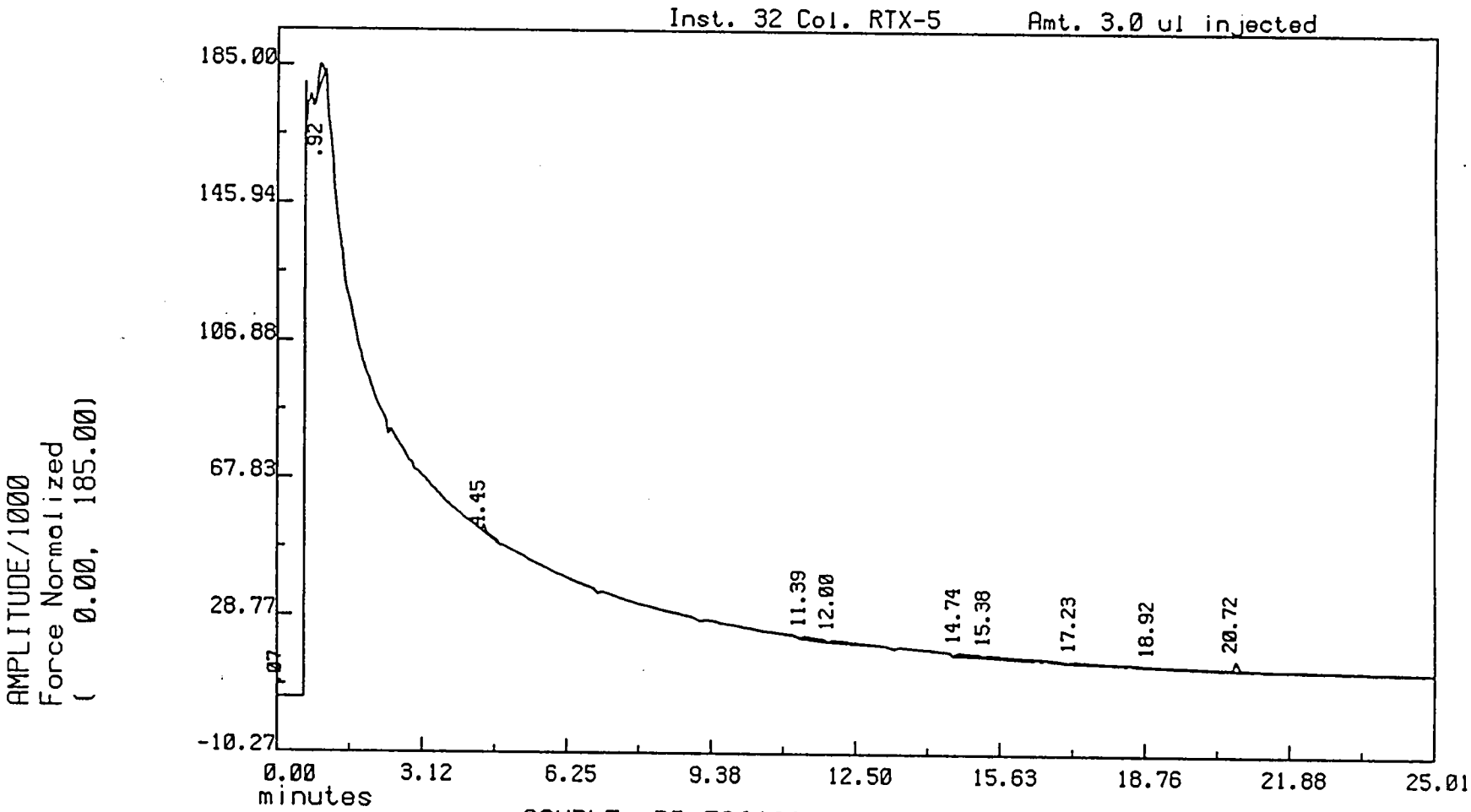
	CONCENTRATION (ug/kg)	DETECTION LIMIT (ug/kg)
1. PCB-1016	BDL	20
2. PCB-1221	BDL	20
3. PCB-1232	BDL	20
4. PCB-1242	BDL	20
5. PCB-1248	BDL	20
6. PCB-1254	BDL	20
7. PCB-1260	BDL	20

SURROGATE RECOVERY - Introduced at the beginning of the extraction, the surrogate standard is a select compound that analytically mimics the response of certain analytes. A known concentration of this surrogate is added to the sample and a percent recovery is calculated. This recovery acts as a barometer of extraction efficiency and analytical response for the individual sample.

	% Recovery	Control Range
TETRACHLORO-M-XYLENE	106	(20-150)*
DECACHLOROBIPHENYL	100	(20-150)*

*Advisory surrogate; with the exception of dilutions recovery below 20% requires action step (re-extraction and re-analysis).

BDL - BELOW DETECTION LIMIT



SAMPLE: PP 564444

ANALYZED: Mon Aug 2, 1993 01:00:47

RESULT: /RESULT/R32L028.RES METHOD: CAP32

PESTICIDE MATRIX SPIKE COMPARISON

	CCN	CLIENT NAME
ORIGINAL	562735	DISPCOMP
MATRIX SPIKE 1	562736	DISPCOMPMS
MATRIX SPIKE 2	562737	DISPCOMPMSD

COMPOUND	CONC OF ORIG UG/KG	SPIKE CONC UG/KG
Aroclor 1254	0	667

MATRIX 1 CONC	MATRIX 2 CONC	%REC 1	%REC 2	RPD
785	570	117.69	85.46	31.73

Percent recovery is calculated by suotracting the amount in the original from the amount in the spike and comparing that to the amount spiked.

COMPUCHEM LABORATORIES

QUALITY ASSURANCE NOTICE

Matrix Spike (MS) ID# 562736
MS Duplicate (MSD) ID# 562737
Blank Spike ID# 562738
Original Matrix ID# 562735
Client ID# DJSPCOMP
Case # 27539

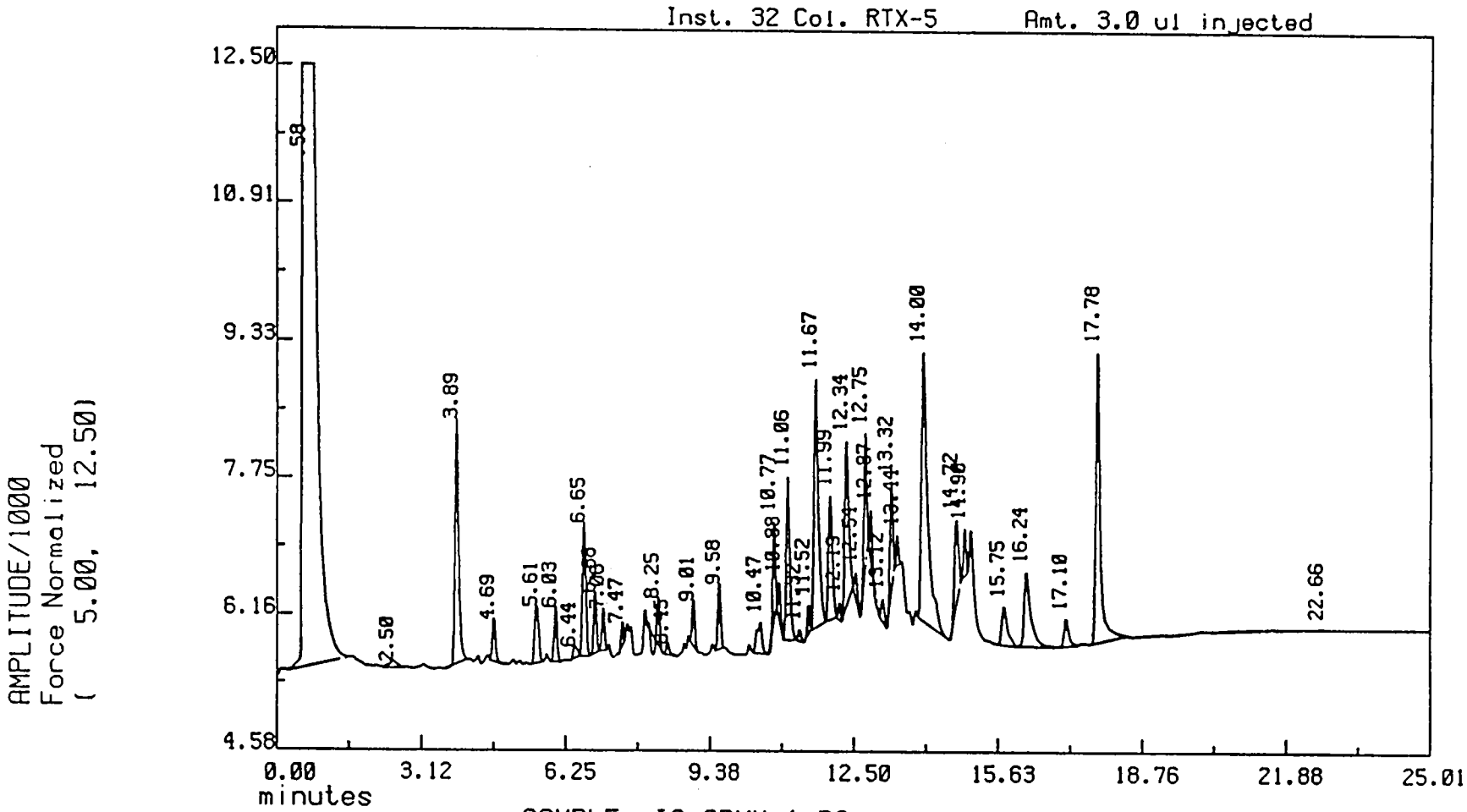
All surrogate and/or spike recovery criteria were not met for the duplicate matrix spikes listed above (MS/MSD). The same surrogate recovery trend was also observed for the original sample used to prepare the spikes. A Quality Control blank spike was prepared and analyzed with this batch of samples and matrix spikes, and all QC criteria have been met for this spike.

We have attributed the unacceptable recoveries in the matrix spikes and original to the particular matrix of the sample used, rather than to deficiencies in the laboratory's analytical system. We are reporting all three sets of spike data and the original sample data with reference to this qualifying notice.

Reviewer's initials/ID CBS / 8/19

date 8·12·93

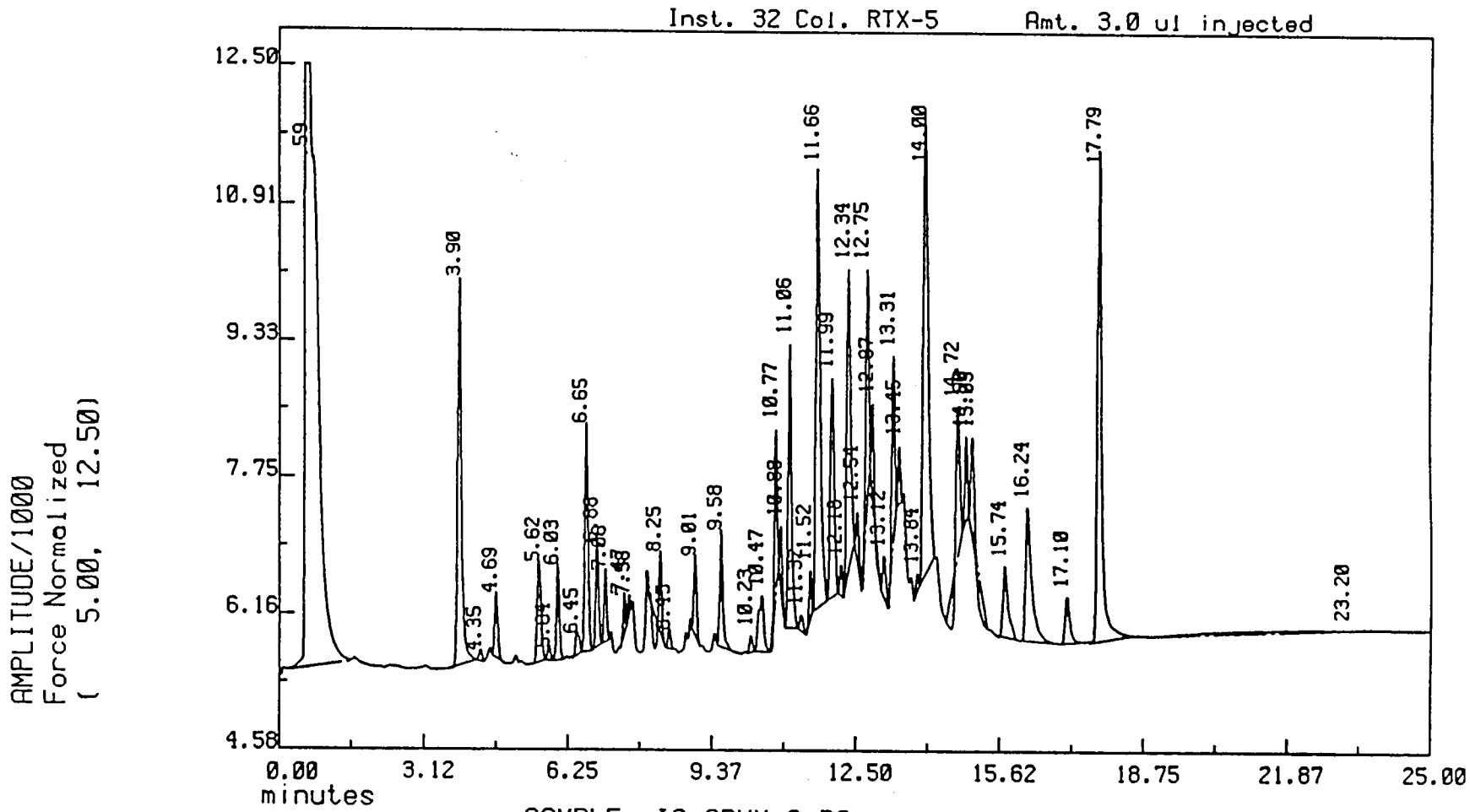
QAN-GC-5
001



SAMPLE: IS ARMX-1 B6

.. ANALYZED: Thu Jul 22, 1993 21:44:37

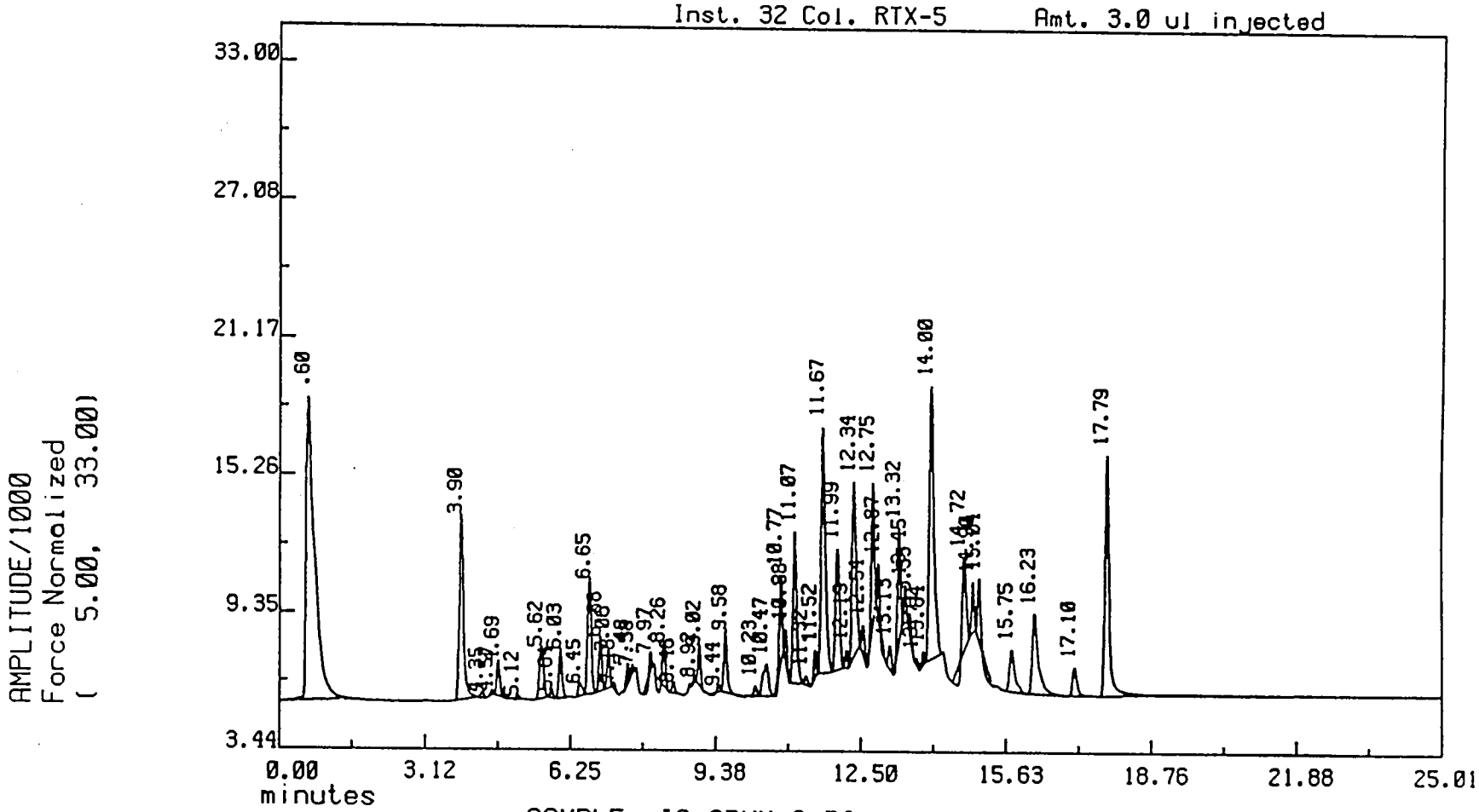
RESULT: /RESULT/R32K012.RES METHOD: CAP32



SAMPLE: IS ARMX-2 B6

ANALYZED: Thu Jul 22, 1993 22:14:08

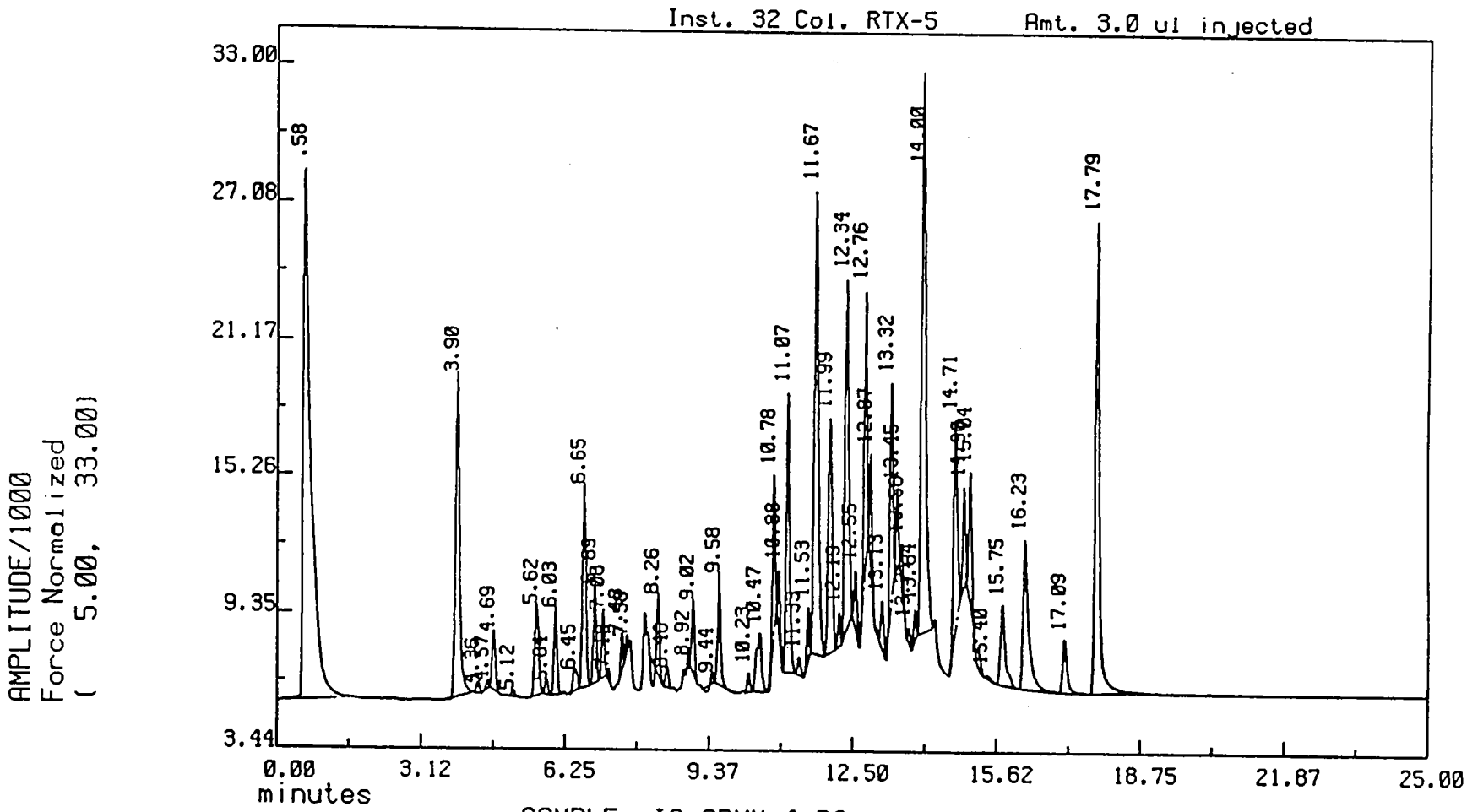
RESULT: /RESULT/R32K013.RES METHOD: CAP32



SAMPLE: IS ARMX-3 BI

ANALYZED: Thu Jul 22, 1993 22:43:36

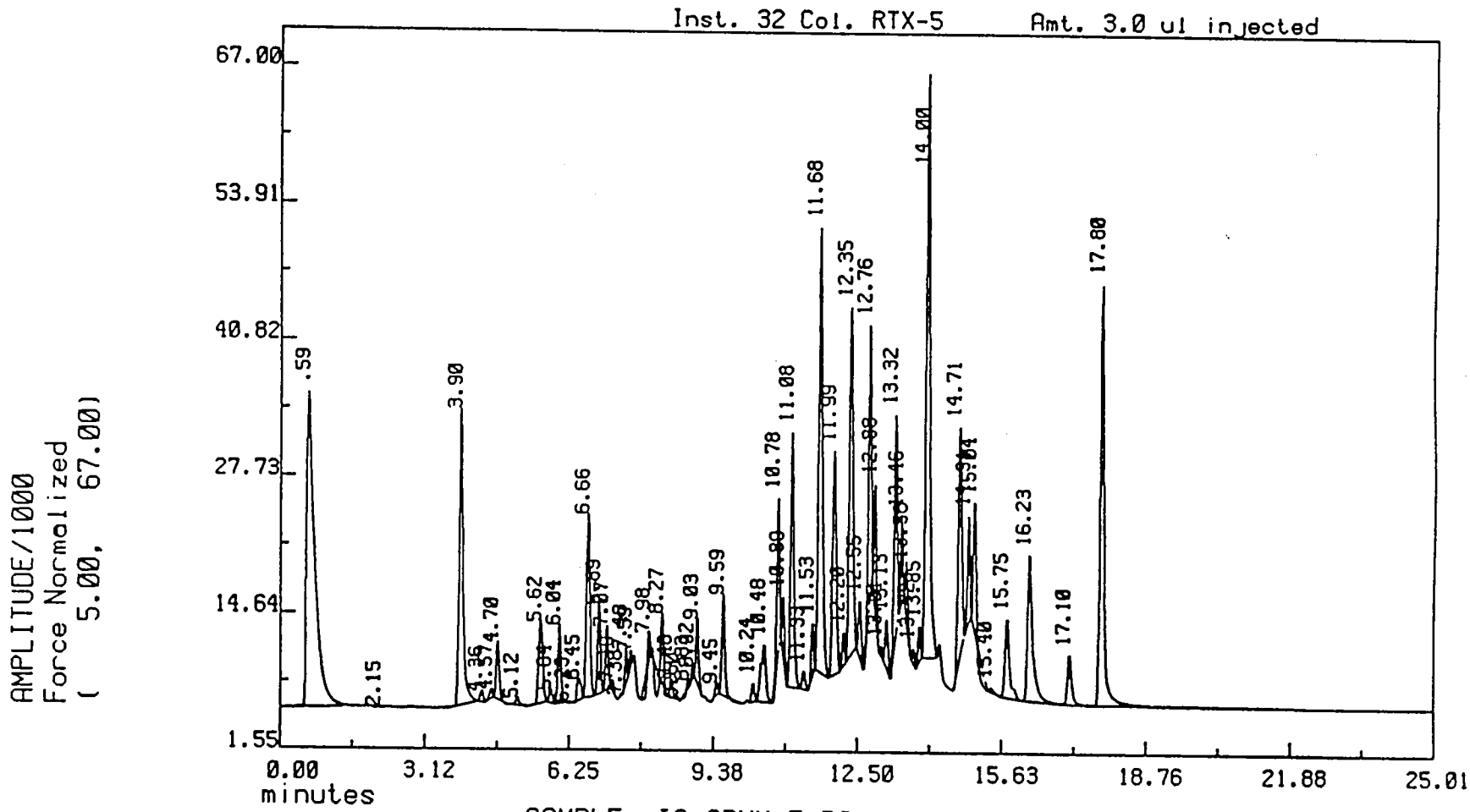
RESULT: /RESULT/R32K014.RES METHOD: CAP32



SAMPLE: IS ARMX-4 B6

ANALYZED: Thu Jul 22, 1993 23:13:07

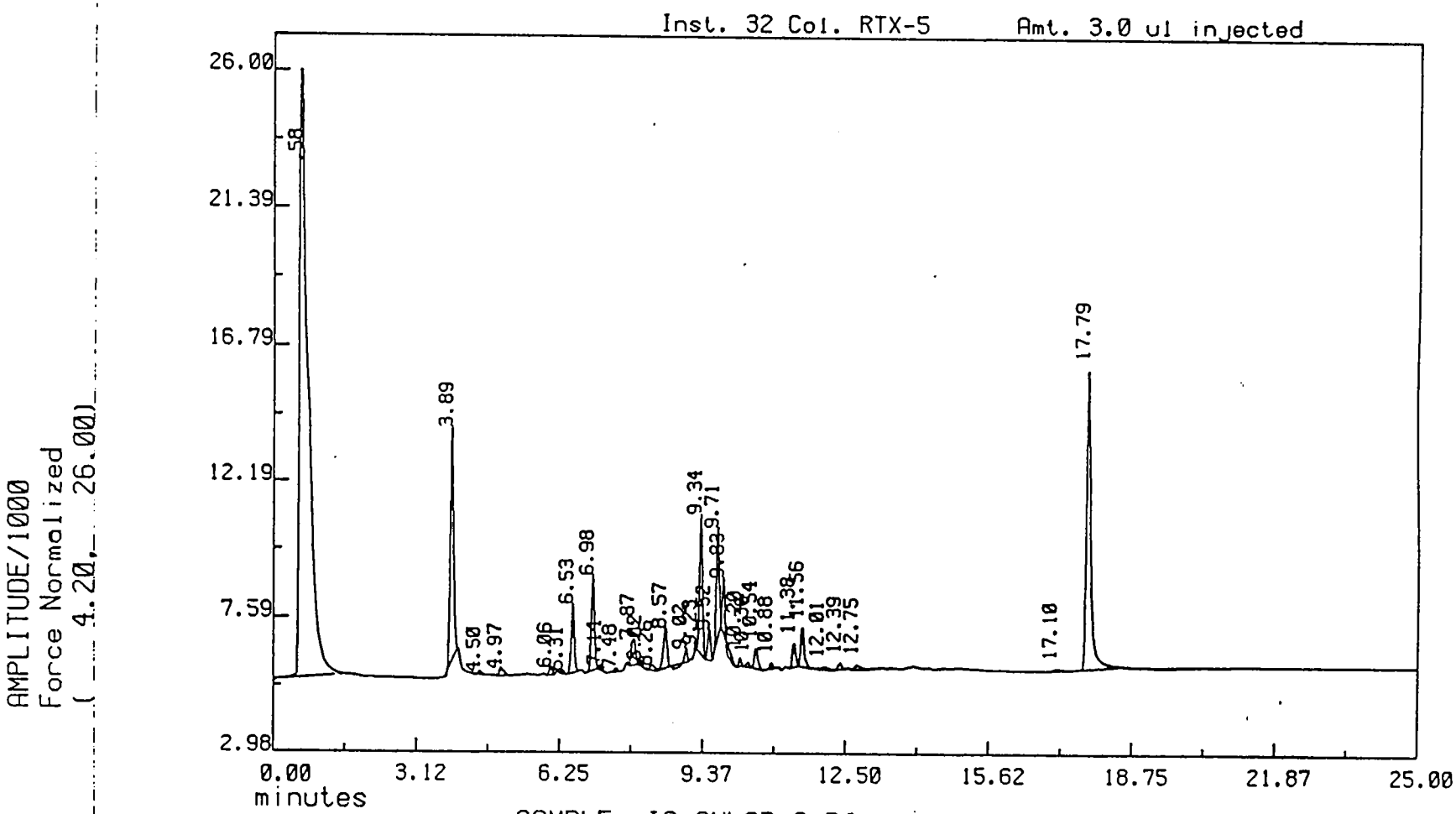
RESULT: /RESULT/R32K015.RES METHOD: CAP32



SAMPLE: IS ARMX-5 B6

ANALYZED: Thu Jul 22, 1993 23:42:46

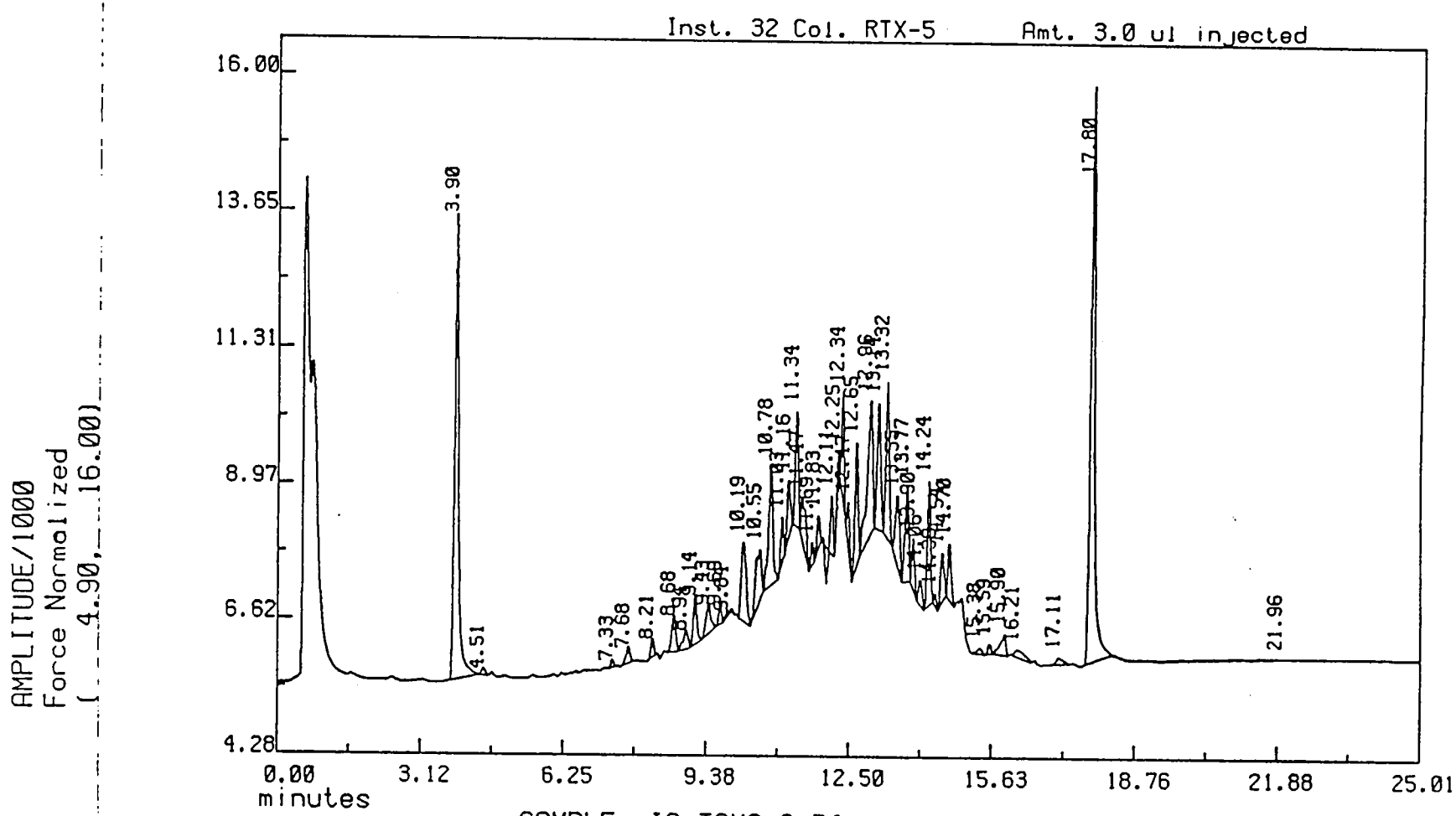
RESULT: /RESULT/R32K016.RES METHOD: CAP32



SAMPLE: IS CHLOR-3 B4

.. ANALYZED: Fri Jul 23, 1993 00:12:20

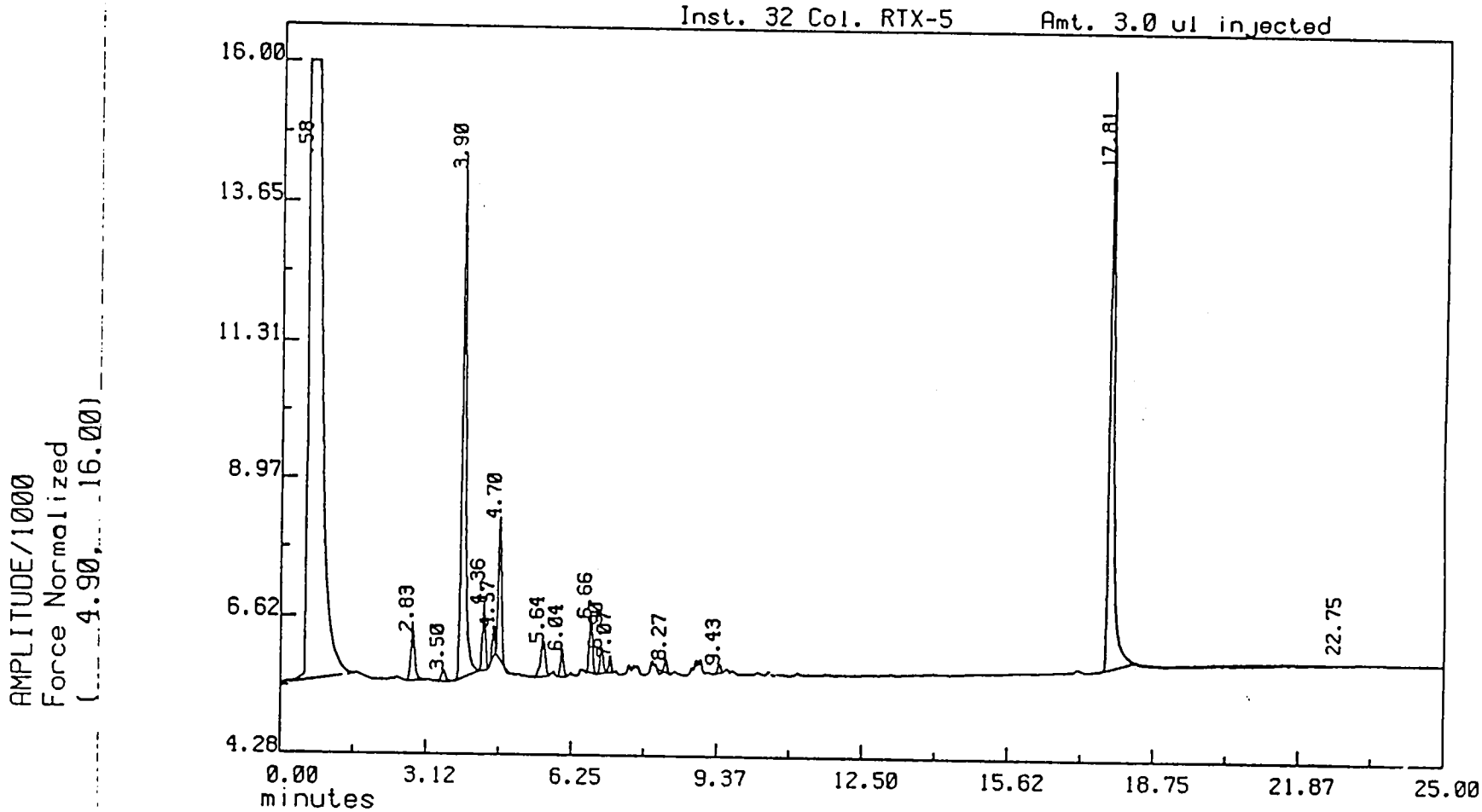
RESULT: /RESULT/R32K017.RES METHOD: CAP32



SAMPLE: IS TOXA-3 B4

ANALYZED: Fri Jul 23, 1993 00:41:56

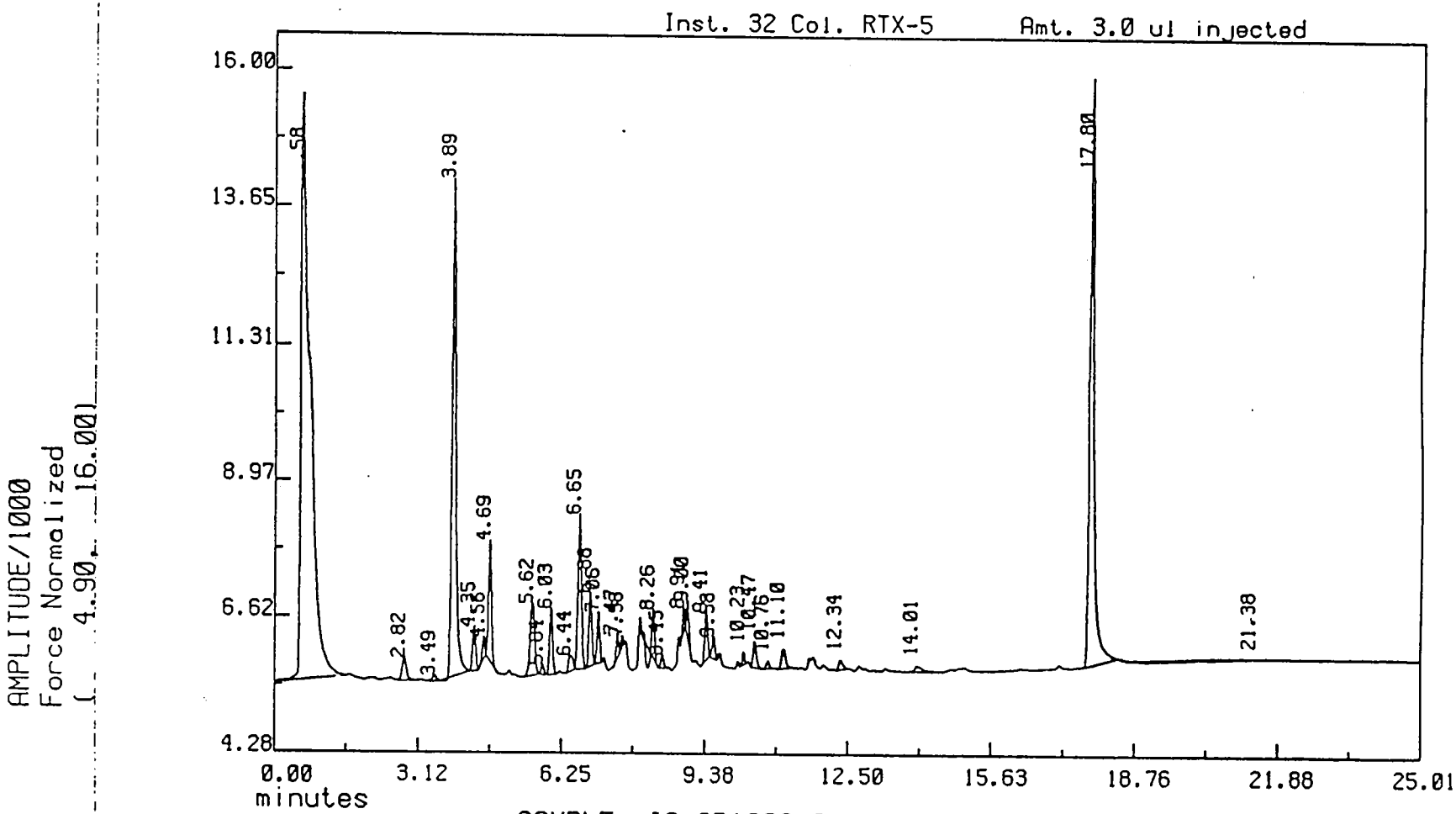
RESULT: /RESULT/R32K018.RES METHOD: CAP32



SAMPLE: IS AR1221-3 B6

ANALYZED: Fri Jul 23, 1993 01:11:31

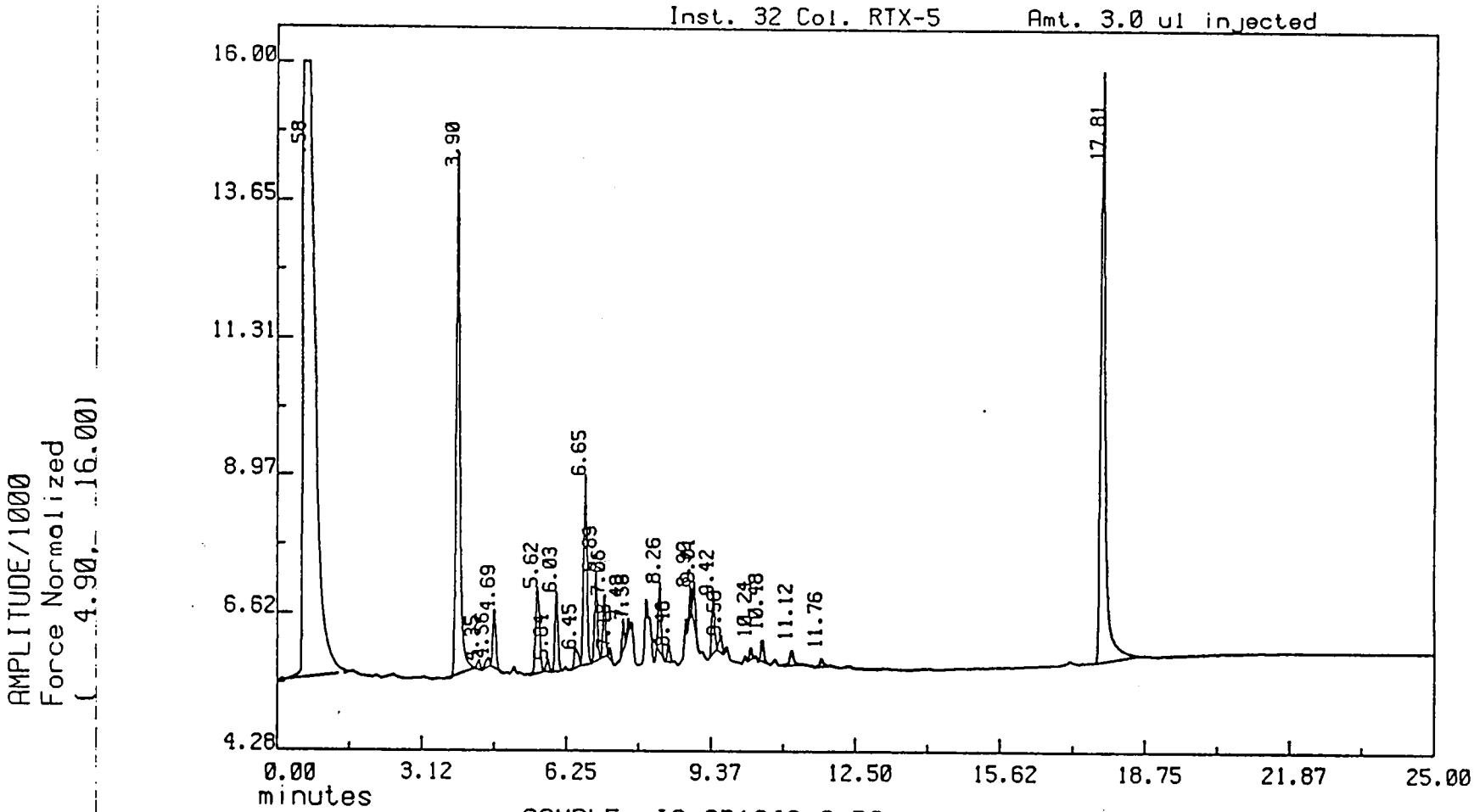
RESULT: /RESULT/R32K019.RES METHOD: CAP32



SAMPLE: IS AR1232-3 B6

ANALYZED: Fri Jul 23, 1993 01:41:04

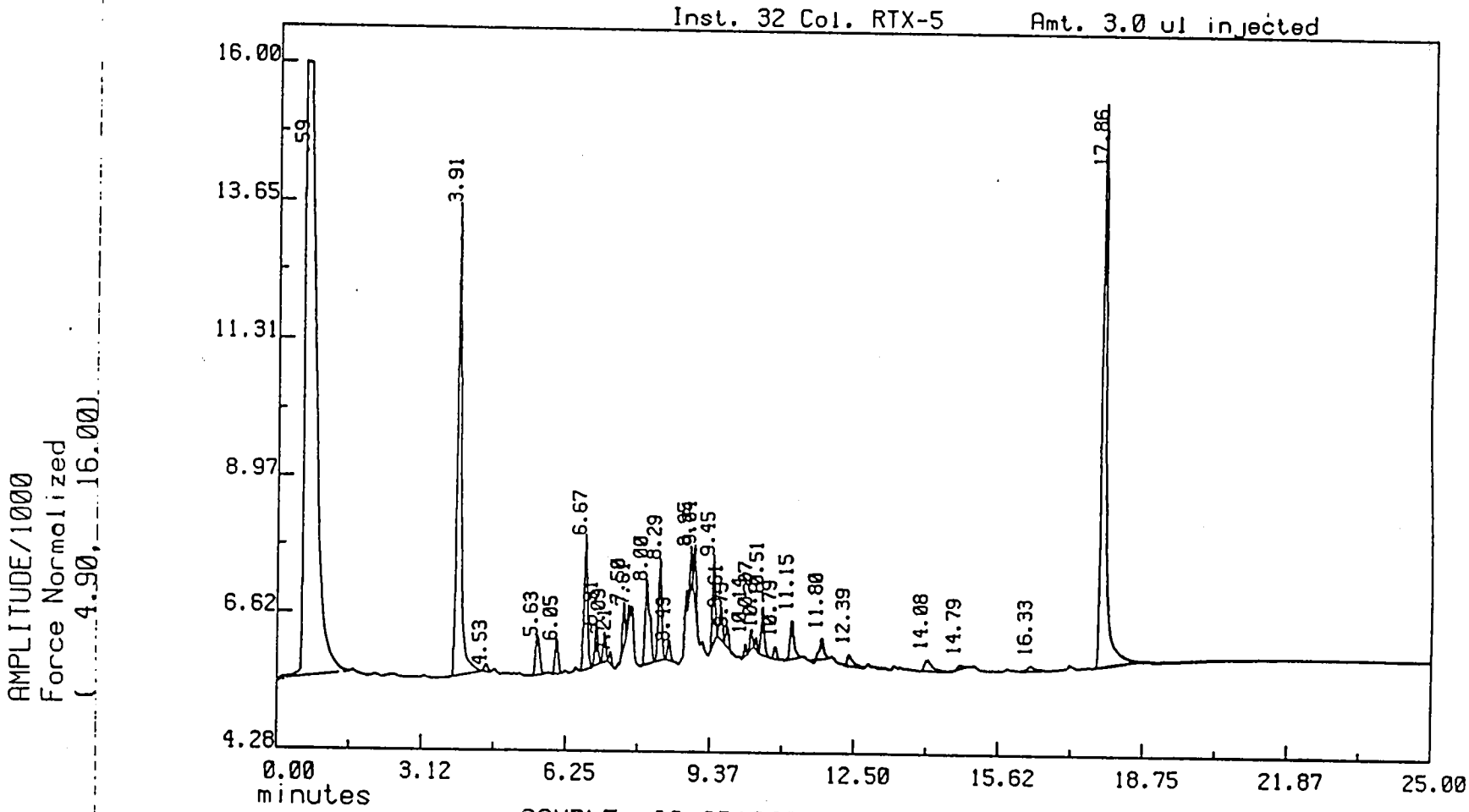
RESULT: /RESULT/R32K020.RES METHOD: CAP32



SAMPLE: IS AR1242-3 B6

ANALYZED: Fri Jul 23, 1993 02:10:36

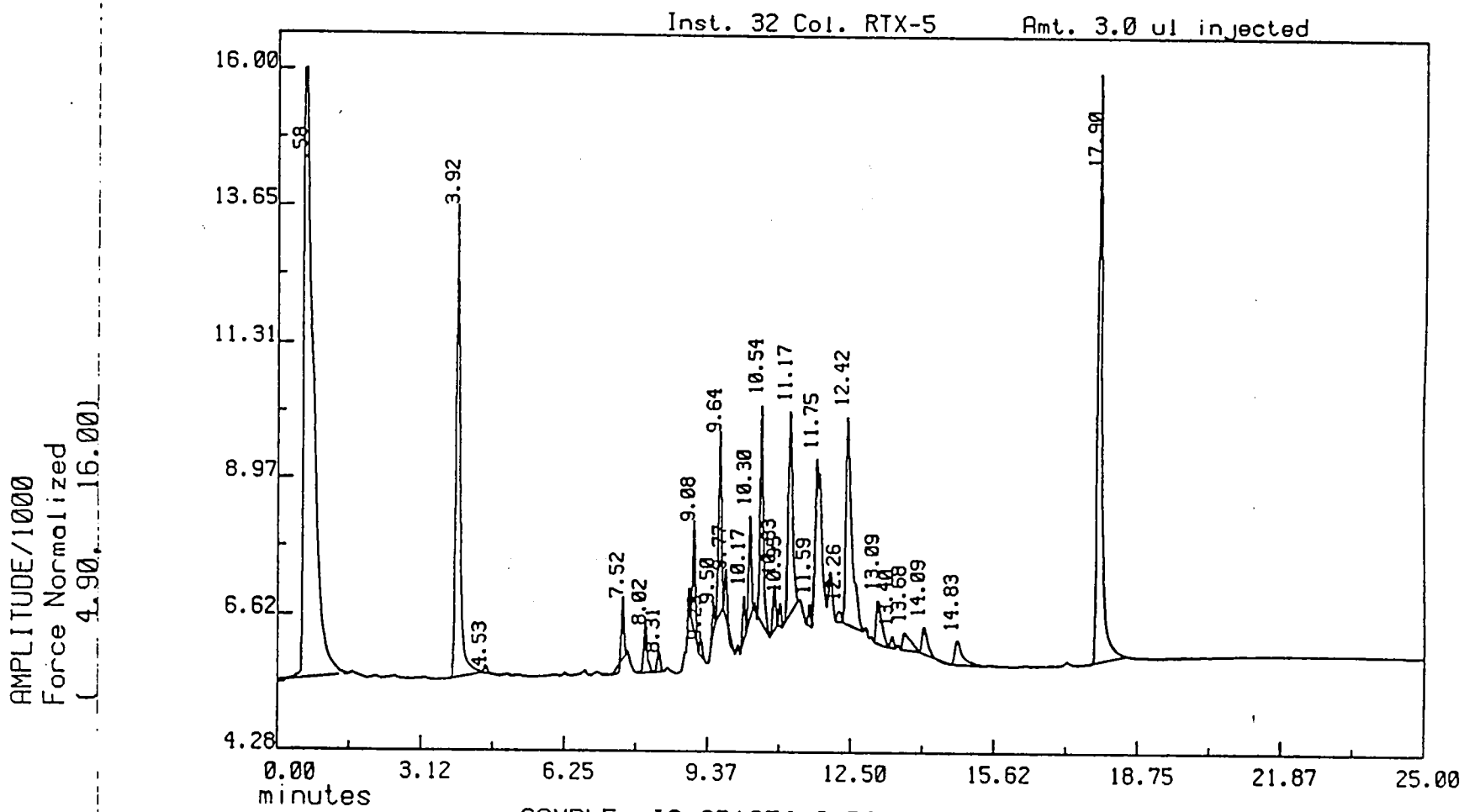
RESULT: /RESULT/R32K021.RES METHOD: CAP32



SAMPLE: IS AR1248-3 B7

ANALYZED: Fri Jul 23, 1993 02:40:04

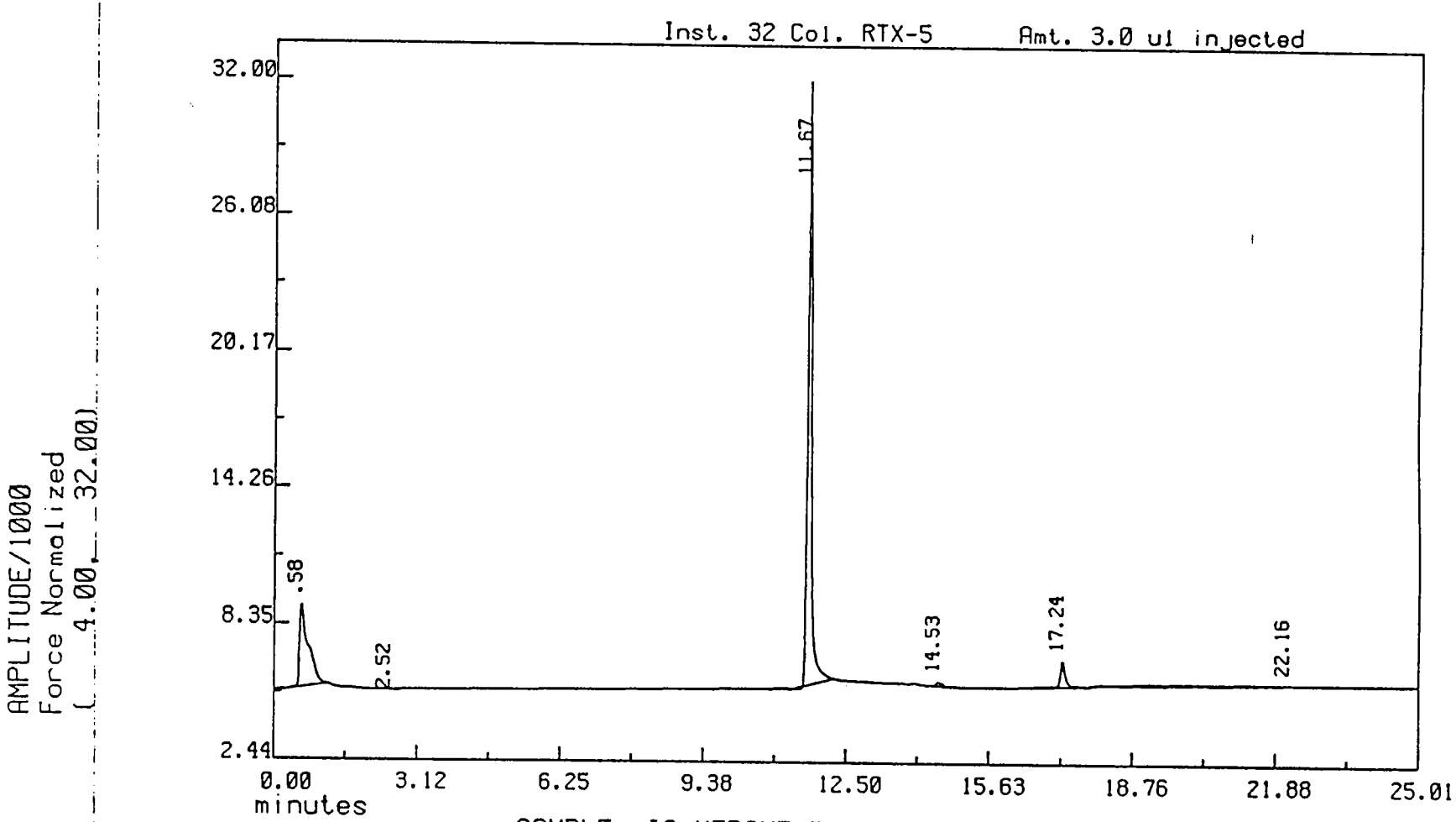
RESULT: /RESULT/R32K022.RES METHOD: CAP32



SAMPLE: IS AR1254-3 B6

ANALYZED: Fri Jul 23, 1993 03:09:33

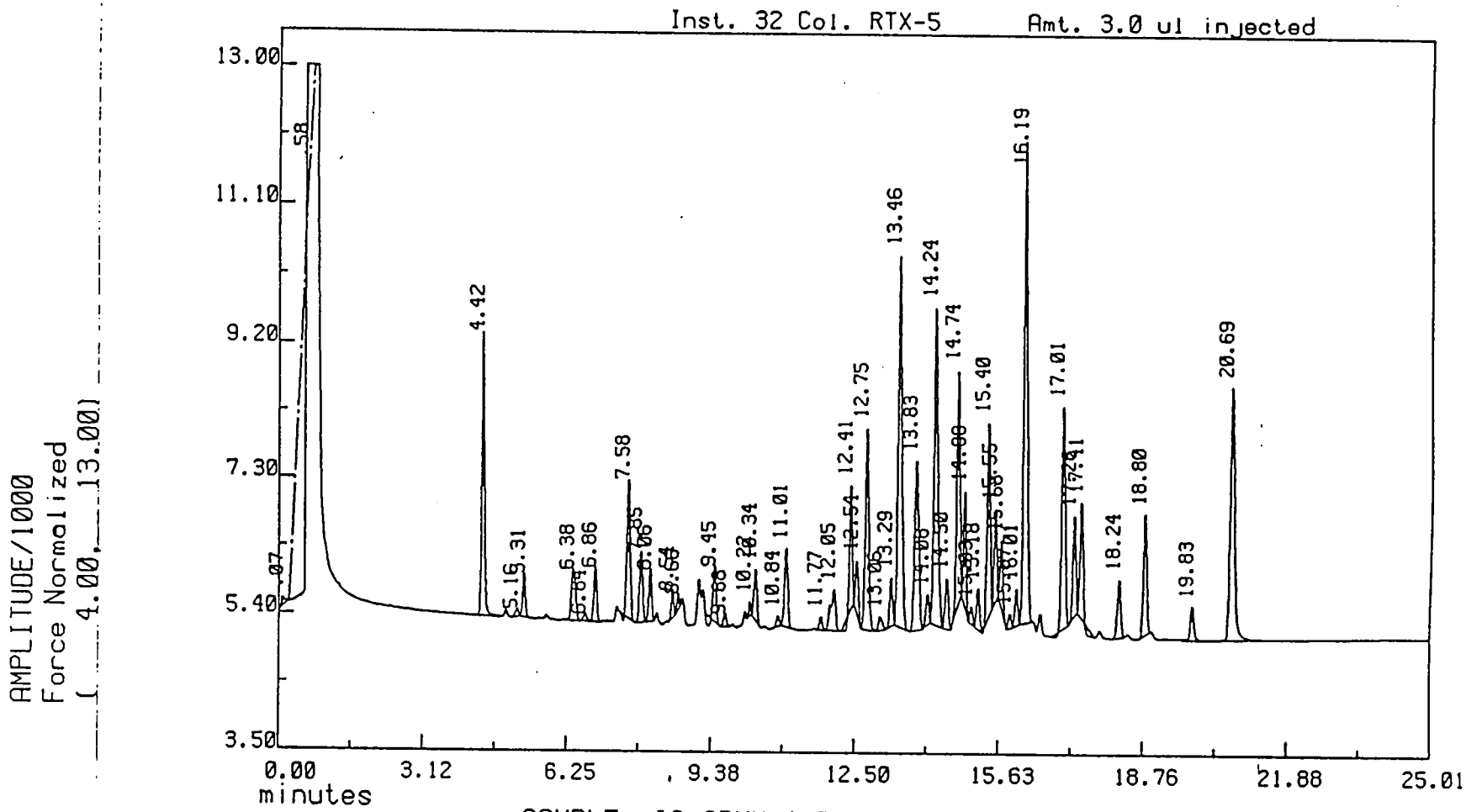
RESULT: /RESULT/R32K023.RES METHOD: CAP32



SAMPLE: IS KEPONE D

•• ANALYZED: Fri Jul 23, 1993 03:39:05

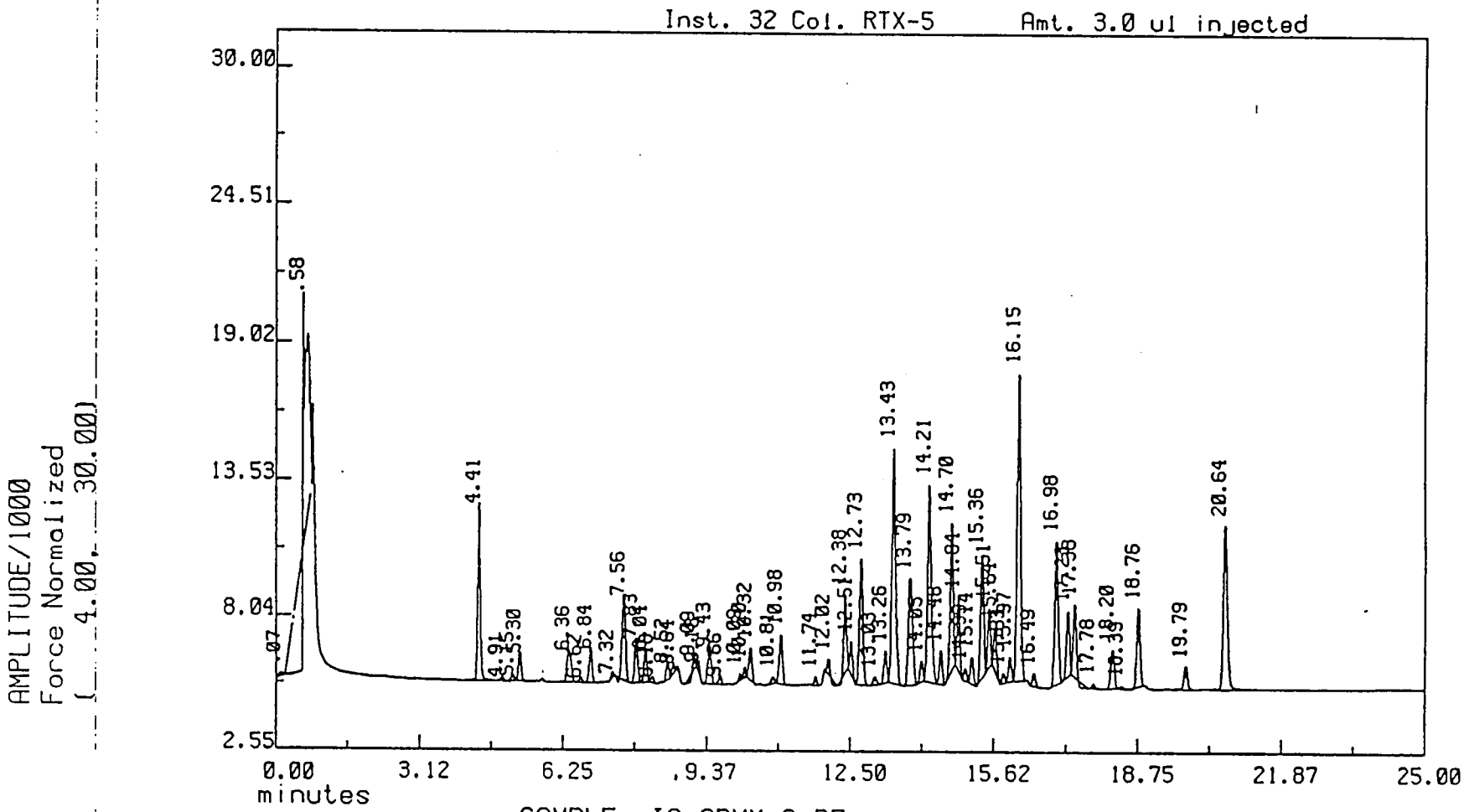
RESULT: /RESULT/R32K024.RES METHOD: CAP32



SAMPLE: IS ARMX-1 B7

ANALYZED: Thu Jul 29, 1993 19:26:14

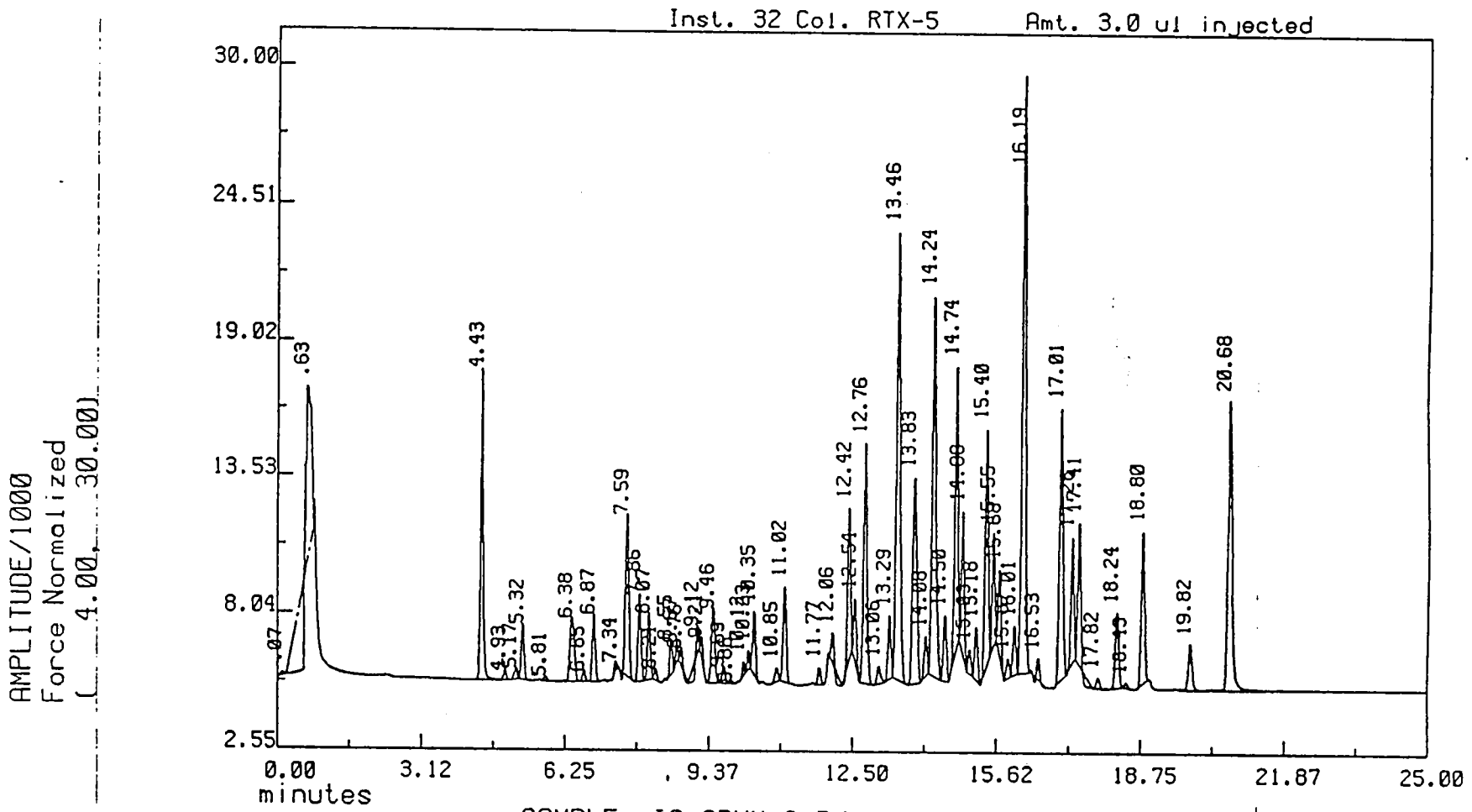
RESULT: /RESULT/R32L012.RES METHOD: CAP32



SAMPLE: IS ARMX-2 B7

ANALYZED: Thu Jul 29, 1993 19:55:40

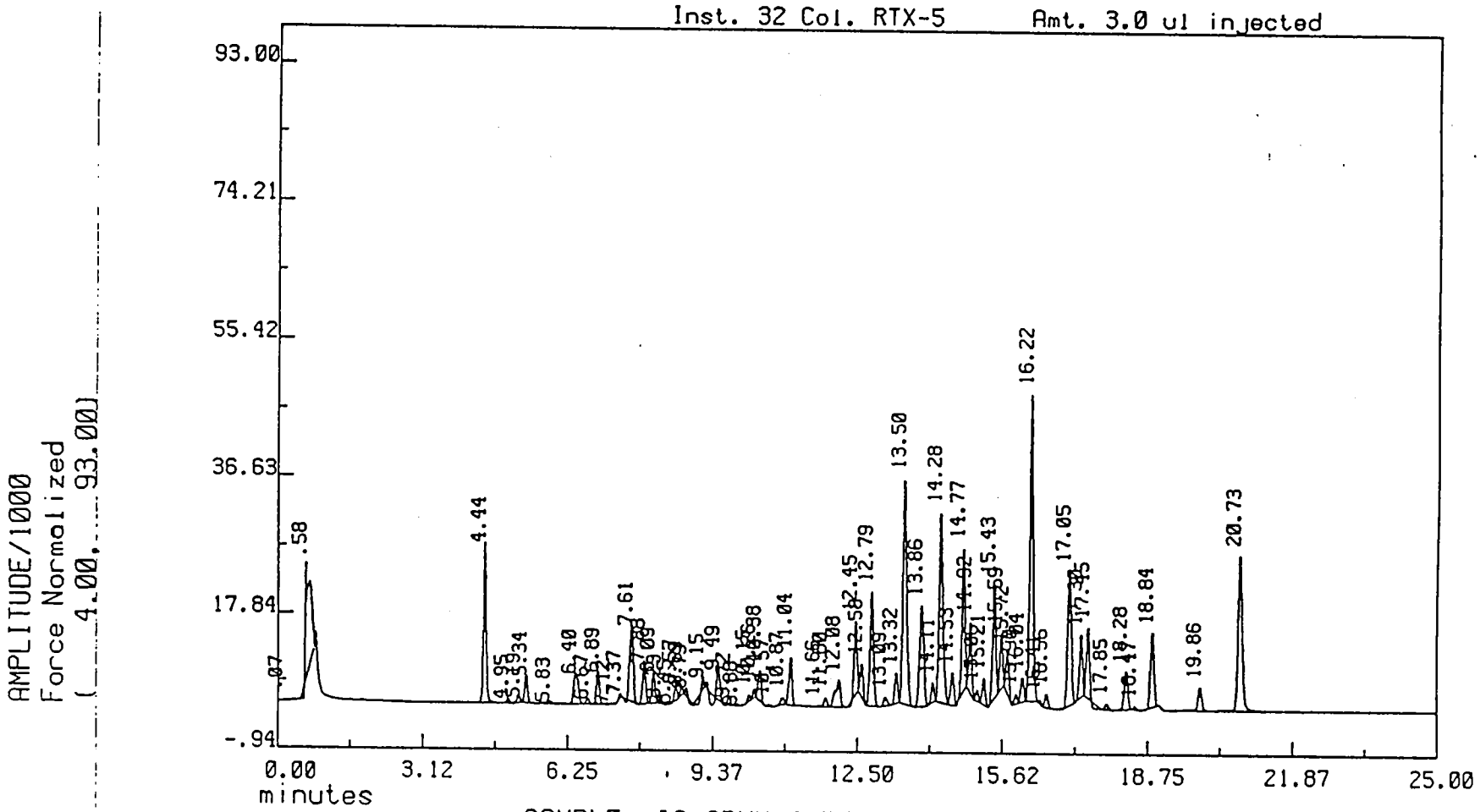
RESULT: /RESULT/R32L013.RES METHOD: CAP32



SAMPLE: IS ARMX-3 BJ

ANALYZED: Thu Jul 29, 1993 20:25:04

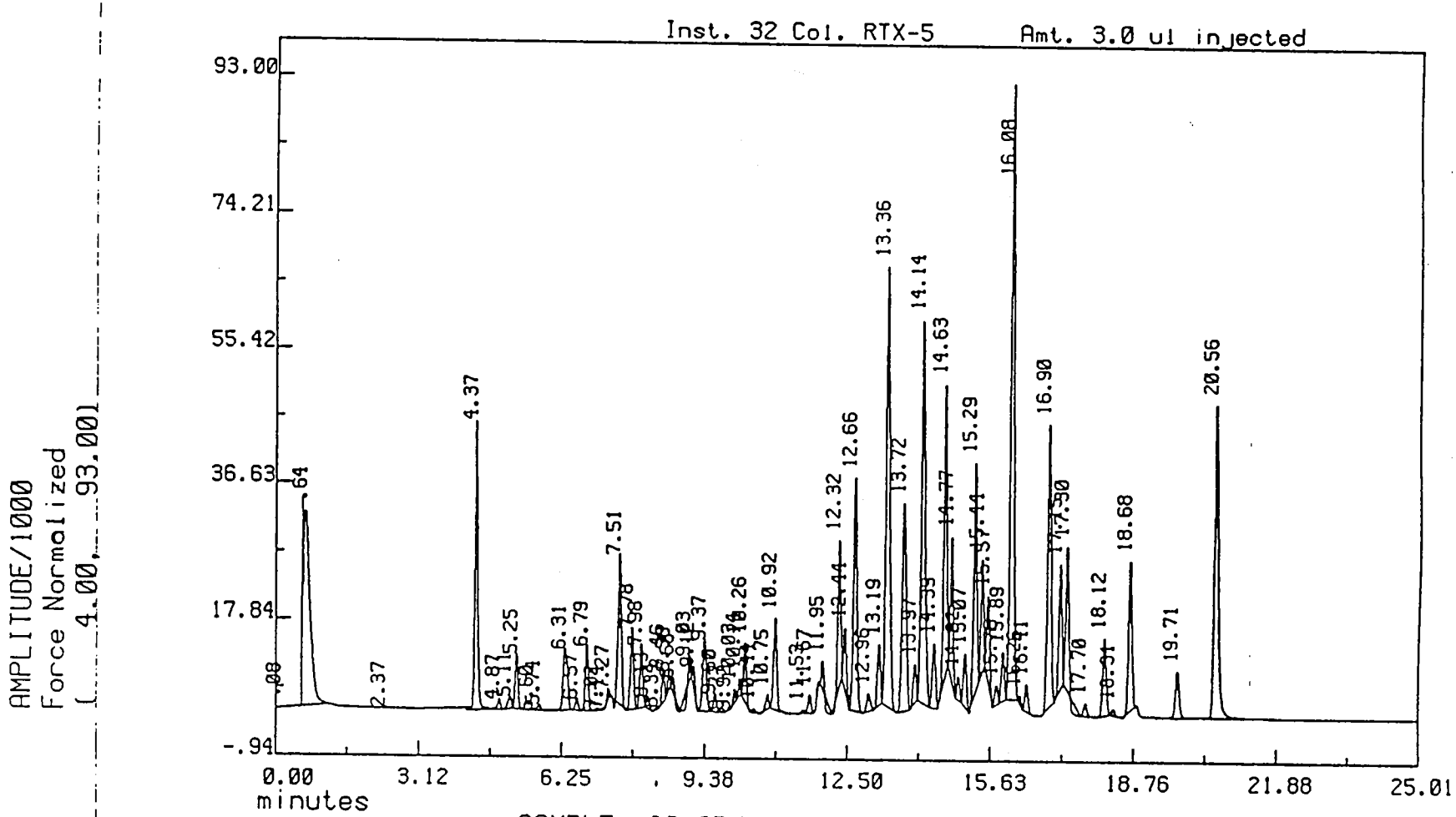
RESULT: /RESULT/R32L014.RES METHOD: CAP32



SAMPLE: IS ARMX-4 B7

ANALYZED: Thu Jul 29, 1993 20:54:29

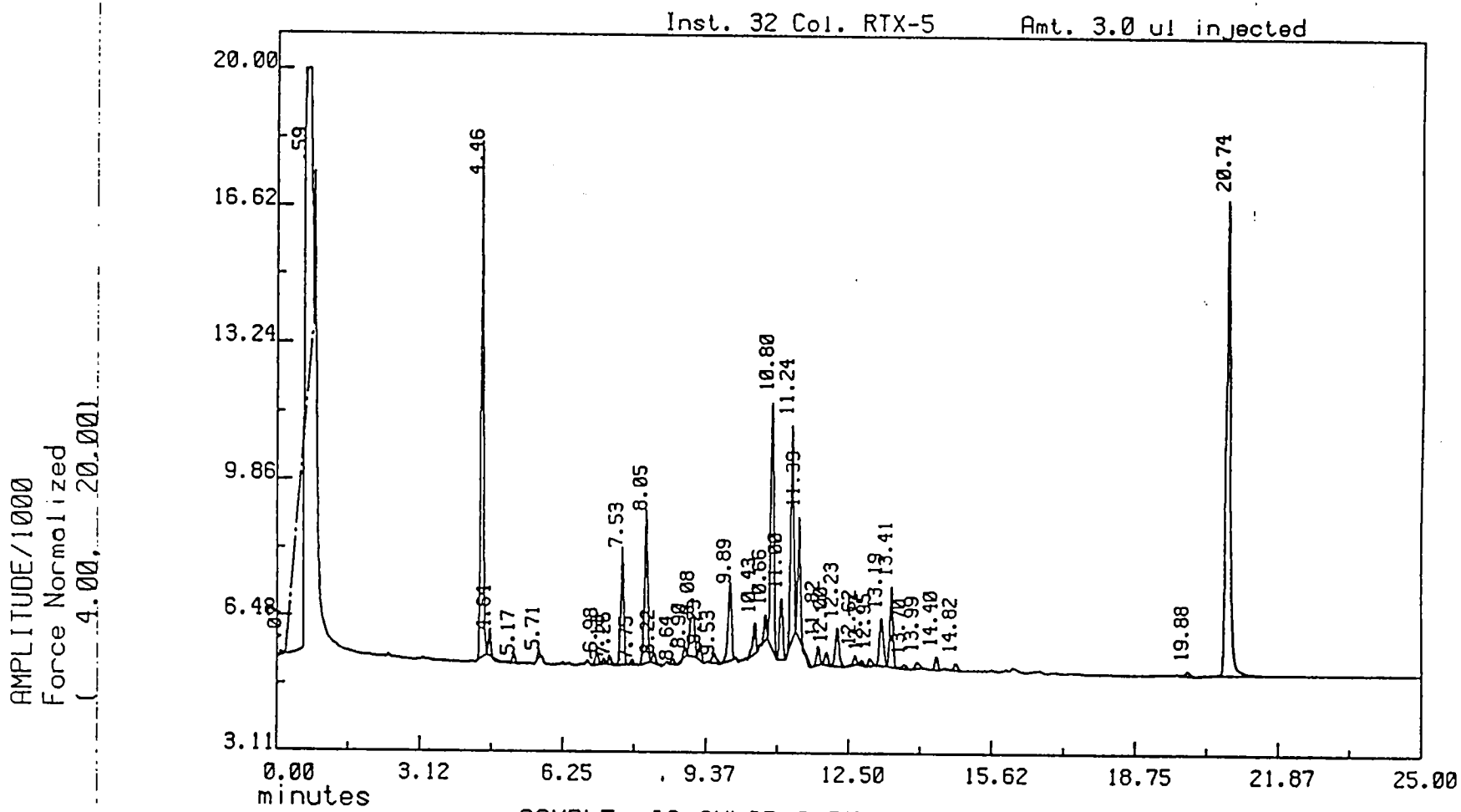
RESULT: /RESULT/R32L015.RES METHOD: CAP32



SAMPLE: IS ARMX-5 B7

ANALYZED: Thu Jul 29, 1993 21:24:04

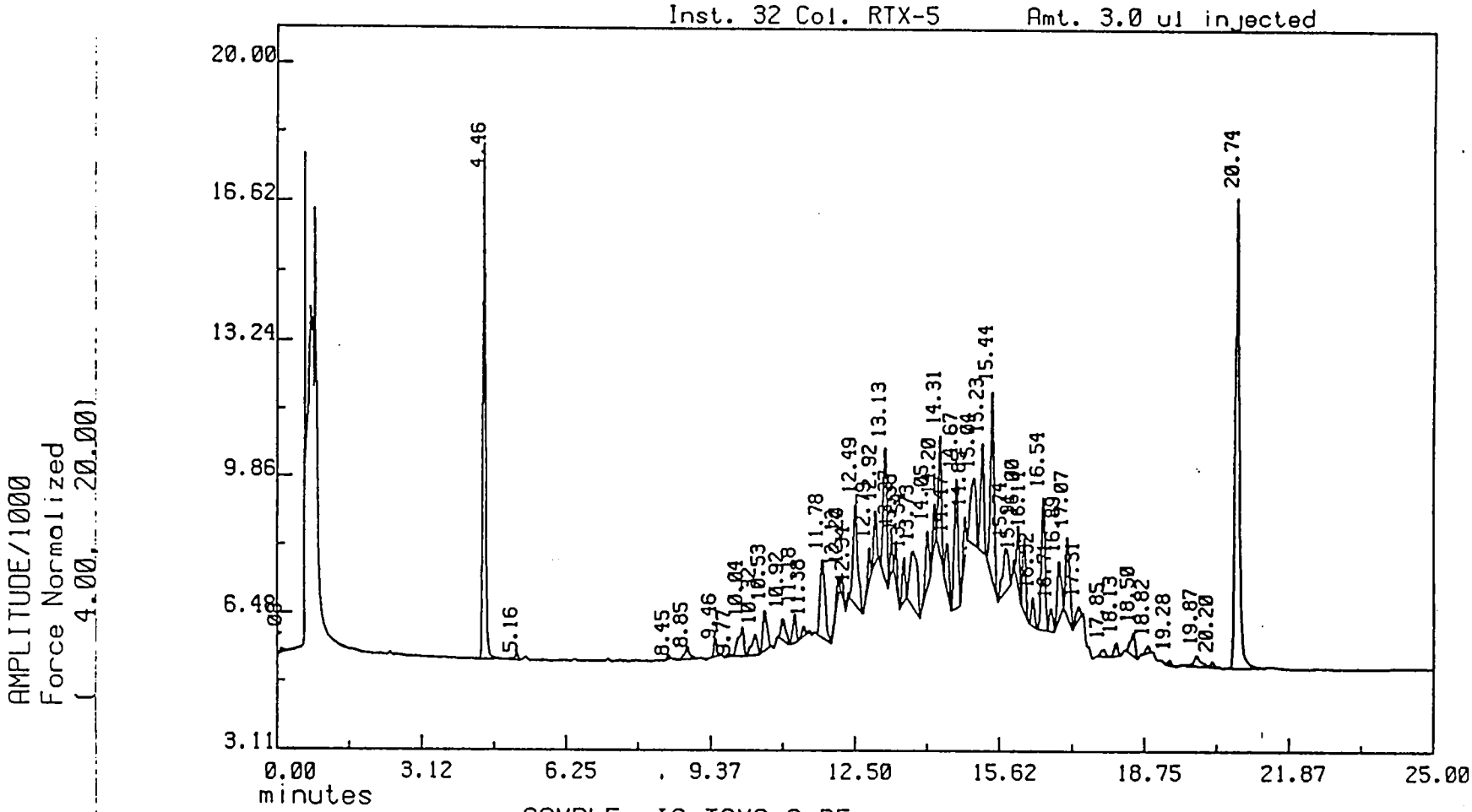
RESULT: /RESULT/R32L016.RES METHOD: CAP32



SAMPLE: IS CHLOR-3 B5

ANALYZED: Thu Jul 29, 1993 21:53:36

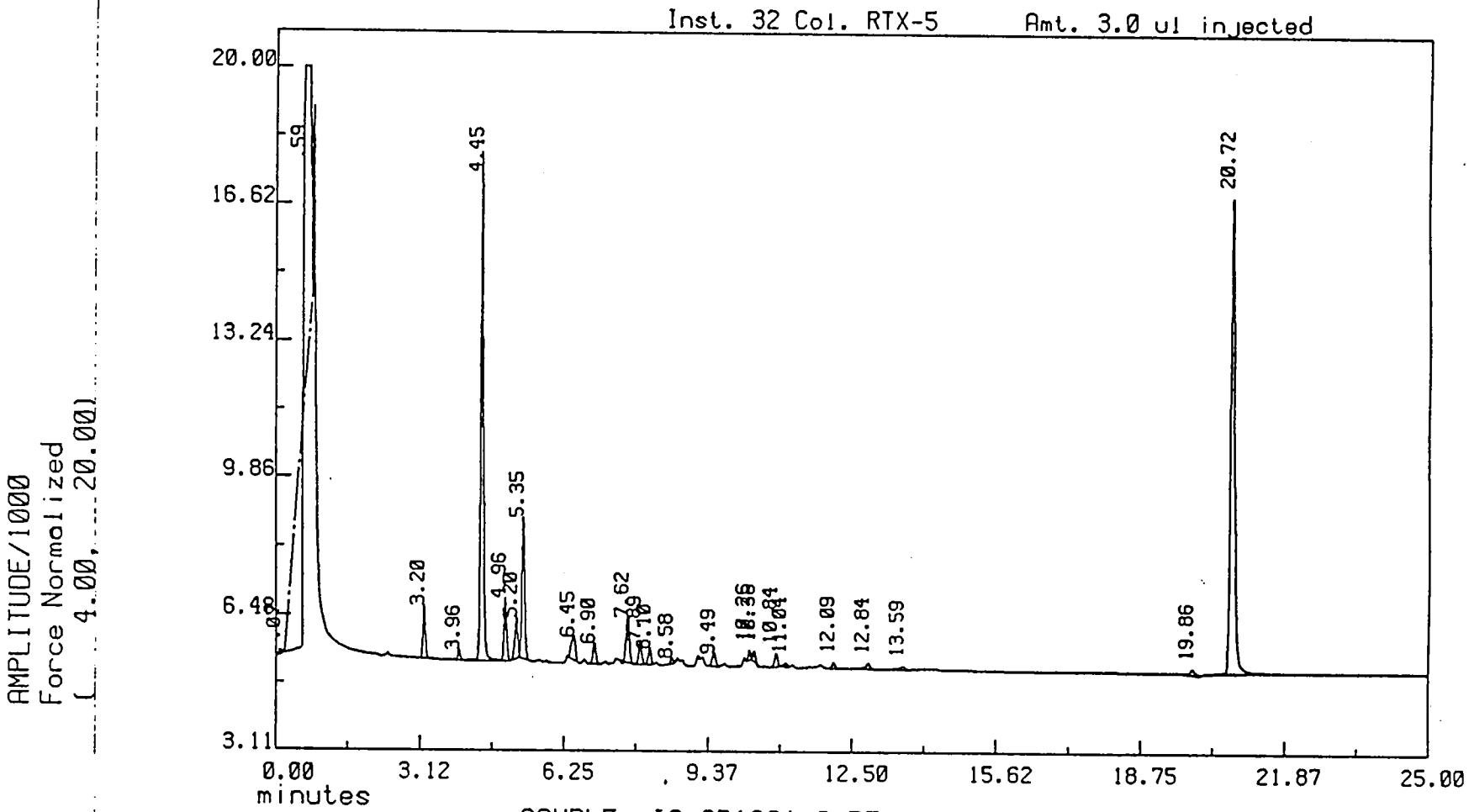
RESULT: /RESULT/R32L017.RES METHOD: CAP32



SAMPLE: IS TOXA-3 B5

ANALYZED: Thu Jul 29, 1993 22:23:08

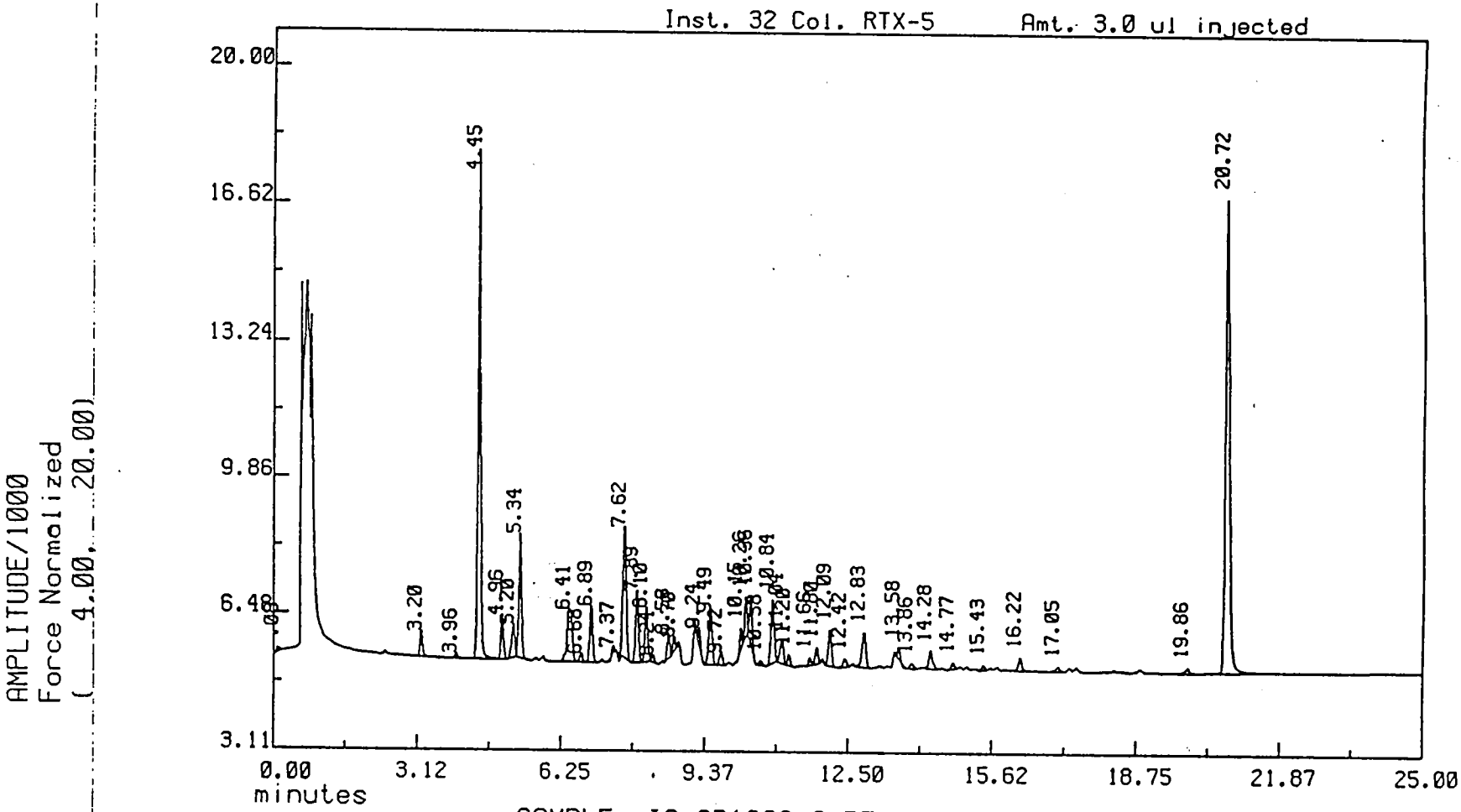
RESULT: /RESULT/R32L018.RES METHOD: CAP32



SAMPLE: IS AR1221-3 B7

ANALYZED: Thu Jul 29, 1993 22:52:41

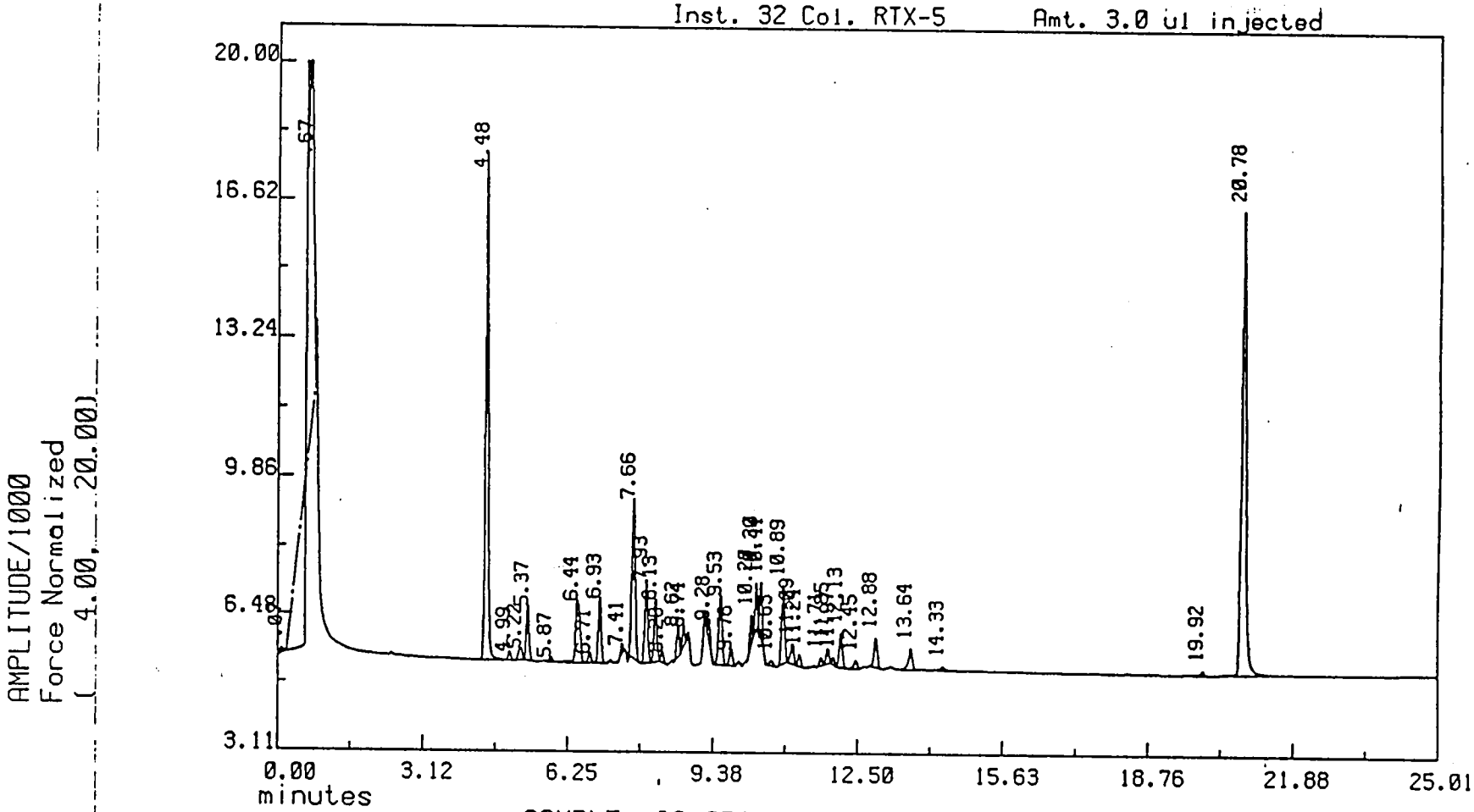
RESULT: /RESULT/R32L019.RES METHOD: CAP32



SAMPLE: IS AR1232-3 B7

ANALYZED: Thu Jul 29, 1993 23:22:12

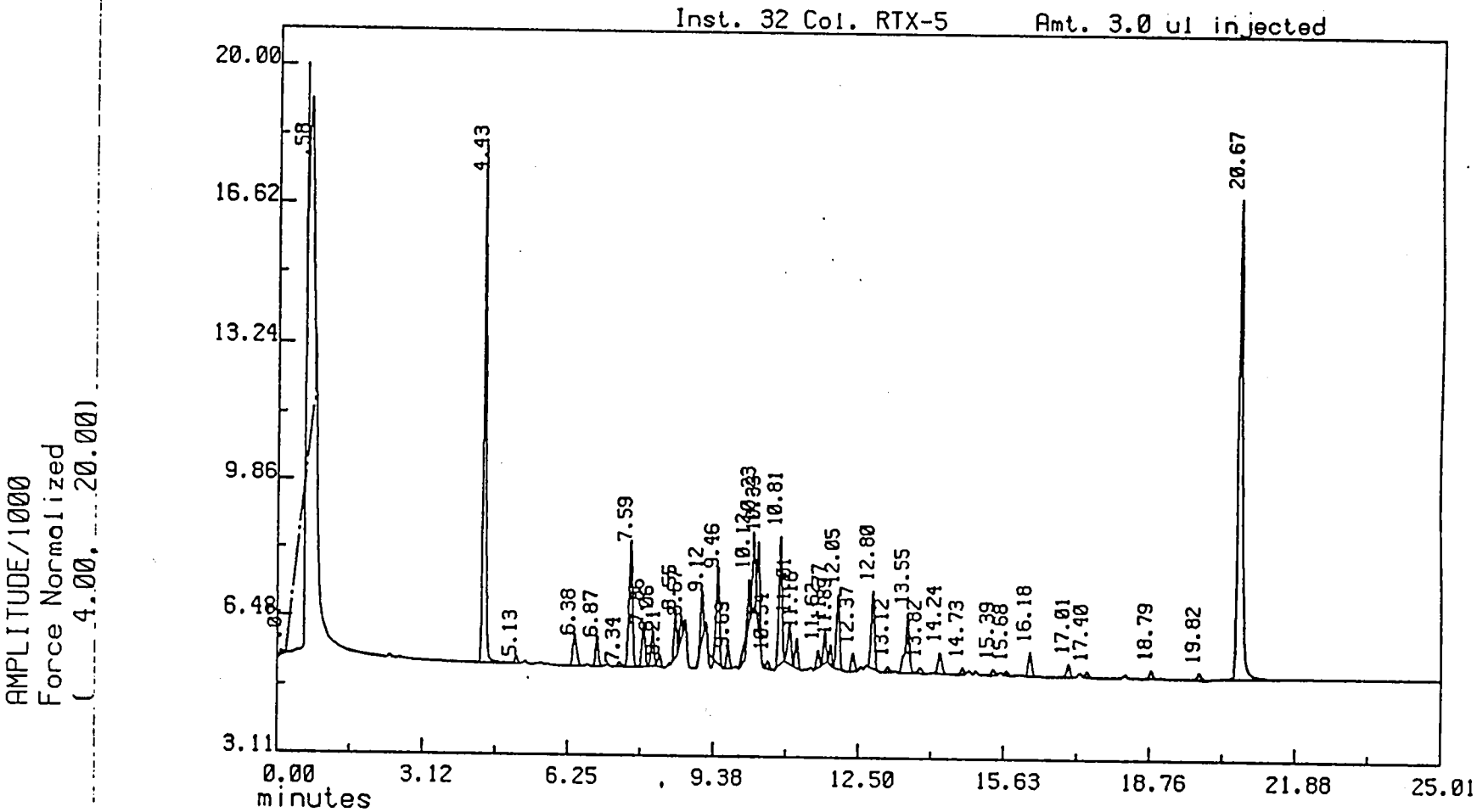
RESULT: /RESULT/R32L020.RES METHOD: CAP32



SAMPLE: IS AR1242-3 B7

ANALYZED: Thu Jul 29, 1993 23:51:42

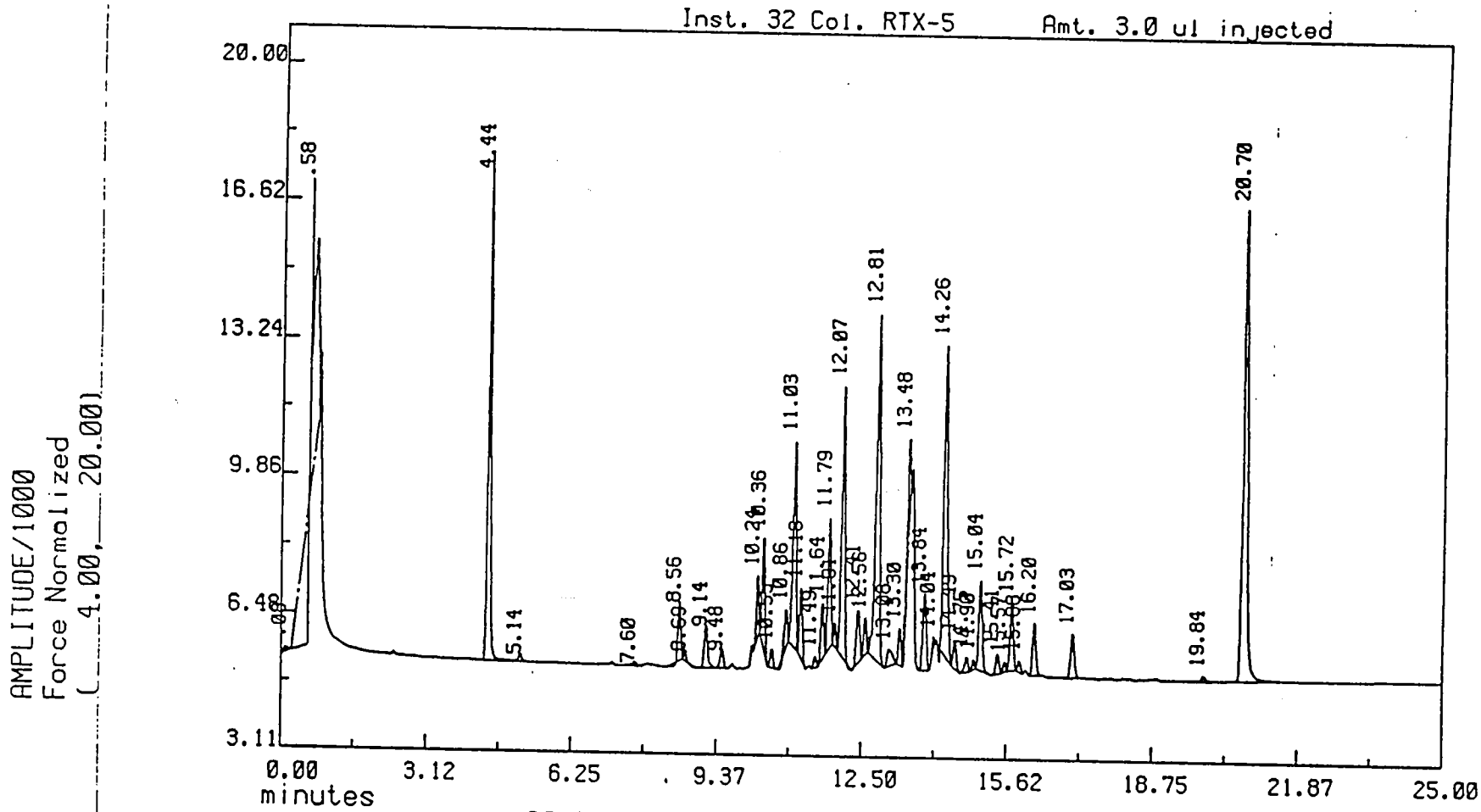
RESULT: /RESULT/R32L021.RES METHOD: CAP32



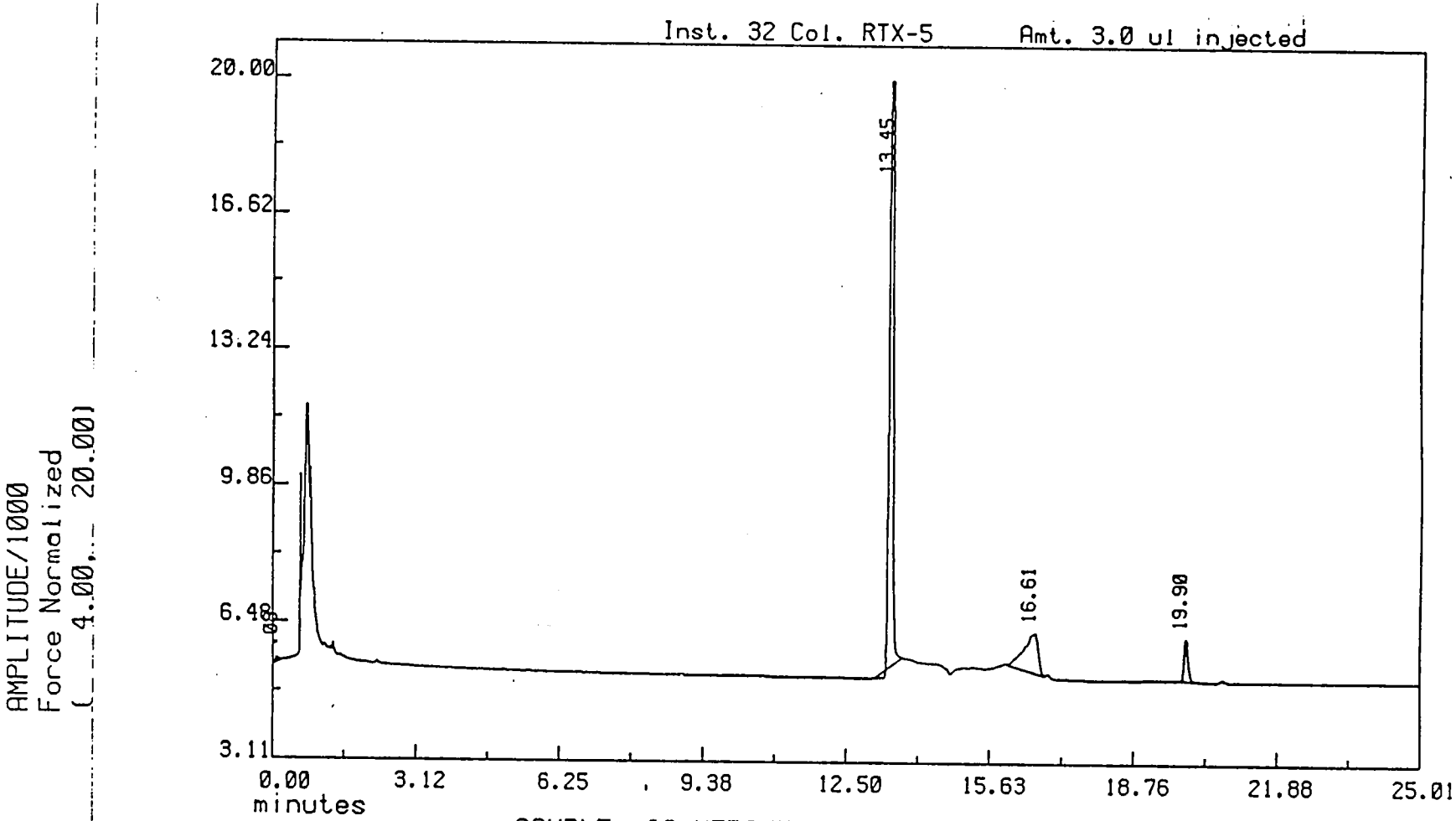
SAMPLE: IS AR1248-3 B8

ANALYZED: Fri Jul 30, 1993 00:21:12

RESULT: /RESULT/R32L022.RES METHOD: CAP32



SAMPLE: IS AR1254-3 B7
ANALYZED: Fri Jul 30, 1993 00:50:41
RESULT: /RESULT/R32L023.RES METHOD: CAP32



SAMPLE: IS KEPONE D

ANALYZED: Fri Jul 30, 1993 01:20:09

RESULT: /RESULT/R32L024.RES METHOD: CAP32

COMPUCHEM LABORATORIES, INC. P.O. Box 12652 3308 Chapel Hill/Nelson Highway Research Triangle Park, NC 27709 (919) 549-8263

17/AUG/93

GROUNDWATER TECHNOLOGY
ATTN: JOSEPH GIANDONATO
233 WILMINGTON-W.CHESTER PIKE
SUITE 201
CHADDS FORD, PA 19317

Subject: Report of Data - Account Number 500535

ATTN: JOSEPH GIANDONATO

Enclosed are the results of analytical work performed in accordance with the referenced account number.

This report covers 1 sample(s) appearing on the attached listing and their associated Quality Control Data.

Thank you for selecting CompuChem Laboratories for your sample analysis. If you should have questions or require additional analytical services please contact your representative at 1-919-549-8263.

Sincerely,

Elise L. Cobb
Supervisor, Report Deliverables

Attachment

COMPUCHEM
LABORATORIES, INC.

17/AUG/93

GROUNDWATER TECHNOLOGY
ATTN: JOSEPH GIANDONATO
233 WILMINGTON-W.CHESTER PIKE
SUITE 201
CHADDS FORD, PA 19317

ACCOUNT #: 500535

CC#	SAMPLE-ID	RECEIPT DATE
562729	DISPCOMP	7/14/93

TOTAL NUMBER OF SAMPLES = 1

COMPUCHEM LABORATORIES, INC. P.O. Box 12652 3308 Chapel Hill/Nelson Highway Research Triangle Park, NC 27709 (919) 549-8263

Unless noted by quality assurance notices included in this report of data, all quality control requirements associated with the preparation and analysis of this sample delivery group have been satisfied.

Release of the analytical data contained in this data package has been authorized by the laboratory manager or his designee, as verified by the following signature.

Jeanne C Alston

JEANNE C. ALSTON
FINAL TECHNICAL REVIEWER
DATE: Aug. 17 1993

COMPUCHEM LABORATORIES, INC.

INORGANIC METHOD TCLP REPORT OF DATA
SUBMITTED TO:

Mr. Joseph Giandonato
Groundwater Technology
233 Wilmington-Westchester Pike
Suite 201
Chadds Ford, PA 19317

CHRONICLE

ITEM NUMBER	SAMPLE IDENTIFIER	COMPUCHEM NUMBER	DATE RECEIVED	ANALYSIS COMPLETED
1.	DISPCOMP	562729	07/14/93	08/12/93

COMPUCHEM LABORATORIES, INC.

INORGANIC METHOD TCLP
SUMMARY REPORT
SAMPLE ID: DISPCOMP
CCN: 562729

ELEMENT	DETECTED AMOUNT (Mg/L)	COMPUCHEM REPORT LIMIT (Mg/L)	REGULATORY LEVEL (Mg/L)
ARSENIC	BRL	2.5	5.0
BARIUM	BRL	50.0	100.0
CADMIUM	BRL	0.5	1.0
CHROMIUM	BRL	2.5	5.0
LEAD	BRL	2.5	5.0
SELENIUM	BRL	0.5	1.0
SILVER	BRL	2.5	5.0
MERCURY	BRL	0.1	0.2

BRL = Below Reporting Limits

COMPUCHEM LABORATORIES, INC.

INORGANIC METHOD TCLP
SUMMARY REPORT
SAMPLE ID: LEACHATE BLANK
CCN: 564242

ELEMENT	DETECTED AMOUNT (Mg/L)	COMPUCHEM REPORT LIMIT (Mg/L)	REGULATORY LEVEL (Mg/L)
ARSENIC	BRL	2.5	5.0
BARIUM	BRL	50.0	100.0
CADMIUM	BRL	0.5	1.0
CHROMIUM	BRL	2.5	5.0
LEAD	BRL	2.5	5.0
SELENIUM	BRL	0.5	1.0
SILVER	BRL	2.5	5.0
MERCURY	BRL	0.1	0.2

BRL = Below Reporting Limits

COMPUCHEM LABORATORIES, INC.

INORGANIC METHOD TCLP
LABORATORY CONTROL SAMPLE (LCS) SUMMARY DATA
CCN: 562732

ELEMENT	SPIKE ADDED (ug/L)	LCS CONC. (ug/L)	PERCENT RECOVERY	#	QC LIMITS RECOVERY
ARSENIC	5000	4760	95.2		75-125
BARIUM	100000	97200	97.2		75-125
CADMIUM	1000	920	92.0		75-125
CHROMIUM	5000	4700	94.0		75-125
LEAD	5000	4790	95.8		75-125
SELENIUM	1000	990	99.0		75-125
SILVER	1000	45.7	4.6	*	75-125
MERCURY	200	183.0	91.5		75-125

column to be used to flag recovery values with an asterisk

* recovery is outside of QC limits:

Low recoveries for silver are not rejected due to that analyte's sensitivity to chlorides and light at the matrix spiking level.

COMPUCHEM LABORATORIES, INC.

INORGANIC METHOD TCLP
DUPLICATE QUALITY CONTROL SUMMARY
ORIG. SAMPLE ID: DISPCOMP
ORIG. CCN: 562729
DUP CCN: 562731

ELEMENT	ORIGINAL CONC. (ug/L)	DUPLICATE CONC. (ug/L)	RPD OBSERVED	#	QC LIMITS (SEE BELOW)
ARSENIC	-5.90	-16.6	N/A		N/A
BARIUM	553	563	N/A		N/A
CADMIUM	-.430	-.104	N/A		N/A
CHROMIUM	3.99	7.99	N/A		N/A
LEAD	-17.6	9.48	N/A		N/A
SELENIUM	19.4	24.9	N/A		N/A
SILVER	-.415	-.040	N/A		N/A
MERCURY	.010	.200	N/A		N/A

column to be used to flag recovery values with an asterisk
* recovery is outside of QC limits

In keeping with the intent of EPA CLP analytical protocol, the following acceptance criteria are applied to quality control for duplicate TCLP samples:

If either result is greater than 50% of the regulatory limits, the results must agree within 20% RPD.

If either result is less than 20% of the requlatory limits, no acceptance limits are applied.

All other results must agree within 20% of regulatory limits

COMPUCHEM LABORATORIES, INC.

INORGANIC METHOD TCLP
MATRIX SPIKE QUALITY CONTROL SUMMARY
ORIG. SAMPLE ID: DISPCOMP
ORIG. CCN: 562729
SPK. CCN: 562730

ELEMENT	SPIKE ADDED (ug/L)	ORIGINAL CONC. (ug/L)	MS % CONC. (ug/L)	% RECOVERY	#	QC LIMITS RECOVERY
ARSENIC	5000	-5.90	4610	92.3		75-125
BARIUM	100000	553	95200	94.6		75-125
CADMIUM	1000	-.430	836	83.6		75-125
CHROMIUM	5000	3.99	4350	86.9		75-125
LEAD	5000	-17.6	4440	89.2		75-125
SELENIUM	1000	19.4	967	94.8		75-125
SILVER	1000	-.415	875	87.5		75-125
MERCURY	200	.010	190	95.0		75-125

Low recoveries for silver are not rejected due to that analyte's sensitivity to chlorides and light at the matrix spiking level.

column to be used to flag recovery values with an asterisk
* recovery is outside of QC limits

ICAP Runlog

Page 1 of 2

Method (circle one): (1) ICVTCLP

Date 08/11/93

CLP 200.7
SW-846 6010

Operator [illegible]
Case Name: 901295, 901296
File Name: N/A

#	Sample ID	Comments	Time	#	Sample ID	Comments	Time
	ICV	(1)		1	563568	ICSW	
	ICB			2	563565		
1	ICSA			3	563567	D(563565)	
2	ICSAB			4	563566	SS(563565)	
3	CRI	P1		5	563565	SER. DIL. 5X	
4				6	563576		
5				7	563618		
6		8/11/93		8	563622		
7				9	563629		
8				10	563842		
9					CCV		
10					CCB		
	CCV					8/11/93	
	CCB			1	563849		
		8/11/93		2	563953		
1	568967	PBW		3	563960		
2	563732	LCSW		4	563980		
3	562729			5	563990		
4	562731	D(562729)		6	564128		
5	562730	SS(562729)		7	564132		
6	562729	SER. DIL. 5X		8	564242		
7	568968	PBW		9	565745		
8				10	565746		
9					CCV		
10		8/11/93			CCB		
	CCV						
	CCB					8/11/93	
	#Samples				Instrument Hrs.		
	#Dilutions	8/11/93			QC Samples		

Reviewed By [illegible] Date 8/11/93

ICAP Runlog

Page 2 of 2
Date 08/11/93

Method (circle one):

CLP 200.7
SW-846 6010

Operator [illegible]
Case Name: 901295, 901296
File Name: N/A

#	Sample ID	Comments	Time	#	Sample ID	Comments	Time
	ICV			1			
	ICB	[illegible] 8/11/93		2			
1	566277			3			
2	CRT	PI		4			
3	ICSA			5			
4	ICSAB			6			
5				7			
6				8			
7		[illegible] 8/11/93		9		[illegible] 8/11/93	
8				10			
9					CCV		
10					CCB		
	CCV						
	CCB			1			
				2			
1				3			
2				4			
3				5			
4				6			
5		[illegible] 8/11/93		7			
6				8			
7				9			
8				10			
9					CCV		
10					CCB		
	CCV						
	CCB						
	#Samples				Instrument Hrs.		
	#Dilutions				QC Samples		

Reviewed By [illegible] Date 8/11/93

INORGANIC SDG 901295

Standardization Rpt. Wed 08-11-93 01:15:34 PM page 1

Method: TCLP Standard: BLANK

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Avge	.00000	-.00220	.00030	.00213	-.00047	-.01520	-.00320
SDev	.00000	.00080	.00020	.00023	.00083	.00356	.00035
%RSD	.00000	-36.364	66.018	10.825	-178.43	-23.390	-10.825
#1	.00000	-.00300	.00051	.00240	-.00140	-.01120	-.00300
#2	.00000	-.00140	.00029	.00200	.00020	-.01640	-.00360
#3	.00000	-.00220	.00011	.00200	-.00020	-.01800	-.00300

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Avge	.01540	.00507	.00233	-.00193	.00107	.00067	.01591
SDev	.00069	.00083	.00012	.00042	.00117	.00012	.00126
%RSD	4.4988	16.434	4.9487	-21.534	109.86	17.321	7.9199
#1	.01460	.00440	.00220	-.00240	.00020	.00060	.01626
#2	.01580	.00480	.00240	-.00160	.00060	.00060	.01696
#3	.01580	.00600	.00240	-.00180	.00240	.00080	.01451

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Avge	.00040	.00471	-.00002	.00727	.00087
SDev	.00000	.00243	.00031	.00023	.00369
%RSD	.00000	51.475	-1400.0	3.1781	425.73
#1	.00040	.00488	-.00038	.00700	.00400
#2	.00040	.00221	.00020	.00740	.00180
#3	.00040	.00705	.00011	.00740	-.00320

INORGANIC SDG 901295

Standardization Rpt. Wed 08-11-93 01:19:38 PM page 1

Method: TCLP Standard: XCL11

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Avge	.00000	.00220	.89003	1.3379	.91060	1.4299	.17420
SDev	.00000	.00171	.00288	.0084	.00529	.0082	.00035
%RSD	.00000	77.673	.32300	.62471	.58110	.57060	.19886
#1	.00000	.00400	.89058	1.3390	.90860	1.4224	.17400
#2	.00000	.00200	.89258	1.3456	.91660	1.4386	.17460
#3	.00000	.00060	.88692	1.3290	.90660	1.4288	.17400

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Avge	.43607	.00053	.00233	-.00207	.00553	.00053	.01639
SDev	.00197	.00101	.00012	.00031	.00031	.00023	.00083
%RSD	.45249	188.75	4.9487	-14.783	5.5212	43.301	5.0572
#1	.43740	.00160	.00240	-.00240	.00560	.00040	.01624
#2	.43700	-.00040	.00240	-.00180	.00520	.00040	.01728
#3	.43380	.00040	.00220	-.00200	.00580	.00080	.01564

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Avge	.00040	1.5648	-.00330	2.2298	.67673
SDev	.00000	.0165	.00019	.0085	.01192
%RSD	.00000	1.0561	-5.7993	.38128	1.7614
#1	.00040	1.5695	-.00327	2.2296	.68440
#2	.00040	1.5785	-.00351	2.2384	.68280
#3	.00040	1.5464	-.00313	2.2214	.66300

INORGANIC SDG 901295

Standardization Rpt. Wed 08-11-93 01:23:41 PM page 1

Method: TCLP Standard: PLSB2

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Avge	.00007	-.00073	.00020	.00273	-.00060	-.01093	-.00320
SDev	.00012	.00012	.00020	.00012	.00111	.00333	.00020
%RSD	173.21	-15.746	100.00	4.2245	-185.59	-30.463	-6.2500
#1	.00020	-.00080	.00000	.00260	-.00080	-.01200	-.00300
#2	.00000	-.00060	.00040	.00280	.00060	-.01360	-.00340
#3	.00000	-.00080	.00020	.00280	-.00160	-.00720	-.00320

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Avge	.01667	.81253	.00233	-.00213	.00133	.00060	.01892
SDev	.00012	.00297	.00012	.00046	.00081	.00035	.00287
%RSD	.69282	.36537	4.9487	-21.651	60.622	57.735	15.152
#1	.01660	.81180	.00220	-.00240	.00180	.00080	.01893
#2	.01660	.81000	.00240	-.00240	.00180	.00080	.02179
#3	.01680	.81580	.00240	-.00160	.00040	.00020	.01605

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Avge	.00040	.00739	-.00038	.00740	-.00160
SDev	.00000	.00505	.00042	.00020	.00160
%RSD	.00000	68.323	-111.76	2.7027	-100.00
#1	.00040	.01318	-.00084	.00760	-.00160
#2	.00040	.00514	-.00027	.00720	.00000
#3	.00040	.00386	-.00002	.00740	-.00320

INORGANIC SDG 901295

Standardization Rpt. Wed 08-11-93 01:27:46 PM page 1

Method: TCLP Standard: XCL2

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Avge	1.4931	.43920	.00936	-.00033	-.00447	-.04493	-.00453
SDev	.0073	.00212	.00060	.00023	.00099	.00711	.00023
%RSD	.48844	.48192	6.4068	-69.282	-22.088	-15.833	-5.0943
#1	1.4956	.43680	.01001	-.00060	-.00400	-.05120	-.00480
#2	1.4987	.44080	.00923	-.00020	-.00380	-.03720	-.00440
#3	1.4848	.44000	.00883	-.00020	-.00560	-.04640	-.00440

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Avge	.02653	.00407	.69793	-.02993	1.6892	1.5016	.02186
SDev	.00050	.00121	.00462	.00095	.0089	.0086	.00133
%RSD	1.8969	29.644	.66240	-3.1576	.52724	.57396	6.0972
#1	.02700	.00520	.70080	-.02920	1.6914	1.5050	.02136
#2	.02660	.00420	.70040	-.02960	1.6968	1.5080	.02337
#3	.02600	.00280	.69260	-.03100	1.6794	1.4918	.02085

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Avge	.77360	.00376	2.3046	.00633	-.00227
SDev	.00382	.00407	.0118	.00042	.00103
%RSD	.49325	108.07	.51241	6.5737	-45.279
#1	.77560	.00748	2.3076	.00620	-.00340
#2	.77600	-.00058	2.3146	.00680	-.00140
#3	.76920	.00438	2.2916	.00600	-.00200

Standardization Rpt. Wed 08-11-93 01:31:50 PM page 1

Method: TCLP Standard: XCL3A

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Avge	.00007	-.00113	.00040	.00253	-.00127	-.00720	-.00320
SDev	.00012	.00076	.00017	.00031	.00212	.00694	.00020
%RSD	173.21	-66.811	43.381	12.059	-167.35	-96.385	-6.2500
#1	.00000	-.00080	.00060	.00220	-.00160	-.00560	-.00320
#2	.00020	-.00200	.00031	.00280	.00100	-.00120	-.00300
#3	.00000	-.00060	.00029	.00260	-.00320	-.01480	-.00340

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Avge	.01507	.00473	.00227	2.8361	.00120	.00520	4.6439
SDev	.00064	.00031	.00012	.0197	.00020	.00000	.0244
%RSD	4.2671	6.4543	5.0943	.69633	16.667	.00000	.52555
#1	.01460	.00480	.00220	2.8146	.00100	.00520	4.6173
#2	.01580	.00440	.00220	2.8404	.00120	.00520	4.6492
#3	.01480	.00500	.00240	2.8534	.00140	.00520	4.6652

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Avge	.00020	.00527	-.00076	.00693	.00033
SDev	.00000	.00197	.00028	.00023	.00383
%RSD	.00000	37.330	-36.880	3.3309	1148.4
#1	.00020	.00555	-.00051	.00720	-.00080
#2	.00020	.00708	-.00071	.00680	.00460
#3	.00020	.00318	-.00107	.00680	-.00280

Analysis Report QC Standard Wed 08-11-93 01:35:57 PM page 1

Method: TCLP Sample Name: ICV ICVTCLP Operator:
Run Time: 08/11/93 13:31:59
Comment: ICV ICVTCLP
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	98609.	4776.0	4785.0	4714.0	4776.5	1017.7	975.37
SDev	200.	7.0	11.9	9.8	21.0	25.7	2.98
%RSD	.20236	.14639	.24791	.20828	.43981	2.5272	.30597
#1	98839.	4777.6	4779.9	4703.5	4763.3	996.45	978.75
#2	98478.	4768.4	4776.5	4723.0	4800.8	1046.3	973.11
#3	98511.	4782.1	4798.5	4715.5	4765.5	1010.3	974.24

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-12.863	-62.186	-.04300	-45.374	-9.0767	-1.3347	20.549
SDev	5.491	9.636	1.66986	14.669	2.3577	1.5428	52.204
%RSD	-42.686	-15.496	-3883.0	-32.329	-25.976	-115.60	254.05
#1	-19.204	-51.163	-1.9712	-33.591	-6.4470	-.44438	5.2329
#2	-9.7193	-69.016	.91060	-40.727	-9.7812	-3.1162	78.698
#3	-9.6674	-66.378	.93154	-61.803	-11.002	-.44340	-22.284

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	-.00317	8.2653	7.1671	-1.7997	-101.60
SDev	.00374	12.311	1.7458	1.3746	59.11
%RSD	-117.92	148.95	24.359	-76.376	-58.180
#1	-.00748	22.221	7.1395	-2.0997	-151.90
#2	-.00073	-1.0571	8.9265	-.29996	-116.39
#3	-.00131	3.6322	5.4352	-2.9996	-36.496

Analysis Report QC Standard Wed 08-11-93 01:39:58 PM page 1

Method: TCLP Sample Name: S0 Operator:
Run Time: 08/11/93 13:36:02
Comment: ICB
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	2.8788	-7.5595	2.8513	5.9892	1.4765	9.2263	1.1277
SDev	1.6482	17.2138	2.3275	1.7289	12.129	18.430	1.1277
%RSD	57.255	-227.71	81.628	28.866	821.48	199.75	99.997
#1	4.6178	-.00715	1.3236	7.9856	7.3345	13.839	1.1282
#2	2.6790	4.5871	Q5.5300	4.9909	-12.469	-11.072	-.00022
#3	1.3395	-27.259	1.7002	4.9913	9.5644	24.911	2.2551

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-7.9154	-20.731	-1.9280	21.072	2.3647	.44169	70.614
SDev	9.8701	8.896	2.8930	10.741	4.1654	1.5414	34.749
%RSD	-124.69	-42.910	-150.05	50.973	176.15	348.97	49.211
#1	-.00401	-13.318	.96287	32.809	1.9688	2.2215	42.539
#2	-4.7665	-30.596	-4.8232	11.731	-1.5886	-.44729	59.824
#3	-18.976	-18.280	-1.9238	18.677	6.7140	-.44916	109.48

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	.00002	.60724	-.04859	-2.9996	-77.925
SDev	.00139	4.2472	.62158	.8999	8.877
%RSD	5803.1	699.42	-1279.2	-30.000	-11.392
#1	.00005	2.3165	.21371	-2.0997	-69.047
#2	-.00138	3.7334	.39884	-3.8995	-77.925
#3	.00140	-4.2283	-.75832	-2.9996	-86.802

Analysis Report QC Standard Wed 08-11-93 01:43:59 PM page 1

Method: TCLP Sample Name: ICSA Operator:
Run Time: 08/11/93 13:40:02
Comment: ICSA ICSA
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	15.381	1441.0	-18.451	16.968	-112.06	96.427	31.610
SDev	.671	60.0	2.279	4.492	21.66	69.890	1.537
%RSD	4.3625	4.1614	-12.350	26.475	-19.328	72.479	4.8621
#1	15.334	1488.4	-16.886	12.476	-120.66	71.382	33.385
#2	16.074	1461.0	-21.065	16.967	-87.426	175.39	30.705
#3	14.735	1373.6	-17.403	21.460	-128.11	42.511	30.740

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	518380.	8.1320	-1.9626	533180.	2.7264	192530.	529550.
SDev	1573.	29.885	.0113	2773.	3.6328	797.	781.
%RSD	.30348	367.50	-.57407	.52000	133.25	.41386	.14740
#1	518810.	36.295	-1.9625	536380.	1.8969	193450.	529160.
#2	516640.	11.321	-1.9740	531680.	6.7022	192010.	529040.
#3	519700.	-23.220	-1.9514	531480.	-.41996	192130.	530450.

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	-1.2908	16.947	5.7194	75.289	752.61
SDev	1.3762	12.125	1.8779	.900	99.05
%RSD	-106.62	71.547	32.833	1.1952	13.160
#1	-1.8147	19.252	5.6911	75.289	786.15
#2	-2.3280	3.8347	7.6113	76.189	830.54
#3	.27041	27.754	3.8558	74.390	641.15

Analysis Report QC Standard Wed 08-11-93 01:48:00 PM page 1

Method: TCLP Sample Name: ICSAB Operator:
Run Time: 08/11/93 13:44:03
Comment: ICSAB ICSAB
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	500.93	1416.9	895.43	462.02	4528.4	98.710	967.74
SDev	2.90	72.0	16.56	3.46	17.3	49.235	.77
%RSD	.57961	5.0813	1.8499	.74849	.38151	49.878	.07974
#1	499.64	1450.2	882.22	460.02	4539.9	149.03	968.04
#2	498.90	1334.2	890.05	466.01	4536.7	96.465	966.86
#3	504.26	1466.1	914.01	460.02	4508.5	50.636	968.31

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	516110.	1.0235	506.17	533790.	505.43	192690.	527240.
SDev	1903.	24.864	1.66	1939.	3.80	584.	1994.
%RSD	.36868	2429.2	.32874	.36334	.75132	.30284	.37819
#1	515640.	24.064	507.12	532400.	508.21	192450.	526240.
#2	514480.	4.3374	504.25	532970.	501.10	192270.	525940.
#3	518200.	-25.331	507.14	536010.	506.96	193360.	529530.

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	464.79	873.63	483.70	963.17	670.74
SDev	8.41	11.09	2.15	4.16	95.93
%RSD	1.8101	1.2689	.44484	.43153	14.303
#1	455.22	861.13	486.18	960.77	756.56
#2	468.09	882.29	482.54	960.77	688.50
#3	471.05	877.46	482.37	967.96	567.17

Analysis Report QC Standard Wed 08-11-93 01:52:01 PM page 1

Method: TCLP Sample Name: CRI Operator:
Run Time: 08/11/93 13:48:05
Comment: CRI
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-.24675	Q87.463	11.225	Q24.423	50.222	Q260.18	21.822
SDev	.42739	13.912	3.366	5.397	4.531	19.38	2.349
%RSD	-173.21	15.907	29.988	22.098	9.0214	7.4468	10.762
#1	-.74026	Q72.269	10.675	22.927	51.659	Q268.49	19.189
#2	.00000	Q99.577	Q14.832	19.932	53.859	Q274.02	23.701
#3	.00000	Q90.543	8.1674	Q30.410	45.147	Q238.04	22.575

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-5.2724	Q76.171	Q5.1425	-8.5256	107.47	.41218	69.203
SDev	14.6178	19.845	1.6533	4.1653	8.30	1.5310	17.431
%RSD	-277.25	26.053	32.150	-48.856	7.7208	371.44	25.188
#1	-2.0264	Q56.435	Q3.2337	-3.7161	99.173	2.1800	83.461
#2	7.4496	96.123	Q6.1245	-10.946	115.77	-.47158	49.771
#3	-21.240	Q75.955	Q6.0694	-10.915	107.47	-.47190	74.377

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	24.972	69.530	107.07	39.594	Q168.67
SDev	7.463	11.971	5.39	.520	73.05
%RSD	29.885	17.218	5.0323	1.3122	43.306
#1	33.589	75.895	103.82	40.194	Q87.789
#2	Q20.659	76.974	104.10	39.295	188.40
#3	Q20.667	Q55.721	113.29	39.295	229.83

Analysis Report QC Standard Wed 08-11-93 01:56:03 PM page 1

Method: TCLP Sample Name: CCV Operator:
Run Time: 08/11/93 13:52:06
Comment: CCV CVS1
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	5030.8	5134.0	4982.8	4929.0	4972.2	4851.9	494.55
SDev	31.7	63.6	42.4	52.4	60.7	155.2	4.53
%RSD	.63085	1.2380	.85155	1.0631	1.2213	3.1997	.91568
#1	4994.2	5073.8	4940.6	4877.2	4903.2	4714.4	490.02
#2	5047.8	5200.4	5025.5	4981.9	5017.7	5020.2	499.08
#3	5050.4	5127.8	4982.4	4928.0	4995.7	4821.0	494.55

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	5070.9	5050.0	5246.0	53251.	5124.3	5128.9	52578.
SDev	37.1	64.7	77.8	718.	58.0	56.3	494.
%RSD	.73165	1.2817	1.4834	1.3482	1.1326	1.0974	.93997
#1	5034.0	4978.8	5168.2	52523.	5067.0	5076.6	52088.
#2	5108.2	5105.3	5323.9	53959.	5183.1	5188.5	53076.
#3	5070.6	5066.0	5245.9	53269.	5122.7	5121.8	52569.

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	5114.7	4953.1	5137.1	4991.9	4779.0
SDev	50.5	107.6	48.5	66.9	136.6
%RSD	.98650	2.1730	.94499	1.3408	2.8593
#1	5065.6	4833.9	5082.4	4929.2	4636.0
#2	5166.4	5043.2	5174.9	5062.4	4908.3
#3	5112.1	4982.2	5154.1	4984.1	4792.9

Analysis Report QC Standard Wed 08-11-93 02:00:05 PM page 1

Method: TCLP Sample Name: CCB Operator:
Run Time: 08/11/93 13:56:08
Comment: CCB
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	.44651	-2.9221	2.3867	2.4955	-16.854	-21.220	-1.8817
SDev	.77337	22.5346	.6692	6.0513	15.399	5.762	1.7236
%RSD	173.21	-771.17	28.038	242.48	-91.371	-27.155	-91.598
#1	.00000	-13.657	2.7461	7.9861	Q-34.457	-19.374	-3.3860
#2	.00000	-18.082	1.6146	-3.9925	-5.8783	-16.606	-2.2581
#3	1.3395	22.973	2.7993	3.4931	-10.225	-27.678	-.00101

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-19.012	-20.646	-1.9276	-.07465	4.7394	-6.6714	34.484
SDev	12.618	8.926	.0113	4.06720	.6875	2.0377	27.166
%RSD	-66.369	-43.235	-.58542	-5448.1	14.506	-30.544	78.780
#1	-4.7138	-13.419	-1.9198	-2.4554	4.3421	-7.1151	3.1159
#2	-23.735	-17.894	-1.9225	-2.3902	5.5332	-8.4508	49.947
#3	-28.588	-30.624	-1.9405	4.6216	4.3428	-4.4484	50.388

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	-.00369	4.0258	-.12167	-2.6996	-101.60
SDev	.00628	17.350	1.88082	2.0782	12.90
%RSD	-170.16	430.96	-1545.8	-76.980	-12.696
#1	.00052	-9.3224	-1.4251	-.29996	-110.48
#2	-.01090	23.638	-.97435	-3.8995	-86.802
#3	-.00068	-2.2378	2.0345	-3.8995	-107.52

Analysis Report Wed 08-11-93 02:04:06 PM page 1

Method: TCLP Sample Name: PBW U 568967 #13 Operator:
Run Time: 08/11/93 14:00:10
Comment: SDG:901295 1:1
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	.19975	-15.203	-.41973	7.4868	-1.4921	-4.6159	.00491
SDev	.34598	23.064	1.58159	2.2867	17.6270	40.3327	.00183
%RSD	173.21	-151.71	-376.81	30.543	-1181.4	-873.79	37.242
#1	.00000	9.2587	-1.0032	4.9918	16.152	27.677	.00387
#2	.00000	L-36.553	-1.6267	7.9857	-1.5261	-49.824	.00385
#3	.59926	-18.315	1.3707	9.4829	-19.102	8.3001	.00703

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	.03430	-21.449	-3.8505	6.9488	3.9483	18.229	63.970
SDev	16.463	7.848	1.6666	20.334	5.6036	5.819	88.372
%RSD	47999.	-36.587	-43.282	292.62	141.93	31.920	138.15
#1	-18.976	-15.754	-4.8047	18.633	10.273	15.559	127.65
#2	9.5524	-30.401	-1.9261	18.744	-.39764	14.225	101.19
#3	9.5267	-18.193	-4.8208	-16.530	1.9697	24.904	-36.924

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	.00151	15.743	-1.0099	-2.3997	-74.965
SDev	.00600	15.145	1.4661	1.3746	48.714
%RSD	397.72	96.199	-145.17	-57.282	-64.982
#1	.00546	1.4731	-2.6878	-2.0997	-101.60
#2	-.00540	31.633	-.36552	-3.8995	-104.56
#3	.00447	14.124	.02357	-1.1998	-18.741

Analysis Report Wed 08-11-93 02:08:07 PM page 1

Method: TCLP Sample Name: LCSW U 563732 #14 Operator:
Run Time: 08/11/93 14:04:11
Comment: SDG:901295 1:1 = LCSTCLP
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	97247.	4762.4	919.57	4700.0	4793.4	990.91	45.708
SDev	535.	61.9	2.64	48.8	4.6	20.90	12.164
%RSD	.55059	1.3005	.28673	1.0374	.09593	2.1089	26.612
#1	97384.	4795.8	919.88	4703.5	4791.9	1013.1	40.445
#2	96656.	4690.9	916.79	4649.6	4789.8	971.53	37.063
#3	97700.	4800.4	922.03	4747.0	4798.6	988.14	59.617

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-8.0717	-53.833	-1.9638	-21.736	-13.547	16.449	113.95
SDev	9.9439	10.631	.0009	24.573	7.570	4.074	58.19
%RSD	-123.19	-19.748	-.04354	-113.05	-55.882	24.766	51.065
#1	-4.9371	-56.188	-1.9642	-47.573	-15.611	15.561	67.850
#2	-.07278	-63.089	-1.9628	-18.973	-19.871	12.892	94.661
#3	-19.205	-42.222	-1.9643	1.3394	-5.1587	20.893	179.33

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	.00834	-6.3761	5.9080	-.59992	-99.625
SDev	.00634	19.3082	.1425	3.16025	81.166
%RSD	76.044	-302.82	2.4125	-526.78	-81.471
#1	.00111	14.090	5.9815	2.3997	-6.9047
#2	.01296	-24.267	5.7437	-3.8995	-157.82
#3	.01095	-8.9513	5.9988	-.29996	-134.15

Analysis Report Wed 08-11-93 02:12:09 PM page 1

Method: TCLP Sample Name: XXX U 562729 #15 Operator:
Run Time: 08/11/93 14:08:12
Comment: SDG:901295 1:1 DISPCOMP
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	552.97	-5.8968	-.42963	3.9930	-17.627	19.360	-.41473
SDev	4.99	39.3375	1.78890	4.3218	9.918	42.611	.65156
%RSD	.90285	-667.09	-416.38	108.23	-56.267	220.10	-157.10
#1	547.86	L-40.862	-1.8584	6.4884	-16.900	8.2891	-.03952
#2	553.22	36.696	1.5767	6.4880	L-27.889	66.414	-.03759
#3	557.84	-13.524	-1.0072	-.99737	-8.0924	-16.623	-1.1671

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	26.958	4.8314	-4.8173	430070.	7.5498	104.22	2642.2
SDev	5.532	5.1467	2.8884	6748.	2.0504	4.00	66.2
%RSD	20.519	106.53	-59.959	1.5690	27.158	3.8348	2.5037
#1	23.816	6.5025	L-7.7122	422360.	5.1823	100.23	2613.6
#2	23.713	8.9348	-1.9353	432930.	8.7325	108.22	2717.8
#3	33.345	-.94320	-4.8045	434910.	8.7347	104.22	2595.1

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	510.28	-6.7247	-.57363	153.88	-68.061
SDev	2.99	7.9066	1.96792	3.41	47.377
%RSD	.58575	-117.58	-343.07	2.2140	-69.610
#1	506.83	.15742	-.18114	149.98	-21.701
#2	512.01	-4.9705	1.1685	155.38	-66.088
#3	512.01	-15.361	-2.7082	156.28	-116.39

INORGANIC SDG 901295

Analysis Report Wed 08-11-93 02:16:10 PM page 1

Method: TCLP Sample Name: DUP U 562731 #16 Operator:
Run Time: 08/11/93 14:12:14
Comment: SDG:901295 1:1 DISPCOMPD
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	562.80	-16.574	-.10354	7.9850	9.4810	24.896	-.03978
SDev	5.37	18.381	.50640	1.4971	31.194	23.971	2.98664
%RSD	.95403	-110.90	-489.09	18.748	329.02	96.287	-7507.3
#1	563.20	-13.632	.25765	6.4878	44.694	52.575	-2.2971
#2	557.24	.15800	.11410	7.9855	-1.5596	11.058	-1.1691
#3	567.95	L-36.249	-.68237	9.4819	-14.692	11.054	3.3468

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	31.676	-9.0644	-3.8681	438970.	6.3562	105.98	2785.3
SDev	16.701	5.3158	1.6773	3795.	2.0569	12.60	49.3
%RSD	52.723	-58.645	-43.363	.86449	32.360	11.886	1.7712
#1	47.523	-13.286	-4.8318	438950.	7.5420	101.53	2789.3
#2	33.271	-3.0947	-1.9313	435190.	7.5455	96.212	2734.1
#3	14.236	-10.812	-4.8411	442780.	3.9811	120.20	2832.6

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	524.07	16.722	1.9118	160.78	4.9319
SDev	10.78	19.136	1.4490	2.38	15.376
%RSD	2.0560	114.44	75.791	1.4808	311.77
#1	527.52	3.1937	1.8438	163.48	-3.9456
#2	511.99	38.616	.49801	158.98	22.687
#3	532.69	8.3553	3.3936	159.88	-3.9456

Analysis Report Wed 08-11-93 02:20:11 PM page 1

Method: TCLP Sample Name: SPK U 562730 #17 Operator:
Run Time: 08/11/93 14:16:15
Comment: SDG:901295 1:1 DISPCOMPS
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	95207.	4613.9	835.54	4347.7	4443.4	966.91	874.59
SDev	676.	62.6	9.71	49.0	52.2	30.86	3.62
%RSD	.70996	1.3568	1.1623	1.1267	1.1739	3.1920	.41428
#1	95978.	4668.4	837.70	4399.6	4501.3	1002.0	877.22
#2	94927.	4627.6	843.99	4341.2	4428.8	954.92	876.10
#3	94717.	4545.5	824.94	4302.3	4400.1	943.84	870.46

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	31.731	-40.539	-1.9532	407200.	-10.485	90.021	2558.3
SDev	13.657	8.494	2.8953	4612.	1.616	1.543	56.0
%RSD	43.041	-20.952	-148.23	1.1326	-15.416	1.7138	2.1874
#1	47.500	-31.326	-4.8530	411810.	-8.6209	90.906	2603.3
#2	23.822	-48.058	-1.9440	407210.	-11.498	88.240	2575.9
#3	23.870	-42.233	.9375	402590.	-11.336	90.918	2495.7

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	489.58	19.207	4.1434	150.28	-117.38
SDev	2.99	19.734	1.4024	2.26	68.15
%RSD	.61016	102.74	33.847	1.5070	-58.056
#1	491.30	34.906	5.3725	152.68	-113.43
#2	491.31	-2.9463	2.6157	148.18	-51.292
#3	486.13	25.662	4.4420	149.98	-187.41

Analysis Report Wed 08-11-93 02:24:12 PM page 1

Method: TCLP Sample Name: XXX S 562729 #18 Operator:
Run Time: 08/11/93 14:20:16
Comment: SDG:901295 1:5 DISPCOMPL
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	122.54	-16.735	-.19690	2.9958	11.716	11.991	-.38526
SDev	1.20	30.361	1.03239	5.2591	23.201	10.479	2.34739
%RSD	.97987	-181.42	-524.33	175.55	198.02	87.393	-609.29
#1	121.16	9.1095	-1.3020	-2.4951	33.763	19.372	-1.1347
#2	123.24	-9.1426	-.03147	7.9876	13.874	16.604	-2.2664
#3	123.24	L-50.171	.74279	3.4950	-12.488	-.00343	2.2453

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	17.524	-17.445	.02387	94557.	5.0582	23.848	661.37
SDev	5.524	5.228	3.3527	1263.	2.4710	.781	27.59
%RSD	31.520	-29.969	14045.	1.3352	48.851	3.2760	4.1715
#1	14.279	-23.296	-1.9202	93181.	7.8282	24.750	651.52
#2	23.902	-13.233	3.8953	94830.	4.2653	23.398	640.05
#3	14.391	-15.805	-1.9035	95661.	3.0809	23.396	692.53

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	113.78	-6.7585	-3.9792	34.195	-90.748
SDev	8.95	18.5919	2.5454	2.893	134.189
%RSD	7.8673	-275.09	-63.967	8.4593	-147.87
#1	103.45	-25.145	-1.3579	32.995	-172.62
#2	118.95	12.033	-6.4411	37.495	-163.74
#3	118.95	-7.1633	-4.1386	32.096	64.115

Analysis Report Wed 08-11-93 02:28:13 PM page 1

Method: TCLP Sample Name: PBW U 568968 #19 Operator:
Run Time: 08/11/93 14:24:16
Comment: SDG:901296 1:1
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-.69326	4.4722	2.5355	3.9923	9.5158	18.452	2.6325
SDev	.67099	28.478	3.4329	3.4581	22.325	37.580	2.6032
%RSD	-96.788	636.77	135.39	86.618	234.61	203.66	98.886
#1	-1.3395	H36.387	2.6230	1.9964	-10.303	58.126	5.6383
#2	.00000	-4.6243	H5.9239	7.9853	H33.702	13.839	1.1284
#3	-.74026	-18.346	-.94031	1.9952	5.1492	-16.609	1.1307

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	12.643	.83923	-.00990	-.04106	1.1824	2.6637	89.105
SDev	5.487	17.676	1.68146	22.5680	7.1422	4.6872	46.582
%RSD	43.403	2106.3	-16984.	-54958.	604.03	175.96	52.278
#1	18.979	16.575	.96354	-16.481	1.9740	-1.7847	118.47
#2	9.4948	4.2295	.95824	25.689	7.8958	2.2180	113.45
#3	9.4545	-18.287	-1.9515	-9.3319	-6.3226	7.5579	35.395

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	-.00210	8.9176	1.6497	-2.6996	-36.496
SDev	.00747	18.496	1.9663	1.3746	57.074
%RSD	-355.06	207.41	119.19	-50.918	-156.38
#1	-.00446	10.852	.10176	-1.1998	-77.925
#2	-.00811	26.370	.98515	-2.9996	-60.170
#3	.00626	-10.469	3.8621	-3.8995	28.605

Analysis Report QC Standard Wed 08-11-93 02:32:14 PM page 1

Method: TCLP Sample Name: CCV Operator:
Run Time: 08/11/93 14:28:18
Comment: CCV CVS1
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	5041.5	5248.7	5068.6	4927.0	5053.7	5039.2	497.94
SDev	50.4	27.0	65.1	43.4	38.9	55.7	.02
%RSD	.99894	.51515	1.2840	.88164	.77059	1.1054	.00384
#1	5085.9	5272.3	5142.2	4974.4	5097.1	5081.1	497.95
#2	4986.7	5219.2	5018.7	4889.1	5021.9	4976.0	497.92
#3	5051.8	5254.7	5044.9	4917.6	5042.0	5060.4	497.94

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	5176.5	5113.8	5211.1	53359.	5119.0	5138.2	53839.
SDev	60.7	32.9	53.2	515.	47.9	48.6	450.
%RSD	1.1731	.64419	1.0213	.96539	.93487	.94518	.83503
#1	5235.7	5151.0	5265.8	53931.	5173.5	5181.7	54331.
#2	5114.4	5088.4	5159.5	52932.	5083.6	5085.8	53450.
#3	5179.5	5102.1	5208.2	53213.	5100.1	5147.1	53738.

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	5124.2	4881.5	5161.1	5043.8	5189.4
SDev	48.6	38.4	59.5	37.1	205.4
%RSD	.94759	.78693	1.1530	.73482	3.9585
#1	5176.8	4879.5	5215.0	5084.9	5026.6
#2	5081.1	4920.8	5097.3	5012.9	5121.3
#3	5114.7	4844.1	5171.0	5033.6	5420.2

Analysis Report QC Standard Wed 08-11-93 02:36:16 PM page 1

Method: TCLP Sample Name: CCB Operator:
Run Time: 08/11/93 14:32:20
Comment: CCB
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	.64626	9.2110	.96492	1.4973	-23.445	13.840	-.37692
SDev	.67099	12.088	2.3765	3.1172	31.227	19.960	1.30197
%RSD	103.83	131.23	246.29	208.19	-133.19	144.22	-345.42
#1	1.3395	18.344	-1.3718	4.9914	Q-34.456	19.376	1.1265
#2	.00000	13.786	3.3793	.49940	Q-47.675	30.448	-1.1293
#3	.59926	-4.4964	.88721	-.99874	11.795	-8.3035	-1.1279

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-14.270	-14.128	-3.8559	-7.0667	.78876	-3.1152	61.118
SDev	.018	11.061	3.3346	16.2639	5.1684	1.3321	47.908
%RSD	-.12853	-78.295	-86.482	-230.15	655.26	-42.761	78.385
#1	-14.260	-13.316	Q-7.7064	-16.530	4.3454	-3.1163	85.313
#2	-14.259	-25.572	-1.9225	-16.384	-5.1399	-4.4468	5.9382
#3	-14.291	-3.4945	-1.9387	11.713	3.1608	-1.7826	92.104

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	.00158	-7.8268	-.12448	-3.2995	-67.074
SDev	.00529	14.3170	1.61137	1.0391	64.989
%RSD	334.28	-182.92	-1294.5	-31.492	-96.892
#1	-.00004	-3.0138	-1.1439	-3.8995	-101.60
#2	-.00271	3.4636	-.96277	-3.8995	-107.52
#3	.00749	-23.930	1.7332	-2.0997	7.8911

Analysis Report Wed 08-11-93 02:40:17 PM page 1

Method: TCLP Sample Name: LCSW U 563568 #22 Operator:
Run Time: 08/11/93 14:36:21
Comment: SDG:901296 1:1 = LCSTCLP
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	96366.	4613.4	862.61	4658.6	4648.2	943.86	576.14
SDev	576.	49.2	5.92	33.9	57.4	26.69	4.92
%RSD	.59776	1.0675	.68601	.72796	1.2344	2.8280	.85310
#1	95706.	4599.9	856.28	4622.7	4585.1	924.48	570.50
#2	96623.	4572.3	863.55	4663.1	4662.1	932.79	578.39
#3	96769.	4668.0	868.00	4690.1	4697.3	974.30	579.52

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-3.1769	-66.326	-1.9668	-5.0242	-12.933	9.3354	69.791
SDev	19.1780	10.988	.0072	18.7197	1.440	4.6836	28.996
%RSD	-603.67	-16.567	-.36383	-372.59	-11.136	50.170	41.547
#1	-23.766	-64.973	-1.9670	9.3281	-14.474	8.8911	75.170
#2	.05677	-77.929	-1.9595	-26.198	-12.701	4.8899	38.482
#3	14.179	-56.077	-1.9738	1.7974	-11.622	14.225	95.720

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	.00358	-.22490	6.4104	-1.4998	-116.39
SDev	.00246	4.78307	1.1927	1.8732	56.22
%RSD	68.527	-2126.7	18.605	-124.90	-48.305
#1	.00543	-5.7126	6.4446	-2.9996	-178.54
#2	.00080	3.0587	5.2009	-2.0997	-69.047
#3	.00453	1.9792	7.5855	.59992	-101.60

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Method: TCLP Sample Name: XXX U 563565 #23 Operator:
Run Time: 08/11/93 14:40:22
Comment: SDG:901296 1:1 W01B0502
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	1120.3	7.4835	51.469	5.4898	-18.455	38.746	-.89129
SDev	8.2	4.6257	5.789	2.2871	20.295	16.837	.64887
%RSD	.73058	61.812	11.248	41.660	-109.97	43.454	-72.801
#1	1129.2	7.3814	55.750	7.9851	L-30.157	30.442	-.52075
#2	1113.1	2.9096	44.882	3.4933	L-30.188	58.121	-.51260
#3	1118.5	12.159	53.774	4.9911	4.9794	27.673	-1.6405

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	11.069	9.8113	-1.9338	671210.	52.206	33.685	9496.2
SDev	16.681	8.6363	.0063	6359.	2.062	4.294	27.2
%RSD	150.71	88.024	-.32337	.94746	3.9507	12.747	.28590
#1	28.488	16.910	-1.9383	678540.	51.010	31.862	9525.5
#2	9.4802	12.328	-1.9365	667180.	54.587	30.604	9471.9
#3	-4.7613	.19617	-1.9266	667900.	51.020	38.590	9491.3

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	3868.2	94.011	.91264	749.60	-87.789
SDev	32.3	33.189	1.0423	8.31	24.640
%RSD	.83510	35.303	114.20	1.1090	-28.067
#1	3904.4	60.376	1.6586	759.19	-107.52
#2	3842.3	94.922	1.3576	744.80	-95.680
#3	3857.8	126.74	-.27824	744.80	-60.170

Analysis Report Wed 08-11-93 02:48:19 PM page 1

Method: TCLP Sample Name: DUP U 563567 #24 Operator:
Run Time: 08/11/93 14:44:23
Comment: SDG:901296 1:1 W01B0502D
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	1138.8	-16.724	53.501	7.4870	-18.429	40.591	-1.2722
SDev	5.6	13.169	3.022	3.1171	16.225	33.483	1.7238
%RSD	.49521	-78.743	5.6477	41.633	-88.046	82.488	-135.50
#1	1135.2	-24.371	53.195	6.4885	-12.551	66.425	.60791
#2	1145.3	-24.284	56.664	10.981	-5.9608	52.585	-2.7783
#3	1135.9	-1.5178	50.644	4.9915	L-36.774	2.7632	-1.6462

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-4.7112	22.876	-2.8841	675040.	49.426	29.654	9516.2
SDev	4.7391	5.204	1.6743	3185.	2.989	2.042	3.6
%RSD	-100.59	22.750	-58.053	.47181	6.0483	6.8875	.03801
#1	.03512	24.488	-4.8174	674320.	52.195	27.882	9519.0
#2	-9.4431	17.057	-1.9152	678530.	46.256	29.192	9517.5
#3	-4.7258	27.084	-1.9197	672290.	49.826	31.888	9512.1

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	3892.3	81.000	-1.3962	749.30	-115.41
SDev	12.8	5.702	.8145	2.38	121.08
%RSD	.32768	7.0394	-58.335	.31775	-104.92
#1	3886.3	74.613	-.56303	750.19	19.728
#2	3907.0	82.811	-2.1906	751.09	-214.05
#3	3883.7	85.577	-1.4350	746.60	-151.90

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Analysis Report Wed 08-11-93 02:52:20 PM page 1

Method: TCLP Sample Name: SPK U 563566 #25 Operator:
Run Time: 08/11/93 14:48:24
Comment: SDG:901296 1:1 W01B0502S
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	91468.	4578.6	888.30	4317.2	4403.7	990.91	887.30
SDev	2050.	75.7	22.11	76.7	64.4	110.30	9.38
%RSD	2.2416	1.6529	2.4891	1.7763	1.4620	11.131	1.0569
#1	93126.	4648.5	913.44	4375.6	4474.9	1057.3	894.81
#2	92101.	4589.2	879.62	4345.7	4386.8	1051.8	890.31
#3	89175.	4498.2	871.85	4230.4	4349.5	863.58	876.79

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	23.782	-37.879	-.04388	641110.	27.409	39.250	8910.3
SDev	12.552	10.752	1.67824	11252.	1.808	1.610	159.0
%RSD	52.780	-28.384	-3824.8	1.7552	6.5970	4.1030	1.7840
#1	28.423	-25.504	.90624	650180.	28.694	37.392	9036.5
#2	33.354	-44.925	.94374	644630.	28.191	40.112	8962.6
#3	9.5707	-43.208	-1.9816	628520.	25.341	40.245	8731.7

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	3697.5	79.167	7.3127	714.50	-156.84
SDev	74.6	12.433	3.4088	8.17	92.37
%RSD	2.0170	15.705	46.615	1.1428	-58.895
#1	3759.6	90.671	9.6518	717.80	-51.292
#2	3718.2	80.854	3.4015	720.50	-222.92
#3	3614.8	65.976	8.8847	705.20	-196.29

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Method: TCLP Sample Name: XXX S 563565 #26 Operator:
Run Time: 08/11/93 14:52:25
Comment: SDG:901296 1:5 W01B0502L
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	234.42	5.2979	13.122	4.9914	-18.358	61.809	-.85459
SDev	2.32	16.458	2.860	1.4971	20.437	27.725	.65033
%RSD	.98974	310.65	21.796	29.994	-111.33	44.856	-76.099
#1	235.75	-12.944	13.803	3.4944	-1.5157	33.207	-1.2299
#2	231.74	19.031	15.579	6.4886	-12.463	63.654	-1.2302
#3	235.75	9.8072	9.9823	4.9914	L-41.094	88.565	-.10365

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-9.4882	3.3936	-4.8125	149250.	12.484	54.020	2066.9
SDev	9.5162	8.5717	.0040	2196.	1.187	2.761	80.2
%RSD	-100.29	252.59	-.08230	1.4714	9.5051	5.1112	3.8791
#1	-9.4559	-5.5120	-4.8081	148160.	12.483	53.142	1979.4
#2	-19.020	4.1057	-4.8157	147810.	11.298	51.804	2084.5
#3	.01173	11.587	-4.8139	151780.	13.671	57.113	2136.8

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	870.53	19.668	-1.3719	173.68	-142.04
SDev	11.95	15.260	.6601	2.60	104.05
%RSD	1.3723	77.588	-48.117	1.4957	-73.253
#1	863.63	37.200	-2.1151	175.18	-24.660
#2	863.64	9.3674	-.85360	170.68	-222.92
#3	884.32	12.437	-1.1471	175.18	-178.54

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Analysis Report Wed 08-11-93 03:00:23 PM page 1

Method: TCLP Sample Name: XXX U 563576 #27 Operator:
Run Time: 08/11/93 14:56:26
Comment: SDG:901296 1:1 W01B0703
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	1138.8	-7.4262	2.4327	16.471	-6.6725	62.730	-1.0250
SDev	12.6	4.5158	5.1654	3.117	27.9487	25.718	1.3029
%RSD	1.1068	-60.810	212.33	18.923	-418.87	40.999	-127.11
#1	1152.6	-11.967	-3.1578	19.964	9.4826	33.205	-.27548
#2	1135.9	-7.3759	7.0284	13.975	9.4449	80.261	-2.5295
#3	1127.9	-2.9357	3.4276	15.473	L-38.945	74.724	-.27004

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-11.068	-1.3605	-4.8152	607440.	29.701	64.536	11442.
SDev	9.933	5.3514	.0131	6288.	3.131	3.536	102.
%RSD	-89.750	-393.35	-.27182	1.0352	10.542	5.4793	.89519
#1	-14.254	-3.1140	-4.8217	612410.	33.252	65.842	11527.
#2	-19.017	4.6477	-4.8239	609550.	28.515	60.533	11471.
#3	.06759	-5.6152	-4.8002	600370.	27.336	67.233	11328.

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	2146.1	63.784	-.92450	107.09	-114.42
SDev	20.7	19.612	2.18157	2.26	25.85
%RSD	.96375	30.747	-235.97	2.1148	-22.595
#1	2166.8	58.453	.14535	109.48	-92.720
#2	2146.1	85.510	.51563	106.79	-107.52
#3	2125.4	47.388	-3.4345	104.99	-143.03

INORGANIC SDG 901295

Analysis Report Wed 08-11-93 03:04:24 PM page 1

Method: TCLP Sample Name: XXX U 563618 #28 Operator:
Run Time: 08/11/93 15:00:28
Comment: SDG:901296 1:1 W01B0202
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	1099.7	-16.810	12.682	4.4918	-14.842	42.435	-.23008
SDev	17.8	4.676	2.997	1.7293	23.335	34.608	1.13115
%RSD	1.6183	-27.817	23.633	38.498	-157.22	81.555	-491.64
#1	1116.4	-12.153	13.764	6.4886	L-41.304	77.495	-1.3602
#2	1101.7	-16.772	14.989	3.4938	-6.0115	41.513	-.23215
#3	1081.0	-21.505	9.2945	3.4931	2.7893	8.2977	.90210

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-9.4968	2.7848	-4.8224	656500.	42.764	40.113	10380.
SDev	12.5552	18.037	.0090	7943.	3.125	.806	171.
%RSD	-132.20	647.70	-.18597	1.2099	7.3075	2.0090	1.6484
#1	-18.987	17.975	-4.8151	661710.	43.938	39.647	10493.
#2	-14.243	-17.151	-4.8197	660440.	45.133	39.649	10464.
#3	4.7396	7.5303	-4.8324	647360.	39.222	41.044	10183.

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	1780.6	138.67	.26681	546.82	-70.034
SDev	23.9	36.27	1.4948	4.76	58.763
%RSD	1.3410	26.157	560.24	.87079	-83.906
#1	1794.4	180.14	-.94939	548.62	-3.9456
#2	1794.4	122.99	-.18579	550.42	-116.39
#3	1753.1	112.87	1.9356	541.42	-89.761

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Method: TCLP Sample Name: XXX U 563622 #29 Operator:
Run Time: 08/11/93 15:04:29
Comment: SDG:901296 1:1 W01B0102
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	771.96	10.909	15.520	6.4880	-9.9259	-1.8522	-.53372
SDev	9.03	27.915	1.683	6.8619	9.1883	23.0471	1.96158
%RSD	1.1703	255.88	10.844	105.76	-92.569	-1244.3	-367.53
#1	782.28	17.143	14.523	4.9912	-17.245	-27.686	-2.7988
#2	768.14	35.181	14.575	13.975	-12.919	5.5294	.59565
#3	765.46	-19.596	17.464	.49809	.38565	16.600	.60195

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-14.291	7.3247	L-5.7906	644650.	32.693	47.697	10022.
SDev	12.557	7.9637	1.6616	6903.	2.472	4.832	113.
%RSD	-87.866	108.72	-28.695	1.0708	7.5603	10.130	1.1265
#1	-28.527	16.380	L-7.7093	652520.	29.921	46.287	10018.
#2	-4.7940	4.1844	-4.8221	641830.	34.669	43.727	9910.8
#3	-9.5507	1.4098	-4.8404	639610.	33.488	53.077	10137.

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	4033.6	284.69	.94667	482.33	-38.469
SDev	56.7	29.97	2.0669	5.27	116.515
%RSD	1.4059	10.526	218.33	1.0932	-302.88
#1	4098.2	278.85	-.66437	488.33	37.483
#2	4010.3	317.14	.22723	480.23	19.728
#3	3992.2	258.07	3.2771	478.43	-172.62

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Method: TCLP Sample Name: XXX U 563629 #30 Operator:
Run Time: 08/11/93 15:08:31
Comment: SDG:901296 1:1 W01B031D
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	1196.5	5.8468	95.964	7.9857	-17.706	41.517	-.61062
SDev	23.1	35.630	3.016	3.9616	22.878	8.303	.64649
%RSD	1.9316	609.39	3.1429	49.609	-129.21	20.000	-105.87
#1	1218.8	28.633	97.018	12.478	.61031	41.517	-.23843
#2	1198.1	L-35.212	92.563	4.9909	L-43.349	33.214	-.23631
#3	1172.7	24.119	98.312	6.4885	-10.378	49.820	-1.3571

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	6.3395	6.2105	-2.8905	683840.	4.3071	9.0218	10474.
SDev	7.2553	12.613	1.6684	11507.	.6821	2.6979	195.
%RSD	114.44	203.09	-57.719	1.6827	15.838	29.904	1.8595
#1	14.246	9.5196	-4.8169	693940.	4.6857	8.9825	10660.
#2	4.7841	16.839	-1.9301	686260.	3.5196	6.3438	10490.
#3	-.01186	-7.7268	-1.9244	671310.	4.7159	11.739	10271.

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	1745.3	64.301	-.33309	1131.1	-136.12
SDev	30.5	15.233	.55012	14.6	44.91
%RSD	1.7467	23.691	-165.15	1.2934	-32.993
#1	1771.2	73.331	-.64274	1142.5	-184.45
#2	1753.1	46.713	.30206	1136.2	-95.680
#3	1711.7	72.859	-.65860	1114.6	-128.23

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Method: TCLP Sample Name: XXX U 563842 #31 Operator:
Run Time: 08/11/93 15:12:32
Comment: SDG:901296 1:1 W02B0201
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	786.70	18.673	5.0535	5.4912	L-54.402	7.3751	-1.6132
SDev	3.88	40.583	4.4154	2.2873	24.215	33.253	1.2953
%RSD	.49375	217.34	87.373	41.654	-44.511	450.89	-80.293
#1	782.28	32.280	5.3107	3.4945	L-78.638	-24.917	-3.1090
#2	788.23	-26.965	9.3347	4.9923	L-30.207	5.5300	-.86051
#3	789.57	50.704	.51515	7.9868	L-54.361	41.512	-.87029

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	7.9715	11.341	-3.8355	H1835200.	32.297	40.986	7454.1
SDev	7.2708	13.903	1.6651	18855.	2.372	1.288	47.4
%RSD	91.210	122.59	-43.414	1.0274	7.3457	3.1430	.63610
#1	14.279	7.4030	-1.9127	H1816500.	34.671	41.055	7416.2
#2	9.6155	-.16867	-4.7954	H1834700.	32.293	39.665	7438.9
#3	.01942	26.787	-4.7983	H1854200.	29.926	42.239	7507.3

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	6425.4	79.988	-3.5236	64.191	-59.183
SDev	62.7	21.041	.8393	.520	87.999
%RSD	.97592	26.305	-23.819	.80937	-148.69
#1	6368.5	98.228	-2.5966	64.491	34.524
#2	6415.1	84.767	-4.2320	63.591	-140.07
#3	6492.7	56.969	-3.7421	64.491	-72.006

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Method: TCLP Sample Name: CCV Operator:
Run Time: 08/11/93 15:31:20
Comment: CCV CVS1
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	4931.2	5164.9	5008.3	4914.6	4972.8	4871.2	493.40
SDev	25.0	56.7	53.0	41.7	39.6	103.2	.01
%RSD	.50706	1.0974	1.0586	.84906	.79677	2.1185	.00180
#1	4945.9	5219.3	5047.1	4934.0	4958.2	4989.8	493.40
#2	4945.4	5169.3	5030.0	4943.0	5017.7	4801.6	493.41
#3	4902.3	5106.2	4947.9	4866.7	4942.7	4822.3	493.39

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	5056.2	5088.1	5207.8	53852.	5089.9	5089.4	53279.
SDev	47.3	36.8	45.2	565.	40.5	35.2	410.
%RSD	.93554	.72252	.86829	1.0488	.79505	.69080	.76955
#1	5100.3	5104.5	5223.2	54172.	5109.6	5096.5	53477.
#2	5062.2	5113.9	5243.4	54186.	5116.8	5120.5	53553.
#3	5006.2	5046.0	5156.9	53200.	5043.4	5051.2	52808.

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	5078.5	4849.0	5073.9	4997.6	5064.1
SDev	45.5	26.4	30.1	41.4	13.7
%RSD	.89530	.54479	.59250	.82887	.26990
#1	5096.6	4871.5	5088.9	5018.3	5056.2
#2	5112.2	4820.0	5093.5	5024.6	5079.9
#3	5026.8	4855.6	5039.3	4949.9	5056.2

Analysis Report QC Standard Wed 08-11-93 03:39:19 PM page 1

Method: TCLP Sample Name: CCB Operator:
Run Time: 08/11/93 15:35:23
Comment: CCB
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	.00000	-24.159	.72845	2.9951	2.2510	7.3814	-1.5042
SDev	.00000	41.427	.88153	4.3228	23.530	50.459	1.7224
%RSD	.00000	-171.48	121.01	144.33	1045.3	683.60	-114.51
#1	.00000	13.920	1.1358	.49910	Q29.392	16.608	-.00058
#2	.00000	Q-68.273	-.28309	.49946	-12.400	52.591	-3.3834
#3	.00000	-18.124	1.3327	7.9866	-10.239	-47.054	-1.1285

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-28.474	-8.4424	-2.8836	-4.7422	1.9743	-2.2194	40.158
SDev	9.556	17.4106	1.6607	10.7381	1.1835	.7706	37.775
%RSD	-33.559	-206.23	-57.590	-226.44	59.944	-34.720	94.067
#1	-38.049	4.0608	-1.9283	-16.471	1.9750	-3.1092	10.436
#2	-28.436	-28.328	-1.9214	-2.3620	.79046	-1.7756	82.667
#3	-18.938	-1.0600	-4.8012	4.6062	3.1574	-1.7734	27.369

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	-4.3047	-15.890	-1.4706	.59992	-90.748
SDev	1.4900	11.325	1.6522	.89987	66.587
%RSD	-34.613	-71.276	-112.35	150.00	-73.376
#1	-2.5842	-6.8259	.00147	.59992	-24.660
#2	-5.1622	-28.586	-1.1558	-.29996	-89.761
#3	-5.1678	-12.257	-3.2576	1.4998	-157.82

INORGANIC SDG 901295

Analysis Report Wed 08-11-93 03:43:20 PM page 1

Method: TCLP Sample Name: XXX U 563849 #34 Operator:
Run Time: 08/11/93 15:39:24
Comment: SDG:901296 1:1 W01B0602
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	1899.7	-10.561	-.13663	9.4828	-10.333	.91823	-.93835
SDev	7.8	12.105	3.43256	1.4971	24.507	39.372	1.72508
%RSD	.40895	-114.62	-2512.3	15.788	-237.17	4287.8	-183.84
#1	1896.0	-15.086	3.6195	9.4820	-5.9536	19.371	-2.8193
#2	1894.5	-19.752	-3.1107	7.9861	L-36.735	-44.291	.57001
#3	1908.7	3.1550	-.91865	10.980	11.689	27.675	-.56581

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	11.097	16.849	-3.8589	652330.	48.987	30.117	20476.
SDev	7.307	4.383	1.6738	4931.	4.483	2.072	127.
%RSD	65.843	26.016	-43.376	.75595	9.1517	6.8784	.62187
#1	4.7128	19.536	-4.8389	653890.	47.011	28.321	20609.
#2	19.066	19.220	-4.8116	646800.	45.832	32.384	20356.
#3	9.5123	11.791	-1.9262	656290.	54.119	29.647	20463.

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	4205.2	56.148	.37687	210.87	-141.05
SDev	28.4	21.117	2.3559	3.64	39.96
%RSD	.67442	37.610	625.12	1.7247	-28.328
#1	4214.7	80.314	3.0127	210.27	-181.50
#2	4173.3	41.248	-1.5236	207.57	-140.07
#3	4227.6	46.882	-.35847	214.77	-101.60

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Analysis Report Wed 08-11-93 03:47:21 PM page 1

Method: TCLP Sample Name: XXX U 563953 #35 Operator:
Run Time: 08/11/93 15:43:25
Comment: SDG:901296 1:1 W02B0301
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	1342.8	-.19123	6.2649	11.480	21.047	-15.697	1.7160
SDev	10.6	27.4872	1.8812	2.287	15.434	36.857	1.1360
%RSD	.79179	-14374.	30.027	19.922	73.331	-234.80	66.202
#1	1334.8	2.8711	8.2055	13.975	4.9288	-24.921	1.7187
#2	1354.8	-29.081	6.1399	10.981	22.521	-47.066	.57864
#3	1338.8	25.637	4.4494	9.4829	35.691	24.896	2.8507

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	58.652	24.021	-1.9236	H1903300.	49.330	84.479	9683.0
SDev	9.934	11.020	.0114	29092.	1.806	16.293	151.2
%RSD	16.937	45.875	-.59400	1.5285	3.6621	19.286	1.5620
#1	47.531	24.791	-1.9314	H1879700.	47.357	70.312	9587.1
#2	66.646	34.636	-1.9105	H1935800.	50.903	80.843	9857.4
#3	61.779	12.637	-1.9290	H1894400.	49.729	102.28	9604.5

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	4152.6	125.06	-.77794	3032.3	-108.50
SDev	55.0	15.55	1.90439	41.8	49.63
%RSD	1.3254	12.433	-244.80	1.3796	-45.745
#1	4103.5	123.23	.51511	2996.3	-140.07
#2	4212.1	110.51	-2.9648	3078.2	-51.292
#3	4142.3	141.44	.11590	3022.4	-134.15

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Method: TCLP Sample Name: XXX U 563960 #36 Operator:
Run Time: 08/11/93 15:47:27
Comment: SDG:901296 1:1 W02B0101
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	985.39	-9.1611	2.7148	17.469	L-35.320	38.744	.07954
SDev	3.43	38.8025	1.3647	3.116	8.872	16.608	1.3029
%RSD	.34788	-423.56	50.268	17.841	-25.119	42.865	1638.0
#1	982.46	-7.7432	1.3076	19.964	L-36.848	55.352	.83126
#2	989.16	L-48.653	2.8042	18.466	L-43.328	38.744	-1.4249
#3	984.54	28.913	4.0325	13.975	L-25.783	22.137	.83224

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	39.627	15.102	-1.9295	705160.	32.564	44.638	5593.9
SDev	15.280	9.895	.0105	2070.	4.933	2.305	27.7
%RSD	38.559	65.522	-.54278	.29358	15.149	5.1629	.49437
#1	57.056	16.951	-1.9304	703010.	28.614	41.977	5562.7
#2	28.540	23.943	-1.9396	707140.	38.094	45.959	5615.2
#3	33.284	4.4128	-1.9187	705340.	30.984	45.978	5603.9

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	2275.4	59.893	.20421	269.06	-63.129
SDev	9.0	26.662	1.7456	1.37	82.857
%RSD	.39400	44.517	854.81	.51088	-131.25
#1	2270.2	87.230	.33948	270.56	19.728
#2	2285.8	33.961	1.8782	267.86	-63.129
#3	2270.2	58.487	-1.6051	268.76	-145.99

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Method: TCLP Sample Name: XXX U 563980 #37 Operator:
Run Time: 08/11/93 15:51:28
Comment: SDG:901296 1:1 W02B0401
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	955.03	2.0114	2.6933	11.479	L-32.387	11.067	-1.1087
SDev	5.25	23.729	.5361	2.287	7.965	49.899	2.3516
%RSD	.54963	1179.7	19.906	19.922	-24.594	450.86	-212.10
#1	958.35	15.773	3.2825	10.981	L-34.609	-44.290	-3.7453
#2	948.98	15.650	2.2341	9.4826	-23.547	24.907	.77222
#3	957.75	-25.389	2.5635	13.974	L-39.005	52.585	-.35313

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	9.5095	20.356	-2.8919	680080.	36.538	26.403	4879.8
SDev	4.7173	12.818	3.3317	5325.	2.987	4.313	35.8
%RSD	49.606	62.968	-115.21	.78297	8.1753	16.334	.73378
#1	4.7924	17.163	-4.8036	686080.	36.931	21.485	4879.9
#2	14.227	9.4362	-4.8273	678270.	39.309	28.184	4915.5
#3	9.5090	34.468	.95526	675900.	33.374	29.540	4843.9

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	2682.2	83.350	-.09984	131.68	-114.42
SDev	20.9	21.782	2.40314	2.75	49.28
%RSD	.77912	26.133	-2407.0	2.0877	-43.069
#1	2704.6	95.091	-2.8652	129.28	-169.66
#2	2678.8	58.217	1.0841	134.68	-98.639
#3	2663.2	96.744	1.4816	131.08	-74.965

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Method: TCLP Sample Name: XXX U 563990 #38 Operator:
Run Time: 08/11/93 15:55:29
Comment: SDG:901296 1:1 W02B0501
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	1166.7	23.323	2.3475	10.980	-22.790	18.450	-1.4883
SDev	2.5	10.558	2.5142	2.593	24.151	33.368	1.1275
%RSD	.21034	45.268	107.10	23.619	-105.97	180.86	-75.755
#1	1166.0	11.132	.96894	12.478	L-36.682	-16.610	-1.4877
#2	1169.4	29.480	.82415	7.9854	L-36.784	22.141	-.36117
#3	1164.6	29.358	5.2495	12.477	5.0971	49.819	-2.6161

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	3.1293	13.479	-.96953	608490.	40.357	19.551	8507.5
SDev	7.2555	13.894	1.67003	3237.	.001	2.765	33.7
%RSD	231.86	103.08	-172.25	.53197	.00359	14.143	.39571
#1	4.7534	28.848	-1.9250	606220.	40.358	17.343	8468.7
#2	-4.8007	9.7789	.95883	607050.	40.358	18.657	8526.3
#3	9.4350	1.8092	-1.9424	612200.	40.356	22.652	8527.7

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	2696.0	51.121	.89566	265.46	-119.35
SDev	10.8	39.730	1.4463	2.75	80.12
%RSD	.39906	77.717	161.48	1.0356	-67.126
#1	2683.9	17.329	-.54675	266.06	-211.09
#2	2699.4	94.888	.88785	262.46	-63.129
#3	2704.6	41.147	2.3459	267.86	-83.843

Analysis Report Wed 08-11-93 04:03:26 PM page 1

Method: TCLP Sample Name: XXX U 564128 #39 Operator:
Run Time: 08/11/93 15:59:30
Comment: SDG:901296 1:1 W02B060
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	898.12	-16.475	1.3786	5.9889	-20.551	-2.7705	-1.4391
SDev	12.54	36.298	4.6553	2.2871	7.090	29.1617	2.2566
%RSD	1.3959	-220.32	337.68	38.190	-34.498	-1052.6	-156.81
#1	908.19	11.045	3.2112	6.4895	L-25.725	-5.5380	-3.6994
#2	902.09	L-57.612	-3.9141	3.4929	-23.458	-30.450	.81388
#3	884.08	-2.8575	4.8387	7.9843	-12.470	27.676	-1.4319

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-1.5891	7.4937	-1.9350	719220.	15.633	16.945	6881.9
SDev	11.9323	1.4023	.0258	13124.	.007	2.083	83.4
%RSD	-750.91	18.714	-1.3340	1.8247	.04444	12.295	1.2122
#1	-14.204	6.8700	-1.9058	728250.	15.625	15.139	6884.7
#2	9.5175	6.5115	-1.9440	725250.	15.635	16.472	6963.9
#3	-.08097	9.0997	-1.9550	704170.	15.638	19.224	6797.1

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	2329.7	18.285	1.1077	144.28	-61.156
SDev	38.1	23.417	4.3021	1.87	29.641
%RSD	1.6349	128.06	388.38	1.2983	-48.468
#1	2353.0	42.429	-3.7446	146.38	-63.129
#2	2350.4	-4.3295	2.6119	143.68	-30.578
#3	2285.8	16.756	4.4558	142.78	-89.761

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Analysis Report Wed 08-11-93 04:07:27 PM page 1

Method: TCLP Sample Name: XXX U 564132 #40 Operator:
Run Time: 08/11/93 16:03:31
Comment: SDG:901296 1:1 W02B0801
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	992.78	-23.535	1.0407	3.9924	L-27.898	19.374	-.88243
SDev	6.75	14.027	.7536	2.2886	7.613	19.375	1.72489
%RSD	.67977	-59.603	72.417	57.324	-27.288	100.01	-195.47
#1	995.26	L-35.823	1.5282	1.9950	L-32.305	33.214	.99952
#2	997.94	-26.529	1.4212	3.4925	L-32.281	27.678	-1.2587
#3	985.14	-8.2520	.17266	6.4895	-19.107	-2.7692	-2.3881

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-14.267	-10.532	-2.9014	667830.	2.9290	8.3015	7083.3
SDev	12.553	13.822	1.6418	4744.	2.9820	.7552	64.2
%RSD	-87.983	-131.23	-56.586	.71041	101.81	9.0968	.90566
#1	-.04933	-12.980	-1.9555	662460.	.16167	7.4295	7050.2
#2	-23.818	4.3499	-1.9515	669540.	6.0871	8.7349	7157.2
#3	-18.935	-22.967	-4.7972	671480.	2.5383	8.7400	7042.4

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	980.83	30.475	1.4886	202.17	-120.34
SDev	11.94	1.340	4.7108	1.56	60.81
%RSD	1.2177	4.3966	316.45	.77094	-50.535
#1	967.04	30.183	4.5371	200.37	-190.37
#2	987.73	31.937	3.8659	203.07	-80.884
#3	987.73	29.305	-3.9371	203.07	-89.761

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Analysis Report Wed 08-11-93 04:11:28 PM page 1

Method: TCLP Sample Name: XXX U 564242 #41 Operator:
Run Time: 08/11/93 16:07:32
Comment: SDG:901296 1:1 W.I.P.
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	1.3395	1.4466	.84938	5.9892	-5.8993	5.5333	1.1333
SDev	.0000	21.542	1.6529	3.4589	34.5873	29.293	.0012
%RSD	.00000	1489.1	194.60	57.753	-586.29	529.39	.10483
#1	1.3395	9.0377	2.4896	1.9952	24.915	27.676	1.1346
#2	1.3395	18.165	.87449	7.9860	.69668	-27.682	1.1329
#3	1.3395	-22.863	-.81594	7.9864	L-43.310	16.605	1.1323

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	11.090	-11.527	-2.8931	105.62	3.9472	16.896	166.77
SDev	2.753	10.350	1.6570	26.68	1.3691	1.334	71.23
%RSD	24.827	-89.788	-57.275	25.263	34.686	7.8927	42.712
#1	9.4251	-8.1100	-1.9521	117.37	5.5282	18.228	218.31
#2	14.268	-3.3181	-1.9209	75.077	3.1561	16.900	85.489
#3	9.5767	-23.154	-4.8064	124.41	3.1574	15.561	196.53

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	-5.1701	14.630	.11126	8.6988	-63.129
SDev	.0013	5.227	3.3812	.8999	42.984
%RSD	-.02473	35.725	3039.1	10.345	-68.090
#1	-5.1715	20.500	3.9579	7.7989	-21.701
#2	-5.1695	12.910	-1.2335	9.5987	-107.52
#3	-5.1692	10.481	-2.3906	8.6988	-60.170

INORGANIC SDG 901295

Analysis Report Wed 08-11-93 04:15:29 PM page 1

Method: TCLP Sample Name: XXX U 565745 #42 Operator:
Run Time: 08/11/93 16:11:33
Comment: SDG:901296 1:1 W.I.P.
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	.24675	.12879	1.1984	6.4891	-16.131	-9.2283	-.74796
SDev	.42739	12.104	1.8763	6.5267	15.878	24.1832	2.34787
%RSD	173.21	9398.6	156.56	100.58	-98.431	-262.05	-313.90
#1	.00000	9.3570	2.2637	1.9973	-8.0792	-2.7696	-3.3799
#2	.74026	-13.576	-.96803	13.976	L-34.421	11.070	1.1312
#3	.00000	4.6053	2.2996	3.4943	-5.8920	-35.985	.00476

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-18.970	-29.777	-3.8415	96.189	6.3187	13.343	106.89
SDev	14.258	12.379	1.6673	24.314	4.4871	2.039	72.95
%RSD	-75.161	-41.573	-43.403	25.277	71.013	15.281	68.247
#1	-33.237	-42.744	-4.8040	82.149	4.3440	11.565	83.108
#2	-18.952	-28.500	-4.8042	124.26	11.454	12.894	188.76
#3	-4.7210	-18.085	-1.9162	82.154	3.1576	15.568	48.801

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	-5.1682	5.7239	-2.5230	5.6992	-59.183
SDev	.0087	25.891	.4388	2.0782	92.131
%RSD	-.16836	452.33	-17.390	36.464	-155.67
#1	-5.1753	25.325	-2.7919	6.8990	-145.99
#2	-5.1585	-23.626	-2.7605	3.2995	-69.047
#3	-5.1707	15.474	-2.0167	6.8990	37.483

INORGANIC SDG 901295

Analysis Report Wed 08-11-93 04:19:31 PM page 1

Method: TCLP Sample Name: XXX U 565746 #43 Operator:
Run Time: 08/11/93 16:15:34
Comment: SDG:901296 1:1 W.I.P.
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	.64626	L-45.800	.72327	3.9931	-10.322	1.8436	-.74822
SDev	.67099	13.598	3.9025	1.7288	9.639	51.511	1.30218
%RSD	103.83	-29.690	539.56	43.294	-93.382	2794.0	-174.04
#1	1.3395	L-32.178	-1.6931	4.9909	-14.744	49.821	.00404
#2	.00000	L-45.847	5.2255	4.9916	-16.956	8.3022	.00314
#3	.59926	L-59.374	-1.3625	1.9969	.73451	-52.592	-2.2519

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	28.592	1.7140	.00630	65.683	5.1345	11.116	145.23
SDev	16.448	23.714	1.6670	28.481	1.3714	.771	30.58
%RSD	57.528	1383.5	26451.	43.361	26.709	6.9372	21.058
#1	38.058	-10.592	.96119	96.223	4.3450	11.560	163.45
#2	38.119	29.051	.97623	39.847	4.3406	10.226	162.31
#3	9.5992	-13.317	-1.9185	60.979	6.7181	11.563	109.92

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	-5.1724	14.574	-1.0508	7.7989	-111.46
SDev	.0071	20.125	1.3517	3.2445	53.05
%RSD	-.13632	138.09	-128.63	41.603	-47.591
#1	-5.1759	25.426	.49465	5.0993	-172.62
#2	-5.1769	26.944	-2.0125	11.398	-77.925
#3	-5.1642	-8.6477	-1.6347	6.8990	-83.843

Analysis Report QC Standard Wed 08-11-93 04:26:44 PM page 1

Method: TCLP Sample Name: CCV Operator:
Run Time: 08/11/93 16:22:47
Comment: CCV CVS1
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	4760.7	4879.9	4705.4	4638.2	4690.6	4735.6	476.79
SDev	35.4	47.4	50.1	62.7	81.8	117.3	2.86
%RSD	.74446	.97185	1.0652	1.3518	1.7434	2.4769	.59896
#1	4799.9	4924.8	4735.2	4708.0	4768.5	4847.3	479.81
#2	4731.0	4830.3	4647.6	4586.8	4605.4	4613.4	474.14
#3	4751.1	4884.6	4733.5	4619.7	4698.0	4746.3	476.40

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	4943.5	4815.7	4933.4	50522.	4807.4	4839.4	52129.
SDev	44.3	52.7	73.6	702.	61.3	57.0	484.
%RSD	.89661	1.0938	1.4910	1.3892	1.2761	1.1778	.92869
#1	4989.9	4873.8	5016.0	51308.	4876.5	4904.7	52653.
#2	4901.6	4770.9	4874.9	49957.	4759.3	4799.4	51699.
#3	4939.1	4802.5	4909.4	50302.	4786.5	4814.1	52035.

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	4808.7	4628.7	4845.5	4686.5	4748.5
SDev	55.2	54.2	53.1	61.9	175.9
%RSD	1.1487	1.1703	1.0958	1.3212	3.7036
#1	4871.7	4690.5	4904.8	4756.4	4671.5
#2	4768.2	4606.3	4802.5	4638.6	4949.7
#3	4786.3	4589.3	4829.1	4664.6	4624.2

Analysis Report QC Standard Wed 08-11-93 04:30:46 PM page 1

Method: TCLP Sample Name: CCB Operator:
Run Time: 08/11/93 16:26:50
Comment: CCB
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	.00000	13.816	1.6953	5.9892	-11.722	35.983	-1.1293
SDev	.00000	31.884	3.0535	3.4576	10.850	31.437	2.2553
%RSD	.00000	230.78	180.11	57.730	-92.562	87.365	-199.71
#1	.00000	Q50.258	4.9438	7.9849	-16.847	58.126	-1.1281
#2	.00000	.12367	-1.1162	7.9860	-19.060	49.823	-3.3852
#3	.00000	-8.9350	1.2584	1.9967	.74131	.00103	1.1254

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-20.616	-4.9824	Q-6.7492	-2.4518	5.1339	-4.4494	67.115
SDev	7.209	18.8228	1.6584	12.1619	2.4650	2.6677	18.437
%RSD	-34.966	-377.79	-24.572	-496.05	48.014	-59.956	27.471
#1	-14.356	-.92570	-4.8342	4.5482	7.8968	-1.7822	83.284
#2	-18.996	11.481	Q-7.7064	4.5917	4.3449	-4.4485	47.037
#3	-28.497	-25.503	Q-7.7069	-16.495	3.1600	-7.1175	71.025

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	-.00409	7.7368	.01596	.59992	-86.802
SDev	.00285	5.7674	1.9256	1.5586	106.324
%RSD	-69.523	74.545	12067.	259.81	-122.49
#1	-.00162	3.1937	2.2390	2.3997	-9.8639
#2	-.00345	5.7913	-1.1360	-.29996	-208.13
#3	-.00721	14.225	-1.0551	-.29996	-42.415

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Analysis Report Wed 08-11-93 04:34:52 PM page 1

Method: TCLP Sample Name: XXX U 566277 #46 Operator:
Run Time: 08/11/93 16:30:56
Comment: SDG:901296 1:1 W.I.P.
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	.24675	7.6772	.19729	10.481	-9.5450	46.127	.00860
SDev	.99266	32.076	1.8219	4.813	9.9173	19.637	1.1261
%RSD	402.29	417.82	923.43	45.925	-103.90	42.571	13096.
#1	1.3395	41.164	-.89991	13.976	.71071	49.818	1.1350
#2	.00000	-22.773	-.80854	12.477	-19.085	24.907	.00809
#3	-.59926	4.6399	2.3003	4.9908	-10.260	63.657	-1.1173

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-12.689	-9.1079	-2.8936	131.43	3.5509	30.235	94.632
SDev	2.744	17.9055	1.6731	7.06	1.3699	4.623	26.843
%RSD	-21.624	-196.59	-57.821	5.3735	38.578	15.289	28.365
#1	-14.264	11.518	-1.9158	124.38	1.9691	27.566	114.33
#2	-9.5209	-18.176	-1.9395	131.41	4.3416	27.566	105.51
#3	-14.282	-20.665	-4.8255	138.51	4.3421	35.573	64.058

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	.00590	16.317	.18662	5.3992	-118.37
SDev	.00463	8.624	2.0412	1.0391	94.71
%RSD	78.563	52.850	1093.8	19.245	-80.013
#1	.00334	21.006	-2.0863	5.9992	-214.05
#2	.00311	21.580	1.8635	5.9992	-116.39
#3	.01124	6.3649	.78266	4.1994	-24.660

INORGANIC SDG 901295

Analysis Report QC Standard Wed 08-11-93 04:40:42 PM page 1

Method: TCLP Sample Name: CRI Operator:
Run Time: 08/11/93 16:36:45
Comment: CRI
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	.00000	Q99.644	9.3982	23.927	45.757	175.30	18.811
SDev	.00000	36.527	1.8776	5.668	22.186	41.64	1.303
%RSD	.00000	36.658	19.979	23.689	48.485	23.754	6.9264
#1	.00000	63.144	Q7.2719	Q30.414	Q69.281	Q127.32	18.059
#2	.00000	Q136.20	10.828	19.934	Q25.211	202.06	18.058
#3	.00000	Q99.589	10.094	21.432	42.780	196.52	20.316

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	4.3947	Q73.810	9.0535	.94145	101.94	-5.3657	61.412
SDev	11.022	7.191	2.8994	10.827	5.35	2.0407	40.321
%RSD	250.80	9.7427	32.025	1150.1	5.2441	-38.033	65.657
#1	-1.9613	Q80.938	9.0365	3.2521	101.54	-7.1440	100.39
#2	-1.9762	Q73.933	Q6.1627	10.427	96.803	-5.8154	19.873
#3	17.122	Q66.558	11.961	-10.855	107.47	-3.1376	63.970

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	Q22.380	81.877	98.005	39.294	Q142.04
SDev	5.382	20.257	2.722	1.800	42.71
%RSD	24.048	24.741	2.7773	4.5802	30.070
#1	Q20.663	Q59.094	100.85	41.094	191.36
#2	28.411	88.681	97.737	37.495	Q117.38
#3	Q18.066	Q97.857	95.427	39.295	Q117.38

Analysis Report QC Standard Wed 08-11-93 04:44:43 PM page 1

Method: TCLP Sample Name: ICSA Operator:
Run Time: 08/11/93 16:40:47
Comment: ICSA ICSA
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	13.595	1297.0	-18.271	14.973	-105.37	71.430	30.114
SDev	.346	49.4	1.803	7.387	13.36	16.114	.868
%RSD	2.5449	3.8116	-9.8685	49.336	-12.678	22.559	2.8827
#1	13.994	1257.6	-16.338	19.965	-116.28	56.236	29.305
#2	13.395	1352.5	-18.568	18.468	-90.474	69.727	30.006
#3	13.395	1281.0	-19.908	6.4871	-109.37	88.329	31.031

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	493770.	9.8439	-3.8532	503640.	6.6695	183640.	513810.
SDev	4666.	16.864	1.6813	6300.	6.0593	2097.	4894.
%RSD	.94507	171.32	-43.634	1.2509	90.851	1.1419	.95247
#1	492280.	28.772	-1.9120	502400.	5.8840	183450.	513070.
#2	498990.	-3.5830	-4.8031	510460.	1.0413	185830.	519040.
#3	490020.	4.3427	-4.8447	498050.	13.083	181650.	509330.

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	9.3809	20.253	-.56503	76.489	822.65
SDev	8.5131	17.539	3.94313	1.873	174.80
%RSD	90.750	86.602	-697.87	2.4490	21.248
#1	-.16212	22.389	-2.7273	77.089	812.78
#2	16.195	1.7430	-2.9540	74.390	1002.2
#3	12.110	36.626	3.9862	77.989	652.99

INORGANIC SDG 901295

Analysis Report QC Standard Wed 08-11-93 04:48:44 PM page 1

Method: TCLP Sample Name: ICSAB Operator:
Run Time: 08/11/93 16:44:48
Comment: ICSAB ICSAB
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	426.41	1279.9	831.09	415.12	4081.6	116.68	890.01
SDev	2.05	28.7	2.25	3.96	4.8	26.75	1.22
%RSD	.47985	2.2448	.27105	.95413	.11732	22.929	.13731
#1	428.64	1252.2	833.49	419.61	4082.2	137.91	889.23
#2	425.97	1309.6	829.02	412.12	4076.6	86.630	889.39
#3	424.63	1278.0	830.76	413.62	4086.1	125.49	891.42

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	471270.	-4.7798	484.30	476640.	454.19	173910.	490130.
SDev	539.	9.4513	.03	1020.	2.46	384.	951.
%RSD	.11446	-197.74	.00550	.21403	.54247	.22070	.19397
#1	470830.	1.5089	484.28	475980.	456.95	173810.	490510.
#2	471870.	-15.648	484.29	477810.	453.38	174340.	490830.
#3	471110.	-.19970	484.33	476130.	452.23	173590.	489050.

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	428.00	784.51	432.85	920.87	664.83
SDev	.15	42.78	4.44	4.53	75.56
%RSD	.03495	5.4531	1.0264	.49185	11.365
#1	427.98	756.38	436.34	916.67	682.58
#2	428.16	763.40	434.36	920.27	729.93
#3	427.87	833.74	427.85	925.67	581.97

Analysis Report QC Standard Wed 08-11-93 04:56:38 PM page 1

Method: TCLP Sample Name: CCV Operator:
Run Time: 08/11/93 16:52:41
Comment: CCV CVS1
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	4564.7	4767.8	4620.0	4532.4	4597.9	4661.9	465.84
SDev	47.8	4.5	49.1	62.2	47.4	68.6	2.37
%RSD	1.0467	.09540	1.0617	1.3734	1.0312	1.4714	.50919
#1	4536.8	4763.6	4588.2	4486.5	4561.2	4666.0	463.94
#2	4537.4	4772.6	4595.4	4507.4	4581.2	4591.3	465.08
#3	4619.8	4767.0	4676.5	4603.2	4651.5	4728.3	468.50

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	4794.1	4718.4	4856.2	49354.	4689.9	4716.0	50569.
SDev	36.0	35.5	83.3	665.	65.7	70.3	291.
%RSD	.74992	.75327	1.7146	1.3468	1.4019	1.4900	.57470
#1	4776.0	4699.7	4791.8	48768.	4632.7	4662.2	50393.
#2	4770.9	4696.2	4826.5	49219.	4675.3	4690.2	50410.
#3	4835.5	4759.4	4950.2	50077.	4761.7	4795.5	50905.

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	4695.8	4543.7	4705.9	4651.1	4536.4
SDev	54.2	170.8	64.1	54.5	71.6
%RSD	1.1532	3.7585	1.3615	1.1711	1.5782
#1	4649.3	4486.2	4660.9	4608.0	Q4455.5
#2	4682.9	Q4409.1	4677.7	4633.2	4591.6
#3	4755.2	4735.8	4779.3	4712.3	4562.0

Analysis Report QC Standard Wed 08-11-93 05:00:40 PM page 1

Method: TCLP Sample Name: CCB Operator:
Run Time: 08/11/93 16:56:43
Comment: CCB
Mode: CONC Corr. Factor: 1

Elem	Ba4934	As1936	Cd2288	Cr2677	Pb2203	Se1960	Ag3280
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	.00000	-24.310	1.1870	1.9966	.72004	-23.988	-.75254
SDev	.74026	20.552	2.3456	2.9939	7.5948	49.925	1.30281
%RSD	.00000	-84.540	197.60	149.95	1054.8	-208.12	-173.12
#1	-.74026	-22.812	2.6724	-.99716	9.4898	-71.965	-.00087
#2	.00000	Q-45.570	-1.5171	1.9963	-3.6745	27.679	.00015
#3	.74026	-4.5486	2.4058	4.9907	-3.6552	-27.678	-2.2569

Elem	Al3082	Sb2068	Be3130	Ca3158	Co2286	Fe2599	Mg3832
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter	ug/Liter
Avge	-3.1325	-11.486	-1.9243	-25.911	4.7406	-4.0002	91.692
SDev	7.2932	18.032	.0144	17.729	1.3686	2.7774	16.221
%RSD	-232.82	-156.99	-.74676	-68.423	28.869	-69.432	17.690
#1	4.8409	9.2799	-1.9081	-23.522	3.1604	-3.1102	73.230
#2	-9.4666	-20.548	-1.9295	-44.712	5.5330	-1.7769	98.189
#3	-4.7718	-23.190	-1.9353	-9.4970	5.5286	-7.1136	103.66

Elem	Mn2576	Ni2316	V_2924	Zn2138	Tl1908
Units	ug/Liter	ug/Liter	ug/Liter	ug/Liter	Ug/Liter
Avge	-5.1769	12.066	-.66956	-.29996	-101.60
SDev	.0027	10.215	2.39505	1.79975	28.54
%RSD	-.05139	84.655	-357.70	-600.00	-28.088
#1	-5.1796	20.939	-3.3775	1.4998	-69.047
#2	-5.1768	14.360	.19820	-.29996	-122.31
#3	-5.1743	.89962	1.1707	-2.0997	-113.43

Standards/QC Preparation for ICAP

Item to be prepared	Preparation Instructions	Prepared by	Date
Standard blank (S0, ICB, CCB)	Place in a 200-ml volumetric flask: 150 ml of deionized water 4.0 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-164-15) Bring up to volume with deionized water. Prepare daily.	AKL	8/11/93
Standard XCL-11 (S)	Place in a 100-ml volumetric flask: 90 ml of deionized water 2.0 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-164-15) Pipet 1.0 ml XCL-11 (Ref#: 7M2-158-12) into flask. Bring up to volume with deionized water. Prepare daily.	AKL	8/11/93
Standard XCL-2 (S)	Place in a 100-ml volumetric flask: 90 ml of deionized water 2.0 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-164-15) Pipet 1.0 ml XCL-2 (Ref#: 7M2-158-11) into flask. Bring up to volume with deionized water. Prepare daily.	AKL	8/11/93
Standard XCL-3A	Place in a 100-ml volumetric flask: 90 ml of deionized water 2.0 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-164-15) Pipet 1.0 ml XCL-3A (Ref#: 7M2-158-9) into flask. Bring up to volume with deionized water. Prepare daily.	AKL	8/11/93
Standard PLSB2-2X (S)	Place in a 100-ml volumetric flask: 90 ml of deionized water 2.0 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-164-15) Pipet 1.0 ml of PLSB2-2X (Ref#: 7M2-165-1) into flask. Bring up to volume with deionized water. Prepare daily.	AKL	8/11/93
CCV solution (CVS1)	Place in a 200-ml volumetric flask: 150 ml of deionized water 4.0 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-164-15) Pipet 1.0 ml XCL-2 (Ref#: 7M2-158-11) into flask. Pipet 1.0 ml XCL-11 (Ref#: 7M2-158-12) into flask. Pipet 1.0 ml XCL-3A (Ref#: 7M2-158-9) into flask. Pipet 1.0 ml PLSB2-2X (Ref#: 7M2-165-1) into flask. Bring up to volume with deionized water. Place solution in an acid washed Teflon bottle. Prepare as needed.	AKL	8/10/93 8/11/93

Reviewed by: [signature] Date: 8-12-93

Standards/QC Preparation for ICAP

Item to be prepared	Preparation instructions	Prepared by	Date
ICV1 solution	Place in a 200-ml volumetric flask: 150 ml of deionized water 4.0 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-164-15) Pipet 20.0 ml ICV1 (Ref#: 7M2-164-6) into flask. Bring up to volume with deionized water. Place solution in an acid washed Teflon bottle. Prepare as needed.	AKL	8/6/93
ICV3 solution	Place in a 200-ml volumetric flask: 150 ml of deionized water 4.0 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-164-15) Pipet 20.0 ml ICV3C (Ref# 7M2-164-5) into flask. Bring up to volume with deionized water. Place solution in an acid washed Teflon bottle. Prepare as needed.	AKL	8/5/93
SPEXAS solution	Place in a 200-ml volumetric flask: 150 ml of deionized water 4.0 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-164-15) Pipet 1.0 ml PLAS2-2X (Ref#: 7M2-160-12) into flask. Pipet 1.0 ml PLTL2-2X (Ref#: 7M2-162-13) Pipet 1.0 ml PLPB2-2X (Ref#: 7M2-164-7) into flask. Pipet 1.0 ml PLSE2-2X (Ref#: 7M2-163-4) into flask. Bring up to volume with deionized water. Place solution in an acid washed Teflon bottle. Prepare as needed.	AKL	8/4/93
Intercheck solution A (ICSA)	Place in a 200-ml volumetric flask: 150 ml of deionized water 4.0 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-164-15) Pipet 20.0 ml ICSA (Ref#: 7M2-165-4) into flask. Bring up to volume with deionized water. Place solution in an acid washed Teflon bottle.	AKL	8/10/93

Reviewed by: [signature] Date: 8-12-93

Standards/QC Preparation for ICAP

Item to be prepared	Preparation instructions	Prepared by	Date
Intercheck solution AB (ICSAB)	Place in a 200-ml volumetric flask: 20.0 ml of ICSA (Ref#: 7M2-165-4) 20.0 ml of ICSAB stock solution (Ref#: 7M2- 162-12) 4.0 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-164-15) Bring up to volume with deionized water. Place in a Teflon bottle. Prepare as needed.	AKL	8/10/93
CRI stock solution A for P1	Place in a 100-ml volumetric flask: 80 ml of deionized water 2.0 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-164-15) Pipet 2X the IDL for As, Se, Pb, and Tl into flask. Bring up to volume with deionized water. Place solution in an acid washed Teflon bottle. Prepare as needed.	AKL	7/15/93
CRI stock solution A for P2	Place in a 100-ml volumetric flask: 80 ml of deionized water 2.0 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-164-15) Pipet 2X the IDL for As, Se, Pb, and Tl into flask. Bring up to volume with deionized water. Place solution in an acid washed Teflon bottle. Prepare as needed.	AKL	7/15/93
CRI solution	Place in a 200-ml volumetric flask: 150 ml of deionized water 4.0 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-164-15) Pipet CRI stock solution A (P1 or 2) into flask.(Please see ICP solutions log) Pipet 0.20 CRDL-1 Ref#: 7M2-163-11 into flask. Bring up to volume with deionized water. Place solution in an acid washed Teflon bottle. Prepare as needed.	LJ	8/6/93
Dissolved Metals Only:			
LCS	Add 1.0 ml of LCSW solution (Ref#: N/A) to 9.0 ml of deionized water (2% HNO_3, Baker Instra-analyzed Trace Metals grade, Ref#: N/A).	N/A	N/A
Prep Blank	Use acidified water (2% HNO_3, Baker Instra-analyzed Trace Metals grade, Ref#: N/A).	N/A	N/A
Sample Spike	Add 0.1 ml of XCL-19 (Ref#: N/A) to 10.0 ml of sample.	N/A	N/A

Reviewed by: [signature] Date: 8-12-93

INORGANIC SDG 901295

03:06:16 12 Aug 1993 Folder: CV811 Protocol: HG2 Page 1

Line	Conc.	Units	SD/RSD	1	2	3	4	5

*** Standard: 1 Rep: 1 Seq: 0 03:06:16 12 Aug 1993 HG

Hg .0000 PPB -750
Ave. Int. = -750 S. D. = 0

*** Standard: 2 Rep: 1 Seq: 1 03:08:41 12 Aug 1993 HG

Hg .5000 PPB 11573
Ave. Int. = 11573 S. D. = 0

*** Standard: 3 Rep: 1 Seq: 2 03:11:07 12 Aug 1993 HG

Hg 1.000 PPB 16999
Ave. Int. = 16999 S. D. = 0

*** Standard: 4 Rep: 1 Seq: 3 03:13:34 12 Aug 1993 HG

Hg 3.000 PPB 60225
Ave. Int. = 60225 S. D. = 0

*** Standard: 5 Rep: 1 Seq: 4 03:16:15 12 Aug 1993 HG

Hg 5.000 PPB 96288
Ave. Int. = 96288 S. D. = 0

*** Standard: 6 Rep: 1 Seq: 5 03:18:57 12 Aug 1993 HG

Hg 10.00 PPB 201318
Ave. Int. = 201318 S. D. = 0

Hg Cold Vapor by LEEMAN PS 200

QC= ICV-5 (07491) T= 4.9 ug/L
8-12-93

CCV= 3.0 ug/L

Corr= 0.9995

Pages 1-12

SDG: 901295 901296

406327 768560

406246

INORGANIC SDG 901295

Protocol: HG2

Rev: 2.005 Time: 03:19:11 12 Aug 1993

Folder: CV011 Seq: 6 Print: On

User: Batch: Id: StdGRep1 Cup: Gas: 0.30 LPM

State: Idle Macro AUTOCR9 01 : F3 Print Xmit: Off Autosampler: On

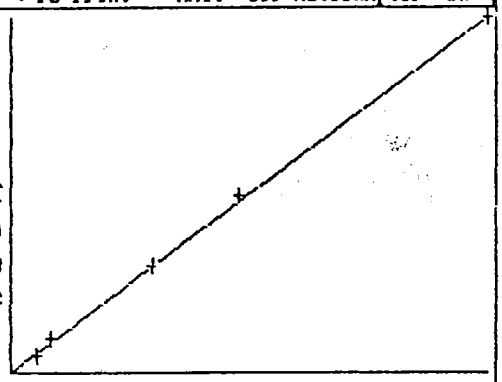
CALIBRATION: Line Calibration

Line: Hg

	Conc.	Calc.	Dev.	Accepted LiNear	
S1	.0000	.0176	.0176	Quadratic	
S2	.5000	.6302	.1302	WtdLinear	
S3	1.000	.8999	-.1001		C
S4	3.000	3.049	.0487	Accept	o
S5	5.000	4.841	-.1587		n
S6	10.00	10.06	.0624	StdAdd	c

A .0006000 r .999592

B 4.97009e-5 C 5.40716e-2



Relative Absorbance

	Mean	%RSD	
S1	-750	0	-750
S2	11573	0	11573
S3	16999	0	16999
S4	68225	0	68225
S5	96200	0	96200
S6	201318	0	201318

New cal coefficients stored

INORGANIC SDG 901295

Folder: CV811 Page 2
03:22:03 12 Aug 1993 Protocol: HG2

Line Conc. Units SD/RSD 1 2 3 4 5

*** Check Standard: 3 Ck3ICV Seq: 6 03:22:03 12 Aug 1993 HG

Line	Flag	%Rcv.	Found	True	Units	SD/RSD
Hg		118.6	5.811	4.900	PPB	.0000

*** Check Standard: 1 Ck1ICB/CCB Seq: 7 03:24:48 12 Aug 1993 HG

Line	Flag	Found	Range(+/-)	Units	SD/RSD
Hg		.0315	.2000	PPB	.0000

*** Check Standard: 4 Ck4CRA Seq: 8 03:27:11 12 Aug 1993 HG

Line	Flag	%Rcv.	Found	True	Units	SD/RSD
Hg	L	55.62	.1112	.2000	PPB	.0000

*** Check Standard: 2 Ck2CCV Seq: 9 03:29:40 12 Aug 1993 HG

Line	Flag	%Rcv.	Found	True	Units	SD/RSD
Hg		97.10	2.913	3.000	PPB	.0000

*** Check Standard: 1 Ck1ICB/CCB Seq: 10 03:32:25 12 Aug 1993 HG

Line	Flag	Found	Range(+/-)	Units	SD/RSD
Hg		.0289	.2000	PPB	.0000

*** Sample ID: 568967 Seq: 11 03:34:46 12 Aug 1993 HG

PBW 1:1

Hg	.0733	PPB	.0000	.0733

*** Sample ID: 562732 Seq: 12 03:37:06 12 Aug 1993 HG

LCSW 1:25

Hg	7.303	PPB	.0000	7.303

*** Sample ID: 562729 Seq: 13 03:39:53 12 Aug 1993 HG

DISPCOMP 1:1

Hg	-.0022	PPB	.0000	-.0022

*** Sample ID: 562731 Seq: 14 03:42:13 12 Aug 1993 HG

DISPCOMPD 1:1

Hg	.2000	PPB	.0000	.2000

*** Sample ID: 562730 Seq: 15 03:44:34 12 Aug 1993 HG

DISPCOMPS 1:25

Hg	7.542	PPB	.0000	7.542

*** Sample ID: 564242 Seq: 16 03:47:20 12 Aug 1993 HG

W.I.P. 1:1

Hg	.0098	PPB	.0000	.0098

*** Sample ID: 568968 Seq: 17 03:49:41 12 Aug 1993 HG

PBW 1:1

Hg	.0854	PPB	.0000	.0854

```
                                    Folder:   CV811                                  Page 3
03:52:02 12 Aug 1993                Protocol: HG2

Line    Conc.  Units      SD/RSD       1        2        3        4        5
-----------------------------------------------------------------------------------

*** Sample ID: 563568                    Seq:  18      03:52:02 12 Aug 1993 HG
                                 LCSW        1:25
Hg     7.276   PPB        .0000      7.276

*** Sample ID: 563565                    Seq:  19      03:54:49 12 Aug 1993 HG
                                 W01B0502    1:1
Hg    -.0056   PPB        .0000     -.0056

*** Sample ID: 563567                    Seq:  20      03:57:10 12 Aug 1993 HG
                                 W01B0502D   1:1
Hg     .0999   PPB        .0000      .0999

*** Check Standard: 2  Ck2CCV          Seq:  21      03:59:36 12 Aug 1993 HG
Line  Flag  %Rcv.    Found    True  Units       SD/RSD
Hg          102.9    3.087   3.000  PPB         .0000

*** Check Standard: 1  Ck1ICB/CCB      Seq:  22      04:02:14 12 Aug 1993 HG
Line  Flag  Found Range(+/-) Units       SD/RSD
Hg          -.0182    .2000    PPB         .0000

*** Sample ID: 563566                    Seq:  23      04:04:35 12 Aug 1993 HG
                                 W01B0502S   1:25
Hg     7.741   PPB        .0000      7.741

*** Sample ID: 563576                    Seq:  24      04:07:34 12 Aug 1993 HG
                                 W01B0703    1:1
Hg     .0363   PPB        .0000      .0363

*** Sample ID: 563618                    Seq:  25      04:09:52 12 Aug 1993 HG
                                 W01B0202    1:1
Hg     .0269   PPB        .0000      .0269

*** Sample ID: 563622                    Seq:  26      04:12:10 12 Aug 1993 HG
                                 W01B0102    1:1
Hg     .0623   PPB        .0000      .0623

*** Sample ID: 563629                    Seq:  27      04:14:28 12 Aug 1993 HG
                                 W01B031D    1:1
Hg     .0226   PPB        .0000      .0226

*** Sample ID: 563842                    Seq:  28      04:16:47 12 Aug 1993 HG
                                 W02B0201    1:1
Hg     .0618   PPB        .0000      .0618

*** Sample ID: 563849                    Seq:  29      04:19:06 12 Aug 1993 HG
                                 W01B0602    1:1
Hg     .0864   PPB        .0000      .0864
```

INORGANIC SDG 901295

Folder: CV811 Page 4
04:21:26 12 Aug 1993 Protocol: HG2

Line	Conc.	Units	SD/RSD	1	2	3	4	5

*** Sample ID: 563953 Seq: 30 04:21:26 12 Aug 1993 HG
W02B0301 1:1
Hg .0443 PPB .0000 .0443

*** Sample ID: 563960 Seq: 31 04:23:45 12 Aug 1993 HG
W02B0101 1:1
Hg .0690 PPB .0000 .0690

*** Sample ID: 563980 Seq: 32 04:26:04 12 Aug 1993 HG
W02B0401 1:1
Hg .0442 PPB .0000 .0442

*** Check Standard: 2 Ck2CCV Seq: 33 04:26:25 12 Aug 1993 HG

Line	Flag	%Rcv.	Found	True	Units	SD/RSD
Hg		103.1	3.094	3.000	PPB	.0000

*** Check Standard: 1 Ck1ICB/CCB Seq: 34 04:30:59 12 Aug 1993 HG

Line	Flag	Found	Range(+/-)	Units	SD/RSD
Hg		-.0364	.2000	PPB	.0000

*** Sample ID: 563990 Seq: 35 04:33:19 12 Aug 1993 HG
W02B0501 1:1
Hg .0356 PPB .0000 .0356

*** Sample ID: 564128 Seq: 36 04:35:38 12 Aug 1993 HG
W02B060 1:1
Hg .1047 PPB .0000 .1047

*** Sample ID: 564132 Seq: 37 04:37:56 12 Aug 1993 HG
W02B0801 1:1
Hg .0700 PPB .0000 .0700

*** Sample ID: 565745 Seq: 38 04:40:13 12 Aug 1993 HG
W.I.P. 1:1
Hg .0122 PPB .0000 .0122

*** Sample ID: 565746 Seq: 39 04:42:32 12 Aug 1993 HG
W.I.P. 1:1
Hg .0718 PPB .0000 .0718

*** Sample ID: 566277 Seq: 40 04:44:50 12 Aug 1993 HG
W.I.P. 1:1
Hg .0621 PPB .0000 .0621

*** Sample ID: 569105 Seq: 41 04:47:08 12 Aug 1993 HG
PBW 1:1
Hg .0897 PPB .0000 .0897

Folder: CV811 Page 5
04:49:26 12 Aug 1993 Protocol: HG2

Line	Conc.	Units	SD/RSD	1	2	3	4	5

*** Sample ID: 563920 Seq: 42 04:49:26 12 Aug 1993 HG
LCSW 1:1

Hg	3.029	PPB	.0000	3.029

*** Sample ID: 563917 Seq: 43 04:52:04 12 Aug 1993 HG
W02R0717 1:1

Hg	.0120	PPB	.0000	.0120

*** Sample ID: 563919 Seq: 44 04:54:22 12 Aug 1993 HG
W02R0717D 1:1

Hg	.0578	PPB	.0000	.0578

*** Check Standard: 2 Ck2CCV Seq: 45 04:56:43 12 Aug 1993 HG

Line	Flag	%Rcv.	Found	True	Units	SD/RSD
Hg		100.3	3.009	3.000	PPB	.0000

*** Check Standard: 1 Ck1ICB/CCB Seq: 46 04:59:23 12 Aug 1993 HG

Line	Flag	Found	Range(+/-)	Units	SD/RSD
Hg		.0232	.2000	PPB	.0000

*** Sample ID: 563918 Seq: 47 05:01:43 12 Aug 1993 HG
W02R0717S 1:1

Hg	1.060	PPB	.0000	1.060

*** Sample ID: 564072 Seq: 48 05:04:07 12 Aug 1993 HG
W02F0718 1:1

Hg	.0157	PPB	.0000	.0158

*** Sample ID: 565502 Seq: 49 05:06:25 12 Aug 1993 HG
L01W0201 1:1

Hg	.3469	PPB	.0000	.3469

*** Sample ID: 565505 Seq: 50 05:08:44 12 Aug 1993 HG
W07W0201 1:1

Hg	.2723	PPB	.0000	.2723

*** Sample ID: 565506 Seq: 51 05:11:02 12 Aug 1993 HG
W07W0301 1:1

Hg	.1737	PPB	.0000	.1737

*** Sample ID: 565921 Seq: 52 05:13:20 12 Aug 1993 HG
W04F0726 1:1

Hg	.1095	PPB	.0000	.1095

*** Sample ID: 565922 Seq: 53 05:15:38 12 Aug 1993 HG
L01W0301 1:1

Hg	.1472	PPB	.0000	.1472

INORGANIC SDG 901295

Folder: CV811 Page 6
05:17:56 12 Aug 1993 Protocol: HG2

Line	Conc.	Units	SD/RSD	1	2	3	4	5

*** Sample ID: 565924 Seq: 54 05:17:56 12 Aug 1993 HG
L01W0101 1:1
Hg .0739 PPB .0000 .0739

*** Sample ID: 565926 Seq: 55 05:20:14 12 Aug 1993 HG
L01W011D 1:1
Hg .1653 PPB .0000 .1653

*** Sample ID: 565927 Seq: 56 05:22:32 12 Aug 1993 HG
W04R0726 1:1
Hg .1708 PPB .0000 .1708

*** Check Standard: 2 Ck2CCV Seq: 57 05:24:53 12 Aug 1993 HG

Line	Flag	%Rcv.	Found	True	Units	SD/RSD
Hg		99.00	2.970	3.000	PPB	.0000

*** Check Standard: 1 Ck1ICB/CCB Seq: 58 05:27:28 12 Aug 1993 HG

Line	Flag	Found	Range(+/-)	Units	SD/RSD
Hg		-.0546	.2000	PPB	.0000

*** Sample ID: 565930 Seq: 59 05:29:48 12 Aug 1993 HG
W07W0401 1:1
Hg .1248 PPB .0000 .1248

*** Sample ID: 566591 Seq: 60 05:32:07 12 Aug 1993 HG
W05R0728 1:1
Hg .0791 PPB .0000 .0791

*** Sample ID: 566928 Seq: 61 05:34:26 12 Aug 1993 HG
W04W0401 1:1
Hg .0600 PPB .0000 .0600

*** Sample ID: 566929 Seq: 62 05:36:45 12 Aug 1993 HG
W04W0201 1:1
Hg .1186 PPB .0000 .1186

*** Sample ID: 566930 Seq: 63 05:39:07 12 Aug 1993 HG
W04F0301 1:1
Hg .0563 PPB .0000 .0563

*** Sample ID: 569490 Seq: 64 05:41:27 12 Aug 1993 HG
PBS 1:1
Hg .0116 PPB .0000 .0116

*** Sample ID: 564906 Seq: 65 05:43:46 12 Aug 1993 HG
LCSS 1:1 10 4/8/93
Hg 1.139 PPB .0000 1.139 20

INORGANIC SDG 901295

Folder: CVA11 Page 7
05:46:15 12 Aug 1993 Protocol: HG2

Line	Conc.	Units	SD/RSD	1	2	3	4	5

*** Sample ID: 564925 Seq: 66 05:46:15 12 Aug 1993 HG
TASSISL26 1:1
Hg .1006 PPB .0000 .1006

*** Sample ID: 564907 Seq: 67 05:48:34 12 Aug 1993 HG
TASSISL26D 1:1
Hg .0689 PPB .0000 .0689

*** Sample ID: 564906 Seq: 68 05:50:54 12 Aug 1993 HG
TASSISL26S 1:1
Hg 1.113 PPB .0000 1.113

*** Check Standard: 2 Ck2CCV Seq: 69 05:53:17 12 Aug 1993 HG

Line	Flag	%Rcv.	Found	True	Units	SD/RSD
Hg		100.8	3.025	3.000	PPB	.0000

*** Check Standard: 1 Ck1ICB/CCB Seq: 70 05:55:54 12 Aug 1993 HG

Line	Flag	Found	Range(+/-)	Units	SD/RSD
Hg		-.0029	.2000	PPB	.0000

*** Sample ID: 564905 Seq: 71 05:58:14 12 Aug 1993 HG
TASSISL15 1:1
Hg .0755 PPB .0000 .0755

*** Sample ID: 564909 Seq: 72 06:00:34 12 Aug 1993 HG
TASSISL13 1:1
Hg .0944 PPB .0000 .0944

*** Sample ID: 564910 Seq: 73 06:02:53 12 Aug 1993 HG
TASSISL12 1:1
Hg .0627 PPB .0000 .0627

*** Sample ID: 564912 Seq: 74 06:05:13 12 Aug 1993 HG
TASSISL21 1:1
Hg .1317 PPB .0000 .1317

*** Sample ID: 564913 Seq: 75 06:07:32 12 Aug 1993 HG
TASSISL17 1:1
Hg .2506 PPB .0000 .2506

*** Sample ID: 564914 Seq: 76 06:09:52 12 Aug 1993 HG
TASSISL22 1:1
Hg -.0063 PPB .0000 -.0063

*** Sample ID: 564915 Seq: 77 06:12:12 12 Aug 1993 HG
TASSISL23 1:1
Hg .0152 PPB .0000 .0152

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                                    Folder:   CV811                          Page 8
06:14:32 12 Aug 1993                Protocol: HG2

Line   Conc.  Units     SD/RSD      1        2        3        4        5
-------------------------------------------------------------------------------

*** Sample ID: 564916                    Seq:  78     06:14:32 12 Aug 1993 HG
                                TASSISL16   1:1
Hg    .0744   PPB       .0000     .0744

*** Sample ID: 564917                    Seq:  79     06:16:56 12 Aug 1993 HG
                                TASSISL03   1:1
Hg    .0125   PPB       .0000     .0125

*** Sample ID: 564918                    Seq:  80     06:19:19 12 Aug 1993 HG
                                TASSISL02   1:1
Hg    .1268   PPB       .0000     .1268

*** Check Standard: 2  Ck2CCV          Seq:  81     06:21:42 12 Aug 1993 HG
Line  Flag  %Rcv.   Found    True  Units      SD/RSD
Hg          96.59    2.898   3.000  PPB        .0000

*** Check Standard: 1  Ck1ICB/CCB      Seq:  82     06:24:16 12 Aug 1993 HG
Line  Flag  Found Range(+/-) Units      SD/RSD
Hg          .0124    .2000    PPB        .0000

*** Sample ID: 564919                    Seq:  83     06:26:37 12 Aug 1993 HG
                                TASSISL01   1:1
Hg    .0842   PPB       .0000     .0842

*** Sample ID: 564911                    Seq:  84     06:28:59 12 Aug 1993 HG
                                TASSISL20   1:1
Hg    .0328   PPB       .0000     .0328

*** Sample ID: 564920                    Seq:  85     06:31:20 12 Aug 1993 HG
                                TASSISD07   1:1
Hg   -.0155   PPB       .0000    -.0155

*** Sample ID: 564921                    Seq:  86     06:33:42 12 Aug 1993 HG
                                TASSISD03   1:1
Hg    .0122   PPB       .0000     .0122

*** Sample ID: 564922                    Seq:  87     06:36:03 12 Aug 1993 HG
                                TASSISD02   1:1
Hg    .1743   PPB       .0000     .1743

*** Sample ID: 564923                    Seq:  88     06:38:24 12 Aug 1993 HG
                                TASSISL24   1:1
Hg    .0849   PPB       .0000     .0849

*** Sample ID: 565819                    Seq:  89     06:40:46 12 Aug 1993 HG
                                TASSISD01   1:1
Hg    .1276   PPB       .0000     .1277
```

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06:43:09 12 Aug 1993 Protocol: HG2

Line	Conc.	Units	SD/RSD	1	2	3	4	5

*** Sample ID: 565820 Seq: 90 06:43:09 12 Aug 1993 HG
TASSISS02 1:1
Hg .1326 PPB .0000 .1326

*** Sample ID: 564924 Seq: 91 06:45:32 12 Aug 1993 HG
TASSISL25 1:1
Hg .0909 PPB .0000 .0909

*** Sample ID: 565490 Seq: 92 06:47:54 12 Aug 1993 HG
PBS 1:1
Hg .0958 PPB .0000 .0958

*** Check Standard: 2 Ck2CCV Seq: 93 06:50:17 12 Aug 1993 HG

Line	Flag	%Rcv.	Found	True	Units	SD/RSD
Hg		100.9	3.027	3.000	PPB	.0000

*** Check Standard: 1 Ck1ICB/CCB Seq: 94 06:52:55 12 Aug 1993 HG

Line	Flag	Found	Range(+/-)	Units	SD/RSD
Hg		.0597	.2000	PPB	.0000

*** Sample ID: 564097 Seq: 95 06:55:17 12 Aug 1993 HG
LCSS 1:10
Hg 2.132 PPB .0000 2.132

*** Sample ID: 564096 Seq: 96 06:57:46 12 Aug 1993 HG
W02B0801D 1:1
Hg .2697 PPB .0000 .2697

*** Sample ID: 564095 Seq: 97 07:00:09 12 Aug 1993 HG
W02B0801S 1:1
Hg 1.271 PPB .0000 1.271

omit sipper missed *** Sample ID: 564122 Seq: 98 07:02:32 12 Aug 1993 HG
W02B0601 1:1
Hg .1221 PPB .0000 .1221

*** Sample ID: 564094 Seq: 99 07:04:55 12 Aug 1993 HG
W02B0703 1:1
Hg .1705 PPB .0000 .1705

*** Sample ID: 564104 Seq: 100 07:07:18 12 Aug 1993 HG
W02B0701 1:1
Hg -.0142 PPB .0000 -.0142

*** Sample ID: 564111 Seq: 101 07:09:41 12 Aug 1993 HG
W02B0803 1:1
Hg .0613 PPB .0000 .0613

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07:12:05 12 Aug 1993 Protocol: HG2

Line	Conc.	Units	SD/RSD	1	2	3	4	5

*** Sample ID: 564115 Seq: 102 07:12:05 12 Aug 1993 HG
W02B0601 1:1
Hg .1578 PPB .0000 .1578

*** Sample ID: 565150 Seq: 103 07:14:29 12 Aug 1993 HG
W07B0301 1:1
Hg .1717 PPB .0000 .1717

*** Sample ID: 565151 Seq: 104 07:16:54 12 Aug 1993 HG
W07B0303 1:1
Hg .1394 PPB .0000 .1394

*** Check Standard: 2 Ck2CCV Seq: 105 07:19:17 12 Aug 1993 HG

Line	Flag	%Rcv.	Found	True	Units	SD/RSD
Hg		102.8	3.083	3.000	PPB	.0000

*** Check Standard: 1 Ck1ICB/CCB Seq: 106 07:21:49 12 Aug 1993 HG

Line	Flag	Found	Range(+/-)	Units	SD/RSD
Hg		.0355	.2000	PPB	.0000

*** Sample ID: 565152 Seq: 107 07:24:13 12 Aug 1993 HG
W07B0307 1:1
Hg .0157 PPB .0000 .0157

omit *** Sample ID: 565154 Seq: 108 07:26:37 12 Aug 1993 HG
L01B0301 1:1
Hg .2302 PPB .0000 .2303

*** Sample ID: 565158 Seq: 109 07:29:01 12 Aug 1993 HG
L01B0305 1:1
Hg -.0936 PPB .0000 -.0936

*** Sample ID: 565185 Seq: 110 07:31:25 12 Aug 1993 HG
SAND 1:1
Hg .0931 PPB .0000 .0931

*** Sample ID: 565199 Seq: 111 07:33:50 12 Aug 1993 HG
BENT 1:1
Hg .1102 PPB .0000 .1103

*** Sample ID: 566896 Seq: 112 07:36:15 12 Aug 1993 HG
L01B043D 1:1
Hg .0055 PPB .0000 .0055

*** Sample ID: 566897 Seq: 113 07:38:40 12 Aug 1993 HG
L01R0402 1:1
Hg .1937 PPB .0000 .1937

Folder: CV811 Page 11
07:41:05 12 Aug 1993 Protocol: HG2

Line	Conc.	Units	SD/RSD	1	2	3	4	5

*** Sample ID: 566899 Seq: 114 07:41:05 12 Aug 1993 HG
L01B0407 1:1

Hg	.0340	PPB	.0000	.0340

*** Check Standard: 2 Ck2CCV Seq: 115 07:43:29 12 Aug 1993 HG

Line	Flag	%Rcv.	Found	True	Units	SD/RSD
Hg		103.6	3.109	3.000	PPB	.0000

*** Check Standard: 1 Ck1ICB/CCB Seq: 116 07:46:01 12 Aug 1993 HG

Line	Flag	Found	Range(+/-)	Units	SD/RSD
Hg		-.0348	.2000	PPB	.0000

*** Check Standard: 2 Ck2CCV Seq: 117 07:58:06 12 Aug 1993 HG

Line	Flag	%Rcv.	Found	True	Units	SD/RSD
Hg		103.7	3.111	3.000	PPB	.0000

*** Check Standard: 1 Ck1ICB/CCB Seq: 118 08:00:41 12 Aug 1993 HG

Line	Flag	Found	Range(+/-)	Units	SD/RSD
Hg		-.0503	.2000	PPB	.0000

*** Sample ID: 566901 W06B0602 Seq: 119 08:03:02 12 Aug 1993 HG

Hg	.1109	PPB	.0000	.1109

*** Sample ID: 566902 L01B0403 Seq: 120 08:05:22 12 Aug 1993 HG

Hg	.0365	PPB	.0000	.0365

*** Sample ID: 566903 ~~L01B0403~~ W06B0609 ~ 8-12-93 Seq: 121 08:07:44 12 Aug 1993 HG

Hg	.0255	PPB	.0000	.0255

*** Sample ID: 566904 W06B0610 Seq: 122 08:10:06 12 Aug 1993 HG

Hg	-.0340	PPB	.0000	-.0340

*** Sample ID: 566905 W06B0605 Seq: 123 08:12:26 12 Aug 1993 HG

Hg	.0273	PPB	.0000	.0273

*** Sample ID: 564~~242~~122 8-12-93 W02B0601 Seq: 124 08:14:48 12 Aug 1993 HG

Hg	.2045	PPB	.0000	.2046

omit *** Sample ID: 564~~122~~096 8-12-93 Seq: 125 08:17:09 12 Aug 1993 HG

Hg	.2804	PPB	.0000	.2804

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Folder: CV811 Page 12
08:19:30 12 Aug 1993 Protocol: HG2

Line	Conc.	Units	SD/RSD	1	2	3	4	5

omit *** Sample ID: 564096 Seq: 126 08:19:30 12 Aug 1993 HG

Hg 1.206 PPB .0000 1.206

omit *** Sample ID: 564095 Seq: 127 08:21:56 12 Aug 1993 HG

Hg .2720 PPB .0000 .2720

*** Sample ID: 565154 L0180301 Seq: 128 08:24:17 12 Aug 1993 HG

Hg .1814 PPB .0000 .1814

*** Check Standard: 2 Ck2CCV Seq: 129 08:26:39 12 Aug 1993 HG

Line	Flag	%Rcv.	Found	True	Units	SD/RSD
Hg		102.5	3.076	3.000	PPB	.0000

*** Check Standard: 1 Ck1ICB/CCB Seq: 130 08:29:12 12 Aug 1993 HG

Line	Flag	Found	Range(+/-)	Units	SD/RSD
Hg		.0530	.2000	PPB	.0000

*** Sample ID: 562731 DISPCOMPD Seq: 131 08:31:34 12 Aug 1993 HG

Hg -.0215 PPB .0000 -.0215

*** Sample ID: 564908 Seq: 132 08:33:57 12 Aug 1993 HG
LCSS 1:10
Hg 2.308 PPB .0000 2.308

*** Sample ID: 123123 564242 MIP Seq: 133 08:36:25 12 Aug 1993 HG
SDG 901296

Hg -.0638 PPB .0000 -.0638

*** Sample ID: 123123 Seq: 134 08:38:43 12 Aug 1993 HG

Hg .0006 PPB .0000 .0006

*** Check Standard: 2 Ck2CCV Seq: 135 08:41:04 12 Aug 1993 HG

Line	Flag	%Rcv.	Found	True	Units	SD/RSD
Hg		103.1	3.092	3.000	PPB	.0000

*** Check Standard: 1 Ck1ICB/CCB Seq: 136 08:43:42 12 Aug 1993 HG

Line	Flag	Found	Range(+/-)	Units	SD/RSD
Hg		-.0133	.2000	PPB	.0000

Mercury Preparation Log

Method (circle one): CLP: 245.1/.5 (SW-846) 7470/7471 Case type: TCLP SDG ID: 901296 Procedure code: -74 Prepared by: M Wilson Date: 8-10-93

#	CCN (Lab ID)	Date Rec'd	Customer ID	Initial Wt./Vol.	Final Vol.	Description Before	Description After	pH	Dilution Factor	Standard Curve
1	563565	7-16-93	W01B0502	100ml	100ml	colorless clear	violet	6		0 ml 100 ppb Hg to 100 ml
2	563576	7-16-93	W01B0703							0.5 ml 100 ppb Hg to 100 ml
3	563618	7-15-93	W01B0202							1.0 ml 100 ppb Hg to 100 ml
4	563622	↓	W01B0102							3.0 ml 100 ppb Hg to 100 ml
5	563629	7-15-93	W01B0310							5.0 ml 100 ppb Hg to 100 ml
6	563842	7-17-93	W02B0201							10.0 ml 100 ppb Hg to 100 ml
7	563849	7-17-93	W01B0602					↓		The standards listed above were prepared in the same manner and at the same time as the associated samples.
8	563953	7-19-93	W02B0201					6		MW 8-10-93
9	563960	↓	W02B0101					7		
10	563980	↓	W02B0401					↓		
11	563990	7-19-93	W02B0501					7		
12	564128	7-20-93	W02B0160					6		
13	564132	7-20-93	W02B0801					6		
14	564242	7-21-93	W.I.P.					5		
15	565745	7-27-93	W.I.P.					5		MW 8-10-93
16	565746	7-27-93	W.I.P.	↓	↓	↓	↓	3		
17	566277	7-29-93	W.I.P.	100ml	100ml	colorless clear	violet	5		
18										
19			MW	8-10-93						
20										
21	563566		Sample spike	100ml	100ml	Ref CCN: (563565)				
22	563567	MW 8-10-93	Duplicate spike	↓	↓	Ref CCN: (563565)				
23	563568		Lab ctrl. sample			Reviewed by/date: Diana E. Nixon 8/10/93				
24	568968		Prep. blank	100 ml	100ml					

QC (SS): See page 1PPP 1 19
Ref#:
QC (LCS):
Ref#:

Mercury Preparation Log

Method (circle one): (CLP: 245.1/.5) SW-846: 7470/7471 Case type: Platinum SDG ID: 406246 Procedure code: -74 Prepared by: R. Hatcher Date: 8/10/93

#	CCN (Lab ID)	Date Rec'd	Customer ID	Initial Wt./Vol.	Final Vol.	Description Before	Description After	pH	Dilution Factor	Standard Curve
1	563917	7/19/93	W02R0717	100ml	100ml	Colorless clear	violet	2		0 ml 100 ppb Hg to 100 ml
2	564072	7/20/93	W02F0718			Brown cloudy				0.5 ml 100 ppb Hg to 100 ml
3	565502	7/24/93	L01W0201							1.0 ml 100 ppb Hg to 100 ml
4	565505		W07W0201							3.0 ml 100 ppb Hg to 100 ml
5	565506	7/24/93	W07W0301			Brown cloudy				5.0 ml 100 ppb Hg to 100 ml
6	565921	7/27/93	W04F0726			Colorless clear				10.0 ml 100 ppb Hg to 100 ml
7	565922		L01W0301			Brown cloudy				The standards listed above were prepared in the same manner and at the same time as the associated samples.
8	565924		L01W0101							
9	565926		L01W011D			Brown cloudy				
10	565927		W04R0726			Colorless clear				
11	565930	7/27/93	W07W0401			Brown cloudy				
12	566591	7/29/93	W06R0728			Colorless clear				
13	566928	7/30/93	W04W0401			Brown cloudy				
14	566929		W04W0201							
15	566930	7/30/93	W04W0301	100ml	100ml	Brown clear	violet	RH 8/10/93 ~~RH~~ 2		
16										
17										
18				RH 8/10/93						
19										
20										
21	563918		Sample spike	100ml	100ml	Ref CCN: (563917)				QC (SS): 1.0ml 100ppb HG → 100ml
22	563919	RH 8/10/93	Duplicate spike			Ref CCN: (563917)				Ref#: 7M2-156-10
23	563920		Lab ctrl. sample			Reviewed by/date: 8/11/93				QC (LCS): 3.0ml 100ppb HG → 100ml
24	569105		Prep. blank	100ml	100ml	Laura E. Nixon				Ref#: 7M2-156-10

INORGANIC SDG 901295

COMPUCHEM LABS LOGBOOK 1F 13

Mercury Preparation Log

Method (circle one): CLP: 245.1/.5 SW-846: 7470/7471 Case type: platinum SDG ID: 758560 Procedure code: -162 Prepared by: [illegible] Date: 8-11-93

#	CCN (Lab ID)	Date Rec'd	Customer ID	Initial Wt./Vol.	Final Vol.	Description Before	Description After	pH	Dilution Factor	Standard Curve
1	564925	7-23-93	TASSISL26	0.20g	100ml	brown med	violet	N/A	N/A	0 ml 100 ppb Hg to 100 ml
2	564905		TASSISL15							0.5 ml 100 ppb Hg to 100 ml
3	564909		TASSISL13							1.0 ml 100 ppb Hg to 100 ml
4	564910		TASSISL12							3.0 ml 100 ppb Hg to 100 ml
5	564911		TASSISL20							5.0 ml 100 ppb Hg to 100 ml
6	564912		TASSISL21			black				10.0 ml 100 ppb Hg to 100 ml
7	564913		TASSISL27 1 [illegible]			brown				The standards listed above were prepared in the same manner and at the same time as the associated samples.
8	564914		TASSISL22							
9	564915		TASSISL23			black				
10	564916		TASSISL16			brown				[illegible] 8-11-93
11	564917		TASSISL03			black				
12	564918		TASSISL02			brown				
13	564919		TASSISL01							
14	564920		TASSISD07			black				
15	564921		TASSISD03							
16	564922		TASSISD02			brown				
17	564923		TASSISL24							
18	564924		TASSISL25							
19	565819	7-25-93	TASSISD01							
20	565820	7-25-93	TASSISS02							
21	564906		Sample spike			Ref CCN: (564925)				
22	564907	[illegible] 8-11-93	Duplicate spike			Ref CCN: (564925)				
23	564908		Lab ctrl. sample			Reviewed by/date: 8/11/93				
24	564910		Prep. blank	0.20g	[illegible] ml	[illegible]				

QC (SS): 1.0 ml 100ppb Hg → 100 ml
Ref#: 7M2-156-10
QC (LCS): 0.2g Solid Hg → 100 ml
Ref#: 7M2.165-6

COMPUCHEM LABS LOGBOOK 1F 13

Mercury Preparation Log

Method (circle one): CLP: 245.1/.5 SW-846: 7470/7471 Case type: Platinum SDG ID: 406327 Procedure code: -162 Prepared by: [illegible] Date: 8-11-93

#	CCN (Lab ID)	Date Rec'd	Customer ID	Initial Wt./Vol.	Final Vol.	Description Before	Description After	pH	Dilution Factor	Standard Curve
1	564122	7-20-93	W02B0601 ~~TABSIS002~~	0.20g	100ml	brown med	violet	N/A	N/A	0 ml 100 ppb Hg to 100 ml
2	564094		W02B0703							0.5 ml 100 ppb Hg to 100 ml
3	564104		W02B0701							1.0 ml 100 ppb Hg to 100 ml
4	564111		W02B0803							3.0 ml 100 ppb Hg to 100 ml
5	564115		W02B0601							5.0 ml 100 ppb Hg to 100 ml
6	565150	7-23-93	W07B0301			black				10.0 ml 100 ppb Hg to 100 ml
7	565151		W07B0303			brown				The standards listed above were prepared in the same manner and at the same time as the associated samples.
8	565152		W07B0307							
9	565154		L01B0301							
10	565158		L01B0305							
11	565185		SAND							
12	565199		BENT			grey				
13	566896	7-30-93	L01B0430			black				
14	566897		L01B0402			brown				
15	566899		L01B0407							
16	566901		W06B0602			black				
17	566902		L01B0403							
18	566903		W06B0609			brown				
19	566904		W06B0610			brown				
20	566905	7-30-93	W06B0605							
21	564095		Sample spike							
22	564096		Duplicate spike							
23	564097	8-31-93	Lab ctrl. sample							
1	565490		Prep. blank	0.20g	100ml					

Ref CCN: (564122)

Ref CCN: (564122)

Reviewed by/date: [signature] 8/11/93

QC (SS): 1.0 ml 100 ppb Hg → 100 ml

Ref#: 7M2-156-10

QC (LCS): 0.2g solid LCS → 100 ml

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Starting Date: 08-12-1993

Time	Sam. Type	Lab ID----	Client ID----------		Dil.---	Conc/Abs	%R----	Status Flags
0306	STB	Std1Rep1			1			
0308	STD	Std2Rep1			1			
0311	STD	Std3Rep1			1			
0313	STD	Std4Rep1			1			
0316	STD	Std5Rep1			1			
0318	STD	Std6Rep1			1			
0322	ICV	Ck3ICV			1	5.811	118.59	
0324	ICB	Ck1ICB/CCB			1	.0315		
0327	CRA	Ck4CRA			1	.1112	55.60	
0329	CCV	Ck2CCV			1	2.913	97.10	
0332	CCB	Ck1ICB/CCB			1	.0289		
0334	SAM	568967	PBW	1:1	1	.0733		
0337	SAM	562732	LCSW	1:25	1	7.303		R
		Comment: INSERT not used						
0339	SAM	562729	DISPCOMP	1:1	1	-.0023		
0342	SAM	562731	DISPCOMPD	1:1	1	.2000		
0344	SAM	562730	DISPCOMPS	1:25	1	7.542		
0347	SAM	564242	W.I.P.	1:1	1	.0098		
0349	SAM	568968	PBW	1:1	1	.0854		
0352	SAM	563568	LCSW	1:25	1	7.276		R
		Comment: INSERT not used						
0354	SAM	563565	W01B0502	1:1	1	-.0056		
0357	SAM	563567	W01B0502D	1:1	1	.0999		
0359	CCV	Ck2CCV			1	3.087	102.90	
0402	CCB	Ck1ICB/CCB			1	-.0182		
0404	SAM	563566	W01B0502S	1:25	1	7.741		
0407	SAM	563576	W01B0703	1:1	1	.0363		
0409	SAM	563618	W01B0202	1:1	1	.0289		
0412	SAM	563622	W01B0102	1:1	1	.0623		
0414	SAM	563629	W01B0310	1:1	1	.0226		
0416	SAM	563842	W02B0201	1:1	1	.0618		
0419	SAM	563849	W01B0602	1:1	1	.0864		
0421	SAM	563953	W02B0301	1:1	1	.0443		
0423	SAM	563960	W02B0101	1:1	1	.0690		
0426	SAM	563980	W02B0401	1:1	1	.0442		
0428	CCV	Ck2CCV			1	3.094	103.13	
0430	CCB	Ck1ICB/CCB			1	-.0365		
0433	SAM	563990	W02B0501	1:1	1	.0356		
0435	SAM	564128	W02B060	1:1	1	.1047		
0437	SAM	564132	W02B0901	1:1	1	.0700		
0440	SAM	565745	W.I.P.	1:1	1	.0122		
0442	SAM	565746	W.I.P.	1:1	1	.0718		
0444	SAM	566277	W.I.P.	1:1	1	.0621		
0447	SAM	569105	PBW	1:1	1	.0897		
0449	SAM	563920	LCSW	1:1	1	3.029		R
		Comment: INSERT not used						
0452	SAM	563917	W02R0717	1:1	1	.0120		
0454	SAM	563919	W02R07170	1:1	1	.0578		
0456	CCV	Ck2CCV			1	3.009	100.30	
0459	CCB	Ck1ICB/CCB			1	.0232		
0501	SAM	563918	W02R0717S	1:1	1	1.080		
0504	SAM	564072	W02F0718	1:1	1	.0158		
0506	SAM	565502	I01W0201	1:1	1	.3469		

Mercury Analysis Report for File CV811.PRN Page 0

Starting Date: 08-12-1993

Time	Sam. Type	Lab ID----	Client ID----------		Dil.---	Conc/Abs	%R----	Status Flags
0508	SAM	565505	W07W0201	1:1	1	.2723		
0511	SAM	565506	W07W0301	1:1	1	.1737		
0513	SAM	565921	W04F0726	1:1	1	.1095		
0515	SAM	565922	L01W0301	1:1	1	.1472		
0517	SAM	565924	L01W0101	1:1	1	.0739		
0520	SAM	565926	L01W0110	1:1	1	.1653		
0522	SAM	565927	W04R0726	1:1	1	.1708		
0524	CCV	Ck2CCV			1	2.970	99.00	
0527	CCB	Ck1ICB/CCB			1	-.0546		
0529	SAM	565930	W07W0401	1:1	1	.1248		
0532	SAM	566591	W05R0728	1:1	1	.0791		
0534	SAM	566928	W04W0401	1:1	1	.0600		
0536	SAM	566929	W04W0201	1:1	1	.1186		
0539	SAM	566930	W04E0301	1:1	1	.0563		
0541	SAM	569490	PBS	1:1	1	.0116		
0543	LCSS	564908	LCS287		1	1.139		L
0546	SAM	564925	TASSISL26	1:1	1	.1006		
0548	SAM	564907	TASSISL260	1:1	1	.0689		
0550	SAM	564906	TASSISL26S	1:1	1	1.113		
0553	CCV	Ck2CCV			1	3.025	100.83	
0555	CCB	Ck1ICB/CCB			1	-.0029		
0558	SAM	564905	TASSISL15	1:1	1	.0755		
0600	SAM	564909	TASSISL13	1:1	1	.0944		
0602	SAM	564910	TASSISL12	1:1	1	.0627		
0605	SAM	564912	TASSISL21	1:1	1	.1317		
0607	SAM	564913	TASSISL17	1:1	1	.2506		
0609	SAM	564914	TASSISL22	1:1	1	-.0063		
0612	SAM	564915	TASSISL23	1:1	1	.0152		
0614	SAM	564916	TASSISL16	1:1	1	.0744		
0616	SAM	564917	TASSISL03	1:1	1	.0125		
0619	SAM	564918	TASSISL02	1:1	1	.1268		
0621	CCV	Ck2CCV			1	2.898	96.60	
0624	CCB	Ck1ICB/CCB			1	.0124		
0626	SAM	564919	TASSISL01	1:1	1	.0842		
0628	SAM	564911	TASSISL20	1:1	1	.0328		
0631	SAM	564920	TASSISD07	1:1	1	-.0155		
0633	SAM	564921	TASSISD03	1:1	1	.0122		
0636	SAM	564922	TASSISD02	1:1	1	.1743		
0638	SAM	564923	TASSISL24	1:1	1	.0849		
0640	SAM	565819	TASSISD01	1:1	1	.1277		
0643	SAM	565820	TASSISS02	1:1	1	.1326		
0645	SAM	564924	TASSISL25	1:1	1	.0909		
0647	SAM	565490	PBS	1:1	1	.0958		
0650	CCV	Ck2CCV			1	3.027	100.90	
0652	CCB	Ck1ICB/CCB			1	.0597		
0655	LCSS	564097	LCS287		1	2.132		L
0657	SAM	564096	W02B0801D	1:1	1	.2697		
0700	SAM	564095	W02B0801S	1:1	1	1.271		
0702	SAM	564122	W02B0601	1:1	1	.1221		
0704	SAM	564094	W02B0703	1:1	1	.1705		
0707	SAM	564104	W02B0701	1:1	1	-.0142		
0709	SAM	564111	W02B0603	1:1	1	.0613		
0712	SAM	564115	W02B0601	1:1	1	.1578		

Mercury Analysis Report for File CV811.PRN Page 0

Starting Date: 08-12-1993

Time	Sam. Type	Lab ID----	Client ID----------		Dil.---	Conc/Abs	%R----	Status Flags
0714	SAM	565150	W07B0301	1:1	1	.1717		
0716	SAM	565151	W07B0303	1:1	1	.1394		
0719	CCV	Ck2CCV			1	3.083	102.77	
0721	CCB	Ck1ICB/CCB			1	.0355		
0724	SAM	565152	W07B0307	1:1	1	.0157		
0726	SAM	565154	L01B0301	1:1	1	.2303		R
		Comment: INSERT not used						
0729	SAM	565158	L01B0305	1:1	1	-.0936		
0731	SAM	565185	SAND	1:1	1	.0931		
0733	SAM	565199	BENT	1:1	1	.1103		
0736	SAM	566896	L01B043D	1:1	1	.0055		
0738	SAM	566897	L01R0402	1:1	1	.1937		
0741	SAM	566899	L01B0407	1:1	1	.0340		
0743	CCV	Ck2CCV			1	3.109	103.63	
0746	CCB	Ck1ICB/CCB			1	-.0348		
0758	CCV	Ck2CCV			1	3.111	103.70	
0800	CCB	Ck1ICB/CCB			1	-.0503		
0803	SAM	566901			1	.1109		
0805	SAM	566902			1	.0385		
0807	SAM	566903			1	.0255		
0810	SAM	566904			1	-.0340		
0812	SAM	566905			1	.0273		
0814	SAM	564242	W.I.P.	1:1	1	.2046		
0817	SAM	564122	W02B0601	1:1	1	.2804		
0819	SAM	564096	W02B0801D	1:1	1	1.206		R
		Comment: INSERT not used						
0821	SAM	564095	W02B0801S	1:1	1	.2720		R
		Comment: INSERT not used						
0824	SAM	565154	L01B0301	1:1	1	.1814		
0826	CCV	Ck2CCV			1	3.076	102.53	
0829	CCB	Ck1ICB/CCB			1	.0530		
0831	SAM	562731	DISPCOMPO	1:1	1	-.0215		
0833	SAM	564908	LCSS	1:10	1	2.308		
0836	SAM	$564242	W.I.P.	1:1	1	-.0638		
0838	SAM	123123			1	.0006		
0841	CCV	Ck2CCV			1	3.092	103.07	
0843	CCB	Ck1ICB/CCB			1	-.0133		
0847	CCV	Ck2CCV			1	3.049	101.63	
0849	CCB	Ck1ICB/CCB			1	.0602		
0851	SAM	564908	LCSS	1:10	1	1.204		@
0854	SAM	123123			1	11.10	)	@
0858	SAM	123123			1	.1244		@
0900	CCV	Ck2CCV			1	2.891	96.37	@
0903	CCB	Ck1ICB/CCB			1	-.0204		@

Status Codes:

B = Blank Failure
L = LCS Failure
O = Order of Samples Wrong
Q = ICV/CCV Failure
R = Rejected by Analyst
T = 2 Hr. CCV Time Exceeded
U = Times Between Samples and CCV Are Not Uniform

* = Sample Not Considered in Run
@ = Sample After Specified End of Run
) = Result Exceeds Linear Range
% = 10% Rule Violation
^ = Preceding QC Failed or not present
v = Following QC Failed of Not Present

Automated Mercury Runlog

Methods:
SW-846 (CLP)

901296
901295

Page 1 of 3 Date: 8-12-93

Operator: [illegible]
Case Name 406327 758560 406246
Filename CV811

No.	Sample ID	Comments	Time	No.	Sample ID	Comments	Time
	ICV			1	563990		
	ICB CRA = ICV/ICB			2	564128		
1	568967	PBW		3	564132		
2	562732	LCSW 1:36		4	565745		
3	562729			5	565746		
4	562731	DUP		6	566277		
5	562730	SPK 1:25		7	569105	PBW	
6	564242			8	563920	LCSW	
7	568968	PBW		9	563917		
8	563568	LCSW		10	563919	DUP	
9	563565				CCV		
10	563567	DUP			CCB		
	CCV			1	563918	SPK	
	CCB			2	569072		
1	563566	SPK 1:25		3	565502		
2	563576			4	565505		
3	563618			5	565506		
4	563622			6	565921		
5	563629			7	565922		
6	563842			8	565924		
7	563849			9	565926		
8	563953			10	565927		
9	563960				CCV		
10	563980				CCB		
	CCV				N/A		
	CCB				N/A		

# Injects		#Pst. Dig. Spk.	
# Samples		Calib. QC	
# Dilutions		QC Samples	
Inst. Hours			

qa 8-12-93

Reviewed By: [signature] Date: 8/12/93

Automated Mercury Runlog

Methods:
SW-846 (CLP)

Page 2 of 3 Date: 8-12-93

Operator: [illegible]
Case Name SAME
Filename ↓

No.	Sample ID	Comments	Time	No.	Sample ID	Comments	Time
	ICV			1	~~564918~~	564919	
	ICB 8-12-93			2	565507	564911	
1	565930			3	565505	564920	
2	566591			4	565506	564921	
3	566928			5	565921	564922	
4	566929			6	565922	564923	
5	566930			7	565924	565819	
6	569490	PBS		8	565926	565820	
7	564908	LCSS 1:20		9	565927	564924	
8	564925			10	8-12-93	565490	
9	564907	DUP			CCV		
10	564906	SPK			CCB		
	CCV			1	564907	LCSS 1:10	
	CCB			2	~~564906~~ D96	8-11-93	
1	564905			3	~~564905~~ D95		
2	564909			4	564122		
3	564910			5	564094		
4	564912			6	564104		
5	564913			7	564111		
6	564914			8	564115		
7	564915			9	565150		
8	564916			10	565151		
9	564917				CCV		
10	564918 8-12-93				CCB		
	CCV				N/A		
	CCB				N/A		

# Injects		#Pst. Dig. Spk.	8-12-93
# Samples		Calib. QC	
# Dilutions		QC Samples	
Inst. Hours			

Reviewed By: [signature] Date: 8/12/93

Automated Mercury Runlog

Methods:
SW-846 (CLP)

Page 3 of 3 Date: 8-12-93

Operator: [illegible]
Case Name SAME
Filename ↓

No.	Sample ID	Comments	Time	No.	Sample ID	Comments	Time
	ICV			1	562781		
	ICB 8-12-93			2	564908 1:10	ECSS	
1	565152			3	564242		
2	565154	omit		4	123123		
3	565158			5			
4	565185			6			
5	565199			7			
6	566896			8			
7	566897			9			
8	566899			10	8-12-93		
9	CCV				CCV		
10	CCB				CCB		
	CCV			1			
	CCB			2			
1	566901			3			
2	566902			4			
3	566903			5			
4	566904			6			
5	566905			7			
6	564122			8			
7	564096	omit N/A		9	8-12-93		
8	564095	omit		10			
9	123123				CCV		
10	565154				CCB		
	CCV						
	CCB						

# Injects		#Pst. Dig. Spk.	8-12-93
# Samples		Calib. QC	
# Dilutions		QC Samples	
Inst. Hours			

Reviewed By: [signature] Date: 8/12/93

Standards/QC Preparation for Cold Vapor Mercury

Item to be prepared	Preparation instructions	Prepared by	Date
Hg stock solution (10 ppm)	Place in a 100-ml volumetric flask: 1.0 ml of Hg *PLHG4-2X (Ref#: 7M2-156-10) 5.0 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-169-15) Dilute to 100 ml with deionized water. Prepare as needed.	CR	7-28-93
Hg standard solution (100 ppb)	Place in a 100-ml volumetric flask: 1.0 ml of Hg stock solution (10 ppm) 5.0 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-165-7) Dilute to 100 ml with deionized water. Prepare as needed.	CR	8-5-93
5% potassium permanganate solution	Place into a 1000-ml Erlenmeyer flask: 50.0 g of $KMnO_4$ (Baker Analyzed, Ref#: 7M2-159-16) Dilute to 1000 ml with deionized water. Transfer to a 2500-ml amber bottle. Prepare as needed.	CR	8-5-93
5% potassium persulfate solution	Place into a 1000-ml Erlenmeyer flask: 50.0 g of $K_2S_2O_8$ (Baker Analyzed, Ref#: 7M2-156-17) Dilute to 1000 ml with deionized water. Transfer to a 1250-ml amber bottle. Prepare as needed.	CR	8-15-93
Hydroxylamine hydrochloride	Place into a 1000-ml volumetric flask: 240.0 g of NH_2OH-HCl (baker Analyzed, Ref#: 7M2-165-5) Dilute to 1000 ml with deionized water. Place solution in a bottle. Prepare as needed. (This can be prepared at 500 ml using 120.0 g of NH_2OH-HCl.)	AKL	8-11-93
Stannous chloride	**Automated:** Place into a 250-ml flaeker: 12.5 g of $SnCl_2$-$2H_2O$ (Baker Analyzed, Ref#: 7M2-160-9) 62.5 ml of HCl (Baker Analyzed, Ref#: 7M2-165-9) Dilute to 250 ml with deionized water. Prepare as needed.	AKL	8-10-93
	Manual: Place into a 250-ml flaeker: 50.0 g of $SnCl_2$-$2H_2O$ (Baker Analyzed, Ref#: N/A) 50.0 ml of HCl (Baker Analyzed, Ref#: N/A) Dilute to 500 ml with deionized water. Prepare as needed.	N/A	N/A

*SPEX concentration: 1000 ppm

Reviewed by: Judy C. Dan Date: 8/12/93

Standards/QC Preparation for Cold Vapor Mercury

Item to be prepared	Preparation instructions	Prepared by	Date
Standard (0, 0.5, 1.0, 3.0, 5.0, 10.0)	Pipet into 250-ml fleakers: 0, 0.5, 1.0, 3.0, 5.0, and 10.0 ml of Hg standard solution Dilute each fleaker to 100 ml with deionized water. 5.0 ml of H_2SO_4 (Baker Analyzed, Ref#: 7M2-155-12) 2.5 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-164-19 15 ml of $KMnO_4$ solution and 8 ml of $K_2S_2O_8$ solution. All standards are digested with samples and recorded on the appropriate logs submitted with this data. Prepare with each batch of samples.	LZ	8-11
LCS (Water)	Prepare 250-ml volumetric fleaker: 3.0 ml of Hg standard solution (100 ppb) 100 ml of deionized water 5.0 ml of H_2SO_4 (Ref#: 7M2-155-12) 2.5 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-165-17) 15 ml of $KMnO_4$ solution 8 ml of $K_2S_2O_8$ solution Prepare with each batch of samples.	SEE prep page	8-12-93
LCS (Soil)	Place in a 250-ml fleaker: 0.2 g of EPA Reference Material Solid LCS (0287) (Ref#: 7M2-160-13) 5.0 ml of H_2SO_4 (Ref#: 7M2-155-12) 2.5 ml of concentrated HNO_3 (Baker Instra-analyzed Trace Metals grade, Ref#: 7M2-165-7) 15 ml of $KMnO_4$ solution 8 ml of $K_2S_2O_8$ solution Add 50 ml of deionized water. Prepare with each batch of samples.	SEE prep page	8-12-93
Sample Spike (Water)	Place into a 250-ml fleaker: 1.0 ml of Hg standard solution (100 ppb) 100 ml of sample 5.0 ml of H_2SO_4 (Ref#: 7M2-155-12) 2.5 ml of concentrated HNO_3 (Ref#: 7M2-165-7) 15 ml of $KMnO_4$ solution 8 ml of $K_2S_2O_8$ solution. Prepare with each batch of samples.	SEE prep page	8-12-93

Reviewed by: Judy Gilbert Date: 8/12/93

Standards/QC Preparation for Cold Vapor Mercury

Item to be prepared	Preparation instructions	Prepared by	Date
Sample Spike (Soil)	Place into a 250-ml fleaker: 1.0 ml of Hg standard solution (100 ppb) 0.2 g of sample 5.0 ml of H_2SO_4 (Ref#: 7M2-155-12) 2.5 ml of concentrated HNO_3 (Ref#: 7M2-165-7) 15 ml of $KMnO_4$ solution 8 ml of $K_2S_2O_8$ solution. Add 50 ml of deionized water. Prepare with each batch of samples.	N/A See prep page	N/A SO 8-12-93
ICV-5 Solution	Place in a 100-ml volumetric flask: 50 ml of deionized water 2.0 ml of concentrated HNO_3 (Baker instra-analyzed trace metals grade, Ref#: 7M2-164-15) Pipet 1.0 ml of ICV-5 (Ref#: 7M2-161-11) into flask. Bring up to volume with deionized water.	CR	7-21-93
CRA Solution	Place in a 100-ml volumetric flask: 50 ml of deionized water 2.0 ml of concentrated HNO_3 (Baker instra-analyzed trace metals grade Ref#: 7M2-164-15) Pipet 0.2 ml of Hg standard solution (100 ppb) into flask. Bring up to volume with deionized water.	LJ	8-12-93

Reviewed by: Judy C Dow Date: 8/12/93

Standards/QC Preparation for Cold Vapor Mercury

Item to be prepared	Preparation instructions	Prepared by	Date
Sample Spike (Soil)	Place into a 250-ml fleaker: 1.0 ml of Hg standard solution (100 ppb) 0.2 g of sample 5.0 ml of H_2SO_4 (Ref#: 7M2-155-12) 2.5 ml of concentrated HNO_3 (Ref#: 7M2-165-7) 15 ml of $KMnO_4$ solution 8 ml of $K_2S_2O_8$ solution. Add 50 ml of deionized water. Prepare with each batch of samples.	N/A See prep page	N/A SO 8-12-93
ICV-5 Solution	Place in a 100-ml volumetric flask: 50 ml of deionized water 2.0 ml of concentrated HNO_3 (Baker instra-analyzed trace metals grade, Ref#: 7M2-164-15) Pipet 1.0 ml of ICV-5 (Ref#: 7M2-161-11) into flask. Bring up to volume with deionized water.	CR	7-21-93
CRA Solution	Place in a 100-ml volumetric flask: 50 ml of deionized water 2.0 ml of concentrated HNO_3 (Baker instra-analyzed trace metals grade Ref#: 7M2-164-15) Pipet 0.2 ml of Hg standard solution (100 ppb) into flask. Bring up to volume with deionized water.	LJ	8-12-93

Reviewed by: Judy C. Dow Date: 8/12/93

INORGANIC SDG 901295

COMPUCHEM LDRS LOGBOOK ID 14

Method (circle one): CLP SW-846 3005 (dissolved) 3050 Case type: [illegible]

#	CCN (Lab ID)	Date Rec'd	Customer ID	Initial Plasma (wt/vol)	Final Plasma (vol)	Initial Furnace (wt/vol)	Final Furnace (vol)	Description Before	Description After	pH	Dilution Factor
1	562729	7-14-93	DISPCOMP	100ml	100ml			colorless clear	colorless clear	5	
2	564242		W.I.P.	100ml	100ml		8-10-93	colorless clear	colorless clear	5	
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21	Sample spike: 562730			100ml	100ml			Ref CCN: (562729)			
22	Duplicate spike: 562731			↓	↓			Ref CCN: (564242)			
23	Lab ctrl. sample 562732							Reviewed by/date: 8/10/93			
24	Prep. blank: 568967			100ml	100ml						

QC F Ref#: NA

QC F Ref#:

QC P Ref#: SS See pg. 19

QC P Ref#: LCS 1 PPP 1

8-10-93

8-10-93

8/10/93

Laura E. Nixon

1944

INORGANIC SDG 901295

COMPUCHEM LABS LOGBOOK 1F 13

Mercury Preparation Log

Method (circle one): CLP: 245.1/.5/SW-846: 7470/7471 Case type: TCLP SDG ID: 901295 Procedure code: -74 Prepared by: mwilson Date: 8-10-93

#	CCN (Lab ID)	Date Rec'd	Customer ID	Initial Wt./Vol.	Final Vol.	Description Before	Description After	pH	Dilution Factor	Standard Curve
1	562729	7-14-93	DISPCOMP	100ml	100ml	colorless clear	violet	5		0 ml 100 ppb Hg to 100 ml
2	564242	7-21-93	W.I.P.	100ml	100ml	colorless clear	violet	5		0.5 ml 100 ppb Hg to 100 ml
3										1.0 ml 100 ppb Hg to 100 ml
4										3.0 ml 100 ppb Hg to 100 ml
5										5.0 ml 100 ppb Hg to 100 ml
6										10.0 ml 100 ppb Hg to 100 ml
7										The standards listed above were prepared in the same manner and at the same time as the associated samples.
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21	562730		Sample spike	100ml	100ml	Ref CCN: (562729)				
22	562731		Duplicate spike	↓	↓	Ref CCN: (562729)				
23	562732		Lab ctrl. sample			Reviewed by/date: Diana E. Nixon 8/10/93				
24	568967		Prep. blank	100ml	100ml					

mw 8-10-93

mw 8-10-93

LMW 8-10-93

QC (SS): Ref#: See page 1 PPP 1, 19

QC (LCS): Ref#:

COMPUCHEM LABORATORIES, INC.

ASSIGNED TO: Mary Sweatt

DATE EXTRACTED 7/21/93

TCLP WASTE CHARACTERIZATION LEACHATE

EMPLOYEE ID: 2024

-814

QUEUE # 54

	COMPU-CHEM SAMPLE NUMBER	CASE #	CLIENT #	PRE-TEST pH VALUE START	PRE-TEST pH VALUE FINAL	EXTRACT. FLUID 1	EXTRACT. FLUID 2	PARTICLE REDUCT. DONE (Y/N)	SAMPLE WEIGHT (g)	FINAL LEACH. pH VALUE	FINAL VOLUME (ml)	DATE FILTERED	COMMENTS
1	562729	27539	DISPCOMP	6.90	1.88	✓		N	100	5.35	1750	7-22-93	
2	563616	27400	W01B0202	7.40	1.99	✓		N	100	6.27	1725	7-22-93	PPS 0004
3	563616DUP			7.40	1.99	✓		N	100	6.27	1400	7-22-93	
4	563620		W01B0102	7.22	1.97	✓		N	100	6.40	1700	7-22-93	
5	563620DUP			7.22	1.97	✓		N	100	6.40	1625	7-22-93	
6	563624		W01B031D	6.90	1.87	✓		N	100	6.42	1700	7-22-93	
7	563624DUP			6.90	1.87	✓		N	100	6.42	1625	7-22-93	
8	563557		W01B0502	6.65	1.89	✓		N	100	6.32	1650	7-22-93	
9	563557DUP			6.65	1.89	✓		N	100	6.32	1575	7-22-93	
10	563574		W01B0703	6.41	1.87	✓		N	100	6.47	1625	7-22-93	
11	563574DUP			6.41	1.87	✓		N	100	6.47	1550	7-22-93	
12								MAS 7-21-93					
13													
14	564241	BLANK		4.89	4.89	✓		—	2000ml	4.89	2000	7-22-93	
15	564242	BLANK		4.89	4.89	✓		—	2000ml	4.89	2000	7-22-93	

MANUAL COUNTER 468/ 1518

FINAL VOL. VERIFIED: M Sweatt

REVIEWED BY:

RECEIVED BY:

ROTATION TIME ONLY

DATE / TIME STARTED 7-21-93, 8:15AM

DATE / TIME COMPLETED 7-22-93, 12:15AM

7/26

INORGANIC SDG 901295

INORGANICS WORKLIST

PAGE 1

LEACHATE METALS PR

08/04/1993

QUEUE 148 PROCEDURE -74 LOGPAGE 9010295 EXP DATE 7/27/93

TIME 01:34

QC CCMs 562730 562731 562732
SS D BS

	CCM	ID	SAMPLING	TYPE	RECDATE	TAT	MA	DUE	SDG	LAB INSTRUCTIONS
1	562729	DISPCOMP	07/12	PR	7/14/93	35	SO	08/18	27539	METHOD 418.1

SUBTOTAL OF CCMs FOR LOGKEY 9010295 : 1

Standards/QC Preparation for TCLP

METALS

Laboratory Control Sample	Sample Spike
Place in a 100-ml volumetric flask:	Place in a 100-ml volumetric flask:
0.1 ml of PLCD2-2X (ref#: 7m2-160-1)	0.1 ml of PLCD2-2X (ref#: 7m2-160-1)
0.1 ml of PLSE2-2X (ref#: 7m2-152-4)	0.1 ml of PLSE2-2X (ref#: ~~7m2-160~~ 152-4) mw 8-10-93
0.1 ml of PLAG2-2X (ref#: 7m2-159-15)	0.1 ml of PLAG2-2X ref#: 7m2-159-15)
1.0 ml of PLBA2-2X (ref#: 7m2-162-15)	1.0 ml of PLBA2-2X (ref#: 7m2-162-15)
0.5 ml of PLCR2-2X (ref#: 7m2-161-8)	0.5 ml of PLCR2-2X (ref#: 7m2-161-8)
0.5 ml of PLAS2-2X (ref#: 7m2-160-1)	0.5 ml of PLAS2-2X (ref#: 7m2-160-1)
0.5 ml of PLPB2-2X (ref#: 7m2-151-5)	0.5 ml of PLPB2-2X (ref#: 7m2-151-5)
2.0 ml of HNO_3 (Baker, ref#: 7m2-164-15)	2.0 ml of HNO_3 (Baker, ref#: 7m2-164-15)
Dilute to mark with deionized water.	Dilute to mark with original sample.
Prepared by/date: mwilson 8-10-93	Prepared by/date: mwilson 8-10-93

MERCURY

Stock solution A (10 ppm)	Laboratory Control Sample	Sample Spike
Place into a 100-ml volumetric flask:	Place into a 100-ml fleaker:	Place into a 100-ml fleaker:
1.0 ml of PLHG2-2X (ref#: 7m2-156-10)	2.0 ml of Hg stock solution A (10 ppm)	2.0 ml of Hg stock sol'n. A
2.0 ml of HNO_3 (Baker, ref#: 7m2-164-15)	2.0 ml of HNO_3 (Baker, ref#: 7m2-164-15)	2.0 ml of HNO_3 (ref#: 7m2-164-15)
Dilute to mark with deionized water.	Dilute to mark with deionized water.	Dilute to mark with original sample.
Prepared by/date: mwilson 8-9-93	Prepared by/date: mwilson 8-10-93	Prepared by/date: mwilson 8-10-93

Elements	Final solution concentration of spike added (ppb)	Original bottle concentration (SPEX)
As	5,000	1,000 ppm
Ba	100,000	10,000 ppm
Cd	1,000	1,000 ppm
Cr	5,000	1,000 ppm
Pb	5,000	1,000 ppm
Ag	1,000	1,000 ppm
Hg	200	1,000 ppm
Se	1,000	1,000 ppm

Reviewed by: Laura E. Nixon **Date:** 8/10/93

INORGANIC SDG 901295

CHAIN-OF-CUSTODY RECORD

№ 33779

CompuChem Laboratories, Inc.
3308 Chapel Hill/Nelson Highway
Research Triangle Park, NC 27709

1-800-833-5097

Ship to:	Project Name: YORKTOWN	Field Point-of-Contact: William L. Hughes
	Sampler Name: Bill Hughes	Telephone No: (804) 436-7881
		Sampling for project complete? (Y) or N (See Note 1.)
Carrier: AIRBORNE Airbill No.: 5904362225	Sampler Signature: William L. Hughes	Project-specific (PS) or Batch (B) QC: ____

Box #1: 1. Surface Water 2. Ground Water 3. Leachate 4. Rinsate 5. Soil/Sediment/Sludge 6. Trip Blank 7. Oil 8. Waste 9. Other: ____

Box #2: A. HCl B. HNO_3 C. $NaHSO_4$ D. $Na_2S_2O_3$ E. Ice Only O. Other: ____ N. Not Preserved

Box #3: F. Filtered U. Unfiltered

Box #4: C. CLP 3/90 S. SW-846 W. CWA 600-series L. Low Conc. CLP R. Radiological T. TCLP O. Other

Box #5: H - High M - Medium L - Low

Sample ID (Organics: 9 characters max, Inorganics: 6 characters; see Note 2)	Date: Year: 19__	Time	Box #1 Matrix	Box #2 Preservative	Box #3 Filtered/Unfiltered	Box #4 Method	Box #5 Expect. Conc.	No. of Bottles	Use for Lab QC (MS or DUP)	Organics Analysis: VOA-GC/MS	SV-GC/MS	Pest/PCB-GC	Herb-GC	VOA-GC	Inorganics: Metals	Mercury	Cyanides	Other: Radiologicals	TOC/TOX	O&G/TPH	Phenols	Other	Remarks/Comments
DISPCOMP	7/12	2:15	5	E	U	O	H	8															~~TCLP~~ BTEX by EPA 8020
	/	:																					TCLP Metals
	/	:																					% Moisture
	/	:																					TOX by EPA 9020
	/	:																					TPH by EPA 418.1
	/	:																					PCBs by EPA 8080
	/	:																					
	/	:																					
	/	:																					
	/	:																					

562 729 • 562 734 •
√ 733 • √ 735 •
739 •

RECEIVED IN GOOD CONDITION 7/14/93

Client's Special Instructions:

Lab: Received in Good Condition? Y or N Describe Problems, If Any:

#1 Relinquished By: (Sig.) William L Hughes	Date: 7/13/93	#2 Relinquished By: (Sig.)	Date:	#3 Relinquished By: (Sig.)	Date:	Sample storage time requested? ____ (in days, see Note 3)
Company Name: GSI	Time: 4:00	Company Name:	Time:	Company Name:	Time:	
#1 Received By: (Sig.) V. Batt	Date: 7/14/93	#2 Received By (Sig.)	Date:	#3 Received By: (Sig.)	Date:	DESTROY or RETURN data after five years of archival? (Circle choice; see Note 4)
Company Name: CompuChem	Time: 0830	Company Name:	Time:	Company Name:	Time:	

Note: "N" lab will hold samples to await remainder of project-maximizing batch size and minimizing QC ratio; if "Y" lab will [illegible] processing batches now. Note (2): If CLP inorganics diskette required, ID limited to maximum of six characters.
Note: Samples stored 60 days after date report mailed at no extra charge. Note (4): All lab copies of data destroyed after five years unless client requests and pays for return of copies; annual storage fee billed in January of year six.

Navy Analysis of Navy Special Fuel Oil (NSFO)

JUL 9 '93 10:08 PAGE.002

ANALYSIS OF FUEL OIL, GRADE NSFO

LAB REPORT NO. 36100 DATE 07/09/93

FROM: COMMANDING OFFICER (CODE 702), FISC, 1968 GILBERT ST STE 600, NORFOLK, VA 23511-3392

LAB SAMPLE NO.: N34107
SOURCE: PILOT TEST PROGRAM FOR NSFO
DATE SAMPLED: 06/22/93

TO: YORKTOWN FUEL DIVISION

REF(A)ASTM D 396

MARKINGS	LIMITS OF REF (A) GRADE FO TYPE B2 TEST	RESULTS
APPEARANCE	REPORT	OPAQUE
ASH, %WT (NO. 4 & NO. 5)		
FLASH POINT, @ F		15.1
GRAVITY, API @60 F		
POUR POINT, @ F (NO. 4)		
SEDIMENT BY EXTRACTION, %WT	REPORT	
SULFUR, %WT		
WATER, %VOL	REPORT	
WATER & SEDIMENT, %VOL (CALC.)		
VISCOSITY CS @ 104 F		11.9
VISCOSITY CS @ 212 F		883.6
VISCOSITY SSU @ 104 F		66.1
VISCOSITY SSU @ 212 F		
BTU (CALC)		17,754/LB
BTU (CALC)		142,707/GAL
BTU (CALC)		480
VISCOSITY, SSU @ 122 DGS F		126
VISCOSITY, SSU @ 180 DGS F		14.9
GRAVITY, API @ 78.0°F		15.0
GRAVITY, API @ 120°F		15.1
GRAVITY, API @ 160°F		14.4
GRAVITY, API @ 180°F		

Post-it brand fax transmittal memo 7671 | # of pages ▸ 1
To Taylor Snoddy | From Frankington
Co. 651 Norwood | Co. 651 Norwood
Dep. | Phone #
Fax # 804-436-2312 | Fax #

PRODUCT AS REPRESENTED BY SAMPLE MEETS SPEC. LIMITS OF REF (A)?

REMARKS:
API GRAVITY READINGS WERE DIFFICULT TO DO AT ELEVATED TEMPERATURES DUE TO THE EQUILIBRATION TIMES NEEDED FOR READINGS. THEREFORE, TEMPERATURE VARIATIONS OF 5°F BETWEEN INITIAL AND FINAL READINGS AT UPPER TEMPERATURES EXISTS.

APPROVED BY DIRECTION
B. O'Hourly

07.14.93 08:13 AM +LANTDIV CODE 18 P01

FROM: Commanding Officer (Code 702), Naval Supply Center, Bldg W-388,
Norfolk, VA 23512-5100

LAB SAMPLE NO.: N00110
SOURCE: TEST WELL #MW-13

TO: YORKTOWN FUEL DIVISION

DATE SAMPLED: 10/01/92

F(A)ASTM D 396

RKINGS	LIMITS OF REF (A) GRADE FO TYPE B2 TEST	RESULTS
PEARANCE	REPORT	OPAQUE
H, %WT (NO. 4 & NO. 5)		
ASH POINT, @ F		200+
AVITY, API @60 F		18.5
UR POINT, @ F (NO. 4)		
DIMENT BY EXTRACTION, %WT	REPORT	
LFUR, %WT		1.72
TER, %VOL	REPORT	
TER & SEDIMENT, %VOL (CALC.)		
SCOSITY CS @ 104 F		
SCOSITY CS @ 212 F		10.58
SCOSITY SSU @ 104 F		
SCOSITY SSU @ 212 F		61.3
U (CALC)		
U (CALC)		17880/LB
U (CALC)		140465/GL
SCOSITY, SSU @ 122 DGS F		228.7
ECIFIC GRAVITY		0.9433

Post-It™ brand fax transmittal memo 7671 | # of pages ▸ 6

To Taylor Sword	From J. Conway
Co. GW Tech.	Co.
Dept.	Phone # 445-4112
Fax # 436-2312	Fax #

ODUCT AS REPRESENTED BY SAMPLE MEETS
EC. LIMITS OF REF (A)? NO

MARKS:
MPLE'S VISCOSITY AT 212 DGS F CORRELATES TO A FUEL OIL, GRADE NO. 5 HEAVY.

BMITTED BY

APPROVED BY DIRECTION
G. D. Howell
G. D. HOWELL

ENVIRONMENTAL LABORATORY
NAVAL SUPPLY CENTER, NORFOLK

REPORT OF CHEMICAL ANALYSIS

REPORT # 93E0005

SAMPLE LOCATION TEST WELL #MW-13
GENERATOR: FUEL DEPARTMENT YORKTOWN
REQUESTOR: DEAN HOWELL
DATE SAMPLED: 10/01/92
DATE RECEIVED: 10/08/92
VOLUME OF WATER:0 GALS

OF:NSC NORFOLK
TIME SAMPLED:
SAMPLER:
VOLUME OF OIL:N/K GALS

OIL PHASE

TESTS	LIMITS	METHOD	RESULTS
TOTAL HALOGENS (as Chloride)	1000 PPM	9076	0 ppm
FLASH POINT	>100 deg F	1010	deg F
ARSENIC	5 PPM	3040/6010	0.00 ppm
CADMIUM	2 PPM		0.00 ppm
CHROMIUM	10 PPM		0.00 ppm
LEAD	100 PPM		0.00 ppm

WATER PHASE

TESTS	METHODS	RESULTS
TOTAL ORGANIC HALOGENS (as Chloride)	9020	0 ug/L

METALS:

SPECIES	RESULTS	200.7 SPECIES	RESULTS
SILVER	0.000 mg/L	ARSENIC	0.000 mg/L
BERYLLIUM	0.000 mg/L	CADMIUM	0.000 mg/L
CHROMIUM	0.000 mg/L	COPPER	0.000 mg/L
NICKEL	0.000 mg/L	LEAD	0.000 mg/L
THALLIUM	0.000 mg/L	SELENIUM	0.000 mg/L
ANTIMONY	0.000 mg/L	ZINC	0.000 mg/L

REMARKS

N/K = NOT KNOWN. NO HALOGENS OR METALS WERE DETECTED IN THE OIL PHASE.

Any zero values represent concentrations less than the detection limits of the instrumentation. Additionally, these test results may have been zero filled and actually reflect only 2 significant figures.

ANALYST/DATE Terri P. Overby 10/8/92

REVIEWED BY/DATE D. Howell 10/8/92

"QUALITY PERFORMANCE....QUALITY PRODUCTS"

FUEL OIL 535

MSDS No.
APPC 277

Rev. Date
02/15/83

ARCO PETROLEUM PRODUCTS COMPANY
DIVISION OF ATLANTIC RICHFIELD COMPANY
515 SOUTH FLOWER STREET
LOS ANGELES, CALIFORNIA 90071

IMPORTANT: Read this MSDS before handling and disposing of this product and pass this information on to employees, customers, and users of this product

I. General

Trade Name: FUEL OIL 535	Telephone Numbers EMERGENCY 800/424-9300 CHEMTREC 310/810-1000 COMPANY CUSTOMER SERVICE 213/486-8258 INFO ONLY
Other Names: COMMERCIAL 535; ASTM NO. 6 (HEAVY) GRADE FUEL OIL (D-396); RESIDUAL FUEL OIL; BUNKER FUEL; [illegible]	
Chemical Family: PETROLEUM HYDROCARBONS	DOT Hazardous Materials Proper Shipping Name: FUEL OIL, NO. 5
Generic Name: FUEL OIL NO. 6	DOT Hazard Class: COMBUSTIBLE LIQUID
CAS No. 68476-33-5* / Company ID No. 1863818828	UN/NA ID No. NA 1533

II. Summary of Hazards

WARNING
MAY BE HARMFUL TO SKIN! AVOID SKIN CONTACT AND BREATHING MISTS OR VAPORS, ESPECIALLY WHEN HEATED. PROLONGED OR REPEATED SKIN CONTACT MAY CAUSE IRRITATION OR MORE SERIOUS SKIN DISORDERS. SIMILAR OILS CONTAINING POLYCYCLIC AROMATIC HYDROCARBONS HAVE CAUSED SKIN CANCER ON TEST ANIMALS. IN CASE OF CONTACT, WASH THOROUGHLY AND REPORT ANY SKIN IRRITATION TO MEDICAL PERSONNEL. SEE SECTION IV. FOR ADDITIONAL INFORMATION.
HEAVY FUEL OILS ARE USUALLY HANDLED HOT. AVOID CONTACT WITH HOT LIQUIDS.
MODERATELY COMBUSTIBLE! OSHA/NFPA CLASS-IIIA COMBUSTIBLE LIQUID.

III. Fire and Explosion

Flash Point (Method) GT 150°F (D-93) SEE FIREFIGHTING PROCEDURES	Autoignition Temperature (Method) GT 500°F (EST.)	Flammable Limits (% Vol in Air) At Normal Atmospheric Temperature and Pressure Lower AP 1.0 Upper AP 5.0 BASED UPON "FUEL OIL NO. 2"

Unusual Fire and Explosion Hazards: MODERATELY COMBUSTIBLE! WHEN HEATED ABOVE THE FLASH POINT, THIS MATERIAL WILL RELEASE FLAMMABLE VAPORS WHICH IF EXPOSED TO A SOURCE OF IGNITION CAN BURN OR BE EXPLOSIVE IN CONFINED SPACES. MISTS OR SPRAYS MAY BE FLAMMABLE AT TEMPERATURES BELOW THE NORMAL FLASH POINT. KEEP AWAY FROM HEAT AND OPEN FLAME.

Extinguishing Media: DRY CHEMICAL, HALON, AND CARBON DIOXIDE. FOAM AND WATER FOG ARE EFFECTIVE, BUT MAY CAUSE FROTHING.

Special Fire Fighting Procedures: FOR FIRES INVOLVING THIS MATERIAL, DO NOT ENTER ANY ENCLOSED OR CONFINED FIRE SPACE WITHOUT PROPER PROTECTIVE EQUIPMENT. THIS MAY INCLUDE SELF-CONTAINED BREATHING APPARATUS TO PROTECT AGAINST THE HAZARDOUS EFFECTS OF COMBUSTION PRODUCTS AND OXYGEN DEFICIENCIES. COOL TANKS AND CONTAINERS EXPOSED TO FIRE WITH WATER. IMPROPER USE OF WATER AND EXTINGUISHING MEDIA CONTAINING WATER MAY CAUSE FROTHING WHICH CAN SPREAD THE FIRE OVER A LARGER AREA.

11/09/92 16:02 ☎804 445 6662 LANDIV CODE 18 003

...iling Point T 350° F	Evaporation Rate (Ratio of Time) (ETHER = 1) GT 1		Dry Point N/AP
...ing Point /AP	Vapor Pressure (REID-PSIA AT 100° F) LT 0.1		Volatile Characteristics SLIGHT
...c Gravity (H,O = 1 at 39.2° F)).94 TO 0.99	Vapor Sp. Gr. (Air = 1.0 at 60° - 90° F) AP 7	Solubility in Water NEGLIGIBLE	Stability STABLE
...ardous Polymerization ...T EXPECTED TO OCCUR	Viscosity, Units, Temp., Method AP 300 TO 900 SUS AT 100° F D2161		pH N/AP

...her Physical ...d Chemical Properties	BLENDED TO MEET REGULATORY & CUSTOMER REQUIREMENTS INCLUDING VISCOSITY, POUR, SULFUR, & HEAVY METALS.
...pearance ...d Odor	BROWN TO BLACK-COLORED, VISCOUS LIQUID; SLIGHTLY CRACKED OR BURNT TO ASPHALTIC ODOR.
...nditions ... Avoid	EXTREME HEAT AND OPEN FLAME.
...terials ... Avoid	STRONG ACIDS, ALKALIES, AND OXIDIZERS SUCH AS LIQUID CHLORINE AND OXYGEN.
...ardous ...composition ...oducts	BURNING OR EXCESSIVE HEATING MAY PRODUCE CO AND OTHER HARMFUL GASES/VAPORS INCLUDING OXIDES AND/OR OTHER COMPOUNDS OF S & N, POSSIBLY H2S, & METALS.

Additional Precautions

...orage

PARTS AND EQUIPMENT USING OR CONTAINING THIS MATERIAL MUST BE STEAM-CLEANED PRIOR TO ALL MAINTENANCE PROCEDURES. ALL MATERIAL SAMPLING SHOULD BE CONDUCTED IN A MANNER WHICH AVOIDS VAPOR INHALATION OR SKIN CONTACT. SPECIAL CARE AND LABELING MUST BE PROVIDED DURING TRANPORTATION/HANDLING OF LABORATORY SAMPLES. USE GOOD PERSONAL HYGIENE PRACTICES. WASH HANDS BEFORE EATING, DRINKING, SMOKING, OR USE OF TOILET FACILITIES. TAKE A SHOWER AFTER WORK USING SOAP AND WATER. AVOID USING SOLVENTS (GASOLINE, KEROSENE, ETC.) OR ABRASIVE SKIN CLEANERS. OIL-SOAKED CLOTHING MUST BE PROMPTLY REMOVED AND LAUNDERED BEFORE REUSE. DISCARD CONTAMINATED LEATHER GOODS.

...neral ...mments

SPECIFIC EXPOSURE STANDARDS/CONTROL LIMITS FOR HEAVY FUEL OIL HAVE NOT BEEN AGREED UPON; THEREFORE, BOTH ACGIH TLV CONTROL GUIDELINES (SEE SECTION VI.) ARE SUGGESTED FOR INTERIM USE UNTIL SPECIFIC STANDARDS/CONTROL LIMITS ARE ADOPTED. THE PARTICULATE POLYCYCLIC AROMATIC HYDROCARBONS (PPAH) TLV IS BASED UPON COAL TAR PITCH VOLATILES (AS BENZENE SOLUBLES), NOT UPON PETROLEUM RESIDUA.

SOME OF THE INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE MIXTURE ITSELF.

- - - Note - - - Qualifications:			
	EQ = Equal	AP = Approximately	N/AV = Not Available
	LT = Less Than	UK = Unkown	N/AP = Not Applicable
	GT = Greater Than	TR = Trace	N/DA = No Data Available

Disclaimer of Liability

...e information in this MSDS was obtained from sources which we believe are reliable. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY REPRESENTATION OR WARRANTY, EXPRESS OR IMPLIED, REGARDING ITS ACCURACY OR CORRECTNESS.

...onditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. ...HIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNEC... WITH THE HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

Health Hazards

rimary	SKIN CONTACT WITH HOT OIL MAY CAUSE SEVERE THERMAL BURNS.
E OF EXPOSURE	SIGNS AND SYMPTOMS
nhalation	NO SIGNIFICANT SIGNS OR SYMPTOMS INDICATIVE OF ANY ADVERSE HEALTH EFFECTS ARE EXPECTED TO OCCUR UPON SHORT-TERM EXPOSURES.
ye ontact	EYE IRRITATION MAY RESULT FROM CONTACT WITH LIQUID, MISTS, AND/OR VAPORS.
kin bsorption	AFTER PROLONGED OR REPEATED CONTACT WITH LARGE AMOUNTS OF THIS MATERIAL, ABSORPTION THROUGH THE SKIN MAY OCCUR AND PRODUCE TOXIC EFFECTS.
kin ritation	SKIN IRRITATION MAY OCCUR. MORE SERIOUS SKIN DISORDERS MAY OCCUR UPON PROLONGED OR REPEATED SKIN CONTACT. SEE "EFFECTS OF OVEREXPOSURE" BOX BELOW.
gestion	NOT APPLICABLE.
fects Of verexposure	ALTHOUGH THERE IS NO SPECIFIC EVIDENCE THAT THIS MATERIAL IS CARCINOGENIC TO HUMANS, EXPERIMENTS HAVE SHOWN THAT SIMILAR MATERIALS CONTAINING POLYCYCLIC AROMATIC HYDROCARBONS HAVE CAUSED SKIN CANCER ON TEST ANIMALS.

Protective Equipment

ory	NONE IS NEEDED UNDER NORMAL CONDITIONS WITH ADEQUATE VENTILATION. IF EXPOSURE EXCEEDS THE CONTROL LIMITS, RESPIRATORY PROTECTIVE EQUIPMENT WHICH MEETS 29 CFR 1910.134 AND IS NIOSH/MSHA APPROVED MUST BE WORN.
ntilation	USE ADEQUATE VENTILATION TO KEEP OIL MISTS/VAPORS BELOW EXPOSURE CONTROL LEVELS SHOWN IN SECTION VI. (ALSO SEE SECTION XI.) SPECIAL VENTILATION MAY BE REQUIRED FOR HANDLING CONDITIONS AT ELEVATED TEMPERATURES..
ye	IN ADDITION TO SAFETY GLASSES, CHEMICAL GOGGLES AND/OR FACE SHIELD SHOULD ALSO BE WORN IF SPLASHING CANNOT BE AVOIDED AND/OR THE MATERIAL IS BEING HANDLED HOT. CONTACT LENSES SHOULD NOT BE WORN.
kin	WHEN SKIN CONTACT IS POSSIBLE, AND ESPECIALLY WHEN HANDLING HOT MATERIAL, PROTECTIVE CLOTHING SUCH AS LEATHER-FACED OR ASBESTOS GLOVES, IMPERVIOUS APRON, LONG-SLEEVES, BOOTS, AND FACIAL PROTECTION MUST BE WORN.
ther	EMERGENCY EYE WASH FOUNTAINS SHOULD BE AVAILABLE IN THE VICINITY OF ANY POTENTIAL EXPOSURE, AND A SAFETY SHOWER SHOULD ALSO BE AVAILABLE IF THE MATERIAL IS BEING HANDLED HOT. (SEE SECTION XI. - HANDLING AND STORAGE.)

Occupational Exposure Limits

Substance	Source	Date
OIL MIST, MINERAL (SEE SECTION XI.)	ACGIH	1982

Exposure Limit Value/Time	Short Term Limit/Time	Peak Limit
5 MG/M3 / 8 HOURS	10 MG/M3 / 15 MINUTES	NOT ESTABLISHED

Substance	Source	Date
PPAH (BENZENE SOLUBLES) SEE SECTION XI.	ACGIH	1982

Exposure Limit Value/Time	Short Term Limit/Time	Peak Limit
0.2 MG/M3 / 8 HOURS	NOT ESTABLISHED	NOT ESTABLISHED

VII. Emergency and First Aid

Inhalation	IMMEDIATELY REMOVE FROM CONTAMINATED AREA TO FRESH AIR. RESTORE AND/OR SUPPORT BREATHING AS REQUIRED.
Eye Contact	FLUSH EYES WITH CLEAN, LOW-PRESSURE WATER FOR AT LEAST 15 MINUTES, OCCASIONALLY LIFTING THE EYELIDS. IF PAIN OR REDNESS PERSISTS AFTER FLUSHING, OBTAIN MEDICAL ATTENTION.
Skin Contact	REMOVE CONTAMINATED CLOTHING. WIPE EXCESS OIL OFF WITH A DRY CLOTH. WASH AFFECTED AREA WELL WITH A WATERLESS CLEANSER FOLLOWED BY SOAP AND WATER. HOT LIQUID MAY CAUSE BURNS; APPLY ICE COMPRESSES AND GET MEDICAL TREATMENT.
Ingestion	INGESTION IS UNLIKELY. HOWEVER, IF SWALLOWED, DO NOT INDUCE VOMITING, SINCE ASPIRATION INTO THE LUNGS WILL CAUSE CHEMICAL PNEUMONIA. MUST OBTAIN MEDICAL ATTENTION IMMEDIATELY.
Note to Physician	HEAVY FUEL OILS CONTAIN MORE THAN 20% "PETROLEUM DISTILLATES".

VIII. Spill and Disposal

Precautions If Material is Spilled or Released	CONTAIN SPILL. REMOVE ALL IGNITION SOURCES AND SAFELY STOP FLOW OF SPILL. SPILL MAY CREATE SLIPPING HAZARDS. PREVENT FROM ENTERING ALL WATER BODIES, IF POSSIBLE. EVACUATE ALL NON-ESSENTIAL PERSONNEL. IN URBAN AREAS, CLEANUP AS SOON AS POSSIBLE; IN NATURAL ENVIRONMENTS, CLEANUP ON ADVICE FROM ECOLOGISTS. THIS MATERIAL WILL FLOAT ON WATER. ABSORBANT MATERIAL AND PADS CAN BE USED. NOTIFY THE NATIONAL RESPONSE CENTER (800/424-8802) AND COMPLY WITH ALL APPLICABLE LAWS. THE SPILLED MATERIAL AND ANY WATER OR SOIL WHICH IT HAS CONTACTED MAY BE HAZARDOUS TO ANIMAL/AQUATIC LIFE.
Waste Disposal Methods	MAXIMIZE PRODUCT RECOVERY FOR REUSE OR RECYCLING. CONDITIONS OF USE MAY CAUSE THIS MATERIAL TO BECOME A "HAZARDOUS WASTE" AS DEFINED BY STATE OR FEDERAL LAWS. USE APPROVED TREATMENT, TRANSPORTERS, AND DISPOSAL SITES IN COMPLIANCE WITH ALL LAWS. IF SPILL IS INTRODUCED INTO A WASTEWATER SYSTEM, THE CHEMICAL AND BIOLOGICAL OXYGEN DEMAND WILL LIKELY INCREASE. PROPERLY ACCLIMATE THE BIOMASS TO THE SPILL MATERIAL. POTENTIAL TREATMENT AND DISPOSAL METHODS INCLUDE LAND FARMING, INCINERATION, AND LAND DISPOSAL, IF PERMITTED.

IX. Components

(This may not be a complete list of components)

Component Name	CAS No.		Composition amount (Wt.) (See Note on Page 4)
PETROLEUM DISTILLATES		AP	20 TO 100 PERCENT
PETROLEUM RESIDUUMS		AP	0 TO 80 PERCENT
SULFUR	7704-34-8	LT	2 PERCENT
NITROGEN	7727-37-9	LT	2 PERCENT
WATER	7732-18-5	LT	0.5 PERCENT
HEAVY METALS (V, NI, FE, CU, ETC.)		LT	0.05 PERCENT

Compositions given are typical values, not specifications.

APPENDIX C

LIQUID LEVEL DATA

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: MAY 3, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57			0.00	0.00	0.00		
MW-2S	48.23			0.00	0.00	0.00		
MW-3S	48.72			0.00	0.00	0.00		
MW-4S	47.89			0.00	0.00	0.00		
MW-5S	49.06			0.00	0.00	0.00		
RW-1S	49.92	14.65		0.00	0.00	14.65	35.27	
MW-1H	49.54			0.00	0.00	0.00		
MW-2H	50.20			0.00	0.00	0.00		
MW-3H	50.37			0.00	0.00	0.00		
MW-4H	50.23			0.00	0.00	0.00		
MW-5H	51.16			0.00	0.00	0.00		
RW-2H	52.18	17.00	16.50	0.50	0.49	16.52	35.67	
RW-3X	52.51	17.00		0.00	0.00	17.00	35.51	

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: MAY 4, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57	12.60		0.00	0.00	12.60	35.97	
MW-2S	48.23	13.40	13.00	0.40	0.39	13.01	35.22	
MW-3S	48.72	13.70	13.50	0.20	0.19	13.51	35.21	
MW-4S	47.89	12.80	12.70	0.10	0.10	12.70	35.19	
MW-5S	49.06	13.60	13.60	0.00	0.00	13.60	35.46	Tr. Product
RW-1S	49.92	14.50	13.70	0.80	0.78	13.72	36.20	
MW-1H	49.54		14.50	-14.50	-14.07	14.07		No Water
MW-2H	50.20	14.40	14.40	0.00	0.00	14.40	35.80	
MW-3H	50.37	14.55		0.00	0.00	14.55	35.82	
MW-4H	50.23	14.40	14.40	0.00	0.00	14.40	35.83	
MW-5H	51.16	15.20	15.00	0.20	0.19	15.01	36.15	
RW-2H	52.18	16.50	16.50	0.00	0.00	16.50	35.68	
RW-3X	52.51	17.00		0.00	0.00	17.00	35.51	

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: MAY 10. 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57	13.10		0.00	0.00	13.10	35.47	
MW-2S	48.23		12.33	-12.33	-11.96	11.96		
MW-3S	48.72		13.13	-13.13	-12.74	12.74		
MW-4S	47.89	12.43		0.00	0.00	12.43	35.46	
MW-5S	49.06	13.24		0.00	0.00	13.24	35.82	
RW-1S	49.92	14.06	12.12	1.94	1.88	12.18	37.74	
MW-1H	49.54	13.10	12.20	0.90	0.87	12.23	37.31	
MW-2H	50.20	14.35		0.00	0.00	14.35	35.85	
MW-3H	50.37	14.53		0.00	0.00	14.53	35.84	
MW-4H	50.23	14.45		0.00	0.00	14.45	35.78	
MW-5H	51.16	15.30		0.00	0.00	15.30	35.86	
RW-2H	52.18	17.62	15.54	2.08	2.02	15.60	36.58	
RW-3X	52.51		16.58	-16.58	-16.08	16.08		

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: MAY 12, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57		11.82	-11.82	-11.47	11.47		
MW-2S	48.23		11.81	-11.81	-11.46	11.46		
MW-3S	48.72		12.04	-12.04	-11.68	11.68		
MW-4S	47.89	11.73		0.00	0.00	11.73	36.16	
MW-5S	49.06	12.44		0.00	0.00	12.44	36.62	
RW-1S	49.92	13.81	12.12	1.69	1.64	12.17	37.75	
MW-1H	49.54		11.93	-11.93	-11.57	11.57		
MW-2H	50.20		13.55	-13.55	-13.14	13.14		
MW-3H	50.37		13.74	-13.74	-13.33	13.33		
MW-4H	50.23		13.41	-13.41	-13.01	13.01		
MW-5H	51.16		12.84	-12.84	-12.45	12.45		
RW-2H	52.18		21.46	-21.46	-20.82	20.82		
RW-3X	52.51		19.36	-19.36	-18.78	18.78		

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: MAY 14, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57		12.97	-12.97	-12.58	12.58		
MW-2S	48.23		11.91	-11.91	-11.55	11.55		
MW-3S	48.72	13.17		0.00	0.00	13.17	35.55	
MW-4S	47.89	12.39		0.00	0.00	12.39	35.50	
MW-5S	49.06	12.88		0.00	0.00	12.88	36.18	
RW-1S	49.92	12.35		0.00	0.00	12.35	37.57	
MW-1H	49.54		12.79	-12.79	-12.41	12.41		
MW-2H	50.20	13.60		0.00	0.00	13.60	36.60	
MW-3H	50.37	13.69		0.00	0.00	13.69	36.68	
MW-4H	50.23	13.52		0.00	0.00	13.52	36.71	
MW-5H	51.16	14.46		0.00	0.00	14.46	36.70	
RW-2H	52.18		20.02	-20.02	-19.42	19.42		
RW-3X	52.51		17.46	-17.46	-16.94	16.94		

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: MAY 17, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57	12.63	12.08	0.55	0.53	12.10	36.47	
MW-2S	48.23	11.84		0.00	0.00	11.84	36.39	
MW-3S	48.72		12.48	-12.48	-12.11	12.11		
MW-4S	47.89	11.52		0.00	0.00	11.52	36.37	
MW-5S	49.06	12.98		0.00	0.00	12.98	36.08	
RW-1S	49.92		13.20	-13.20	-12.80	12.80		
MW-1H	49.54		14.48	-14.48	-14.05	14.05		
MW-2H	50.20	13.15		0.00	0.00	13.15	37.05	
MW-3H	50.37	13.24		0.00	0.00	13.24	37.13	
MW-4H	50.23	13.08		0.00	0.00	13.08	37.15	
MW-5H	51.16	14.08		0.00	0.00	14.08	37.08	
RW-2H	52.18		15.06	-15.06	-14.61	14.61		
RW-3X	52.51		15.63	-15.63	-15.16	15.16		

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: MAY 19, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57		12.47	-12.47	-12.10	12.10		
MW-2S	48.23		12.10	-12.10	-11.74	11.74		
MW-3S	48.72		12.50	-12.50	-12.13	12.13		
MW-4S	47.89	11.79		0.00	0.00	11.79	36.10	
MW-5S	49.06	12.92		0.00	0.00	12.92	36.14	
RW-1S	49.92		13.58	-13.58	-13.17	13.17		
MW-1H	49.54		13.28	-13.28	-12.88	12.88		
MW-2H	50.20	13.82		0.00	0.00	13.82	36.38	
MW-3H	50.37	14.97		0.00	0.00	14.97	35.40	
MW-4H	50.23	13.85		0.00	0.00	13.85	36.38	
MW-5H	51.16	14.86		0.00	0.00	14.86	36.30	
RW-2H	52.18		16.82	-16.82	-16.32	16.32		
RW-3X	52.51		16.22	-16.22	-15.73	15.73		

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: MAY 21, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57		13.38	-13.38	-12.98	12.98		
MW-2S	48.23		12.24	-12.24	-11.87	11.87		
MW-3S	48.72		12.50	-12.50	-12.13	12.13		
MW-4S	47.89	11.88		0.00	0.00	11.88	36.01	
MW-5S	49.06	12.93		0.00	0.00	12.93	36.13	
RW-1S	49.92		13.80	-13.80	-13.39	13.39		
MW-1H	49.54		13.40	-13.40	-13.00	13.00		
MW-2H	50.20	14.06		0.00	0.00	14.06	36.14	
MW-3H	50.37	14.11		0.00	0.00	14.11	36.26	
MW-4H	50.23	13.97		0.00	0.00	13.97	36.26	
MW-5H	51.16	14.80		0.00	0.00	14.80	36.36	
RW-2H	52.18		15.90	-15.90	-15.42	15.42		
RW-3X	52.51		16.22	-16.22	-15.73	15.73		

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: MAY 24, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57	13.24		0.00	0.00	13.24	35.33	
MW-2S	48.23		11.90	-11.90	-11.54	11.54		
MW-3S	48.72		12.14	-12.14	-11.78	11.78		
MW-4S	47.89	12.90		0.00	0.00	12.90	34.99	
MW-5S	49.06	12.75		0.00	0.00	12.75	36.31	
RW-1S	49.92		13.33	-13.33	-12.93	12.93		
MW-1H	49.54		13.09	-13.09	-12.70	12.70		
MW-2H	50.20	13.84		0.00	0.00	13.84	36.36	
MW-3H	50.37	13.88		0.00	0.00	13.88	36.49	
MW-4H	50.23	13.77		0.00	0.00	13.77	36.46	
MW-5H	51.16	14.77		0.00	0.00	14.77	36.39	
RW-2H	52.18		15.68	-15.68	-15.21	15.21		
RW-3X	52.51		16.04	-16.04	-15.56	15.56		

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: MAY 26, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57	12.32		0.00	0.00	12.32	36.25	
MW-2S	48.23		11.95	-11.95	-11.59	11.59		
MW-3S	48.72		12.15	-12.15	-11.79	11.79		
MW-4S	47.89	11.64		0.00	0.00	11.64	36.25	
MW-5S	49.06	12.79		0.00	0.00	12.79	36.27	
RW-1S	49.92		13.30	-13.30	-12.90	12.90		
MW-1H	49.54		13.12	-13.12	-12.73	12.73		
MW-2H	50.20	13.76		0.00	0.00	13.76	36.44	
MW-3H	50.37	13.92		0.00	0.00	13.92	36.45	
MW-4H	50.23	13.81		0.00	0.00	13.81	36.42	
MW-5H	51.16	14.70		0.00	0.00	14.70	36.46	
RW-2H	52.18		15.47	-15.47	-15.01	15.01		
RW-3X	52.51		16.03	-16.03	-15.55	15.55		

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: MAY 28, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57		12.78	-12.78	-12.40	12.40		
MW-2S	48.23		11.97	-11.97	-11.61	11.61		
MW-3S	48.72		12.14	-12.14	-11.78	11.78		
MW-4S	47.89	11.66		0.00	0.00	11.66	36.23	
MW-5S	49.06	12.78		0.00	0.00	12.78	36,28	
RW-1S	49.92		13.54	-13.54	-13.13	13.13		
MW-1H	49.54		13.14	-13.14	-12.75	12.75		
MW-2H	50.20	13.68		0.00	0.00	13.68	36.52	
MW-3H	50.37	14.09		0.00	0.00	14.09	36.28	
MW-4H	50.23	13.80		0.00	0.00	13.80	36.43	
MW-5H	51.16	14.69		0.00	0.00	14.69	36.47	
RW-2H	52.18		15.67	-15.67	-15.20	15.20		
RW-3X	52.51		16.02	-16.02	-15.54	15.54		

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: JUNE 1, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57	12.57		0.00	0.00	12.57	36.00	
MW-2S	48.23		12.11	-12.11	-11.75	11.75		
MW-3S	48.72		12.32	-12.32	-11.95	11.95		
MW-4S	47.89	10.98		0.00	0.00	10.98	36.91	
MW-5S	49.06	12.88		0.00	0.00	12.88	36.18	
RW-1S	49.92		14.29	-14.29	-13.86	13.86		
MW-1H	49.54		13.20	-13.20	-12.80	12.80		
MW-2H	50.20	13.79		0.00	0.00	13.79	36.41	
MW-3H	50.37	13.98		0.00	0.00	13.98	36.39	
MW-4H	50.23	13.82		0.00	0.00	13.82	36.41	
MW-5H	51.16	14.74		0.00	0.00	14.74	36.42	
RW-2H	52.18		14.69	-14.69	-14.25	14.25		
RW-3X	52.51		16.07	-16.07	-15.59	15.59		

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: JUNE 2, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57	12.85		0.00	0.00	12.85	35.72	
MW-2S	48.23		12.32	-12.32	-11.95	11.95		
MW-3S	48.72		12.68	-12.68	-12.30	12.30		
MW-4S	47.89	12.19		0.00	0.00	12.19	35.70	
MW-5S	49.06	13.14		0.00	0.00	13.14	35.92	
RW-1S	49.92		14.27	-14.27	-13.84	13.84		
MW-1H	49.54		13.26	-13.26	-12.86	12.86		
MW-2H	50.20	13.94		0.00	0.00	13.94	36.26	
MW-3H	50.37	14.07		0.00	0.00	14.07	36.30	
MW-4H	50.23	13.95		0.00	0.00	13.95	36.28	
MW-5H	51.16	14.84		0.00	0.00	14.84	36.32	
RW-2H	52.18		14.82	-14.82	-14.38	14.38		
RW-3X	52.51		16.12	-16.12	-15.64	15.64		

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: JUNE 4, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57	13.02		0.00	0.00	13.02	35.55	
MW-2S	48.23		12.12	-12.12	-11.76	11.76		
MW-3S	48.72		12.82	-12.82	-12.44	12.44		
MW-4S	47.89	12.34		0.00	0.00	12.34	35.55	
MW-5S	49.06	13.26		0.00	0.00	13.26	35.80	
RW-1S	49.92		14.72	-14.72	-14.28	14.28		
MW-1H	49.54		13.46	-13.46	-13.06	13.06		
MW-2H	50.20	14.05		0.00	0.00	14.05	36.15	
MW-3H	50.37	14.15		0.00	0.00	14.15	36.22	
MW-4H	50.23	14.04		0.00	0.00	14.04	36.19	
MW-5H	51.16	14.92		0.00	0.00	14.92	36.24	
RW-2H	52.18		15.96	-15.96	-15.48	15.48		
RW-3X	52.51		15.29	-15.29	-14.83	14.83		

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: JUNE 9, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57			0.00	0.00	0.00		Steam Break out –
MW-2S	48.23	12.30		0.00	0.00	12.30	35.93	
MW-3S	48.72	12.12		0.00	0.00	12.12	36.60	
MW-4S	47.89	12.36		0.00	0.00	12.36	35.53	
MW-5S	49.06	12.85		0.00	0.00	12.85	36.21	
RW-1S	49.92		14.08	-14.08	-13.66	13.66		
MW-1H	49.54		13.18	-13.18	-12.78	12.78		
MW-2H	50.20	13.88		0.00	0.00	13.88	36.32	
MW-3H	50.37	14.05		0.00	0.00	14.05	36.32	
MW-4H	50.23	13.75		0.00	0.00	13.75	36.48	
MW-5H	51.16	14.80		0.00	0.00	14.80	36.36	
RW-2H	52.18		14.98	-14.98	-14.53	14.53		
RW-3X	52.51		16.05	-16.05	-15.57	15.57		

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: JUNE 11, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57	13.47		0.00	0.00	13.47	35.10	
MW-2S	48.23		12.58	-12.58	-12.20	12.20		
MW-3S	48.72		13.40	-13.40	-13.00	13.00		
MW-4S	47.89	12.63		0.00	0.00	12.63	35.26	
MW-5S	49.06	13.33		0.00	0.00	13.33	35.73	
RW-1S	49.92		14.22	-14.22	-13.79	13.79		Steam Rising
MW-1H	49.54			0.00	0.00	0.00		Missed
MW-2H	50.20	14.11		0.00	0.00	14.11	36.09	
MW-3H	50.37	14.25		0.00	0.00	14.25	36.12	
MW-4H	50.23	14.25		0.00	0.00	14.25	35.98	
MW-5H	51.16			0.00	0.00	0.00		Missed
RW-2H	52.18			0.00	0.00	0.00		Missed
RW-3X	52.51			0.00	0.00	0.00		Missed

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: JUNE 14, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57		12.72	-12.72	-12.34	12.34		Hot
MW-2S	48.23		12.34	-12.34	-11.97	11.97		Warm
MW-3S	48.72		12.88	-12.88	-12.49	12.49		Hot
MW-4S	47.89	12.10		0.00	0.00	12.10	35.79	Odor/film
MW-5S	49.06	13.28		0.00	0.00	13.28	35.78	
RW-1S	49.92			0.00	0.00	0.00		
MW-1H	49.54		13.73	-13.73	-13.32	13.32		
MW-2H	50.20	14.35		0.00	0.00	14.35	35.85	
MW-3H	50.37	14.54		0.00	0.00	14.54	35.83	
MW-4H	50.23	14.48		0.00	0.00	14.48	35.75	
MW-5H	51.16	15.26		0.00	0.00	15.26	35.90	
RW-2H	52.18			0.00	0.00	0.00		
RW-3X	52.51			0.00	0.00	0.00		

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: JUNE 16, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57	12.24		0.00	0.00	12.24	36.33	
MW-2S	48.23		12.43	-12.43	-12.06	12.06		
MW-3S	48.72		13.01	-13.01	-12.62	12.62		
MW-4S	47.89	12.29		0.00	0.00	12.29	35.60	
MW-5S	49.06	13.45		0.00	0.00	13.45	35.61	
RW-1S	49.92		14.08	-14.08	-13.66	13.66		
MW-1H	49.54		13.84	-13.84	-13.42	13.42		
MW-2H	50.20	14.40		0.00	0.00	14.40	35.80	
MW-3H	50.37	14.57		0.00	0.00	14.57	35.80	
MW-4H	50.23	14.44		0.00	0.00	14.44	35.79	
MW-5H	51.16	15.40		0.00	0.00	15.40	35.76	
RW-2H	52.18		16.17	-16.17	-15.68	15.68		
RW-3X	52.51		19.30	-19.30	-18.72	18.72		

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: JUNE 18, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57		12.96	-12.96	-12.57	12.57		Hot Prod.
MW-2S	48.23		12.50	-12.50	-12.13	12.13		Hot Prod.
MW-3S	48.72		13.09	-13.09	-12.70	12.70		Hot Prod.
MW-4S	47.89	12.52		0.00	0.00	12.52	35.37	
MW-5S	49.06	13.54		0.00	0.00	13.54	35.52	
RW-1S	49.92		14.17	-14.17	-13.74	13.74		
MW-1H	49.54		13.87	-13.87	-13.45	13.45		
MW-2H	50.20	14.48		0.00	0.00	14.48	35.72	
MW-3H	50.37	14.62		0.00	0.00	14.62	35.75	
MW-4H	50.23	14.51		0.00	0.00	14.51	35.72	
MW-5H	51.16	15.47		0.00	0.00	15.47	35.69	
RW-2H	52.18		16.27	-16.27	-15.78	15.78		
RW-3X	52.51		16.92	-16.92	-16.41	16.41		

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: JUNE 21, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.9	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57		13.02	-13.02	-12.63	12.63		
MW-2S	48.23		12.69	-12.69	-12.31	12.31		
MW-3S	48.72		13.18	-13.18	-12.78	12.78		
MW-4S	47.89	12.95		0.00	0.00	12.95	34.94	
MW-5S	49.06	13.57		0.00	0.00	13.57	35.49	
RW-1S	49.92		14.17	-14.17	-13.74	13.74		
MW-1H	49.54		13.92	-13.92	-13.50	13.50		
MW-2H	50.20	14.53		0.00	0.00	14.53	35.67	
MW-3H	50.37	14.64		0.00	0.00	14.64	35.73	
MW-4H	50.23	14.52		0.00	0.00	14.52	35.71	
MW-5H	51.16	15.43		0.00	0.00	15.43	35.73	
RW-2H	52.18		16.25	-16.25	-15.76	15.76		
RW-3X	52.51		17.05	-17.05	-16.54	16.54		

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: JUNE 25, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	P.T.	P.T. X.8	ADJ. DTW	ELEV. WATER	COMMENTS
MW-1S	48.57		13.18	-13.18	-10.54	10.54		
MW-2S	48.23		12.73	-12.73	-10.18	10.18		
MW-3S	48.72		13.34	-13.34	-10.67	10.67		
MW-4S	47.89	13.08		0.00	0.00	13.08	34.81	
MW-5S	49.06	13.64		0.00	0.00	13.64	35.42	
RW-1S	49.92		14.27	-14.27	-11.42	11.42		
MW-1H	49.54		13.98	-13.98	-11.18	11.18		
MW-2H	50.20	14.59		0.00	0.00	14.59	35.61	
MW-3H	50.37	14.72		0.00	0.00	14.72	35.65	
MW-4H	50.23	14.58		0.00	0.00	14.58	35.65	
MW-5H	51.16	15.47		0.00	0.00	15.47	35.69	
RW-2H	52.18		16.35	-16.35	-13.08	13.08		
RW-3X	52.51		17.17	-17.17	-13.74	13.74		

GROUNDWATER GRADIENT DATA

CLIENT: U.S. NAVY/FISC YORKTOWN
LOCATION: YORKTOWN, VIRGINIA
DATE: JULY 6, 1993

MONITORING WELL

NO.	TOP WELL ELEV.	DTW	DTP	PT	PT X.8	ADJ. DTW	ELEV. WATER	COMMENTS	LL ELEV.
MW-1S	48.57		13.46	-13.46	-10.77	10.77			35.11
MW-2S	48.23		12.99	-12.99	-10.39	10.39			35.24
MW-3S	48.72		13.61	-13.61	-10.89	10.89			35.11
MW-4S	47.89	12.94		0.00	0.00	12.94	34.95		34.95
MW-5S	49.06	14.45		0.00	0.00	14.45	34.61		34.61
RW-1S	49.92		14.72	-14.72	-11.78	11.78			35.20
MW-1H	49.54		14.21	-14.21	-11.37	11.37			35.33
MW-2H	50.20	14.89		0.00	0.00	14.89	35.31		35.31
MW-3H	50.37	14.75		0.00	0.00	14.75	35.62		35.62
MW-4H	50.23	14.93		0.00	0.00	14.93	35.30		35.30
MW-5H	51.16	15.81		0.00	0.00	15.81	35.35		35.35
RW-2H	52.18		16.69	-16.69	-13.35	13.35			35.49
RW-3X	52.51		17.13	-17.13	-13.70	13.70			35.38

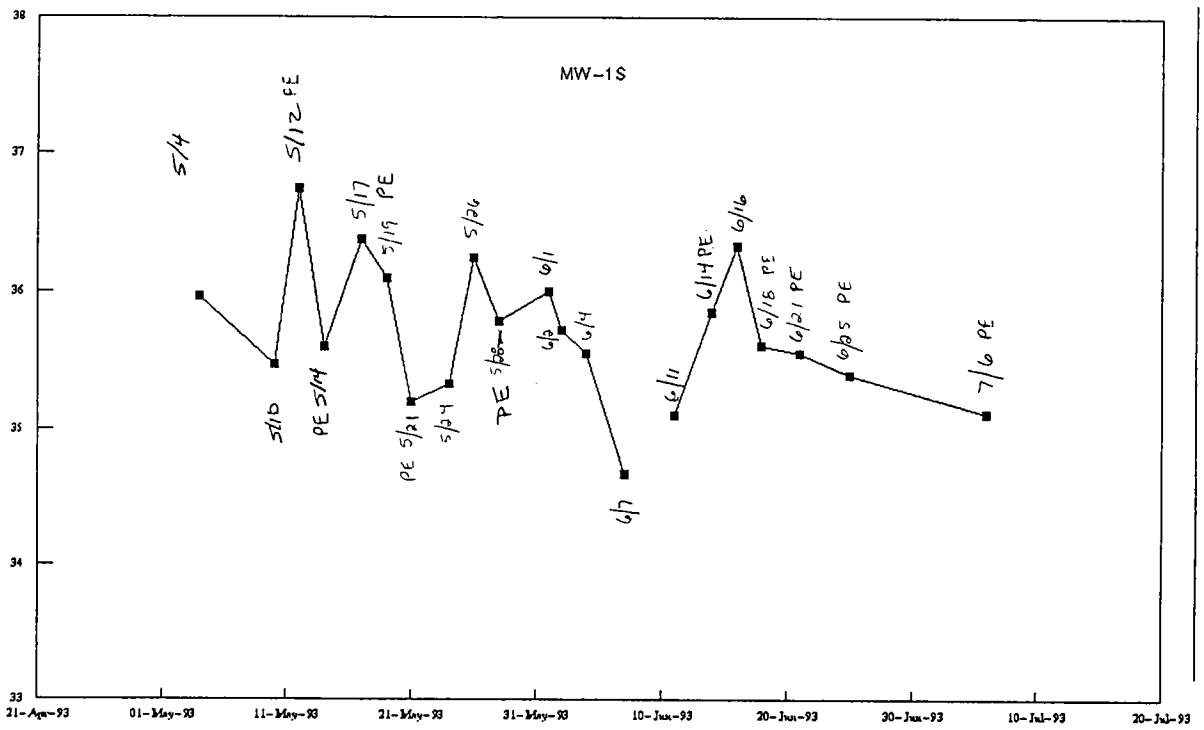
Hydrograph Data

LL ELEVATION, BASE; REGARDLESS OF IF TOP OF PRODUCT
OR TOP OF WATER TABLE. COMBINED. GRAPHS TO BE ANNOTATED.

DATE	WELL MW-1B	MW-2B	MW-5B	MW-4B	MW-6B	RW-1B	MW-1H	MW-2H	MW-3H	MW-4H	MW-5H	RW-2H	RW-3X
04-May-93	36.07	36.16	36.16	36.17	36.46	36.06	36.04	36.00	36.62	36.63	36.12	35.66	35.51
10-May-93	36.47	36.60	35.60	36.46	36.62	37.41	37.16	36.65	36.64	36.78	35.66	36.22	35.93
12-May-93	36.76	36.42	36.66	36.16	36.62	36.11	37.61	36.65	36.63	36.62	36.32	30.72	33.15
14-May-93	36.00	36.32	36.56	36.50	36.16	37.67	36.75	36.60	36.66	36.71	36.70	32.16	35.06
17-May-93	36.36	36.30	36.24	36.37	36.06	36.72	36.06	37.06	37.13	37.15	37.06	37.12	36.66
19-May-93	36.10	36.13	36.22	36.10	36.14	36.34	36.26	36.36	36.40	36.36	36.30	35.36	36.29
21-May-93	36.19	35.99	36.22	36.01	36.13	36.12	36.14	36.14	36.26	36.26	32.36	36.26	36.29
24-May-93	36.33	36.33	36.66	34.99	36.31	36.59	36.45	36.36	36.49	36.46	36.39	36.50	36.47
26-May-93	36.25	36.26	36.57	36.25	36.27	36.62	36.42	36.44	36.45	36.42	36.46	36.71	36.46
28-May-93	35.79	36.26	36.58	36.23	36.26	36.36	36.40	36.52	36.26	36.43	36.47	36.51	36.49
01-Jun-93	36.00	36.12	36.40	36.91	36.16	35.63	36.34	36.41	36.39	36.41	36.42	37.49	36.44
02-Jun-93	35.72	35.91	36.04	35.70	35.92	35.65	36.26	36.26	36.30	36.26	36.32	37.36	36.39
04-Jun-93	35.55	36.11	35.90	35.55	35.60	35.20	36.06	35.70	36.22	36.19	36.24	36.22	37.22
07-Jun-93	34.67	35.97	36.23	35.69	35.67	34.44	36.02	36.01	36.02	36.03	36.07	35.35	36.09
09-Jun-93		35.93	36.60	35.53	36.21	35.64	36.36	36.32	36.32	36.45	36.36	37.20	36.46
11-Jun-93	35.10	35.65	35.32	35.26	35.73	35.70		36.09	36.12	35.96			
14-Jun-93	35.65	35.89	35.64	35.79	35.76		35.81	35.85	35.83	35.75	35.90		
16-Jun-93	36.33	35.80	35.71	35.60	35.61	35.64	35.70	35.60	35.80	35.79	35.76	36.01	33.21
18-Jun-93	36.61	35.73	35.63	35.70	35.62	35.76	35.67	35.72	35.75	35.72	35.69	35.91	35.59
21-Jun-93	35.55	35.54	35.54	34.94	35.49	35.76	35.62	35.67	35.73	35.71	35.73	35.93	35.46
25-Jun-93	35.39	35.50	35.36	34.61	35.42	35.65	35.56	35.61	35.65	35.65	35.69	35.83	35.34
06-Jul-93	35.11	35.24	35.11	34.95	34.61	35.20	35.33	35.31	35.62	35.30	35.35	35.49	35.35

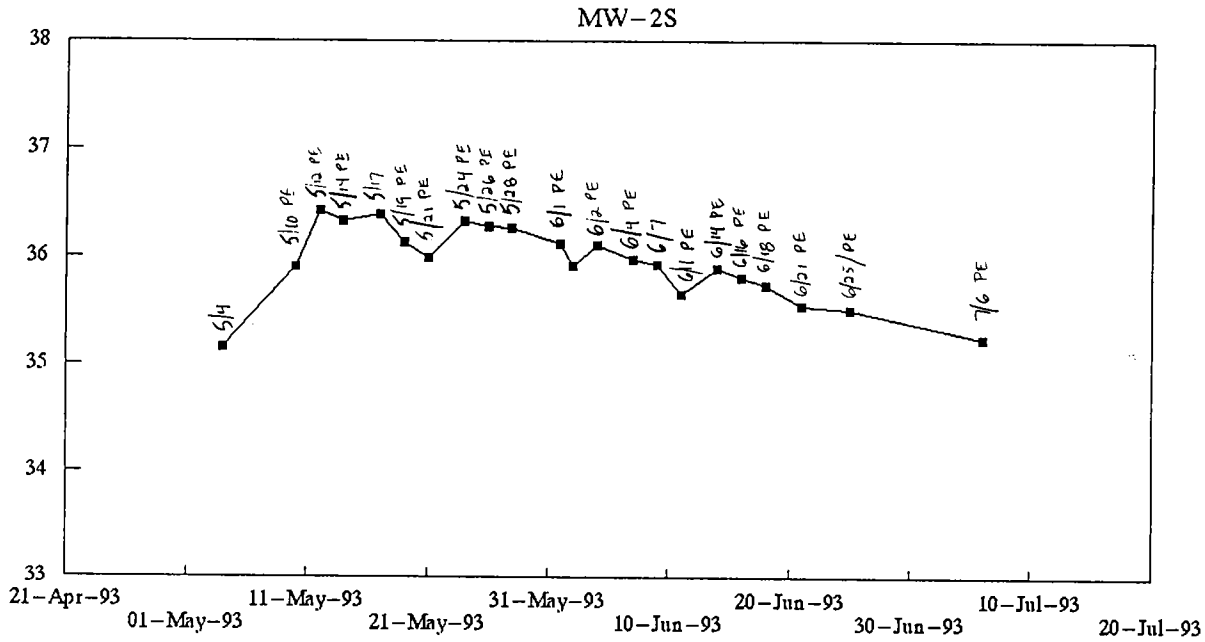
MW-1S

DATE	LL ELEV.
04-May-93	35.97
10-May-93	35.47
12-May-93	36.75
14-May-93	35.60
17-May-93	36.38
19-May-93	36.10
21-May-93	35.19
24-May-93	35.33
26-May-93	36.25
28-May-93	35.79
01-Jun-93	36.00
02-Jun-93	35.72
04-Jun-93	35.55
07-Jun-93	34.67
09-Jun-93	
11-Jun-93	35.10
14-Jun-93	35.85
16-Jun-93	36.33
18-Jun-93	35.61
21-Jun-93	35.55
25-Jun-93	35.39
06-Jul-93	35.11



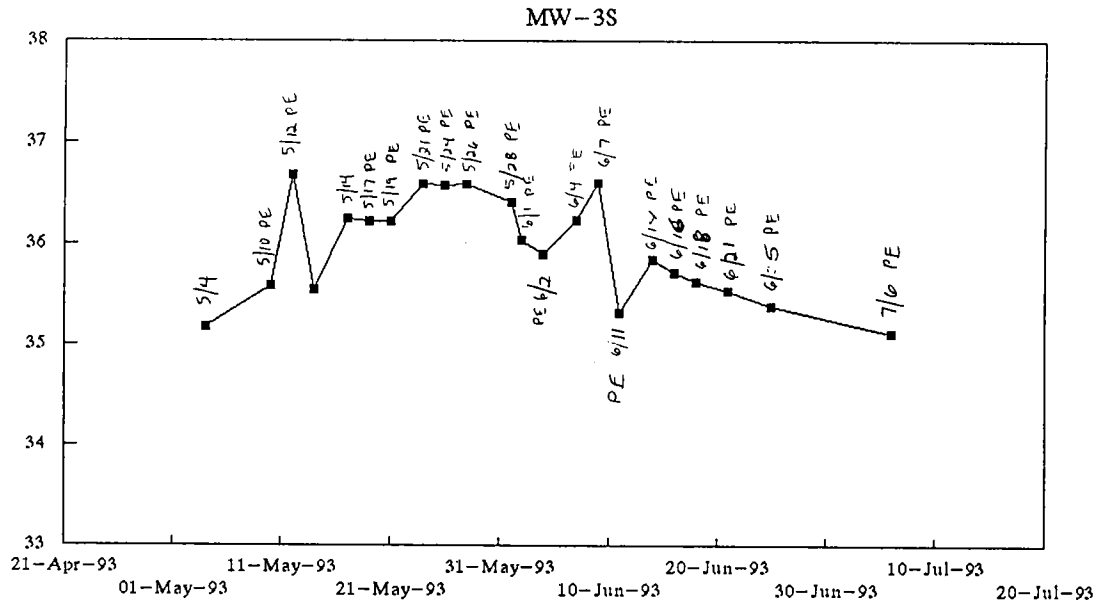
MW-2S

DATE	LL ELEV
04-May-93	35.15
10-May-93	35.90
12-May-93	36.42
14-May-93	36.32
17-May-93	36.39
19-May-93	36.13
21-May-93	35.99
24-May-93	36.33
26-May-93	36.28
28-May-93	36.26
01-Jun-93	36.12
02-Jun-93	35.91
04-Jun-93	36.11
07-Jun-93	35.97
09-Jun-93	35.93
11-Jun-93	35.65
14-Jun-93	35.89
16-Jun-93	35.80
18-Jun-93	35.73
21-Jun-93	35.54
25-Jun-93	35.50
06-Jul-93	35.24



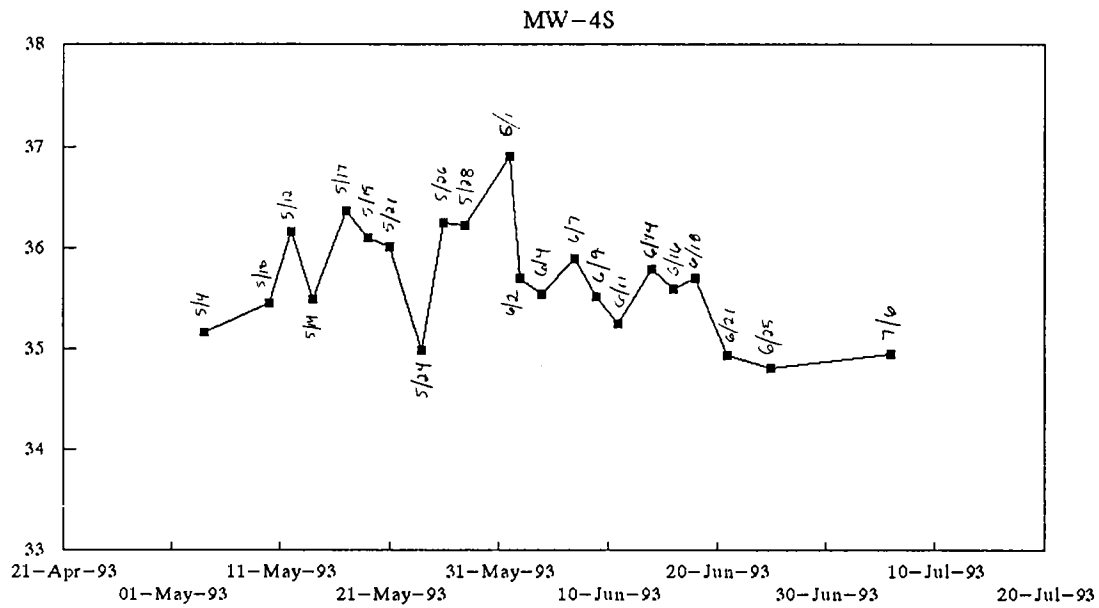
MW-3S B:\MW-3SHY

DATE	LL ELEV
04-May-93	35.18
10-May-93	35.59
12-May-93	36.68
14-May-93	35.55
17-May-93	36.24
19-May-93	36.22
21-May-93	36.22
24-May-93	36.58
26-May-93	36.57
28-May-93	36.58
01-Jun-93	36.40
02-Jun-93	36.04
04-Jun-93	35.90
07-Jun-93	36.23
09-Jun-93	36.60
11-Jun-93	35.32
14-Jun-93	35.84
16-Jun-93	35.71
18-Jun-93	35.63
21-Jun-93	35.54
25-Jun-93	35.38
06-Jul-93	35.11



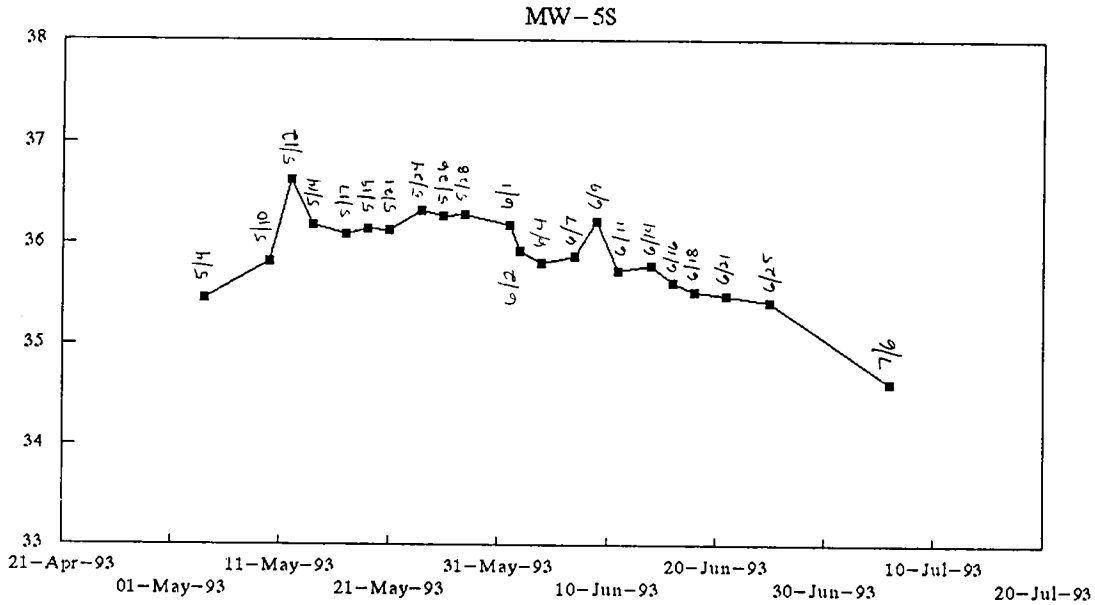
MW-4S b:\MW-4SHY

DATE	LL ELEV
04-May-93	35.17
10-May-93	35.46
12-May-93	36.16
14-May-93	35.50
17-May-93	36.37
19-May-93	36.10
21-May-93	36.01
24-May-93	34.99
26-May-93	36.25
28-May-93	36.23
01-Jun-93	36.91
02-Jun-93	35.70
04-Jun-93	35.55
07-Jun-93	35.89
09-Jun-93	35.53
11-Jun-93	35.26
14-Jun-93	35.79
16-Jun-93	35.60
18-Jun-93	35.70
21-Jun-93	34.94
25-Jun-93	34.81
06-Jul-93	34.95



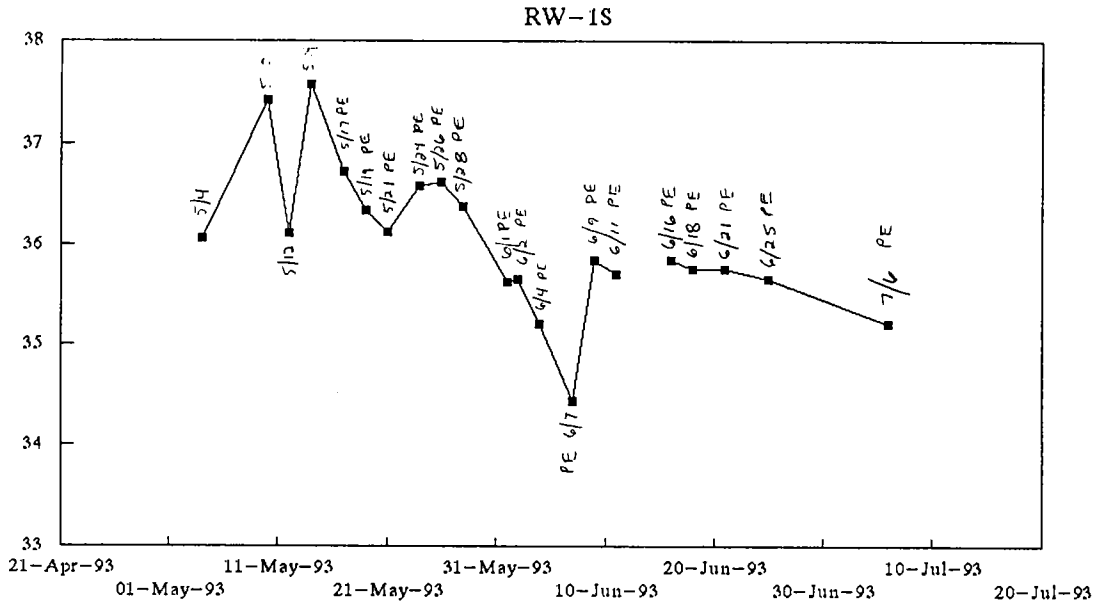
MW-5S B:\MW-5SHY

DATE	LLELEV
04-May-93	35.46
10-May-93	35.82
12-May-93	36.62
14-May-93	36.18
17-May-93	36.08
19-May-93	36.14
21-May-93	36.13
24-May-93	36.31
26-May-93	36.27
28-May-93	36.28
01-Jun-93	36.18
02-Jun-93	35.92
04-Jun-93	35.80
07-Jun-93	35.87
09-Jun-93	36.21
11-Jun-93	35.73
14-Jun-93	35.78
16-Jun-93	35.61
18-Jun-93	35.52
21-Jun-93	35.49
25-Jun-93	35.42
06-Jul-93	34.61



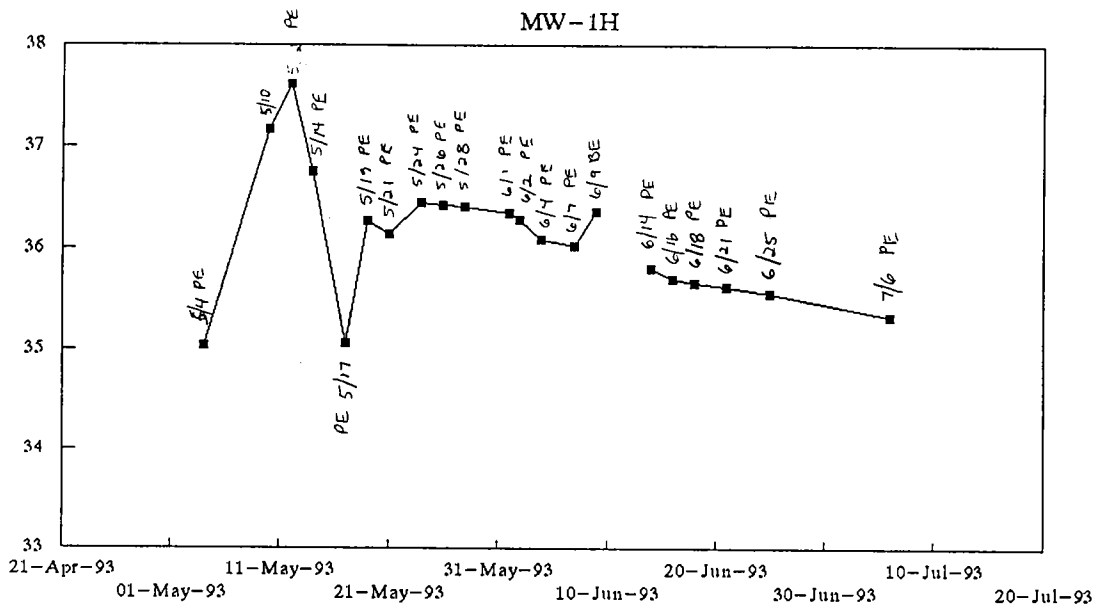
RW-1S B:\RW-1SHY

DATE	LL ELEV
04-May-93	36.06
10 May 93	37.41
12-May-93	36.11
14-May-93	37.57
17-May-93	36.72
19-May-93	36.34
21-May-93	36.12
24-May-93	36.59
26-May-93	36.62
28-May-93	36.38
01-Jun-93	35.63
02-Jun-93	35.65
04-Jun-93	35.20
07-Jun-93	34.44
09-Jun-93	35.84
11-Jun-93	35.70
14-Jun-93	
16-Jun-93	35.84
18-Jun-93	35.75
21-Jun-93	35.75
25-Jun-93	35.65
06-Jul-93	35.20



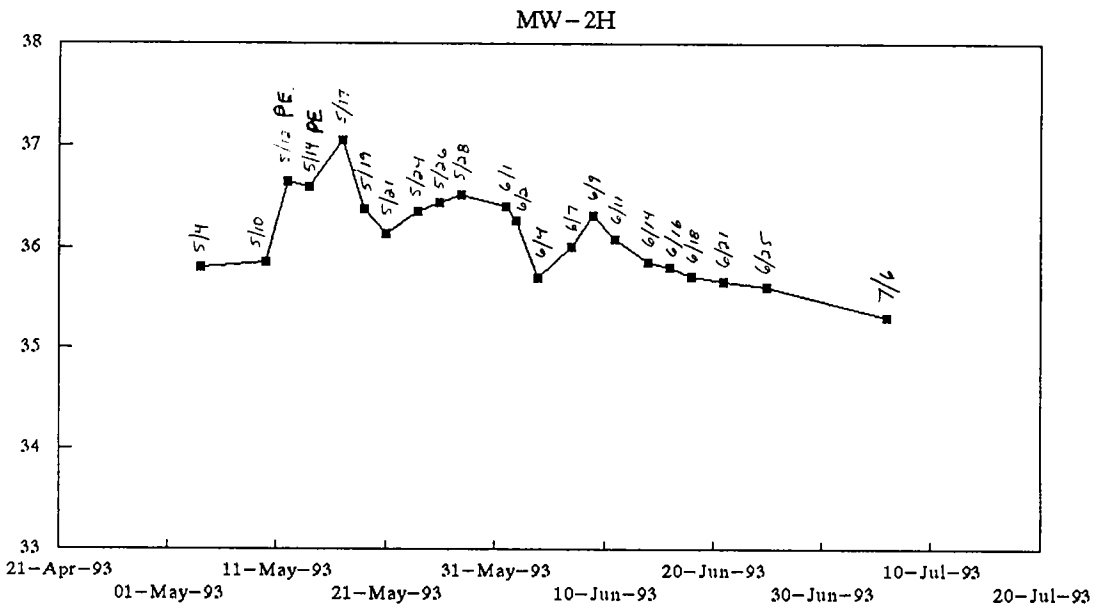
MW-1H b:\mw-1hshy

DATE	LL ELEV
04-May-93	35.04
10-May-93	37.16
12-May-93	37.61
14-May-93	36.75
17-May-93	35.06
19-May-93	36.26
21-May-93	36.14
24-May-93	36.45
26-May-93	36.42
28-May-93	36.40
01-Jun-93	36.34
02-Jun-93	36.28
04-Jun-93	36.08
07-Jun-93	36.02
09-Jun-93	36.36
11-Jun-93	
14-Jun-93	35.81
16-Jun-93	35.70
18-Jun-93	35.67
21-Jun-93	35.62
25-Jun-93	35.56
06-Jul-93	35.33



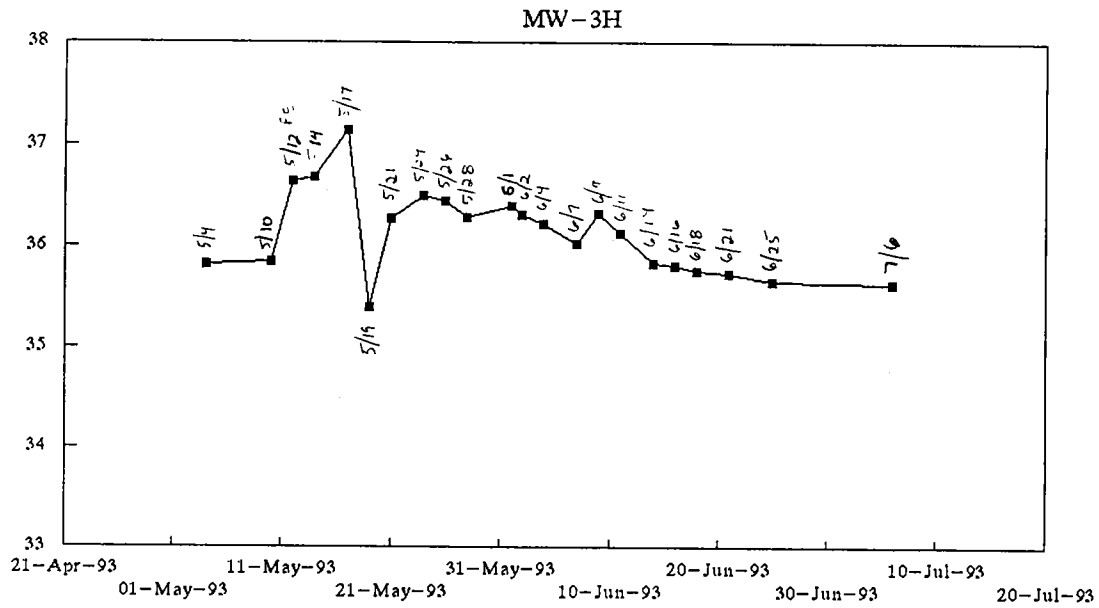
MW-2H B:\MW-2HSHY

DATE	LL ELEV
04-May-93	35.80
10-May-93	35.85
12-May-93	36.65
14-May-93	36.60
17-May-93	37.05
19-May-93	36.38
21-May-93	36.14
24-May-93	36.36
26-May-93	36.44
28-May-93	36.52
01-Jun-93	36.41
02-Jun-93	36.26
04-Jun-93	35.70
07-Jun-93	36.01
09-Jun-93	36.32
11-Jun-93	36.09
14-Jun-93	35.85
16-Jun-93	35.80
18-Jun-93	35.72
21-Jun-93	35.67
25-Jun-93	35.61
06-Jul-93	35.31



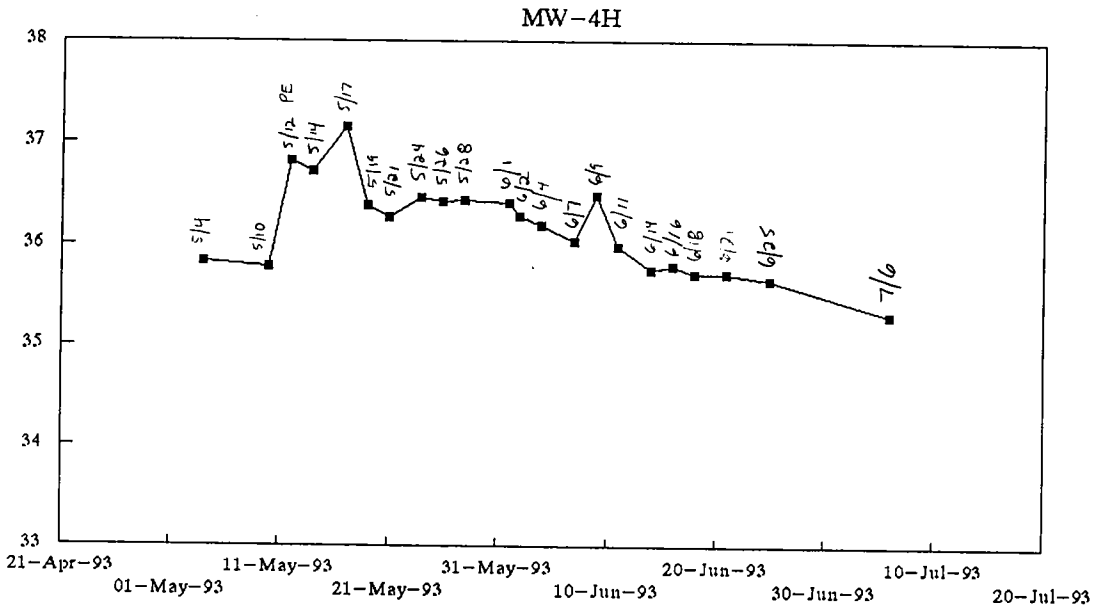
MW-3H b:\MW-3HSHY

DATE	LL ELEV
04-May-93	35.82
10-May-93	35.84
12-May-93	36.63
14-May-93	36.68
17-May-93	37.13
19-May-93	35.40
21-May-93	36.26
24-May-93	36.49
26-May-93	36.45
28-May-93	36.28
01-Jun-93	36.39
02-Jun-93	36.30
04-Jun-93	36.22
07-Jun-93	36.02
09-Jun-93	36.32
11-Jun-93	36.12
14-Jun-93	35.83
16-Jun-93	35.80
18-Jun-93	35.75
21-Jun-93	35.73
25-Jun-93	35.65
06-Jul-93	35.62



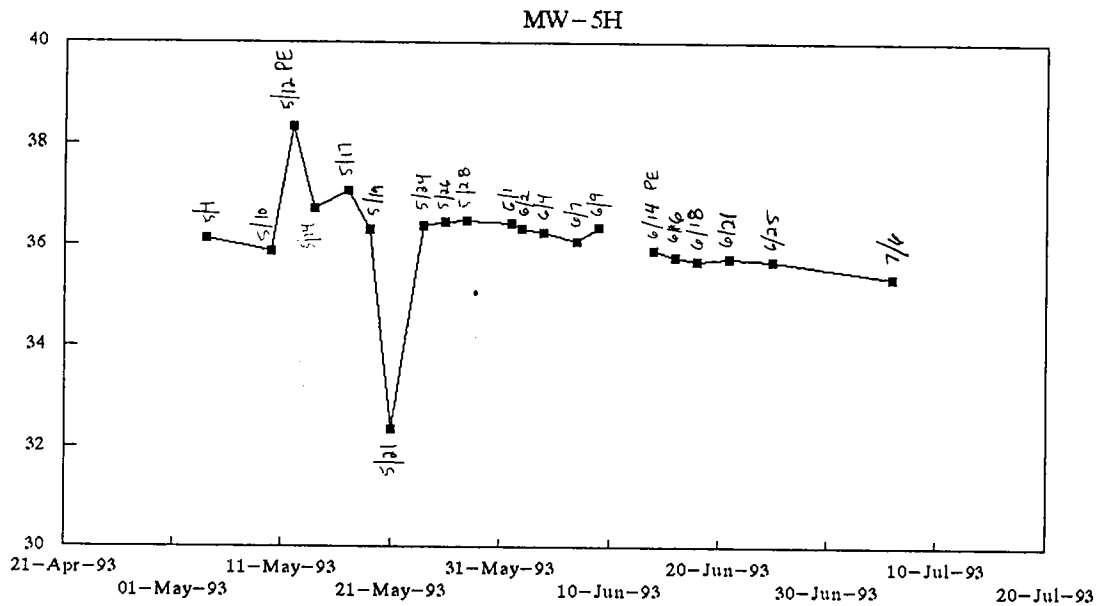
MW-4H b:\MW-4HSHY

DATE	LL ELEV
04-May-93	35.83
10-May-93	35.78
12-May-93	36.82
14-May-93	36.71
17-May-93	37.15
19-May-93	36.38
21-May-93	36.26
24-May-93	36.46
26-May-93	36.42
28-May-93	36.43
01-Jun-93	36.41
02-Jun-93	36.28
04-Jun-93	36.19
07-Jun-93	36.03
09-Jun-93	36.48
11-Jun-93	35.98
14-Jun-93	35.75
16-Jun-93	35.79
18-Jun-93	35.72
21-Jun-93	35.71
25-Jun-93	35.65
06-Jul-93	35.30



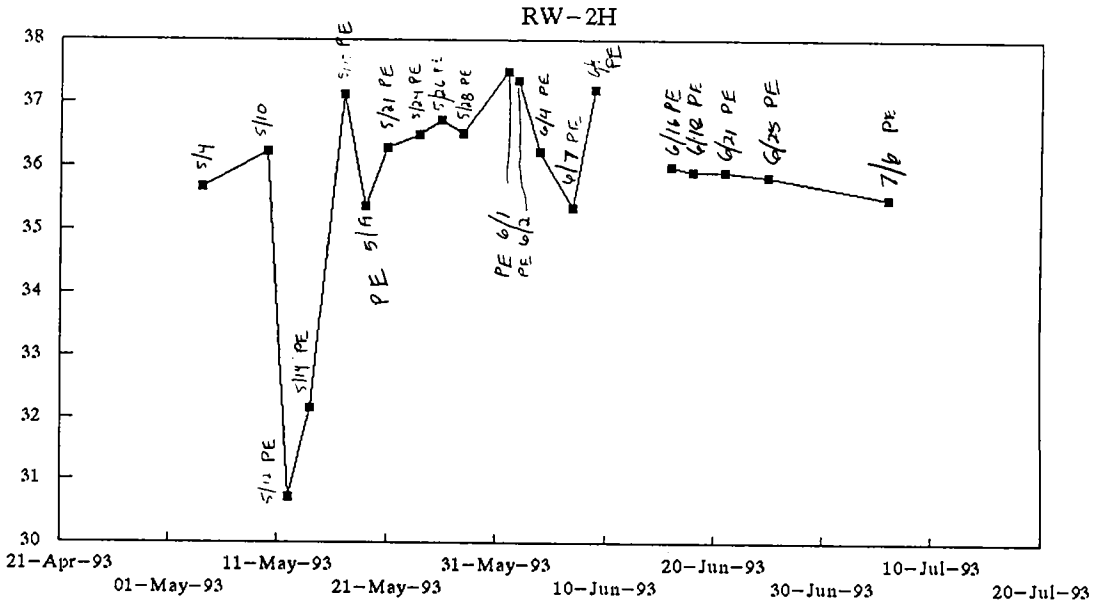
MW-5H B:\MW-5HSHY

DATE	LLELEV
04-May-93	36.12
10-May-93	35.86
12-May-93	38.32
14-May-93	36.70
17-May-93	37.08
19-May-93	36.30
21-May-93	32.36
24-May-93	36.39
26-May-93	36.46
28-May-93	36.47
01-Jun-93	36.42
02-Jun-93	36.32
04-Jun-93	36.24
07-Jun-93	36.07
09-Jun-93	36.36
11-Jun-93	
14-Jun-93	35.90
16-Jun-93	35.76
18-Jun-93	35.69
21-Jun-93	35.73
25-Jun-93	35.69
06-Jul-93	35.35



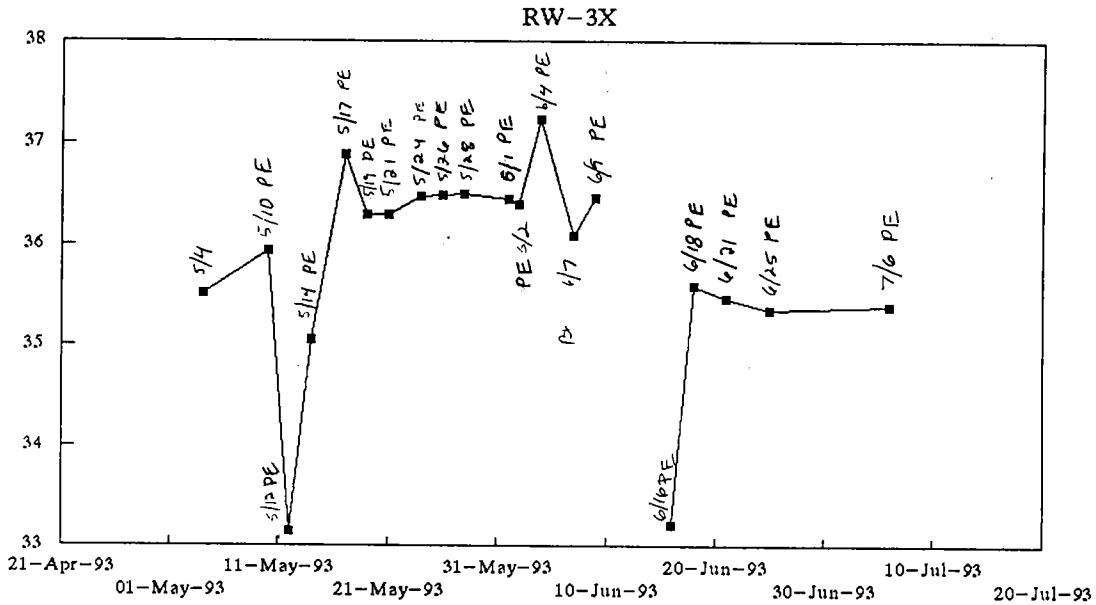
RW-2H B;\RW-2HSHY

DATE	LL ELEV
04-May-93	35.68
10 May 93	36.22
12-May-93	30.72
14-May-93	32.16
17-May-93	37.12
19-May-93	35.36
21-May-93	36.28
24-May-93	36.50
26-May-93	36.71
28-May-93	36.51
01-Jun-93	37.49
02-Jun-93	37.36
04-Jun-93	36.22
07-Jun-93	35.35
09-Jun-93	37.20
11-Jun-93	
14-Jun-93	
16-Jun-93	36.01
18-Jun-93	35.91
21-Jun-93	35.93
25-Jun-93	35.83
06-Jul-93	35.49



RW-3X B:\RW-3XHY

DATE	LL ELEV
04-May-93	35.51
10-May-93	35.93
12-May-93	33.15
14-May-93	35.05
17-May-93	36.88
19-May-93	36.29
21-May-93	36.29
24-May-93	36.47
26-May-93	36.48
28-May-93	36.49
01-Jun-93	36.44
02-Jun-93	36.39
04-Jun-93	37.22
07-Jun-93	36.09
09-Jun-93	36.46
11-Jun-93	
14-Jun-93	
16-Jun-93	33.21
18-Jun-93	35.59
21-Jun-93	35.46
25-Jun-93	35.34
06-Jul-93	35.38



APPENDIX D

AQUIFER ANALYSIS DATA

Data Logger Readings

SE2000
Environmental Logger
05/20 13:15

Unit# 414 Test 1

Setups:	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6
Type	Level (F)	Level (F)	Level (F)	Function	Function	Function
Mode	TOC	TOC	TOC			
I.D.	MW1	MW2	MW3	MW-4	MW-5	RW-1S
Reference	0.000	0.000	0.000			
SG	1.000	1.000	1.000			
Linearity	0.140	0.111	0.037	0.150	0.133	0.122
Scale factor	20.060	20.013	10.020	50.139	20.116	20.111
Offset	0.078	-0.052	0.003	-0.022	0.011	-0.010
Delay mSEC	50.000	50.000	50.000	50.000	50.000	50.000

Step 0 05/04 09:57:40

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6
(1020) 0.0000 1	-0.006	-0.012	-0.003	2.249	1.909	2.204
0.0083 2	-0.006	-0.006	-0.003	2.249	1.909	2.171
0.0166 3	-0.006	-0.012	-0.003	2.249	1.909	2.135
0.0250 4	0.000	-0.006	-0.003	2.249	1.909	2.102
0.0333 5	-0.006	-0.012	-0.003	2.249	1.909	2.066
0.0416	-0.006	-0.006	-0.003	2.249	1.909	2.033
0.0500	-0.006	-0.012	-0.003	2.249	1.909	2.003
0.0583	-0.006	-0.006	-0.003	2.249	1.909	1.970
0.0666	-0.006	-0.006	-0.003	2.249	1.909	1.937
0.0750 10	-0.006	-0.006	-0.003	2.249	1.909	1.904
0.0833	0.000	-0.006	-0.003	2.249	1.909	1.873
0.0916	-0.006	-0.006	-0.003	2.249	1.909	1.843
0.1000	0.000	-0.006	-0.003	2.249	1.909	1.813
0.1083	0.000	-0.012	-0.003	2.249	1.909	1.780
0.1166 15	0.000	-0.012	-0.003	2.249	1.909	1.749
0.1250	-0.006	-0.006	-0.003	2.249	1.909	1.716
0.1333	-0.006	-0.006	-0.003	2.249	1.909	1.686
0.1416	0.000	-0.006	-0.003	2.249	1.909	1.658
0.1500	0.000	-0.006	-0.003	2.249	1.909	1.625
0.1583 20	-0.006	-0.006	-0.003	2.249	1.909	1.598
0.1666	-0.006	-0.006	-0.003	2.249	1.909	1.567
0.1750	-0.006	-0.012	-0.003	2.249	1.906	1.540
0.1833	-0.006	-0.006	-0.003	2.249	1.909	1.510
0.1916	0.000	-0.006	-0.003	2.249	1.909	1.479
0.2000 25	-0.006	-0.006	-0.003	2.249	1.909	1.438
0.2083	-0.006	-0.006	-0.003	2.249	1.909	1.399
0.2166	-0.006	-0.006	-0.003	2.249	1.909	1.364
0.2250	-0.006	0.000	-0.003	2.249	1.909	1.333
0.2333	-0.012	-0.006	-0.003	2.249	1.909	1.306
0.2416 30	0.000	-0.006	-0.003	2.249	1.909	1.275
0.2500	-0.006	-0.006	-0.003	2.249	1.909	1.242
0.2583	0.000	-0.006	-0.003	2.249	1.909	1.204
0.2666	-0.006	-0.006	-0.003	2.249	1.909	1.160
0.2750	-0.006	-0.006	-0.003	2.249	1.909	1.121
0.2833 35	-0.006	-0.006	-0.003	2.249	1.909	1.083
0.2916	0.000	-0.012	-0.003	2.249	1.909	1.038

0.3000 37	0.000	-0.006	-0.003	2.249	1.909	1.005
0.3083	-0.006	-0.006	-0.003	2.249	1.909	0.964
0.3166	-0.006	-0.012	-0.003	2.249	1.909	0.925
0.3250 40	-0.006	-0.012	-0.003	2.249	1.909	0.890
0.3333	-0.006	-0.006	-0.003	2.249	1.909	0.862
0.3500	-0.006	-0.006	-0.003	2.249	1.909	0.813
0.3666	-0.006	-0.006	-0.003	2.249	1.909	0.763
0.3833	-0.006	0.000	-0.003	2.249	1.906	0.713
0.4000 45	-0.006	-0.006	0.000	2.249	1.906	0.664
0.4166	0.000	-0.006	-0.003	2.249	1.909	0.617
0.4333	-0.006	-0.006	-0.003	2.249	1.909	0.567
0.4500	-0.006	-0.006	-0.003	2.249	1.906	0.515
0.4666	0.000	-0.006	-0.003	2.249	1.909	0.474
0.4833 50	-0.006	-0.006	-0.003	2.249	1.909	0.427
0.5000	0.000	-0.006	-0.003	2.249	1.909	0.380
0.5166	-0.006	-0.006	0.000	2.249	1.909	0.328
0.5333	-0.006	-0.006	-0.003	2.249	1.906	0.289
0.5500	0.000	-0.006	-0.003	2.249	1.909	0.248
0.5666 55	-0.006	-0.006	0.000	2.249	1.909	0.212
0.5833	-0.006	-0.006	0.000	2.249	1.909	0.185
0.6000	0.000	-0.006	0.000	2.249	1.909	0.160
0.6166	0.000	-0.006	0.000	2.249	1.909	0.149
0.6333	-0.006	-0.006	0.000	2.249	1.909	0.138
0.6500 60	0.000	-0.006	-0.003	2.249	1.909	0.127
0.6666	-0.006	-0.006	-0.003	2.249	1.909	0.121
0.6833	-0.006	-0.006	0.000	2.249	1.909	0.119
0.7000	0.000	-0.006	0.000	2.249	1.909	0.116
0.7166	0.000	-0.006	-0.003	2.249	1.909	0.119
0.7333 65	-0.006	-0.006	-0.003	2.242	1.909	0.113
0.7500	0.000	-0.006	-0.003	2.249	1.909	0.113
0.7666	-0.006	-0.006	0.000	2.249	1.909	0.113
0.7833	0.000	-0.006	0.000	2.242	1.909	0.110
0.8000	0.000	-0.006	0.000	2.249	1.906	0.110
0.8166 70	0.000	-0.006	0.000	2.249	1.909	0.113
0.8333	-0.006	-0.006	0.000	2.249	1.909	0.119
0.8500	-0.006	-0.006	0.000	2.249	1.909	0.130
0.8666	0.000	-0.006	0.000	2.242	1.909	0.141
0.8833	0.000	-0.006	0.000	2.249	1.909	0.152
0.9000 75	0.000	-0.006	0.000	2.242	1.909	0.160
0.9166	-0.006	-0.006	0.000	2.242	1.906	0.171
0.9333	0.000	-0.006	0.000	2.249	1.909	0.179
0.9500	0.000	-0.006	0.000	2.249	1.909	0.190
0.9666	-0.006	-0.006	0.000	2.242	1.909	0.201
0.9833 80	0.000	-0.006	0.000	2.249	1.909	0.220
1.0000	0.000	-0.006	0.000	2.249	1.909	0.234
1.2000	0.000	-0.006	0.000	2.249	1.909	0.452
1.4000	0.000	-0.006	0.003	2.242	1.906	0.631
1.6000	0.006	0.000	0.006	2.236	1.906	0.779
1.8000 85	0.000	0.000	0.003	2.242	1.909	0.920
2.0000	0.000	-0.006	0.003	2.242	1.909	1.091
2.2000	0.006	-0.006	0.003	2.242	1.909	1.229
2.4000	0.000	-0.006	0.003	2.242	1.909	1.245
2.6000	0.000	-0.006	0.006	2.242	1.909	0.782
2.8000 90	0.000	-0.006	0.006	2.242	1.906	0.548
3.0000	0.000	-0.006	0.006	2.242	1.909	0.212
3.2000	0.000	-0.012	0.006	2.242	1.909	0.226
3.4000	0.000	-0.006	0.006	2.236	1.909	0.287
3.6000	0.006	-0.006	0.009	2.236	1.909	0.355
3.8000 95	0.006	-0.006	0.009	2.236	1.909	0.432
4.0000 96	0.006	-0.006	0.009	2.236	1.909	0.501

	1	2	3	4	5	6
4.2000	0.006	-0.006	0.009	2.236	1.909	0.565
4.4000	0.006	-0.006	0.009	2.236	1.909	0.631
4.6000	0.006	-0.006	0.009	2.236	1.909	0.705
4.8000	0.006	-0.006	0.012	2.236	1.906	0.771
5.0000	0.006	-0.006	0.012	2.236	1.909	0.840
5.2000	0.012	-0.006	0.012	2.236	1.909	0.920
5.4000	0.012	-0.006	0.015	2.236	1.909	1.000
5.6000	0.012	-0.006	0.015	2.236	1.909	1.063
5.8000	0.012	0.000	0.015	2.236	1.906	1.113
6.0000	0.012	-0.006	0.015	2.236	1.909	1.157
6.2000	0.012	-0.006	0.015	2.236	1.909	1.201
6.4000	0.012	-0.006	0.015	2.236	1.906	1.234
6.6000	0.019	-0.006	0.015	2.236	1.909	1.270
6.8000	0.019	0.000	0.019	2.236	1.909	1.300
7.0000	0.012	-0.006	0.019	2.236	1.909	1.325
7.2000	0.019	0.000	0.022	2.236	1.909	1.353
7.4000	0.019	0.000	0.022	2.229	1.909	1.386
7.6000	0.019	0.000	0.022	2.236	1.906	1.413
7.8000	0.019	0.000	0.022	2.236	1.906	1.441
8.0000	0.031	0.000	0.022	2.229	1.909	1.463
8.2000	0.019	-0.006	0.022	2.236	1.909	1.482
8.4000	0.025	0.000	0.022	2.229	1.906	1.499
8.6000	0.019	0.000	0.022	2.229	1.906	1.512
8.8000	0.025	0.000	0.022	2.229	1.906	1.521
9.0000	0.025	0.000	0.022	2.229	1.906	1.532
9.2000	0.025	-0.006	0.025	2.229	1.906	1.543
9.4000	0.025	0.000	0.025	2.229	1.906	1.548
9.6000	0.025	0.000	0.025	2.229	1.906	1.559
9.8000	0.025	0.000	0.025	2.229	1.906	1.565
10.0000	0.031	0.000	0.025	2.229	1.906	1.570
12.0000	0.038	0.000	0.028	2.229	1.906	1.614
14.0000	0.044	0.006	0.034	2.222	1.906	1.625
16.0000	0.044	0.006	0.031	2.222	1.903	1.669
18.0000	0.044	0.006	0.034	2.222	1.903	1.733
20.0000	0.057	0.019	0.044	2.215	1.900	1.807
22.0000	0.057	0.019	0.047	2.222	1.900	1.871
24.0000	0.057	0.025	0.050	2.215	1.900	1.926
26.0000	0.019	0.012	0.057	2.229	1.900	2.019
28.0000	-0.006	0.000	0.050	2.236	1.906	2.055
30.0000	-0.012	-0.006	0.053	2.236	1.906	2.055
32.0000	-0.019	-0.012	0.047	2.242	1.909	2.064
34.0000	-0.019	-0.019	0.047	2.242	1.909	2.075
36.0000	-0.031	-0.025	0.041	2.249	1.912	2.088
38.0000	-0.038	-0.031	0.038	2.249	1.914	2.119
40.0000	-0.038	-0.031	0.044	2.249	1.914	2.127
42.0000	-0.038	-0.038	0.041	2.256	1.914	2.135
44.0000	-0.031	-0.038	0.047	2.249	1.912	2.121
46.0000	-0.031	-0.038	0.047	2.249	1.912	2.102
48.0000	-0.038	-0.038	0.047	2.249	1.914	2.113
50.0000	-0.019	-0.038	0.047	2.242	1.914	2.017
52.0000	0.038	-0.025	0.047	2.215	1.912	2.003
54.0000	0.044	-0.012	0.050	2.222	1.909	2.042
56.0000	0.025	0.000	0.060	2.236	1.903	2.248
58.0000	0.000	-0.006	0.050	2.242	1.909	2.259
60.0000	-0.006	-0.012	0.044	2.242	1.912	2.251
62.0000	-0.019	-0.012	0.047	2.249	1.912	2.259
64.0000	-0.025	-0.019	0.041	2.249	1.914	2.246
66.0000	-0.019	-0.019	0.050	2.249	1.912	2.196
68.0000	-0.031	-0.025	0.038	2.256	1.917	2.212
70.0000	-0.031	-0.038	0.028	2.270	1.923	2.243

	1	2	3	4	5	6
72.0000	-0.025	-0.031	0.034	2.256	1.917	2.204
74.0000	-0.025	-0.031	0.028	2.256	1.917	2.190
76.0000	-0.031	-0.038	0.025	2.270	1.920	2.190
78.0000	-0.025	-0.031	0.028	2.256	1.917	2.179
80.0000	-0.019	-0.025	0.038	2.249	1.914	2.177
82.0000	-0.019	-0.031	0.031	2.256	1.917	2.182
84.0000	-0.038	-0.044	0.009	2.270	1.925	2.193
86.0000	-0.044	-0.038	0.009	2.270	1.925	2.193
88.0000	-0.038	-0.038	0.022	2.270	1.923	2.193
90.0000	-0.031	-0.038	0.025	2.263	1.920	2.196
92.0000	-0.050	-0.050	0.006	2.277	1.925	2.210
94.0000	-0.050	-0.050	0.000	2.284	1.925	2.218
96.0000	-0.057	-0.057	-0.003	2.284	1.931	2.221
98.0000	-0.057	-0.057	-0.009	2.284	1.931	2.226
100.000	-0.057	-0.057	-0.012	2.291	1.934	2.221
120.000	-0.088	-0.076	-0.034	2.304	1.942	2.235
140.000	-0.120	-0.095	-0.053	2.311	1.956	2.215
160.000	-0.146	-0.114	-0.066	2.325	1.967	2.124
180.000	-0.177	-0.139	-0.098	2.332	1.986	2.144
200.000	-0.177	-0.133	-0.079	2.325	1.980	2.108
220.000	-0.197	-0.139	-0.101	2.332	1.994	2.105
240.000	-0.197	-0.139	-0.104	2.332	2.002	2.091
260.000	-0.222	-0.139	-0.123	2.353	2.014	2.077
280.000	-0.197	-0.069	-0.120	2.332	2.011	2.028
300.000	-0.222	-0.088	-0.139	2.332	2.025	2.022
320.000	-0.235	-0.164	-0.142	2.325	2.036	2.014
340.000	-0.260	-0.196	-0.158	2.346	2.047	2.017
360.000	-0.273	-0.209	-0.158	2.339	2.049	1.989
380.000	-0.292	-0.215	-0.165	2.339	2.058	1.956
400.000	-0.298	-0.209	-0.161	2.339	2.058	1.953
420.000	-0.317	-0.221	-0.168	2.339	2.069	1.956
440.000	-0.330	-0.228	-0.174	2.346	2.074	1.973
460.000	-0.343	-0.234	-0.180	2.346	2.077	1.959
480.000	-0.349	-0.240	-0.187	2.346	2.085	1.967
500.000	-0.355	-0.247	-0.187	2.346	2.088	1.970
520.000	-0.374	-0.253	-0.193	2.353	2.093	1.967
540.000	-0.387	-0.266	-0.200	2.359	2.099	1.964
560.000	-0.394	-0.272	-0.206	2.359	2.105	1.964
580.000	-0.406	-0.278	-0.212	2.359	2.107	1.956
600.000	-0.406	-0.278	-0.219	2.359	2.110	1.945
620.000	-0.425	-0.285	-0.225	2.366	2.116	1.964
640.000	-0.432	-0.285	-0.228	2.366	2.118	1.909
660.000	-0.438	-0.291	-0.231	2.366	2.121	1.898
680.000	-0.444	-0.297	-0.238	2.366	2.127	1.906
700.000	-0.451	-0.304	-0.244	2.366	2.129	1.915
720.000	-0.476	-0.310	-0.250	2.373	2.135	1.904
740.000	-0.476	-0.310	-0.253	2.373	2.135	1.901
760.000	-0.502	-0.323	-0.260	2.373	2.140	1.893
780.000	-0.470	-0.323	-0.260	2.359	2.143	1.862
800.000	1.061	-0.190	0.193	2.057	2.102	1.512
820.000	0.915	0.000	0.657	2.009	2.066	1.454
840.000	0.336	0.057	0.574	2.091	2.063	1.631
860.000	0.133	0.019	0.517	2.132	2.066	1.730
880.000	0.019	-0.012	0.457	2.153	2.074	1.769
900.000	-0.031	-0.031	0.409	2.174	2.077	1.824
920.000	-0.063	-0.044	0.361	2.181	2.082	1.865
940.000	-0.088	-0.063	0.320	2.194	2.088	1.904
960.000	-0.108	-0.076	0.282	2.201	2.093	1.920
980.000	-0.127	-0.082	0.250	2.208	2.093	1.934
1000.00	-0.139	-0.088	0.222	2.215	2.099	1.970

		2	3	4	5	6
1200.00	-0.222	-0.145	0.066	2.249	2.121	2.080
1400.00	-0.228	-0.164	0.003	2.263	2.107	2.124

YORKTOWN PUMP TEST DATA
MAY 4, 1993

IN MINUTES

LINE NO	ELAPSED TIME	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6
1	0.0000	-0.006	-0.012	-0.003	2.249	1.909	2.204
2	0.0083	-0.006	-0.006	-0.003	2.249	1.909	2.171
3	0.0166	-0.006	-0.012	-0.003	2.249	1.909	2.135
4	0.0250	0.000	-0.006	-0.003	2.249	1.909	2.102
5	0.0333	-0.006	-0.012	-0.003	2.249	1.909	2.066
6	0.0416	-0.006	-0.006	-0.003	2.249	1.909	2.033
7	0.0500	-0.006	-0.012	-0.003	2.249	1.909	2.003
8	0.0583	-0.006	-0.006	-0.003	2.249	1.909	1.970
9	0.0666	-0.006	-0.006	-0.003	2.249	1.909	1.937
10	0.0750	-0.006	-0.006	-0.003	2.249	1.909	1.904
11	0.0833	0.000	-0.006	-0.003	2.249	1.909	1.873
12	0.0916	-0.006	-0.006	-0.003	2.249	1.909	1.843
13	0.1000	0.000	-0.006	-0.003	2.249	1.909	1.813
14	0.1083	0.000	-0.012	-0.003	2.249	1.909	1.780
15	0.1166	0.000	-0.012	-0.003	2.249	1.909	1.749
16	0.1250	-0.006	-0.006	-0.003	2.249	1.909	1.716
17	0.1333	-6.000	-0.006	-0.003	2.249	1.909	1.686
18	0.1416	0.000	-0.006	-0.003	2.249	1.909	1.658
19	0.1500	0.000	-0.006	-0.003	2.249	1.909	1.625
20	0.1583	-0.006	-0.006	-0.003	2.249	1.909	1.598
21	0.1666	-0.006	-0.006	-0.003	2.249	1.909	1.567
22	0.1750	-0.006	-0.012	-0.003	2.249	1.909	1.540
23	0.1833	-0.006	-0.006	-0.003	2.249	1.909	1.510
24	0.1916	0.000	-0.006	-0.003	2.249	1.909	1.479
25	0.2000	-0.006	-0.006	-0.003	2.249	1.909	1.438
26	0.2083	-0.006	-0.006	-0.003	2.249	1.909	1.399
27	0.2166	-0.006	-0.006	-0.003	2.249	1.909	1.364
28	0.2250	-0.006	-0.006	-0.003	2.249	1.909	1.333
29	0.2333	-0.012	-0.006	-0.003	2.249	1.909	1.306
30	0.2416	0.000	-0.006	-0.003	2.249	1.909	1.275
31	0.2500	-0.006	-0.006	-0.003	2.249	1.909	1.242
32	0.2583	0.000	-0.006	-0.003	2.249	1.909	1.204
33	0.2666	-0.006	-0.006	-0.003	2.249	1.909	1.160
34	0.2750	-0.006	-0.006	-0.003	2.249	1.909	1.121
35	0.2833	-0.006	-0.006	-0.003	2.249	1.909	1.083
36	0.2916	0.000	-0.012	-0.003	2.249	1.909	1.038
37	0.3000	0.000	-0.006	-0.003	2.249	1.909	1.005
38	0.3083	-0.006	-0.006	-0.003	2.249	1.909	0.964
39	0.3166	-0.006	-0.012	-0.003	2.249	1.909	0.925
40	0.3250	-0.006	-0.012	-0.003	2.249	1.909	0.890
41	0.3333	-0.006	-0.006	-0.003	2.249	1.909	0.862
42	0.3500	-0.006	-0.006	-0.003	2.249	1.909	0.813
43	0.3666	-0.006	-0.006	-0.003	2.249	1.909	0.763
44	0.3833	-0.006	0.000	-0.003	2.249	1.906	0.713
45	0.4000	-0.006	-0.006	0.000	2.249	1.906	0.664
46	0.4166	0.000	-0.006	-0.003	2.249	1.909	0.617
47	0.4333	-0.006	-0.006	-0.003	2.249	1.909	0.567
48	0.4500	-0.006	-0.006	-0.003	2.249	1.906	0.515
49	0.4666	0.000	-0.006	-0.003	2.249	1.909	0.474
50	0.4833	-0.006	-0.006	-0.003	2.249	1.909	0.427
51	0.5000	0.000	-0.006	-0.003	2.249	1.909	0.380
52	0.5166	-0.006	-0.006	0.000	2.249	1.909	0.328

YORKTOWN PUMP TEST DATA
MAY 4, 1993

IN MINUTES

LINE NO	ELAPSED TIME	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6
53	0.5333	-0.006	-0.006	-0.003	2.249	1.906	0.289
54	0.5500	0.000	-0.006	-0.003	2.249	1.909	0.248
55	0.5666	-0.006	-0.006	0.000	2.249	1.909	0.212
56	0.5833	-0.006	-0.006	0.000	2.249	1.909	0.185
57	0.6000	0.000	-0.006	0.000	2.249	1.909	0.160
58	0.6166	0.000	-0.006	0.000	2.249	1.909	0.149
59	0.6333	-0.006	-0.006	0.000	2.249	1.909	0.138
60	0.6500	0.000	-0.006	-0.003	2.249	1.909	0.127
61	0.6666	-0.006	-0.006	-0.003	2.249	1.909	0.121
62	0.6833	-0.006	-0.006	0.000	2.249	1.909	0.119
63	0.7000	0.000	-0.006	0.000	2.249	1.909	0.116
64	0.7166	0.000	-0.006	-0.003	2.249	1.909	0.119
65	0.7333	-0.006	-0.006	-0.003	2.242	1.909	0.113
66	0.7500	0.000	-0.006	-0.003	2.249	1.909	0.113
67	0.7666	-0.006	-0.006	0.000	2.249	1.909	0.113
68	0.7833	0.000	-0.006	0.000	2.242	1.909	0.110
69	0.8000	0.000	-0.006	0.000	2.249	1.906	0.110
70	0.8166	0.000	-0.006	0.000	2.249	1.909	0.113
71	0.8333	-0.006	-0.006	0.000	2.249	1.909	0.119
72	0.8500	-0.006	-0.006	0.000	2.249	1.909	0.130
73	0.8666	0.000	-0.006	0.000	2.242	1.909	0.141
74	0.8833	0.000	-0.006	0.000	2.249	1.909	0.152
75	0.9000	0.000	-0.006	0.000	2.242	1.909	0.160
76	0.9166	-0.006	-0.006	0.000	2.242	1.906	0.171
77	0.9333	0.000	-0.006	0.000	2.249	1.909	0.179
78	0.9500	0.000	-0.006	0.000	2.249	1.909	0.190
79	0.9666	-0.006	-0.006	0.000	2.242	1.909	0.201
80	0.9833	0.000	-0.006	0.000	2.249	1.909	0.220
81	1.0000	0.000	-0.006	0.000	2.249	1.909	0.234
82	1.2000	0.000	-0.006	0.000	2.249	1.909	0.452
83	1.4000	0.000	-0.006	0.003	2.242	1.906	0.631
84	1.6000	0.006	0.000	0.006	2.236	1.906	0.779
85	1.8000	0.000	0.000	0.003	2.242	1.909	0.920
86	2.0000	0.000	-0.006	0.003	2.242	1.909	1.091
87	2.2000	0.006	-0.006	0.003	2.242	1.909	1.229
88	2.4000	0.000	-0.006	0.003	2.242	1.909	1.245
89	2.6000	0.000	-0.006	0.006	2.242	1.909	0.782
90	2.8000	0.000	-0.006	0.006	2.242	1.906	0.548
91	3.0000	0.000	-0.006	0.006	2.242	1.909	0.212
92	3.2000	0.000	-0.012	0.006	2.242	1.909	0.226
93	3.4000	0.000	-0.006	0.006	2.236	1.909	0.287
94	3.6000	0.006	-0.006	0.009	2.236	1.909	0.355
95	3.8000	0.006	-0.006	0.009	2.236	1.909	0.432
96	4.0000	0.006	-0.006	0.009	2.236	1.909	0.501
97	4.2000	0.006	-0.006	0.009	2.236	1.909	0.565
98	4.4000	0.006	-0.006	0.009	2.236	1.909	0.631
99	4.6000	0.006	-0.006	0.009	2.236	1.909	0.705
100	4.8000	0.006	-0.006	0.012	2.236	1.906	0.771
101	5.0000	0.006	-0.006	0.012	2.236	1.909	0.840
102	5.2000	0.012	-0.006	0.012	2.236	1.909	0.920
103	5.4000	0.012	-0.006	0.015	2.236	1.909	1.000
104	5.6000	0.012	-0.006	0.015	2.236	1.909	1.063

YORKTOWN PUMP TEST DATA
MAY 4, 1993

IN MINUTES

LINE NO	ELAPSED TIME	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6
105	5.8000	0.012	0.000	0.015	2.236	1.906	1.113
106	6.0000	0.012	-0.006	0.015	2.236	1.909	1.157
107	6.2000	0.012	-0.006	0.015	2.236	1.909	1.201
108	6.4000	0.012	-0.006	0.015	2.236	1.906	1.234
109	6.6000	0.019	-0.006	0.015	2.236	1.909	1.270
110	6.8000	0.019	0.000	0.019	2.236	1.909	1.300
111	7.0000	0.012	-0.006	0.019	2.236	1.909	1.325
112	7.2000	0.019	0.000	0.022	2.236	1.909	1.353
113	7.4000	0.019	0.000	0.022	2.229	1.909	1.386
114	7.6000	0.019	0.000	0.022	2.236	1.906	1.413
115	7.8000	0.019	0.000	0.022	2.236	1.906	1.441
116	8.0000	0.031	0.000	0.022	2.229	1.909	1.463
117	8.2000	0.019	-0.006	0.022	2.236	1.909	1.482
118	8.4000	0.025	0.000	0.022	2.229	1.906	1.499
119	8.6000	0.019	0.000	0.022	2.229	1.906	1.512
120	8.8000	0.025	0.000	0.022	2.229	1.906	1.521
121	9.0000	0.025	0.000	0.022	2.229	1.906	1.532
122	9.2000	0.025	-0.006	0.025	2.229	1.906	1.543
123	9.4000	0.025	0.000	0.025	2.229	1.906	1.548
124	9.6000	0.025	0.000	0.025	2.229	1.906	1.559
125	9.8000	0.025	0.000	0.025	2.229	1.906	1.565
126	10.0000	0.031	0.000	0.025	2.229	1.906	1.570
127	12.0000	0.038	0.000	0.028	2.229	1.906	1.614
128	14.0000	0.044	0.006	0.034	2.222	1.906	1.625
129	16.0000	0.044	0.006	0.031	2.222	1.903	1.669
130	18.0000	0.044	0.006	0.034	2.222	1.903	1.733
131	20.0000	0.057	0.019	0.044	2.215	1.900	1.807
132	22.0000	0.057	0.019	0.047	2.222	1.900	1.871
133	24.0000	0.057	0.025	0.050	2.215	1.900	1.926
134	26.0000	0.019	0.012	0.057	2.229	1.900	2.019
135	28.0000	-0.006	0.000	0.050	2.236	1.906	2.055
136	30.0000	-0.012	-0.006	0.053	2.236	1.906	2.055
137	32.0000	-0.019	-0.012	0.047	2.242	1.909	2.064
138	34.0000	-0.019	-0.019	0.047	2.242	1.909	2.075
139	36.0000	-0.031	-0.025	0.041	2.249	1.912	2.088
140	38.0000	-0.038	-0.031	0.038	2.249	1.914	2.119
141	40.0000	-0.038	-0.031	0.044	2.249	1.914	2.127
142	42.0000	-0.038	-0.038	0.041	2.256	1.914	2.135
143	44.0000	-0.031	-0.038	0.047	2.249	1.912	2.121
144	46.0000	-0.031	-0.038	0.047	2.249	1.912	2.102
145	48.0000	-0.038	-0.038	0.047	2.249	1.914	2.113
146	50.0000	-0.019	-0.038	0.047	2.242	1.914	2.017
147	52.0000	0.038	-0.025	0.047	2.215	1.912	2.003
148	54.0000	0.044	-0.012	0.050	2.222	1.909	2.042
149	56.0000	0.025	0.000	0.060	2.236	1.903	2.248
150	58.0000	0.000	-0.006	0.050	2.242	1.909	2.259
151	60.0000	-0.006	-0.012	0.044	2.242	1.912	2.251
152	62.0000	-0.019	-0.012	0.047	2.249	1.912	2.259
153	64.0000	-0.025	-0.019	0.041	2.249	1.914	2.246
154	66.0000	-0.019	-0.019	0.050	2.249	1.912	2.196
155	68.0000	-0.031	-0.025	0.038	2.256	1.917	2.212
156	70.0000	-0.031	-0.038	0.028	2.270	1.923	2.243

YORKTOWN PUMP TEST DATA
MAY 4, 1993

IN MINUTES

LINE NO	ELAPSED TIME	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6
157	72.0000	-0.025	-0.031	0.034	2.256	1.917	2.204
158	74.0000	-0.025	-0.031	0.028	2.256	1.917	2.190
159	76.0000	-0.031	-0.038	0.025	2.270	1.920	2.19
160	78.0000	-0.025	-0.031	0.028	2.256	1.917	2.179
161	80.0000	-0.019	-0.025	0.038	2.249	1.914	2.177
162	82.0000	-0.019	-0.031	0.031	2.256	1.917	2.182
163	84.0000	-0.038	-0.044	0.009	2.270	1.925	2.193
164	86.0000	-0.044	-0.038	0.009	2.270	1.925	2.193
165	88.0000	-0.038	-0.038	0.022	2.270	1.923	2.193
166	90.0000	-0.031	-0.038	0.025	2.263	1.920	2.196
167	92.0000	-0.050	-0.050	0.006	2.277	1.925	2.210
168	94.0000	-0.050	-0.050	0.000	2.284	1.925	2.218
169	96.0000	-0.057	-0.057	-0.003	2.284	1.931	2.221
170	98.0000	-0.057	-0.057	-0.009	2.284	1.931	2.226
171	100.0000	-0.057	-0.057	-0.012	2.291	1.934	2.221
172	120.0000	-0.088	-0.076	-0.034	2.304	1.942	2.235
173	140.0000	-0.120	-0.095	-0.053	2.311	1.956	2.215
174	160.0000	-0.146	-0.114	-0.066	2.325	1.967	2.124
175	180.0000	-0.177	-0.133	-0.098	2.332	1.986	2.144
176	200.0000	-0.177	-0.139	-0.079	2.325	1.980	2.108
177	220.0000	-0.197	-0.139	-0.101	2.332	1.994	2.105
178	240.0000	-0.197	-0.139	-0.104	2.332	2.002	2.091
179	260.0000	-0.222	-0.139	-0.123	2.353	2.014	2.077
180	280.0000	-0.197	-0.069	-0.120	2.332	2.011	2.028
181	300.0000	-0.222	-0.088	-0.139	2.332	2.025	2.022
182	320.0000	-0.235	-0.164	-0.142	2.325	2.036	2.014
183	340.0000	-0.260	-0.196	-0.158	2.346	2.047	2.017
184	360.0000	-0.273	-0.209	-0.158	2.339	2.049	1.989
185	380.0000	-0.292	-0.215	-0.165	2.339	2.058	1.956
186	400.0000	-0.298	-0.209	-0.161	2.339	2.058	1.953
187	420.0000	-0.317	-0.221	-0.168	2.339	2.069	1.956
188	440.0000	-0.330	-0.228	-0.174	2.346	2.074	1.973
189	460.0000	-0.343	-0.234	-0.180	2.346	2.077	1.959
190	480.0000	-0.349	-0.240	-0.187	2.346	2.085	1.967
191	500.0000	-0.355	-0.247	-0.187	2.346	2.088	1.970
192	520.0000	-0.374	-0.253	-0.193	2.353	2.093	1.967
193	540.0000	-0.387	-0.266	-0.200	2.359	2.099	1.964
194	560.0000	-0.394	-0.276	-0.206	2.359	2.105	1.964
195	580.0000	-0.406	-0.278	-0.212	2.359	2.107	1.956
196	600.0000	-0.406	-0.278	-0.219	2.359	2.110	1.945
197	620.0000	-0.425	-0.285	-0.225	2.366	2.116	1.964
198	640.0000	-0.432	-0.285	-0.228	2.366	2.118	1.909
199	660.0000	-0.438	-0.291	-0.231	2.366	2.121	1.898
200	680.0000	-0.444	-0.297	-0.238	2.366	2.127	1.906
201	700.0000	-0.451	-0.304	-0.244	2.366	2.129	1.915
202	720.0000	-0.476	-0.310	-0.250	2.373	2.135	1.904
203	740.0000	-0.476	-0.310	-0.253	2.373	2.135	1.901
204	760.0000	-0.502	-0.323	-0.260	2.373	2.140	1.893
205	780.0000	-0.470	-0.323	-0.260	2.359	2.143	1.862
206	800.0000	1.061	-0.190	0.193	2.057	2.102	1.512
207	820.0000	0.915	0.000	0.657	2.009	2.066	1.454
208	840.0000	0.336	0.057	0.574	2.091	2.063	1.631

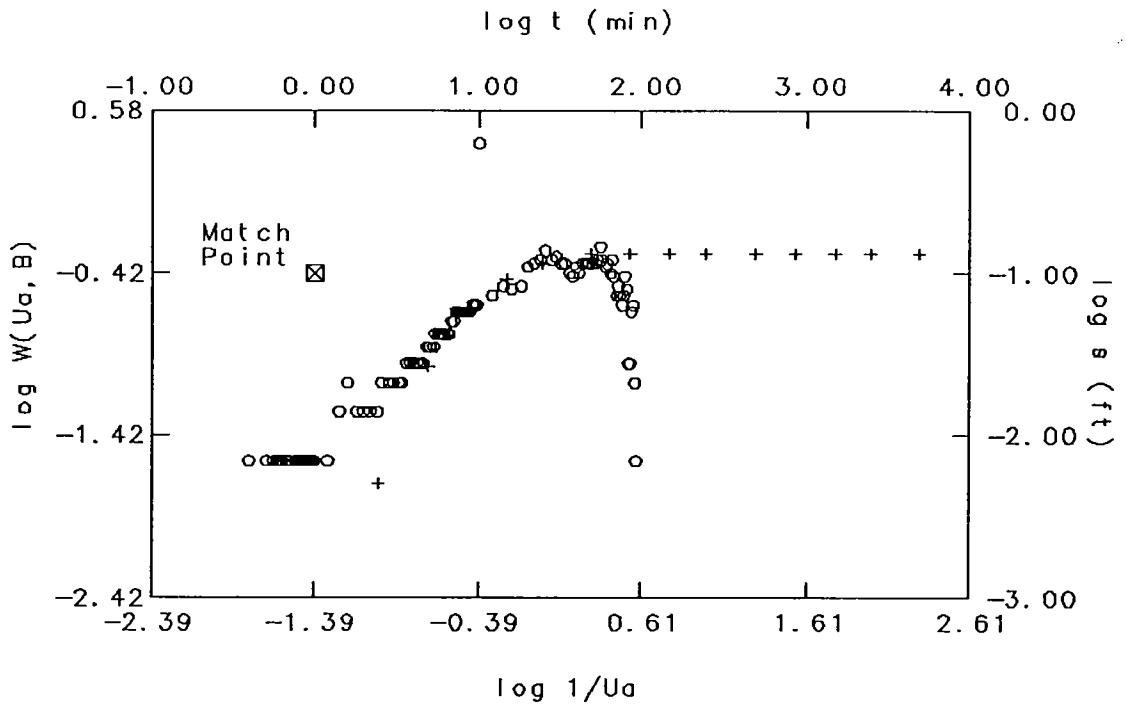
YORKTOWN PUMP TEST DATA
MAY 4, 1993

IN MINUTES

LINE NO	ELAPSED TIME	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6
209	860.0000	0.133	0.019	0.517	2.132	2.066	1.730
210	880.0000	0.019	-0.012	0.457	2.153	2.074	1.769
211	900.0000	-0.031	-0.031	0.409	2.174	2.077	1.824
212	920.0000	-0.063	-0.044	0.361	2.181	2.082	1.865
213	940.0000	-0.088	-0.063	0.320	2.194	2.088	1.904
214	960.0000	-0.108	-0.076	0.282	2.201	2.093	1.920
215	980.0000	-0.127	-0.082	0.250	2.208	2.093	1.934
216	1000.0000	-0.139	-0.088	0.222	2.215	2.099	1.970
217	1200.0000	-0.222	-0.145	0.066	2.249	2.121	2.080
	1400.0000	-0.228	-0.164	0.003	2.263	2.107	2.124

Graphic Well Analysis Package (GWAP) Pump Test Analysis

YORKTOWN MW-3S



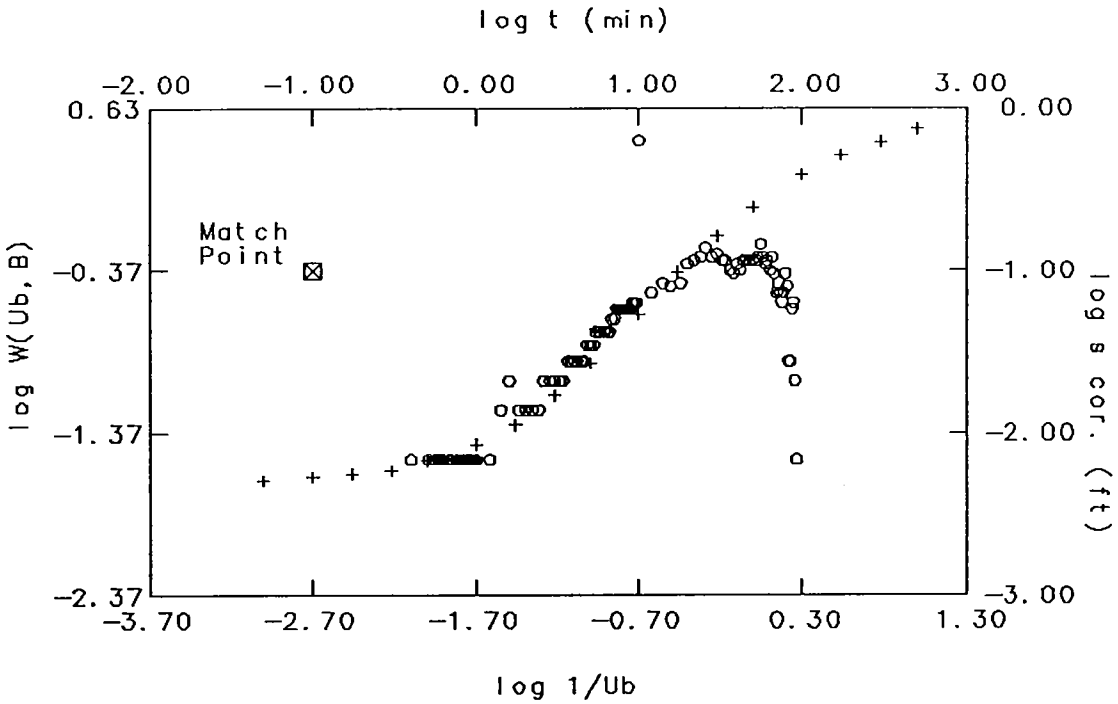
o – Data
+ – Type Curve
Unconf. Elastic: beta = 0.60

MATCH POINT		SOLUTION	
t	= 1.000E+0000	Transmissivity	= 8.712E+0002 gpd/ft
s	= 1.000E-0001	Hydraulic. Cond.	= 7.709E+0001 gpd/sq ft
1/Ua	= 4.074E-0002	Storativity	= 4.423E-0002
W(Ua, B)	= 3.802E-0002		

WELL INFORMATION	
WELL IDENTIFICATION	: MW-3S
DATE OF AQUIFER TEST	: 5/4/93
AQUIFER THICKNESS (b)	: 1.130E+0001 ft
DISCHARGE RATE (Q)	: 2.000E+0000 gpm
PUMPING WELL RADIUS (r)	: 6.667E-0001 ft
DISTANCE OF OBS. WELL FROM PUMPING WELL (d)	: 6.700E+0000 ft

GROUNDWATER TECHNOLOGY, INC.

YORKTOWN MW-3S



o – Data
+ – Type Curve
Unconf. Delayed: beta = 6.00

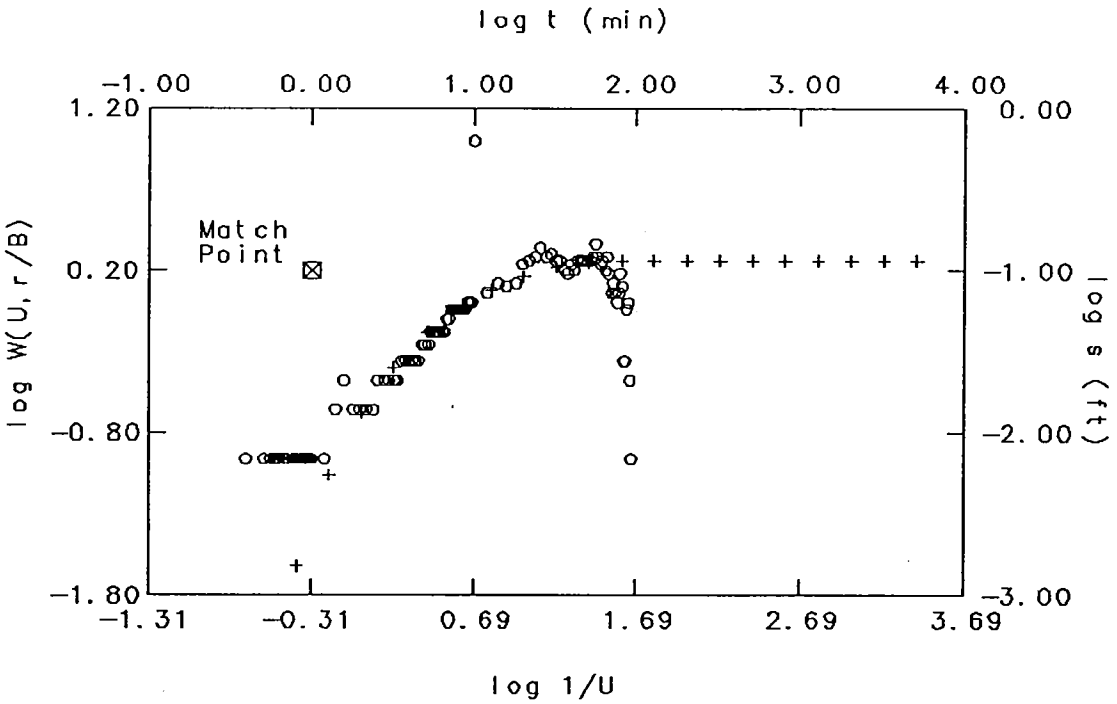
MATCH POINT			SOLUTION		
t	=	1.000E-0001	Transmissivity	=	9.775E+0002 gpd/ft
s	=	1.000E-0001	Hydraulic. Cond.	=	8.650E+0001 gpd/sq ft
1/Ub	=	1.995E-0003	Specific Yield	=	1.013E-0001
W(Ub, B)	=	4.266E-0002			

WELL INFORMATION

WELL IDENTIFICATION	:	MW-3S
DATE OF AQUIFER TEST	:	5/4/93
AQUIFER THICKNESS (b)	:	1.130E+0001 ft
DISCHARGE RATE (Q)	:	2.000E+0000 gpm
PUMPING WELL RADIUS (r)	:	6.667E-0001 ft
DISTANCE OF OBS. WELL FROM PUMPING WELL (d)	:	6.700E+0000 ft

GROUNDWATER TECHNOLOGY, INC.

YORKTOWN MW-3S



o – Data
+ – Type Curve
Conf. Leaky: r/B = 0.50

MATCH POINT			SOLUTION		
t	=	1.000E+0000	Transmissivity	=	3.632E+0003 gpd/ft
s	=	1.000E-0001	Hydraulic. Cond.	=	3.214E+0002 gpd/sq ft
1/U	=	4.898E-0001	Storativity	=	6.135E-0002
W(U,r/B)	=	1.585E-0001	Leakage Factor	=	1.340E+0001 ft

WELL INFORMATION		
WELL IDENTIFICATION	:	MW-3S
DATE OF AQUIFER TEST	:	5/4/93
AQUIFER THICKNESS (b)	:	1.130E+0001 ft
DISCHARGE RATE (Q)	:	2.000E+0000 gpm
PUMPING WELL RADIUS (r)	:	6.667E-0001 ft
DISTANCE OF OBS. WELL FROM PUMPING WELL (d)	:	6.700E+0000 ft

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Data for Pump Test

Well Name: MW-3S Date of Test: 5/4/93
Aquifer Thickness (b): 11.300 ft
Pumped Well Discharge(Q) = 2.000 gpm
Radius of Pumping Well = 0.667 ft
Distance of Observation Well from Pumping Well = 6.700 ft

Entry No.	Time(t) (min)	Drawdown(s) (ft)	t / d^2 (min/sq ft)
1	0.000	0.000	
2	0.008	0.000	1.849E-0004
3	0.017	0.000	3.698E-0004
4	0.025	0.000	5.569E-0004
5	0.033	0.000	7.418E-0004
6	0.042	0.000	9.267E-0004
7	0.050	0.000	1.114E-0003
8	0.058	0.000	1.299E-0003
9	0.067	0.000	1.484E-0003
10	0.075	0.000	1.671E-0003
11	0.083	0.000	1.856E-0003
12	0.092	0.000	2.041E-0003
13	0.100	0.000	2.228E-0003
14	0.108	0.000	2.413E-0003
15	0.117	0.000	2.597E-0003
16	0.125	0.000	2.785E-0003
17	0.133	0.000	2.969E-0003
18	0.142	0.000	3.154E-0003
19	0.150	0.000	3.342E-0003
20	0.158	0.000	3.526E-0003
21	0.167	0.000	3.711E-0003
22	0.175	0.000	3.898E-0003
23	0.183	0.000	4.083E-0003
24	0.192	0.000	4.268E-0003
25	0.200	0.000	4.455E-0003
26	0.208	0.000	4.640E-0003
27	0.217	0.000	4.825E-0003
28	0.225	0.000	5.012E-0003
29	0.233	0.000	5.197E-0003
30	0.242	0.000	5.382E-0003
31	0.250	0.000	5.569E-0003
32	0.258	0.000	5.754E-0003
33	0.267	0.000	5.939E-0003
34	0.275	0.000	6.126E-0003
35	0.283	0.000	6.311E-0003
36	0.292	0.000	6.496E-0003
37	0.300	0.000	6.683E-0003
38	0.308	0.000	6.868E-0003
39	0.317	0.000	7.053E-0003
40	0.325	0.000	7.240E-0003
41	0.333	0.000	7.425E-0003

42	0.350	0.000	7.797E-0003
43	0.367	0.000	8.167E-0003
44	0.383	0.000	8.539E-0003
45	0.400	0.007	8.911E-0003
46	0.417	0.000	9.280E-0003
47	0.433	0.000	9.652E-0003
48	0.450	0.000	1.002E-0002
49	0.467	0.000	1.039E-0002
50	0.483	0.000	1.077E-0002
51	0.500	0.000	1.114E-0002
52	0.517	0.007	1.151E-0002
53	0.533	0.000	1.188E-0002
54	0.550	0.000	1.225E-0002
55	0.567	0.007	1.262E-0002
56	0.583	0.007	1.299E-0002
57	0.600	0.007	1.337E-0002
58	0.617	0.007	1.374E-0002
59	0.633	0.007	1.411E-0002
60	0.650	0.000	1.448E-0002
61	0.667	0.000	1.485E-0002
62	0.683	0.007	1.522E-0002
63	0.700	0.007	1.559E-0002
64	0.717	0.000	1.596E-0002
65	0.733	0.000	1.634E-0002
66	0.750	0.000	1.671E-0002
67	0.767	0.007	1.708E-0002
68	0.783	0.007	1.745E-0002
69	0.800	0.007	1.782E-0002
70	0.817	0.007	1.819E-0002
71	0.833	0.007	1.856E-0002
72	0.850	0.007	1.894E-0002
73	0.867	0.007	1.930E-0002
74	0.883	0.007	1.968E-0002
75	0.900	0.007	2.005E-0002
76	0.917	0.007	2.042E-0002
77	0.933	0.007	2.079E-0002
78	0.950	0.007	2.116E-0002
79	0.967	0.007	2.153E-0002
80	0.983	0.007	2.190E-0002
81	1.000	0.007	2.228E-0002
82	1.200	0.007	2.673E-0002
83	1.400	0.014	3.119E-0002
84	1.600	0.021	3.564E-0002
85	1.800	0.014	4.010E-0002
86	2.000	0.014	4.455E-0002
87	2.200	0.014	4.901E-0002
88	2.400	0.014	5.346E-0002
89	2.600	0.021	5.792E-0002
90	2.800	0.021	6.237E-0002
91	3.000	0.021	6.683E-0002
92	3.200	0.021	7.129E-0002
93	3.400	0.021	7.574E-0002
94	3.600	0.028	8.020E-0002
95	3.800	0.028	8.465E-0002
96	4.000	0.028	8.911E-0002
97	4.200	0.028	9.356E-0002
98	4.400	0.028	9.802E-0002
99	4.600	0.028	1.025E-0001
100	4.800	0.034	1.069E-0001
101	5.000	0.034	1.114E-0001

102	5.200	0.034	1.158E-0001
103	5.400	0.041	1.203E-0001
104	5.600	0.041	1.247E-0001
105	5.800	0.041	1.292E-0001
106	6.000	0.041	1.337E-0001
107	6.200	0.041	1.381E-0001
108	6.400	0.041	1.426E-0001
109	6.600	0.041	1.470E-0001
110	6.800	0.051	1.515E-0001
111	7.000	0.051	1.559E-0001
112	7.200	0.058	1.604E-0001
113	7.400	0.058	1.648E-0001
114	7.600	0.058	1.693E-0001
115	7.800	0.058	1.738E-0001
116	8.000	0.058	1.782E-0001
117	8.200	0.058	1.827E-0001
118	8.400	0.058	1.871E-0001
119	8.600	0.058	1.916E-0001
120	8.800	0.058	1.960E-0001
121	9.000	0.058	2.005E-0001
122	9.200	0.064	2.049E-0001
123	9.400	0.064	2.094E-0001
124	9.600	0.064	2.139E-0001
125	9.800	0.064	2.183E-0001
126	10.000	0.644	2.228E-0001
127	12.000	0.071	2.673E-0001
128	14.000	0.085	3.119E-0001
129	16.000	0.078	3.564E-0001
130	18.000	0.085	4.010E-0001
131	20.000	0.108	4.455E-0001
132	22.000	0.115	4.901E-0001
133	24.000	0.122	5.346E-0001
134	26.000	0.138	5.792E-0001
135	28.000	0.122	6.237E-0001
136	30.000	0.129	6.683E-0001
137	32.000	0.115	7.129E-0001
138	34.000	0.115	7.574E-0001
139	36.000	0.101	8.020E-0001
140	38.000	0.094	8.465E-0001
141	40.000	0.108	8.911E-0001
142	42.000	0.101	9.356E-0001
143	44.000	0.115	9.802E-0001
144	46.000	0.115	1.025E+0000
145	48.000	0.115	1.069E+0000
146	50.000	0.115	1.114E+0000
147	52.000	0.115	1.158E+0000
148	54.000	0.122	1.203E+0000
149	56.000	0.145	1.247E+0000
150	58.000	0.122	1.292E+0000
151	60.000	0.108	1.337E+0000
152	62.000	0.115	1.381E+0000
153	64.000	0.101	1.426E+0000
154	66.000	0.122	1.470E+0000
155	68.000	0.094	1.515E+0000
156	70.000	0.071	1.559E+0000
157	72.000	0.085	1.604E+0000
158	74.000	0.071	1.648E+0000
159	76.000	0.064	1.693E+0000
160	78.000	0.071	1.738E+0000
161	80.000	0.094	1.782E+0000

162	82.000	0.078	1.827E+0000
163	84.000	0.028	1.871E+0000
164	86.000	0.028	1.916E+0000
165	88.000	0.058	1.960E+0000
166	90.000	0.064	2.005E+0000
167	92.000	0.021	2.049E+0000
168	94.000	0.007	2.094E+0000
169	96.000	0.000	2.139E+0000
170	98.000	-1.000	2.183E+0000
171	100.000	-1.000	2.228E+0000
172	120.000	-1.000	2.673E+0000
173	140.000	-1.000	3.119E+0000
174	160.000	-1.000	3.564E+0000
175	180.000	-1.000	4.010E+0000
176	200.000	-1.000	4.455E+0000
177	220.000	-1.000	4.901E+0000
178	240.000	-1.000	5.346E+0000
179	260.000	-1.000	5.792E+0000
180	280.000	-1.000	6.237E+0000
181	300.000	-1.000	6.683E+0000
182	320.000	-1.000	7.129E+0000
183	340.000	-1.000	7.574E+0000
184	360.000	-1.000	8.020E+0000
185	380.000	-1.000	8.465E+0000
186	400.000	-1.000	8.911E+0000
187	420.000	-1.000	9.356E+0000
188	440.000	-1.000	9.802E+0000
189	460.000	-1.000	1.025E+0001
190	480.000	-1.000	1.069E+0001
191	500.000	-1.000	1.114E+0001
192	520.000	-1.000	1.158E+0001
193	540.000	-1.000	1.203E+0001
194	560.000	-1.000	1.247E+0001
195	580.000	-1.000	1.292E+0001
196	600.000	-1.000	1.337E+0001
197	640.000	-1.000	1.426E+0001
198	660.000	-1.000	1.470E+0001
199	700.000	-1.000	1.559E+0001
200	720.000	-1.000	1.604E+0001
201	740.000	-1.000	1.648E+0001

	MW-3S		DRWDWN
ELAPSED TIME	13.7		
0.0000	-13.700	13.7	0
0.0083	-13.700	13.7	0
0.0166	-13.700	13.7	0
0.0250	-13.700	13.7	0
0.0333	-13.700	13.7	0
0.0416	-13.700	13.7	0
0.0500	-13.700	13.7	0
0.0583	-13.700	13.7	0
0.0666	-13.700	13.7	0
0.0750	-13.700	13.7	0
0.0833	-13.700	13.7	0
0.0916	-13.700	13.7	0
0.1000	-13.700	13.7	0
0.1083	-13.700	13.7	0
0.1166	-13.700	13.7	0
0.1250	-13.700	13.7	0
0.1333	-13.700	13.7	0
0.1416	-13.700	13.7	0
0.1500	-13.700	13.7	0
0.1583	-13.700	13.7	0
0.1666	-13.700	13.7	0
0.1750	-13.700	13.7	0
0.1833	-13.700	13.7	0
0.1916	-13.700	13.7	0
0.2000	-13.700	13.7	0
0.2083	-13.700	13.7	0
0.2166	-13.700	13.7	0
0.2250	-13.700	13.7	0
0.2333	-13.700	13.7	0
0.2416	-13.700	13.7	0
0.2500	-13.700	13.7	0
0.2583	-13.700	13.7	0
0.2666	-13.700	13.7	0
0.2750	-13.700	13.7	0
0.2833	-13.700	13.7	0
0.2916	-13.700	13.7	0
0.3000	-13.700	13.7	0
0.3083	-13.700	13.7	0
0.3166	-13.700	13.7	0
0.3250	-13.700	13.7	0
0.3333	-13.700	13.7	0
0.3500	-13.700	13.7	0
0.3666	-13.700	13.7	0
0.3833	-13.700	13.7	0
0.4000	-13.693	13.6931	0.0069
0.4166	-13.700	13.7	0
0.4333	-13.700	13.7	0
0.4500	-13.700	13.7	0
0.4666	-13.700	13.7	0
0.4833	-13.700	13.7	0
0.5000	-13.700	13.7	0
0.5166	-13.693	13.6931	0.0069
(54) 0.5333	-13.700	13.7	0

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0.5500	-13.700	13.7	0
0.5666	-13.693	13.6931	0.0069
0.5833	-13.693	13.6931	0.0069
0.6000	-13.693	13.6931	0.0069
0.6166	-13.693	13.6931	0.0069
0.6333	-13.693	13.6931	0.0069
0.6500	-13.700	13.7	0
0.6666	-13.700	13.7	0
0.6833	-13.693	13.6931	0.0069
0.7000	-13.693	13.6931	0.0069
0.7166	-13.700	13.7	0
0.7333	-13.700	13.7	0
0.7500	-13.700	13.7	0
0.7666	-13.693	13.6931	0.0069
0.7833	-13.693	13.6931	0.0069
0.8000	-13.693	13.6931	0.0069
0.8166	-13.693	13.6931	0.0069
0.8333	-13.693	13.6931	0.0069
0.8500	-13.693	13.6931	0.0069
0.8666	-13.693	13.6931	0.0069
0.8833	-13.693	13.6931	0.0069
0.9000	-13.693	13.6931	0.0069
0.9166	-13.693	13.6931	0.0069
0.9333	-13.693	13.6931	0.0069
0.9500	-13.693	13.6931	0.0069
0.9666	-13.693	13.6931	0.0069
0.9833	-13.693	13.6931	0.0069
1.0000	-13.693	13.6931	0.0069
1.2000	-13.693	13.6931	0.0069
1.4000	-13.686	13.6862	0.0138
1.6000	-13.679	13.6793	0.0207
1.8000	-13.686	13.6862	0.0138
2.0000	-13.686	13.6862	0.0138
2.2000	-13.686	13.6862	0.0138
2.4000	-13.686	13.6862	0.0138
2.6000	-13.679	13.6793	0.0207
2.8000	-13.679	13.6793	0.0207
3.0000	-13.679	13.6793	0.0207
3.2000	-13.679	13.6793	0.0207
3.4000	-13.679	13.6793	0.0207
3.6000	-13.672	13.6724	0.0276
3.8000	-13.672	13.6724	0.0276
4.0000	-13.672	13.6724	0.0276
4.2000	-13.672	13.6724	0.0276
4.4000	-13.672	13.6724	0.0276
4.6000	-13.672	13.6724	0.0276
4.8000	-13.666	13.6655	0.0345
5.0000	-13.666	13.6655	0.0345
5.2000	-13.666	13.6655	0.0345
5.4000	-13.659	13.6586	0.0414

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5.6000	-13.659	13.6586	0.0414
5.8000	-13.659	13.6586	0.0414
6.0000	-13.659	13.6586	0.0414
6.2000	-13.659	13.6586	0.0414
6.4000	-13.659	13.6586	0.0414
6.6000	-13.659	13.6586	0.0414
6.8000	-13.649	13.6494	0.0506
7.0000	-13.649	13.6494	0.0506
7.2000	-13.643	13.6425	0.0575
7.4000	-13.643	13.6425	0.0575
7.6000	-13.643	13.6425	0.0575
7.8000	-13.643	13.6425	0.0575
8.0000	-13.643	13.6425	0.0575
8.2000	-13.643	13.6425	0.0575
8.4000	-13.643	13.6425	0.0575
8.6000	-13.643	13.6425	0.0575
8.8000	-13.643	13.6425	0.0575
9.0000	-13.643	13.6425	0.0575
9.2000	-13.636	13.6356	0.0644
9.4000	-13.636	13.6356	0.0644
9.6000	-13.636	13.6356	0.0644
9.8000	-13.636	13.6356	0.0644
10.0000	-13.636	13.6356	0.0644
12.0000	-13.629	13.6287	0.0713
14.0000	-13.615	13.6149	0.0851
16.0000	-13.622	13.6218	0.0782
18.0000	-13.615	13.6149	0.0851
20.0000	-13.592	13.5919	0.1081
22.0000	-13.585	13.585	0.115
24.0000	-13.578	13.5781	0.1219
26.0000	-13.562	13.562	0.138
28.0000	-13.578	13.5781	0.1219
30.0000	-13.571	13.5712	0.1288
32.0000	-13.585	13.585	0.115
34.0000	-13.585	13.585	0.115
36.0000	-13.599	13.5988	0.1012
38.0000	-13.606	13.6057	0.0943
40.0000	-13.592	13.5919	0.1081
42.0000	-13.599	13.5988	0.1012
44.0000	-13.585	13.585	0.115
46.0000	-13.585	13.585	0.115
48.0000	-13.585	13.585	0.115
50.0000	-13.585	13.585	0.115
52.0000	-13.585	13.585	0.115
54.0000	-13.578	13.5781	0.1219
56.0000	-13.555	13.5551	0.1449
58.0000	-13.578	13.5781	0.1219
60.0000	-13.592	13.5919	0.1081
62.0000	-13.585	13.585	0.115
64.0000	-13.599	13.5988	0.1012

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66.0000	-13.578	13.5781	0.1219
68.0000	-13.606	13.6057	0.0943
70.0000	-13.629	13.6287	0.0713
72.0000	-13.615	13.6149	0.0851
74.0000	-13.629	13.6287	0.0713
76.0000	-13.636	13.6356	0.0644
78.0000	-13.629	13.6287	0.0713
80.0000	-13.606	13.6057	0.0943
82.0000	-13.622	13.6218	0.0782
84.0000	-13.672	13.6724	0.0276
86.0000	-13.672	13.6724	0.0276
88.0000	-13.643	13.6425	0.0575
90.0000	-13.636	13.6356	0.0644
92.0000	-13.679	13.6793	0.0207
94.0000	-13.693	13.6931	0.0069
96.0000	-13.700	13.7	0
98.0000	-13.714	13.7138	-0.0138
100.0000	-13.721	13.7207	-0.0207
120.0000	-13.771	13.7713	-0.0713
140.0000	-13.815	13.815	-0.115
160.0000	-13.845	13.8449	-0.1449
180.0000	-13.919	13.9185	-0.2185
200.0000	-13.875	13.8748	-0.1748
220.0000	-13.925	13.9254	-0.2254
240.0000	-13.932	13.9323	-0.2323
260.0000	-13.976	13.976	-0.276
280.0000	-13.969	13.9691	-0.2691
300.0000	-14.013	14.0128	-0.3128
320.0000	-14.020	14.0197	-0.3197
340.0000	-14.057	14.0565	-0.3565
360.0000	-14.057	14.0565	-0.3565
380.0000	-14.073	14.0726	-0.3726
400.0000	-14.063	14.0634	-0.3634
420.0000	-14.080	14.0795	-0.3795
440.0000	-14.093	14.0933	-0.3933
460.0000	-14.107	14.1071	-0.4071
480.0000	-14.123	14.1232	-0.4232
500.0000	-14.123	14.1232	-0.4232
520.0000	-14.137	14.137	-0.437
540.0000	-14.153	14.1531	-0.4531
560.0000	-14.167	14.1669	-0.4669
580.0000	-14.181	14.1807	-0.4807
600.0000	-14.197	14.1968	-0.4968
620.0000	-14.211	14.2106	-0.5106
640.0000	-14.218	14.2175	-0.5175
660.0000	-14.224	14.2244	-0.5244
680.0000	-14.240	14.2405	-0.5405
700.0000	-14.254	14.2543	-0.5543
720.0000	-14.268	14.2681	-0.5681
740.0000	-14.275	14.275	-0.575

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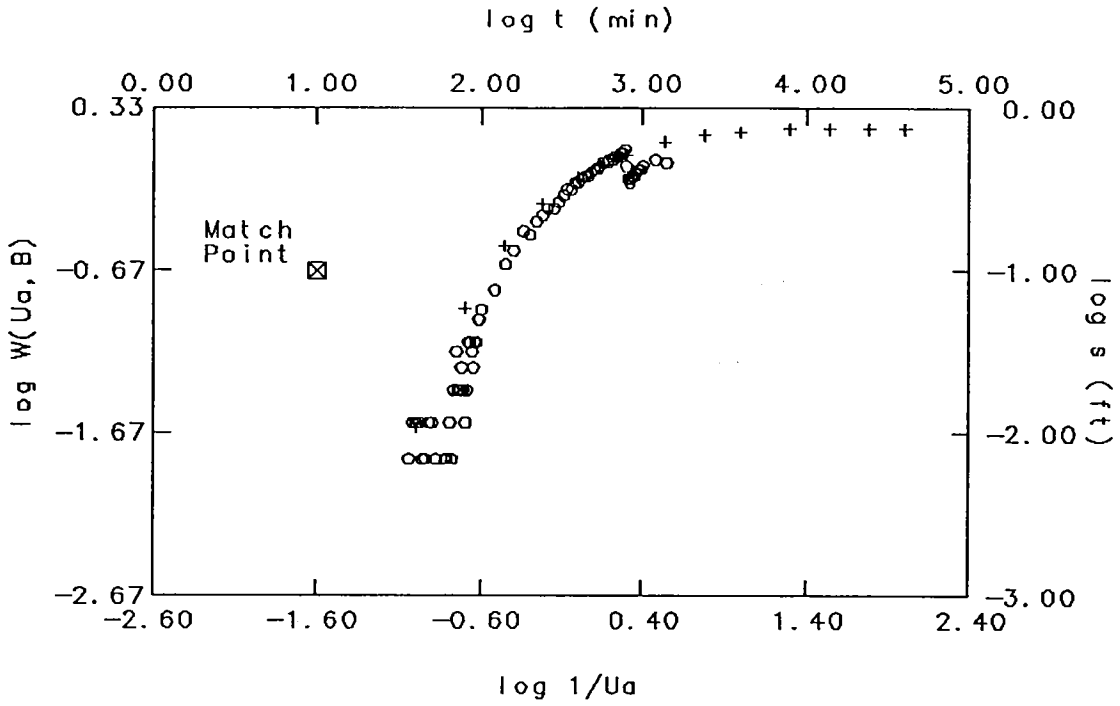
760.0000	-14.291	14.2911	-0.5911
780.0000	-14.291	14.2911	-0.5911
800.0000	-13.249	13.2492	0.4508
820.0000	-12.182	12.182	1.518
840.0000	-12.373	12.3729	1.3271
860.0000	-12.504	12.504	1.196
880.0000	-12.642	12.642	1.058
900.0000	-12.752	12.7524	0.9476
920.0000	-12.863	12.8628	0.8372
940.0000	-12.957	12.9571	0.7429
960.0000	-13.045	13.0445	0.6555
980.0000	-13.118	13.1181	0.5819
1000.0000	-13.183	13.1825	0.5175
1200.0000	-13.541	13.5413	0.1587
1400.0000	-13.686	13.6862	0.0138

YORKTOWN MW-5S



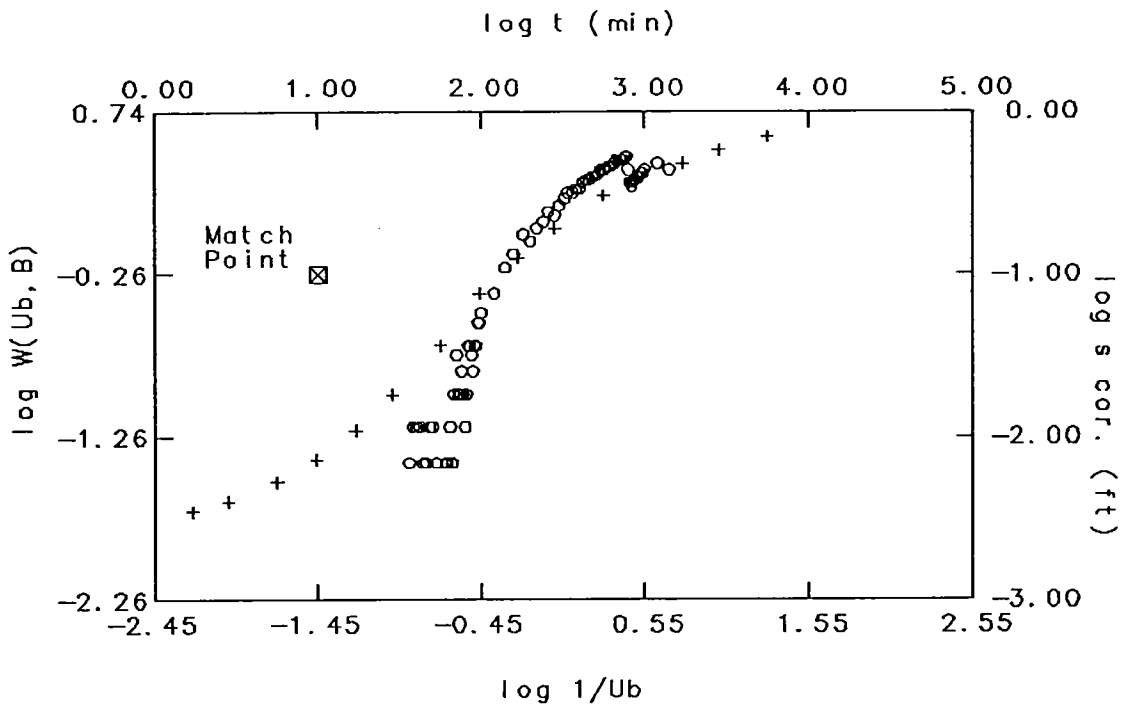
o – Data
+ – Type Curve
Unconf. Elastic: beta = 0.10

MATCH POINT			SOLUTION		
t	=	1.000E+0001	Transmissivity	=	4.899E+0002 gpd/ft
s	=	1.000E-0001	Hydraulic. Cond.	=	4.297E+0001 gpd/sq ft
1/Ua	=	2.512E-0002	Storativity	=	2.153E-0002
W(Ua,B)	=	2.138E-0002			

WELL INFORMATION		
WELL IDENTIFICATION	:	MW-5S
DATE OF AQUIFER TEST	:	5/4/93
AQUIFER THICKNESS (b)	:	1.140E+0001 ft
DISCHARGE RATE (Q)	:	2.000E+0000 gpm
PUMPING WELL RADIUS (r)	:	6.667E-0001 ft
DISTANCE OF OBS. WELL FROM PUMPING WELL (d)	:	2.900E+0001 ft

GROUNDWATER TECHNOLOGY, INC.

YORKTOWN MW-5S



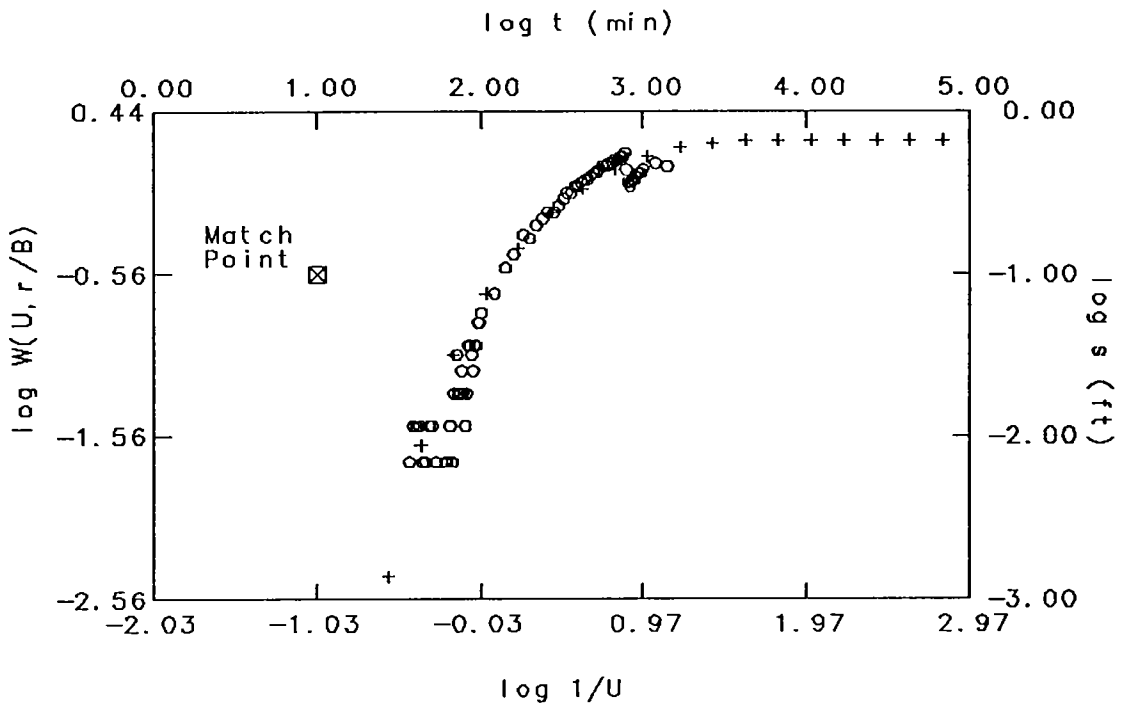
o – Data
+ – Type Curve
Unconf. Delayed: beta = 7.00

MATCH POINT			SOLUTION		
t	=	1.000E+0001	Transmissivity	=	1.259E+0003 gpd/ft
s	=	1.000E-0001	Hydraulic. Cond.	=	1.105E+0002 gpd/sq ft
1/Ub	=	3.548E-0002	Specific Yield	=	3.918E-0002
W(Ub, B)	=	5.495E-0002			

WELL INFORMATION		
WELL IDENTIFICATION	:	MW-5S
DATE OF AQUIFER TEST	:	5/4/93
AQUIFER THICKNESS (b)	:	1.140E+0001 ft
DISCHARGE RATE (Q)	:	2.000E+0000 gpm
PUMPING WELL RADIUS (r)	:	6.667E-0001 ft
DISTANCE OF OBS. WELL FROM PUMPING WELL (d)	:	2.900E+0001 ft

GROUNDWATER TECHNOLOGY, INC.

YORKTOWN MW-5



o – Data
+ – Type Curve
Conf. Leaky: r/B = 0.50

MATCH POINT			SOLUTION		
t	=	1.000E+0001	Transmissivity	=	6.311E+0002 gpd/ft
s	=	1.000E-0001	Hydraulic. Cond.	=	5.536E+0001 gpd/sq ft
1/U	=	9.333E-0002	Storativity	=	2.986E-0002
W(U,r/B)	=	2.754E-0002	Leakage Factor	=	5.800E+0001 ft

WELL INFORMATION		
WELL IDENTIFICATION	:	MW-5S
DATE OF AQUIFER TEST	:	5/4/93
AQUIFER THICKNESS (b)	:	1.140E+0001 ft
DISCHARGE RATE (Q)	:	2.000E+0000 gpm
PUMPING WELL RADIUS (r)	:	6.667E-0001 ft
DISTANCE OF OBS. WELL FROM PUMPING WELL (d)	:	2.900E+0001 ft

GROUNDWATER TECHNOLOGY, INC.

Data for Pump Test

Well Name: MW-5S Date of Test: 5/4/93
Aquifer Thickness (b): 11.400 ft
Pumped Well Discharge(Q) = 2.000 gpm
Radius of Pumping Well = 0.667 ft
Distance of Observation Well from Pumping Well = 29.000 ft

Entry No.	Time(t) (min)	Drawdown(s) (ft)	t / d^2 (min/sq ft)
1	0.000	0.000	
2	0.008	0.000	9.869E-0006
3	0.017	0.000	1.974E-0005
4	0.025	0.000	2.973E-0005
5	0.033	0.000	3.960E-0005
6	0.042	0.000	4.946E-0005
7	0.050	0.000	5.945E-0005
8	0.058	0.000	6.932E-0005
9	0.067	0.000	7.919E-0005
10	0.075	0.000	8.918E-0005
11	0.083	0.000	9.905E-0005
12	0.092	0.000	1.089E-0004
13	0.100	0.000	1.189E-0004
14	0.108	0.000	1.288E-0004
15	0.117	0.000	1.386E-0004
16	0.125	0.000	1.486E-0004
17	0.133	0.000	1.585E-0004
18	0.142	0.000	1.684E-0004
19	0.150	0.000	1.784E-0004
20	0.158	0.000	1.882E-0004
21	0.167	0.000	1.981E-0004
22	0.175	0.000	2.081E-0004
23	0.183	0.000	2.180E-0004
24	0.192	0.000	2.278E-0004
25	0.200	0.000	2.378E-0004
26	0.208	0.000	2.477E-0004
27	0.217	0.000	2.576E-0004
28	0.225	0.000	2.675E-0004
29	0.233	0.000	2.774E-0004
30	0.242	0.000	2.873E-0004
31	0.250	0.000	2.973E-0004
32	0.258	0.000	3.071E-0004
33	0.267	0.000	3.170E-0004
34	0.275	0.000	3.270E-0004
35	0.283	0.000	3.369E-0004
36	0.292	0.000	3.467E-0004
37	0.300	0.000	3.567E-0004
38	0.308	0.000	3.666E-0004
39	0.317	0.000	3.765E-0004
40	0.325	0.000	3.864E-0004
41	0.333	0.000	3.963E-0004

42	0.350	0.000	4.162E-0004
43	0.367	0.000	4.359E-0004
44	0.383	0.000	4.558E-0004
45	0.400	0.000	4.756E-0004
46	0.417	0.000	4.954E-0004
47	0.433	0.000	5.152E-0004
48	0.450	0.000	5.351E-0004
49	0.467	0.000	5.548E-0004
50	0.500	0.000	5.945E-0004
51	0.517	0.000	6.143E-0004
52	0.533	0.000	6.341E-0004
53	0.550	0.000	6.540E-0004
54	0.567	0.000	6.737E-0004
55	0.583	0.000	6.936E-0004
56	0.600	0.000	7.134E-0004
57	0.617	0.000	7.332E-0004
58	0.633	0.000	7.530E-0004
59	0.650	0.000	7.729E-0004
60	0.667	0.000	7.926E-0004
61	0.683	0.000	8.125E-0004
62	0.700	0.000	8.323E-0004
63	0.717	0.000	8.521E-0004
64	0.733	0.000	8.719E-0004
65	0.750	0.000	8.918E-0004
66	0.767	0.000	9.115E-0004
67	0.783	0.000	9.314E-0004
68	0.800	0.000	9.512E-0004
69	0.817	0.000	9.710E-0004
70	0.833	0.000	9.908E-0004
71	0.850	0.000	1.011E-0003
72	0.867	0.000	1.030E-0003
73	0.883	0.000	1.050E-0003
74	0.900	0.000	1.070E-0003
75	0.917	0.000	1.090E-0003
76	0.933	0.000	1.110E-0003
77	0.950	0.000	1.130E-0003
78	0.967	0.000	1.149E-0003
79	0.983	0.000	1.169E-0003
80	1.000	0.000	1.189E-0003
81	1.200	0.000	1.427E-0003
82	1.400	0.000	1.665E-0003
83	1.600	0.000	1.902E-0003
84	1.800	0.000	2.140E-0003
85	2.000	0.000	2.378E-0003
86	2.200	0.000	2.616E-0003
87	2.400	0.000	2.854E-0003
88	2.600	0.000	3.092E-0003
89	2.800	0.000	3.329E-0003
90	3.000	0.000	3.567E-0003
91	3.200	0.000	3.805E-0003
92	3.400	0.000	4.043E-0003
93	3.600	0.000	4.281E-0003
94	3.800	0.000	4.518E-0003
95	4.000	0.000	4.756E-0003
96	4.200	0.000	4.994E-0003
97	4.400	0.000	5.232E-0003
98	4.600	0.000	5.470E-0003
99	4.800	0.000	5.707E-0003
100	5.000	0.000	5.945E-0003
101	5.200	0.000	6.183E-0003

102	5.400	0.000	6.421E-0003
103	5.600	0.000	6.659E-0003
104	5.800	0.000	6.897E-0003
105	6.000	0.000	7.134E-0003
106	6.200	0.000	7.372E-0003
107	6.400	0.000	7.610E-0003
108	6.600	0.000	7.848E-0003
109	6.800	0.000	8.086E-0003
110	7.000	0.000	8.323E-0003
111	7.200	0.000	8.561E-0003
112	7.400	0.000	8.799E-0003
113	7.600	0.000	9.037E-0003
114	7.800	0.000	9.275E-0003
115	8.000	0.000	9.512E-0003
116	8.200	0.000	9.750E-0003
117	8.400	0.000	9.988E-0003
118	8.600	0.000	1.023E-0002
119	8.800	0.000	1.046E-0002
120	9.000	0.000	1.070E-0002
121	9.200	0.000	1.094E-0002
122	9.400	0.000	1.118E-0002
123	9.600	0.000	1.141E-0002
124	9.800	0.000	1.165E-0002
125	10.000	0.000	1.189E-0002
126	12.000	0.000	1.427E-0002
127	14.000	0.000	1.665E-0002
128	16.000	0.000	1.902E-0002
129	18.000	0.000	2.140E-0002
130	20.000	0.000	2.378E-0002
131	22.000	0.000	2.616E-0002
132	24.000	0.000	2.854E-0002
133	26.000	0.000	3.092E-0002
134	28.000	0.000	3.329E-0002
135	30.000	0.000	3.567E-0002
136	32.000	0.000	3.805E-0002
137	34.000	0.000	4.043E-0002
138	36.000	0.007	4.281E-0002
139	38.000	0.012	4.518E-0002
140	40.000	0.012	4.756E-0002
141	42.000	0.012	4.994E-0002
142	44.000	0.007	5.232E-0002
143	46.000	0.007	5.470E-0002
144	48.000	0.012	5.707E-0002
145	50.000	0.012	5.945E-0002
146	52.000	0.007	6.183E-0002
147	54.000	0.000	6.421E-0002
148	56.000	0.000	6.659E-0002
149	58.000	0.000	6.897E-0002
150	60.000	0.007	7.134E-0002
151	62.000	0.007	7.372E-0002
152	64.000	0.012	7.610E-0002
153	66.000	0.007	7.848E-0002
154	68.000	0.018	8.086E-0002
155	70.000	0.032	8.323E-0002
156	72.000	0.018	8.561E-0002
157	74.000	0.018	8.799E-0002
158	76.000	0.025	9.037E-0002
159	78.000	0.018	9.275E-0002
160	80.000	0.012	9.512E-0002
161	82.000	0.018	9.750E-0002

162	84.000	0.037	9.988E-0002
163	86.000	0.037	1.023E-0001
164	88.000	0.032	1.046E-0001
165	90.000	0.025	1.070E-0001
166	92.000	0.037	1.094E-0001
167	94.000	0.037	1.118E-0001
168	96.000	0.051	1.141E-0001
169	98.000	0.051	1.165E-0001
170	100.000	0.058	1.189E-0001
171	120.000	0.076	1.427E-0001
172	140.000	0.108	1.665E-0001
173	160.000	0.133	1.902E-0001
174	180.000	0.177	2.140E-0001
175	200.000	0.163	2.378E-0001
176	220.000	0.196	2.616E-0001
177	240.000	0.214	2.854E-0001
178	260.000	0.242	3.092E-0001
179	280.000	0.235	3.329E-0001
180	300.000	0.267	3.567E-0001
181	320.000	0.292	3.805E-0001
182	340.000	0.317	4.043E-0001
183	360.000	0.322	4.281E-0001
184	380.000	0.343	4.518E-0001
185	400.000	0.343	4.756E-0001
186	420.000	0.368	4.994E-0001
187	440.000	0.380	5.232E-0001
188	460.000	0.386	5.470E-0001
189	480.000	0.405	5.707E-0001
190	500.000	0.412	5.945E-0001
191	520.000	0.423	6.183E-0001
192	540.000	0.437	6.421E-0001
193	560.000	0.451	6.659E-0001
194	580.000	0.455	6.897E-0001
195	600.000	0.462	7.134E-0001
196	620.000	0.476	7.372E-0001
197	640.000	0.481	7.610E-0001
198	660.000	0.488	7.848E-0001
199	680.000	0.501	8.086E-0001
200	700.000	0.506	8.323E-0001
201	720.000	0.520	8.561E-0001
202	740.000	0.520	8.799E-0001
203	760.000	0.531	9.037E-0001
204	780.000	0.538	9.275E-0001
205	800.000	0.444	9.512E-0001
206	820.000	0.361	9.750E-0001
207	840.000	0.354	9.988E-0001
208	860.000	0.361	1.023E+0000
209	880.000	0.380	1.046E+0000
210	900.000	0.386	1.070E+0000
211	920.000	0.398	1.094E+0000
212	940.000	0.412	1.118E+0000
213	960.000	0.423	1.141E+0000
214	980.000	0.423	1.165E+0000
215	1000.000	0.437	1.189E+0000
216	1200.000	0.488	1.427E+0000
217	1400.000	0.455	1.665E+0000

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time	mw-5s	drwdwn
	13.6	
0.0000	-13.5993	0
0.0083	-13.5993	0
0.0166	-13.5993	0
0.0250	-13.5993	0
0.0333	-13.5993	0
0.0416	-13.5993	0
0.0500	-13.5993	0
0.0583	-13.5993	0
0.0666	-13.5993	0
0.0750	-13.5993	0
0.0833	-13.5993	0
0.0916	-13.5993	0
0.1000	-13.5993	0
0.1083	-13.5993	0
0.1166	-13.5993	0
0.1250	-13.5993	0
0.1333	-13.5993	0
0.1416	-13.5993	0
0.1500	-13.5993	0
0.1583	-13.5993	0
0.1666	-13.5993	0
0.1750	-13.5993	0
0.1833	-13.5993	0
0.1916	-13.5993	0
0.2000	-13.5993	0
0.2083	-13.5993	0
0.2166	-13.5993	0
0.2250	-13.5993	0
0.2333	-13.5993	0
0.2416	-13.5993	0
0.2500	-13.5993	0
0.2583	-13.5993	0
0.2666	-13.5993	0
0.2750	-13.5993	0
0.2833	-13.5993	0
0.2916	-13.5993	0
0.3000	-13.5993	0
0.3083	-13.5993	0
0.3166	-13.5993	0
0.3250	-13.5993	0
0.3333	-13.5993	0
0.3500	-13.5993	0
0.3666	-13.5993	0
0.3833	-13.6062	-0.0069
0.4000	-13.6062	-0.0069
0.4166	-13.5993	0
0.4333	-13.5993	0
0.4500	-13.6062	-0.0069
0.4666	-13.5993	0
0.4833	-13.5993	0
0.5000	-13.5993	0
0.5166	-13.5993	0

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0.5333	-13.6062	-0.0069
0.5500	-13.5993	0
0.5666	-13.5993	0
0.5833	-13.5993	0
0.6000	-13.5993	0
0.6166	-13.5993	0
0.6333	-13.5993	0
0.6500	-13.5993	0
0.6666	-13.5993	0
0.6833	-13.5993	0
0.7000	-13.5993	0
0.7166	-13.5993	0
0.7333	-13.5993	0
0.7500	-13.5993	0
0.7666	-13.5993	0
0.7833	-13.5993	0
0.8000	-13.6062	-0.0069
0.8166	-13.5993	0
0.8333	-13.5993	0
0.8500	-13.5993	0
0.8666	-13.5993	0
0.8833	-13.5993	0
0.9000	-13.5993	0
0.9166	-13.6062	-0.0069
0.9333	-13.5993	0
0.9500	-13.5993	0
0.9666	-13.5993	0
0.9833	-13.5993	0
1.0000	-13.5993	0
1.2000	-13.5993	0
1.4000	-13.6062	-0.0069
1.6000	-13.6062	-0.0069
1.8000	-13.5993	0
2.0000	-13.5993	0
2.2000	-13.5993	0
2.4000	-13.5993	0
2.6000	-13.5993	0
2.8000	-13.6062	-0.0069
3.0000	-13.5993	0
3.2000	-13.5993	0
3.4000	-13.5993	0
3.6000	-13.5993	0
3.8000	-13.5993	0
4.0000	-13.5993	0
4.2000	-13.5993	0
4.4000	-13.5993	0
4.6000	-13.5993	0
4.8000	-13.6062	-0.0069
5.0000	-13.5993	0
5.2000	-13.5993	0

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5.4000	-13.5993	0
5.6000	-13.5993	0
5.8000	-13.6062	-0.0069
6.0000	-13.5993	0
6.2000	-13.5993	0
6.4000	-13.6062	-0.0069
6.6000	-13.5993	0
6.8000	-13.5993	0
7.0000	-13.5993	0
7.2000	-13.5993	0
7.4000	-13.5993	0
7.6000	-13.6062	-0.0069
7.8000	-13.6062	-0.0069
8.0000	-13.5993	0
8.2000	-13.5993	0
8.4000	-13.6062	-0.0069
8.6000	-13.6062	-0.0069
8.8000	-13.6062	-0.0069
9.0000	-13.6062	-0.0069
9.2000	-13.6062	-0.0069
9.4000	-13.6062	-0.0069
9.6000	-13.6062	-0.0069
9.8000	-13.6062	-0.0069
10.0000	-13.6062	-0.0069
12.0000	-13.6062	-0.0069
14.0000	-13.6062	-0.0069
16.0000	-13.6131	-0.0138
18.0000	-13.6131	-0.0138
20.0000	-13.62	-0.0207
22.0000	-13.62	-0.0207
24.0000	-13.62	-0.0207
26.0000	-13.62	-0.0207
28.0000	-13.6062	-0.0069
30.0000	-13.6062	-0.0069
32.0000	-13.5993	0
34.0000	-13.5993	0
36.0000	-13.5924	0.0069
38.0000	-13.5878	0.0115
40.0000	-13.5878	0.0115
42.0000	-13.5878	0.0115
44.0000	-13.5924	0.0069
46.0000	-13.5924	0.0069
48.0000	-13.5878	0.0115
50.0000	-13.5878	0.0115
52.0000	-13.5924	0.0069
54.0000	-13.5993	0
56.0000	-13.6131	-0.0138
58.0000	-13.5993	0
60.0000	-13.5924	0.0069
62.0000	-13.5924	0.0069

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64.0000	-13.5878	0.0115
66.0000	-13.5924	0.0069
68.0000	-13.5809	0.0184
70.0000	-13.5671	0.0322
72.0000	-13.5809	0.0184
74.0000	-13.5809	0.0184
76.0000	-13.574	0.0253
78.0000	-13.5809	0.0184
80.0000	-13.5878	0.0115
82.0000	-13.5809	0.0184
84.0000	-13.5625	0.0368
86.0000	-13.5625	0.0368
88.0000	-13.5671	0.0322
90.0000	-13.574	0.0253
92.0000	-13.5625	0.0368
94.0000	-13.5625	0.0368
96.0000	-13.5487	0.0506
98.0000	-13.5487	0.0506
100.0000	-13.5418	0.0575
120.0000	-13.5234	0.0759
140.0000	-13.4912	0.1081
160.0000	-13.4659	0.1334
180.0000	-13.4222	0.1771
200.0000	-13.436	0.1633
220.0000	-13.4038	0.1955
240.0000	-13.3854	0.2139
260.0000	-13.3578	0.2415
280.0000	-13.3647	0.2346
300.0000	-13.3325	0.2668
320.0000	-13.3072	0.2921
340.0000	-13.2819	0.3174
360.0000	-13.2773	0.322
380.0000	-13.2566	0.3427
400.0000	-13.2566	0.3427
420.0000	-13.2313	0.368
440.0000	-13.2198	0.3795
460.0000	-13.2129	0.3864
480.0000	-13.1945	0.4048
500.0000	-13.1876	0.4117
520.0000	-13.1761	0.4232
540.0000	-13.1623	0.437
560.0000	-13.1485	0.4508
580.0000	-13.1439	0.4554
600.0000	-13.137	0.4623
620.0000	-13.1232	0.4761
640.0000	-13.1186	0.4807
660.0000	-13.1117	0.4876
680.0000	-13.0979	0.5014
700.0000	-13.0933	0.506
720.0000	-13.0795	0.5198