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The In-Situ Decontamination of Sand and Gravel Aquifers by Chemically Enhanced Solubilization of Multiple-Compound DNAPLs With Surfactant Solutions
Phase I: Laboratory and Pilot Field-Scale Testing
Phase II: Solubilization Test and Partitioning Interwell Tracer Tests

Final Report
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Federal Energy Technology Center
P.O. Box 880
Morgantown, West Virginia 26507-0880

By
INTERA, Inc.
6850 Austin Center Boulevard
Suite 300
Austin, Texas 78731

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Phase I: Laboratory and Pilot Field-Scale Testing

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Acknowledgement

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Abstract

Laboratory, numerical simulation, and field studies have been conducted to assess the potential use of micellar-surfactant solutions to solubilize chlorinated solvents contaminating sand and gravel aquifers. Laboratory studies were conducted at the State University of New York at Buffalo (SUNY) while numerical simulation and field work were undertaken by INTERA Inc. in collaboration with Martin Marietta Energy Systems Inc. at the Paducah Gaseous Diffusion Plant (PGDP) in Kentucky.

Ninety-nine surfactants were screened for their ability to solubilize trichloroethene (TCE), perchloroethylene (PCE), and carbon tetrachloride (CTET). Ten of these were capable of solubilizing TCE to concentrations greater than 15,000 mg/L, compared to its aqueous solubility of 1,100 mg/L. Four surfactants were identified as good solubilizers of all three chlorinated solvents. Of these, a secondary alcohol ethoxylate was the first choice for *in situ* testing because of its excellent solubilizing ability and its low propensity to sorb. However, this surfactant did not meet the Commonwealth of Kentucky's acceptance criteria. Consequently, it was decided to use a surfactant approved for use by the Food and Drug Administration as a food-grade additive. As a 1% micellar-surfactant solution, this sorbitan monooleate has a solubilization capacity of 16,000 mg TCE/L, but has a higher propensity to sorb to clays than has the alcohol ethoxylate.

Constraints beyond INTERA's control prevented the assessment of the potentially suitable surfactants in the laboratory with cores and ground waters from the site. These constraints, which could not be resolved before the field test, meant the surfactant solution had to be injected without laboratory testing of the surfactant's compatibility with the aquifer materials.

The field test was conducted in the alluvial aquifer which is located 20 to 30 meters beneath a vapor degreasing operation at PGDP. This aquifer has become contaminated with TCE due to leakage of perhaps 40,000 liters of TCE, which has generated a plume of dissolved TCE extending throughout an area of approximately

$3\ km^2$ in the aquifer. Most of the TCE is believed to be present in the overlying lacustrine deposits and in the aquifer itself as a dense, non-aqueous phase liquid, or DNAPL.

The objective of the field test was to assess the efficacy of the surfactant for *in situ* TCE solubilization. This involved the injection and subsequent extraction of the surfactant solution through a single well. The aqueous concentrations of TCE in this well have consistently been measured at 300 to 550 mg TCE/L over a period of three years. Capillary and bond numbers were calculated and evaluated to confirm the improbability of mobilization of DNAPL due to the lowering of the interfacial tension by the surfactant solution. The injection phase lasted 3.75 days at 3.8 liters per minute (1 gpm), while the extraction phase lasted 16 days at 3.8 liters per minute (1 gpm). The extraction operation, which removed four times the injected volume, recovered only 34% of the surfactant, probably due to sorption, precipitation, or liquid crystal formation of the surfactant, or some combination of these processes. Due to this loss of surfactant *in situ*, there was no enhancement of aqueous TCE concentrations in the recovered ground waters. TCE behaved nonconservatively during the early stages of extraction, suggesting that it may have been sorbed to the immobilized surfactants.

Although the test demonstrated that sorbitan monooleate was unsuitable as a solubilizer in this aquifer, the single-well test was demonstrated to be a viable method for the *in situ* testing of surfactants or cosolvents prior to proceeding to full-scale remediation. It is probable that this result could have been identified in the SUNY laboratory beforehand and an alternative surfactant chosen and tested with core materials, had it been possible to transfer core off site.

It is recommended that (1) detailed core analyses to screen surfactants meeting the Commonwealth of Kentucky's acceptance criteria be conducted, (2) the field studies at C-400 planned by PGDP for next spring be complemented with computational studies of DNAPL migration to assist in the design of the drilling program, and (3) an inter-well DNAPL solubilization test be undertaken over a distance of at least 10 meters to test the efficacy of DNAPL solubilization by micellar surfactant solution.

1.0 INTRODUCTION

1.1 Surfactant-Enhanced Aquifer Remediation

Dense, non-aqueous phase liquids or DNAPLs, in particular chlorinated solvents such as trichloroethene (TCE), pose an as-yet unresolved ground-water contamination problem at DOE facilities across the nation. Figure 1.1 shows the migration of DNAPL in a sand and gravel aquifer system and the development of a DNAPL zone, comprising several vertical fingers and horizontal pools. Also shown are two dissolved-phase plumes, one partially due to vapor migration to the water table, the other due solely to DNAPL dissolution beneath the water table. The mobility of DNAPLs in the subsurface, their low aqueous solubility, and the heterogeneity of typical aquifer systems combine to create conditions that inhibit rapid *in situ* remediation by traditional pump-and-treat methods. Thus, tens to hundreds of liters of DNAPL may require tens to hundreds of years to be dissolved by ground-water extraction (Johnson and Pankow, 1992).

Such long remediation times mean that short-term remediation target dates will not be met. The hazardous waste clean-up program presently being undertaken by the U.S. Department of Energy is committed to the decontamination of the Weapons Complex facilities in 30 years (i.e., by the year 2019). As Mackay and Cherry (1989) have noted about DNAPLs in general, ". . . very little success has been achieved in even locating the subsurface sources, let alone removing them." Thus, it is essential that methods be developed to permit the rapid location, characterization, and remediation of such DNAPL sources if DOE's deadline is to be met.

A particularly attractive approach to the characterization and remediation of DNAPL sites involves the use of surfactants to enhance the dissolution of DNAPLs by a process known as solubilization. Surfactant-enhanced aquifer remediation (SEAR) is the generic name given to the process of *in situ* DNAPL remediation employing micellar surfactant solutions (Jackson, 1993).

The mechanism of solubilization displayed by nonionic and anionic surfactants arises from the formation of micelles by the surfactant in aqueous solutions (Rosen, 1989). Surfactants, or surface-active solutes, have polar and nonpolar groups that exhibit hydrophilic and hydrophobic properties, respectively. At certain characteristic concentrations, surfactants exhibit marked changes in several physical and chemical properties, e.g., electrical conductivity, interfacial tension and detergency. The concentration of the surfactant at which these phenomena occur is known as the critical micelle concentration, or CMC. At this concentration, the polar and nonpolar groups become oriented such that they form colloidal clusters of molecules in solution. The clusters are characterized by the interfacing of the hydrophilic groups with the water molecules on the outside of the cluster, while the hydrophobic groups are arranged pointing toward the interior of the cluster.

At the CMC, aqueous solutions of surfactants show a greatly enhanced ability to dissolve compounds that are otherwise sparingly soluble in aqueous solution. The hydrophobic interior of the micelles creates a nonpolar environment in the center of the cell which is capable of accommodating nonpolar molecules, effectively bringing the contaminants into solution. This process of solubilization has been defined by Rosen (1989) as ". . . the spontaneous dissolving of a substance (solid, liquid, or gas) by reversible interaction with the micelles of a surfactant in activity of the solubilized material." Figure 1.2 shows a schematic interpretation of solubilization.

It is well known in the petroleum industry that extremely high effective aqueous solubilities for organic compounds can be obtained by lowering the interfacial tensions of oil/surfactant mixtures to values less than 0.1 dynes/cm (Lake, 1989). By this method, it is possible to mobilize and displace petroleum hydrocarbons as an "oil bank." However, when remediating contaminated sites, such mobilization of DNAPLs could well result in their vertical displacement through permeable windows in sedimentary aquitards and through fractures in rock, resulting in deeper contamination. This has necessitated a different approach for surfactant-enhanced aquifer remedation. The alternative approach seeks to maintain the interfacial tensions above 1 dyne/cm to minimize the possibility of vertical and horizontal mobilization while striving for maximum effective solubility. Fountain et al. (1991) demonstrate that dilute (1%) surfactant solutions may have interfacial tensions exceeding 1 dyne/cm with respect to perchloroethylene (PCE) with a solubilization capacity of 1 g PCE / g surfactant, where the aqueous solubility of PCE is 0.0002 g PCE/g water.

1.2 Objectives

This project is composed of two phases and has the final objective of demonstrating SEAR as a practical remediation technology in sand and gravel aquifers with ground water contaminated by DNAPLs such as chlorinated solvents. The first phase of this project, *Laboratory and Pilot Field Scale Testing,* which is the subject of the work so far, had two specific objectives:

1. to identify surfactants or blends of surfactants in the laboratory that will efficiently extract PCE and TCE from a sand aquifer by micellar solubilization; and

2. to test the efficacy of the surfactant or surfactant blend(s) to solubilize the DNAPLs, perchloroethylene (PCE) and trichloroethylene (TCE), *in situ* by injection and then withdrawal of a surfactant solution through an existing well within the sand aquifer at a government-owned contaminated site.

(The underlined parts reflect changes to these specific objectives proposed by INTERA in its Cost to Complete proposal of September 28, 1994, in order to remove inconsistencies between the specific objectives listed above and the tasks set out by the Morgantown Energy Technology Center (METC) in the Statement of Work.)

These specific objectives became tasks in the Phase 1 project. The task structure is as follows:

Task 1.1: Information required for the National Environmental Policy Act (NEPA);

Task 1.2: Laboratory experiments to identify and characterize surfactants and their solubilization activity;

Task 1.3: Single-well, injection-withdrawal test for DNAPL solubilization;

Task 1.4: Phase 1 topical report.

1.3 Site Selection

The Statement of Work prepared for this contract by METC indicated that the field work would be conducted at a government-owned plant. A number of issues arose which indicated that it would be advantageous to conduct the field test at the Paducah Gaseous Diffusion Plant [PGDP] in Kentucky (see Figure 1.3). Most important of these was the possibility that the test might be conducted in a shallow aquifer (20 to 30 feet deep) at the "Drop Test" site at PGDP, which had been used for drop-testing UF_6 cylinders and at which site TCE had leaked into the subsurface. Because PGDP was already committed to characterizing the Drop Test site by drilling numerous boreholes into the shallow aquifer, there was a significant cost advantage to using a shallow contaminated aquifer system rather than a deeper one. The decision to conduct the field test at PGDP with Martin Marietta Energy Services was endorsed by Mr. Jeff Walker of EM-50 (Germantown, MD) during a telephone discussion on February 17, 1993.

However, on December 3, 1993, after one full year of field testing at the Drop Test site, PGDP decided to abandon the site because it had become clear that the shallow formation was not the high permeability sand and gravel PGDP first thought it to be. Rather, analysis of a core sample from the Drop Test Site at the State University of New York at Buffalo (SUNY-Buffalo) indicated that it was a poorly sorted material composed of clays and silts (10%), sands (24%), and gravel (63%). (Cores from the Drop Test Site could be shipped to Buffalo because they were not radioactively contaminated; this was not the case with the C-400 cores.) This soil material had a hydraulic conductivity of much less than 0.001 cm/s, which is the minimum acceptable hydraulic conductivity for the Phase 1 test. In a ground-water system with a hydraulic conductivity of less than 0.001 cm/s, the period of surfactant injection would be of the order of months—not days—for the surfactant solution to migrate out 10 feet from the injection well, and an equally long period of extraction. Because the Statement of Work clearly indicated that the test should be in a sand aquifer and therefore only a week of field work had been budgeted, the Drop Test site was clearly unsuitable for use for this test (see Progress Report dated January 12, 1994, ISD 15).

A second site at PGDP, the C-400 site, was chosen because a particular well at the site (MW-156) had a sufficiently high hydraulic conductivity and had TCE concentrations greater than 100 mg/L, which suggested a nearby TCE DNAPL zone. Thus, as the Statement of Work indicated, an existing well could be employed. Consequently, a Work Plan for this new site was prepared in January and February 1994.

1.4 Scope Limitations

Three issues arose prior to the test which affected the original scope of the field test. First, Sandia National Laboratories was not able to subcontract with INTERA to test the effectiveness of the surfactant in the laboratory. Second, Martin Marietta Energy Systems' policy prevented INTERA from having cores of the RGA sent to SUNY-Buffalo for testing with the surfactants deemed suitable for injection. Third, the original preferred surfactant for the field test did not meet the State of Kentucky's acceptance criteria. Because these issues affected testing the efficacy of micellar-surfactant solutions prior to injection, it is necessary to discuss their importance in the hope that they might be resolved before the commencement of Phase 2.

1.4.1 Difficulties in Contracting with Sandia National Laboratories

The original Statement of Work (SOW) of the contract included provision for work to be undertaken at the Sandia National Laboratories. The proposed role of Sandia in the Phase 1 study was identified in paragraph 2 of Task 1.2 of the SOW. The tests at Sandia concerned laboratory-scale and bench-scale solubilization experiments employing single- and multiple-component DNAPLs with the surfactant blend identified by Dr. Fountain at the State University of New York at Buffalo (SUNY-Buffalo).

DOE Albuquerque and DOE/METC were unable to reach agreement on the issue of the permissibility of Sandia National Laboratories being a subcontractor to INTERA for this work (J. Harness, METC, personal communication). This disagreement was noted in each monthly progress report submitted by INTERA to METC, beginning with that of June 18, 1993 (ISD 8). Therefore INTERA recommended to DOE (see Cost-to-Complete Proposal dated September 28, 1994) that the Phase 1 SOW should be changed to reflect the fact that these tests cannot be included in the Contract. The inability of Sandia to assist in the assessment of the surfactant was a considerable disadvantage to the project.

1.4.2 Difficulties in Transfer of RGA Cores to SUNY-Buffalo

During 1993, when the focus of the field work was on the Drop Test site, PGDP sent a core to SUNY-Buffalo for use in surfactant screening and hydrogeological characterization of the HU2 formation (see Figure 3.2). During the spring of 1994, there were prolonged and ultimately unsuccessful discussions between Martin Marietta Energy Systems at Oak Ridge, SUNY-Buffalo, DOE/METC, and INTERA over the shipping of a second core to SUNY for testing with surfactants which appeared to be suitable for employment in the RGA (HU4-5). This second core was to be taken from the PGDP core archives representing aquifer materials from the RGA near MW-156.

The difficulty in transferring this second core appears to have arisen from the presence of alpha and beta emitters in the aquifer samples (gross alpha = 3-5 pCi/g; gross beta = 6-10 pCi/g). The alpha emitters might include U, Pu, or other actinides, while the beta emitter would likely be ^{99}Tc. Lawyers for Martin at Oak Ridge wrote SUNY-Buffalo requesting changes to SUNY's Radioactive Materials License to allow for (1) the presence of tritium in these samples, (2) an extension of the license to include elements with atomic numbers 84 through 98 (i.e., the actinide series, radium etc.) and (3) concentrations of up to 100 mCi for isotopes with atomic numbers 84 to 98. SUNY responded that tritium was already covered and that the requirement for a 100 mCi quantity of each radioisotope with atomic number 84 to 98 was unreasonable in the light of the measured contamination, but that SUNY nevertheless was willing to explore changes to its license. Unfortunately, these changes could not be implemented before the test was undertaken in August 1994.

PGDP assisted in determining the nature of the aquifer materials by submitting a sample to the Oak Ridge National Laboratory for x-ray diffraction analysis. This testing revealed that more than 90% of the clay-sized fraction of this sample (~ 0.7% of the total sample, i.e., boring H007, 63-69 ft, sample #4382) was composed of quartz, with lesser amounts of kaolinite, smectite and hematite (memorandum from Dr. Mark Elless, Oak Ridge National Laboratory, to K.R. Davis, PGDP, dated 2.18.94). Therefore, it appears probable that the total concentration of smectite, an expandable clay mineral which could readily sorb surfactants, would be about 0.02% of the total sample. Such a concentration would be unlikely to exert a pronounced negative effect on surfactant injection within the RGA.

1.4.3 Difficulties with Employment of the Preferred Surfactant

On March 24, PGDP and INTERA made a presentation to the Division of Waste Management, Environmental Protection Cabinet, of the Commonwealth of Kentucky concerning the proposed field test. The state representatives agreed to allow the test to go forward provided that:

1. additional scoping calculations were made using higher hydraulic conductivities in estimating the bond number (see Section 4) than had been used initially by INTERA; and

2. an alternative surfactant be chosen which did not contain reagent chemicals prohibited in Kentucky ground waters (Tergitol, an alcohol ethoxylate, contains unreacted reagent chemicals such as 1,4-dioxane and glycol ether which are prohibited in Kentucky ground waters).

Tergitol had been shown to perform excellently during the *in situ* solubilization of carbon tetrachloride at the DuPont chlorocarbon facility near Corpus Christi, Texas, by Dr. John Fountain of SUNY-Buffalo (Fountain, 1993). Tergitol was replaced with a sorbitan monooleate surfactant (T-MAZ 80K) which had sorbed appreciably during the Corpus Christi test but was chosen on the basis of the expected low clay content of the RGA and its FDA-approved status as a food-grade additive with good biodegradation properties and very low toxicity.

Later, the state of Kentucky indicated to PGDP that it would like to see the majority of the surfactant recovered. Consequently, by agreement with PGDP, the extraction period was lengthened to four times the injection period. This resulted in the length of the field test being extended from 49 man-days in the proposal to 90 days in the field, adding considerably to the cost of the field test. Final approval to conduct the field test was granted by the Commonwealth of Kentucky in June (letter of Caroline Haight, June 3, 1994).

2.0 LABORATORY EXPERIMENTS TO IDENTIFY AND CHARACTERIZE SURFACTANTS AND THEIR SOLUBILIZATION ACTIVITY

A significant factor in selecting a surfactant for the field test is its ability to solubilize TCE, PCE, and CTET. Toxicity, sorption, interfacial tension, and viscosity must also be evaluated before a final selection can be made. The following sections detail the analyses performed by SUNY to determine an appropriate surfactant for the C-400 site at PGDP.

2.1 Aquifer Characterization

Aquifer characterization data is critical in the selection of an appropriate surfactant for the field test. Grain size distribution, clay chemistry, and total organic carbon content determine the sorption of the surfactant to the soils (see Section 2.4). A knowledge of site water chemistry is critical because many surfactants are intolerant of high cation concentrations. No samples were made available to SUNY for characterization of the aquifer sediments or water from the C-400 site; therefore, no core characterization studies could be conducted. As a result, several assumptions had to be made to assure a reasonable choice of surfactants. Surfactant sorption is proportional to the smectite clay content and total organic carbon (TOC) content. Clay percentages have been reported to be considerably less than 1%, so clay adsorption was not expected to be significant. Because this aquifer is well below the surface, it was reasonable to assume that TOC values will be low and thus sorption will also be low. Because the water chemistry was unknown, the selected surfactant must be tolerant of a wide range of conditions to minimize potential problems resulting from variations in aquifer, soil, and water chemistry.

2.2 Solubilization

Examination of solubilization results for TCE, PCE (perchloroethylene), and CTET (carbon tetrachloride) suggest that sorbitan derivatives, ethoxylated amide derivatives, secondary alcohol ethoxylates, castor oil derivatives, and alkylaryl sulfonate derivatives are the best solubilizers. The results and experiments are discussed in detail below.

2.2.1 HLB Determination

Any organic liquid, such as a surfactant or a chlorinated solvent, can be ascribed an HLB number, i.e., a hydrophilic-lipophilic balance number. In order to form a microemulsion of a chlorinated solvent in a surfactant solution, it is best to match the HLB number of the surfactant solution with the HLB number of the chlorinated solvent.

Therefore, an initial task was to identify the HLBs of the three chlorinated solvents of concern: TCE, PCE, and CTET. Knowing these values, potentially suitable surfactants could be identified from previously reported values.

The HLB was determined for TCE, PCE, and CTET using the Tergitol secondary alcohol ethoxylates by gas chromatograph (GC) analysis of surfactant contaminant mixtures. Solutions of 25 ml of 1% surfactant in distilled water plus excess (>0.5 ml) TCE, PCE or CTET were prepared and stirred for a minimum of 24 hours. The TCE was dyed red with Sudan IV to enhance visibility. The solutions were then centrifuged at 3,500 rpm for one hour and analyzed.

The Tergitol with the highest solubilized concentration represents the HLB of the contaminant. An HLB of 14.7 was determined for TCE and CTET, and an HLB of 13.3 for PCE (see Table 2.1 and Figure 2.1). Once the HLB was established, quantitative gas chromatograph (GC) screening f nonionic and anionic surfactants was undertaken.

2.2.2 Solubilization of TCE

The ability of a 1% surfactant solution to solubilize TCE was determined by GC analysis of surfactant contaminant mixtures using a test parameter known as the maximum additive concentration (MAC). The MAC represents the maximum concentration of TCE or other contaminant which can be solubilized by a given volume. To determine the MAC, 25 ml solutions of 1% surfactant in distilled water plus excess (0.5 ml) TCE were prepared and stirred for a minimum of 24 hours. The TCE was dyed red with Sudan IV to enhance visibility. The solutions were then centrifuged at 3,500 rpm for one hour and analyzed. Additional volumes of TCE were added, stirred, and analyzed until a limit was achieved above which solubilization no longer occurred—the MAC. Initial screening of nonionic surfactants proceeded using 1% solutions of surfactants with HLBs ranging from 14 to 17. A total of 99 surfactants was screened, including 25 nonionics and 74 anionics (see Tables 2.2 and 2.3). The results are discussed below.

Examination of the data indicates that 10 of the 99 surfactants tested to date solubilize TCE at greater than 15,000 ppm (5 nonionics, 5 anionics) (see Tables 2.2 and 2.3). Among the nonionics, sorbitan monooleates and castor oil derivatives are the most promising, since they are food grade additives and have high solubilization values (>16,000 ppm). In addition, the soya sterol, with a solubilization value of about 29,000 ppm, is also promising. Within the anionics, alkylaryl sulfonates, sulfonate/nonionic blends, and phosphate esters show the best solubilization (>15,000 ppm). Castor oil sulfates and sulfonates are also good solubilizers, with solubilities ranging from 10,000 ppm to approximately 15,000 ppm.

2.2.3 Solubilization of Other Contaminants

In addition to TCE, PCE and CTET are other contaminants of concern. To determine if the other contaminants could be remediated efficiently using the same surfactants, 25 ml solutions of 1% surfactant plus 0.5 ml of PCE or CTET were prepared for GC analysis. The solutions were stirred for a minimum of two days and then centrifuged at 3,500 rpm for one hour before analysis.

Examination of the data indicates that the surfactants that are good solubilizers of TCE will also solubilize the PCE and CTET. Generally, PCE solubilizes less than TCE and the solubility of CTET showed more variation (see Tables 2.2 and 2.3). For example, the solubilization of TCE in the sorbitan derivatives is generally greater than 13,000 ppm, whereas the solubilization of PCE is generally less than 6,000 ppm and the solubilization for CTET ranged from 10,500 to 12,500 ppm. Four surfactants are good general solubilizers of all contaminants. These are no. 60 (a Sorbitan monooleate), no. 119 (an Alkylaryl sulfonate isopropylamine), no. 135 (C11-C15 secondary alcohol ethoxylate) and no. 154 (POE 7 Oleamide).

Comparison of the MAC to aqueous solubility of the various contaminants suggests that the increase in solubility of the contaminant is a function of the aqueous solubility. PCE with a solubility of 150 ppm attains 135 times the aqueous solubility. TCE with a solubility of 1,100 ppm attains a maximum of 23 times aqueous solubility.

2.2.4 Solubilization of Mixtures

Most of the tests were done using one component DNAPLs (TCE or PCE) because it eliminates possible complications arising from their interaction; however, mixtures are more typical of actual DNAPL contamination found in the field. To study whether co-solvent effects (i.e., the enhancement of DNAPL solubility due to the presence of dissolved components of another DNAPL) occur between the components of a DNAPL mixture, mixtures of PCE and TCE were prepared in the following proportions (TCE:PCE) for each surfactant under consideration (#18, #135, and #154): 90:10, 75:25, 50:50, and 25:75 (see Table 2.4).

Examination of the results indicates that the percent of TCE and PCE solubilized is approximately equal to the percent of TCE and PCE present in the DNAPL mixture. This indicates that co-solvent effects are insignificant.

2.3 Toxicity

The toxicity of any compound that will be injected into water-bearing zones is of concern since remediation is supposed to solve contamination problems, not exacerbate them. The surfactants under consideration are either food grade additives or food usage additives, which means that small amounts are not toxic. Surfactants in general have very low toxicity to mammals. Their LD50s (lethal dosage at which 50 percent of test animals are killed) are in the same range as sodium chloride (Swisher, 1987). Several types of surfactants, including many of the sorbitan derivatives (i.e. surfactants nos. 18, 60, 64 and 161) and the sodium lauryl sulfate are classified as food grade additives by the FDA (CFR 21.172). Many others are classified as suitable for use on food and food processing equipment, including the alcohol ethoxylates like surfactant no. 135. One major use of surfactants is in dish-washing soaps; thus, it is likely that small amounts of surfactants are ingested regularly by large segments of the population. Surfactants, however, have higher toxicities to aquatic life and thus the discharge levels to fresh water must be regulated.

All the surfactants currently under consideration are non-toxic to humans, especially at concentrations of 1% or 2%.

2.4 Sorption

Sorption refers to the combination of adsorption and absorption since they can seldom be independently evaluated in ground-water systems. Because surfactants are organic compounds, their sorption on clay and organic aquifer materials may be significant and thus may be an important factor in determining the cost of remediation. Sorption isotherms are typically Langmuirian with a steep slope prior to the critical micellar concentration (CMC) and then a nearly flat slope above the CMC. The shape of the isotherm has been explained by two different models: (1) the site model, and (2) the micelle model. The site model is a conventional interpretation in which it is assumed that by the time the CMC is reached, all sites on the surface have received a mono layer of surfactants. Sorption is minimal above this point. The micelle model is based on the distribution of surfactants in the aqueous phase. Below the CMC, surfactant molecules are present as monomers; their concentration in the aqueous phase is the same as the total surfactant concentration up to the CMC. Above the concentrations where micelles form, the concentration of the monomers remains at the CMC concentration. Any additional surfactant added to the system forms micelles and thus the aqueous monomer phase concentration does not change. Since micelles are not believed to be sorbed (they have strongly polar outer shells), sorption is controlled by the monomer concentration up to the CMC and is flat above it as the monomer concentration stays constant. Data are consistent with either model.

Sorption varies with mineralogy of the aquifer, organic content, and water chemistry. In the target zone, there was assumed to be little organic carbon and minor amounts of smectitic clays (<< 1% reported; see Section 1.4.2). It is highly probable that these smectites control the sorption of the surfactants. Because smectite clays have large surface areas (Grim, 1968), surfactants as surface active agents should be expected to react strongly with them. Thus, in the presence of these clays, it is expected their percentage controls the sorption of the surfactants. Examination of sorption on smectite-rich sediments suggest that this is true. In fact, sorption in these soils is considerably higher than sorption on 3% organic soils tested in our laboratory. The results of the batch tests are discussed below.

2.4.1 Batch Tests

The clay mineralogy of the core sample received in September 1993 for the Drop Test site indicated that there was a maximum of 3% interlayered illite/smectite clay, with approximately 50% of the clay being smectites. Based on these data, batch tests were prepared using a mixture of 3% illite/smectite clay (40% smectite) and 97% sand for the following four surfactants:

- no. 60 (Sorbitan monooleate)
- no. 119 (Alkylaryl sulfonate isopropylamine)
- no. 135 (C11-C15 secondary alcohol ethoxylate)
- no. 154 (POE 7 oleamide).

Eight grams of soil were added to 40 ml of 1% surfactant prepared in water with a total dissolved solid content of 2,612 mg/L. The flasks were shaken for 24 hours to ensure that equilibrium had been reached. The solutions were then analyzed using either UV analysis or the cobalt thiocyanate dye method for nonionics (Greff et al., 1965). The difference between the initial and final concentrations of surfactant were used to calculate the retardation factor. The retardation factor (R) is a ratio of the velocity of water through a soil system to the velocity of a solute (such as a surfactant) through the same system. This ratio is a function of the sorption of the compound on the soil. Examination of the data suggests all surfactants under consideration have retardation factors lower than 5 in 3% clay soils with brackish water (see Table 2.5). Surfactant no. 119 was not tested because the solution was cloudy, making it unsuitable for use.

Subsequent analysis of similar aquifer material from borehole H007 (see Figure 3.1 for location) by Oak Ridge Laboratories indicates that there is only 0.02% clay in the target formation. Retardation decreases with decreasing clay (see Table 2.5) and thus the actual retardation values should be less than 2, making them acceptable for use.

In addition, the batch studies were conducted using water with a total dissolved solid content (TDS) of 2,612 mg/L, which is considered brackish water (Freeze and Cherry, 1979). Although the ground water in the Paducah aquifer is expected to be fresh water, no site water analyses were available to us and thus this composition represents a probable upper limit. Many surfactants are sensitive to ionic strength, and using brackish water ensures that the chosen surfactant will be tolerant of a wide range of water chemistry.

2.5 Surfactant Physical Properties

The physical properties of surfactant solutions, such as interfacial tension, critical micellar concentration, and viscosity affect their transport through the subsurface and their ability to solubilize contaminants. The interfacial tension between the surfactant and the contaminant determines whether the contaminant will be mobilized horizontally or vertically during surfactant flushing. The critical micellar concentration determines the point at which a surfactant can solubilize the contaminant through the formation of micelles. The solutions used during remediation must exceed this concentration to maximize contaminant solubilization. The viscosity of the surfactant solution partly determines whether it can flow easily through the subsurface. Examination of these properties suggests that surfactants nos. 18, 135, and 154 are viable for use at Paducah.

2.5.1 Interfacial Tension

Surfactants have the ability to lower the interfacial tension of the DNAPLs by several orders of magnitude, which in theory would allow horizontal movement of the DNAPL through traction of pumped ground water. However, reducing the interfacial tension of the contaminant sufficiently to mobilize the contaminant horizontally may also induce unwanted vertical mobility (Fountain, 1992; Palmer and Fish, 1992), making the task of DNAPL retrieval that much more difficult. Laboratory and field tests suggest that no vertical movement occurs if the IFT is at least 1 dyne/cm.

The IFT between TCE, PCE, and CTET and several 1% surfactant solutions were measured (see Table 2.6). Obtaining IFT values between TCE and the surfactant solutions proved to be problematic because emulsions formed on the interface, leading to apparently elevated IFT values. However, comparison of IFT values between the surfactant solutions and the DNAPL compounds where emulsions did not form suggests that IFT values between the surfactant solutions and TCE should be similar to IFT values between the surfactant solutions and PCE or CTET. Thus, IFT values between a particular surfactant solution and TCE can be estimated from the IFT values between the surfactant solution and PCE or CTET. Using such an estimation, a 1% solution of surfactant no. 135, for example, has an IFT with TCE of between 5 and 7 dynes/cm. Examination of the results suggests that most of the surfactant types of interest at 1% solution have IFTs greater than 1 dyne/cm with respect to TCE, PCE, and CTET, and may be suitable for use.

2.5.2 Critical Micellar Concentration

Determination of the critical micellar concentration (CMC) is essential to the determination of the percent surfactant that can be used in the field test. The CMC value represents the minimum volume percentage of surfactant that can be used in solution and maintain the micellar structure necessary for contaminant solubilization. The CMC for surfactant no. 135 (linear alcohol ethoxylate) is reported as 0.011%, and for surfactant no. 18 (sorbitan monooleate) it is 0.012% (PPG Corporation communication to R.E. Jackson). Surface tension measurements confirm that the critical micellar concentration is considerably less than 1% for both surfactants (see Table 2.7). Thus, use of a minimum of a 1% surfactant solution ensures the presence of micelles during remediation.

2.5.3 Viscosity

Viscosity measurements were made on 1% and 2% solutions of surfactants nos. 18, 135, and 154 to ensure that the solutions have a low enough viscosity to permit movement through the aquifer. Examination of the data indicates that the viscosity of the 1% and 2% solutions is similar to that of water (see Table 2.8) and thus the solutions should flow at approximately the same rate as the ground water.

2.6 Solubilization Kinetics

Column studies were conducted to determine the relative solubilization kinetics between TCE and surfactants nos. 18, 135, and 154. The maximum concentration obtained and the number of pore volumes required to reach the maximum concentration were used to measure the solubilization kinetics between the contaminant and the surfactant.

Examination of the data in Table 2.9 suggests that, of the three target surfactants, no. 18 exhibits the best kinetics. It produced effluent containing 13,600 ppm of dissolved TCE within one pore volume, which is 84% of the MAC determined in vial tests (@ 16,000 ppm). Surfactant 154 reached 10,000 ppm TCE after 1 pore volume, which is 55% of the vial MAC (@ 18,000 ppm). Surfactant 135 had a thick layer of emulsion at the base of the column and there appeared to be some drainage of TCE from the column. Number 135 only attained 3,111 ppm after several pore volumes, which is only 24% of the vial MAC (@ 13,000 ppm). There are several possible reasons for this. The mobilization of the TCE to the bottom of the column may have resulted in reduced contact time and area for the surfactant, which would lead to lower solubilization. In addition, the presence of an immobile emulsion may have inhibited the solubilization process.

2.7 Surfactant Selection

The solubilization data suggest that the following surfactants have solubilization values that exceed 10,000 ppm for TCE and are thus possible candidates for use in the field test:

Surfactant No. 18 = POE20 Sorbitan Monooleate
119 = Alkyl Aryl Sulfonate Isopropylamine
121 = PEG 25 Soya Sterol
128 = Aliphatic Phosphate Ester
135 = C11-C15 Secondary Alcohol
154 = POE 7 Oleamide
213 = PEG 1100 Castor Oil
249 = Na Sulfated Ester
250 = Sulfated Castor Oil
271 = 12 POE Nonylphenol

Examination of the sorption and toxicity data suggested that the best choice for the Paducah field test was a secondary alcohol ethoxylate (surfactant no. 135, commercial name: Tergitol 15-S-12). However, this surfactant proved unsatisfactory to the Commonwealth of Kentucky because of the possibility of its containing unreacted reagent chemicals which are prohibited in Kentucky ground waters. The second choice for the surfactant was a sorbitan monooleate (surfactant no. 18, commercial name: T-MAZ-80). It combines excellent solubilization ability with extremely low toxicity but can have a problem with sorption if the soils contain clays and organic materials. Tables 2.10 through 2.13 summarize the solubilization, IFT, viscosity and retardation factor data for surfactant no. 18 and the other sorbitan monooleates in the study.

Surfactant no. 18 increases TCE solubility to approximately 16,000 ppm in a 1% surfactant solution from an aqueous solubility for TCE of 1,100 ppm (see Table 2.10). Table 2.11 shows the interfacial tension between a 1% solution of surfactant no. 18 and TCE is 11.67 dynes/cm which is an order of magnitude greater than the 1 dyne/cm cut-off used in the study. Viscosity measurements made on 1% and 2% solutions of surfactant no. 18 are similar to that of water (see Table 2.12). It is a better performer than Tergitol 15-S-12 (surfactant no. 135) in these respects. It is also tolerant of a wide range of water chemistries ranging from brines to fresh water. It was not initially recommended because its sorption is higher than Tergitol; however, studies indicate that the sorption remains low on sediments if clay and organic contents remain low (see Table 2.13). If the characterization data supplied to SUNY is correct and the clay content is indeed below 1%, sorption should be minimal. Analysis of sorbitan monooleate concentration in solution is also easy, since it may be measured directly by UV adsorption. It is a chromophore, so no dye is required. Finally, the deciding factor in view of the objections raised to Tergitol by the State regulators (see Section 1.4.3), sorbitan monooleates are food grade additives as per CFR 21.172.840 and thus have very low toxicity and high biodegradability.

Surfactant no. 154 was our first alternate. It is a good general solubilizer and is tolerant of a wide range of water chemistry. Its sorption should be low if clay contents are < 1% and it has low toxicity.

The remaining surfactants are unlikely candidates for a variety of reasons. The soya sterol (no. 121) was eliminated because it is a specialty surfactant and its cost is prohibitive. Surfactants no. 119, 213, 249, and 250 precipitate in ground waters with high ionic strengths making them unsuitable for use where water chemistry is unknown. Nonylphenol ethoxylate (surfactant no. 271) may persist for extended periods in the subsurface due to low biodegradability, making them unsuitable for remediation efforts. Phosphate esters such as surfactant no. 128 hydrolyze rapidly, making them unsuitable.

3.0 THE FIELD TEST SITE

3.1 Contaminant Hydrogeology of WMU-11

The field test site is known as Waste Management Unit 11 (WMU-11) and is centered on monitor well MW-156, which is located at the southwestern edge of Building C-400 (Figure 3.1). Large volumes of TCE were used in C-400 to degrease electrical equipment. During an excavation in 1986, it was discovered that substantial amounts of TCE had escaped into the subsurface through a broken connection between the C-400 sump line and a concrete sewer. Estimates reported by Clausen et al. (1992) indicate that some 10,000 gallons (40,000 L) of TCE may have leaked through the broken connection. MW-156 is one of a nest of monitor wells installed at WMU-11 to monitor the concentrations of TCE in the ground-water zone beneath Building C-400.

The hydrostratigrahic profile for MW-155, which is adjacent to and somewhat deeper than MW-156, is shown in Figure 3.2 and summarized in Table 3.1. The well screen for MW-156 is plotted on Figure 3.2 and indicates that it is screened over a distance of 2 m at 19 to 21 m (63 to 70 ft) below grade in a zone of gravelly, fine to medium sand. A mean hydraulic conductivity equal to 3 x 10^{-3} cm/s has been measured by CH2M Hill (1992). The sand pack for MW-156 extends over 4 m from 18.5 to 22.5 m (61 to 75 ft) below grade. MW-155 monitors the lower part of the Regional Gravel Aquifer (RGA or HU5) and has a measured hydraulic conductivity of 4.4 x 10^{-3} cm/s. MW-156 monitors the upper part of the RGA, while MW-157 is screened in HU2 and has a measured hydraulic conductivity of 2.5 x 10^{-5} cm/s. Beneath the RGA is the McNairy formation, which, according to the MW-155 borehole log, is composed of sandy clay that would act as a capillary barrier to penetration of the TCE DNAPL.

The hydrostratigraphy of the surficial sediments beneath C-400 has been analyzed by Phillips (1992) using a number of boreholes (shown in Figure 3.3) together with cross section F-G. The hydrostratigraphic model along the cross section of the subsurface beneath C-400 is shown in Figure 3.4. The basal McNairy formation is overlain by the RGA, which appears to fine upwards. However, the hydraulic conductivities of MW-155 and MW-156, as determined by slug testing, are similar, which suggests that fine- and medium-grained sands are abundant within the RGA and dictate the measured hydraulic and capillary properties. The lacustrine deposits above the RGA contain interbeds of sand and gravel which may provide part of the vertical pathway for DNAPL migration, although PGDP staff have noted fractures in these deposits which provide a more plausible and direct pathway to the RGA.

Clausen et al. (1992) have presented a conceptual model of DNAPL distribution beneath C-400 which is reproduced as Figure 3.5. The concentrations of TCE observed beneath WMU-11 are shown in Table 3.2. They indicate significant contamination to the bottom of the RGA. However, both HU 2 and the upper RGA are especially contaminated. The level of contamination in these two zones, being greater than 10% of the aqueous solubility of TCE, is strongly indicative of the presence of TCE DNAPL zones (EPA, 1992) surrounding the wells. This zone probably is comprised of vertical fingers and horizontal pools of TCE, as shown in Figures 1.1 and 3.5, with the pools perched on capillary barriers and containing large amounts of residual DNAPL and, possibly, some free-phrase TCE. Monitor wells indicate that the RGA is also contaminated with some PCE, indicating that the DNAPL is a multicomponent mixture.

3.2 Scenarios of TCE in the Regional Gravel Aquifer

The conceptual model of DNAPL migration beneath C-400 shown in Figure 3.5 appears to be derived from that proposed by Kueper (1991) in a review of the C-400 DNAPL problem. He noted that:

> The volumes of DNAPL released at PGDP have the potential to migrate to significant depths below ground surface. The ultimate depth of penetration is dependent upon many factors, most of which cannot be practically determined.

Kueper concluded that ". . . it must be assumed that DNAPL has entered the McNairy formation unless it can be proven otherwise," and that DNAPL may be pooled in the RGA above the McNairy.

This does not appear to be the case at the C-400 site. Assuming that the McNairy is indeed a sandy clay as the MW-155 log indicates, the entry of DNAPL into the McNairy would require a DNAPL pool height of at least 4 meters, assuming (very conservatively) a maximum pore throat radius of the sandy clay of 1 μm and a TCE/ground-water interfacial tension of 10 dynes/cm (0.01 N/m). Such a pool would inevitably manifest its presence as free-phase TCE in MW-155. As it is, MW-155, at the base of the RGA, exhibits aqueous TCE concentrations of 2 mg TCE/L, which is too low to allow the nearby presence of substantial amounts of residual TCE DNAPL, let alone a pool of such thickness.

A scenario similar to that of Kueper's was described by McConnell et al. (1994) based on numerical simulation of the C-400 TCE release. McConnell et al. concluded that ". . . residual TCE in the RGA averages about 5% and is fairly uniform; however, a large pool of TCE which is only a few centimeters thick is formed at the RGA-McNairy interface." Similar objections must be made to this scenario as to that of Kueper.

Figure 3.6 shows a schematic of the subsurface beneath C-400 which assumes that the pathway of ground-water recharge and DNAPL migration to the RGA is via a network of interconnected fractures. This aspect of the scenario is consistent with the observations made at the nearby PGDP landfill of deep fractures in the silts and clays extending all the way through the Upper Continental Deposits to the top of the RGA (Clausen et al., 1992, p.106) and with the measurement of dissolved oxygen and below neutral pH in MW-155 ground-water samples (see Section 5.8).

Scenario A of Figure 3.6 shows the distribution of TCE DNAPL within the RGA as a zone located upgradient of MW-156 and limited to the upper RGA. Scenario B in Figure 3.6 is that predicted by McConnell et al. (1994). These two scenarios have been simulated using INTERA's version of the UTCHEM multiphase, multicomponent simulator developed by G.A. Pope, K. Sepehrnoori, and colleagues of the Department of Petroleum and Geosystems Engineering of the University of Texas at Austin.

3.3 Simulation of TCE Scenarios in the Regional Gravel Aquifer

All the scenarios in this section were performed using UTCHEM (the University of Texas Chemical Flood Simulator (Saad, 1989)) a three-dimensional, multi-phase, multi-component, finite difference simulator originally designed to model enhanced-oil recovery.

Two scenarios were modeled in an effort to match the aqueous TCE concentration data in MW-155, 156, and 178. Both involved an area of residual TCE saturation that was allowed to dissolve into the surrounding water until steady state was achieved. Figure 3.7 is a schematic of the cross section that was simulated in both scenarios. The only differences between the two scenarios are the location of the DNAPL source and the size of the grid blocks. The cross section consists of four different stratigraphic layers representing the ground-water zone beneath building C-400 in the vicinity of wells MW-155, 156 and 178. The cross section has a length of 229 m (750 ft) and a depth of 16.5 m (54 ft). The upper 2.4 m represent the bottom of the Lacustrine units consisting of sandy clay. The next 5.5 m represent the upper half of the RGA consisting of sand. The next 6.1 m (20 ft) represent the bottom half of the RGA consisting of gravel. The bottom 2.4 m (8 ft) represent the top of the McNairy Formation, consisting of sandy clay. Three 5-cm (2-inch) diameter wells are completed within this cross section: MW-155, 156, and 178. The first well, MW-156, is screened from -19.2 to -21.3 m (-62 to -70 ft). The next well, MW-155, located 9 m to the north, is screened from -26 to -28 m (-86 to -92 ft). The final well, MW-178, located 64 m to the north, is screened from -18.9 to -20.7 m (-62 to -68 ft). The locations of these wells are shown on Figure 3.3. The DNAPL source for Scenario A is represented by the dark horizontal rectangle within the cross section. Its center is located 27.4 m (90 ft) south of the first well and just within the Upper RGA. Its length is 27.4 m and its height was 0.6 m. This source consists of DNAPL at a residual saturation of 0.15 (i.e., 15% of the pore space is occupied by TCE DNAPL), which means there are 268 liters (71 gallons) of TCE present in this DNAPL zone. The DNAPL source for Scenario B is represented by the dark vertical rectangle at the south of the schematic. Its center is located 45.7 m south of the first well and spans the entire RGA. All blocks within this source are at 0.05 residual saturation TCE DNAPL, except for the bottom one, representing a pool 7.6 cm high, with a residual saturation of 0.40, containing 591 liters (156 gallons) of TCE. This scenario is similar to that of McConnell et al. (1994).

The 25 x 27 block simulation grid for Scenario A is shown in Figure 3.8. The 25 x 32 block simulation grid and schematic for Scenario B is shown in Figure 3.9. The model parameters are the same for both scenarios and are shown in Table 3.3. The left and the right boundaries of the model are constant-pressure boundaries which establish a ground-water gradient of 0.00175 m/m. Ground water entering the boundaries is uncontaminated. The dispersion values were determined by changing the model dispersivities until the aqueous TCE concentrations of the model and the field data were similar.

Both scenarios involved the same simulation, that is, the dissolution of residual or pooled TCE and then the transport through advection and dispersion of the aqueous TCE, creating a plume. When the flow achieved steady state and the plume was no longer growing, the simulation was stopped. The concentration plumes of the two scenarios are shown in Figures 3.10 and 3.11 in units of volume of TCE per unit volume of water. The concentrations at the wells of both scenarios and the field sample concentrations are shown in Table 3.4. Since the well screens covered more than one cell block, the concentrations of all cell blocks used in the well were averaged. As can be seen from Table 3.4, the concentrations of Scenario A are much closer to the measured values than Scenario B's values are, indicating that it is a more likely occurrence. In fact the simulated MW-155 aqueous TCE concentration for Scenario B is two orders of magnitude larger than measured.

It was also determined by numerical simulation that these aqueous TCE concentrations could be simulated with a DNAPL source confined to the Upper Continental Deposits above the RGA. This finding underlines the uncertainty of the knowledge of the DNAPL zone, although Scenario A of Figure 3.6 is the most likely scenario because of the probable presence of through-going fractures in the Upper Continental Deposits.

4.0 DESIGN OF FIELD TEST

The field test that INTERA undertook for DOE at PGDP is based on the concept (Jackson and Pickens, 1994) that DNAPLs can be identified in the subsurface by contacting the DNAPL with a micellar-surfactant solution. This occurs through the enhancement of the effective solubility of the DNAPL chemical by incorporating the DNAPL molecules within surfactant micelles, which are colloidal aggregates of surfactant molecules (see Figure 1.2). By the injection and extraction of micellar-surfactant solutions into a geologic formation, the DNAPL zone is contacted by the solution and the aqueous concentrations of the DNAPL chemicals are raised above their aqueous solubilities. This allows the positive identification of the DNAPL zone around the injection well and also allows the identification of other components in the DNAPL—in this case, PCE, which is suspected of being present in the DNAPL with TCE. This test also provides an excellent means of testing the efficacy of the surfactant for solubilizing the DNAPL, which was the primary purpose of the field test.

The particular configuration chosen for the field test at PGDP was a single-well injection-extraction test using MW-156, i.e., surfactants were first injected into the subsurface through MW-156 , pushed out 10 feet into the aquifer, and then extracted by back production through the same well. The rate of surfactant injection is a critical issue in that the rate should not cause mobilization of the TCE DNAPL while, at the same time, the surfactant front should migrate a significant distance into the aquifer over a reasonably short period of time. The concern with DNAPL mobilization is that it may result in more DNAPL seeping into the lower RGA than most probably is already present. While this would not seem to make matters much worse than they already are, it was not the intention of the test to promote deeper migration of the DNAPL, and the State of Kentucky demanded assurance that the McNairy formation would not be jeopardized further. Thus, the potential for DNAPL mobilization was addressed before the test.

Computations of DNAPL mobility require the computation of the interfacial, advective, and buoyancy forces affecting the fate of the DNAPL in the porous media. The two dimensionless numbers which measure these three forces are the bond (N_B) and capillary (N_C) numbers, which are (Pennell et al., 1984):

$$N_B = \frac{\Delta\rho g k k_{rw}}{\sigma}$$

$$N_C = \frac{k\rho g i}{\sigma} = \frac{q\mu_w}{\sigma}$$

where:

k	=	intrinsic permeability of aquifer (cm^2);
k_{rw}	=	relative permeability of aquifer to water (dimensionless);
ρ	=	density of the aqueous phase (g/cm^3);
σ	=	interfacial tension (dynes/cm or g cm/s^2 cm);
g	=	acceleration due to gravity (cm/s^2);
$\Delta\rho$	=	density difference between DNAPL and water (g/cm^3);
i	=	hydraulic gradient (dimensionless);
q	=	Darcy velocity (cm/s); and
μ_w	=	absolute viscosity of water in centipoise (g/s cm).

Assuming an injection rate of 1 gpm, which will produce a Darcy velocity of 530 cm/day at MW-156, and an interfacial tension of TCE (vs. ground water) of 10 dynes/cm, one obtains $N_C = 6.2 \times 10^{-6}$. Assuming a density difference between TCE and ground water of 0.46 g/cm^3, an intrinsic permeability of 3×10^{-8} cm^2 ($K = 3 \times 10^{-3}$ cm/s), and a relative permeability of 0.1, one obtains $N_B = 0.2 \times 10^{-5}$. The introduction of a surfactant solution might change the interfacial tension (IFT) between micellar-surfactant solution and the DNAPL. However, a sorbitan monooleate surfactant solution (T-MAZ 80K) with an IFT of 11 dynes/cm (vs. TCE) was injected, consequently no pronounced changes in either dimensionless number were expected. Even if the IFT had decreased to only 3 dynes/cm, values of $N_C = 2.0 \times 10^{-5}$ and $N_B = 0.6 \times 10^{-5}$ would have been obtained.

Abriola et al. (1993) have shown that PCE, a chlorinated solvent with similar properties to TCE, is initially mobilized in the vertical direction when the sum of the capillary and bond numbers is approximately 2×10^{-4} (see Figure 4.1). For coarse sand (i.e., 20-30 mesh), the critical number could be as low as 4×10^{-5}. Since the sum of the capillary and bond numbers for the 1 gpm surfactant injection-extraction test was approximately 0.8×10^{-5}, there was a safety factor of about twenty inhibiting vertical mobilization. If it was assumed that the logs of MW-156 were incorrect and that the sand adjacent to the well screen was coarse-grained rather than fine- to medium-grained (as reported and as indicated by the hydraulic conductivity value), then the factor of safety was about ten. Furthermore, it should be appreciated that the most probable consequence of vertical mobilization is the partial desaturation of pores and the redistribution of DNAPL elsewhere in the same formation, not a catastrophic cascading of DNAPL to greater depths.

Assuming the hydraulic conductivity of the RGA is of the order of 10^{-5} m/s, the aquifer thickness is 2.1 m (set equal to the length of the well screen), and an injection rate of ~1 gpm (3.8 L/min), it takes approximately 4 days for a dilute surfactant solution to migrate 3 m radially from MW-156, assuming no significant surfactant sorption. Thus, the volume of injectate was estimated to be 96 hrs x 3.8 L/min x 60 min/hr = 21,800 L. Employing a 1% surfactant solution, approximately 60 gallons of pure surfactant would be injected.

The arrival time of 96 hours was computed using the GTFM code by the equation:

$$t = \frac{\pi r^2 b \theta}{Q}$$

where b = 2.1 m, θ = 0.35, Q = 3.8 L/min, and r = 3.1 m. The injection pressure was computed using the GTFM code as 1.7 m using a specific storage of 10^{-5} m^{-1} and a constant pressure boundary set at 1,500 m.

Two conditions were considered which could contribute to a situation by which the surfactant front would not migrate as far as 3.1 m radially. In the first case, surfactant sorption and/or precipitation could retard surfactant migration. However, the high dissolved TCE concentrations recorded at MW-156 indicate that DNAPL is quite close to the well. Consequently, should the surfactant have a retardation factor = 1.2, a migration distance of over 2.4 m would be attained, which was deemed sufficient for the purposes of this test. In the second case, because the screen length was approximately half the length of the sand pack, it was possible that injected surfactant might not enter the aquifer adjacent to the well screen. However, because of the low injection rate used, this was not deemed particularly likely.

To recover as much injected surfactant as possible for regulatory purposes, it was planned to extract a volume of ground water four times the injected volume, i.e., about 90,840 L.

5.0 THE FIELD TEST

5.1 The Injection/Extraction System

The test (see Section 4.0) consisted of a surfactant injection phase followed by an extraction phase in a single well, MW-156. As such, an equipment configuration versatile enough to accommodate both circumstances was required. The function of the injection system was to transfer a surfactant mix stored in tanks at the surface to the well. The function of the extraction system was to back produce the surfactant solution injected and any DNAPL which had been solubilized. Work began on setting up the injection/extraction system on July 27, and continued through August 1, 1994.

Figure 5.1 is a schematic showing the injection configuration. Reference to the figure shows that the surfactant mix was pumped from the tanks by a centrifugal pump located on the surface. Reinforced Teflon hose connected the pump to a drain at the base of each tank. Multiple valves installed in line provided for control of flow and divided the system into segments that could be sealed and individually drained upon disassembly, minimizing the risk of spillage. The surfactant mix was transferred into the well by means of a brass drop pipe installed to a depth of 18 m below grade, near the top of the screened interval.

Figure 5.2 is a schematic of the extraction system. Reference to the figure shows that the centrifugal pump at the surface of the injection system was replaced by an electric submersible pump downhole and that the metering system (i.e. rotameter and totalizing meter) has been reversed due to the change in direction of flow. The system discharge lines were connected to the top of the discharge tanks. Drop pipes were utilized in the tanks to minimize foaming of the surfactant solution as it was pumped in.

The area immediately around the well head and tank storage area was divided into the exclusion and contaminant reduction zones shown on Figure 5.3. The exclusion zone defined the area where contamination could occur. The contaminant reduction zone provided a transition zone between the exclusion zone and clean area of the site. Personnel entering the exclusion zone were required to have the health and safety training required by 29 CFR 1910.120, the 40-hour health-and-safety course offered by PGDP, and the level of personnel protection specified by the project Health and Safety Plan.

The exclusion zone was provided with a 20 mil cross laminate high density polyethylene secondary containment liner to guard against possible contamination of the site due to spillage. The liner was laid over a set of forms which created a series of secondary containment cells. In addition, a two-inch trash pump was kept on site so that, in the event of a spill, the spillage could be immediately pumped into an empty tank.

The injection/extraction tanks and surfactant drum were stored in the area identified as the Unloading Bay on Figure 5.3. This bay is designed to contain spills. It is constructed of concrete being sloped from both ends to a central drain. Placing the secondary containment liner down in the bay and adding forms to support the liner at each end provided much more spillage containment volume than required. Plywood sheeting was laid over the liner to protect it from the forklift traffic bringing tanks in and out of the bay.

A consideration in the overall design of the plumbing system was that it should maintain integrity, without leaking or rupturing, if a valve was inadvertently closed during operation or a line became clogged. All materials, including the reinforced Teflon hose, were chosen with this criterion in mind. In addition, a submersible pump was chosen which allowed the pumping rate to be controlled by adjusting the speed of revolution of the pump motor rather than running a pump at a constant speed and constricting flow by means of a valve. This assured that even if there was a break in the discharge line, no more than approximately 3.8 L/min would be released until the personnel on site could shut the system down.

The rate of injection and extraction was closely monitored and controlled. Both the injection and extraction systems were equipped with a one-gallon-per-minute flow control or dole valve, a rotameter, and a totalizing flow meter. These items were mounted on a vertical panel to facilitate proper function and monitoring. Flow rates were checked and adjusted, if required, at intervals not exceeding an hour during all phases of the test (i.e., pre-test, injection, and extraction).

Power and lighting were supplied by PGDP, as were the 1,200-gallon (4,500-liter) polyethylene tanks used to store the surfactant solution and extraction water. All water extracted was picked up and transferred to tanker trucks by PGDP Waste Management. The water was then transported to an incinerator at DOE Oak Ridge, Tennessee.

As it was critical that test operations were not interrupted, spare pumps, hose, fittings, and a generator were in place if needed. The only piece of equipment that failed during the test was a centrifugal pump used to inject the surfactant solution. This pump was immediately replaced and operations resumed.

5.2 The Pre-Test

A pre-test of the system was conducted on August 3 and 4, with water being extracted from well MW-156. The purpose of the pre-test was to establish background concentrations of dissolved TCE, test the system's operation, and allow the field team to function together under actual test conditions.

A test of system integrity was conducted before initiating injection/extraction operations. The valves at the well head and discharge tank were closed and the system was pressurized with nitrogen gas. The initial test revealed several loose connections which were tightened and the system was repressurized. The system was then monitored for half an hour with no loss of pressure.

A total of 3,796 L (1,003 gallons) of water was extracted between 1030 hours on August 3 and 0243 hours on August 4. The water was directed to a storage tank for handling as described in Section 5.1.

5.3 Injection Operations

A total of 19,553 L (5,166 gallons) of surfactant solution was pumped into well MW-156, beginning at 1830 hours on August 5 and ending at 0949 hours on August 9. The surfactant, T-MAZ 80K (PPG Industries, Inc.), was prepared as a 1% solution with drinking quality water obtained at PGDP. A Materials Safety Data Sheet for the surfactant is given in Appendix A. The rate of injection was 3.8 L/min.

The surfactant mixture was prepared in the injection tanks on site. Figure 5.4 is a schematic showing the mixing apparatus. Once the injection tank was filled with drinking-quality water, surfactant was transferred from the storage drum to a metered feed tank. With the recirculating pump in operation, the surfactant was bled into the system for mixing. The recirculating pump was kept in continuous operation during injection until the fluid level in the tank had been drawn down to the point that the mixing action caused the surfactant solution to foam.

During mixing operations, the flow rate of surfactant into the process was closely monitored. Samples of the mixture were collected at a minimum of hourly intervals by raising the diffuser in the tank and filling the sample vial from a diffuser port. These samples were visually monitored for the presence of surfactant globules. The surfactant mixture in each tank was measured prior to allowing the mixture to be injected into the subsurface. In addition, a sample of the surfactant mixture from each tank was captured at the system sampling connection during injection and analyzed. At no time was anything injected other than thoroughly mixed 1% surfactant solution.

During the course of injection, the rate remained generally steady at one gallon per minute plus or minus a few hundredths of a gallon. Only one significant deviation from this rate occurred during the first day of injection. For a period of less than one hour the average injection rate fell to 2.4 L/min. The average overall flow rate for the 87.32 hours of injection was 3.73 L/min.

Although the rate of injection remained constant, the water level in the well increased steadily over the entire period of injection. This was during the same period that the water level in piezometer 109, completed in the same stratigraphic horizon and monitored as a control point, fell. Piezometer 109 is located approximately 450 m due south of well MW-156. Figure 5.5 shows the injection rate and water levels in well MW-156. The water level in piezometer 109 during this time period is shown in Figure 5.6. The continuous rise in the water level at MW-156 suggests that the hydraulic conductivity of the aquifer/filter pack was progressively degraded. Possible explanations for this degradation are adhesion of the surfactant to the aquifer materials and some of the surfactant coming out of solution in the aquifer. Injection data, including injection rates and water levels, are given in Appendix B.

5.4 Extraction Operations

Injection of the surfactant solution ended at 0949 hours on August 9, 1994. At that time, the system was reconfigured for extraction operations. Fluid extraction was initiated at 1400 hours the same day and continued until 1100 hours on August 25, 1994. During that time, a total of 86,949 liters of fluid was removed from the well. This water was directed to polyethylene tanks for temporary storage at the bay area prior to removal. PGDP Waste Management staff periodically retrieved the tanks for transfer and disposal of the water, as described in Section 5.1.

The rate of extraction was verified and adjusted, if required, at a minimum of once an hour during the extraction phase. Although the rate periodically deviated from 3.8 L per minute, these variations were of short duration. The average extraction rate for the entire test was 3.80 L/min (1.005 gpm).

Water-level changes in the well during the first few days of extraction lend support to the possibility that the hydraulic conductivity of the aquifer/filter pack was degraded by injection operations. Figure 5.7 shows the extraction rate and water level in well MW-156. The water level in control piezometer 109 during this period is shown in

Figure 5.8. Water levels typically respond to the initiation of extraction operations by falling. The level in MW-156 actually rose for the first two days and did not begin to decline steadily until the fifth day. Such behavior would be expected if material in the aquifer/filter pack responsible for a general degradation of hydraulic conductivity were being removed by back production. Water levels at the control point, Piezometer 109, were generally declining during this same period. Extraction phase data, to include extraction rates and water levels, are given in Appendix C.

Upon completion of the test, the extraction system was disassembled and all equipment removed to on-site storage facilities. Equipment which had come into contact with the extracted ground water was first scanned for radiation by personnel from the PGDP Health Physics Department and decontaminated at an on-site decontamination pad before storage.

5.5 Sampling Procedures

Water samples were collected at MW-156 and MW-155 throughout the test. Samples from MW-156 were analyzed for trichloroethene (TCE), surfactant, technetium-99 (Tc-99), temperature, and dichloroethene (DCE). MW-155 samples were analyzed for TCE, surfactant, dissolved oxygen (DO), temperature, and pH. By design, more samples were collected than were analyzed. Water samples were collected from MW-156 and MW-155 as outlined in the Sampling and Analysis Plan. PGDP staff collected the samples from MW-155, and INTERA and PGDP staff collected the samples from MW-156.

The MW-155 samples were collected according to the projected sampling schedule in the Sampling and Analysis Plan, except that two samples per day were collected during the surfactant injection phase also. The number of samples collected from MW-156 also exceeded the number projected in the Sampling and Analysis Plan. This was because of the unanticipated slow recovery of TCE concentrations in MW-156 during the extraction phase. The slow return to background TCE concentrations required an extension of the period during which frequent sampling was needed. Thus, hourly samples were collected during the first 4.5 days of the extraction phase. This period was followed by a 2-day period of bi-hourly sampling before the sampling frequency was lowered to 6 times per day.

INTERA analyzed for TCE and surfactant concentrations in MW-155 and MW-156 samples at the PGDP laboratory trailer (T-17). These samples were collected in 20 mL glass EPA vials with teflon septa. Triplicate samples from MW-156 were collected at least once for every 10 samples collected. All the samples from MW-155 were triplicates, but only two triplicates per set were given to INTERA for analysis. The remaining triplicates from MW-155 were analyzed by PGDP.

In addition to these samples, 2 to 6 Tc-99 samples were collected daily from MW-156. These samples were collected in 500 mL polyethylene bottles containing nitric acid preservative.

Finally, additional samples for "IR Qual," alpha and beta radiation, and volatile organic compounds (VOCs) were collected in containers provided by PGDP. The VOC samples were analyzed by PGDP for TCE, 1,1,1-trichloroethane, and pyrene.

Sampling from MW-156 began by opening the valve on the sample line to allow about one liter of water to flush through the line into a waste bucket. The flow was then maintained at a rate of approximately 100 mL/min while sample bottles were filled. The temperature of the sample port purge water was frequently measured and recorded in the sample log book. For VOC samples, the amount of headspace in the bottles was always kept below 0.1 mL and almost always below about 0.01 mL.

The small amount of headspace allowed in the sample vials has a negligible impact on the concentrations of TCE measured. A headspace of 0.1 mL can only contain about 0.003 mg TCE as estimated by the following calculations. First, if it is assumed that the water contains TCE at a concentration (C) of 100 mg/L, then according to the Henry's Law constant for TCE (H_{TCE} = 0.007 atm-m^3/mol, Schwille, 1988), the partial pressure of TCE in the headspace (P_{TCE}) would be

$$P_{TCE} = \frac{H_{TCE} * C}{MW_{TCE}} = 0.0053 \text{ atm.}$$

MW_{TCE} is the molecular weight of TCE (131.5 g/mol). The mass of TCE in the headspace (M_{hs}) can be estimated from the following equation

$$M_{hs} = \frac{P_{TCE}}{P_T} * G * V_{hs} * MW_{TCE} = 0.003 \text{ mg}$$

where P_T is the total pressure (1 atm), G is the standard molar volume for an ideal gas (0.0446 mol/L), and V_{hs} is the volume of headspace (0.1 mL). The mass of TCE in the water (M_{aq}) is calculated to be

$$M_{aq} = C * V_{aq} = 2 \text{ mg}$$

where V_{aq} is the volume of water (20 mL). Comparing M_{hs} to M_{aq} reveals that 99.85% of the TCE is in the water. Thus, volatilization of TCE into a very large 0.1 mL headspace could only decrease the aqueous concentration by 0.15%. Of course, the error would be even smaller in water containing surfactant above the critical micelle concentration. Certainly, the potential error in TCE analyses introduced by a large 0.1 mL headspace in a 20 mL vial is negligible compared to the error introduced by the injection of sample to the gas chromatograph (GC), the calibration of the GC, and the detector response. The accuracy and precision of GC analyses is discussed in depth later.

All samples from MW-156 were immediately placed in coolers containing frozen "blue-ice" packs. Within 24 hours they were transferred either to a refrigerator in the field laboratory trailer or to PGDP. Those transferred to PGDP were accompanied by chain-of-custody forms. Samples from MW-155 were transferred to INTERA upon collection and were immediately placed in the field coolers to await delivery to the refrigerator in the field laboratory trailer.

5.6 Field Analytical Procedures

The field analytical procedures were outlined in detail in the Sampling and Analysis Plan. Basically, these procedures refer to the analyses performed by INTERA at the field laboratory trailer, i.e., surfactant, TCE, and some DCE analyses.

5.6.1 TCE and DCE Analysis

All the field TCE analyses for samples from MW-156 were performed on an SRI 8610 gas chromatograph (GC) equipped with an electrolytic conductivity detector (ELCD). At first, this GC was used to analyze samples from MW-155, but because the TCE detection limit for the ELCD is about 1 mg/L, the backup GC, an SRI 8610a with an electron capture detector (ECD), was used for the remaining samples from MW-155. The 8610a with ECD was also used to measure DCE concentrations in a few samples from MW-156.

Injections were performed using a 1 microliter Hamilton 7000 series syringe with Chaney adapter. The syringe was cleaned in methanol (5 pumps) and then in deionized rinse water (5 pumps) before collecting a microliter of sample. To check the effectiveness of this cleaning procedure, a microliter of the deionized rinse water was frequently injected into the GC. No more than a negligible TCE peak ever resulted.

The sample was collected by inserting the needle through the teflon septum of the 20 mL sample vial, pumping five times to remove any air bubbles or residual from the deionized rinse water, and slowly filling the syringe. Within about 5 seconds, the sample was rapidly injected onto the column of the GC.

Before each batch of analyses, the GCs were allowed to warm up and calibration standards were run. Retention times, peak heights, and peak areas were recorded in the laboratory log book. Each calibration standard was run at least twice to ensure reproducible measurements. When the peak area of a repeated injection of a calibration standard differed from the previous measurement by more than 10%, an additional injection was performed for an additional peak area measurement. Drift in GC response was monitored by rerunning standards after about every 10 samples analyzed. When the drift appeared greater than 10%, all of the calibration standards were rerun.

Occasionally, the response of the 8610 with ELCD drifted and/or varied markedly. When this happened, the capillary tubing of the detector was inspected. If the tubing was believed damaged, it was replaced. During the course of the field test, the capillary tubing was replaced three times. The 8610a with ECD proved more reliable than the 8610 with ELCD. Measurements were always reproducible and drifting was never a problem after the initial warm-up period.

5.6.2 Surfactant Analysis

The concentration of surfactant, T-MAZ-80K, was measured using a Hitachi U-2000 UV spectrophotometer and rectangular quartz cuvettes. The spectrophotometer measures the difference in absorbance at a given wavelength between a cuvette containing an aliquot of sample and one containing a blank.

A standard of 0.1% surfactant in deionized water was used to determine the optimum wavelength for concentration measurements. The scan from 200 to 800 nm indicated that 232.4 nm was the optimum wavelength. However, TCE strongly absorbs UV light below 240 nm. As the wavelength increases to 250 nm, the TCE absorbance fades rapidly. Thus, the wavelength for T-MAZ-80K concentration measurements was chosen to be 245 nm. At this wavelength, the absorbance of about 40 mg/L TCE was approximately 0.02 while the absorbance of 0.1% T-MAZ was about 0.64.

Surfactant analysis of a sample was always performed after the TCE concentration was determined so that possible interference in surfactant concentration measurement could be determined. As it turned out, samples containing high concentrations of surfactant (greater than 0.1%) had low concentrations of TCE (less than 50 mg/L). Also, because all samples with high concentrations of surfactant had to be diluted 9 to 1 with deionized water prior to surfactant analysis, the diluted samples contained less than 5 mg/L TCE. Thus, for these samples, no special procedures were necessary to remove TCE prior to surfactant analysis.

When surfactant concentrations were low and TCE concentrations were high, TCE had to be sparged from the sample prior to surfactant analysis. This was done by bubbling nitrogen into the sample for about 10 minutes. The TCE concentration was measured after the sparging to make sure that it was below 40 mg/L.

The UV spectrophotometer provided highly reliable and reproducible measurements as demonstrated by repeated readings of calibration standards. The practical quantitation limit for the surfactant at 245 nm was around 0.01%.

Surfactant concentrations in MW-156 samples were also measured in the PGDP laboratory. The results, listed in Table 5.3 and plotted in Figure 5.11, closely match the results obtained by INTERA.

5.6.3 Temperature Measurement

Thermometers were used to measure the temperature of water flowing out of the sample port from MW-156, coolers, and refrigerators. Special thermometers with data loggers were used to monitor the temperature of the refrigerators at the field laboratory trailer.

Three field thermometers, each having a slightly different range of temperatures, were used at the site. Prior to use they were tested against each other in ice water at about 2.5°C and tap water at about 20°C. The readings from each thermometer were within 0.5°C at both temperatures. Temperature measurement simply involved immersing the tip of the thermometer in the fluid being analyzed for at least 30 seconds.

5.7 MW-156 Results

MW-156, which is screened in the Upper RGA, was monitored for temperature and concentrations of TCE, surfactant, Tc-99, and DCE. The following sections present the results from each type of analysis.

5.7.1 TCE Concentrations

A summary of the qualified TCE concentrations measured by INTERA appears in Table 5.1. After rigorous calibration calculations and QA/QC screening, some of the data collected by INTERA were eliminated due to excessive drift in GC response, manifested by rapidly increasing or decreasing peak areas for given standards over short periods of time. When more than one qualified concentration measurement was available for a given sample, the measurements were averaged. This table contains the qualified and averaged data resulting from the QA/QC screening. The calibration curves, squares of the correlation coefficients (R Squared), and qualified raw data are included in Appendix D.

The precision of the measurements was determined by calculating 95% confidence intervals for the field triplicates. Confidence intervals were estimated assuming a Student's t distribution with two degrees of freedom. The estimates are presented in Table 5.2 and plotted in Figure 5.9. Measurements from 15 of the 17 triplicates indicate confidence intervals within ± 16% of the sample mean. Only the 2 sets of triplicates from the pre-test showed 95% confidence intervals larger than ± 16%.

The accuracy of the measurements depends on the calibration standards and the calibration curves. A review of the R Squared values (the squares of the correlation coefficients) in Appendix D reveals that 38% of the R Square values were 0.999 or higher, 38% were in the range of 0.995 to 0.999, and 23% were in the range of 0.99 to 0.995. Note that if R Square equals 0.990, then the correlation coefficient (the square root of R Square) is 0.995.

A final check on the accuracy of field TCE concentration measurements is provided by the results of the PGDP TCE measurements listed in Table 5.3. The differences in matched pairs were calculated to determine the mean, sample standard deviation, and whether the differences in field and PGDP lab measurements were significantly different at the 5% significance level. The results are shown in Table 5.4.

The hypothesis test indicated that TCE measurements by the PGDP lab were significantly lower than the field measurements. Table 5.4 indicates that the PGDP measurements were consistently higher than field measurements during the pre-test and consistently lower than the field measurements during last 12 days of the extraction period. While differences are apparent, they are not large considering the differences in analytical equipment and the precision of the measurements; the pairs with the largest differences still agree within a factor of 2. The procedures, equipment, and notes taken during the field and laboratory analyses would need to be closely examined to determine which measurements are most credible. However, it should be noted that the field-measured TCE data (Figure 5.10) indicates that the final TCE concentrations during the extraction phase are about equal to the pre-test values, which is not the case for the laboratory data (Figure 5.11). Because each set of measurements provides clear and unconflicting results regarding the objectives of the test (i.e., the efficacy of the surfactant), there is no need to determine which measurements are more accurate.

A plot of the field TCE concentration measurements from Table 5.1 is shown in Figure 5.10. The PGDP TCE concentration measurements are plotted in Figure 5.11. The measurements are plotted versus time in days since the extraction phase began. Negative time indicates time before the beginning of the extraction phase. The pre-test, surfactant injection phase, and extraction phase are marked on the figure. The TCE concentration measured during the surfactant injection phase is the TCE concentration of the surfactant solution being injected.

According to the field data, the approximate TCE concentration during the pre-test was around 350 mg/L. The concentration dropped to less than 1 mg/L during the injection phase while clean surfactant solution was injected. Once the extraction phase started, the TCE concentration slowly increased to around 75 mg/L after 4 days, increased more rapidly in the next 4 days to about 250 mg/L, and then more slowly to about 320 mg/L by the end of the extraction phase. The apparent dip in TCE concentrations during the ninth day may or may not be real. While the field data shows a dip at this time, the PGDP laboratory data suggests a temporary leveling off instead.

5.7.2 Surfactant Concentrations

All surfactant data obtained during the test exceeded QA/QC standards and are included in Table 5.1. Unlike the GC, the UV-spectrophotometer was calibrated to calculate concentrations directly, without resorting to calculation of peak areas. The calibration curve was forced through the origin (i.e., ABS = 0 at 0.000% surfactant concentration). Calibration was highly consistent throughout the test and the squares of the correlation coefficients always exceeded 0.999. Precision calculations based on triplicates indicate a 95% confidence interval of about ± 4% of the mean concentration for high surfactant concentrations. The practical detection limit was about 0.01% due to background interferences and the sensitivity of the detector at 245 nm. The accuracy and precision calculations for the surfactant analyses are included in Appendix E.

The data are plotted in Figure 5.10. The data in this figure are in units of % by volume ($P_{v/v}$) and are calculated from the following equation

$$P_{v/v} = 100\% * \frac{M_{surf}}{M_T} * \frac{d_T}{d_{surf}},$$

where M_{surf}/M_T is the weight fraction of surfactant in the solution and d_T/d_{surf} is the ratio of the density of the solution (approximately 1.0 g/mL) to the density of surfactant (1.09 g/mL).

The data show that the surfactant was injected at a concentration of around 1% by volume. However, almost as soon as the extraction phase began, the surfactant concentration in MW-156 started falling. In about 2 days, the surfactant concentration fell to about 0.15% by volume, and after about 5 days of extraction it was below practical detection limits of 0.01%. Comparing areas under the curve for the surfactant injection and extraction phases indicates that about 34% of the surfactant injected was recovered.

5.7.3 Tc-99 Concentrations

The results of the Tc-99 analyses by PGDP are included in Table 5.3 and plotted in Figure 5.11. The Tc-99 concentration at MW-156 during the pre-test was around 107 pCi/L. Although there was some scatter in the Tc-99 data during the extraction phase, it appears that the Tc-99 concentration dropped to a minimum around 20-40 pCi/L in the first two days of extraction and then slowly recovered to near pre-test concentrations after about 7 days of extraction where it leveled off.

5.7.4 Temperature

Temperature measurements of extracted ground water at MW-156 can be found in Table 5.1. The temperature leveled off around 21°C during the latter part of the pre-test. Although the temperature of the surfactant solution was never measured by thermometer, solar heating in the mixing tanks caused it to become quite warm compared to fresh ground water. This is further indicated by the high temperatures measured shortly after the extraction phase began. The temperature of the extracted ground water returned to pre-test values within about 4 to 5 days. A graph of the temperature data is shown in Figure 5.12.

5.7.5 DCE Concentrations

The sharp drop in surfactant concentration in MW-156 during the first two days of extraction was curious. An early suggestion was that the surfactant was being degraded by *in situ* microorganisms. The only indicator variable INTERA was equipped to analyze for was the concentration dichloroethene (DCE), a product of the degradation of TCE. If the microbial activity was stimulated by the surfactant, it could cause increased biodegradation of TCE to DCE.

Samples from the pre-test and the extraction period were analyzed by the 8610a GC with ECD. Calibration was limited to two standards and a blank because time was limited and the actual concentrations in the samples were not as important as the relative concentrations. Measuring relative concentrations does not require calibration because they are directly reflected in the raw response of the GC.

Figure 5.13 is a plot of the DCE measurements showing the DCE concentration around 1 mg/L throughout the test. Although only a few measurements were made, it appears that the DCE concentration was slightly higher during the initial part of the extraction phase, suggesting some increased microbial activity. However, considering the high concentrations of TCE, much higher concentrations of DCE would be expected if the microbial activity increased to the level required to degrade a considerable proportion of the injected surfactant. This finding supports the conclusion that microbial activity was not likely the cause of the loss of the bulk of the surfactant injected. The DCE measurements and calibration data can be found in Appendix D.

5.8 MW-155 Results

MW-155, which is screened in the lower RGA, was monitored for temperature, pH, and concentrations of TCE, surfactant, and dissolved oxygen. The purpose of monitoring this well was to determine if the injection of a micellar-surfactant solution into a suspected DNAPL zone around MW-156 would cause vertical mobilization of the DNAPL, which would appear, together with surfactants, in MW-155. The following sections present the results from each type of analysis.

5.8.1 TCE Concentrations

The measured TCE concentrations at MW-155 are shown in Figure 5.14. They remained around 1.5 mg/L for the entire test. A slight increase in measured TCE concentration was observed over the course of the experiment. However, the increase is so small that it easily could have occurred naturally regardless of the surfactant test.

It is also possible that the extended extraction period drew new ground water of slightly different composition into MW-155 from farther outside the testing zone. The data is summarized in Table 5.5.

The MW-155 samples were first analyzed for TCE using the 8610 GC with ELCD, but because the TCE concentrations were near the detection limits of this GC, a switch was made to the 8610a GC with ECD. The calibration curves and raw data are presented in Appendix F. In all cases the square of the correlation coefficient (R Squared) is greater than 0.995 (which implies that the correlation coefficient is always greater than 0.9975).

The best estimate of the precision of the MW-155 TCE measurements is derived by: (1) taking a linear regression of the data collected during the surfactant injection and extraction periods versus time; (2) calculating the standard deviation from this line; and (3) determining the Student's t statistic for the 95% confidence interval. Although this procedure assumes that the TCE concentration is linearly related to time (as it appears to be), it allows a much larger sample population ($n = 39$) from which to estimate 95% confidence intervals. The sample standard deviation from the fitted line was calculated to be 0.13 mg/L, giving a Student t test statistic, $t_{0.025}$, of about 2.025. This value is used to estimate the 95% confidence interval for each independent TCE concentration measured. The result for this data set is a 95% confidence interval for each measurement of approximately ± 0.26 mg/L (or approximately ± 18%).

A few of the MW-155 samples were analyzed by PGDP for TCE concentrations. These results are listed in Table 5.6. These measurements closely match the field measurements by INTERA.

The differences in field and PGDP lab measurements were analyzed by calculating the mean and standard deviation of the differences of matched pairs. These statistics are shown in Table 5.7. A hypothesis test was used to indicate whether the differences in the field and PGDP laboratory measurements are significantly different. Assuming the matched-pair differences can be described by the Student's t distribution, it was found that the field and PGDP TCE measurements for MW-155 are not significantly different.

5.8.2 Surfactant Concentrations

Samples analyzed from MW-155 showed no signs of surfactant. Had surfactant reached MW-155, its maximum concentration at MW-155 would have appeared at the end of the surfactant injection period and the beginning of the extraction period. In addition, TCE concentrations would have increased because the contaminated ground water displaced by the injected surfactant solution would have reached MW-155 before the surfactant. The TCE concentration at MW-155 remained around 1.5 mg/L, which is far below the 350 mg/L TCE concentration in the contaminated ground water in the vicinity of MW-156 prior to the injection of the surfactant solution.

5.8.3 Dissolved Oxygen Concentrations, Temperature, and pH

The dissolved oxygen, temperature, and pH of the MW-155 samples were analyzed by PGDP in the field using a Hydrolab probe with an in-line flow cell. Table 5.6 contains the results. The dissolved oxygen (DO) measurements fluctuated between about 3 and 7 mg/L with no clear trend during the test. The data is plotted in Figure 5.15.

There appeared to be no real trend in temperature either. The temperature of MW-155 samples was nearly always between 18 and 22°C. A plot of the temperature versus time is displayed in Figure 5.16.

The pH was fairly steady during the test except for an increasing trend during days 9 through 12 of the extraction period. Prior to this rise, the pH was around 6, and afterwards it appeared to level off at pH 6.5. The pH data is shown in Figure 5.17. If this pH change is real (i.e., not due to analytical error), it could be due to naturally occurring processes. Whether such changes in pH at MW-155 could result naturally could be determined by examining historical pH data for MW-155. It is also possible that the extended extraction period drew new ground water of slightly different composition into MW-155 from farther outside the testing zone.

The relatively low pH values and the presence of significant amounts of DO in the MW-155 data indicate that the ground waters sampled in MW-155 have not migrated to this part of the RGA by intergranular flow through the Upper Continental Deposits above the RGA (see Figure 3.2). These deposits likely contain substantial amounts of carbonate minerals, in particular calcite and dolomite, as well as considerable amounts of organic matter and other reductants. Intergranular flow through a thick sequence of such common sedimentary materials would result in pH values greater than neutral and the reduction of DO to non-measurable amounts (e.g., Jackson and Patterson, 1982). Rather, the data argue for a mechanism of rapid recharge of ground water to the RGA through an interconnected network of fractures in the Upper Continental Deposits such as has been postulated for DNAPL migration at the C-400 site by Clausen et al. (1992). Fracture flow would expose ground-water recharge to lesser amounts of carbonate minerals and organic matter over shorter residence times, such that recharge to the RGA could produce a ground water similar to that observed in MW-155.

5.9 Simulation of Test

The recovery responses of the TCE, Tc-99, and surfactant from the field were investigated using numerical simulations. The simulations were performed using the SWIFT II flow-and-transport simulator. The model is a 2-dimensional cylindrical grid of the upper RGA centered on the injection/extraction well MW-156. The model consists of 20 radial grid blocks that extend from the wellbore out to 100 feet and 7 vertical layers which make up the 7-foot completed interval of the well. An infinite aquifer boundary condition at the outer edge of the model grid was applied using the Carter-Tracy method. The model parameters are consistent with the parameters used in Section 3.0 and listed in Table 3.3.

The normalized (C/Co) recovery responses of the TCE and Tc-99 are plotted against the simulated recovery of a conservative tracer in Figure 5.18. The simulation of the conservative tracer response was performed by injecting clean water into formation water which contained the tracer. As in the field test, injection continued for 3.72 days, followed by a static period of 0.17 days, followed by extraction for 16 days. From the extraction-period plot it can be seen that the Tc-99 reacted as a conservative tracer with the exception of very early time. However, the TCE responded non-conservatively.

Figure 5.19 shows the normalized surfactant recovery plotted against the simulated recovery of a conservative tracer. In this simulation, a conservative tracer was injected into clean formation water for 3.72 days, followed by a static period of 0.17 days, followed by extraction for 16 days. The plot shows that the surfactant injected during the field test did not respond conservatively.

The conservative recovery of the Tc-99 and the non-conservative recoveries for the surfactant and TCE suggest that the surfactant may have affected the TCE recovery. The surfactant, had it become immobilized by sorbing onto the RGA soils or precipitating in the pore space, may have increased the available sites for sorption of TCE. This would have caused the responses for both the surfactant and TCE to be non-conservative.

6.0 SUMMARY AND CONCLUSIONS

The specific objectives of this first phase of the project were:

1. to screen surfactants in the laboratory and identify those that will efficiently extract PCE, carbon tetrachloride, and TCE from sand aquifers by micellar solubilization, and then to investigate the physical-chemical properties of the best surfactants; and

2. to test, *in situ*, the efficacy of one of these surfactants to solubilize a TCE DNAPL (with minor amounts of PCE) by injection and then extraction of the surfactant solution through an existing well set within a sand and gravel aquifer at the Paducah Gaseous Diffusion Plant.

A total of 99 surfactants (25 nonionics and 74 anionics) were screened for their ability to solubilize TCE, PCE, and carbon tetrachloride. Ten of the 99 surfactants were capable of solubilizing TCE to concentrations greater than 15,000 mg/L. Four surfactants were identified as good solubilizers of all three DNAPL chemicals: a sorbitan monooleate (T-MAZ-80), an alkylaryl sulfonate isopropylamine, a secondary alcohol ethoxylate (Tergitol 15-S-12), and a polyoxyethylene oleamide.

Tergitol was the first choice because of its excellent solubilizing ability and its low propensity to sorb. However, this secondary alcohol ethoxylate did not meet the Commonwealth of Kentucky's acceptance criteria because of the potential presence of unreacted reagents which are banned for injection into ground waters in Kentucky. Consequently, it was decided to use a surfactant approved for use by the FDA as a food-grade additive, namely, T-MAZ-80K, which is manufactured by PPG Chemicals. As a 1% micellar-surfactant solution, this sorbitan monooleate has a solubilization capacity of 16,000 mg TCE/L, but has a higher propensity to sorb to clays than has the Tergitol.

After a year of intense field work by PGDP, the first site chosen for *in situ* testing was found to be unsuitable for conducting a short-term injection-extraction test. Therefore, a second site at PGDP was chosen, the C-400 site, on account of the fact that a particular well at the site (MW-156) had a sufficiently high hydraulic conductivity and had TCE concentrations > 100 mg/L, which suggested a nearby TCE DNAPL zone in this aquifer.

A field test of the efficacy of sorbitan monooleate in solubilizing TCE DNAPL was conducted in August 1994. The injection phase lasted 96 hours, during which time a 1% surfactant solution was injected at the rate of 3.8 L/min (1 gpm). The extraction phase lasted 16 days at a rate of 3.8 L/min. Only one third of the injected surfactant was recovered during the extraction period and, consequently, there was no enhancement in the concentrations of TCE recovered from the well. It is believed that the remainder of the surfactant became sorbed to the aquifer materials or underwent precipitation or liquid crystal formation or some combination of the above. TCE behaved nonconservatively during the early stages of extraction, suggesting that some may have been sorbed to the immobilized surfactant. Therefore, the test has demonstrated that sorbitan monooleate is unsuitable for use as a solubilizer in this aquifer.

It is probable that this result could have been identified in the laboratory beforehand and an alternative surfactant could have been chosen and tested. Paradoxically, these same results demonstrate that the single-well test is a useful method for the *in situ* testing of surfactants or cosolvents before proceeding to larger-scale field testing or remediation.

PGDP's original conceptual model of DNAPL migration and distribution at the C-400 site (Figure 3.5), which is based on the work of Kueper (1991) and supported by the numerical simulations of McConnell et al. (1994), has been tested by numerical simulation and found to be inconsistent with the aqueous TCE concentrations beneath the site. A more probable conceptual model of DNAPL within the sand and gravel aquifer is presented in this report. This model assumes that DNAPL migrated through a fracture network system in the Upper Continental Deposits and penetrated the sand and gravel aquifer (RGA) beneath. This new scenario of DNAPL distribution indicates that it is advisable to repeat this test, following laboratory studies of the reaction of surfactants with the aquifer materials, by an interwell surfactant test, rather than a single-well test, to raise the probability that the DNAPL zone will be encountered by the injected surfactant solution.

7.0 RECOMMENDATIONS

While it has been shown that the micellar surfactant solution did not perform as intended, the single-well test demonstrated its utility for testing surfactants prior to full-scale SEAR. It is probable that the loss of surfactant could have been identified in laboratory tests, had it been possible to ship core from PGDP to SUNY Buffalo for testing beforehand. Furthermore, some way must be found to allow Sandia National Laboratories to play its designated role in this research. Had this contract been in place, some of the difficulties experienced in the field with the surfactant might have been avoided.

Therefore, we urge that the restrictions placed on the testing of the surfactants with aquifer materials from the RGA be swiftly resolved so that aquifer materials from the RGA can be shipped to SUNY-Buffalo and Sandia National Laboratories. Failing this, it will be necessary to set up a temporary laboratory at PGDP to conduct the necessary tests. The expense of such a solution strongly recommends the resolution of the restrictions.

The understanding of the distribution of DNAPL in the RGA beneath C-400 at PGDP is limited. This is quite typical of sites with DNAPL contamination, because of the complexity of the problem. The anticipated program of drilling and coring planned (WAG-6 program) for 1995 at C-400 should be devised to help test divergent hypotheses of the geometry of the DNAPL zone which have been explored in this report. The application of NAPL partitioning tracer tests and multiphase, multicomponent simulators permit an integrated approach to the characterization of DNAPL zones.

Recommendation 1: *The program of drilling and aquifer coring planned by PGDP for WAG-6 1995 should be complemented with field and computational studies to develop a better understanding of the geometry of the DNAPL zones in the Regional Gravel Aquifer and the nature of DNAPL migration at PGDP.*

Because of the limited understanding of the DNAPL zone and the loss of the surfactant *in situ,* it would be advisable to repeat this test as an interwell test rather than a single-well test, so that a larger volume of the RGA can be tested for the presence and composition of the DNAPL. Figure 7.1 is a schematic showing how an interwell DNAPL solubilization test would be undertaken, assuming that the test zone would contain only a limited thickness of residual DNAPL in the upper RGA. A micellar-surfactant solution would be introduced through the injection well and produced at the extraction well. Because the zone of residual TCE DNAPL is much thinner than the thickness of the upper RGA, which is identified as having a hydraulic conductivity of 3×10^{-3} cm/s, the solubilized TCE will be greatly diluted by uncontaminated ground water. This effect is shown in Figure 7.2, which displays the effluent surfactant and TCE concentrations. The coelution of TCE and surfactant in Figure 7.2 indicates the presence of DNAPL and will permit an *in situ* evaluation of the efficacy of a particular surfactant solution.

Recommendation 2: *Following the re-evaluation of appropriate surfactants for use in the RGA at Paducah and the installation of an additional well at the C-400 site, an interwell DNAPL solubilization test should be undertaken over a distance of at least 10 m to test the efficacy of DNAPL solubilization by micellar surfactant solutions.*

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TABLES

Table 2.1: HLB Determination for TCE, PCE, and CTET, Using Tergitol Series (Secondary Linear Alcohol Ethoxylates)

Surfactant No.	HLB	TCE ppm	PCE ppm	CTET ppm
133	12.4		1,450	1,376
134	13.3	6,250	22,548*	12,220
135	14.7	13,322*	5,792	17,876*
136	15.6	6,224	2,770	8,173
137	16.4	7,362	2,516	4,451
138	17.5	3,701		1,701
139	18.0	2,606		

* HLB for each compound

Table 2.2: Solubilization Results for TCE, PCE and CTET in Nonionic Surfactants

Surfactant No.	Surfactant Name	HLB	TCE (ppm)	PCE (ppm)	CTET (ppm)
3/4	POE C12-C15 Linear Alcohol	14.8	3,031		6,308
9	Ethoxylated Alcohol	13	3,247	11,624	2,173
9/10	Ethoxylated Alcohol	14.8	2,020		4,571
10	Ethoxylated Alcohol	15.0	2,777		3,692
18	Sorbitan Monooleate POE 20	15.0	16,157	6,023	12,509
24	Tridecyl Alcohol POE 12	14.5	1,602		5,913
25	Linear Alcohol Ethoxylate	14.4	3,367		7,513
37	PEG Monolaurate	13.6	3,785	23,447	21,071
38/39	PEG Monolaurate	14.8	10,620		3,305
38/39	PEG Monolaurate	14.0	1,694		
60	Sorbitan Monooleate POE 20	15.0	16,338	6,734	10,595
121	PEG 25 Soya Sterol	17.0	29,627	7,783	19,748
133	C11-C15 Secondary Alcohol	12.4		1,450	1,376
134	C11-C15 Secondary Alcohol	13.3	6,250	22,548	12,220
135	C11-C15 Secondary Alcohol	14.7	13,322	5,792	17,876
136	C11-C15 Secondary Alcohol	15.6	6,224	2,770	8,173
137	C11-C15 Secondary Alcohol	16.4	7,362	2,516	4,451
138	C11-C15 Secondary Alcohol	17.5	3,701		1,701
139	C11-C15 Secondary Alcohol	18.0	2,606		
144/145	2,6,8 Trimethyl-4 Nonanol	14.8	9,638		6,902
151	Nonylphenyl Ethoxylate	13.5	8,407	19,063	26,018
154	POE 7 Oleamide	14.0	18,118	32,066	36,850
164	Octylphenol/Polyethoxy Ethanol	13.5		9,573	
170/172	PEG-20/40 Lanolin Alcohol	14.9	14,669		4,355
185	Block Copolymer	12-18	4,319		
213	PEG 1100 Castor Oil		38,358	11,396	21,187
234/235	POE 10/20 Cetyl Ether	14.9	6,674		6,750
271	12 POE Nonylphenol	14.1	14,367	5,916	
272	8 POE Nonlyphenol	12.4	1,535	534	

Table 2.3: Solubilization Results for TCE, PCE and CTET in Anionic Surfactants

Surfactant No.	Surfactant Name	TCE (ppm)	PCE (ppm)	CTET (ppm)
14	Aliphatic Phosphate Ester	13,579	1,872	7,748
22	Phosphated Alkyl Ethoxy K-salt	6,529	732	2,843
31	Na Dodecylbenzene Sulfonate	4,339	773	2,154
32	C12-C13 Alcohol Ethoxysulfate	3,737	584	2,589
41	Aliphatic Phosphate Ester	8,289	863	4,896
45	POE Fatty Alcohol Phosphate Ester	7,346	1,470	7,204
54	Phosphate Ester		4,472	12,253
57	Sulfate		486	2,750
62	Phosphate Ester	4,816	5,083	23,765
67	Anionic/Nonionic Blend	8,668	9,322 8,429	22,452
72	Sulfonate/ POE Ether Blend	15,801	9,940 9,809	29,716
78	Cyclic Carboxylated Amide	3,261	1,752	5,164
109	Na Dioctyl Sulfosuccinate	3,800	3,911	8,302
110	Alkylaryl Polyoxyl Carboxylate	2,711	19,688	
111	Alkylaryl Polyoxyl Carboxylate	1,815	1,450	3,317
112	Alkyl Phenoxyl Ether Sulfate	2,688		2,732
113	Phosphate Ester	4,526	2,490	6,055
118	Na C14-C16 Olefin Sulfonate	3,337	758	2,176
119	Alkyl Aryl Sulfonate Isopropylamine	19,976	3,704	26,125
128	Aliphatic Phosphate Ester	27,284	16,594 12,089	23,279
177	Alkyl Aryl Sulfonate/ Nonionic Blend	21,515	15,070	25,422
193	Benzene, 1,1-oxybis Tetrapropylene Sulfonate	3,695	1,590	2,029
194	DiNa Dihexa/Hexadecyl Diphenol Disulfonate	3,592	2,180	1,800
195	Linear Alkylbenzene Sulfonate	7,411	2,001	5,745

Table 2.3 (continued): Solubilization Results for TCE, PCE and CTET in Anionic Surfactants

Surfactant No.	Surfactant Name	TCE (ppm)	PCE (ppm)	CTET (ppm)
196	Alpha Olefin Sulfonate	6,189	2,226	7,872
197	Alpha Olefin Sulfonate	2,298	1,197	4,959
198	Alkyl Aryl Sulfonate		284	2,414
199	Amine Alkylbenzene Sulfonate	4,154	11,078 10,598	19,773
200	NH3 Alcohol POE(4) Sulfate	4,469	1,057	3,312
205	Na Alkyl Sulfonate	2,891	617	2,137
206	Na Ethoxylated Alcohol Sulfate	2,451	380	1,216
207	Na Alkyl Aryl Sulfonate	2,848	494	1,900
208	Na Alkyl Diphenyl Oxide	1,770[(1)]		2,110
214	Na Alkyl Ether Sulfonate	4,321	939	2,285
215	Na Alkyl Ether Sulfonate	1,712	316	2,444
222	Dodecyl Benzene Sulfonate	3,574	2,040	1,473
223	Dodecyl Benzene Sulfonate	2,358	374	2,656
242	Sulfonated Castor Oil	10,721	6,411	7,652
243	Natural and Synthetic Sulfonate Blend	10,475	2,636	7,217
244	Na POE Nonylphenol Sulfate	3,634	378	3,085
245	Na Sulfonate of Coconut Oil	3,578	413	2,765
246	NH3 POE Alcohol Sulfate	3,464	559	1,636
247	Di-Na Laureth sulfosuccinate		1,293	2,595
248	Sulfated Ester	3,857	624	2,681
249	Na Sulfated Ester	22,996	3,636	11,802
250	Sulfated Castor Oil	14,382	4,243	8,451
251	Sulfated Castor Oil			9,065

Table 2.3 (continued): Solubilization Results for TCE, PCE and CTET in Anionic Surfactants

Surfactant No.	Surfactant Name	TCE (ppm)	PCE (ppm)	CTET (ppm)
252	Sulfated Vegetable Oils			7,592
253	Sulfonated Tall Oil Fatty Acid		3,293	4,963
254	Sulfated Soybean Oil/Ester			15,171
255	Sulfated Glycerol Trioleate			14,895
256	Sulfated Castor Oil	5,390	1,501	6,317
257	Sulfonate/Nonionic Blend			11,921
258	Na Linear Alkylate Sulfonate	4,659	2,914	4,510
260	Alpha Sulfo Methyl Ester	1,443	397	
261	C10 Alpha Olefin Sulfonate	1,854	659	
262	Linear Alkylaryl Na Sulfonate	4,504	1,312	
264	Alkyl Ether Sulfate	2,448	1,051	
266	Cetyl/Steryl Alcohol & Fatty Alcohol Sulfate		744	
267	Sulfonate	1,704	1,720	
268	Sulfated Castor Oil	7,006	7,134	
269	Na C14-C16 Olefin Sulfonate/Na Laureth Sulfate/Lauramide DEA	5,876	2,111	
270	Sodium Lauryl Sulfoacetate/ Di-sodium Laureth	2,757	888	
273	Na 1-Octane Sulfonate	6,293	466	
274	Sulfated Castor Oil	2,961	3,712	
275	Ammonia Neutralized Sulfated Oleic Acid	8,765	6,703	
277	Sodium Tridecyl Sulfosuccinate		908	
278	Sodium Oleoylisopropanolamide Sulfosuccinate	827	906	

Table 2.3 (continued): **Solubilization Results for TCE, PCE and CTET in Anionic Surfactants**

Surfactant No.	Surfactant Name	TCE (ppm)	PCE (ppm)	CTET (ppm)
279	Sodium Dioctyl Sulfosuccinate	6,088	4,277	
280	Sodium Ethoxylated Alcohol Sulfosuccinate	1,598	418	
281	Sodium Oleoylisopropanolamide Sulfosuccinate	2,655	992	
282	Sodium Octyl Sulfate	1,828	363	
283	Sodium Laureth Sulfate	4,909	1,710	
284	Di-sodium Mono-oleamido PEG-2 sulfosuccinate	1,989	653	
285	Sodium Myreth Sulfate	5,147	1,482	
286	Sodium n-decyl Sulfate	1,616	228	
287	Sodium 2-ethylhexyl Sulfate	2,129	625	
288	Sodium Dioctyl Sulfosuccinate/ propylene Glycol	5,444	5,200[2]	
289	Sodium Dicyclohexyl Sulfosuccinate	1,370	295	
290	Sodium Dihexyl Sulfosuccinate	1,000	300	
291	Sodium Diisobutyl Sulfosuccinate	1,208	486	
292	Octylphenol Ethoxylate Sulfonate	3,114	796	
293	C12-C15 Ethoxylate (EO 15) Sulfonate	2,418	854	
294	C12-C15 Ethoxylate (EO 7) Sulfonate	2,563	927	
295	Ammonium Nonylphenoxypoly (ethleneoxy) Ethanol Sulfate	4,659		

(1) Surf 208 incorrectly reported as 1,170 previously.

(2) Surf 288 5200 ppm is average of duplicate analyses of 5420 ppm and 4980 ppm.

Table 2.4: Percent TCE and PCE Solubilized to Percent TCE and PCE in DNAPL Mixtures

Surfactant No.	TCE:PCE in Mixture	% TCE	% PCE
18 Sorbitan Monooleate	90:10	89.1	10.9
	75:25	78.7	21.3
	50:50	57.8	42.2
	25:75	30.9	69.1
154 POE 7 Oleamide	90:10	90.5	9.5
	75:25	77.2	22.8
	50:50	51.3	48.7
	25:75	26.3	73.7
135 C11-C15 Secondary Alcohol	90:10	91.2	8.8
	75:25	79.0	21.0
	50:50	52.6	47.4
	25:75	27.9	72.1

Table 2.5: Retardation Factors for Selected Surfactants

Surfactant number	Natural soil with 10% smectite[1]	Na smectite - sand mixtures[1][2]	Ca smectite - sand mixtures[1][2]	3% illite/ smectite - sand mixture
18	22.05	1% = 1.51 5% = 13.68 10% = 20.70 20% = 19.98	1% = 1.48 5% = 5.95 10% = 12.09 20% = 20.80	
60				2.22
64	20.71			
135				3.54
154				4.33
161	21.68			

(1) Studies other than DOE.

(2) Percentages indicate fraction of clay in mixture.

Table 2.6: Interfacial Tension Measurements Between 1% Surfactant Solutions and PCE, TCE and CTET

Surfactant[1] No. and Standards	PCE IFT (dynes/cm)	TCE IFT (dynes/cm)	CTET IFT (dynes/cm)
Referenced value with D.I. water	44.40	34.50	45.00
Measured value with D.I. water	44.43	27.49	43.48
18	11.08	11.67	11.10
37	8.86	15.85[2]	11.58
60	10.72	11.26	10.72
121	13.64	14.36	14.82
134	6.08	15.26[2]	10.15
135	5.03	14.96[2]	7.01
151	4.08	18.55[2]	8.12
154	9.54	15.6[2]	13.0
194	10.20	9.40	11.43
199	1.67[e]	1.64[2]	1.03[e]
213	16.32	13.16	13.42
222	6.84	7.04	7.23
242	13.06	9.9	13.62
249	7.62	2.46	6.88[e]

(1) See Tables 2.2 and 2.3 for surfactant names.

(2) An emulsion was present at the interface.

Table 2.7: Surfactant Critical Micellar Concentration

Surfactant No.	Surfactant (Volume %)
18	0.012
135	0.011

Table 2.8: Surfactant Solution Viscosities

Solution	Viscosity (kg/m-s)
Distilled water	8.95×10^{-4}
1% Solution No. 18	9.38×10^{-4}
2% Solution No. 18	1.01×10^{-3}
1% Solution No. 135	9.79×10^{-4}
2% Solution No. 135	1.05×10^{-3}
1% Solution No. 154	2.18×10^{-3}
2% Solution No. 154	7.06×10^{-3}

Table 2.9: Surfactant Solubilization Kinetics

Surfactant No.	ml	Pore Volumes	ppm TCE	Average MAC* ppm TCE
18A	40	1	3,526	
18A	57	1.4	12,620	13,136
18B	54	1	3,589	
18B	66	1.2	13,155	13,605
135	56.5	1	806	
135	79.5	1.4	3,923	3,111
154	52	1	2,499	
154	74.5	1.4	9,746	10,796

* The average MAC value as determined once TCE ppm values had reached a plateau.

Table 2.10: Solubilization Data for 1% Sorbitan Monooleate Solutions

Surfactant No.	TCE ppm	PCE ppm	CTET ppm
18	16157	6023	12509
60	16338	6734	10595
64	15407*	5161*	

* From studies other than DOE

Table 2.11: Interfacial Tension (IFT) Measurements Between 1% Sorbitan Monooleate Solutions and TCE, PCE, or CTET

Surfactant No. and Standards	TCE IFT (dynes/cm)	PCE IFT (dynes/cm)	CTET IFT (dynes/cm)
Referenced value with D.I. water	34.50	44.40	45.00
Measured value with D.I. water	27.49	44.43	43.48
18	11.67	11.08	11.10
60	11.26	10.72	10.72

Table 2.12: Viscosity of Sorbitan Monooleates (No. 18)

Solution	Viscosity (kg/m-s)
Distilled Water	8.95×10^{-4}
1% Solution no. 18	9.38×10^{-4}
2% Solution no. 18	1.01×10^{-3}

Table 2.13: Retardation Factors for Sorbitan Monooleates

Surfactant number	Natural soil with 10% smectite[1]	Na smectite - sand mixtures[1][2]	Ca smectite - sand mixtures[1][2]	3% illite/ smectite - sand mixture
18	22.05	1% = 1.51 5% = 13.68 10% = 20.70 20% = 19.98	1% = 1.48 5% = 5.95 10% = 12.09 20% = 20.80	
60				2.22
64	20.71			
161	21.68			

[1] Studies other than DOE.

[2] Percentages indicate fraction of clay in mixture.

Table 3.1: Hydrostratigraphic Data for MW-156 from Phillips (1992)

Hydrogeologic Unit	Thickness (feet)	Description
HU1	21	Loess; mainly yellow-brown clay
HU2	16	Gravel unit, fining upward into a sandy clay
HU3	17	Sandy clay
HU4	6.5	Sand, fine- to medium-grained
HU5	32	Regional Gravel Aquifer; sandy gravel fining upward into a gravelly, fine- to medium-grained sand
-	?	McNairy Fm.; sandy clay

Table 3.2: TCE Contamination in mg/L in the WMU-11 Monitor Well Nest

Date (month and year)	MW-155 Screened Interval: 87-92 feet below surface	MW-156 Screened Interval: 63-70 feet below surface	MW-157 Screened Interval: 30-35 feet below surface
3.91	1.8	>300	>900
7.91	2.4	550	640
6.93	--	460	--
7.93	2.3	400	100
8.93	1.8	380	160
9.93	1.9	400	530
10.93	2.2	380	550
11.93	1.9	370	110

Table 3.3: Model Parameters

Model Parameter	Value
Grid Dimensions	750 ft long, 1ft wide, 54 ft thick
Grid Blocks	Scenario A: 25 x 27 Scenario B: 25 x 32
Volume of TCE	Scenario A: 9.45 ft^3 Scenario B: 20.87 ft^3
Porosity	0.35
Hydraulic Conductivity	Lacustrine Units — 2 x 10^{-5} cm/s 3100 md Upper RGA — 3 x 10^{-3} cm/s 4132 md Lower RGA — 4 x 10^{-3} cm/s 1.0 md McNairy Formation — 1 x 10^{-6} cm/s
K_v/K_h	0.1
Hydraulic Gradient	0.00175 ft/ft
Recharge Rate	4.7 in/yr
Longitudinal Dispersivity	1.0 ft
Transverse Dispersivity	0.2 ft
Residual Saturation of Water	0.35
Residual Saturation of TCE	0.20 in all blocks except for 0.40 for bottom of DNAPL source in Scenario B
Model Dip	0.0 ft/ft

Table 3.4: Comparison of Averaged Concentrations

Well Number	Measured Value (mg/L)	Measured Value* (vol/vol)	Scenario A Value (vol/vol)	Scenario B Value (vol/vol)
155	2.5	1.7×10^{-6}	4.71×10^{-6}	6.7×10^{-4}
156	320	2.2×10^{-4}	3.36×10^{-4}	3.84×10^{-4}
178	110	7.5×10^{-5}	3.62×10^{-5}	4.0×10^{-5}

* Assumes density of TCE = 1,460 kg/m^3.

Table 5.1: Results of Field Analyses for MW-156

Sample Number	Day of Month	Hour of Day	Time Since Extraction Began (days)	Avg. TCE Conc. Data (mg/L)	Surfactant Conc. Data (% by wt)	Surfactant Conc. Data (% by vol)	Temp. ('C)
1	3	11.5	-6.10	353			
4	3	12.5	-6.06	367			22
5	3	13.5	-6.02	350			23
7	3	14.5	-5.98	322			
8	3	15.5	-5.94	308			
10	3	16.5	-5.90	376			
11	3	17.5	-5.85	348			
12	3	18.5	-5.81	312			
13	3	19.5	-5.77	387			
14	3	20.5	-5.73	300			
15	3	21.5	-5.69	382			
16	3	22.5	-5.65	300			21
17	3	23.5	-5.60	356			21
18	4	0.5	-5.56	327			21
19	4	1.5	-5.52	392			
20	4	2.5	-5.48	359			
24	5	18.75	-3.80	< 1	1.14	1.04	
25	6	7.83	-3.26	< 1	1.15	1.06	
30	7	11.17	-2.12	< 1	1.12	1.03	
32	7	15.17	-1.95	< 1	1.12	1.03	
35	8	11.25	-1.11	< 1	1.13	1.04	
37	8	16.5	-0.90		1.09	1.00	
39	9	9.6	-0.18	< 1	1.08	0.99	
40	9	14.25	0.01	< 1	1.09	1.00	
41	9	15	0.04	1	1.04	0.95	
43	9	16	0.08	1	1.05	0.96	
44	9	17	0.13	2	1.04	0.95	
45	9	18	0.17	3			
46	9	19	0.21	4	0.99	0.91	27

Table 5.1 (continued): Results of Field Analyses for MW-156

Sample Number	Day of Month	Hour of Day	Time Since Extraction Began (days)	Avg. TCE Conc. Data (mg/L)	Surfactant Conc. Data (% by wt)	Surfactant Conc. Data (% by vol)	Temp. (°C)
48	9	20	0.25	4			27
49	9	21	0.29	5	0.96	0.88	26
50	9	22	0.33	6			26
51	9	23	0.38	6			26
52	10	0	0.42	7	0.92	0.84	26
53	10	1	0.46	7			25
54	10	2	0.50	8	0.87	0.80	25
55	10	3	0.54	8			25
56	10	4	0.58	9	0.85	0.78	25
57	10	5	0.63	11			25
58	10	6	0.67	11			24
59	10	7	0.71	9	0.78	0.72	24
61	10	8	0.75	12	0.75	0.69	
62	10	9	0.79	11			
63	10	10	0.83	11			
64	10	11	0.88	11	0.69	0.63	
65	10	12	0.92	12			
66	10	13	0.96	11			
67	10	14	1.00	12	0.61	0.56	
68	10	15	1.04	12			
70	10	16	1.08	12	0.56	0.51	
71	10	17	1.13	15			26
72	10	18	1.17	14			25
73	10	19	1.21	15	0.48	0.44	25
76	10	22	1.33	15	0.39	0.36	24
77	11	0	1.42	15			24
78	11	1	1.46	20			23
79	11	2	1.50	19	0.32	0.29	23
80	11	3	1.54	24			23

Table 5.1 (continued): Results of Field Analyses for MW-156

Sample Number	Day of Month	Hour of Day	Time Since Extraction Began (days)	Avg. TCE Conc. Data (mg/L)	Surfactant Conc. Data (% by wt)	Surfactant Conc. Data (% by vol)	Temp. (°C)
81	11	4	1.58	24			23
82	11	5	1.63	27			23
83	11	6	1.67	26	0.25	0.23	23
84	11	7	1.71	29			23
86	11	8	1.75	28			23
87	11	9	1.79	28	0.22	0.20	
88	11	10	1.83	29			
89	11	11	1.88	28			
90	11	12	1.92	28			
91	11	13	1.96	31	0.17	0.16	
92	11	14	2.00	32			
93	11	15	2.04	34			
95	11	16	2.08	36	0.15	0.14	
96	11	17	2.13	43			24
98	11	19	2.21	44			24
100	11	21	2.29	41	0.11	0.10	23
102	11	23	2.38	43			23
105	12	2	2.50		0.09	0.08	22
107	12	4	2.58	50			22
109	12	6	2.67	53	0.06	0.06	22
110	12	7	2.71	57	0.099	0.09	22
112	12	8	2.75	55			22
114	12	10	2.83	54			
115	12	11	2.88		0.061	0.06	
116	12	12	2.92	60			
118	12	14	3.00	63			
120	12	16	3.08	65	0.049	0.04	24
122	12	17	3.13	71			24
124	12	19	3.21	51			23

Table 5.1 (continued): Results of Field Analyses for MW-156

Sample Number	Day of Month	Hour of Day	Time Since Extraction Began (days)	Avg. TCE Conc. Data (mg/L)	Surfactant Conc. Data (% by wt)	Surfactant Conc. Data (% by vol)	Temp. (°C)
125	12	20	3.25		0.048	0.04	22.5
127	12	22	3.33	60			23
129	12	24	3.42	62			22
130	13	1	3.46		0.053	0.05	22
131	13	2	3.50	65			21
133	13	4	3.58	65			21
135	13	6	3.67	67	0.045	0.04	21
138	13	8	3.75	75			22
140	13	10	3.83	73	0.039	0.04	23
142	13	12	3.92	69			
143	13	13	3.96	51			25
144	13	14	4.00	80			
145	13	15	4.04	64	0.028	0.03	24
147	13	16	4.08	66			24
149	13	18	4.17	71			
150	13	19	4.21	81	0.03	0.03	22
153	13	22	4.33	85			22
154	14	3.33	4.56	103			21
155	14	4.33	4.60		0.015	0.014	21
158	14	8	4.75	104			22
159	14	10	4.83		0.012	0.011	22
160	14	12	4.92	101			22
163	14	16	5.08	160			22
164	14	18	5.17	158	0.01	0.009	22
166	14	22	5.33	154			20
167	15	7.5	5.73	207			
169	15	9.15	5.80	209	< 0.01	< 0.009	
171	15	13	5.96	196			22
172	15	15	6.04		< 0.01	< 0.009	

Table 5.1 (continued): Results of Field Analyses for MW-156

Sample Number	Day of Month	Hour of Day	Time Since Extraction Began (days)	Avg. TCE Conc. Data (mg/L)	Surfactant Conc. Data (% by wt)	Surfactant Conc. Data (% by vol)	Temp. (°C)
174	15	17	6.13	218			21
176	15	21	6.29	214			20
178	16	7	6.71	230			
180	16	11	6.88	246			
182	16	15	7.04	225			
184	16	19	7.21	250			21
185	16	23	7.38	250			20
187	17	7.5	7.73	250			
188	17	11	7.88	262			
190	17	15	8.04	236			
192	17	19	8.21	281			21
193	17	23	8.38	240			
195	18	7.5	8.73	218			
196	18	11.25	8.89	209			
198	18	15	9.04	227			
200	18	19	9.21				21
201	18	23	9.38				20
204	19	11	9.88	249			23
208	19	19	10.21				21
209	19	23	10.38				20
211	20	7.75	10.74	265			
212	20	11	10.88	260			20.5
214	20	15	11.04	256			
216	20	19	11.21				20
217	20	23	11.38				19
219	21	7.5	11.73	275			
220	21	11	11.88	289			
222	21	15	12.04	303			
224	21	19	12.21	315			20

Table 5.1 (continued): Results of Field Analyses for MW-156

Sample Number	Day of Month	Hour of Day	Time Since Extraction Began (days)	Avg. TCE Conc. Data (mg/L)	Surfactant Conc. Data (% by wt)	Surfactant Conc. Data (% by vol)	Temp. (°C)
225	21	23	12.38	275			19
227	22	7.5	12.73	277			
230	22	15	13.04	329			
233	22	23	13.38	313			20
236	23	11	13.88	293			
238	23	15	14.04	325			
240	23	19	14.21	299			20
244	24	11	14.88	312			
248	24	19	15.21				20.5
253	25	10.83	15.87	312			

Table 5.2: Precision Estimates for MW-156 Field TCE Analyses

Sample Number	Area 1	Area 2	Area 3	Area 1 Conc. (mg/L)	Area 2 Conc. (mg/L)	Area 3 Conc. (mg/L)	Sample Stand. Dev. (mg/L)	Sample Mean Conc. (mg/L)	Student t 95% Conf. Interval +/- (mg/L)	Student t 95% Conf. Interval +/- (% of mean)
11	22002	18706	19028	413	311	321	56.2	348.2	139.6	40.1%
17	21428	19156	19887	395	325	347	35.9	355.8	89.1	25.0%
44	198.8	221.5	240	1.9	2.0	2.1	0.1	2.0	0.3	16.0%
59	1271	1406	1323	8.6	9.4	8.9	0.4	9.0	1.1	11.8%
70	2215	2315	2167	14	14	13	0.5	13.8	1.2	8.5%
88	3142	3222	3168	29	30	29	0.7	29.2	1.7	5.9%
107	4790	4772	4539	52	52	48	2.4	50.4	6.1	12.1%
118	5151	5080	5215	63	62	64	1.2	63.1	2.9	4.6%
127	5945	5778	5985	61	58	61	1.5	60.1	3.8	6.3%
153	5066	5227	5242	82	87	87	3.1	85.4	7.8	9.1%
180	14355	14561	14964	240	245	254	6.9	246.0	17.1	7.0%
196	11574	11701	11729	207	210	211	2.0	209.0	5.0	2.4%
220	12902	13428	12420	239	252	227	12.2	239.3	30.4	12.7%
228	14563	15772	14592	246	273	247	15.2	255.6	37.7	14.7%
236	13684	13627	12714	227	226	206	12.0	219.7	29.7	13.5%
244	39772	43585	40651	297	334	306	19.5	312.4	48.5	15.5%
253	39456	41907	42505	294	318	324	15.8	311.9	39.2	12.6%

Table 5.3: Results of PGDP Analyses for MW-156

Sample Number	Day of Month	Hour of Day	Time Since Extraction Began (days)	PGDP TCE Conc. Data (mg/L)	PGDP Tc-99 Conc. Data (pCi/L)	PGDP Surfactant Conc. Data (%)
1	3	11.5	-6.10	370	120	0
6	3	14	-6.00		107	
8	3	15.5	-5.94	390		0
10	3	16.5	-5.90		106	
13	3	19.5	-5.77		109	
14	3	20.5	-5.73	400		0
16	3	22.5	-5.65		104	
20	4	2.5	-5.48	400	109	0
41	9	15	0.04	1.3	55	1.1
47	9	19.58	0.23	5.5	79	0.99
49	9	21	0.29		72	
53	10	1	0.46	11	117	0.92
57	10	5	0.63		39	
59	10	7	0.71	15		0.86
62	10	9	0.79		26	
66	10	13	0.96	19	33	0.58
71	10	17	1.13		52	
73	10	19	1.21	24		0.53
75	10	21	1.29		32	
78	11	1	1.46	30	33	0.35
82	11	5	1.63		30	
84	11	7	1.71	35		0.23
87	11	9	1.79		35	
91	11	13	1.96	38	21	0.23
96	11	17	2.13		47	
98	11	19	2.21	44		0.17
100	11	21	2.29		49	
112	12	8	2.75	52	65	0.09
115	12	11	2.88		53	

Table 5.3 (continued): Results of PGDP Analyses for MW-156

Sample Number	Day of Month	Hour of Day	Time Since Extraction Began (days)	PGDP TCE Conc. Data (mg/L)	PGDP Tc-99 Conc. Data (pCi/L)	PGDP Surfactant Conc. Data (%)
118	12	14	3.00		67	
122	12	17	3.13		54	
123	12	18	3.17	59		0.05
138	13	8	3.75	85	80	0.04
141	13	11	3.88		84	
144	13	14	4.00		89	
148	13	17	4.13	80	72	0.02
158	14	8	4.75	100	104	0.018
161	14	14	5.00		86	
164	14	18	5.17	110	97	0.015
166	14	22	5.33		93	
167	15	7.5	5.73	130	92	0
171	15	13	5.96		95	
175	15	19	6.21	120	101	0
177	15	23	6.38		115	
178	16	7	6.71	150	94	0
181	16	13	6.96		93	
184	16	19	7.21	150	105	0
185	16	23	7.38		88	
187	17	7.5	7.73	210	93	0
189	17	13	7.96		100	
192	17	19	8.21	170	113	0
193	17	23	8.38		103	
195	18	7.5	8.73	200	90	0
197	18	13	8.96		107	
200	18	19	9.21	210	106	0
201	18	23	9.38		112	
203	19	7.5	9.73	210	107	0
205	19	13	9.96		112	

Table 5.3 (continued): **Results of PGDP Analyses for MW-156**

Sample Number	Day of Month	Hour of Day	Time Since Extraction Began (days)	PGDP TCE Conc. Data (mg/L)	PGDP Tc-99 Conc. Data (pCi/L)	PGDP Surfactant Conc. Data (%)
208	19	19	10.21	210	100	0
209	19	23	10.38		94	
211	20	7.75	10.74	190	117	0
213	20	13	10.96		108	
216	20	19	11.21	200	95	0
217	20	23	11.38		115	
219	21	7.5	11.73	200	98	0
221	21	13	11.96		111	
224	21	19	12.21	230	102	0
225	21	23	12.38		100	
227	22	7.5	12.73	220	107	0
232	22	19	13.21	210	105	0
233	22	23	13.38		98	
235	23	7.33	13.72	220	97	0
237	23	13	13.96		104	
240	23	19	14.21	240	111	0
242	23	23	14.38		96	
243	24	7.5	14.73	230	95	0
245	24	13	14.96		105	
248	24	19	15.21	220	113	0
249	24	23	15.38		109	
251	25	7.42	15.73	210	121	0
253	25	10.83	15.87	220	105	0

Table 5.4: Matched-Pairs Analysis of Differences in Field and PGDP Results for MW-156

Sample Number	PGDP TCE Conc. Data (ppm)	Field TCE Conc. Data (mg/L)	Difference (mg/L)
1	370	353	17
8	390	308	82
14	400	300	100
20	400	359	41
41	1.3	1	0
53	11	7	4
59	15	9	6
66	19	11	8
73	24	15	9
78	30	20	10
84	35	29	6
91	38	31	7
98	44	44	0
112	52	55	-3
138	85	75	10
158	100	104	-4
164	110	158	-48
167	130	207	-77
178	150	230	-80
184	150	250	-100
187	210	250	-40
192	170	281	-111
195	200	218	-18
211	190	265	-75
219	200	275	-75
224	230	315	-85
227	220	277	-57
240	240	299	-59
253	220	312	-92

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Sample Mean Difference	-22
Sample Standard Deviation	53
Number of Matched Pairs	29
Degrees of Freedom	28
Critical Value of Test Statistic 5% significance level	-1.70
Actual Value of Test Statistic	-2.19

Conclusion

The PGDP TCE measurements are significantly lower than the field measurements.

There is a probability of less than 5% that this conclusion is incorrect.

Table 5.5: Results of Field Analyses for MW-155

Sample Number	Day of Month	Hour of Day	Time Since Extraction Began (days)	Average TCE Concentration Measurement (mg/L)	Surfactant Concentration Measurement (% by wt)	Surfactant Concentration Measurement (% by vol)
2	3	11.5	-6.10	1.4	< 0.01	< 0.01
9	3	15.5	-5.94	< 1	< 0.01	< 0.01
26	6	7.0	-3.29	< 1	< 0.01	< 0.01
28	6	15.5	-2.94	1.4	< 0.01	< 0.01
29	7	6.9	-2.30	1.4	< 0.01	< 0.01
33	7	15.8	-1.92	1.5	< 0.01	< 0.01
34	8	7.0	-1.29	1.4	< 0.01	< 0.01
36	8	16.0	-0.92	1.1	< 0.01	< 0.01
38	9	7.0	-0.29	1.3	< 0.01	< 0.01
42	9	15.5	0.06	1.2	< 0.01	< 0.01
60	10	7.0	0.71	1.4	< 0.01	< 0.01
69	10	16.0	1.08	1.4	< 0.01	< 0.01
85	11	7.0	1.71	1.2	< 0.01	< 0.01
94	11	16.0	2.08	1.3	< 0.01	< 0.01
111	12	7.0	2.71	1.4		
121	12	16.0	3.08	1.2		
137	13	7.0	3.71	1.3		
146	13	16.0	4.08	1.5		
157	14	7.0	4.71	1.4		
162	14	16.0	5.08	1.5		
168	15	7.0	5.71	1.4		
173	15	16.0	6.08	1.4		
179	16	7.0	6.71	1.5		
183	16	16.0	7.08	1.5		
186	17	7.0	7.71	1.5		
191	17	16.0	8.08	1.3		
194	18	7.0	8.71	1.7		
199	18	16.0	9.08	1.6		
202	19	7.0	9.71	1.7		

Table 5.5 (continued): Results of Field Analyses for MW-155

Sample Number	Day of Month	Hour of Day	Time Since Extraction Began (days)	Average TCE Concentration Measurement (mg/L)	Surfactant Concentration Measurement (% by wt)	Surfactant Concentration Measurement (% by vol)
207	19	16.0	10.08	1.5		
210	20	7.0	10.71	1.6		
215	20	16.0	11.08	1.6		
218	21	7.0	11.71	1.7		
223	21	16.0	12.08	1.5		
226	22	7.0	12.71	1.8		
231	22	16.0	13.08	1.6		
234	23	7.0	13.71	1.6		
239	23	16.0	14.08	1.7		
241	24	7.0	14.71	1.8		
247	24	16.0	15.08	1.6		
250	25	7.0	15.71	1.7		
252	25	11.0	15.88	2.2		

Table 5.6: Results of PGDP Analyses for MW-155

Sample Numbe	Day of Month	Hour of Day	Time Since Extraction Began (days)	Dissolved Oxygen (mg/L)	Temp. ('F)	Temp. ('C)	pH	TCE (ppm)
2	3	11.5	-6.10	3.78	67	19.4	5.7	2.0
9	3	15.5	-5.94		77	25.0	6.4	
26	6	7.0	-3.29	5.3	65	18.3	5.2	
28	6	15.5	-2.94	3.94	67	19.4	5.3	
29	7	6.9	-2.30	4	65	18.3	6.1	
33	7	15.8	-1.92	3.94	68	20.0	5.8	
34	8	7.0	-1.29	4.54	65	18.3	6.1	
36	8	16.0	-0.92	3.74	67	19.4	5.8	
38	9	7.0	-0.29	5.56	65	18.3	5.9	
42	9	15.5	0.06	5.62	68	20.0	6	1.6
60	10	7.0	0.71	5.11	66	18.9	5.9	
69	10	16.0	1.08	5.45	73	22.8	6.2	
85	11	7.0	1.71	6.06	72	22.2	5.9	
94	11	16.0	2.08	5.22	72	22.2	6.2	
111	12	7.0	2.71	2.45	66	18.9	5.9	
121	12	16.0	3.08	3.87	68	20.0	6	
137	13	7.0	3.71	3.5	66	18.9	6	
146	13	16.0	4.08	3.72	68	20.0	6.1	
157	14	7.0	4.71	3.88	66	18.9	6.1	
162	14	16.0	5.08	4.06	66	18.9	6	
168	15	7.0	5.71	4.65	66	18.9	6.1	1.5
173	15	16.0	6.08	6.03	72	22.2	6.1	
179	16	7.0	6.71	6.48	65	18.3	5.7	
183	16	16.0	7.08	5.08	68	20.0	5.9	
186	17	7.0	7.71	5.84	67	19.4	5.7	
191	17	16.0	8.08	4.99	70	21.1	6	
194	18	7.0	8.71	6.62	67	19.4	5.8	
199	18	16.0	9.08	4.88	69	20.6	6.1	
202	19	7.0	9.71	6.27	67	19.4	6.2	1.5

Table 5.6 (continued): Results of PGDP Analyses for MW-155

Sample Numbe	Day of Month	Hour of Day	Time Since Extraction Began (days)	Dissolved Oxygen (mg/L)	Temp. (°F)	Temp. (°C)	pH	TCE (ppm)
207	19	16.0	10.08	6.12	72	22.2	6.5	
210	20	7.0	10.71	6.73	69	20.6	6.4	
215	20	16.0	11.08	6.33	69	20.6	6.3	
218	21	7.0	11.71	5.78	65	18.3	6.3	
223	21	16.0	12.08	6.13	70	21.1	6.4	
226	22	7.0	12.71	6.37	66	18.9	6.5	
231	22	16.0	13.08	4.82	67	19.4	6.5	
234	23	7.0	13.71	5.61	66	18.9	6.5	
239	23	16.0	14.08					
241	24	7.0	14.71	6.12	67	19.4	6.5	
247	24	16.0	15.08	5.26	71	21.7	6.6	
250	25	7.0	15.71	6.2	71	21.7	6.5	1.6
252	25	11.0	15.88	4.97	76	24.4	6.5	1.6

Table 5.7: Matched-Pairs Analysis of Differences in Field and PGDP Results for MW-155

Sample Number	PGDP TCE Conc. Data (ppm)	Field TCE Conc. Data (mg/L)	Difference (mg/L)
2	2	1.4	0.6
42	1.6	1.2	0.4
168	1.5	1.4	0.1
202	1.5	1.7	-0.2
250	1.6	1.7	-0.1
252	1.6	2.2	-0.6
Sample Mean			0.2
Sample Standard Deviation			0.3

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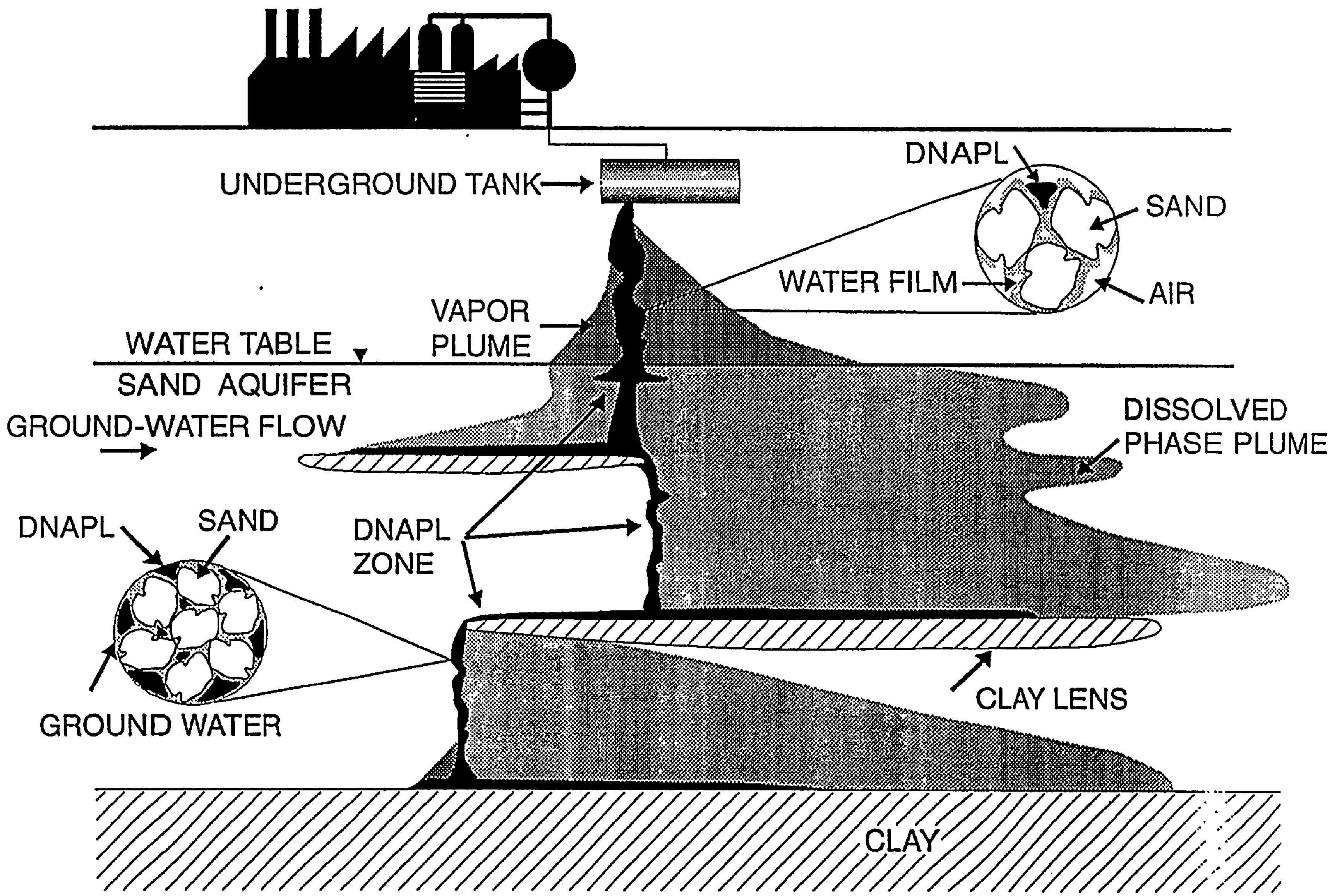
Number of Matched Pairs	6	
Degrees of Freedom	5	
Critical Value of Test Statistic (2-tail)		
5% significance level	2.57	+/-
Actual Value of Test Statistic	1.67	

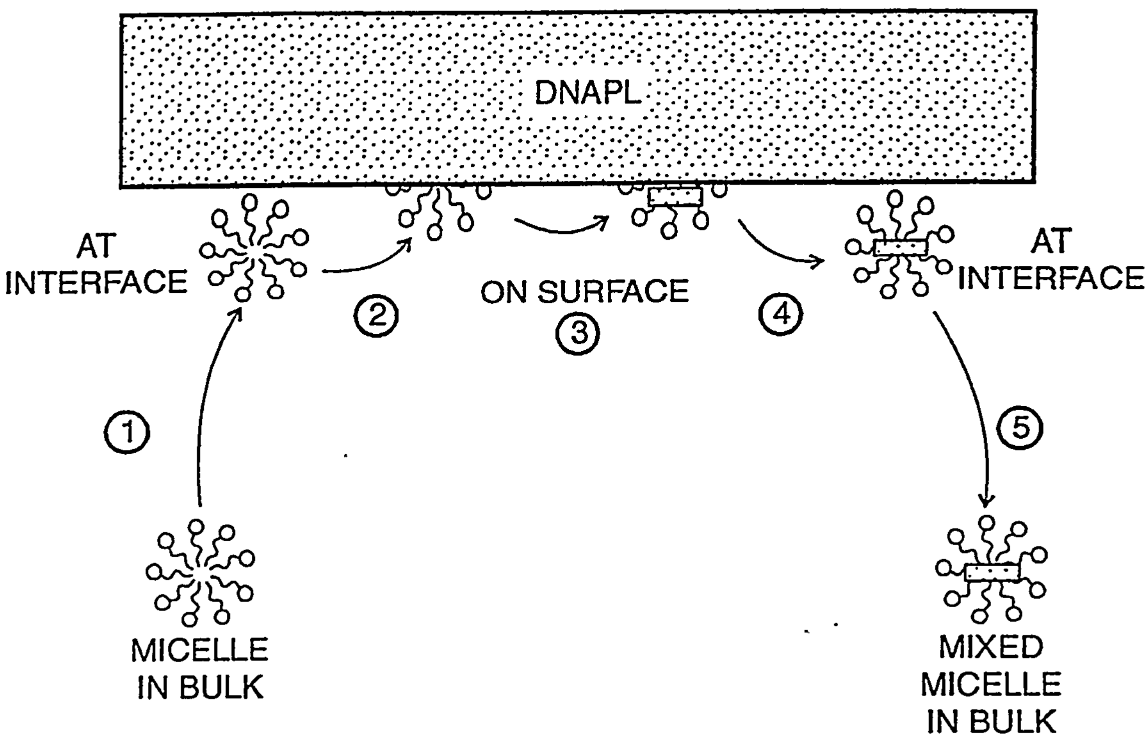
Conclusion

The PGDP TCE measurements are not significantly different from the field measurements for MW-155.

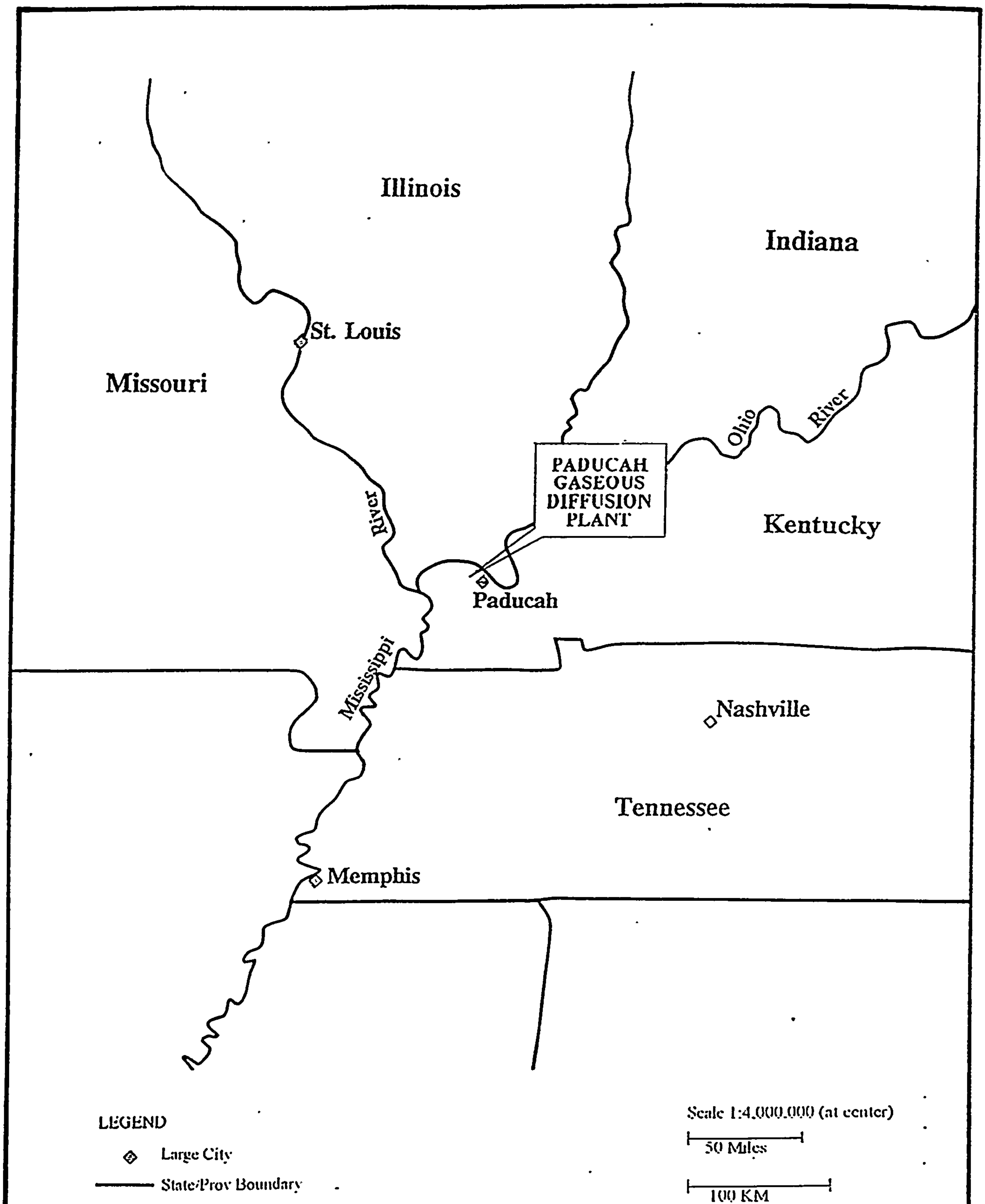
FIGURES



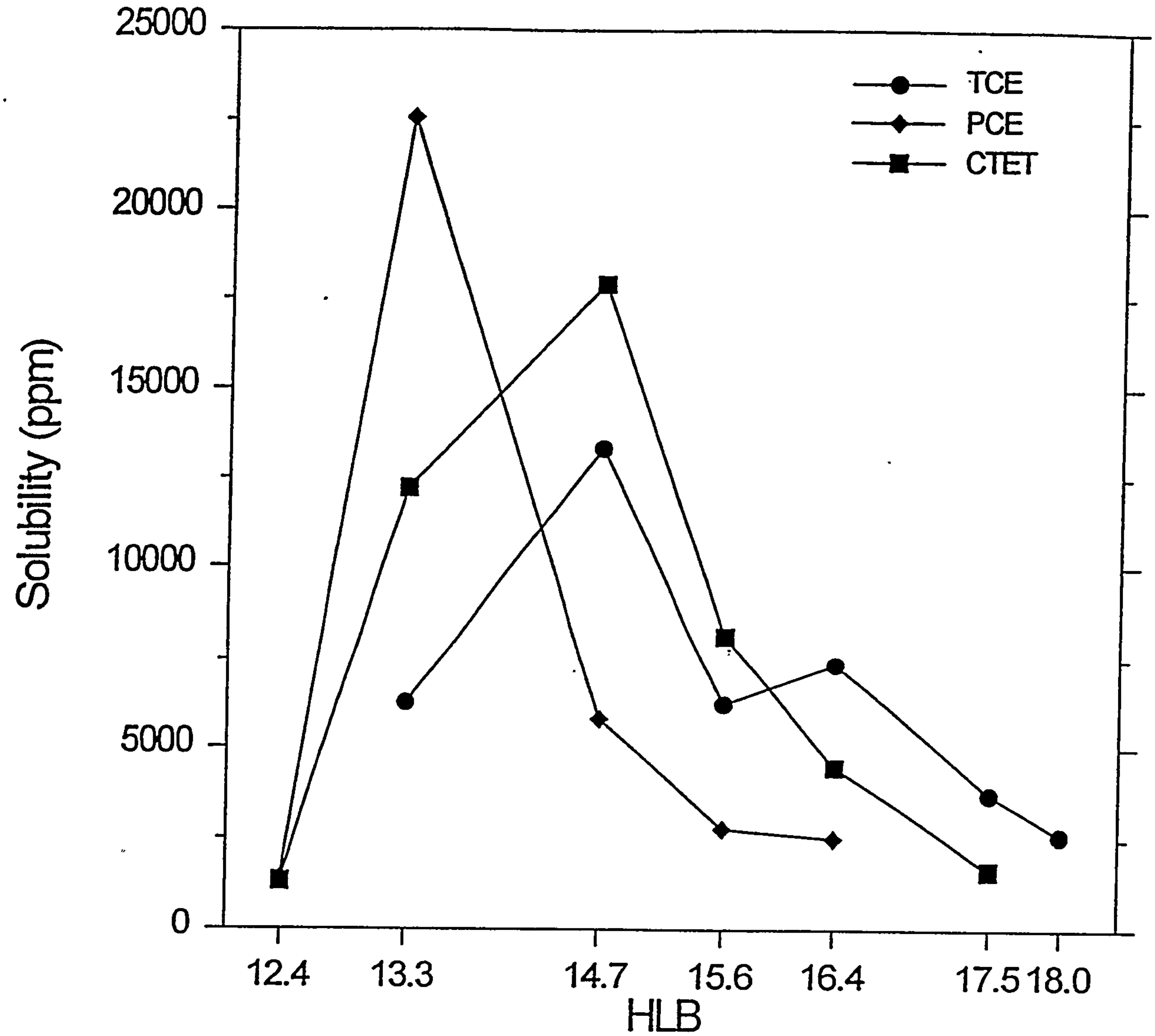
DATE: 10/26/94	Figure 1.1: Schematic showing the migration of DNAPL in a granular aquifer system and the development of both a DNAPL zone , comprising several vertical fingers and horizontal lenses, and two dissolved-phase plumes.
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



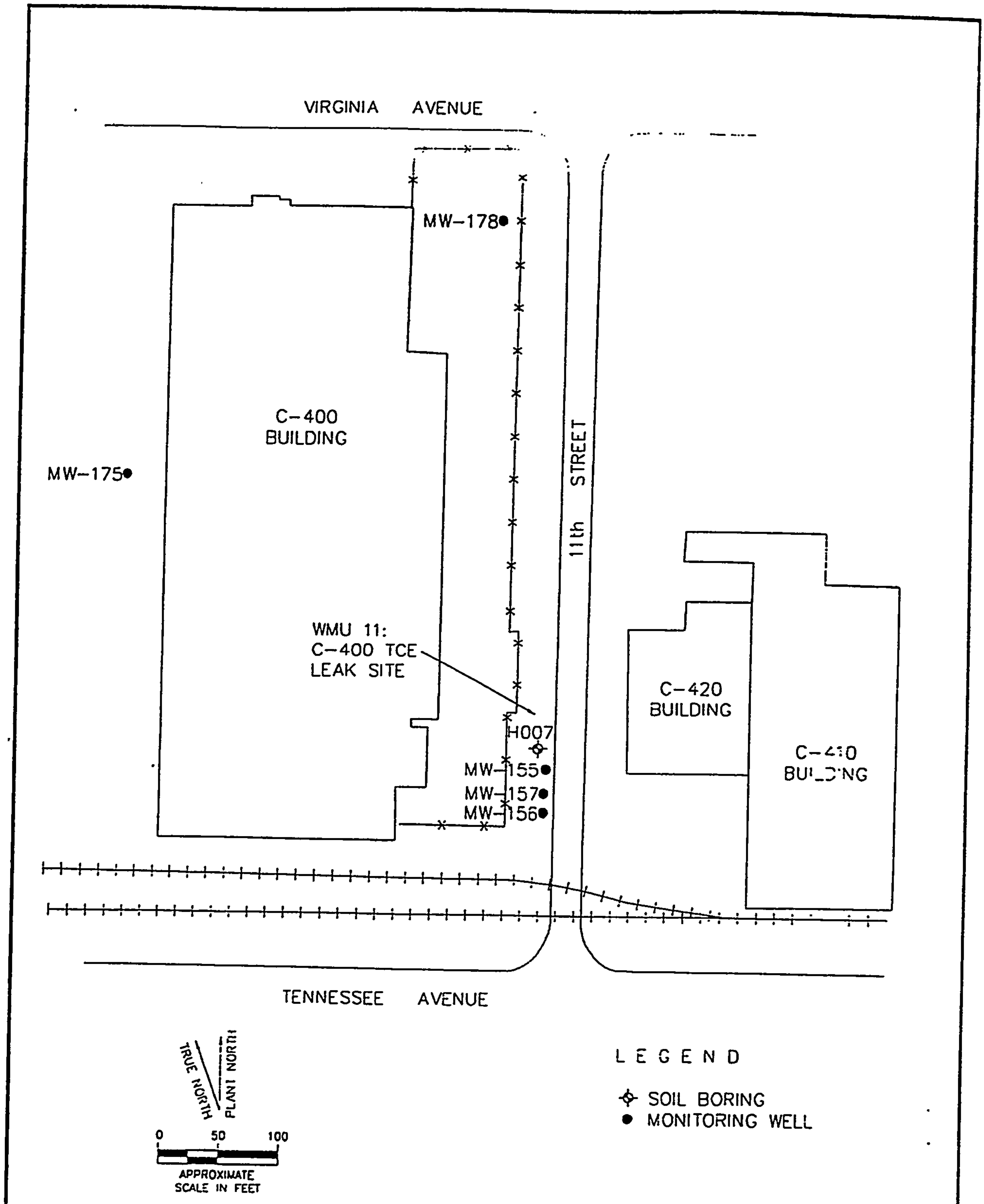
DATE: 10/26/94	Figure 1.2: Schematic mechanism for initial solubilization. Mixed micelle desorption and diffusion [steps (4) to (5)] are assumed to control DNAPL solubilization (Modified after Chan, et al., 1976).
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



DATE:	10/18/94	Figure 1.3 Location of Paducah Gaseous Diffusion Plant, Kentucky
REF:	1125-004	



DATE: 10/26/94	Figure 2.1: Solubility vs HLB for TCE, PCE and CTET.
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



DATE: 10/18/94

REF: 1125-004

Figure 3.1: Field Test Site Map

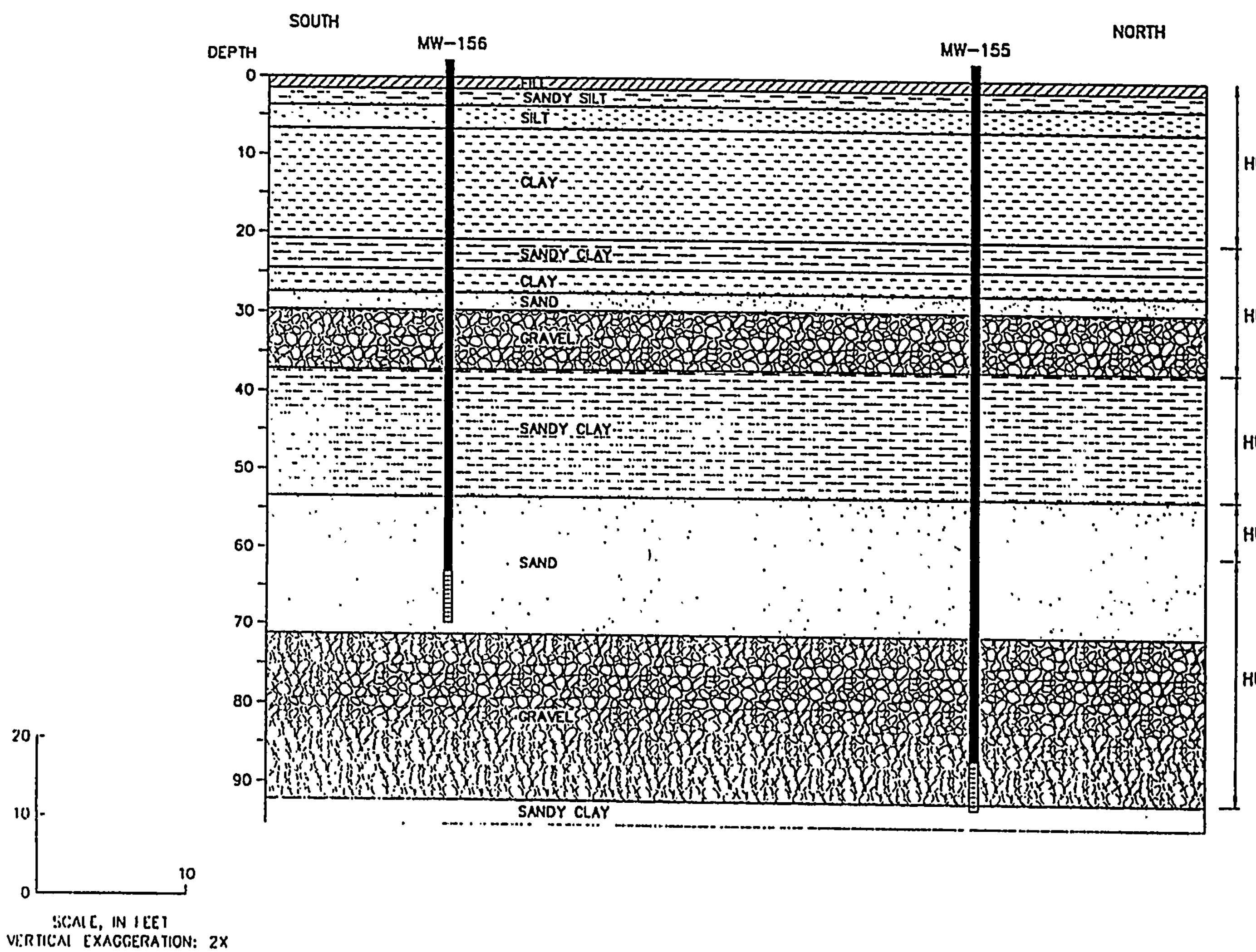
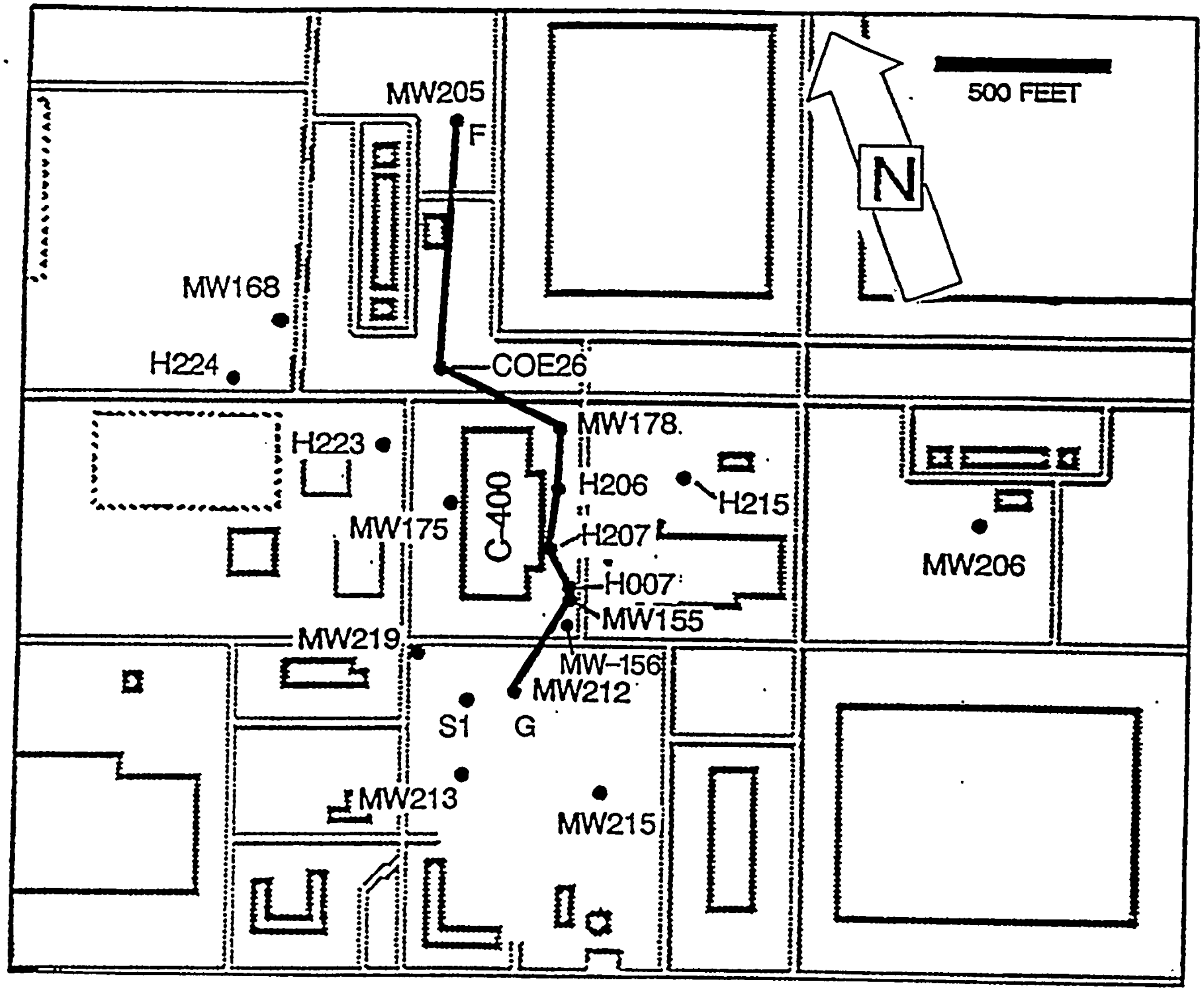


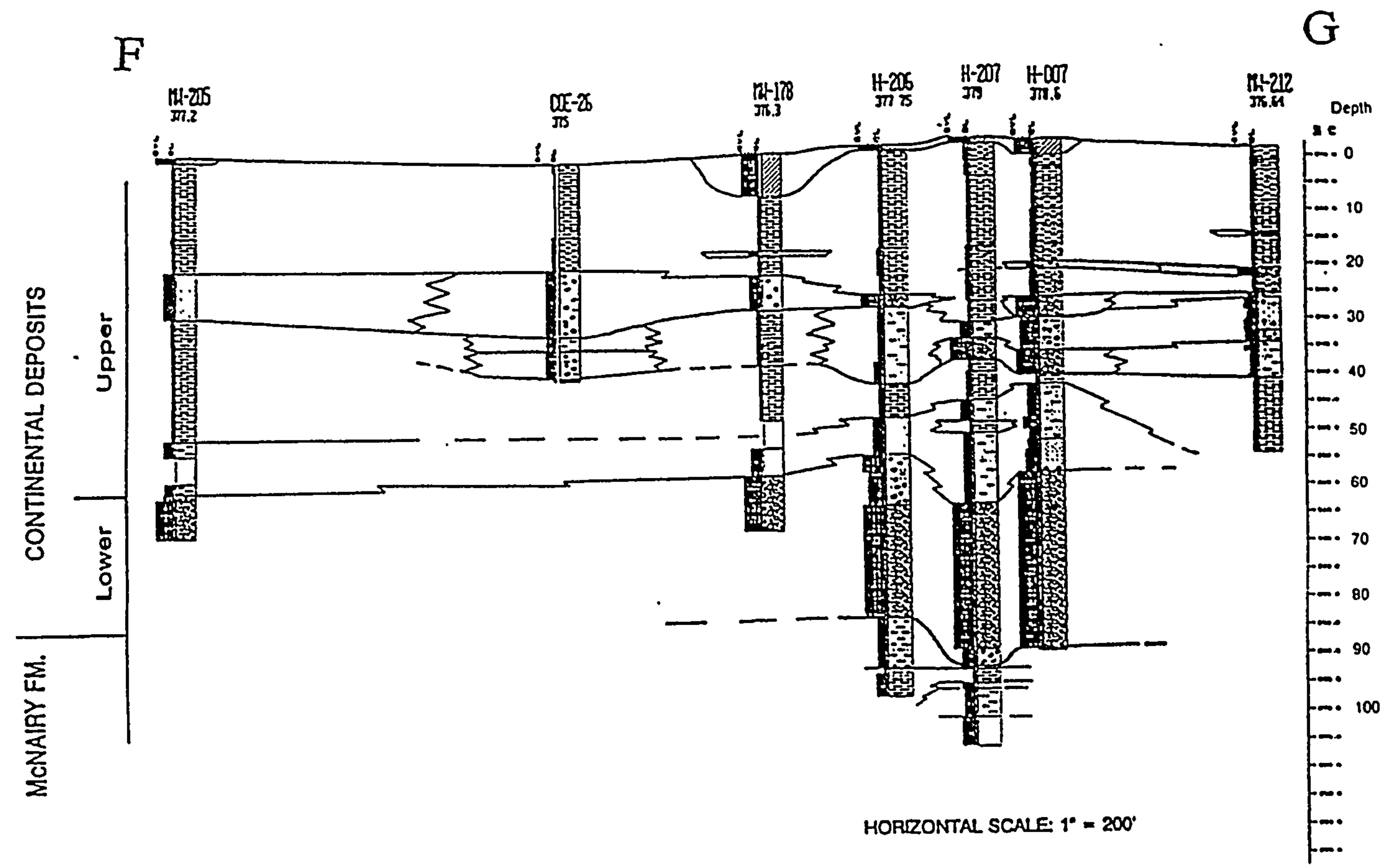
Figure 3.2: Hydrostratigraphic Section for MW-155 Showing Screened Interval for MW-156.



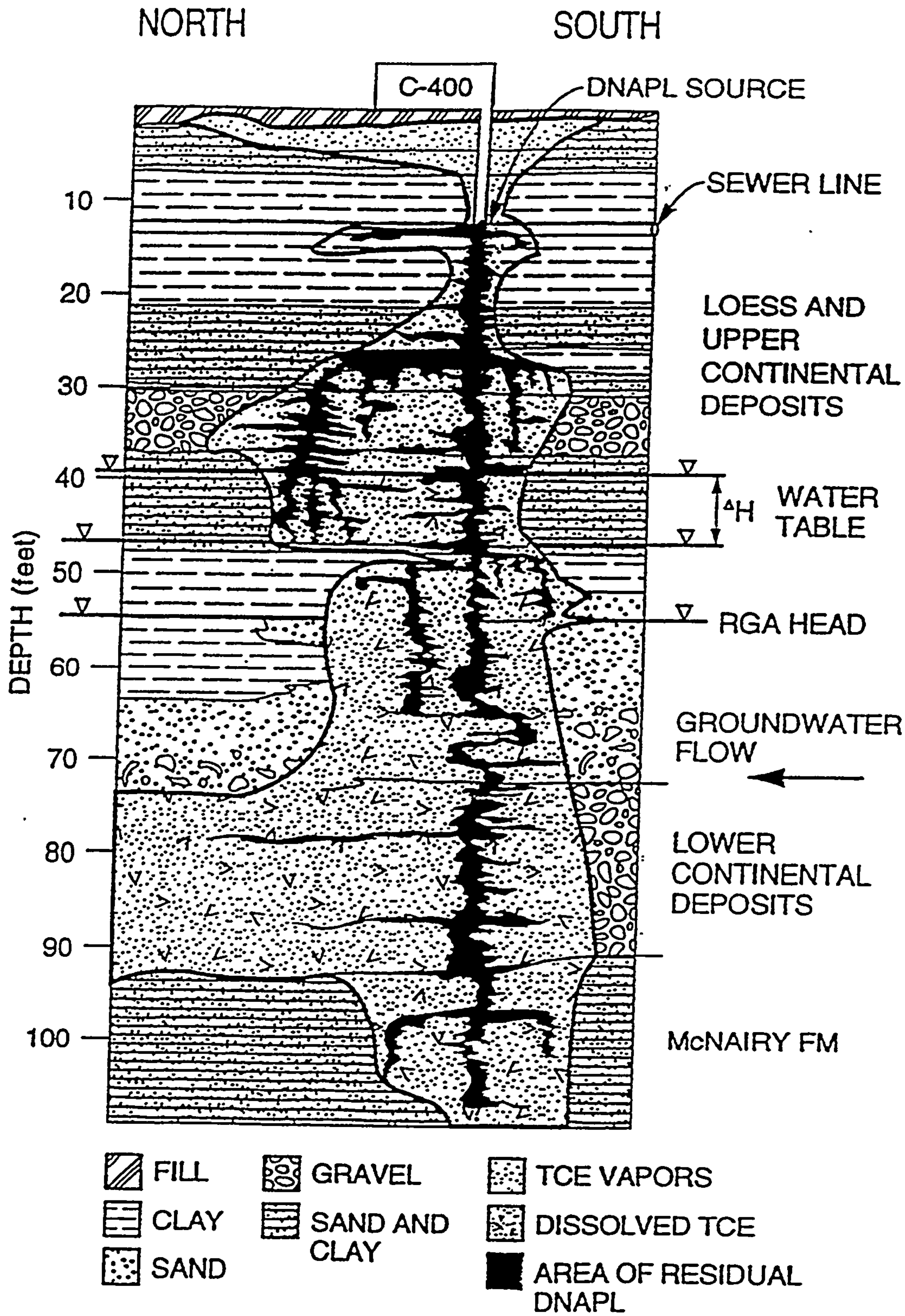
DATE: 10/26/94
REF: 1125-004

Figure 3.3: Locations of soil borings near C-400 and the cross section F-G (after Phillips, 1992).

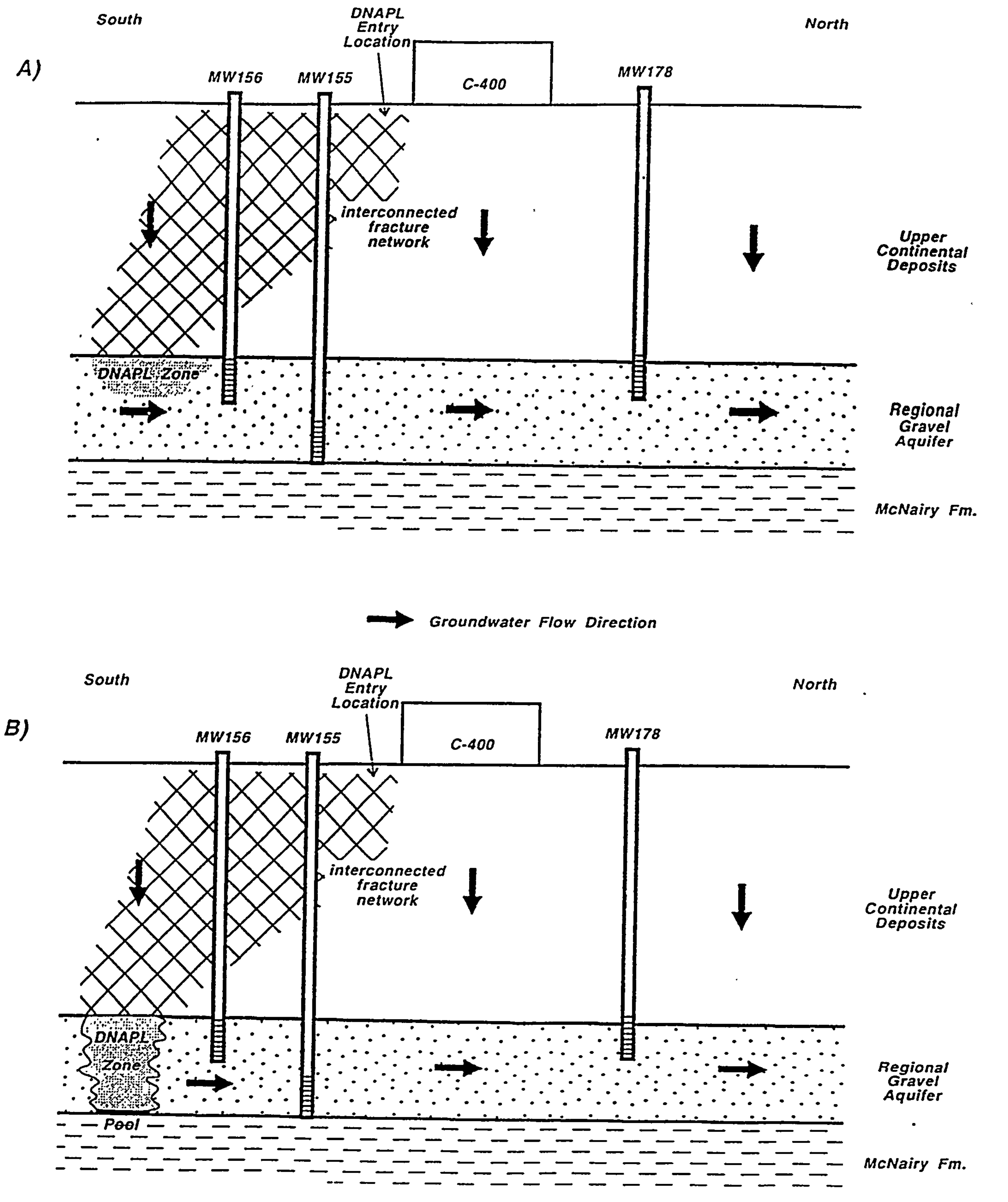
Paducah Gaseous Diffusion Plant
Paducah, Kentucky



DATE: 10/26/94	Figure 3.4: Hydrostratigraphy along east side of building C-400 (after Phillips, 1992).
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



DATE: 10/26/94	Figure 3.5: Conceptual model of DNAPL distribution in the subsurface beneath the C-400 building at PGDP (from Clausen et at., 1992).
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky

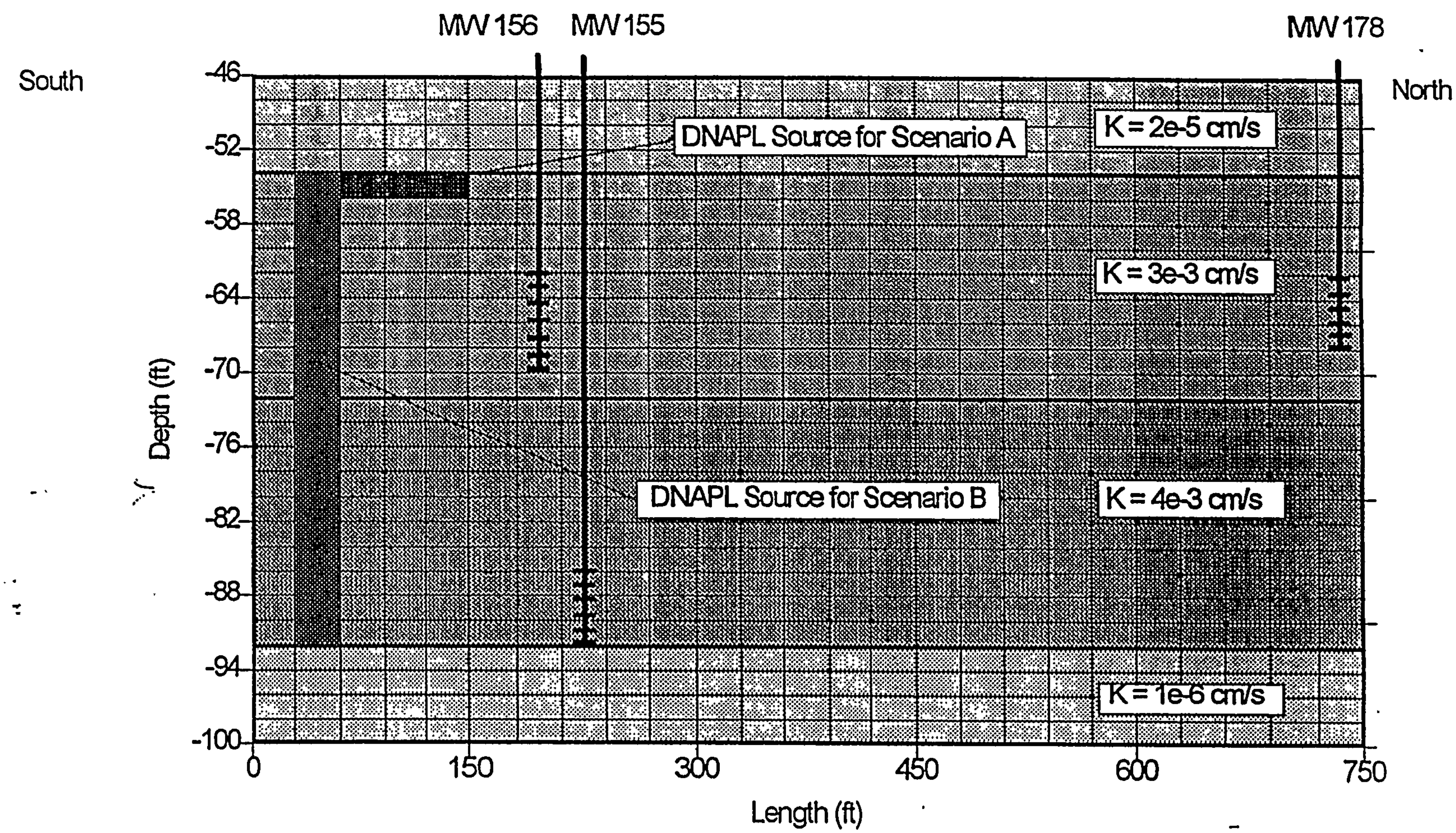


DATE: 10/26/94

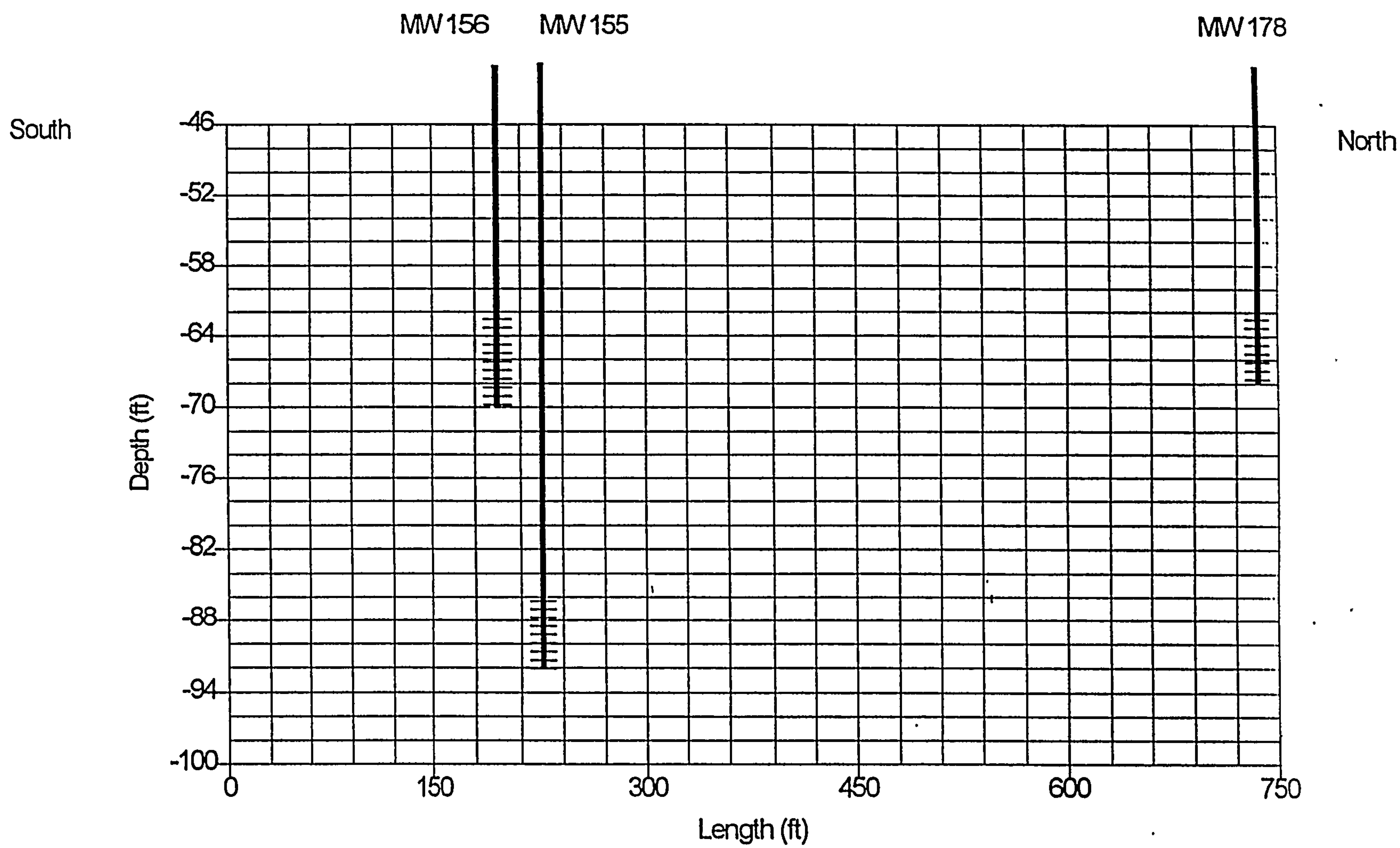
REF: 1125-004

Figure 3.6: Two scenarios simulated to investigate aqueous TCE concentrations in the RGA.

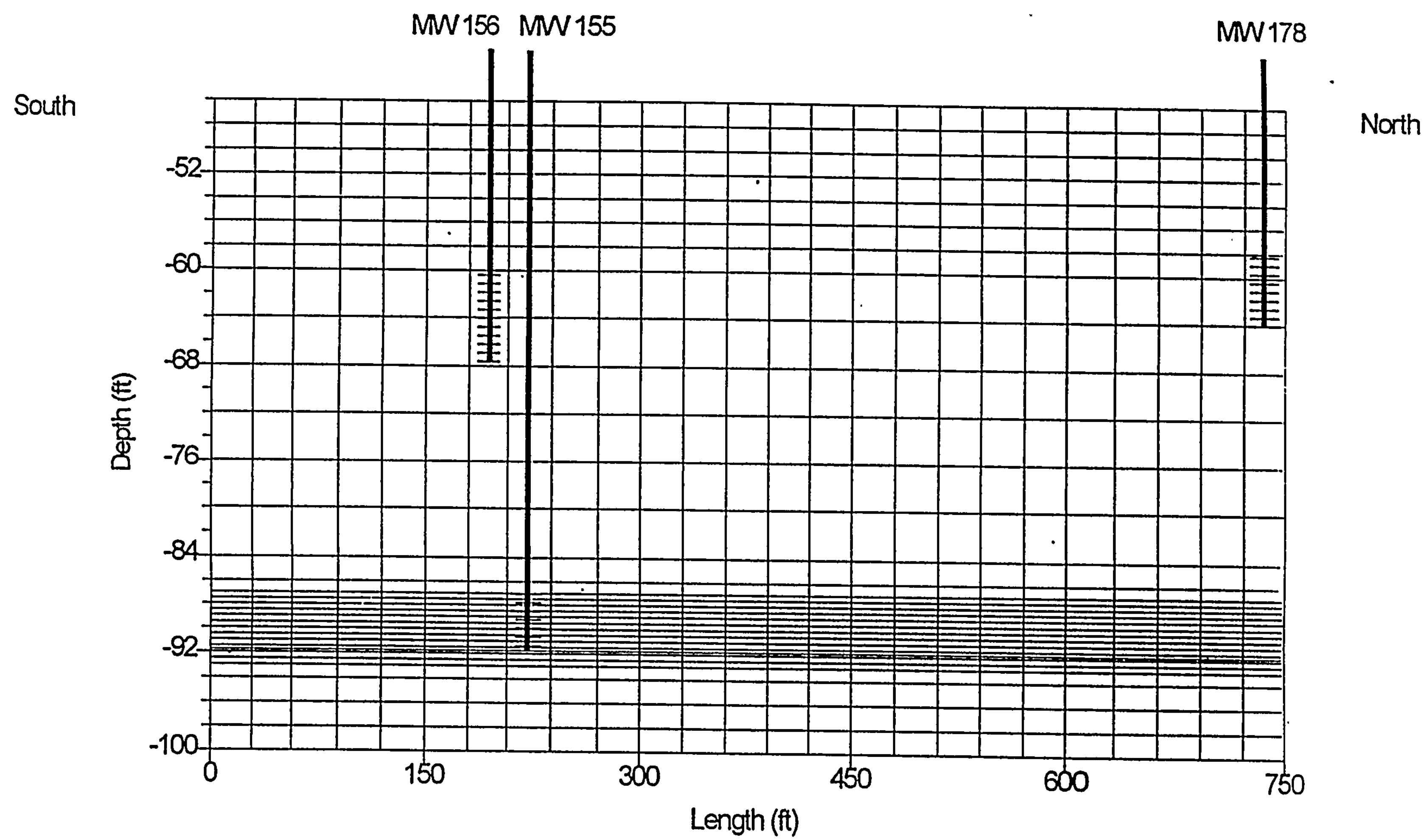
Paducah Gaseous Diffusion Plant
Paducah, Kentucky



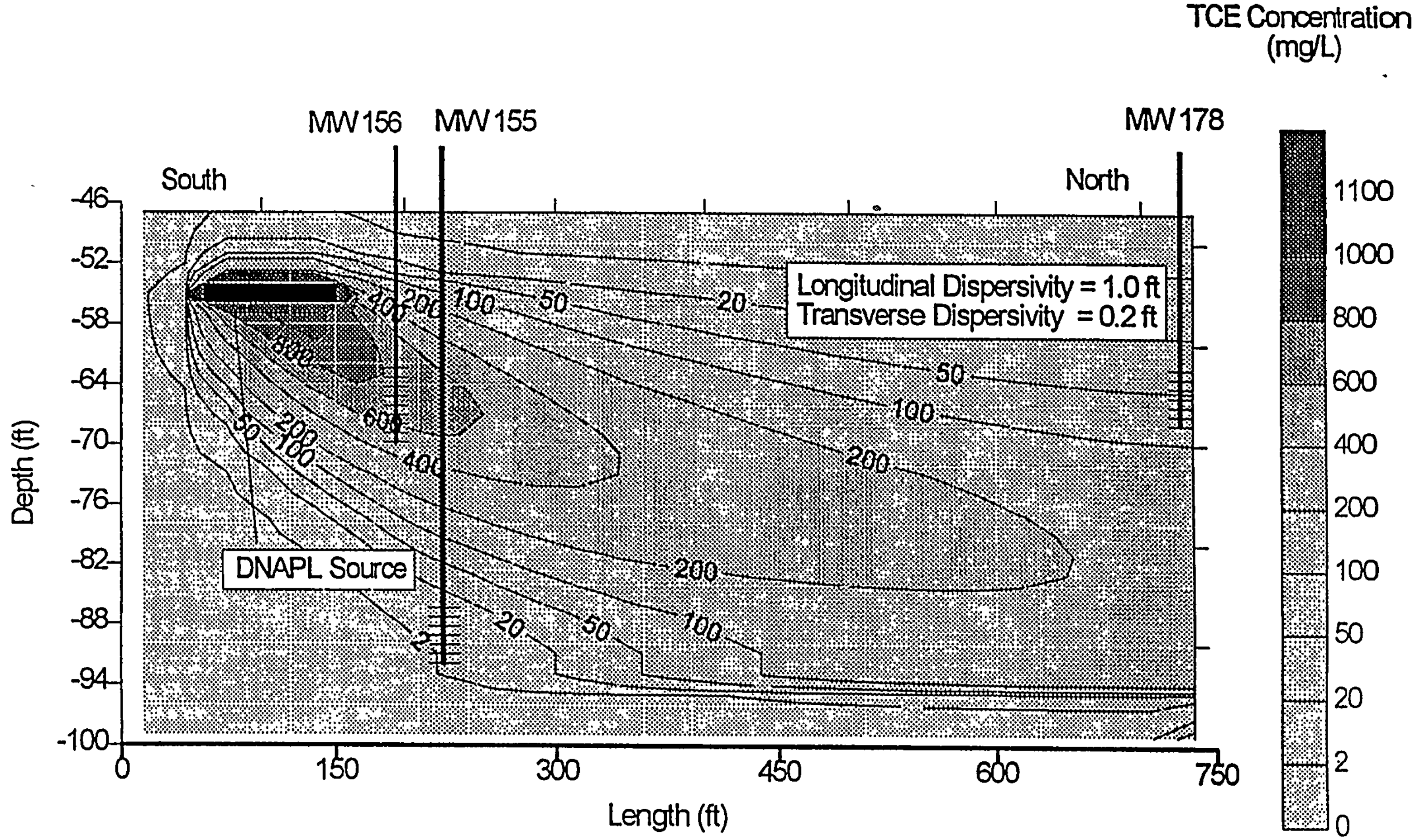
DATE: 10/26/94	Figure 3.7: Stratigraphy and Location of Wells
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



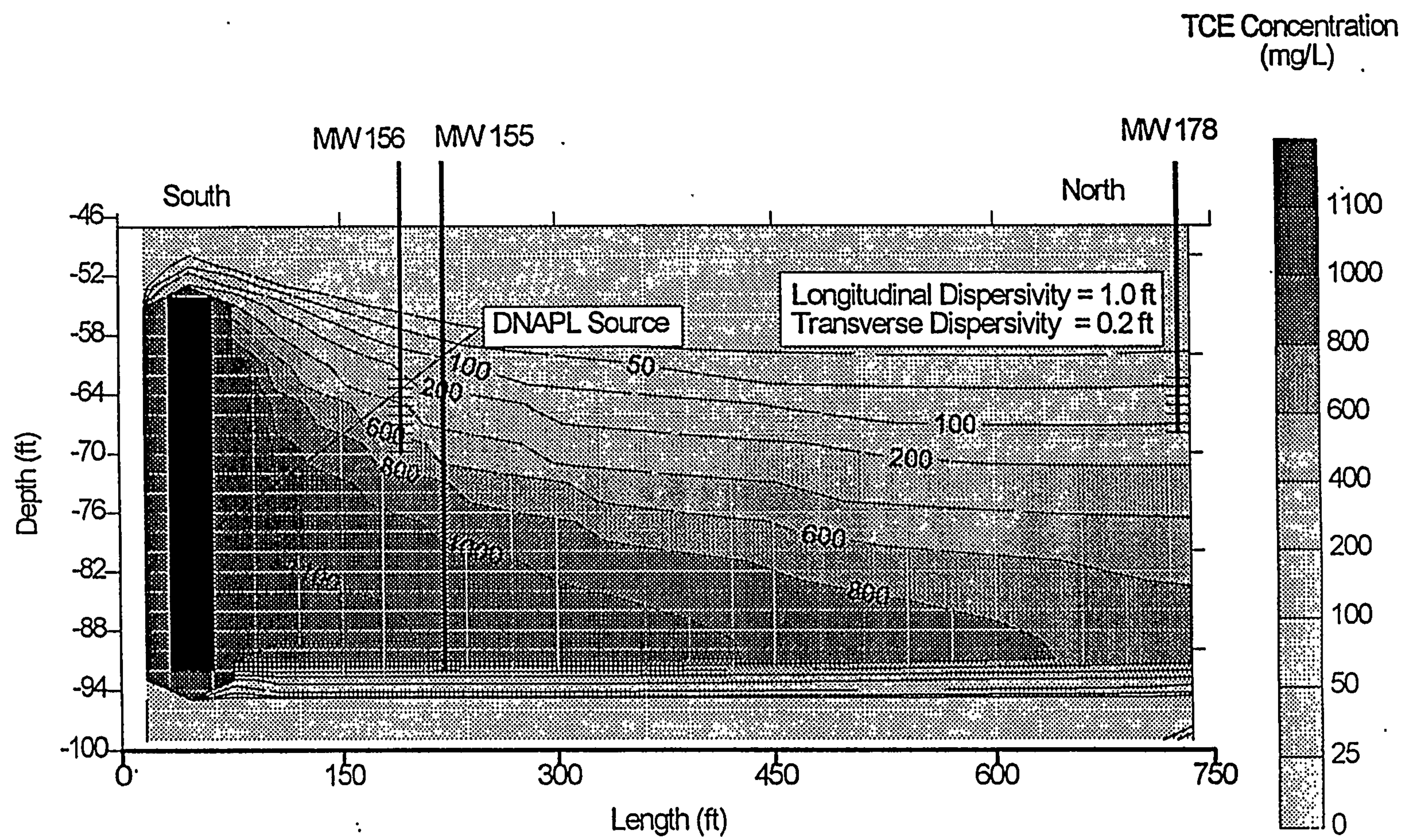
DATE: 10/26/94	Figure 3.8: Cross Sectional Simulation Grid for Scenario A
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



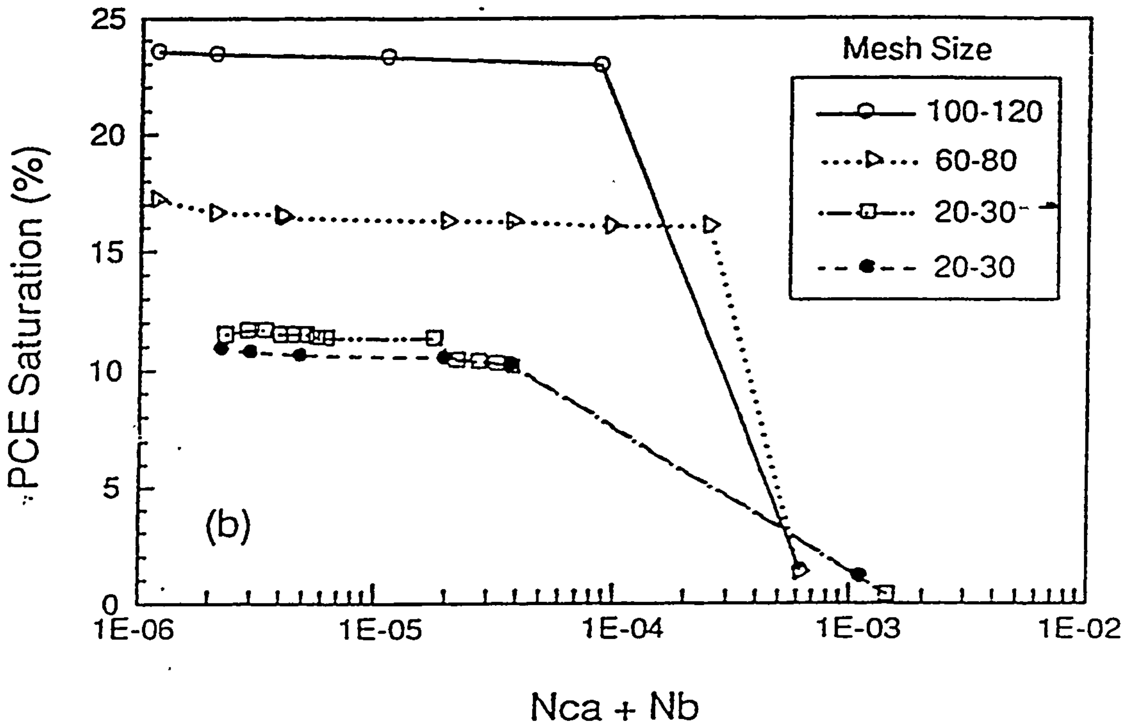
DATE: 10/26/94	Figure 3.9: Cross Sectional Simulation Grid for Scenario **B**
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



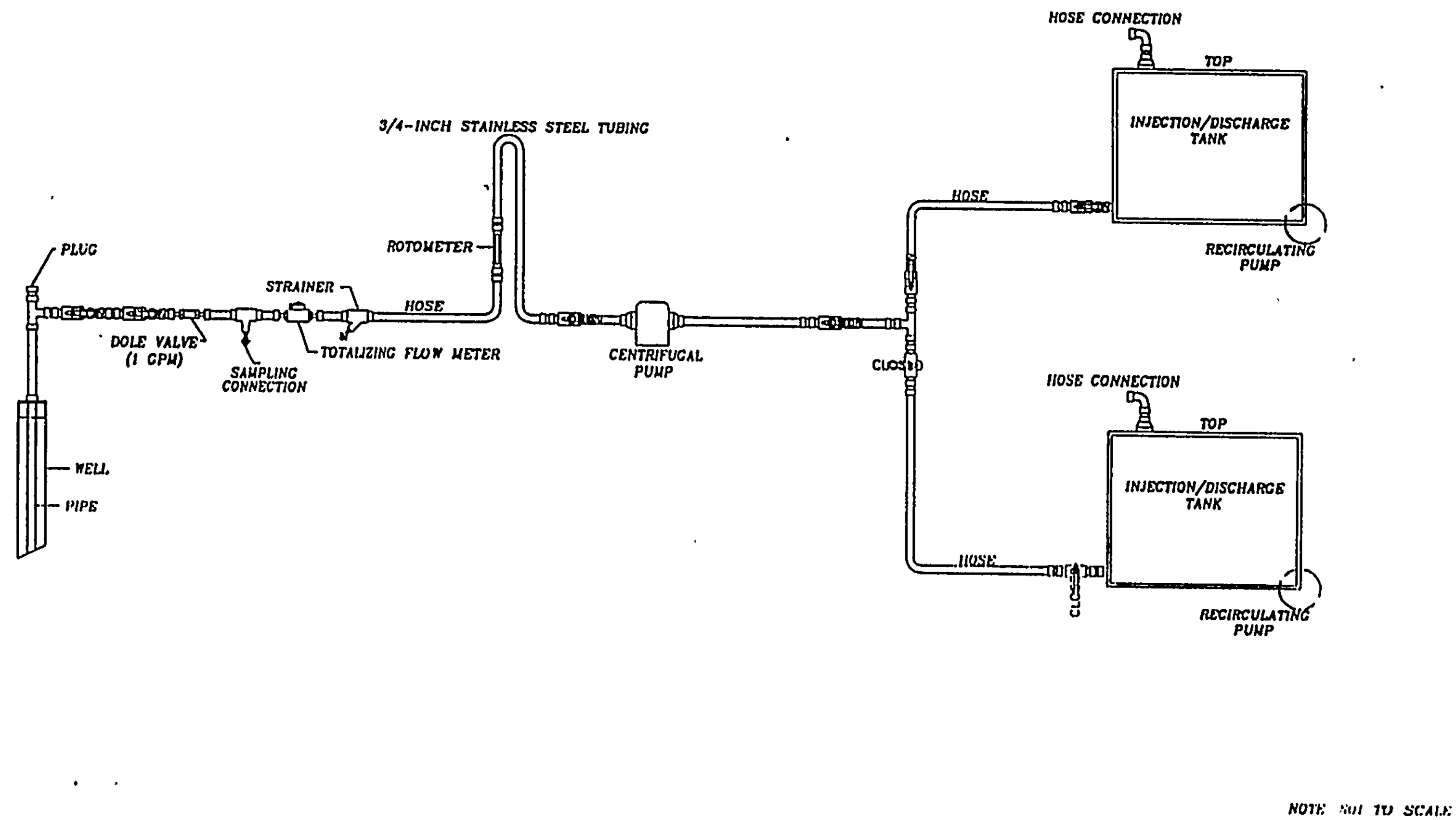
DATE: 10/26/94	Figure 3.10: Scenario A: Log of TCE Concentrations
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



DATE: 10/26/94	Figure 3.11: Scenario B: Log of TCE Concentrations
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



DATE: 10/26/94	Figure 4.1: PCE desaturation curves following the injection of water and surfactant solutions into soil columns containing different size fractions of Ottawa sand. (after Abrjola et al., 1993).
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



INTERA

Figure 5.1: Injection Configuration

DATE: 10/10/94
REF: INJECTIO DWG

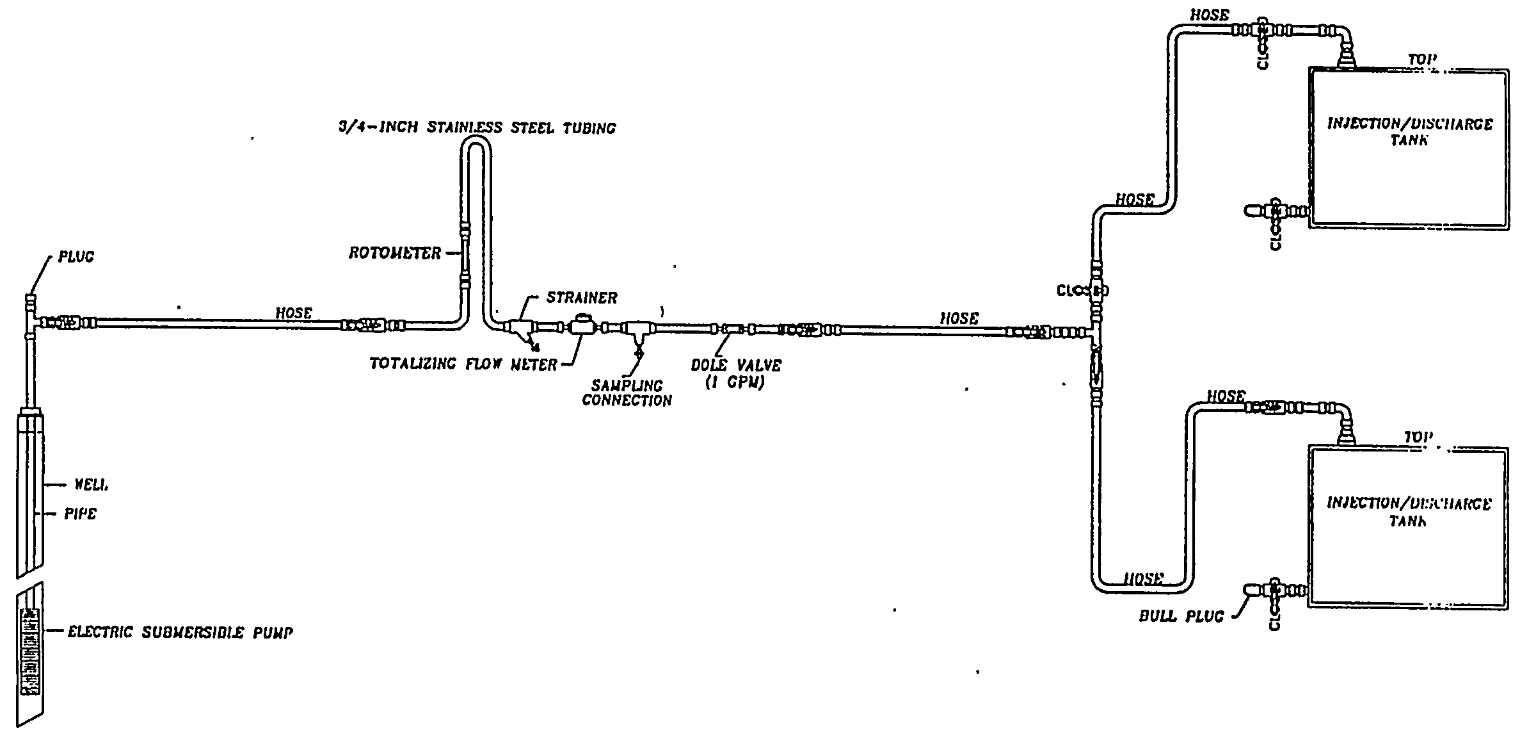
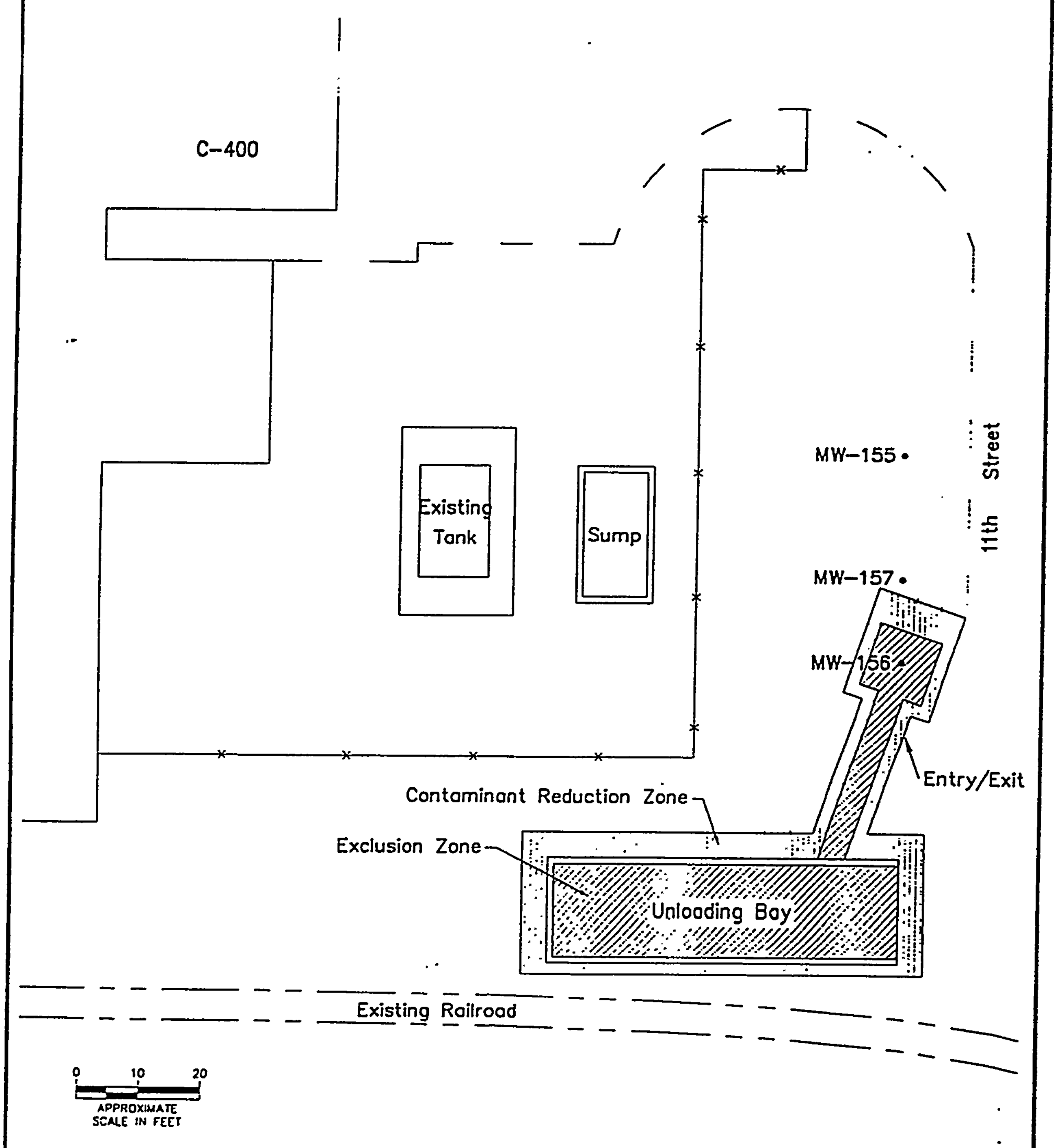


Figure 5.2: Extraction Configuration

DATE: 10/10/94
REF: EXTRACT.DWG



DATE: 10/10/94	Figure 5.3: Site Map Showing Work Zones
REF: 1125-004	

Paducah Gaseous Diffusion Plant
Paducah, Kentucky

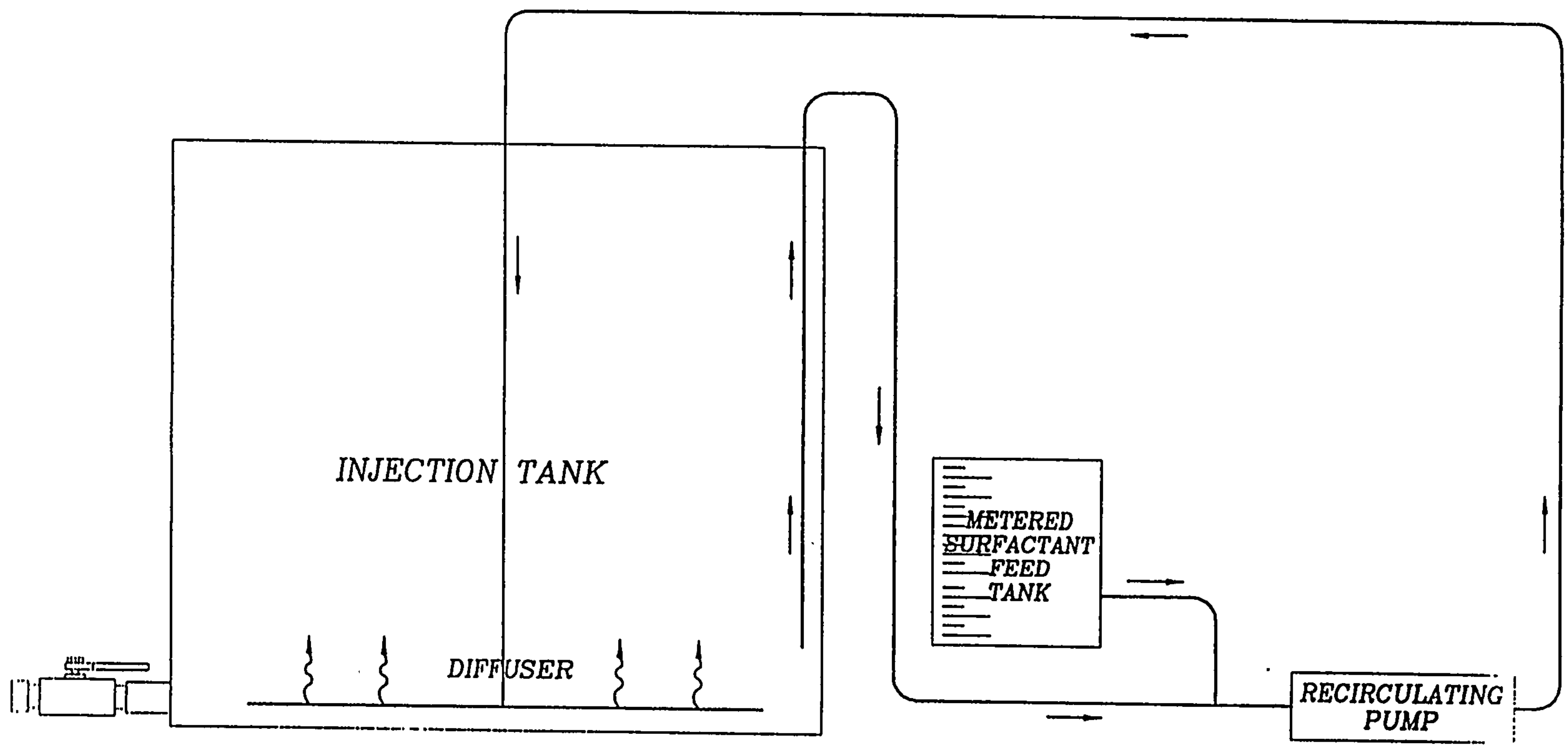
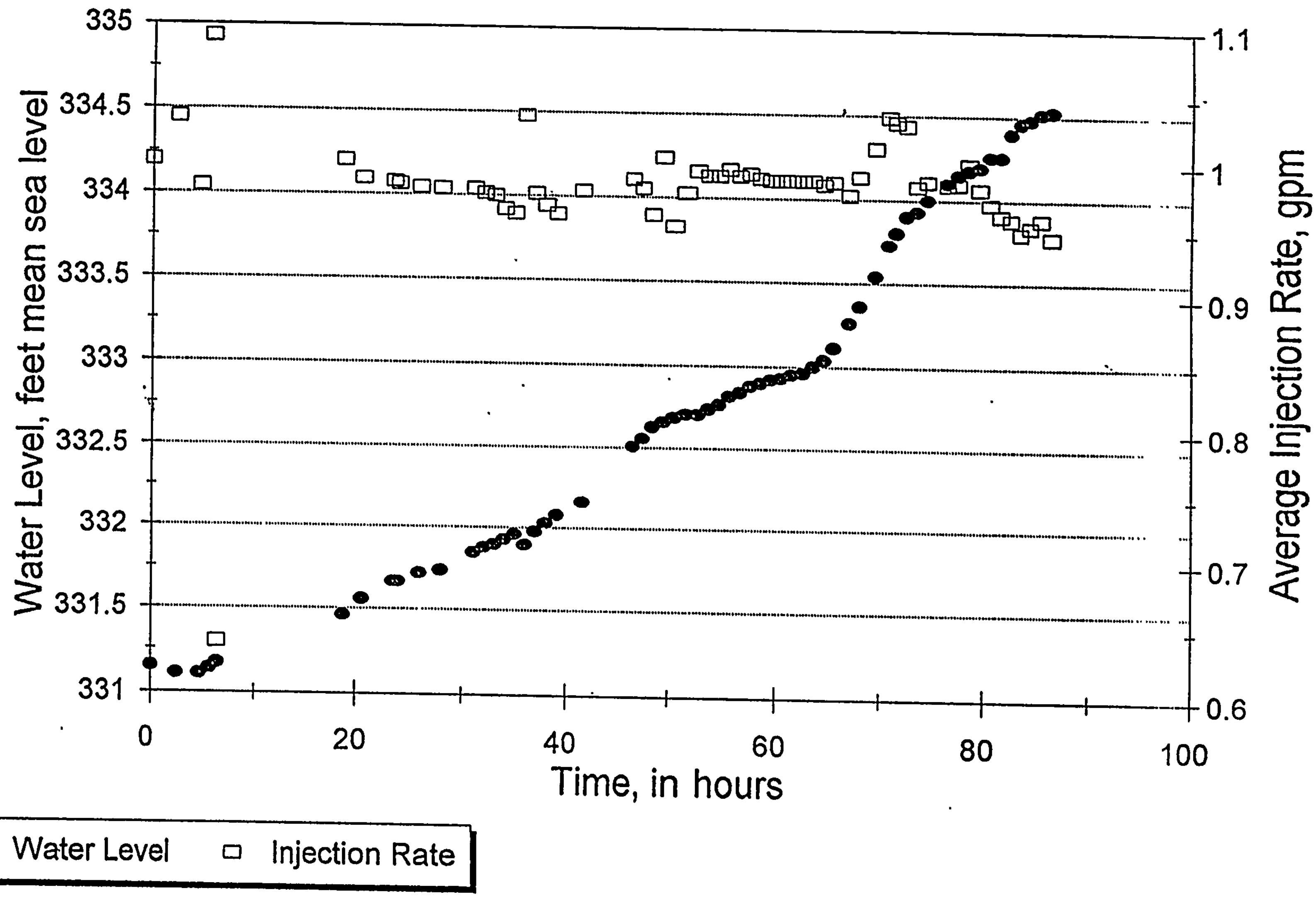
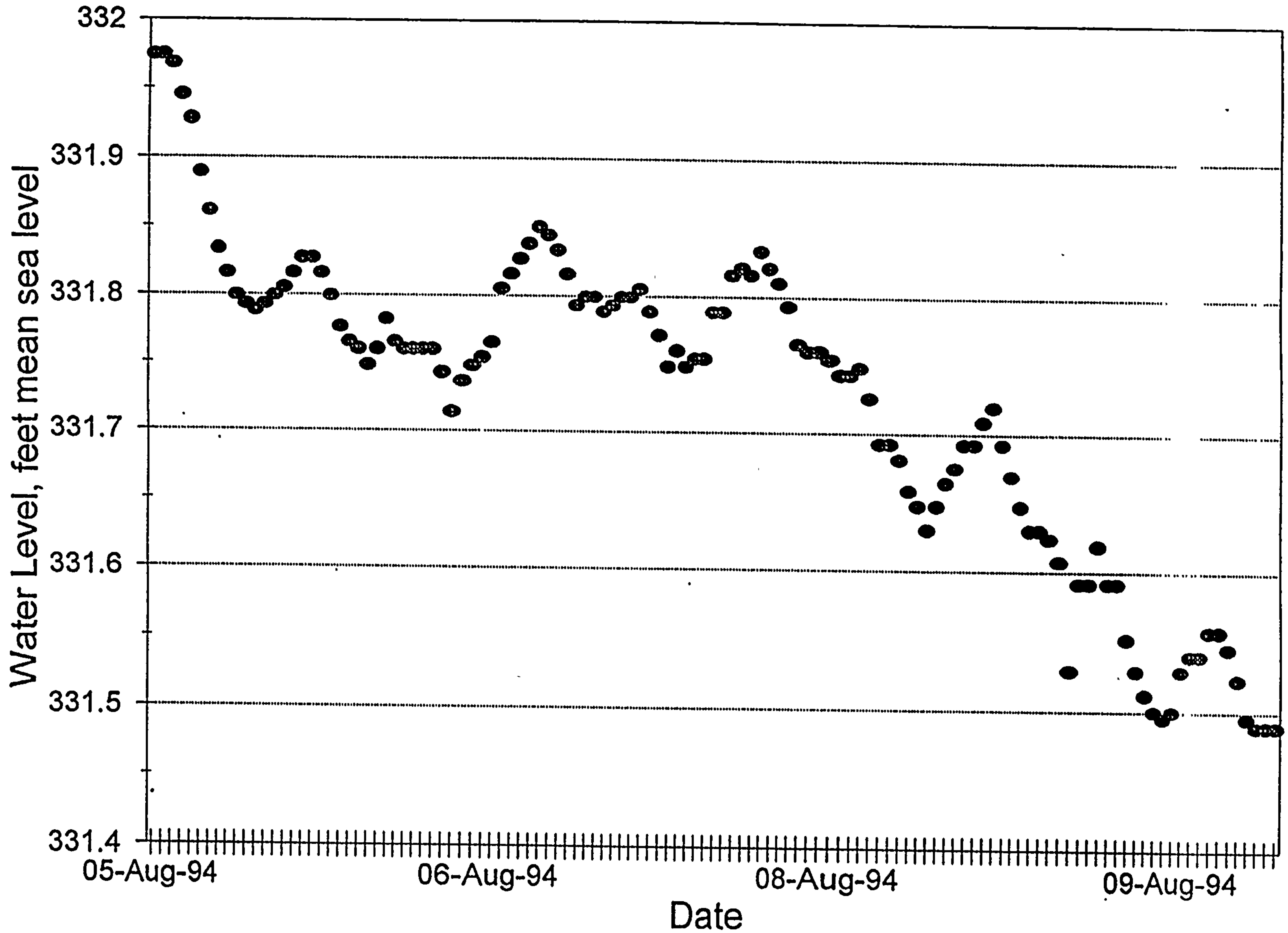


Figure 5.4: Surfactant Mixing and Retention System

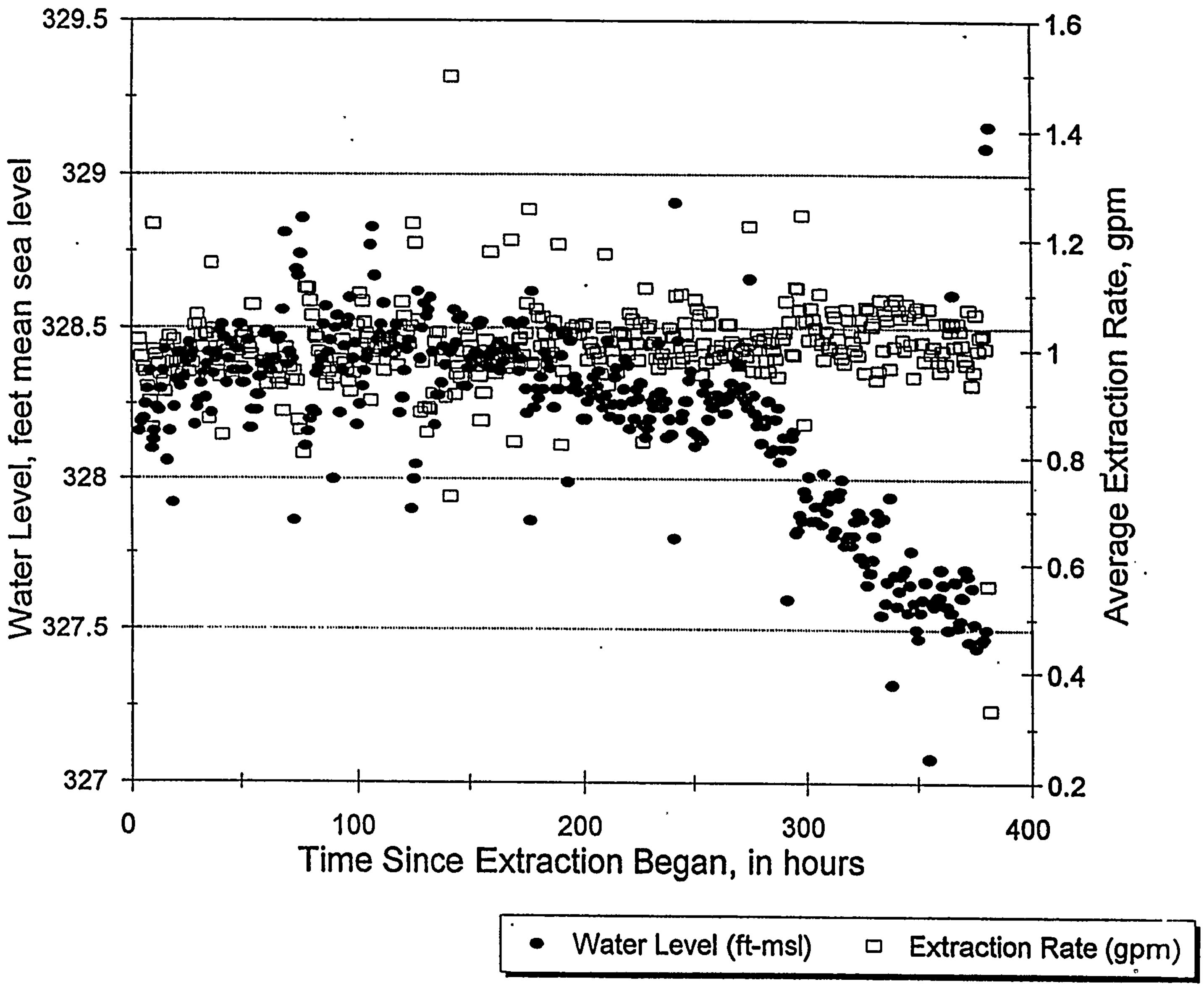
DATE: 10/10/94
REF: MIXING.DWG



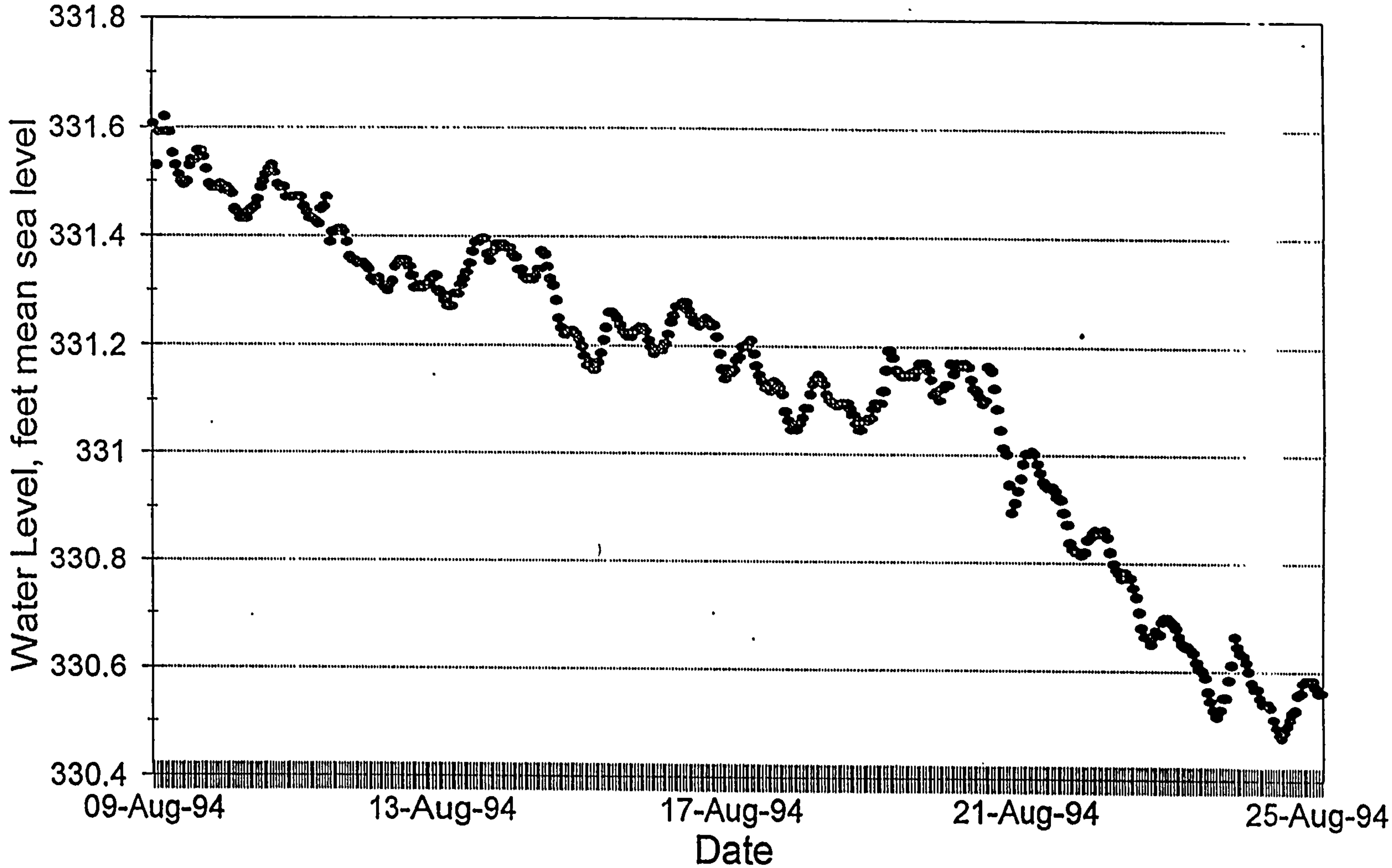
DATE: 10/26/94	Figure 5.5: Injection Phase - MW-156, August 5 - 9, 1994
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



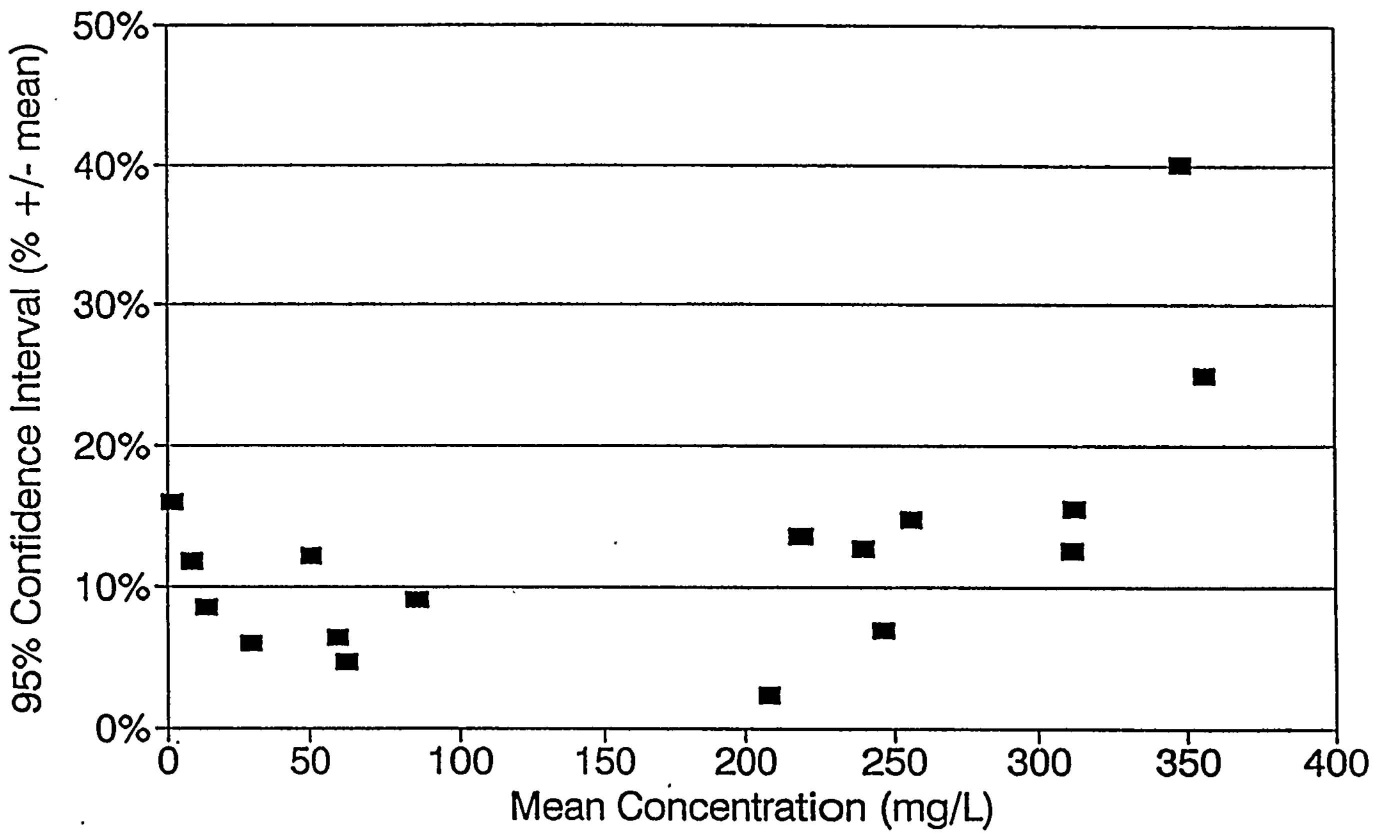
DATE: 10/26/94	Figure 5.6: Water Levels in Piezometer 109 During the Injection Phase, August 5 - 9, 1994
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



DATE: 10/26/94	Figure 5.7: Extraction Phase - MW-156, August 9 - 25, 1994
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



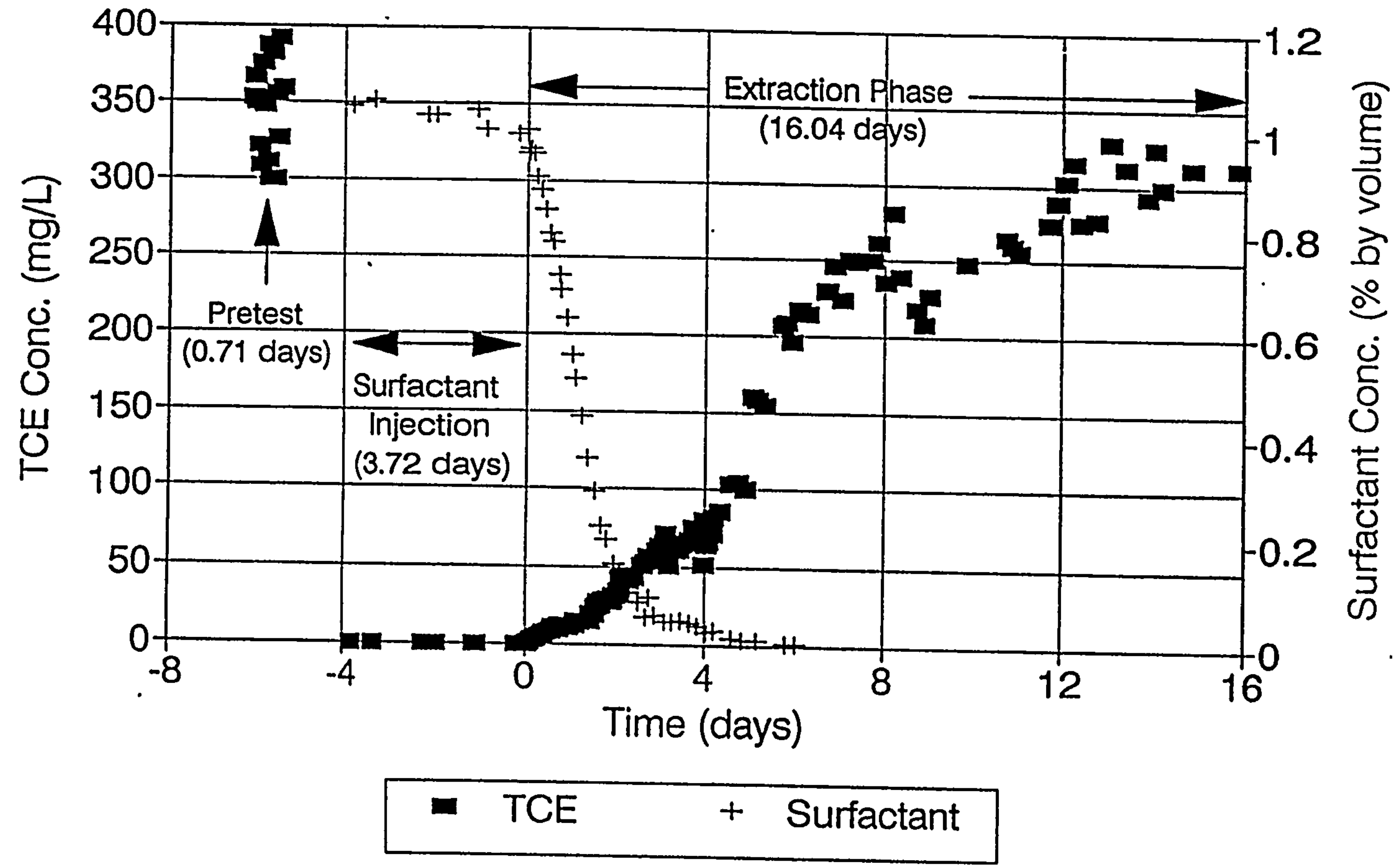
DATE: 10/26/94	Figure 5.8: Water Level in Piezometer 109 During the Extraction Phase, August 9 - 25, 1994
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



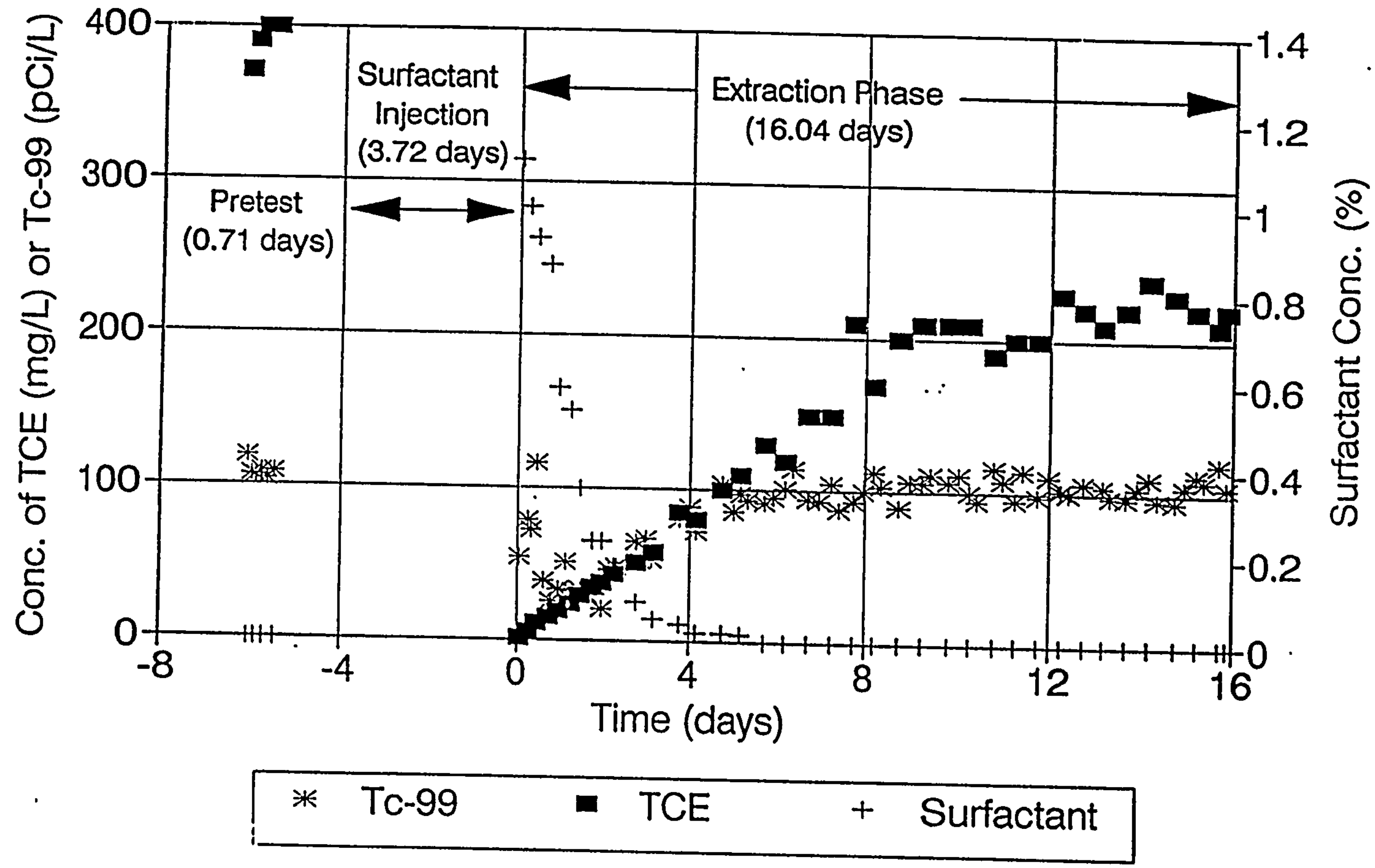
DATE:	10/26/94
REF:	1125-004

Figure 5.9: Plot of Precision Measurements for MW-156 Field TCE Analyses versus Mean TCE Concentrations

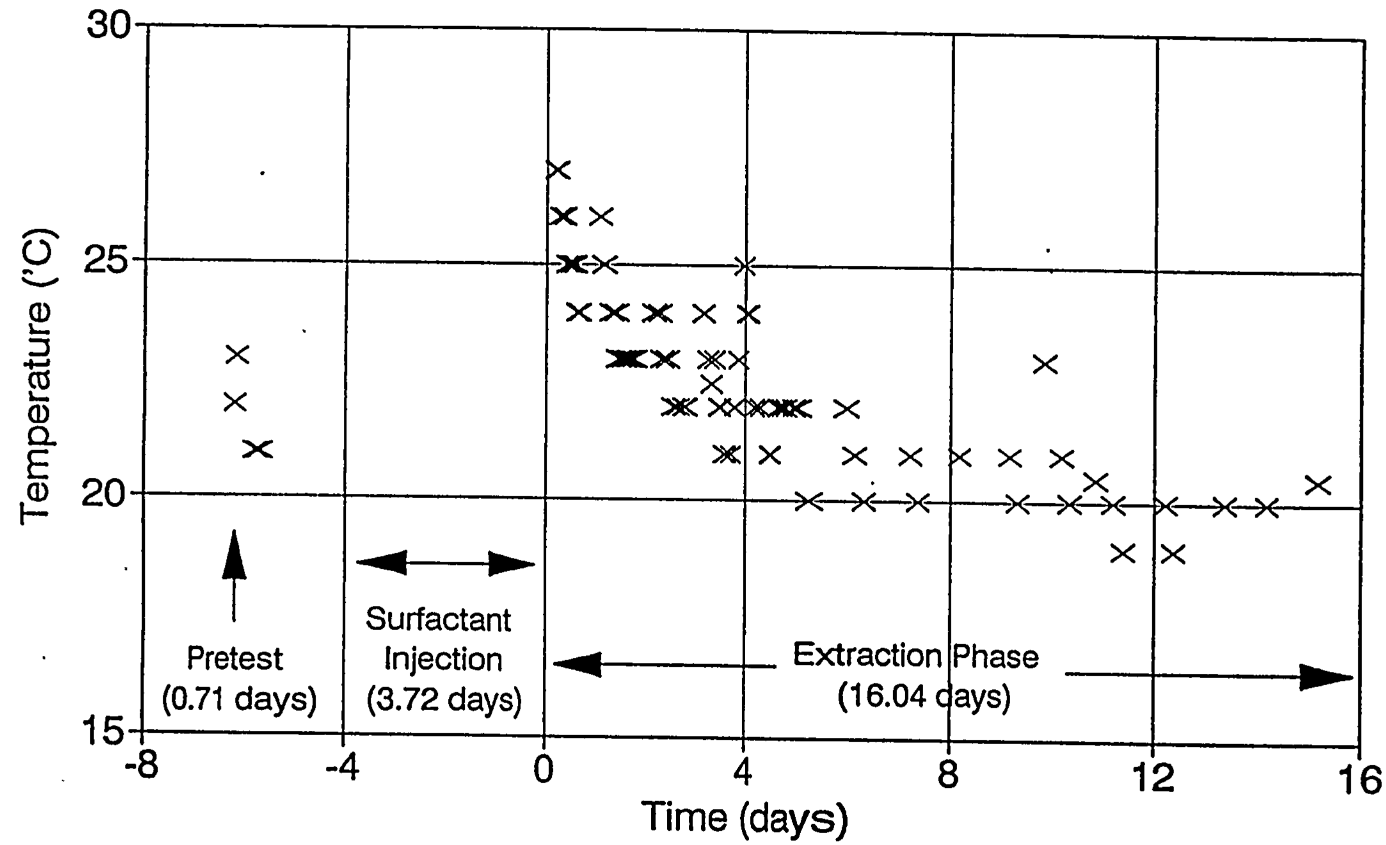
Paducah Gaseous Diffusion Plant
Paducah, Kentucky



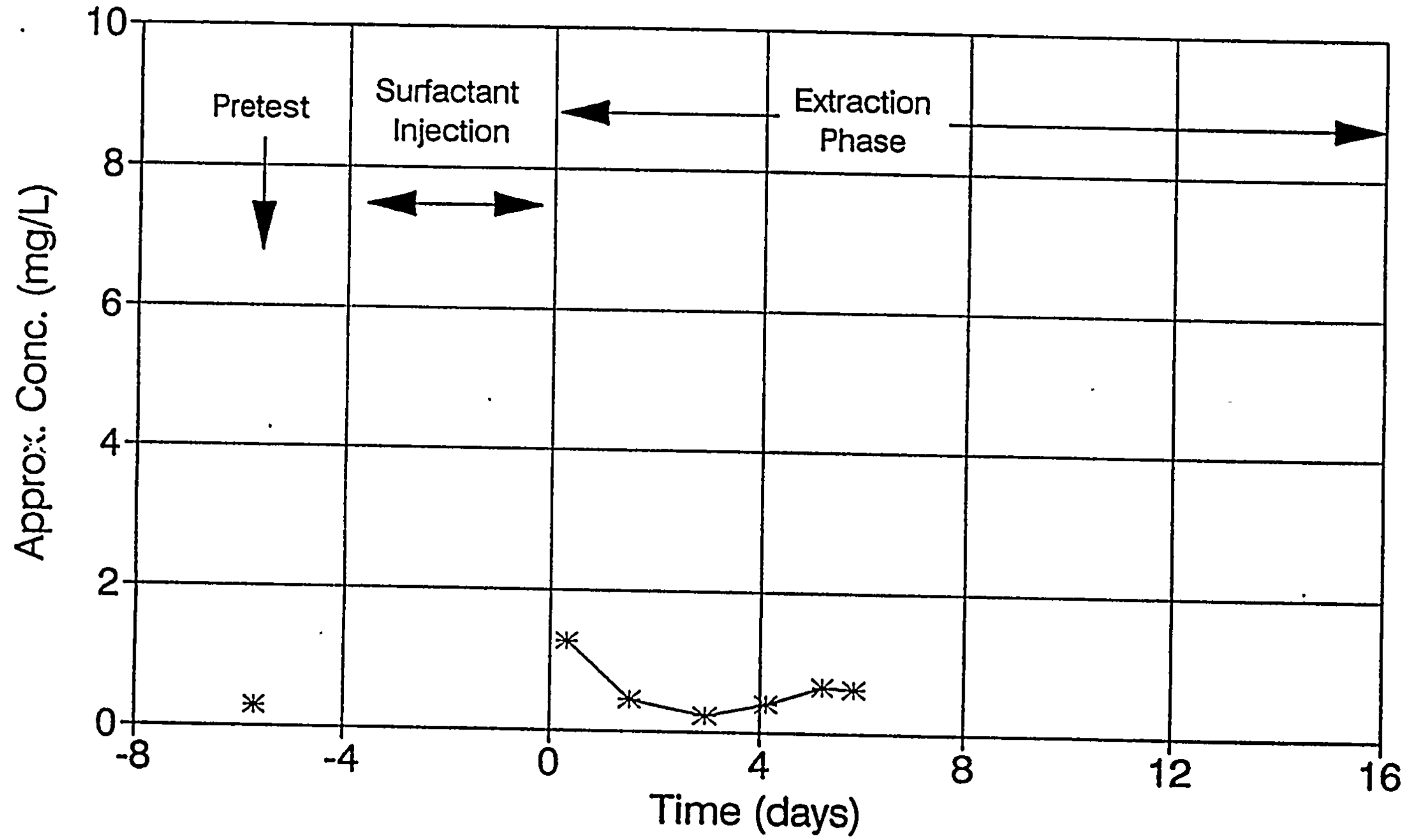
DATE: 10/26/94	Figure 5.10: Plot of Results of Field Analyses for MW-156 versus Time
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



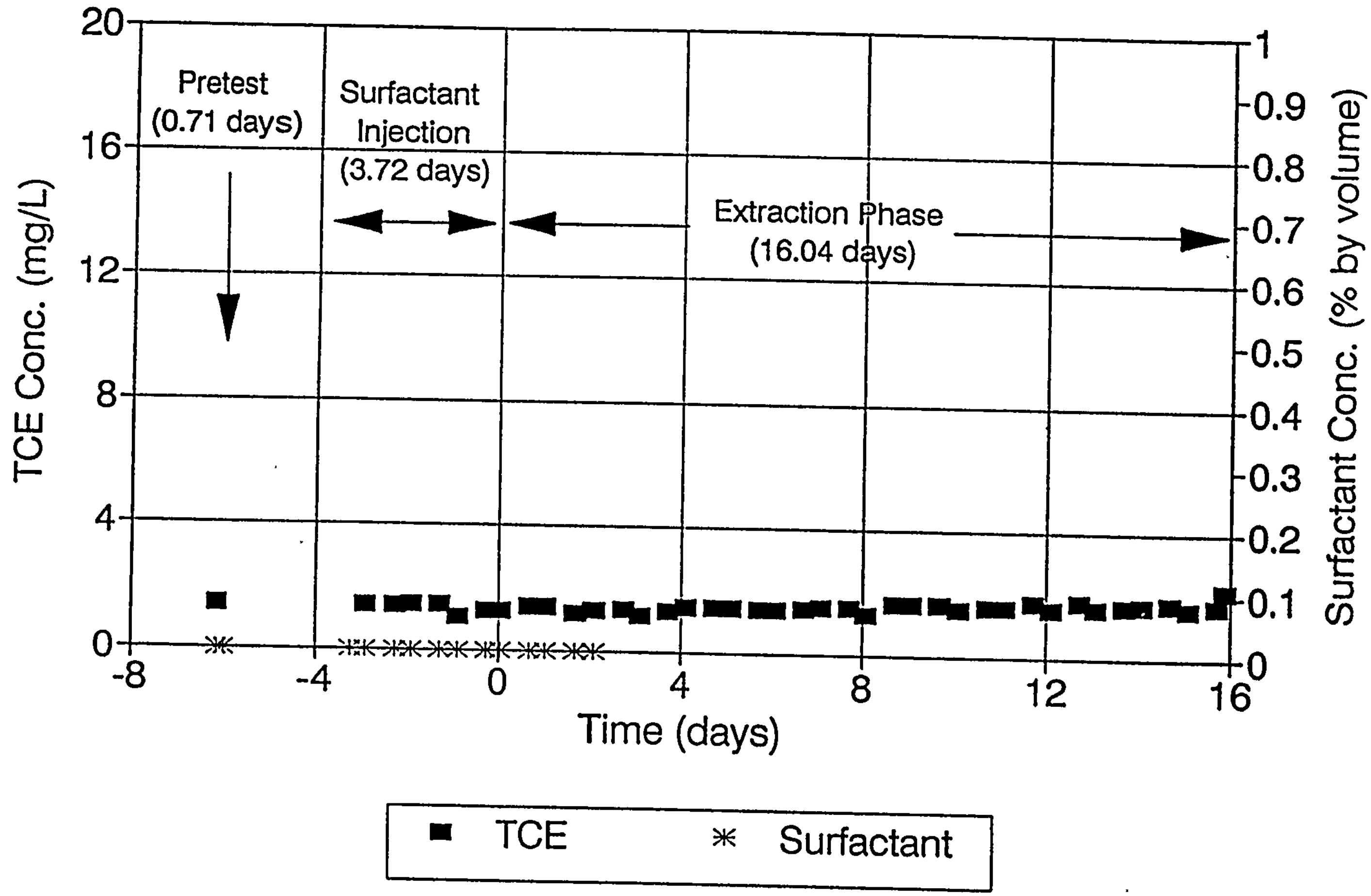
DATE: 10/26/94	Figure 5.11: Plot of Results of PGDP Analyses for MW-156 versus Time
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



DATE: 10/26/94	Figure 5.12: Plot of Sample Temperature for MW-156 versus Time
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky

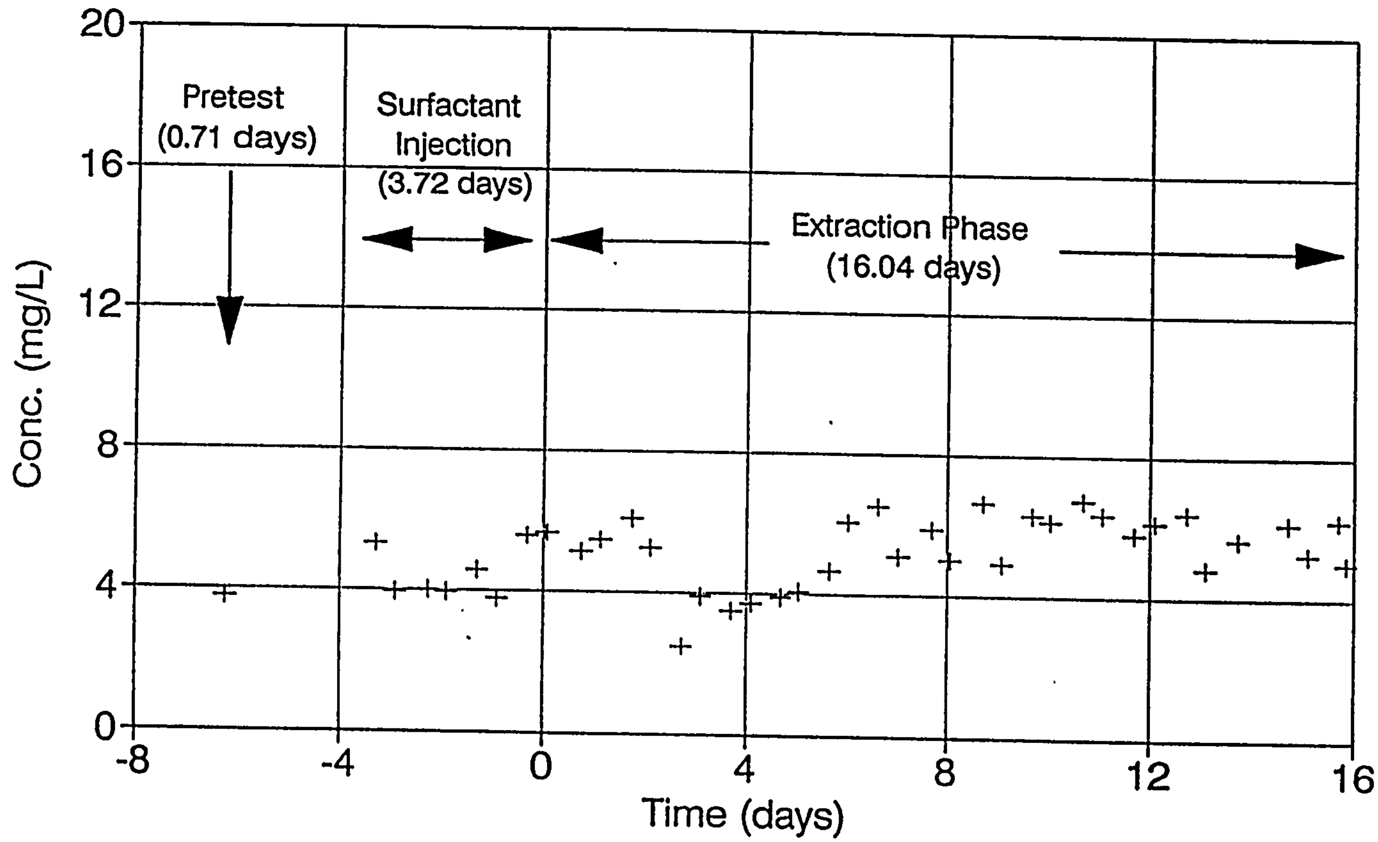


DATE: 10/26/94 REF: 1125-004	Figure 5.13: Plot of Approximate DCE Concentration in Several MW-156 Samples versus Time
	Paducah Gaseous Diffusion Plant Paducah, Kentucky

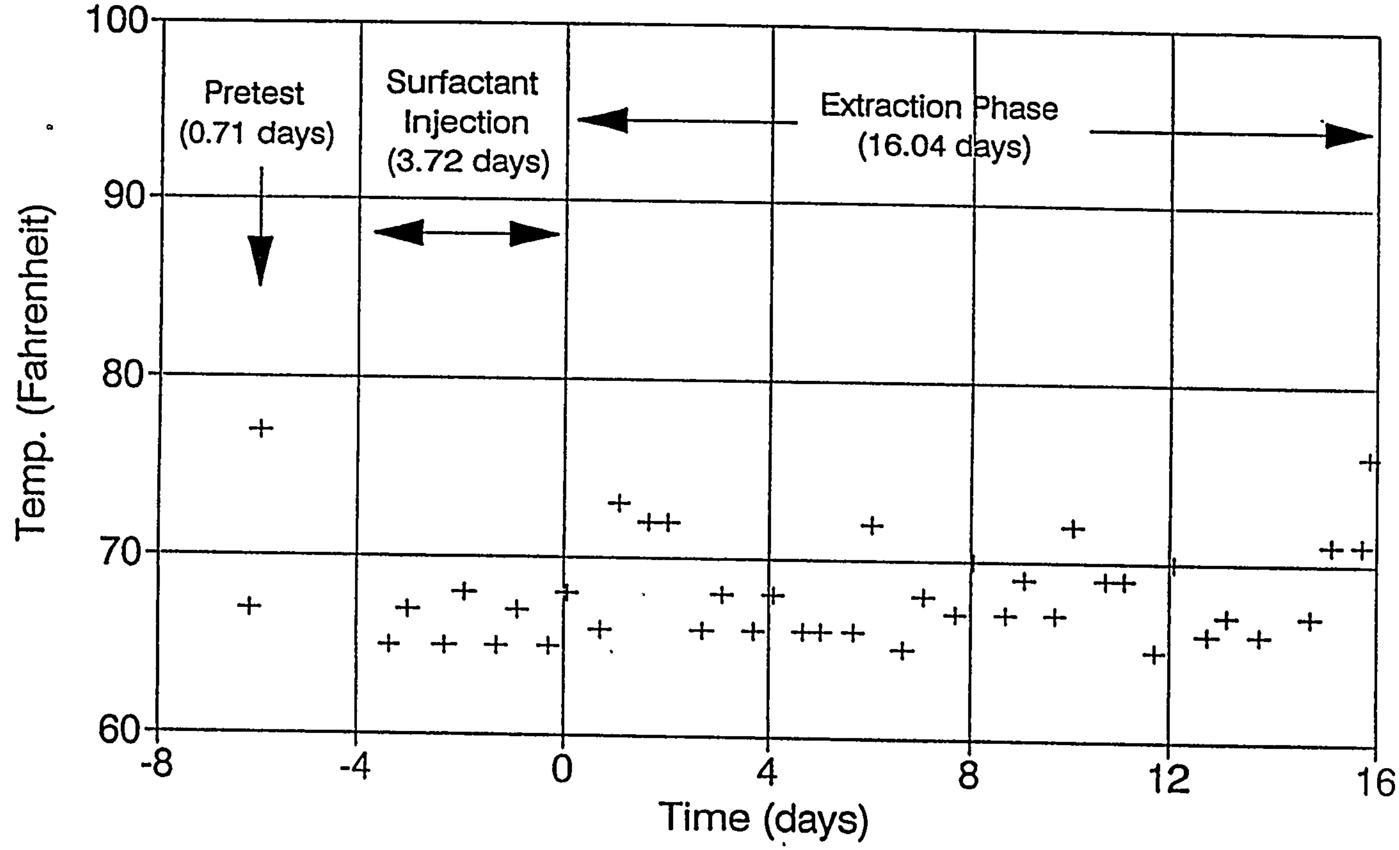


DATE: 10/26/94	Figure 5.14: Plot of Results of Field Analyses for MW-155 versus Time
REF: 1125-004	

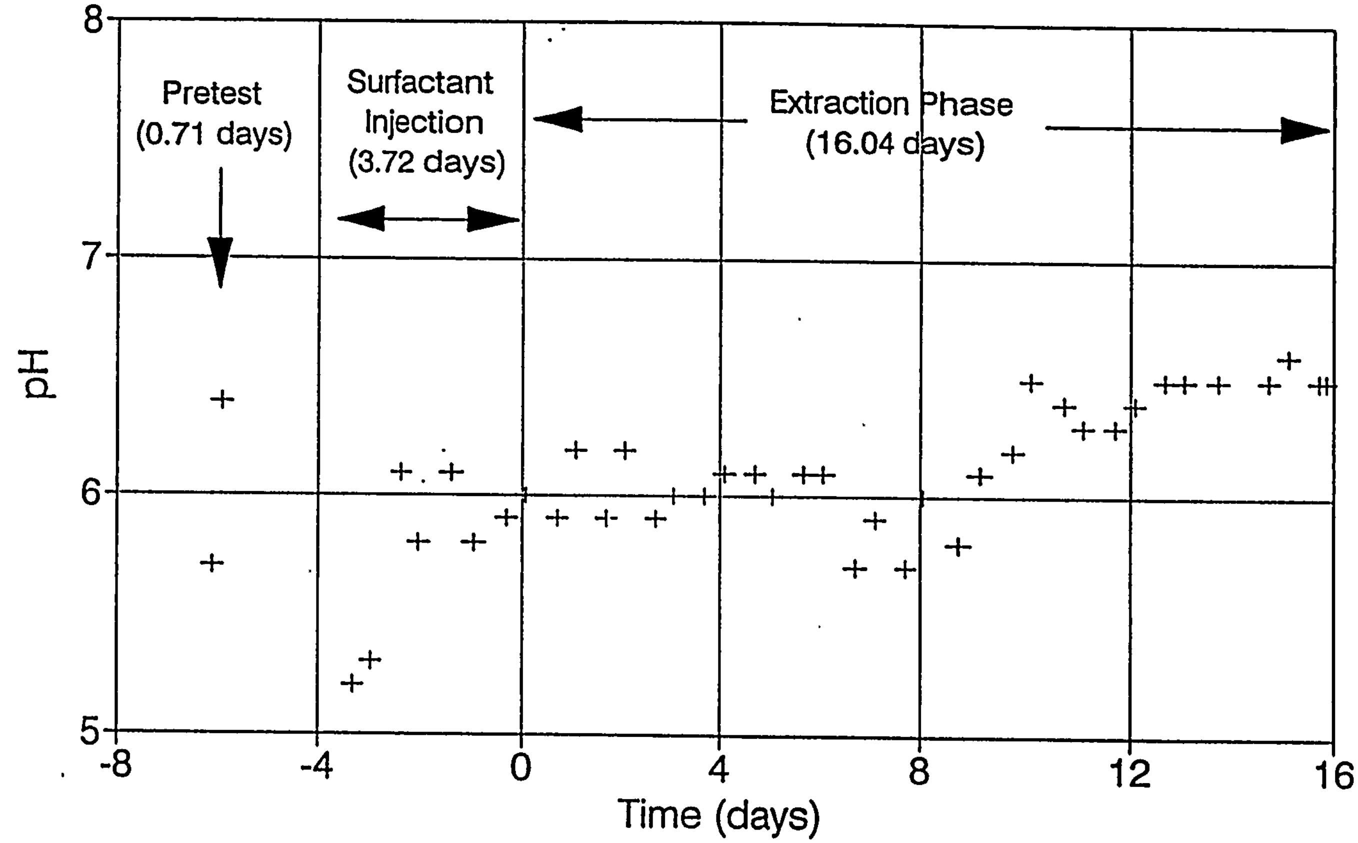
Paducah Gaseous Diffusion Plant
Paducah, Kentucky



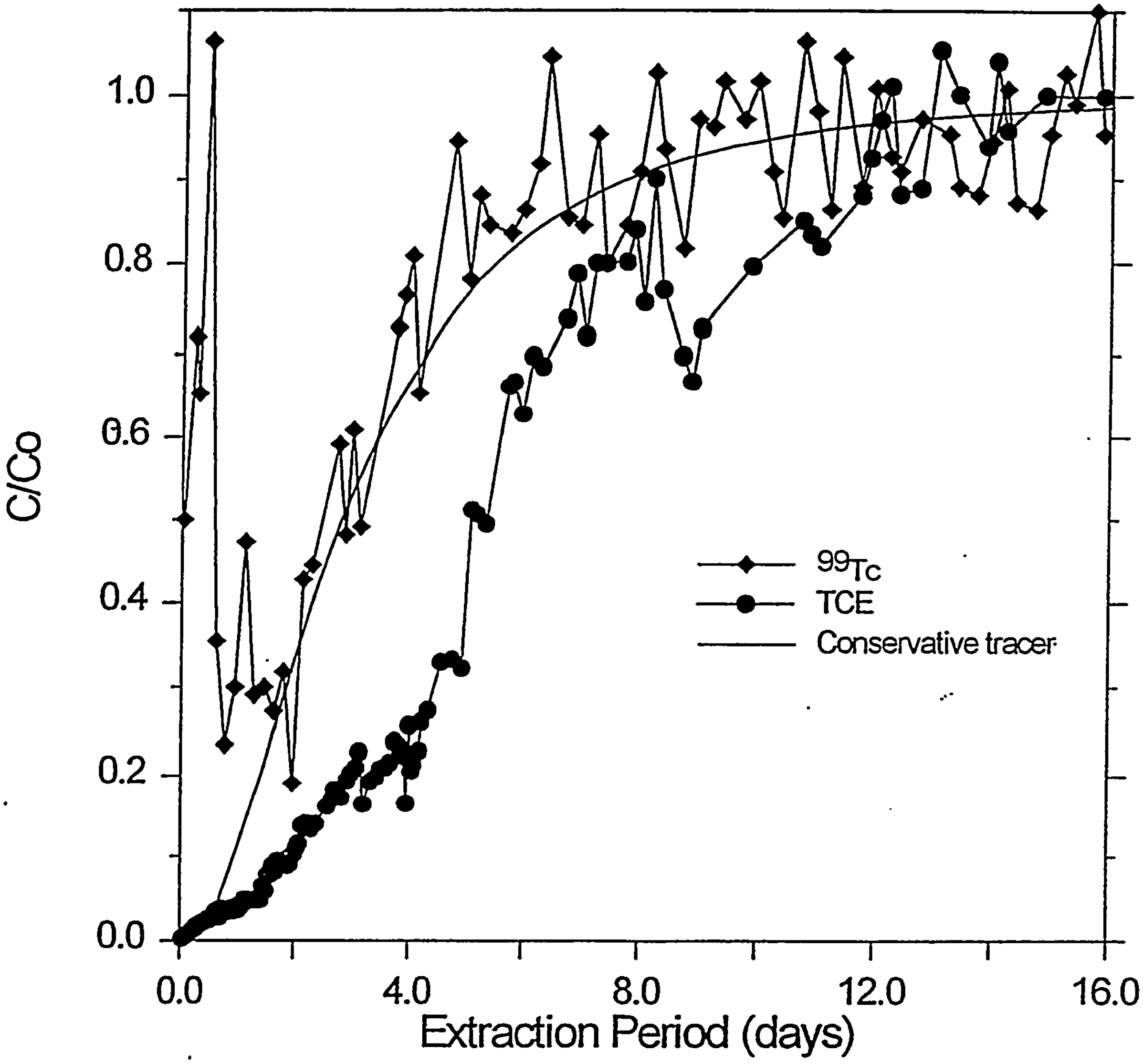
DATE: 10/26/94	Figure 5.15: Plot of Dissolved Oxygen Concentration for MW-155 versus Time
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



DATE: 10/26/94	Figure 5.16: Plot of Sample Temperature for MW-155 versus Time
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



DATE: 10/26/94	Figure 5.17: Plot of pH for MW-155 versus Time
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky

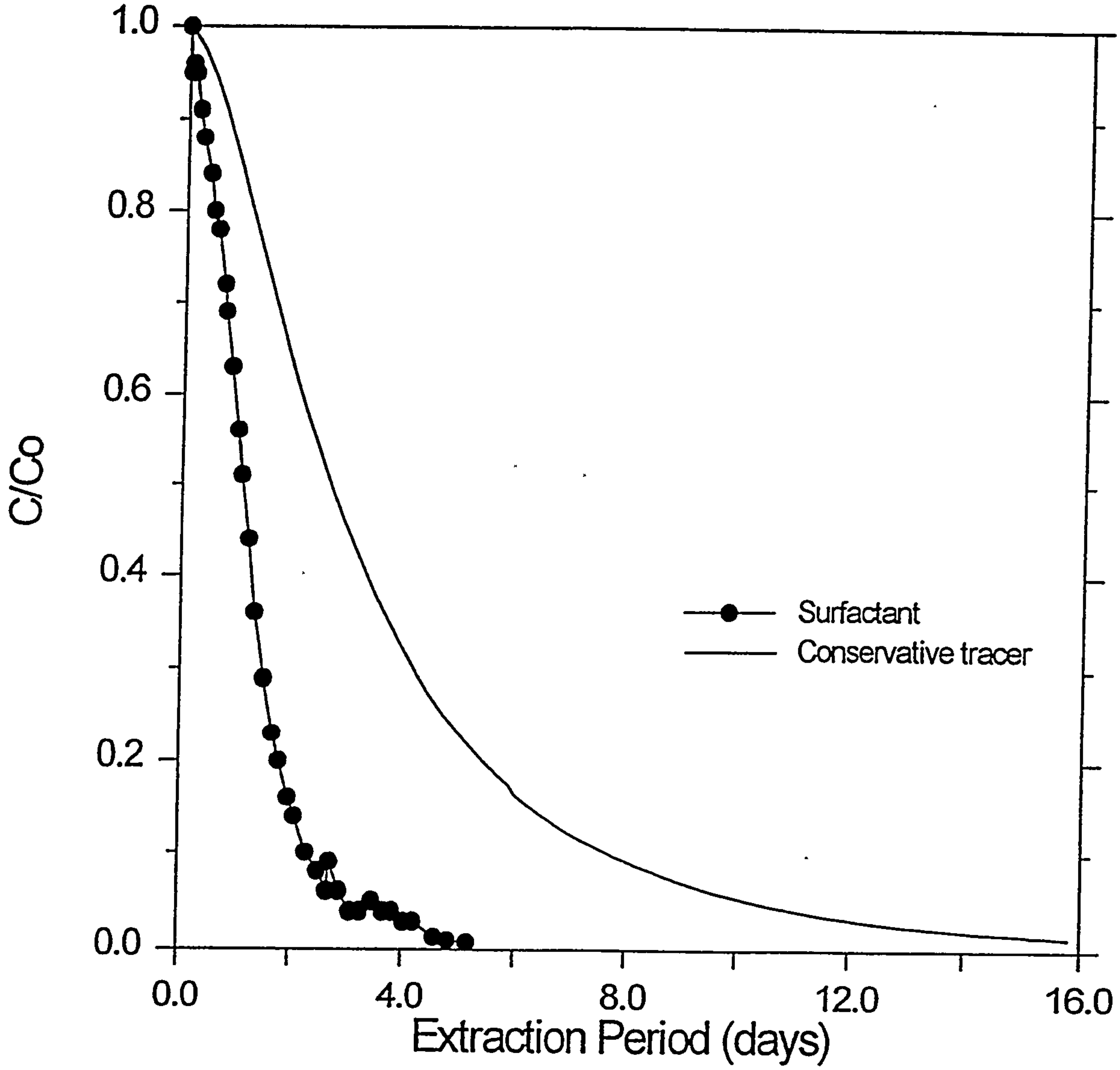


DATE: 10/26/94

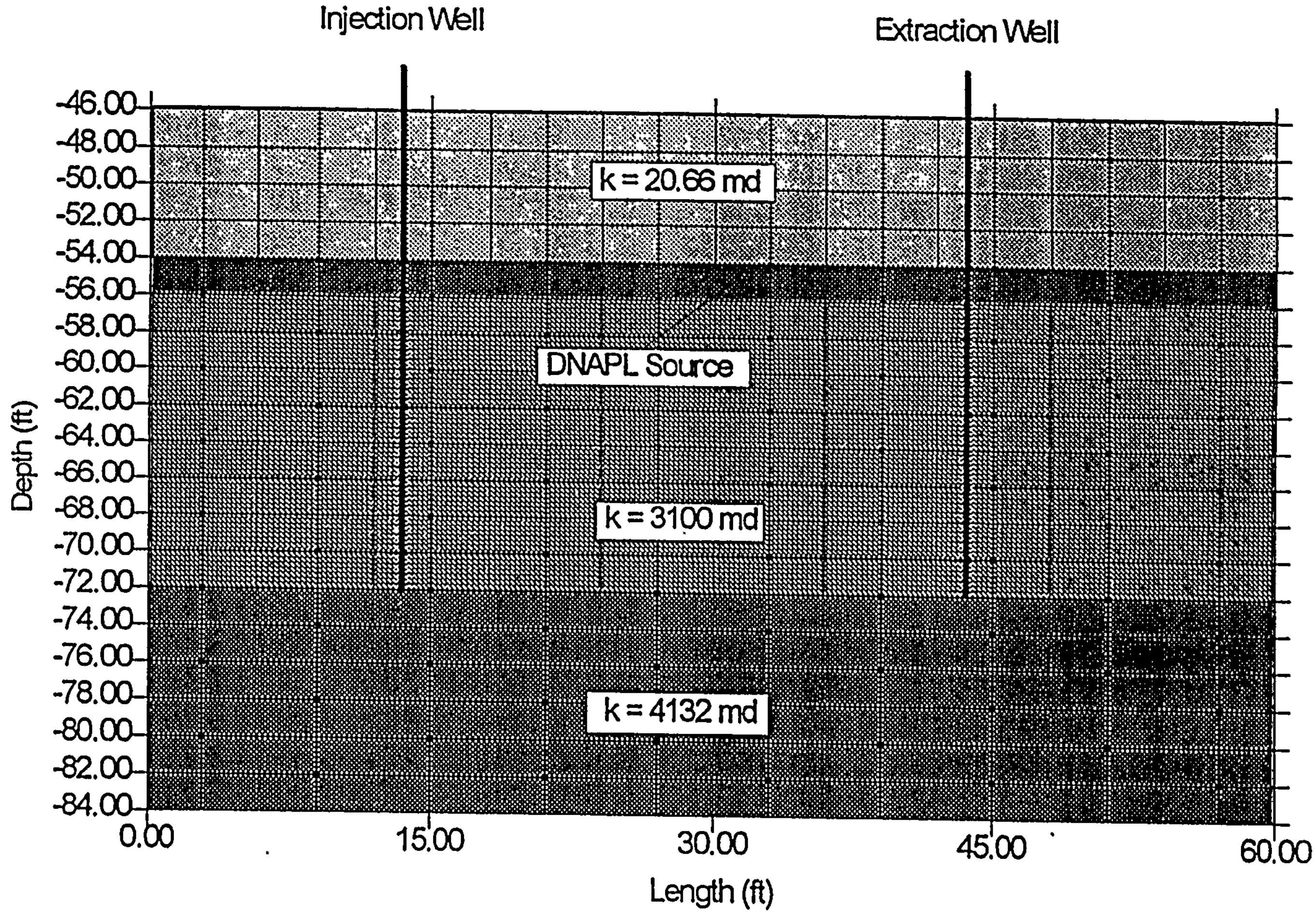
REF: 1125-004

Figure 5.18: ^{99}Tc and TCE Response During Extraction Phase in MW-156

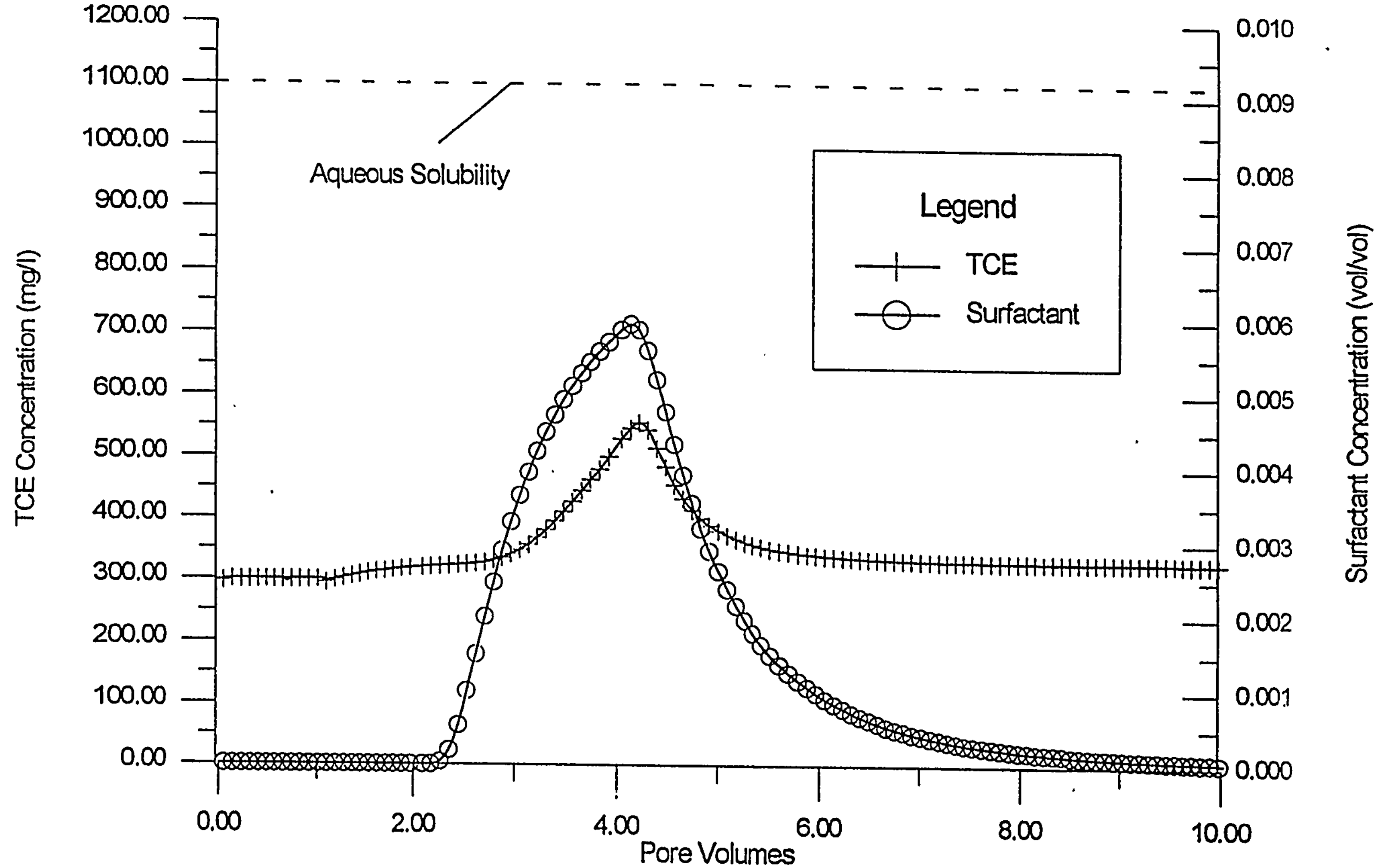
Paducah Gaseous Diffusion Plant
Paducah, Kentucky



DATE: 10/26/94	Figure 5.19: Surfactant recovery during extraction phase compared with that of a conservative tracer.
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



DATE: 10/26/94	Figure 7.1: Schematic of Interwell NAPL Solubilization Test
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky



DATE: 10/26/94	Figure 7.2: TCE and Surfactant Concentrations at the Extraction Well
REF: 1125-004	
	Paducah Gaseous Diffusion Plant Paducah, Kentucky

Appendix A

T-MAZ 80K
Material Safety Data Sheet

technical bulletin

T-MAZ® 80K
POLYSORBATE 80 K

PPG INDUSTRIES, INC.
SPECIALTY CHEMICALS, CHEMICALS GROUP
3938 PORETT DRIVE
GURNEE, ILLINOIS 60031
TEL: (708) 244-3410 TELEX: 25-3310
FAX: (708) 244-9633
CABLE: MAZCHEM GURNEEILL

PPG

GENERAL STATEMENT:

T-MAZ 80K is a sorbitan monooleate which has been ethoxylated with approximately 20 moles of ethylene oxide to give a water soluble, oil and water emulsifier. This product is one of a group of ethoxylated sorbitan fatty acid esters which are often referred to as Polysorbates. These surfactants are mixtures of partial esters of sorbitol and its anhydrides made from fatty acids, such as, tall oil, lauric, palmitic, stearic and oleic, which are then reacted with ethylene oxide, to make them hydrophilic in nature. Some T-MAZ products are designated with an "FG" in the product name, which means they are food grade. This product is marked "K" which means it is food grade with Kosher U Certification.

CMC = 0.0013 g/dL = 13 mg/L

APPLICATIONS:

T-MAZ 80K can be used as a solubilizer and emulsifier of essential oils and fragrances, as a wetting agent, viscosity modifier, anti-stat, stabilizer and dispersing agent. Typical applications are found in baby shampoos because of very low eye irritation, cosmetics and toiletries and ointments. T-MAZ surfactants can also be used in the food, pharmaceutical, textile, and metalworking industries.

SOLUBILITIES:

T-MAZ surfactants are generally soluble or dispersible in water, and, soluble in varying degrees in organic liquids. They are used for oil-in-water emulsions, dispersions or solubilizing oils and to make anhydrous ointments water soluble or washable. Frequently, the T-MAZ surfactants are combined with similarly numbered S-MAZ surfactants to promote emulsion stability.

SALES SPECIFICATIONS

ACID VALUE	2 MAX
SAPONIFICATION VALUE	45-55
HYDROXYL VALUE	65-80
WATER, %	3 MAX
RESIDUE ON IGNITION, %	0.25 MAX
POE, %	65-69.5
APPEARANCE @ 25 C	CLEAR YELLOW LIQUID
ppm, 1,4 DIOXANE	1 MAX
ARSENIC, ppm	1 MAX
HEAVY METALS, %	0.001 MAX

This product is available in bulk, drum, and 5 gallon pail quantities

last revised 01 DEC 1993 DBM/RGL Technical Service Dept.

PPG® INDUSTRIES, INC.
Specialty Chemicals
3938 Porett Drive Gurnee, IL 60031
Informational phone number: (800) 552-1912
24 hour emergency phone number: (304) 843-1300

MATERIAL SAFETY DATA SHEET

PRODUCT INFORMATION

Trade Name: T-MAZ® 80K
Name and/or Family or Description: POLYSORBATE 80 K

DOT Hazard Classification: NON-HAZARDOUS
DOT:
NFPA:HEALTH HAZARD-0-NORMAL MATERIAL; FLAMMABILITY-1-ABOVE 200 DEG F.; REACTIVITY-0-STABLE

CAS NUMBER:	9005-65-6
RCRA HAZARD CLASS: (IF DISCARDED)	NON-HAZARDOUS
EPA PRIORITY POLLUTANTS	NONE
SARA TITLE III (Sec. 313) HAZARDOUS MATERIAL	NONE

HAZARDOUS INGREDIENTS

(This material contains no ingredients which are known by PPG Industries to be hazardous unless listed below).

MATERIAL OR COMPONENT	TLV (UNITS)	APPROX %
NONE KNOWN		

As established by the American Conference of Governmental Industrial Hygienists and/or standards promulgated by the Occupational Safety and Health Administration.

PHYSICAL DATA

BOILING POINT, °F	>300
SOLUBILITY IN WATER @ 25°C	SOLUBLE
SPECIFIC GRAVITY @ 25°C	1.09
VAPOR PRESSURE, mm Hg @ 25°C	<1
VAPOR DENSITY, (AIR=1)	>1
VOLATILES, %, BY VOLUME	<4
APPEARANCE @ 25°C	CLEAR YELLOW LIQUID
ODOR	BLAND
FLASH POINT, PMCC, °F	>300

FIRE AND EXPLOSION HAZARD DATA

Flash Point: (See PHYSICAL DATA section)
Flammable Limits in Air, % by Volume: Unknown LOWER: Undetermined UPPER: Undetermined
Extinguishing Media: Use Carbon Dioxide or Dry Chemical on small fires. Use foam (alcohol, polymer or ordinary) and water spray for large fires.
Special Fire Fighting Procedures: Self-contained breathing apparatus and protective clothing should be worn in fighting fires involving chemicals.
Unusual Fire & Explosion Hazards: None Known to PPG Industries.

HEALTH HAZARD DATA

Threshold Limit Value: Not listed by OSHA or ACGIH.
Effects of Overexposure: Contact with skin or eyes not expected to cause irritation.
Effects of a Single Overexposure:
Swallowing: No evidence of adverse effects from available information.
Skin Absorption: No evidence of adverse effects from available information.
Skin Contact: No evidence of adverse effects from available information.
Eye Contact: No evidence of adverse effects from available information.
Inhalation: No evidence of adverse effects from available information.
Effects of Repeated Overexposure: No evidence of adverse effects from available information.
Emergency and First Aid Procedures: Flush eyes with copious amounts of water for a minimum of 15 minutes. Wash contacted skin areas with soap and water. If irritation develops, consult a physician. Soaked clothing should be changed immediately! Remove to fresh air.
Medical Conditions Aggravated by Overexposure: A knowledge of available toxicology information and of the physical and chemical properties of the material suggests that overexposure is unlikely to aggravate existing medical conditions.
Significant Laboratory Data with Possible Relevance to Human Health Hazard Evaluation:
None currently known unless listed below.

Oral, LD50, rat	>30ml/kg (MILD)
Oral, LD50, mouse	25g/kg (RTECS)
Ocular irritation, rabbit	2.0 (VERY MILD)
Dermal irritation, rabbit	PII = 1.3 (MILD)
Dermal, human patch test	0/50 NON-IRRITATING
Intraperitoneal, LD50, rat	6804mg/kg (RTECS)
Intraperitoneal, LD50, mouse	7600mg/kg (RTECS)
Intravenous, LD50, rat	1790mg/kg (RTECS)
Comedogenicity	0/5 NON-COMEDOGENIC

REACTIVITY DATA

Stability: Stable [X] Unstable [ ]
Incompatabilities: (Materials to Avoid) Strong oxidizing material can cause a reaction.
Hazardous Decomposition Products: Thermal decomposition may produce carbon mono/dioxides.
Hazardous Polymerization: May Occur [ ] Will not occur [X]
Conditions to Avoid: See above statements.

SPILL, LEAK AND DISPOSAL PROCEDURES

Action to take for spills: (Use appropriate Safety Equipment) Use absorbent material to collect and contain for disposal. Contain large spills and pump into a suitable tank. Wash area with suitable detergent and thoroughly rinse.
Disposal Method: All Local, State and Federal Regulations concerning health and pollution should be reviewed to determine approved disposal procedures.

SPECIAL HANDLING INFORMATION

Ventilation:

1. **Local Exhaust:** None should be needed
2. **Mechanical (general):** Recommended
3. **Respiratory Protection (type):** None should be needed (for emergency, use a canister for organic vapors such as GMA from Mine Safety Appliance Co.)

Protective Clothing: Clean, body-covering clothing. In addition, rubber gloves, boots, and apron, depending upon the exposure likely, or as required by your company.
Eye Protection: Chemical Workers Goggles recommended.
Other Protective Equipment: Eye Fountain and Safety Shower in work area.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Store in well ventilated areas at temperatures below 120°F.

last revised 20 OCT 1993 MJC/TBH Compliance Department

Appendix B

Injection Data
(Rates and Heads)

Paducah Gaseous Diffusion Plant
Paducah, Kentucky

DNAPL Solubilization Test - Well MW-156, SE Corner of Building C-400
Injection Phase Data - August 5-9,1994

Time	Minutes Between Readings	Solinst TOC DTW (feet)	Hours into Test	Ground Water Elevation (feet msl)	Totalizer Total Gallons Pumped	Average Injection Rate (gallons/minute)
06:30 PM		50.91	0.00	331.15	1174	1.00
09:07 PM	157	50.95	2.62	331.11	1336	1.03
11:17 PM	130	50.95	4.78	331.11	1463.5	0.98
12:17 AM	60	50.92	5.78	331.14	1529	1.09
01:00 AM	43	50.89	6.50	331.17	1556.4	0.64
01:22 PM	742	50.6	18.87	331.46	2299	1.00
03:07 PM	105	50.5	20.62	331.56	2402.62	0.99
06:00 PM	173	50.39	23.50	331.67	2573	0.98
06:30 PM	30	50.39	24.00	331.67	2602.5	0.98
08:30 PM	120	50.34	26.00	331.72	2720.2	0.98
10:30 PM	120	50.32	28.00	331.74	2837.8	0.98
01:30 AM	180	50.21	31.00	331.85	3014.2	0.98
02:30 AM	60	50.18	32.00	331.88	3072.8	0.98
03:30 AM	60	50.16	33.00	331.9	3131.3	0.97
04:30 AM	60	50.13	34.00	331.93	3189.2	0.96
05:30 AM	60	50.1	35.00	331.96	3246.9	0.96
06:30 AM	60	50.16	36.00	331.9	3309	1.03
07:30 AM	60	50.08	37.00	331.98	3367.6	0.98
08:30 AM	60	50.03	38.00	332.03	3425.7	0.97
09:30 AM	60	49.98	39.00	332.08	3483.4	0.96
12:00 PM	150	49.9	41.50	332.16	3630.3	0.98
05:00 PM	300	49.55	46.50	332.51	3926.8	0.99
06:00 PM	60	49.5	47.50	332.56	3985.7	0.98
07:00 PM	60	49.43	48.50	332.63	4043.4	0.96
08:00 PM	60	49.4	49.50	332.66	4103.7	1.00
09:00 PM	60	49.37	50.50	332.69	4160.9	0.95
10:00 PM	60	49.35	51.50	332.71	4219.6	0.98
11:00 PM	60	49.35	52.50	332.71	4279.3	0.99
12:00 AM	60	49.32	53.50	332.74	4338.8	0.99
01:00 AM	60	49.29	54.50	332.77	4398.3	0.99
02:00 AM	60	49.24	55.50	332.82	4458.1	1.00
03:00 AM	60	49.22	56.50	332.84	4517.6	0.99
04:00 AM	60	49.18	57.50	332.88	4577.2	0.99
05:00 AM	60	49.16	58.50	332.9	4636.6	0.99
06:00 AM	60	49.14	59.50	332.92	4695.9	0.99
07:00 AM	60	49.13	60.50	332.93	4755.2	0.99
08:00 AM	60	49.11	61.50	332.95	4814.5	0.99
09:00 AM	60	49.1	62.50	332.96	4873.8	0.99
10:00 AM	60	49.06	63.50	333	4933.1	0.99
11:03 AM	63	49.02	64.55	333.04	4995.2	0.99
12:00 PM	57	48.95	65.50	333.11	5051.5	0.99
01:30 PM	90	48.8	67.00	333.26	5139.5	0.98
02:30 PM	60	48.7	68.00	333.36	5199	0.99
04:00 PM	90	48.52	69.50	333.54	5290.2	1.01
05:20 PM	80	48.33	70.83	333.73	5373.1	1.04
06:00 PM	40	48.26	71.50	333.8	5414.4	1.03

Paducah Gaseous Diffusion Plant
Paducah, Kentucky

DNAPL Solubilization Test - Well MW-156, SE Corner of Building C-400
Injection Phase Data - August 5-9,1994

Time	Minutes Between Readings	Solinst TOC DTW (feet)	Hours into Test	Ground Water Elevation (feet msl)	Totalizer Total Gallons Pumped	Average Injection Rate (gallons/minute)
07:00 PM	60	48.16	72.50	333.9	5476.2	1.03
08:00 PM	60	48.13	73.50	333.93	5535.3	0.99
09:00 PM	60	48.06	74.50	334	5594.6	0.99
11:00 PM	120	47.96	76.50	334.1	5712.9	0.99
12:00 AM	60	47.91	77.50	334.15	5772.1	0.99
01:00 AM	60	47.88	78.50	334.18	5832.2	1.00
02:00 AM	60	47.86	79.50	334.2	5891.2	0.98
03:00 AM	60	47.8	80.50	334.26	5949.5	0.97
04:00 AM	60	47.8	81.50	334.26	6007.3	0.96
05:00 AM	60	47.66	82.50	334.4	6064.9	0.96
06:00 AM	60	47.6	83.50	334.46	6121.9	0.95
07:00 AM	60	47.58	84.50	334.48	6179.2	0.96
08:00 AM	60	47.54	85.50	334.52	6236.8	0.96
09:00 AM	60	47.53	86.50	334.53	6293.6	0.95

* TOC DTW - Top of Casing Depth to Water

Paducah Gaseous Diffusion Plant
DNAPL Solubilization Test

Water Level in Control Piezometer 109
During the Injection Phase
August 5 - 9, 1994

Date	Time	Ground Water Elevation (feet, msl)
05-Aug-94	12:00 AM	331.974
05-Aug-94	01:00 AM	331.974
05-Aug-94	02:00 AM	331.968
05-Aug-94	03:00 AM	331.945
05-Aug-94	04:00 AM	331.928
05-Aug-94	05:00 AM	331.889
05-Aug-94	06:00 AM	331.861
05-Aug-94	07:00 AM	331.833
05-Aug-94	08:00 AM	331.816
05-Aug-94	09:00 AM	331.799
05-Aug-94	10:00 AM	331.793
05-Aug-94	11:00 AM	331.788
05-Aug-94	12:00 PM	331.793
05-Aug-94	01:00 PM	331.799
05-Aug-94	02:00 PM	331.805
05-Aug-94	03:00 PM	331.816
05-Aug-94	04:00 PM	331.827
05-Aug-94	05:00 PM	331.827
05-Aug-94	06:00 PM	331.816
05-Aug-94	07:00 PM	331.799
05-Aug-94	08:00 PM	331.776
05-Aug-94	09:00 PM	331.765
05-Aug-94	10:00 PM	331.76
05-Aug-94	11:00 PM	331.748
06-Aug-94	12:00 PM	331.76
06-Aug-94	01:00 AM	331.782
06-Aug-94	02:00 AM	331.765
06-Aug-94	03:00 AM	331.76
06-Aug-94	04:00 AM	331.76
06-Aug-94	05:00 AM	331.76
06-Aug-94	06:00 AM	331.76
06-Aug-94	07:00 AM	331.743
06-Aug-94	08:00 AM	331.714
06-Aug-94	09:00 AM	331.737
06-Aug-94	10:00 AM	331.748
06-Aug-94	11:00 AM	331.754
06-Aug-94	12:00 PM	331.765
06-Aug-94	01:00 PM	331.805
06-Aug-94	02:00 PM	331.816
06-Aug-94	03:00 PM	331.827
06-Aug-94	04:00 PM	331.838
06-Aug-94	05:00 PM	331.85
06-Aug-94	06:00 PM	331.844

Date	Time	Ground Water Elevation (feet, msl)
06-Aug-94	02:00 PM	331.816
06-Aug-94	03:00 PM	331.827
06-Aug-94	04:00 PM	331.838
06-Aug-94	05:00 PM	331.85
06-Aug-94	06:00 PM	331.844
06-Aug-94	07:00 PM	331.833
06-Aug-94	08:00 PM	331.816
06-Aug-94	09:00 PM	331.793
06-Aug-94	10:00 PM	331.799
06-Aug-94	11:00 PM	331.799
07-Aug-94	12:00 AM	331.788
07-Aug-94	01:00 AM	331.793
07-Aug-94	02:00 AM	331.799
07-Aug-94	03:00 AM	331.799
07-Aug-94	04:00 AM	331.805
07-Aug-94	05:00 AM	331.788
07-Aug-94	06:00 AM	331.771
07-Aug-94	07:00 AM	331.748
07-Aug-94	08:00 AM	331.76
07-Aug-94	09:00 AM	331.748
07-Aug-94	10:00 AM	331.754
07-Aug-94	11:00 AM	331.754
07-Aug-94	12:00 PM	331.788
07-Aug-94	01:00 PM	331.788
07-Aug-94	02:00 PM	331.816
07-Aug-94	03:00 PM	331.821
07-Aug-94	04:00 PM	331.816
07-Aug-94	05:00 PM	331.833
07-Aug-94	06:00 PM	331.821
07-Aug-94	07:00 PM	331.81
07-Aug-94	08:00 PM	331.793
07-Aug-94	09:00 PM	331.765
07-Aug-94	10:00 PM	331.76
07-Aug-94	11:00 PM	331.76
08-Aug-94	12:00 PM	331.754
08-Aug-94	01:00 AM	331.743
08-Aug-94	02:00 AM	331.743
08-Aug-94	03:00 AM	331.748
08-Aug-94	04:00 AM	331.726
08-Aug-94	05:00 AM	331.692
08-Aug-94	06:00 AM	331.692
08-Aug-94	07:00 AM	331.681
08-Aug-94	08:00 AM	331.658
08-Aug-94	09:00 AM	331.647
08-Aug-94	10:00 AM	331.63
08-Aug-94	11:00 AM	331.647
08-Aug-94	12:00 PM	331.664
08-Aug-94	01:00 PM	331.675
08-Aug-94	02:00 PM	331.692
08-Aug-94	03:00 PM	331.692
08-Aug-94	04:00 PM	331.709

Date	Time	Ground Water Elevation (feet, msl)
08-Aug-94	05:00 PM	331.72
08-Aug-94	06:00 PM	331.692
08-Aug-94	07:00 PM	331.669
08-Aug-94	08:00 PM	331.647
08-Aug-94	09:00 PM	331.63
08-Aug-94	10:00 PM	331.63
08-Aug-94	11:00 PM	331.624
09-Aug-94	12:00 PM	331.607
09-Aug-94	01:00 AM	331.529
09-Aug-94	02:00 AM	331.591
09-Aug-94	03:00 AM	331.591
09-Aug-94	04:00 AM	331.619
09-Aug-94	05:00 AM	331.591
09-Aug-94	06:00 AM	331.591
09-Aug-94	07:00 AM	331.551
09-Aug-94	08:00 AM	331.529
09-Aug-94	09:00 AM	331.512
09-Aug-94	10:00 AM	331.5
09-Aug-94	11:00 AM	331.495
09-Aug-94	12:00 PM	331.5
09-Aug-94	01:00 PM	331.529
09-Aug-94	02:00 PM	331.54
09-Aug-94	03:00 PM	331.54
09-Aug-94	04:00 PM	331.557
09-Aug-94	05:00 PM	331.557
09-Aug-94	06:00 PM	331.545
09-Aug-94	07:00 PM	331.523
09-Aug-94	08:00 PM	331.495
09-Aug-94	09:00 PM	331.489
09-Aug-94	10:00 PM	331.489
09-Aug-94	11:00 PM	331.489

Appendix C

Extraction Data
(Rates and Heads)

A	A	B	C	D	E	F	G	H	I	J	K	L
1	Paducah Gaseous Diffusion Plant - Paducah, Kentucky											
2	DNAPL Solubilization Test											
3	Extraction Phase - Well MW-156											
4	August 9 - 25, 1994											
5												
6												
7	Time	Date & Time	Time Since	Volume In	Totalizer	Totalizer Average	Rotometer Rate	Pump	Hermit	Solinst	Measured	Water Level
8	(hours)		Pumping Started	Discharge Tank	Total Flow	Extraction Rate	(gal/min)	Hertz	TOC DTW *	TOC DTW	By	Elevation
9			(min)	(gal)	(gal)	(gal/min)			(ft)	(ft)		(feet msl)
10												
11	0.0	8/9/94 14:00	0	NA	6340.4		1	NA	54	54	JL	
12	3.2	8/9/94 17:14	194	<250	6538.1	1.019	0.95	NA	53.93	53.9	JL	328.16
13	4.4	8/9/94 18:23	263	300	6606.3	0.988	0.8	NA	53.88	53.87	AHB	328.19
14	5.1	8/9/94 19:03	303	350	6645	0.967	0.8	NA	53.86	53.86	AHB	328.2
15	6.0	8/9/94 20:02	362	400	6701.7	0.961	0.8	NA	53.8	53.81	AHB	328.25
16	7.1	8/9/94 21:04	424	460	6759.5	0.932	0.8	NA	53.74	53.76	AHB	328.3
17	8.2	8/9/94 22:10	490	550	6819.2	0.905	0.7	NA	53.67	53.7	AHB	328.36
18	9.1	8/9/94 23:05	545	600	6866.2	0.855	1	NA	53.94	53.96	AHB	328.1
19	9.8	8/9/94 23:45	585	640	6915.4	1.230	0.9	172	53.9	53.93	AHB	328.13
20	10.1	8/10/94 0:04	604	650	6934.4	1.000	0.95	172	53.86	53.9	AHB	328.16
21	11.0	8/10/94 1:01	661	740	6990.9	0.991	0.95	172	53.78	53.82	CJM	328.24
22	12.0	8/10/94 2:00	720	800	7048.4	0.975	0.95	172	53.79	53.83	CJM	328.23
23	13.0	8/10/94 3:00	780	860	7105.7	0.955	0.95	172	53.71	53.76	CJM	328.3
24	14.0	8/10/94 4:00	840	920	7162.2	0.942	0.95	172	53.65	53.7	CJM	328.36
25	15.0	8/10/94 5:00	900	980	7217.6	0.923	0.9	172	53.62	53.63	CJM	328.43
26	16.0	8/10/94 6:00	960	1040	7278	1.007	1	175/176	53.93	54	CJM	328.06
27	17.0	8/10/94 7:00	1020	1110	7339.5	1.025	0.95	175/176	53.86	53.9	CJM	328.16
28	18.5	8/10/94 8:28	1108	60	7425.6	0.978	0.95	175/176	53.84	54.14	JTL	327.92
29	19.3	8/10/94 9:18	1158	115	7476.5	1.018	0.95	169/170	53.8	53.82	JTL	328.24
30	20.4	8/10/94 10:25	1225	180	7541.8	0.975	0.9	169/170	55.7	53.73	JTL	328.33
31	21.0	8/10/94 11:00	1260	?	7575.5	0.963	0.9	169/170	53.6	53.64	KRD	328.42
32	22.1	8/10/94 12:03	1323	?	7637	0.976	0.9	171	53.72	53.75	JTL	328.31
33	23.0	8/10/94 13:00	1380	330	7691.3	0.953	0.9	171	53.62	53.64	JTL & KRD	328.42
34	24.1	8/10/94 14:08	1448	395	7758	0.981	0.95	172/173	55.69	53.72	JTL	328.34
35	25.2	8/10/94 15:09	1509	460	7817.6	0.977	0.95	172/173	53.62	53.67	JTL	328.39
36	26.2	8/10/94 16:14	1574	550	7880	0.960	0.95	172/173	53.55	53.61	JTL	328.45
37	27.1	8/10/94 17:03	1623	600	7928.7	0.994	0.9	173/174	53.57	53.66	AHB	328.4
38	28.2	8/10/94 18:13	1693	660	7997	0.976	0.85	173/174	53.55	53.64	AHB	328.42
39	29.0	8/10/94 19:00	1740	750	8046.1	1.045	1	175/176	53.76	53.88	AHB	328.18

A	A	B	C	D	E	F	G	H	I	J	K	L
1	Paducah Gaseous Diffusion Plant - Paducah, Kentucky											
2	DNAPL Solubilization Test											
3	Extraction Phase - Well MW-156											
4	August 9 - 25, 1994											
5												
6												
7	Time	Date & Time	Time Since	Volume In	Totalizer	Totalizer Average	Rotometer Rate	Pump	Hermit	Solinst	Measured	Water Level
8	(hours)		Pumping Started	Discharge Tank	Total Flow	Extraction Rate	(gal/min)	Hertz	TOC DTW *	TOC DTW	By	Elevation
9			(min)	(gal)	(gal)	(gal/min)			(ft)	(ft)		(feet msl)
10												
40	30.2	8/10/94 20:11	1811	810	8121.7	1.065	1	175/176	53.71	53.82	AHB	328.24
41	31.2	8/10/94 21:11	1871	870	8184.5	1.047	1	175/176	53.66	53.8	AHB	328.26
42	32.0	8/10/94 22:00	1920	950	8234.8	1.027	0.9	175/176	53.63	53.74	AHB	328.32
43	33.0	8/10/94 23:00	1980	1010	8295.1	1.005	0.9	175/176	53.62	53.71	AHB	328.35
44	34.1	8/11/94 0:03	2043	1090	8360	1.030	1	176/177	53.66	53.79	AHB	328.27
45	35.0	8/11/94 1:00	2100	1150	8418.6	1.028	0.95	176/177	53.56	53.68	CJM	328.38
46	36.0	8/11/94 2:00	2160	60	8471	0.873	0.5	171	53.51	53.64	CJM	328.42
47	37.0	8/11/94 3:00	2220	120	8540.5	1.158	1.3	176/177	53.69	53.84	CJM	328.22
48	38.0	8/11/94 4:00	2280	180	8602.8	1.038	1	171/172	53.57	53.71	CJM	328.35
49	39.0	8/11/94 5:00	2340	240	8663.1	1.005	0.95	171/172	53.52	53.66	CJM	328.4
50	40.0	8/11/94 6:00	2400	300	8721.9	0.980	0.95	171/172	53.49	53.64	CJM	328.42
51	41.0	8/11/94 7:00	2460	360	8779	0.952	0.8	171/172	53.4	53.57	CJM	328.49
52	42.0	8/11/94 8:00	2520	420	8829.6	0.843	0.8	171/172	53.39	53.55	CJM	328.51
53	43.0	8/11/94 9:00	2580	505	8890	1.007	0.9	172	53.45	53.59	JTL	328.47
54	44.2	8/11/94 10:11	2651	570	8960.8	0.997	0.95	174	53.58	53.74	JTL	328.32
55	45.0	8/11/94 11:00	2700	650	9009.3	0.990	0.95	174	53.52	53.66	JTL	328.4
56	46.2	8/11/94 12:10	2770	710	9076.4	0.959	0.9	174	53.47	53.61	JTL	328.45
57	47.2	8/11/94 13:11	2831	770	9138.1	1.011	0.98	175/176	53.55	53.7	JTL	328.36
58	48.1	8/11/94 14:08	2888	850	9195.9	1.014	0.98	175/176	53.55	53.7	JTL	328.36
59	49.1	8/11/94 15:08	2948	920	9255.8	0.998	0.95	175/176	53.47	53.63	JTL	328.43
60	50.0	8/11/94 16:00	3000	965	9306.1	0.967	0.95	175/176	53.38	53.55	JTL	328.51
61	51.0	8/11/94 17:00	3060	1020	9367.6	1.025	0.98	176/177	53.56	53.74	AHB	328.32
62	52.0	8/11/94 18:00	3120	1110	9429	1.023	0.98	176/177	53.5	53.7	AHB	328.36
63	53.0	8/11/94 19:00	3180	1160	9489.2	1.003	0.9	176/177	53.42	53.6	AHB	328.46
64	54.0	8/11/94 20:00	3240	70	9548.7	0.992	1.2	176/177	53.7	53.89	AHB	328.17
65	55.0	8/11/94 21:00	3300	150	9613.6	1.082	1	173/174	53.62	53.83	AHB	328.23
66	56.0	8/11/94 22:00	3360	200	9675.5	1.032	1	173	53.62	53.83	AHB	328.23
67	57.0	8/11/94 23:00	3420	250	9737.4	1.032	1	173/174	53.57	53.78	AHB	328.28
68	58.0	8/12/94 0:00	3480	310	9799.3	1.032	1.03	173/174	53.52	53.72	AHB	328.34

A	A	B	C	D	E	F	G	H	I	J	K	L
1	Paducah Gaseous Diffusion Plant - Paducah, Kentucky											
2	DNAPL Solubilization Test											
3	Extraction Phase - Well MW-156											
4	August 9 - 25, 1994											
5												
6												
7	Time	Date & Time	Time Since	Volume In	Totalizer	Totalizer Average	Rotometer Rate	Pump	Hermit	Solinst	Measured	Water Level
8	(hours)		Pumping Started	Discharge Tank	Total Flow	Extraction Rate	(gal/min)	Hertz	TOC DTW *	TOC DTW	By	Elevation
9			(min)	(gal)	(gal)	(gal/min)			(ft)	(ft)		(feet msl)
10												
69	59.0	8/12/94 1:00	3540	380	9858	0.978	0.95	173/174	53.48	53.68	CJM	328.38
70	60.0	8/12/94 2:00	3600	440	9915.4	0.957	0.9	173	53.38	53.58	CJM	328.48
71	61.0	8/12/94 3:00	3660	500	9971.6	0.937	0.9	173	53.37	53.57	CJM	328.49
72	62.0	8/12/94 4:00	3720	560	10030.3	0.978	0.95	174/175	53.5	53.7	CJM	328.36
73	63.0	8/12/94 5:00	3780	620	10089.2	0.982	0.95	174/175	53.47	53.67	CJM	328.39
74	64.0	8/12/94 6:00	3840	720	10147.1	0.965	0.95	174/175	53.45	53.66	CJM	328.4
75	65.0	8/12/94 7:00	3900	785	10204	0.948	0.9	174/175	53.37	53.6	CJM	328.46
76	66.0	8/12/94 8:00	3960	850	10260.2	0.937	0.9	174/175	53.39	53.59	CJM	328.47
77	67.2	8/12/94 9:10	4030	920	10322.3	0.887	0.9	174/175	53.3	53.5	JTL	328.56
78	68.2	8/12/94 10:11	4091	990	10383.6	1.005	1	176/177	53.56	53.25	JTL	328.81
79	69.2	8/12/94 11:11	4151	1050	10442.5	0.982	0.98	176/177	53.5	53.68	JTL	328.38
80	70.0	8/12/94 12:00	4200	1100	10490	0.969	0.95	176/177	53.43	53.64	JTL	328.42
81	71.0	8/12/94 13:00	4260	1150	10546.7	0.945	0.95	176/177	53.48	53.66	JTL	328.4
82	72.0	8/12/94 14:00	4320	<100	10604.4	0.962	1.25	176/177	53.9	54.2	JTL	327.86
83	73.0	8/12/94 15:00	4380	100	10661	0.943	0.75	169/170	53.1	53.37	AHB	328.69
84	74.0	8/12/94 16:00	4440	>100	10713.2	0.870	0.75	170	53.14	53.39	AHB	328.67
85	75.0	8/12/94 17:00	4500	>100	10764.3	0.852	0.75	169/170	53.09	53.32	AHB	328.74
86	76.0	8/12/94 18:01	4561	300	10813.6	0.808	0.7	169/170	52.97	53.2	AHB	328.86
87	77.0	8/12/94 19:00	4620	360	10879.3	1.114	1.1	175/176	53.67	53.95	AHB	328.11
88	78.0	8/12/94 20:00	4680	440	10946.1	1.113	1.1	176	53.63	53.9	AHB	328.16
89	79.0	8/12/94 21:00	4740	530	11011.5	1.090	1.1	176	53.58	53.86	AHB	328.2
90	80.0	8/12/94 22:00	4800	600	11075.3	1.063	1.1	176	53.55	53.83	AHB	328.23
91	81.0	8/12/94 23:00	4860	>600	11136.9	1.027	1	175/176	53.55	53.84	AHB	328.22
92	82.0	8/13/94 0:00	4920	720	11198.2	1.022	1	175/176	53.42	53.71	KRD	328.35
93	83.0	8/13/94 1:00	4980	800	11258	0.997	1	175/176	53.42	53.69	KRD	328.37
94	84.0	8/13/94 2:00	5040	850	11317.2	0.987	1	175/176	53.37	53.66	KRD	328.4
95	85.0	8/13/94 3:00	5100	915	11375.1	0.965	0.95	175/176	53.27	53.55	KRD	328.51
96	86.0	8/13/94 4:00	5160	990	11431.2	0.935	0.95	175/176	53.23	53.49	KRD	328.57
97	87.0	8/13/94 5:00	5220	1030	11488.8	0.960	1	177/178	53.36	53.64	KRD	328.42

A	A	B	C	D	E	F	G	H	I	J	K	L
1	Paducah Gaseous Diffusion Plant - Paducah, Kentucky											
2	DNAPL Solubilization Test											
3	Extraction Phase - Well MW-156											
4	August 9 - 25, 1994											
5												
6												
7	Time	Date & Time	Time Since	Volume In	Totalizer	Totalizer Average	Rotometer Rate	Pump	Hermit	Solinst	Measured	Water Level
8	(hours)		Pumping Started	Discharge Tank	Total Flow	Extraction Rate	(gal/min)	Hertz	TOC DTW *	TOC DTW	By	Elevation
9			(min)	(gal)	(gal)	(gal/min)			(ft)	(ft)		(feet msl)
10												
98	88.0	8/13/94 6:00	5280	1105	11546.8	0.967	0.98	177	53.33	53.6	KRD	328.46
99	89.2	8/13/94 7:11	5351	60	11614.1	0.948	1.15	177	53.75	54.06	KRD	328
100	90.4	8/13/94 8:25	5425	130	NA		0.95	NA	53.26	53.56	KRD	328.5
101	91.2	8/13/94 9:11	5471	180	11728.1		0.9	NA	53.24	53.52	KRD	328.54
102	92.1	8/13/94 10:07	5527	NA	11783.1	0.982	1.05	NA	53.56	53.84	PEM	328.22
103	93.2	8/13/94 11:12	5592	300	11849.3	1.018	1	NA	53.39	53.7	PEM	328.36
104	94.1	8/13/94 12:07	5647	350	11902.9	0.975	1	NA	53.32	53.62	PEM	328.44
105	95.1	8/13/94 13:03	5703	410	11956.9	0.964	0.95	173/174	53.24	53.55	PEM	328.51
106	96.0	8/13/94 14:00	5760	470	12010.6	0.942	0.95	173/174	53.21	53.53	AHB	328.53
107	97.0	8/13/94 15:00	5820	540	12066	0.923	0.95	173/174	53.14	53.46	AHB	328.6
108	98.0	8/13/94 16:00	5880	610	12123.5	0.958	1	175/176	53.34	53.66	AHB	328.4
109	99.0	8/13/94 17:00	5940	670	12183.2	0.995	1	175/176	53.3	53.61	AHB	328.45
110	100.0	8/13/94 18:02	6002	740	12248	1.045	1.15	178/179	53.52	53.88	AHB	328.18
111	101.0	8/13/94 19:01	6061	820	12313.1	1.103	1.15	178/179	53.48	53.81	AHB	328.25
112	102.1	8/13/94 20:08	6128	920	12386.1	1.090	1.15	178/179	53.4	53.75	AHB	328.31
113	103.0	8/13/94 21:02	6182	960	12442.8	1.050	1.15	178/179	53.36	53.7	AHB	328.36
114	104.0	8/13/94 22:00	6240	1020	12502.5	1.029	1.15	178/179	53.32	53.66	AHB	328.4
115	105.0	8/13/94 23:00	6300	1095	12563.8	1.022	1.05	178/179	53.33	53.64	KRD	328.42
116	106.0	8/14/94 0:00	6360	1145	12618.2	0.907	0.9	176/177	52.98	53.29	KRD	328.77
117	107.0	8/14/94 1:00	6420	75	12677.2	0.983	1.4	180/181	53.88	53.23	KRD	328.83
118	108.0	8/14/94 2:00	6480	140	12737.8	1.010	0.92	172	53.06	53.39	KRD	328.67
119	109.0	8/14/94 3:00	6540	225	12798.1	1.005	1	174/175	53.26	53.6	KRD	328.46
120	110.2	8/14/94 4:10	6610	280	12867.8	0.996	1	174/175	53.24	53.58	KRD	328.48
121	111.0	8/14/94 5:00	6660	320	12917.8	1.000	1	174/175	53.23	53.55	KRD	328.51
122	112.0	8/14/94 6:00	6720	380	12975.6	0.963	0.95	174/175	53.14	53.48	KRD	328.58
123	113.0	8/14/94 7:00	6780	450	13035.9	1.005	1.05	176/177	53.32	53.64	KRD	328.42
124	114.0	8/14/94 8:00	6840	535	13096.2	1.005	1	176/177	53.27	53.6	KRD	328.46
125	115.0	8/14/94 9:00	6900	NA	13155.9	0.995	1	176/177	53.28	53.6	PEM	328.46
126	116.0	8/14/94 10:00	6960	660	13215.7	0.997	1	176/177	53.25	53.58	PEM	328.48

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4	August 9 - 25, 1994											
5												
6												
7	Time	Date & Time	Time Since	Volume In	Totalizer	Totalizer Average	Rotometer Rate	Pump	Hermit	Solinst	Measured	Water Level
8	(hours)		Pumping Started	Discharge Tank	Total Flow	Extraction Rate	(gal/min)	Hertz	TOC DTW *	TOC DTW	By	Elevation
9			(min)	(gal)	(gal)	(gal/min)			(ft)	(ft)		(feet msl)
10												
127	117.0	8/14/94 11:00	7020	730	13276	1.005	1	176/177	53.28	53.62	AHB	328.44
128	118.0	8/14/94 12:00	7080	800	13334.3	0.972	1	176/177	53.2	53.55	AHB	328.51
129	119.0	8/14/94 13:01	7141	870	13398.1	1.046	1.15	178/179	53.48	53.84	AHB	328.22
130	120.0	8/14/94 14:01	7201	945	13463.4	1.088	1.15	178/179	53.43	53.79	AHB	328.27
131	121.1	8/14/94 15:03	7263	1020	13529.2	1.061	1.15	178/179	53.34	53.7	AHB	328.36
132	122.1	8/14/94 16:03	7323	1080	13591.3	1.035	1.1	178/179	53.28	53.63	AHB	328.43
133	123.2	8/14/94 17:11	7391	1150	13660.1	1.012	1.1	178/179	53.23	53.6	AHB	328.46
134	124.1	8/14/94 18:03	7443	75	13714.4	1.044	1.25	178/179	53.76	54.16	AHB	327.9
135	125.1	8/14/94 19:05	7505	155	13790.7	1.231	1.12	178/179	53.67	54.06	AHB	328
136	126.0	8/14/94 20:01	7561		13857.6	1.195	1.12	178/179	53.63	54.01	AHB	328.05
137	127.1	8/14/94 21:06	7626	300	13926.2	1.055	0.9	173.174	53.1	53.44	AHB	328.62
138	128.1	8/14/94 22:05	7685	360	13978.4	0.885	0.8	173.174	53.24	53.66	AHB	328.4
139	129.1	8/14/94 23:03	7743	420	14035.1	0.978	1	173.174	53.17	53.56	JED	328.5
140	130.1	8/15/94 0:03	7803	480	14088.7	0.893	0.9	173.174	53.08	53.48	JED	328.58
141	131.0	8/15/94 1:00	7860	550	14137	0.847	1	174/175	53.1	53.52	JED	328.54
142	132.0	8/15/94 2:00	7920	610	14190.7	0.895	1	174/175	53.14	53.5	JED	328.56
143	133.0	8/15/94 3:01	7981	670	14245	0.890	0.9	174/175	53.08	53.46	JED	328.6
144	134.0	8/15/94 3:57	8037	730	14296.5	0.920	0.85	177/178	53.24	53.64	JED	328.42
145	135.0	8/15/94 4:59	8099	790	14359.5	1.016	1.15	177/178	53.44	53.88	JED	328.18
146	136.0	8/15/94 6:00	8160	860	14422.4	1.031	1	178	53.39	53.78	JED	328.28
147	137.0	8/15/94 6:59	8219	935	14483.3	1.032	1	178	53.4	53.78	JED	328.28
148	138.2	8/15/94 8:14	8294	1030	14556.9	0.981	1	178	53.34	53.74	"PE,M"	328.32
149	139.0	8/15/94 9:00	8340	1060	14602.2	0.985	0.9	178	53.22	53.62	"PE,M"	328.44
150	140.0	8/15/94 10:00	8400	50	14657	0.913	0.95	177	53.32	53.68	"PE,M"	328.38
151	142.0	8/15/94 12:00	8520	155	14744.4	0.728	0.95	172/173	53.27	53.64	KRD	328.42
152	143.0	8/15/94 13:00	8580	220	14834.3	1.498	0.95	172/173	53.25	53.63	AHB	328.43
153	144.1	8/15/94 14:05	8645	NA	14894	0.918	0.95	172/173	53.13	53.5	KRD	328.56
154	145.0	8/15/94 15:00	8700	335	14946.6	0.956	1	173/174	53.23	53.61	KRD	328.45
155	146.0	8/15/94 16:00	8760	390	15004.8	0.970	0.97	173/174	53.14	53.53	AHB	328.53

A	A	B	C	D	E	F	G	H	I	J	K	L
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5												
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7	Time	Date & Time	Time Since	Volume In	Totalizer	Totalizer Average	Rotometer Rate	Pump	Hermit	Solinst	Measured	Water Level
8	(hours)		Pumping Started	Discharge Tank	Total Flow	Extraction Rate	(gal/min)	Hertz	TOC DTW *	TOC DTW	By	Elevation
9			(min)	(gal)	(gal)	(gal/min)			(ft)	(ft)		(feet msl)
10												
156	147.0	8/15/94 17:00	8820	450	15061.8	0.950	0.98	173/174	53.14	53.52	AHB	328.54
157	148.0	8/15/94 18:00	8880	530	15121.6	0.997	1.01	176/177	53.36	53.75	AHB	328.31
158	149.0	8/15/94 19:01	8941	600	15185	1.039	1	176/177	53.33	53.75	AHB	328.31
159	150.1	8/15/94 20:05	9005	700	15250.7	1.027	1	176/177	53.29	53.69	AHB	328.37
160	151.0	8/15/94 21:01	9061	750	15306.5	0.996	1	176/177	53.26	53.66	AHB	328.4
161	152.0	8/15/94 22:00	9120	800	15364.4	0.981	1	176/177	53.27	53.68	AHB	328.38
162	153.0	8/15/94 23:00	9180	880	15422.6	0.970	1	175/176	53.22	53.64	JED & KRD	328.42
163	154.2	8/16/94 0:10	9250	940	15489.3	0.953	1	175/176	53.16	53.55	JED & KRD	328.51
164	155.0	8/16/94 1:02	9302	1000	15534.5	0.869	0.95	175/176	53.12	53.54	JED & RDS	328.52
165	156.1	8/16/94 2:08	9368	1070	15595.3	0.921	1	177/178	53.22	53.65	JED & RDS	328.41
166	157.0	8/16/94 3:00	9420	1130	15648.2	1.017	1	177/178	53.26	53.68	JED & RDS	328.38
167	158.0	8/16/94 4:01	9481	55	15708.4	0.987	1	177/178	53.23	53.66	JED & RDS	328.4
168	159.0	8/16/94 4:59	9539	130	15776.7	1.178	1.5	171/172	53.26	53.69	JED & RDS	328.37
169	160.0	8/16/94 5:59	9599	200	15835.1	0.973	1	171/172	53.2	53.63	JED & RDS	328.43
170	161.0	8/16/94 7:00	9660	250	15893.5	0.957	1	172/173	53.22	53.64	JED & RDS	328.42
171	162.3	8/16/94 8:20	9740	350	15972.9	0.992	0.95	172/173	53.18	53.61	KRD	328.45
172	163.0	8/16/94 9:00	9780	390	16013.4	1.013	1	174/175	53.3	53.7	JTL	328.36
173	164.0	8/16/94 10:00	9840	450	16073.5	1.002	1	174/175	53.25	53.67	JTL	328.39
174	165.3	8/16/94 11:15	9915	550	16147.6	0.988	1	174/175	53.24	53.64	JTL	328.42
175	166.0	8/16/94 12:00	9960	600	16191.5	0.976	1	175	53.22	53.63	KRD	328.43
176	167.2	8/16/94 13:10	10030	700	16259.2	0.967	0.95	175	53.1	53.54	JTL	328.52
177	168.0	8/16/94 14:00	10080	730	16319.2	1.200	1	176	53.24	53.65	JTL	328.41
178	169.0	8/16/94 15:00	10140	790	16369	0.830	1	176	53.22	53.63	JTL	328.43
179	170.1	8/16/94 16:05	10205	855	16433.1	0.986	0.95	176	53.12	53.55	AHB	328.51
180	171.3	8/16/94 17:20	10280	950	16509.5	1.019	1	177/178	53.25	53.7	AHB	328.36
181	172.0	8/16/94 18:00	10320	1000	16550.4	1.023	1	177/178	53.22	53.66	AHB	328.4
182	173.0	8/16/94 19:00	10380	1060	16609.8	0.990	0.98	177/178	53.1	53.54	AHB	328.52
183	174.2	8/16/94 20:14	10454	NA	16686	1.030	1.05	178/179	53.31	53.76	AHB	328.3
184	175.0	8/16/94 21:00	10500	1150	16735.9	1.085	1.1	179	53.38	53.84	AHB	328.22

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7	Time	Date & Time	Time Since	Volume In	Totalizer	Totalizer Average	Rotometer Rate	Pump	Hermit	Solinst	Measured	Water Level
8	(hours)		Pumping Started	Discharge Tank	Total Flow	Extraction Rate	(gal/min)	Hertz	TOC DTW *	TOC DTW	By	Elevation
9			(min)	(gal)	(gal)	(gal/min)			(ft)	(ft)		(feet msl)
10												
185	176.1	8/16/94 22:06	10566	150	16818.9	1.258	1.2	179	53.74	54.2	AHB	327.86
186	177.0	8/16/94 23:00	10620	220	16871.6	0.976	0.95	171/172	52.98	53.44	AHB	328.62
187	178.0	8/17/94 0:00	10680	280	16929.9	0.972	1	174/175	53.34	53.82	JED/RDS	328.24
188	179.0	8/17/94 0:59	10739	340	16993.3	1.075	1	174/175	53.3	53.76	JED/RDS	328.3
189	180.0	8/17/94 2:00	10800	390	17058	1.061	1	174/175	53.28	53.79	JED/RDS	328.27
190	181.0	8/17/94 3:00	10860	455	17118.4	1.007	1	174/175	53.25	53.72	JED/RDS	328.34
191	182.0	8/17/94 4:00	10920	530	17182	1.060	1	174/175	53.28	53.76	JED/RDS	328.3
192	183.0	8/17/94 5:00	10980	595	17243.8	1.030	1	174/175	53.19	53.64	JED/RDS	328.42
193	184.0	8/17/94 6:00	11040	650	17304.3	1.008	1	174/175	53.17	53.66	JED/RDS	328.4
194	185.0	8/17/94 7:00	11100	740	17363.5	0.987	1	174/175	53.18	53.69	JED/RDS	328.37
195	186.0	8/17/94 8:00	11160	810	17423.2	0.995	0.95	174/175	53.11	53.56	KRD	328.5
196	187.1	8/17/94 9:03	11223	880	17489.5	1.052	1	177	53.34	53.82	JTL	328.24
197	188.0	8/17/94 10:02	11282	950	17550.2	1.029	1	177	53.3	53.76	JTL	328.3
198	189.0	8/17/94 11:00	11340	1010	17619.4	1.193	1	177	53.28	53.76	KRD	328.3
199	190.0	8/17/94 12:00	11400	1070	17668.9	0.825	1	177	53.22	53.65	KRD/JTL	328.41
200	191.0	8/17/94 13:00	11460	1130	17726.6	0.962	1	177/178	53.11	53.58	KRD	328.48
201	192.0	8/17/94 14:00	11520	50	17788.6	1.033	0.95	177/178	53.13	53.57	JTL	328.49
202	193.0	8/17/94 15:00	11580	140	17845.2	0.943	1.25	177	53.59	54.07	JTL	327.99
203	194.2	8/17/94 16:12	11652	210	17919.5	1.032	0.99	172/173	53.13	53.6	AHB	328.46
204	195.0	8/17/94 17:00	11700	NA	17969.4	1.040	1	174/175	53.3	53.76	AHB	328.3
205	196.0	8/17/94 18:00	11760	330	18031.1	1.028	1	174/175	53.23	53.72	AHB	328.34
206	197.0	8/17/94 19:00	11820	400	18093.8	1.045	1	175/176	53.28	53.74	AHB	328.32
207	198.0	8/17/94 20:00	11880	470	18155.5	1.028	1	175/176	53.29	53.77	AHB	328.29
208	200.0	8/17/94 22:02	12002	600	18282.8	1.043	1.05	176/177	53.37	53.86	AHB	328.2
209	201.0	8/17/94 23:00	12060	675	18343.6	1.048	1.2	176/177	53.38	53.86	AHB	328.2
210	202.0	8/18/94 0:00	12120	760	18402.5	0.982	1	176/177	53.31	53.8	RDS &RWP	328.26
211	203.0	8/18/94 1:00	12180	825	18463.3	1.013	1	176/177	53.27	53.76	RDS &RWP	328.3
212	204.0	8/18/94 2:00	12240	890	18523.4	1.002	1	176/177	53.31	53.78	RDS &RWP	328.28
213	205.0	8/18/94 3:00	12300	960	18583.1	0.995	1	176/177	53.23	53.72	RDS &RWP	328.34

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7	Time	Date & Time	Time Since	Volume In	Totalizer	Totalizer Average	Rotometer Rate	Pump	Hermit	Solinst	Measured	Water Level
8	(hours)		Pumping Started	Discharge Tank	Total Flow	Extraction Rate	(gal/min)	Hertz	TOC DTW *	TOC DTW	By	Elevation
9			(min)	(gal)	(gal)	(gal/min)			(ft)	(ft)		(feet msl)
10												
214	206.0	8/18/94 4:00	12360	1020	18642.9	0.997	1	176/177	53.26	53.75	RDS &RWP	328.31
215	207.0	8/18/94 5:00	12420	1080	18702	0.985	1	176/177	53.2	53.7	RDS &RWP	328.36
216	208.0	8/18/94 6:00	12480	1140	18759.4	0.957	0.99	177/178	53.29	53.79	RDS &RWP	328.27
217	209.0	8/18/94 7:00	12540	70	18821.9	1.042	1	177/178	53.34	53.82	RDS &RWP	328.24
218	210.0	8/18/94 8:00	12600	150	18892.4	1.175	1	172	53.31	53.78	JTL	328.28
219	211.2	8/18/94 9:09	12669	210	18957	0.936	0.9	172	53.12	53.6	JTL & KRD	328.46
220	212.0	8/18/94 10:00	12720	300	19008.8	1.016	1	174/175	53.36	53.85	JTL & KRD	328.21
221	213.1	8/18/94 11:06	12786	340	19074.8	1.000	1	174/175	53.32	53.81	KRD	328.25
222	214.0	8/18/94 12:00	12840	390	19127.8	0.981	0.95	174/175	53.23	53.72	JTL	328.34
223	215.0	8/18/94 13:00	12900	445	19185.4	0.960	0.95	174	53.2	53.69	JTL	328.37
224	216.0	8/18/94 14:00	12960	540	19247.1	1.028	1	176/177	53.37	53.86	JTL	328.2
225	217.0	8/18/94 15:00	13020	650	19309.1	1.033	1	176/177	53.32	53.81	JTL	328.25
226	218.3	8/18/94 16:15	13095	675	19386.1	1.027	1	176/177	53.26	53.76	AHB	328.3
227	219.0	8/18/94 17:00	13140	740	19431.6	1.011	0.99	176/177	53.18	53.66	AHB	328.4
228	220.0	8/18/94 18:00	13200	800	19491.2	0.993	0.98	176/177	53.18	53.68	AHB	328.38
229	221.0	8/18/94 19:00	13260	880	19555.2	1.067	1.05	178	53.38	53.89	AHB	328.17
230	222.1	8/18/94 20:05	13325	950	19623.9	1.057	1	178	53.29	53.8	AHB	328.26
231	223.0	8/18/94 21:00	13380	1010	19680.5	1.029	1	178/179	53.33	53.86	AHB	328.2
232	224.0	8/18/94 22:00	13440	1080	19741.3	1.013	1	178	53.26	53.76	AHB	328.3
233	225.0	8/18/94 23:00	13500	1150	19800.2	0.982	0.98	178	53.27	53.79	AHB	328.27
234	226.0	8/19/94 0:00	13560	80	19863.2	1.050	1.25	177/178	53.23	53.74	RDS & RWP	328.32
235	227.0	8/19/94 1:00	13620	140	19913	0.830	0.75	174/175	53.29	53.88	RDS & RWP	328.18
236	228.0	8/19/94 2:00	13680	200	19979.8	1.113	1	174	53.37	53.92	RDS & RWP	328.14
237	229.0	8/19/94 3:00	13740	260	20042.2	1.040	1	173/174	53.35	53.89	RDS & RWP	328.17
238	230.0	8/19/94 4:00	13800	330	20104.9	1.045	1	174	53.33	53.86	RDS & RWP	328.2
239	231.0	8/19/94 5:00	13860	400	20165.5	1.010	1	174	53.26	53.8	RDS & RWP	328.26
240	232.0	8/19/94 6:00	13920	460	20226.4	1.015	1	174	53.29	53.82	RDS & RWP	328.24
241	233.0	8/19/94 7:00	13980	550	20285.5	0.985	1	174	53.23	53.78	RDS & RWP	328.28
242	234.0	8/19/94 8:00	14040	650	20343.5	0.967	0.9	173/174	53.09	53.61	JTL	328.45

A	A	B	C	D	E	F	G	H	I	J	K	L
1	Paducah Gaseous Diffusion Plant - Paducah, Kentucky											
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3	Extraction Phase - Well MW-156											
4	August 9 - 25, 1994											
5												
6												
7	Time	Date & Time	Time Since	Volume In	Totalizer	Totalizer Average	Rotometer Rate	Pump	Hermit	Solinst	Measured	Water Level
8	(hours)		Pumping Started	Discharge Tank	Total Flow	Extraction Rate	(gal/min)	Hertz	TOC DTW *	TOC DTW	By	Elevation
9			(min)	(gal)	(gal)	(gal/min)						
10									(ft)	(ft)		(feet msl)
243	235.0	8/19/94 9:00	14100	670	20402.6	0.985	0.98	175	53.26	53.77	JTL	328.29
244	236.0	8/19/94 10:00	14160	745	20462.2	0.993	0.98	176/177	53.28	53.82	KRD	328.24
245	237.0	8/19/94 11:00	14220	805	20520.8	0.977	1	176/177	53.26	53.8	KRD	328.26
246	238.0	8/19/94 12:00	14280	880	20581.1	1.005	1	177/178	53.38	53.92	JTL	328.14
247	239.0	8/19/94 13:00	14340	950	20643.5	1.040	1	177/178	53.32	53.86	JTL	328.2
248	240.0	8/19/94 14:00	14400	1010	20705	1.025	1	178	53.27	53.91	JTL	328.15
249	241.0	8/19/94 15:00	14460	NA	20766.6	1.027	1.25	178	53.7	54.26	JTL	327.8
250	242.0	8/19/94 16:00	14520	175	20832.6	1.100	0.98	173	53.7	53.15	AHB	328.91
251	243.1	8/19/94 17:03	14583	NA	20894.2	0.978	0.95	172/173	53.06	53.6	AHB	328.46
252	244.5	8/19/94 18:31	14671	NA	20991.2	1.102	1.01	175/176	53.31	53.86	AHB	328.2
253	245.0	8/19/94 19:00	14700	350	21019.8	0.986	1.01	175/176	53.28	53.84	AHB	328.22
254	246.2	8/19/94 20:10	14770	430	21093.3	1.050	1	175/176	53.23	53.8	AHB	328.26
255	247.0	8/19/94 21:00	14820	500	21144.8	1.030	1	175/176	53.23	53.8	AHB	328.26
256	248.0	8/19/94 22:00	14880	570	21205.2	1.007	1	175/176	53.16	53.73	AHB	328.33
257	249.0	8/19/94 23:00	14940	NA	21265.2	1.000	1	175/176	53.14	53.7	AHB	328.36
258	250.0	8/20/94 0:00	15000	700	21323.5	0.972	1	177/178	53.28	53.9	JWD	328.16
259	251.0	8/20/94 1:00	15060	752	21389	1.092	1.01	177/178	53.3	53.95	EFJ	328.11
260	252.0	8/20/94 2:00	15120	840	21453.6	1.077	1	178	53.3	53.91	EFJ	328.15
261	253.0	8/20/94 3:00	15180	915	21517.5	1.065	1	176/178	53.3	53.92	EFJ & JWD	328.14
262	254.0	8/20/94 4:00	15240	970	21574.8	0.955	0.98	176	53.02	53.93	EFJ & JWD	328.13
263	255.0	8/20/94 5:00	15300	1030	21635.5	1.012	1	177/178	53.13	53.77	EFJ & JWD	328.29
264	256.0	8/20/94 6:00	15360	1110	21694.2	0.978	0.98	177	53.09	53.74	EFJ & JWD	328.32
265	257.0	8/20/94 7:00	15420	70	21757	1.047	1	179	53.27	53.86	EFJ & JWD	328.2
266	258.0	8/20/94 8:00	15480	145	21821.2	1.070	0.98	173/174	53.2	53.8	KRD & JTL	328.26
267	259.0	8/20/94 9:00	15540	220	21880.3	0.985	0.98	173/174	53.21	53.82	JTL	328.24
268	260.0	8/20/94 10:00	15600	300	21940.3	1.000	1	173/174	53.2	53.78	JTL	328.28
269	261.0	8/20/94 11:00	15660	330	22000.3	1.000	1	174/175	53.22	53.78	KRD	328.28
270	262.0	8/20/94 12:00	15720	400	22059.6	0.988	1	174/175	53.16	53.8	JTL	328.26
271	263.0	8/20/94 13:00	15780	460	22120.1	1.008	0.99	175/176	53.25	53.8	JTL	328.26

A	A	B	C	D	E	F	G	H	I	J	K	L
1	Paducah Gaseous Diffusion Plant - Paducah, Kentucky											
2	DNAPL Solubilization Test											
3	Extraction Phase - Well MW-156											
4	August 9 - 25, 1994											
5												
6												
7	Time	Date & Time	Time Since	Volume In	Totalizer	Totalizer Average	Rotometer Rate	Pump	Hermit	Solinst	Measured	Water Level
8	(hours)		Pumping Started	Discharge Tank	Total Flow	Extraction Rate	(gal/min)	Hertz	TOC DTW *	TOC DTW	By	Elevation
9			(min)	(gal)	(gal)	(gal/min)			(ft)	(ft)		(feet msl)
10												
272	264.0	8/20/94 14:00	15840	545	22179.7	0.993	1	175/176	53.22	53.84	JTL	328.22
273	265.0	8/20/94 15:00	15900	620	22242.6	1.048	1	176/177	53.22	53.79	JTL	328.27
274	266.0	8/20/94 15:59	15959	690	22304.4	1.047	1	176/177	53.21	53.78	AHB	328.28
275	266.8	8/20/94 16:50	16010	750	22356.2	1.016	1	176/177	53.16	53.74	AHB	328.32
276	268.0	8/20/94 18:02	16082	820	22427.5	0.990	1	176/177	53.21	53.76	AHB	328.3
277	269.0	8/20/94 19:00	16140	880	22486	1.009	0.9	176/177	53.13	53.67	AHB	328.39
278	270.0	8/20/94 19:57	16197	945	22541.5	0.974	0.9	176/177	53.14	53.68	AHB	328.38
279	271.0	8/20/94 21:02	16262	1010	22606.5	1.000	1	178/179	53.21	53.78	AHB	328.28
280	272.0	8/20/94 22:00	16320	1070	22664.8	1.005	0.9	178	53.18	53.75	AHB	328.31
281	273.0	8/20/94 23:00	16380	1140	22724.2	0.990	1	178	53.21	53.8	AHB	328.26
282	274.0	8/21/94 0:00	16440	60	22785	1.013	1	178	53.26	53.82	RDS & EFJ	328.24
283	275.0	8/21/94 1:00	16500	150	22858.6	1.227	1.25	178	53.69	53.4	RDS & EFJ	328.66
284	276.0	8/21/94 2:00	16560	220	22916.4	0.963	1	173/174	53.21	53.78	RDS & EFJ	328.28
285	277.0	8/21/94 3:00	16620	300	22976.5	1.002	1	174/175	53.19	53.84	RDS & EFJ	328.22
286	278.0	8/21/94 4:00	16680	340	23038.2	1.028	1	174/175	53.27	53.88	RDS & EFJ	328.18
287	279.0	8/21/94 5:00	16740	400	23099.2	1.017	1	174/175	53.27	53.86	RDS & EFJ	328.2
288	280.0	8/21/94 6:00	16800	470	23156.8	0.960	1	174/175	53.35	53.94	RDS & EFJ	328.12
289	281.0	8/21/94 7:00	16860	550	23218.1	1.022	0.9	174/175	53.29	53.88	RDS & EFJ	328.18
290	282.0	8/21/94 8:00	16920	650	23277.1	0.983	0.98	174/175	53.24	53.86	JTL	328.2
291	283.0	8/21/94 9:00	16980	680	23334.8	0.962	0.98	175	53.21	53.8	JTL	328.26
292	284.0	8/21/94 10:00	17040	750	23395.7	1.015	1	177	53.36	53.97	JTL	328.09
293	285.0	8/21/94 11:00	17100	815	23455.7	1.000	1	176/177	53.34	53.96	KRD	328.1
294	286.0	8/21/94 12:00	17160	890	23514.8	0.985	0.98	176/177	53.25	53.86	KRD & JTL	328.2
295	287.0	8/21/94 13:00	17220	950	23571.9	0.952	0.98	176/177	53.23	53.82	JTL & WMS	328.24
296	288.0	8/21/94 14:00	17280	1010	23633.9	1.033	1	178/179	53.37	54	JTL & WMS	328.06
297	289.0	8/21/94 15:00	17340	1070	23695.2	1.022	1	178/179	53.34	53.96	JTL	328.1
298	290.0	8/21/94 16:00	17400	1140	23757.2	1.033	0.95	178/179	53.3	53.92	AHB	328.14
299	291.0	8/21/94 17:00	17460	100	23822.6	1.090	1.25	178/179	53.79	54.46	AHB	327.6
300	292.0	8/21/94 18:00	17520	165	23885.8	1.053	1	173/174	53.3	53.96	AHB	328.1

A	A	B	C	D	E	F	G	H	I	J	K	L
1	Paducah Gaseous Diffusion Plant - Paducah, Kentucky											
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4	August 9 - 25, 1994											
5												
6											Measured	Water Level
7	Time	Date & Time	Time Since	Volume In	Totalizer	Totalizer Average	Rotometer Rate	Pump	Hermit	Solinst	By	Elevation
8	(hours)		Pumping Started	Discharge Tank	Total Flow	Extraction Rate	(gal/min)	Hertz	TOC DTW *	TOC DTW		(feet msl)
9			(min)	(gal)	(gal)	(gal/min)			(ft)	(ft)		
10												
301	293.3	8/21/94 19:17	17597	220	23962.3	0.994	0.9	173/174	53.28	53.92	AHB	328.14
302	294.2	8/21/94 20:12	17652	300	24016.8	0.991	0.9	173/174	53.26	53.9	AHB	328.16
303	295.0	8/21/94 21:00	17700	350	24070.3	1.115	1.15	177	53.56	54.24	AHB	327.82
304	296.0	8/21/94 22:02	17762	430	24139.3	1.113	1.12	177	53.54	54.23	AHB	327.83
305	297.0	8/21/94 23:00	17820	510	24201.6	1.074	1.12	177	53.48	54.18	AHB	327.88
306	298.0	8/22/94 0:00	17880	600	24276.4	1.247	1.11	177	53.47	54.2	SJK	327.86
307	299.1	8/22/94 1:03	17943	NA	24330.8	0.863	1.1	177	53.46	54.1	SJK	327.96
308	300.0	8/22/94 2:02	18002	725	24393	1.054	1	177	53.41	54.12	SJK	327.94
309	301.0	8/22/94 3:01	18061	800	24453.1	1.019	0.98	177	53.34	54.05	SJK	328.01
310	302.0	8/22/94 4:00	18120	870	24516.7	1.078	1.15	178	53.52	54.2	SJK	327.86
311	303.0	8/22/94 5:00	18180	950	24580.1	1.057	1	178	53.48	54.2	SJK	327.86
312	304.0	8/22/94 6:00	18240	1020	24642.6	1.042	1	178	53.48	54.15	SJK	327.91
313	305.0	8/22/94 7:01	18301	1075	24704.8	1.020	0.98	178	53.41	54.2	SJK	327.86
314	306.0	8/22/94 8:00	18360	1145	24769.9	1.103	1	178/179	53.45	54.15	JTL	327.91
315	307.0	8/22/94 9:02	18422	90	24832.7	1.013	1	173/174	53.55	54.21	JTL	327.85
316	308.0	8/22/94 10:00	18480	150	24889.8	0.984	0.95	173/174	53.37	54.04	JTL & WMS	328.02
317	309.0	8/22/94 11:00	18540	210	24951.9	1.035	1	174/175	53.5	54.17	KRD	327.89
318	310.0	8/22/94 12:01	18601	300	25013.3	1.007	1	175	53.43	54.13	JTL	327.93
319	311.0	8/22/94 13:00	18660	340	25072.5	1.003	0.99	175	53.4	54.11	JTL	327.95
320	312.0	8/22/94 14:00	18720	400	25136.8	1.072	1.01	176/177	53.55	54.25	JTL	327.81
321	313.0	8/22/94 15:00	18780	475	25200.5	1.062	1.01	176/177	53.49	54.23	JTL & WMS	327.83
322	314.0	8/22/94 16:00	18840	560	25261.8	1.022	1	176/177	53.45	54.12	AHB	327.94
323	315.0	8/22/94 17:00	18900	620	25321.6	0.997	0.98	176/177	53.35	54.1	AHB	327.96
324	316.0	8/22/94 18:00	18960	690	25380.8	0.987	0.95	176/177	53.33	54.06	AHB	328
325	317.1	8/22/94 19:04	19024	760	25443.3	0.977	1.01	178/179	53.58	54.28	AHB	327.78
326	318.0	8/22/94 20:00	19080	825	25503.5	1.075	1.01	178/179	53.54	54.26	AHB	327.8
327	319.0	8/22/94 21:00	19140	900	25567	1.058	1	178/179	53.52	54.25	AHB	327.81
328	320.0	8/22/94 22:02	19202	975	25631.3	1.037	1	178/179	53.54	54.28	AHB	327.78
329	321.0	8/22/94 23:00	19260	1030	25690.2	1.016	1	178/179	53.51	54.25	AHB	327.81

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4	August 9 - 25, 1994											
5												
6												
7	Time	Date & Time	Time Since	Volume In	Totalizer	Totalizer Average	Rotometer Rate	Pump	Hermit	Solinst	Measured	Water Level
8	(hours)		Pumping Started	Discharge Tank	Total Flow	Extraction Rate	(gal/min)	Hertz	TOC DTW *	TOC DTW	By	Elevation
9			(min)	(gal)	(gal)	(gal/min)			(ft)	(ft)		(feet msl)
10												
330	322.0	8/23/94 0:00	19320	1110	25750.3	1.002	1	178/179	53.49	54.2	PDN	327.86
331	323.0	8/23/94 1:00	19380	1150	25809.8	0.992	1	178/179	53.45	54.17	PDN	327.89
332	324.0	8/23/94 2:00	19440	110	25873.3	1.058	1.05	174/175	53.61	54.32	PDN	327.74
333	325.0	8/23/94 3:00	19500	180	25934.9	1.027	1	174/175	53.45	54.19	PDN	327.87
334	326.0	8/23/94 4:00	19560	250	25992.5	0.960	0.99	176/177	53.57	54.34	PDN	327.72
335	327.0	8/23/94 5:00	19620	300	26057.3	1.080	1	176/177	53.66	54.41	PDN	327.65
336	328.0	8/23/94 6:00	19680	370	26121.8	1.075	1	176/177	53.63	54.37	PDN	327.69
337	329.0	8/23/94 7:00	19740	440	26184.5	1.045	1	176/177	53.61	54.33	PDN	327.73
338	330.0	8/23/94 8:00	19800	500	26247.5	1.050	1	176/177	53.61	54.25	JTL	327.81
339	331.0	8/23/94 9:00	19860	570	26304.3	0.947	0.95	175/176	53.43	54.17	MS & JTL	327.89
340	332.0	8/23/94 10:00	19920	630	26362.1	0.963	0.9	177	53.63	54.2	MS & JTL	327.86
341	333.0	8/23/94 11:00	19980	715	26427.6	1.092	1.1	179	53.77	54.51	KRD	327.55
342	334.0	8/23/94 12:00	20040	775	26487.7	1.002	0.95	177	53.47	54.19	MS & JTL	327.87
343	335.0	8/23/94 13:00	20100	850	26551.8	1.068	1.01	179/180	53.71	54.47	MS & JTL	327.59
344	336.0	8/23/94 14:00	20160	925	26615.2	1.057	1.01	179	53.63	54.4	MS & JTL	327.66
345	337.0	8/23/94 15:00	20220	10	26673.3	0.968	0.9	177/178	53.39	54.12	KRD	327.94
346	338.0	8/23/94 16:01	20281	100	26739.5	1.085	1.25	179	53.94	54.74	AHB	327.32
347	339.0	8/23/94 17:00	20340	175	26798.9	1.007	0.9	174/175	53.53	54.38	AHB	327.68
348	340.0	8/23/94 18:00	20400	260	26864.5	1.093	1.15	177	53.71	54.48	AHB	327.58
349	341.1	8/23/94 19:03	20463	300	26932.2	1.075	1	177	53.63	54.43	AHB	327.63
350	342.1	8/23/94 20:08	20528	375	27001.1	1.060	1	177	53.6	54.38	AHB	327.68
351	343.0	8/23/94 21:00	20580	450	27054.1	1.019	1	177	53.57	54.37	AHB	327.69
352	344.0	8/23/94 22:00	20640	530	27114.2	1.002	1	177	53.58	54.36	AHB	327.7
353	345.0	8/23/94 23:00	20700	620	27179.3	1.085	1.15	178/179	53.71	54.5	AHB	327.56
354	346.0	8/24/94 0:00	20760	675	27243.3	1.067	1.05	177/178	53.67	54.41	PDH	327.65
355	347.0	8/24/94 1:00	20820	740	27304.1	1.013	1	177/178	53.51	54.3	PDH	327.76
356	348.0	8/24/94 2:00	20880	800	27361.2	0.952	0.9	179/180	53.55	54.47	PDH	327.59
357	349.0	8/24/94 3:00	20940	875	27425.6	1.073	1	179/180	53.73	54.56	PDH	327.5
358	350.0	8/24/94 4:00	21000	940	27490.4	1.080	1	179/180	53.76	54.59	PDH	327.47

A	A	B	C	D	E	F	G	H	I	J	K	L
1	Paducah Gaseous Diffusion Plant - Paducah, Kentucky											
2	DNAPL Solubilization Test											
3	Extraction Phase - Well MW-156											
4	August 9 - 25, 1994											
5												
6						Totalizer Average	Rotometer Rate	Pump	Hermit	Solinst	Measured	Water Level
7	Time	Date & Time	Time Since	Volume In	Totalizer	Extraction Rate	(gal/min)	Hertz	TOC DTW *	TOC DTW	By	Elevation
8	(hours)		Pumping Started	Discharge Tank	Total Flow	(gal/min)			(ft)	(ft)		(feet msl)
9			(min)	(gal)	(gal)							
10												
359	351.0	8/24/94 5:00	21060	1025	27554	1.060	1	179/180	53.67	54.5	PDH	327.56
360	352.0	8/24/94 6:00	21120	1090	27614.9	1.015	1	179/180	53.61	54.46	PDH	327.6
361	353.0	8/24/94 7:00	21180	1140	27673.8	0.982	1	179/180	53.61	54.4	PDH	327.66
362	355.0	8/24/94 9:00	21300	110	27803.1	1.077	1.25	179/180	54.14	54.98	JTL	327.08
363	356.1	8/24/94 10:06	21366	180	27868.8	0.995	0.99	174/175	53.63	54.47	MS & JTL	327.59
364	357.0	8/24/94 11:00	21420	250	27923.2	1.007	1	175/176	53.66	54.48	MS & JTL	327.58
365	358.0	8/24/94 12:00	21480	300	27986.2	1.050	0.98	175/176	53.64	54.46	KRD & JTL	327.6
366	359.0	8/24/94 13:00	21540	365	28045.1	0.982	1	175/176	53.62	54.45	KRD	327.61
367	360.0	8/24/94 14:00	21600	430	28102.8	0.962	0.98	175/176	53.52	54.36	MS & JTL	327.7
368	361.0	8/24/94 15:00	21660	495	28162.8	1.000	0.98	176/177	53.59	54.41	KRD	327.65
369	362.1	8/24/94 16:04	21724	560	28225.2	0.975	0.95	176/177	53.5	54.48	AHB	327.58
370	363.0	8/24/94 17:01	21781	650	28285.1	1.051	1	178/179	53.7	54.56	AHB	327.5
371	364.0	8/24/94 18:00	21840	720	28346.2	1.036	1	178/179	53.65	54.5	AHB	327.56
372	365.0	8/24/94 19:00	21900	770	28409	1.047	0.99	178/179	53.58	53.45	AHB	328.61
373	366.0	8/24/94 20:00	21960	850	28469.4	1.007	0.98	178/179	53.53	54.4	AHB	327.66
374	367.0	8/24/94 21:00	22020	910	28532.4	1.050	1	179/180	53.67	54.55	AHB	327.51
375	368.0	8/24/94 22:00	22080	1000	28594.6	1.037	1		53.64	54.53	AHB	327.53
376	369.0	8/24/94 23:00	22140	1060	28655.2	1.010	0.99		53.55	54.45	AHB	327.61
377	370.0	8/25/94 0:00	22200	1125	28714.3	0.985	0.99		53.49	54.36	RS & RP	327.7
378	371.0	8/25/94 1:00	22260	60	28772.8	0.975	0.99		53.51	54.38	RS & RP	327.68
379	372.0	8/25/94 2:00	22320	100	28837.3	1.075	1.25		53.73	54.6	RS & RP	327.46
380	373.0	8/25/94 3:00	22380	175	28893.5	0.937	0.99		53.54	54.42	RS & RP	327.64
381	374.0	8/25/94 4:00	22440	245	28951.2	0.962	0.9		53.62	54.54	RS & RP	327.52
382	375.0	8/25/94 5:00	22500	300	29015.2	1.067	1		53.71	54.62	RS & RP	327.44
383	376.0	8/25/94 6:00	22560	370	29075.2	1.000	1		53.7	54.6	RS & RP	327.46
384	377.0	8/25/94 7:00	22620	440	29136.7	1.025	1		53.67	54.6	RS & RP	327.46
385	378.0	8/25/94 8:00	22680	510	29198.4	1.028	1		53.69	54.59	KRD & JTL	327.47
386	379.0	8/25/94 9:00	22740	650	29258.7	1.005	0.99		53.66	54.56	KRD & JTL	327.5
387	380.0	8/25/94 10:00	22800	650	29292.4	0.562	0.3		52.04	52.97	KRD & JTL	329.09

A	A	B	C	D	E	F	G	H	I	J	K	L
1	Paducah Gaseous Diffusion Plant - Paducah, Kentucky											
2	DNAPL Solubilization Test											
3	Extraction Phase - Well MW-156											
4	August 9 - 25, 1994											
5												
6												
7	Time	Date & Time	Time Since	Volume In	Totalizer	Totalizer Average	Rotometer Rate	Pump	Hermit	Solinst	Measured	Water Level
8	(hours)		Pumping Started	Discharge Tank	Total Flow	Extraction Rate	(gal/min)	Hertz	TOC DTW *	TOC DTW	By	Elevation
9			(min)	(gal)	(gal)	(gal/min)			(ft)	(ft)		(feet msl)
10												
388	381.0	8/25/94 11:00	22860	650	29312.5	0.335	0.25		51.96	52.9	KRD & JTL	329.16
389												
390												
391	* TOC DTW - Top of Casing Depth to Water											
392												

Paducah Gaseous Diffusion Plant
DNAPL Solubilization Test

Water Level in Control Piezometer 109
During the Extraction Phase
August 9 - 25. 1994

Date	Time	Ground Water Elevation (feet, msl)
09-Aug-94	12:00 AM	331.607
09-Aug-94	01:00 AM	331.529
09-Aug-94	02:00 AM	331.591
09-Aug-94	03:00 AM	331.591
09-Aug-94	04:00 AM	331.619
09-Aug-94	05:00 AM	331.591
09-Aug-94	06:00 AM	331.591
09-Aug-94	07:00 AM	331.551
09-Aug-94	08:00 AM	331.529
09-Aug-94	09:00 AM	331.512
09-Aug-94	10:00 AM	331.5
09-Aug-94	11:00 AM	331.495
09-Aug-94	12:00 PM	331.5
09-Aug-94	01:00 PM	331.529
09-Aug-94	02:00 PM	331.54
09-Aug-94	03:00 PM	331.54
09-Aug-94	04:00 PM	331.557
09-Aug-94	05:00 PM	331.557
09-Aug-94	06:00 PM	331.545
09-Aug-94	07:00 PM	331.523
09-Aug-94	08:00 PM	331.495
09-Aug-94	09:00 PM	331.489
09-Aug-94	10:00 PM	331.489
09-Aug-94	11:00 PM	331.489
10-Aug-94	12:00 PM	331.495
10-Aug-94	01:00 AM	331.484
10-Aug-94	02:00 AM	331.489
10-Aug-94	03:00 AM	331.484
10-Aug-94	04:00 AM	331.478
10-Aug-94	05:00 AM	331.45
10-Aug-94	06:00 AM	331.444
10-Aug-94	07:00 AM	331.433
10-Aug-94	08:00 AM	331.433
10-Aug-94	09:00 AM	331.433
10-Aug-94	10:00 AM	331.444
10-Aug-94	11:00 AM	331.45
10-Aug-94	12:00 PM	331.455
10-Aug-94	01:00 PM	331.467
10-Aug-94	02:00 PM	331.489
10-Aug-94	03:00 PM	331.5
10-Aug-94	04:00 PM	331.512
10-Aug-94	05:00 PM	331.523
10-Aug-94	06:00 PM	331.529

Date	Time	Ground Water Elevation (feet, msl)
10-Aug-94	02:00 PM	331.489
10-Aug-94	03:00 PM	331.5
10-Aug-94	04:00 PM	331.512
10-Aug-94	05:00 PM	331.523
10-Aug-94	06:00 PM	331.529
10-Aug-94	07:00 PM	331.517
10-Aug-94	08:00 PM	331.495
10-Aug-94	09:00 PM	331.489
10-Aug-94	10:00 PM	331.489
10-Aug-94	11:00 PM	331.472
11-Aug-94	12:00 AM	331.472
11-Aug-94	01:00 AM	331.472
11-Aug-94	02:00 AM	331.472
11-Aug-94	03:00 AM	331.472
11-Aug-94	04:00 AM	331.472
11-Aug-94	05:00 AM	331.455
11-Aug-94	06:00 AM	331.444
11-Aug-94	07:00 AM	331.433
11-Aug-94	08:00 AM	331.433
11-Aug-94	09:00 AM	331.427
11-Aug-94	10:00 AM	331.422
11-Aug-94	11:00 AM	331.45
11-Aug-94	12:00 PM	331.455
11-Aug-94	01:00 PM	331.472
11-Aug-94	02:00 PM	331.39
11-Aug-94	03:00 PM	331.407
11-Aug-94	04:00 PM	331.407
11-Aug-94	05:00 PM	331.413
11-Aug-94	06:00 PM	331.413
11-Aug-94	07:00 PM	331.407
11-Aug-94	08:00 PM	331.39
11-Aug-94	09:00 PM	331.362
11-Aug-94	10:00 PM	331.356
11-Aug-94	11:00 PM	331.356
12-Aug-94	12:00 PM	331.351
12-Aug-94	01:00 AM	331.351
12-Aug-94	02:00 AM	331.351
12-Aug-94	03:00 AM	331.345
12-Aug-94	04:00 AM	331.339
12-Aug-94	05:00 AM	331.323
12-Aug-94	06:00 AM	331.317
12-Aug-94	07:00 AM	331.317
12-Aug-94	08:00 AM	331.323
12-Aug-94	09:00 AM	331.311
12-Aug-94	10:00 AM	331.306
12-Aug-94	11:00 AM	331.3
12-Aug-94	12:00 PM	331.311
12-Aug-94	01:00 PM	331.317
12-Aug-94	02:00 PM	331.345
12-Aug-94	03:00 PM	331.351
12-Aug-94	04:00 PM	331.356

Date	Time	Ground Water Elevation (feet, msl)
12-Aug-94	05:00 PM	331.356
12-Aug-94	06:00 PM	331.356
12-Aug-94	07:00 PM	331.345
12-Aug-94	08:00 PM	331.328
12-Aug-94	09:00 PM	331.306
12-Aug-94	10:00 PM	331.311
12-Aug-94	11:00 PM	331.306
13-Aug-94	12:00 PM	331.311
13-Aug-94	01:00 AM	331.311
13-Aug-94	02:00 AM	331.323
13-Aug-94	03:00 AM	331.328
13-Aug-94	04:00 AM	331.3
13-Aug-94	05:00 AM	331.294
13-Aug-94	06:00 AM	331.283
13-Aug-94	07:00 AM	331.272
13-Aug-94	08:00 AM	331.272
13-Aug-94	09:00 AM	331.294
13-Aug-94	10:00 AM	331.294
13-Aug-94	11:00 AM	331.311
13-Aug-94	12:00 PM	331.323
13-Aug-94	01:00 PM	331.334
13-Aug-94	02:00 PM	331.351
13-Aug-94	03:00 PM	331.373
13-Aug-94	04:00 PM	331.39
13-Aug-94	05:00 PM	331.39
13-Aug-94	06:00 PM	331.396
13-Aug-94	07:00 PM	331.396
13-Aug-94	08:00 PM	331.368
13-Aug-94	09:00 PM	331.356
13-Aug-94	10:00 PM	331.373
13-Aug-94	11:00 PM	331.385
14-Aug-94	12:00 AM	331.379
14-Aug-94	01:00 AM	331.385
14-Aug-94	02:00 AM	331.385
14-Aug-94	03:00 AM	331.379
14-Aug-94	04:00 AM	331.379
14-Aug-94	05:00 AM	331.368
14-Aug-94	06:00 AM	331.362
14-Aug-94	07:00 AM	331.339
14-Aug-94	08:00 AM	331.339
14-Aug-94	09:00 AM	331.328
14-Aug-94	10:00 AM	331.323
14-Aug-94	11:00 AM	331.323
14-Aug-94	12:00 PM	331.323
14-Aug-94	01:00 PM	331.328
14-Aug-94	02:00 PM	331.339
14-Aug-94	03:00 PM	331.373
14-Aug-94	04:00 PM	331.368
14-Aug-94	05:00 PM	331.345
14-Aug-94	06:00 PM	331.323
14-Aug-94	07:00 PM	331.311

Date	Time	Ground Water Elevation (feet, msl)
14-Aug-94	08:00 PM	331.283
14-Aug-94	09:00 PM	331.249
14-Aug-94	10:00 PM	331.232
14-Aug-94	11:00 PM	331.221
15-Aug-94	12:00 AM	331.221
15-Aug-94	01:00 AM	331.227
15-Aug-94	02:00 AM	331.227
15-Aug-94	03:00 AM	331.221
15-Aug-94	04:00 AM	331.21
15-Aug-94	05:00 AM	331.199
15-Aug-94	06:00 AM	331.182
15-Aug-94	07:00 AM	331.165
15-Aug-94	08:00 AM	331.17
15-Aug-94	09:00 AM	331.159
15-Aug-94	10:00 AM	331.159
15-Aug-94	11:00 AM	331.17
15-Aug-94	12:00 PM	331.187
15-Aug-94	01:00 PM	331.21
15-Aug-94	02:00 PM	331.232
15-Aug-94	03:00 PM	331.261
15-Aug-94	04:00 PM	331.261
15-Aug-94	05:00 PM	331.255
15-Aug-94	06:00 PM	331.249
15-Aug-94	07:00 PM	331.238
15-Aug-94	08:00 PM	331.227
15-Aug-94	09:00 PM	331.221
15-Aug-94	10:00 PM	331.216
15-Aug-94	11:00 PM	331.216
16-Aug-94	12:00 AM	331.227
16-Aug-94	01:00 AM	331.227
16-Aug-94	02:00 AM	331.232
16-Aug-94	03:00 AM	331.232
16-Aug-94	04:00 AM	331.227
16-Aug-94	05:00 AM	331.21
16-Aug-94	06:00 AM	331.199
16-Aug-94	07:00 AM	331.187
16-Aug-94	08:00 AM	331.193
16-Aug-94	09:00 AM	331.193
16-Aug-94	10:00 AM	331.193
16-Aug-94	11:00 AM	331.204
16-Aug-94	12:00 PM	331.221
16-Aug-94	01:00 PM	331.244
16-Aug-94	02:00 PM	331.255
16-Aug-94	03:00 PM	331.272
16-Aug-94	04:00 PM	331.272
16-Aug-94	05:00 PM	331.278
16-Aug-94	06:00 PM	331.278
16-Aug-94	07:00 PM	331.266
16-Aug-94	08:00 PM	331.255
16-Aug-94	09:00 PM	331.244
16-Aug-94	10:00 PM	331.244

Date	Time	Ground Water Elevation (feet, msl)
16-Aug-94	11:00 PM	331.238
17-Aug-94	12:00 AM	331.244
17-Aug-94	01:00 AM	331.249
17-Aug-94	02:00 AM	331.244
17-Aug-94	03:00 AM	331.238
17-Aug-94	04:00 AM	331.238
17-Aug-94	05:00 AM	331.216
17-Aug-94	06:00 AM	331.187
17-Aug-94	07:00 AM	331.159
17-Aug-94	08:00 AM	331.142
17-Aug-94	09:00 AM	331.159
17-Aug-94	10:00 AM	331.154
17-Aug-94	11:00 AM	331.159
17-Aug-94	12:00 PM	331.176
17-Aug-94	01:00 PM	331.182
17-Aug-94	02:00 PM	331.199
17-Aug-94	03:00 PM	331.199
17-Aug-94	04:00 PM	331.204
17-Aug-94	05:00 PM	331.21
17-Aug-94	06:00 PM	331.187
17-Aug-94	07:00 PM	331.165
17-Aug-94	08:00 PM	331.148
17-Aug-94	09:00 PM	331.137
17-Aug-94	10:00 PM	331.125
17-Aug-94	11:00 PM	331.125
18-Aug-94	12:00 AM	331.12
18-Aug-94	01:00 AM	331.137
18-Aug-94	02:00 AM	331.131
18-Aug-94	03:00 AM	331.125
18-Aug-94	04:00 AM	331.114
18-Aug-94	05:00 AM	331.08
18-Aug-94	06:00 AM	331.063
18-Aug-94	07:00 AM	331.047
18-Aug-94	08:00 AM	331.052
18-Aug-94	09:00 AM	331.047
18-Aug-94	10:00 AM	331.058
18-Aug-94	11:00 AM	331.069
18-Aug-94	12:00 PM	331.086
18-Aug-94	01:00 PM	331.086
18-Aug-94	02:00 PM	331.114
18-Aug-94	03:00 PM	331.131
18-Aug-94	04:00 PM	331.142
18-Aug-94	05:00 PM	331.148
18-Aug-94	06:00 PM	331.142
18-Aug-94	07:00 PM	331.131
18-Aug-94	08:00 PM	331.114
18-Aug-94	09:00 PM	331.103
18-Aug-94	10:00 PM	331.097
18-Aug-94	11:00 PM	331.097
19-Aug-94	12:00 PM	331.092
19-Aug-94	01:00 AM	331.097

Date	Time	Ground Water Elevation (feet, msl)
19-Aug-94	02:00 AM	331.097
19-Aug-94	03:00 AM	331.097
19-Aug-94	04:00 AM	331.086
19-Aug-94	05:00 AM	331.075
19-Aug-94	06:00 AM	331.058
19-Aug-94	07:00 AM	331.047
19-Aug-94	08:00 AM	331.063
19-Aug-94	09:00 AM	331.063
19-Aug-94	10:00 AM	331.069
19-Aug-94	11:00 AM	331.086
19-Aug-94	12:00 PM	331.097
19-Aug-94	01:00 PM	331.097
19-Aug-94	02:00 PM	331.12
19-Aug-94	03:00 PM	331.159
19-Aug-94	04:00 PM	331.193
19-Aug-94	05:00 PM	331.182
19-Aug-94	06:00 PM	331.159
19-Aug-94	07:00 PM	331.154
19-Aug-94	08:00 PM	331.148
19-Aug-94	09:00 PM	331.148
19-Aug-94	10:00 PM	331.148
19-Aug-94	11:00 PM	331.154
20-Aug-94	12:00 PM	331.148
20-Aug-94	01:00 AM	331.159
20-Aug-94	02:00 AM	331.17
20-Aug-94	03:00 AM	331.17
20-Aug-94	04:00 AM	331.17
20-Aug-94	05:00 AM	331.159
20-Aug-94	06:00 AM	331.142
20-Aug-94	07:00 AM	331.114
20-Aug-94	08:00 AM	331.12
20-Aug-94	09:00 AM	331.103
20-Aug-94	10:00 AM	331.125
20-Aug-94	11:00 AM	331.131
20-Aug-94	12:00 PM	331.131
20-Aug-94	01:00 PM	331.17
20-Aug-94	02:00 PM	331.154
20-Aug-94	03:00 PM	331.17
20-Aug-94	04:00 PM	331.165
20-Aug-94	05:00 PM	331.17
20-Aug-94	06:00 PM	331.17
20-Aug-94	07:00 PM	331.165
20-Aug-94	08:00 PM	331.142
20-Aug-94	09:00 PM	331.125
20-Aug-94	10:00 PM	331.12
20-Aug-94	11:00 PM	331.109
21-Aug-94	12:00 PM	331.097
21-Aug-94	01:00 AM	331.103
21-Aug-94	02:00 AM	331.165
21-Aug-94	03:00 AM	331.159
21-Aug-94	04:00 AM	331.125

Date	Time	Ground Water Elevation (feet, msl)
21-Aug-94	05:00 AM	331.086
21-Aug-94	06:00 AM	331.047
21-Aug-94	07:00 AM	331.013
21-Aug-94	08:00 AM	331.002
21-Aug-94	09:00 AM	330.945
21-Aug-94	10:00 AM	330.894
21-Aug-94	11:00 AM	330.911
21-Aug-94	12:00 PM	330.934
21-Aug-94	01:00 PM	330.956
21-Aug-94	02:00 PM	330.985
21-Aug-94	03:00 PM	331.002
21-Aug-94	04:00 PM	331.002
21-Aug-94	05:00 PM	331.007
21-Aug-94	06:00 PM	331.002
21-Aug-94	07:00 PM	330.985
21-Aug-94	08:00 PM	330.968
21-Aug-94	09:00 PM	330.951
21-Aug-94	10:00 PM	330.945
21-Aug-94	11:00 PM	330.94
22-Aug-94	12:00 PM	330.94
22-Aug-94	01:00 AM	330.934
22-Aug-94	02:00 AM	330.923
22-Aug-94	03:00 AM	330.917
22-Aug-94	04:00 AM	330.894
22-Aug-94	05:00 AM	330.872
22-Aug-94	06:00 AM	330.838
22-Aug-94	07:00 AM	330.827
22-Aug-94	08:00 AM	330.821
22-Aug-94	09:00 AM	330.821
22-Aug-94	10:00 AM	330.816
22-Aug-94	11:00 AM	330.821
22-Aug-94	12:00 PM	330.844
22-Aug-94	01:00 PM	330.849
22-Aug-94	02:00 PM	330.855
22-Aug-94	03:00 PM	330.861
22-Aug-94	04:00 PM	330.855
22-Aug-94	05:00 PM	330.855
22-Aug-94	06:00 PM	330.861
22-Aug-94	07:00 PM	330.849
22-Aug-94	08:00 PM	330.821
22-Aug-94	09:00 PM	330.799
22-Aug-94	10:00 PM	330.787
22-Aug-94	11:00 PM	330.782
23-Aug-94	12:00 PM	330.771
23-Aug-94	01:00 AM	330.782
23-Aug-94	02:00 AM	330.771
23-Aug-94	03:00 AM	330.771
23-Aug-94	04:00 AM	330.754
23-Aug-94	05:00 AM	330.737
23-Aug-94	06:00 AM	330.709
23-Aug-94	07:00 AM	330.68

Date	Time	Ground Water Elevation (feet, msl)
23-Aug-94	08:00 AM	330.664
23-Aug-94	09:00 AM	330.664
23-Aug-94	10:00 AM	330.652
23-Aug-94	11:00 AM	330.664
23-Aug-94	12:00 PM	330.675
23-Aug-94	01:00 PM	330.669
23-Aug-94	02:00 PM	330.692
23-Aug-94	03:00 PM	330.697
23-Aug-94	04:00 PM	330.697
23-Aug-94	05:00 PM	330.692
23-Aug-94	06:00 PM	330.686
23-Aug-94	07:00 PM	330.68
23-Aug-94	08:00 PM	330.664
23-Aug-94	09:00 PM	330.652
23-Aug-94	10:00 PM	330.647
23-Aug-94	11:00 PM	330.647
24-Aug-94	12:00 PM	330.641
24-Aug-94	01:00 AM	330.635
24-Aug-94	02:00 AM	330.618
24-Aug-94	03:00 AM	330.607
24-Aug-94	04:00 AM	330.602
24-Aug-94	05:00 AM	330.59
24-Aug-94	06:00 AM	330.562
24-Aug-94	07:00 AM	330.545
24-Aug-94	08:00 AM	330.528
24-Aug-94	09:00 AM	330.517
24-Aug-94	10:00 AM	330.528
24-Aug-94	11:00 AM	330.551
24-Aug-94	12:00 PM	330.551
24-Aug-94	01:00 PM	330.585
24-Aug-94	02:00 PM	330.613
24-Aug-94	03:00 PM	330.664
24-Aug-94	04:00 PM	330.647
24-Aug-94	05:00 PM	330.635
24-Aug-94	06:00 PM	330.63
24-Aug-94	07:00 PM	330.618
24-Aug-94	08:00 PM	330.602
24-Aug-94	09:00 PM	330.579
24-Aug-94	10:00 PM	330.568
24-Aug-94	11:00 PM	330.568
25-Aug-94	12:00 PM	330.551
25-Aug-94	01:00 AM	330.54
25-Aug-94	02:00 AM	330.54
25-Aug-94	03:00 AM	330.54
25-Aug-94	04:00 AM	330.534
25-Aug-94	05:00 AM	330.511
25-Aug-94	06:00 AM	330.495
25-Aug-94	07:00 AM	330.483
25-Aug-94	08:00 AM	330.478
25-Aug-94	09:00 AM	330.489
25-Aug-94	10:00 AM	330.5

Date	Time	Ground Water Elevation (feet, msl)
25-Aug-94	11:00 AM	330.511
25-Aug-94	12:00 PM	330.523
25-Aug-94	01:00 PM	330.528
25-Aug-94	02:00 PM	330.557
25-Aug-94	03:00 PM	330.562
25-Aug-94	04:00 PM	330.579
25-Aug-94	05:00 PM	330.585
25-Aug-94	06:00 PM	330.585
25-Aug-94	07:00 PM	330.585
25-Aug-94	08:00 PM	330.573
25-Aug-94	09:00 PM	330.562
25-Aug-94	10:00 PM	330.562

Appendix D

MW-156
Gas Chromatograph Data

8-4-94 MW156

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0					
150	13350	13568		13459	149
371	21339	21110		21225	389
1315	46096	52493	50981	49857	1274
1947	70198	74570		72384	1971

Regression Output:

Constant		8653
Std Err of Y Est		1155
R Squared		0.999
No. of Observations		4
Degrees of Freedom		2
X Coefficient(s)	32.33	
Std Err of Coef.	0.796	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
1	19971	20164		20068	353
4	22198	19141	20183	20507	367
5	19982			19982	350
7	17900	22200	17107	19069	322
8	19090	18158		18624	308
10	20799			20799	376
11	22002	18706	19028	19912	348
12	18733			18733	312
13	21175			21175	387
14	18338			18338	300
15	20997			20997	382
16	18356			18356	300
17	21428	19156	19887	20157	356
18	19232			19232	327
19	22646	20008		21327	392
20	18105	22421		20263	359

8-10-94 MW156

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0					
0.9	49.1	45.5		47	1
3.3	402.9	432.6		418	3
15.0	2301.7	2299.6		2301	15

Regression Output:

Constant		-101.12
Std Err of Y Est		12.0214
R Squared		0.99995
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	160	
Std Err of Coef.	1.126	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
40	too small			0	< 1
41	42.2			42	1
43	114			114	1
44	198.8	221.5	240	220	2
45	382			382	3
46	460.7			461	4
48	561			561	4
49	729			729	5
50	826			826	6
51	902			902	6
52	1002			1002	7
53	1076			1076	7
54	1185			1185	8
55	1192			1192	8
56	1344			1344	9
57	1628			1628	11
58	1706			1706	11
59	1271	1406	1323	1333	9
61	1780			1780	12
62	1655			1655	11
63	1623			1623	11
64	1659.8			1660	11
65	1782			1782	12
66	1689			1689	11
67	1874			1874	12
68	1763			1763	12
70	1664			1664	11

8-11-94 MW156

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0					
0.9	141	141.8		141	1
3.3	579.3	574.7		577	3
15.0	2435	2389.8		2412	15

Regression Output:

Constant		23.3665
Std Err of Y Est		35.4041
R Squared		0.99957
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	159.6	
Std Err of Coef.	3.315	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
70	2215	2315	2167	2232	14
71	2410			2410	15
72	2329			2329	14
73	2398			2398	15
76	2438			2438	15
77	2470			2470	15

8-11-94 MW156

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0.0					
15.0	2050	2066		2058	10
59.2	5370	5362		5366	66
150.0	10135	10121		10128	148

Regression Output:

Constant		1464.85
Std Err of Y Est		533.157
R Squared		0.99136
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	58.69	
Std Err of Coef.	5.477	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
78	2632			2632	20
79	2552			2552	19
80	2878			2878	24
81	2888			2888	24
82	3069			3069	27
83	2972			2972	26
84	3169			3169	29
86	3091			3091	28
87	3118			3118	28
88	3142	3222	3168	3177	29
89	3082			3082	28
90	3133			3133	28
91	3297			3297	31
92	3334			3334	32
93	3156			3156	29
95	3407			3407	33

8-12-94 MW156

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0.0					
15.0	2311	2411		2361	9
59.2	5622	5732		5677	67
150.0	10423	10056		10240	147

Regression Output:

Constant		1821
Std Err of Y Est		589.8
R Squared		0.989
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	57.15	
Std Err of Coef.	6.059	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
93	4078			4078	39
95	4020			4020	38
96	4261			4261	43
98	4323			4323	44
100	4185			4185	41
102	4300			4300	43
107	4790	4772	4539	4700	50
109	4858			4858	53
110	5072			5072	57

8-12-94 MW156

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0.0					
15.0	2312	2165		2239	12
59.2	5160	5149.7		5155	63
150.0	10329	9785		10057	149

Regression Output:

Constant		1532
Std Err of Y Est		285.5
R Squared		0.997
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	57.33	
Std Err of Coef.	2.933	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
112	4675			4675	55
114	4614			4614	54
116	4998			4998	60
118	5151	5080	5215	5149	63
120	5280			5280	65
122	5727	5490		5609	71

8-13-94 MW156

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0.0					
15.0	2426	2463		2445	12
59.2	6279.5	6078		6179	64
150.0	12294	12160		12227	148

Regression Output:		
Constant		1600
Std Err of Y Est		425.5
R Squared		0.996
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	71.59	
Std Err of Coef.	4.372	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
124	5262			5262	51
127	5945	5778	5985	5903	60
129	6017			6017	62
131	6232			6232	65
133	6288			6288	65
135	6420			6420	67
138	6944			6944	75
140	6819			6819	73
142	6568			6568	69

8-13-94 MW-156

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0.0					
0.88	149	168	166	161	0.7
3.3	621	609		615	3.5
15.0	2424	2426	2463	2438	15.0

Regression Output:

Constant		51.4455
Std Err of Y Est		48.709
R Squared		0.99918
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	159.5	
Std Err of Coef.	4.561	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
24	48			48	< 1
25	no TCE peak			0	< 1
30	no TCE peak			0	< 1
32	no TCE peak			0	< 1
35	no TCE peak			0	< 1
39	no TCE peak			0	< 1

8-14-94 MW156

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Area 4	Area 5	Avg. Area	Fit Conc (mg/L)
0.0							
59.2	4181	3823	3847	4095	4441	4077	50
150.0	7751	7432				7592	163
371.0	14024	13935				13980	367

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
143	4115			4115	51
144	5009			5009	80
145	4520			4520	64
147	4580			4580	66
149	4738			4738	71
150	5053			5053	81
153	5066	5227	5242	5178	85
154	5724			5724	103
158	5749			5749	104
160	5653			5653	101

Regression Output:

Constant		2510
Std Err of Y Est		500.5
R Squared		0.995
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	31.23	
Std Err of Coef.	2.207	

8-20-94 MW156

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0.0					
72.2	6224	6163		6194	59
135.0	10566	10050	10364	10327	150
617.0	30920	31548		31234	615

Regression Output:

Constant		3560
Std Err of Y Est		930.3
R Squared		0.998
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	44.98	
Std Err of Coef.	2.207	

Sample Numbe.	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
163	10788	10719		10754	160
164	10670			10670	158
166	10507			10507	154
167	12871			12871	207
169	12948			12948	209
171	12376			12376	196
174	13359			13359	218
176	13203			13203	214
178	13905			13905	230
180	14355	14561	14964	14627	246
182	13660			13660	225
184	14801			14801	250
185	14800			14800	250
187	17256			17256	304
188	15353			15353	262
190	16077			16077	278
192	16213			16213	281
193	15488			15488	265

8-23-94 MW156

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0.0					
135.0	8337	8094	8288	8240	126
371.0	18581	19583		19082	389
617.0	28459	27807		28133	608

Regression Output:

Constant		3047.1
Std Err of Y Est		899.74
R Squared		0.9959
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	41.24	
Std Err of Coef.	2.64	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
187	11138			11138	196
190	11354	10705		11030	194
193	11922			11922	215
195	12013	12072		12043	218
196	11574	11701	11729	11668	209
198	12405			12405	227
204	13301			13301	249
211	13989			13989	265
212	13785			13785	260
214	13604			13604	256
219	14381			14381	275
220	12902	13428	12420	12917	239
222	13828			13828	261
225	14404			14404	275
227	13493			13493	253

8-25-94 MW156

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0.0					
135.0	19164	20595	20189	19983	119
371.0	47887	51320	51211	50139	402
617.0	72325	70523		71424	602

Regression Output:

Constant		7285
Std Err of Y Est		4057
R Squared		0.988
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	106.6	
Std Err of Coef.	11.9	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
243	42081	41287		41684	323
246	36623	37410		37017	279
248	37962	34295	39028	37095	280
249	35859	38887		37373	282
251	40717	43506		42112	327

8-25-94 MW156

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0.0					
72.2	15125	15244		15185	57
135.0	23292	24188		23740	140
617.0	74796	74744		74770	639
1102.0	121521	120233		120877	1090

Regression Output:

Constant		9383
Std Err of Y Est		2179
R Squared		0.999
No. of Observations		4
Degrees of Freedom		2
X Coefficient(s)	102.3	
Std Err of Coef.	2.621	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
220	44341	43655		43998	338
222	44617			44617	344
224	41651			41651	315
227	40239			40239	302
230	43768	42253		43011	329
233	41354			41354	313
236	39361			39361	293
238	42625			42625	325
240	39537	40389		39963	299
244	39772	43585	40651	41336	312
253	39456	41907	42505	41289	312

8-15-94 MW156 DCE Concentration Measurements

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0.00				0	-0.09
0.46	277	379	368.5	342	0.55
30.40	16263	16566		16415	30.40

Regression Output:

Constant		46.5505
Std Err of Y Est		66.3439
R Squared		0.99997
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	538.4	
Std Err of Coef.	2.693	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Approx. Conc. (mg/L)
17	103	302		203	0.3
50	845	765	556	722	1.3
81	284			284	0.4
117	175			175	0.2
148	356	176		266	0.4
165	390			390	0.6
170	323	411	412	382	0.6

Sample Numbe	Day of Month	Hour of Day	Time Since Extraction Begun (days)	Approximate DCE Concentration Measurement (mg/L)
17	3	23.5	-5.60	0.3
50	9	22	0.33	1.3
81	11	4	1.58	0.4
117	12	13	2.96	0.2
148	13	17	4.13	0.4
165	14	20	5.25	0.6
170	15	11	5.88	0.6

Appendix E

Calibration, Precision, and Regression Statistics for Field Surfactant Analyses

Surfactant Concentration Calibration Curves

8-12-94

Stand Conc (% by wt)	ABS	Fit Conc (% by wt)
0.000%	-0.008	-0.000%
0.015%	0.079	0.013%
0.038%	0.249	0.040%
0.112%	0.698	0.111%

Regression Output:		
Constant		-0.0062
Std Err of Y Est		0.01174
R Squared		0.99907
No. of Observations		4
Degrees of Freedom		2
X Coefficient(s)	631.935	
Std Err of Coef.	13.6351	

8-13-94

Stand Conc (% by wt)	ABS	Fit Conc (% by wt)
0.000%	-0.006	-0.000%
0.015%	0.085	0.014%
0.038%	0.254	0.040%
0.112%	0.708	0.111%

Regression Output:		
Constant		-0.0029
Std Err of Y Est		0.01094
R Squared		0.99921
No. of Observations		4
Degrees of Freedom		2
X Coefficient(s)	638.017	
Std Err of Coef.	12.7042	

8-14-94

Stand Conc (% by wt)	ABS	Fit Conc (% by wt)
0.000%	-0.009	-0.001%
0.015%	0.084	0.014%
0.038%	0.257	0.040%
0.112%	0.720	0.111%

Regression Output:		
Constant		-0.0057
Std Err of Y Est		0.01147
R Squared		0.99916
No. of Observations		4
Degrees of Freedom		2
X Coefficient(s)	651.367	
Std Err of Coef.	13.3182	

8-21-94

Stand Conc (% by wt)	ABS	Fit Conc (% by wt)
0.000%	-0.004	-0.000%
0.009%	0.052	0.008%
0.015%	0.087	0.014%
0.038%	0.260	0.041%
0.112%	0.718	0.111%

Regression Output:		
Constant		-0.0022
Std Err of Y Est		0.00999
R Squared		0.99913
No. of Observations		5
Degrees of Freedom		3
X Coefficient(s)	646.676	
Std Err of Coef.	10.9979	

Precision Calculations

Field Surfactant Triplicates

Sample Number	Conc. (% by wt)	Conc. (% by wt)	Conc. (% by wt)	Sample Standard Deviation (% by wt)	Sample Mean Conc. (% by wt)	Student t 95% Confidence Interval +/- (% by wt)	+/- (% of mean)
44	1.050%	1.020%	1.050%	0.017%	1.040%	0.043%	4.1%
70	0.550%	0.570%	0.560%	0.010%	0.560%	0.025%	4.4%
172	0.005%	0.006%	0.007%	0.001%	0.006%	0.002%	41.4%

Appendix F

MW-155
Gas Chromatograph Data

8-6-94 MW-155

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0.0					
0.88	156.4	159.4		158	0.8
3.3	582.8	573.7		578	3.4
15.0	2338	2442		2390	15.0

Regression Output:

Constant		37.941
Std Err of Y Est		28.852
R Squared		0.9997
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	157.1	
Std Err of Coef.	2.702	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
2	259			259	1.4
9	78			78	< 1
26	59	82	74.3	72	< 1

8-7-94 MW-155

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0.0					
0.88	53.3	55.8		55	1.1
3.3	309			309	3.0
15.0	1907.7			1908	15.0

Regression Output:

Constant		-92.95
Std Err of Y Est		48.214
R Squared		0.9988
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	133	
Std Err of Coef.	4.515	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
28	90.2			90	1.4
29	16.4			16	< 1

8-8-94 MW-155

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0.0					
0.88	53.6	66	64.3	61	0.8
3.3	245.5	242		244	3.5
15.0	1024	1016.5		1020	15.0

Regression Output:

Constant		10.706
Std Err of Y Est		13.815
R Squared		0.9996
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	67.42	
Std Err of Coef.	1.294	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
33	45			45	< 1
34	46			46	< 1

8-9-94 MW-155

Stand. Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0.0					
0.88	52.5	56.8		55	0.8
3.3	308	322.8		315	3.4
15.0	1492	1465		1479	15.0

Regression Output:

Constant		-25.62
Std Err of Y Est		12.763
R Squared		0.9999
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	100.4	
Std Err of Coef.	1.195	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
36	46.7			47	< 1
38	too low for integration				< 1

8-10-94 MW-155

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0					
0.9	49.1	45.5		47	1
3.3	402.9	432.6		418	3
15.0	2301.7	2299.6		2301	15

Regression Output:

Constant		-101.12
Std Err of Y Est		12.0214
R Squared		0.99995
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	160	
Std Err of Coef.	1.126	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
42	92.6			93	1.2
60	127			127	1.4
69	125			125	1.4

8-11-94 MW-155

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Area 4	Area 5	Avg. Area	Fit Conc (mg/L)
0.0							
0.88	124	106				115	0.8
3.3	442	499	499	454		474	3.4
15.0	1987	2050	2066			2034	15.0

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
85	154			154	1.1
94	171			171	1.2

Regression Output:

Constant		10.3556
Std Err of Y Est		22.5574
R Squared		0.99976
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	135.1	
Std Err of Coef.	2.112	

8-12-94 MW-155

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0.0					
0.88	52	61	61.3	58	0.8
3.3	370.5	382		376	3.4
15.0	1871	1829		1850	15.0

Regression Output:

Constant		-47.982
Std Err of Y Est		8.42754
R Squared		0.99996
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	126.6	
Std Err of Coef.	0.789	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
111	115			115	1.3

8-13-94 MW-155

Stand Conc (mg/L)	Area 1	Area 2	Area 3	Avg. Area	Fit Conc (mg/L)
0.0					
0.88	149	168	166	161	0.7
3.3	621	609		615	3.5
15.0	2424	2426	2463	2438	15.0

Regression Output:

Constant		51.4455
Std Err of Y Est		48.709
R Squared		0.99918
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	159.5	
Std Err of Coef.	4.561	

Sample Numbe	Area 1	Area 2	Area 3	Avg. Area	Conc. (mg/L)
121	169			169	< 1
137	148			148	< 1
146	164			164	< 1

8-20-94 MW-155

Logarithmic Regression

Stand Conc (mg/L)	Log Stand Conc (mg/L)	Area 1	Area 2	Area 3	Log Avg. Area	Fit Conc (mg/L)
0.0						
0.92	-0.036	23264	24629		4.38	0.9
1.9	0.279	35506	35593		4.55	2.0
4.9	0.690	53364	53393		4.73	4.6
0.88	-0.056	24191	23754		4.38	0.9
3.3	0.519	46485	46341		4.67	3.5

Regression Output:

Constant		4.406
Std Err of Y Est		0.012
R Squared		0.996
No. of Observations		5
Degrees of Freedom		3
X Coefficient(s)	0.484	
Std Err of Coef.	0.018	

Sample Numbe	Area 1	Area 2	Area 3	Log Avg. Area	Conc. (mg/L)
34	30171			4.48	1.4
36	26185			4.42	1.1
38	28510			4.45	1.3
42	28678			4.46	1.3
60	29514			4.47	1.4
69	29643			4.47	1.4
85	29550			4.47	1.4
94	30200			4.48	1.4
111	30410			4.48	1.4
121	27538			4.44	1.2
137	28833			4.46	1.3
146	30540			4.48	1.5
157	30458			4.48	1.4
162	30547			4.48	1.5
168	29869			4.48	1.4
173	30126			4.48	1.4
179	30717			4.49	1.5
183	30932			4.49	1.5
186	30857			4.49	1.5
191	29087			4.46	1.3
194	32621			4.51	1.7
199	32242			4.51	1.6
202	32579			4.51	1.7

8-21-94 MW-155

Logarithmic Regression

Stand Conc (mg/L)	Log Stand Conc (mg/L)	Area 1	Area 2	Area 3	Log Avg. Area	Fit Conc (mg/L)
0.0						
0.92	-0.036	21833	22059		4.34	0.9
1.9	0.279	32145	31460		4.50	2.0
4.9	0.690	50167	48629	48866	4.69	4.8

Regression Output:

Constant		4.362
Std Err of Y Est		0.007
R Squared		0.999
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	0.482	
Std Err of Coef.	0.014	

Sample Numbe	Area 1	Area 2	Area 3	Log Avg. Area	Conc. (mg/L)
28	27588			4.44	1.5
29	27198			4.43	1.4
33	27744			4.44	1.5
34	27623			4.44	1.5
207	28101			4.45	1.5
210	28847			4.46	1.6
215	28723			4.46	1.6
218	29968			4.48	1.7

8-25-94 MW-155

Logarithmic Regression

Stand Conc (mg/L)	Log Stand Conc (mg/L)	Area 1	Area 2	Area 3	Log Avg. Area	Fit Conc (mg/L)
0.0						
0.92	-0.036	25412	22760	23769	4.38	0.9
1.9	0.279	32802	34873	34356	4.53	1.9
4.9	0.690	51823	51451		4.71	4.8

Regression Output:

Constant		4.399
Std Err of Y Est		0.006
R Squared		0.999
No. of Observations		3
Degrees of Freedom		1
X Coefficient(s)	0.458	
Std Err of Coef.	0.012	

Sample Numbe	Area 1	Area 2	Area 3	Log Avg. Area	Conc. (mg/L)
223	30569			4.49	1.5
226	32761			4.52	1.8
231	30967			4.49	1.6
234	31332			4.50	1.6
239	31774			4.50	1.7
241	32505			4.51	1.8
247	31206			4.49	1.6
250	32102			4.51	1.7
252	36159	34144	37297	4.55	2.2

Phase II: Solubilization Test and Partitioning Interwell Tracer Tests

Acknowledgment

INTERA Inc. is grateful to Mr. John Sheppard and the personnel of the Portsmouth Gaseous Diffusion Plant for their support and hospitality during the course of this project. Field work could not have been completed without the contributions of Mr. Frank Anderson, Mr. Tullus Crawford and Mr. Tom Houk of Lockheed Martin Energy Systems and Ms. Lynn Kantner of DOE on issues of waste-water treatment, permitting, and coordination of site personnel.

Research at the Portsmouth Gaseous Diffusion Plant facilities is approved when the research offers specific technical applicability toward the remediation of the site.

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Acronyms and Abbreviations

AMSL	above mean sea level
BGS	below ground surface
BTOC	below top of casing
C	Centigrade
cm	centimeters
cm^3	cubic centimeters
cm/s	centimeters per second
COC	Chain of Custody
CRZ	Contamination Reduction Zone
DNAPL	Dense Non-Aqueous-Phase Liquid
DO	dissolved oxygen
DOE	U.S. Department of Energy
E_h	Measured platinum electrode redox potential
EPA	U.S. Environmental Protection Agency
F	Fahrenheit
g	gram
gpm	gallons per minute
GC	Gas Chromatogram
IPA	isopropyl alcohol
KCl	Potassium Chloride
kg	kilogram
K_i	partitioning coefficient
L	liter
LMES	Lockheed Martin Energy Systems
l/s	liters per second
m	meter
mg	milligram
ml	milliliter
mrem	millirem
μS/cm	micro Siemens per centimeter (specific conductance)
NAPL	Non-Aqueous-Phase Liquid
PCBs	Polychlorinated biphenyls
PCE	perchloroethylene, tetrachloroethene
PGDP	Paducah Gaseous Diffusion Plant
pH	negative log of the hydrogen ion activity
PID	photo ionization detector
PITT	Partitioning Interwell Tracer Test
PORTS	Portsmouth Gaseous Diffusion Plant
PPE	personal protective equipment
ppm	parts per million
PVC	polyvinyl chloride
R_f	retardation factor
SEAR	Surfactant Enhanced Aquifer Remediation
S_N	average DNAPL saturation
SUNY	State University of New York at Buffalo
SWMU	Solid Waste Management Unit
TCA	1, 1, 1,-trichloroethane
TCE	trichloroethene
TSCA	Toxic Substances Control Act
UT	University of Texas at Austin
VOC	volatile organic compounds
Ω^{-1}	Specific Conductance

EXECUTIVE SUMMARY

The contamination of alluvial aquifers by dense, non-aqueous phase liquids (DNAPLS), such as trichloroethene (TCE) and other toxic chlorinated hydrocarbons, has caused well closure throughout the USA. In the western USA whole alluvial basins have become contaminated with TCE and other chlorinated solvents, while in the east numerous hazardous waste sites have contaminated nearby municipal well fields with TCE and other solvents. Alluvial (i.e., stream-deposited) materials underlie many DOE facilities, e.g., Hanford, Savannah River and Lawrence Livermore National Labs, and have frequently become contaminated with DNAPLS used for metal-surface cleaning by vapor degreasing. Because of concerns with the potentially harmful effects of drinking dissolved chlorinated hydrocarbons or with inhaling their vapors, these compounds are the principal contaminants of concern at most hazardous waste sites. Unfortunately, as was stated by Mackay and Cherry (1989) of the University of Waterloo "...very little success has been achieved in even locating the subsurface (DNAPL) sources, let alone removing them."

Surfactant-enhanced aquifer remediation (SEAR) has been acknowledged to be a promising, innovative technology for the removal of DNAPLS because of field tests conducted at Laramie, Wyoming in 1988-9 by Surtek and CH2MHill (Pitts et al., 1993) and at Borden, Ontario in 1991-2 by the State University of New York at Buffalo or SUNY (Fountain et al., 1996). The surfactant solutions which were injected into these two alluvial aquifers removed 84% of the creosote and 75% of the perchloroethylene, respectively, by the solubilization of the DNAPLS, i.e., by enhancing their effective solubility in the ground water. Both tests were conducted within sheet-pile walls, which hydraulically isolated the contaminated parts of the alluvial aquifers. During the summer of 1996, INTERA and the University of Texas at Austin (UT) completed a very successful demonstration of SEAR at Hill Air Force Base in Utah in which 99% of the TCE DNAPL in a shallow alluvial aquifer was removed in the course of two short surfactant floods and without sheet-pile walls providing hydraulic isolation. It is noteworthy that the spatial distribution and total volume of the DNAPL were well understood in the Borden and Hill field tests. As the quote of Mackay and Cherry (1989) indicates, this knowledge is particularly unusual, in fact unique, and contributed significantly to the success of these field tests.

In September 1996, one month after the Hill AFB surfactant flood, INTERA, UT and SUNY, in conjunction with DOE and Lockheed Martin Energy Systems, conducted a field test of SEAR at the Portsmouth Gaseous Diffusion Plant (PORTS) in southern Ohio. Like the Hill AFB site, the PORTS site was not hydraulically isolated by sheet-pile walls; however, unlike Hill, knowledge of the local hydrogeological conditions was not well developed. This inadequate knowledge of the DNAPL zone and its hydrogeological properties was to play a very negative role in the solubilization test. At both Hill AFB and at PORTS the team characterized the DNAPL zone in the alluvium by using an innovative tracer test which measured the volume and spatial distribution of DNAPL in the aquifers before and after the solubilization tests. The successful demonstration of these DNAPL-detection tests, known as partitioning interwell tracer tests or PITTs, allowed the team to assess the performance of each solubilization test by direct measurement of the average residual DNAPL saturation both before and after each solubilization test.

The solubilization test at PORTS was conducted in the Gallia alluvium beneath the now-inactive X701B waste disposal pond. This pond had received solvent waste from vapor degreasing and other industrial operations conducted nearby for approximately 30 years and had been identified by DOE as the source of the contamination of the alluvium which is hydraulically connected with Little Beaver Creek, approximately 500 m to the east. The Gallia alluvium is being pumped to remove as much dissolved-phase contamination as is possible, however there is evidently a significant volume, probably in excess of 40,000 L (10,000 gals), of a multicomponent DNAPL (i.e., TCE, PCBs and other chlorinated solvents) which will provide a continuing source of dissolved contamination for many hundreds of years to come unless the DNAPL source is removed. Because of the known occurrence of DNAPL at this site, Lockheed Martin Energy Systems arranged in 1995 for the INTERA/UT/SUNY team to relocate its field work from the Paducah Gaseous Diffusion Plant in Kentucky to the X701B area at PORTS in order to use well BW2G, which had a history of producing DNAPL from the Gallia.

Hydraulic testing of the Gallia alluvium conducted in March 1996, employing BW2G as the extraction well and 65G as the injection well, indicated that the sustainable injection and extraction rates for both the tracer and solubilization tests would be 0.2 L/s (3 gpm) and 0.3 L/s (5 gpm), respectively. The initial PITT, conducted in July 1996, indicated that there was approximately 15 liters (4 gallons) of DNAPL trapped by capillary forces in the basal gravel layer of the Gallia alluvium between two existing wells just west of the former X701B pond. Using this information and hydraulic data collected from the March pumping test, the solubilization test was designed to inject an aqueous surfactant solution containing 4% sodium dihexyl sulfosuccinate, 4% isopropyl alcohol and 0.2% electrolyte (NaCl and $CaCl_2$) for a period of 1½ days. The second PITT, conducted immediately following the solubilization test in late September, measured only 7.5 L of DNAPL remaining in the alluvium between the injection and extraction wells. This indicated that approximately 50% of the DNAPL had been removed by solubilization, however not all of the solubilized DNAPL was recovered at BW2G, the extraction well, because of hydraulic interferences recorded by pressure transducers placed throughout the site.

The difference between the DNAPL recovery at Hill AFB in August (99%) and at PORTS one month later (~50%), *by the same team,* reflects the significant differences in the detail of site characterization and in hydraulic control. At Hill AFB, the hydraulic and capillary properties of the site were well established prior to surfactant flooding. This was not the case at PORTS. In fact, at the end of the first PITT it became apparent that an extremely permeable paleochannel zone of the Gallia ran through the BW2G site and was hydraulically connected with two horizontal wells sited 150 m to the east. Speculation about such a paleochannel had existed at PORTS for some time and was confirmed by INTERA's field work. There can be no question that the paleochannel is critically important in controlling the spatial distribution and migration of DNAPL beneath the X701B site. However even with the horizontal wells inactive, there was considerable hydraulic interference with the injection-extraction operations during the solubilization test so that only about 20% of the DNAPL in the interwell swept zone was recovered at BW2G while the other 30% solubilized was not recovered at BW2G.

The lessons of these two examples of SEAR are clear:

- **Site Characterization:** It is unfortunate but undeniable that the traditional methods have failed to provide the information needed to characterize DNAPL-contaminated sites. Newer soil sampling methods, such as the use of a cone-penetrometer or Geoprobe™, cannot penetrate the basal gravel zones characteristic of fining-upward alluvial deposits which frequently control DNAPL migration, as at PORTS. Thus, it is necessary to employ the more expensive, but reliable hollow-stem auger technology to sample alluvial depositional systems and to install wells. Furthermore, to this date, the EPA-approved method of soil sample collection does not provide for sample preservation to prevent the volatilization of the contaminants of concern. Improper sample preservation can lead to data that provide underestimates of DNAPL contamination (including non-detects or false negatives) or errors in DNAPL compositional analysis. Finally, DNAPL zones can only be removed from alluvium if they are fully characterized using partitioning tracer tests in addition to modifications of these more standard methods. *A DNAPL site may be said to be fully characterized when the spatial distribution of residual DNAPL saturation has been mapped and the total volume of DNAPL is known within an error of 50%, i.e., similar to the uncertainty in the mean hydraulic conductivity of alluvium from hydraulic testing.*

- **Design:** Results of such characterization must be incorporated into a robust design model for solubilization using predictive, numerical simulation and laboratory experimentation. However, no amount of predictive simulation or laboratory experimentation can substitute for incomplete hydrogeologic characterization.

- **Hydraulic Control:** It is quite clear that the injection-extraction geometry for PITTs and SEAR should be a line drive of three injection and three extraction wells. A simple well pair cannot exert the required hydraulic control over the injected tracers or surfactants, particularly if there is any unexpected hydraulic disturbance to the flow field.

- **Wellfields:** The use of existing wells for injection and extraction, rather than the installation of specifically-designed wells was a false economy arising from the stipulation to do so in the DOE/INTERA contract. Existing wells are often poorly completed and, sometimes, require extensive rehabilitation. In DNAPL remediation studies such as this, it is essential that the remediation team supervise the drilling and coring of its own boreholes so that they can inspect the alluvial materials first hand, then preserve cores for analysis and finally install wells to their own specifications.

These conclusions may appear to Federal agencies as being costly, additional requirements for site characterization when it has become accepted that the characterization phase of environmental restoration at DOE and DOD facilities was complete. However, the widespread occurrence of DNAPL beneath Federal facilities was not anticipated when the programs of site characterization began in the 1980's, and such programs must continue if effective remedial measures of any kind are to be employed at DNAPL sites. Furthermore, the continuing costs of pump-and- treat operations, e.g., ~$500,000/yr per site and $30,000/gallon of DNAPL recovered (DNAPL Integrated Product Team, 1996) and risk-based cleanup goals are making DNAPL removal more attractive. Therefore, the operational costs of containing DNAPL contamination are draining environmental restoration budgets within the Federal Government without removing the source of the problem. The results from the Hill and PORTS demonstrations of PITTs and SEAR indicate how DNAPL sites might be characterized and remediated in the 21st century.

This report completes contract DE-AC21-92MC-29111. It complements the Phase I Final Topical Report which was submitted by INTERA in January 1995 and accepted by DOE. That report described the earlier work at the Paducah Gaseous Diffusion Plant in western Kentucky and surfactant screening studies by Prof. John Fountain at SUNY-Buffalo.

1.0 INTRODUCTION

Many DOE facilities are situated in areas of sand and gravel which have become polluted with dense, non-aqueous phase liquids or DNAPLS, such as chlorinated solvents, from the various industrial operations at these facilities. The presence of such DNAPLS in sand and gravel aquifers is now recognized as the principal factor in the failure of standard ground-water remediation methods, i.e., "pump-and-treat" operations, to decontaminate such systems (Mackay and Cherry, 1989).

The principal objective of this study, as stated in the Statement of Work for the contract (DE-AC21-92MC29111), is to demonstrate that multi-component DNAPLS can be readily solubilized and removed from sand and gravel aquifers by dilute surfactant solutions. The specific objectives of the contract are:

1. to identify dilute surfactants or blends of surfactants in the laboratory that will efficiently extract multi-component DNAPLS from sand and gravel aquifers by micellar solubilization (Phase 1);

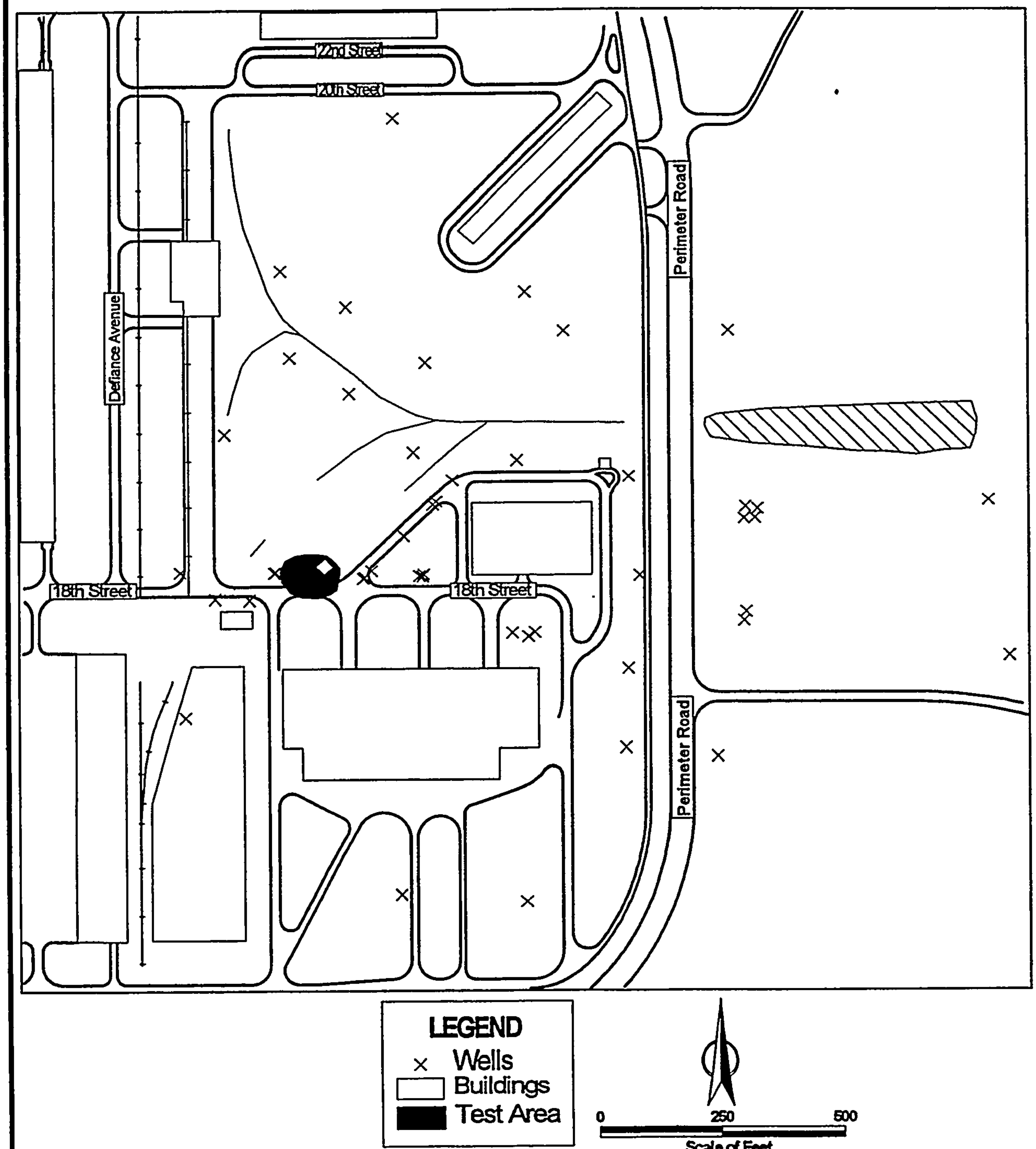
2. to test the efficacy of the identified surfactants or blends of surfactants to solubilize in situ perchloroethylene (PCE) and trichloroethene (TCE) DNAPLS by the injection and the subsequent extraction through an existing well or wells at a government-owned contaminated site (Phase 1); and

3. to demonstrate the full-scale operation of this remedial technology at a government-owned contaminated site using existing wells (Phase 2).

Specific objective number 1 has been completed and reported to DOE (INTERA, 1995). However, the results of the test referred to in specific objective number 2, conducted at Paducah Gaseous Diffusion Plant in 1994, were inconclusive. Following this first test, it was decided by DOE and INTERA to move the test site from Paducah due to difficulties with obtaining core samples of the sand and gravel aquifer containing the DNAPL, and with ascertaining the location of the DNAPL relative to the injection well. The field work at the PORTS facility, discussed in this report, was undertaken between December 1995 and September 1996.

The goal of the interwell DNAPL solubilization test (Butler et al., 1995) is to test the efficacy of a micellar-surfactant solution to solubilize the DNAPL in situ. The test should also demonstrate the ability of Surfactant-Enhanced Aquifer Remediation (SEAR) to enhance the efficiency of conventional pump-and-treat systems in the remediation of DNAPL contamination. The performance of the solubilization test was assessed using before-and-after partitioning interwell tracer tests (Jin et al., 1995).

The surfactant flood and supporting activities described herein were undertaken at the X-701B area at the Portsmouth Gaseous Diffusion Plant (PORTS) in southern Ohio, shown in Figure 1.1. The X-701B area at PORTS originally contained a holding pond which received liquid wastes, including chlorinated solvents, from industrial operations elsewhere on site. The X-701B area is underlain by



Site Map Showing the X-701B Area

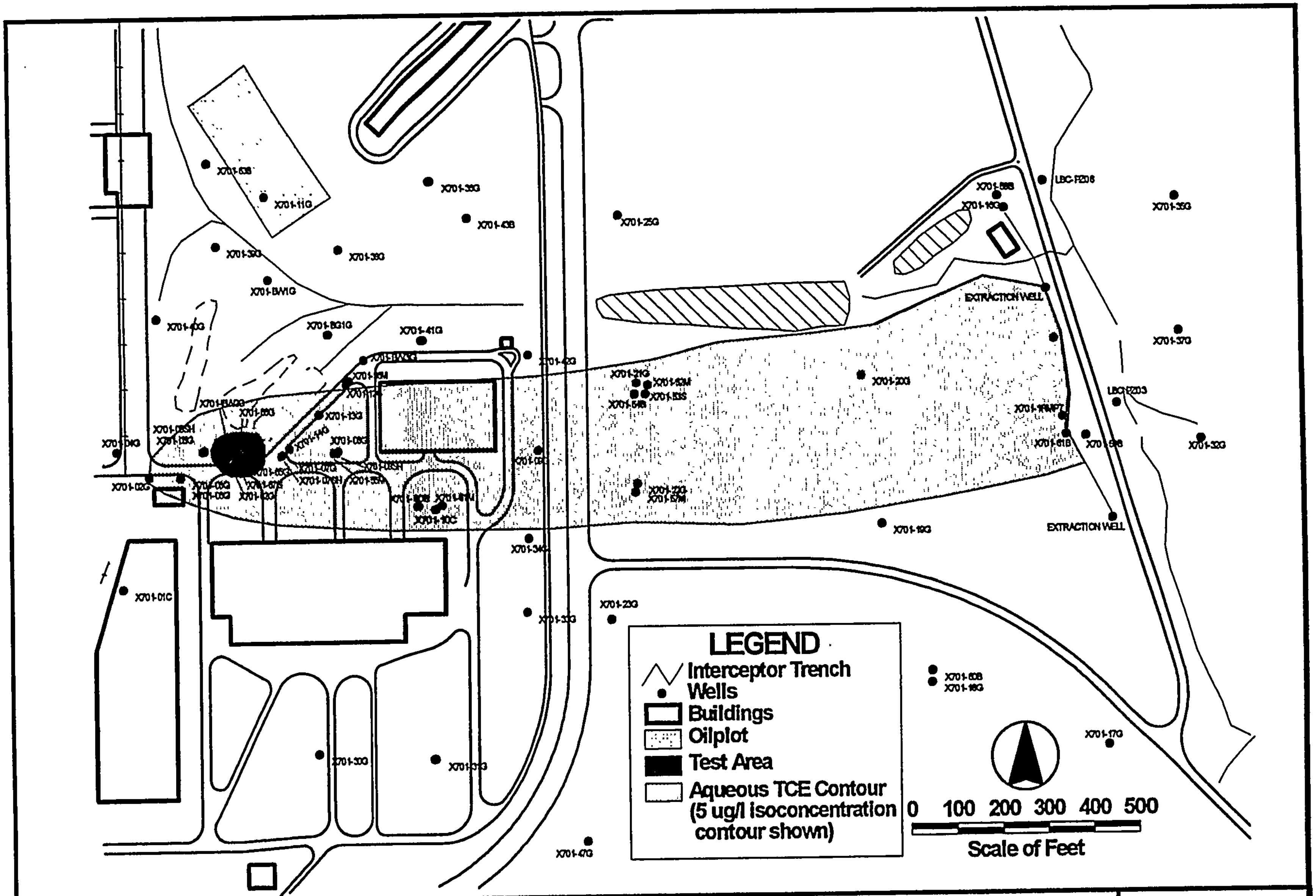
Figure 1.1

lacustrine silts and clays and by deeper alluvium which is contaminated with DNAPL comprised mainly of TCE.

The dissolution of this DNAPL by ground waters flowing through the Gallia has lead to the development of a long aqueous phase plume of TCE and other DNAPL components. The extent of aqueous TCE contamination during 1994 is shown in Figure 1.2. Recent measurements indicate that aqueous TCE concentrations at the perimeter fence have reached 800 mg/L.

The benefits of SEAR arise from the very high effective solubilities which can be obtained by using dilute surfactant solutions to solubilize DNAPL. Because of this enhanced solubilization, it is possible to accelerate the rate of DNAPL removal from the subsurface, which in turn reduces overall operations and maintenance costs for any particular pump-and-treat facility. A further advantage of SEAR is that the technology can be superimposed on an existing pump-and-treat system so that the infrastructure which is invested in the site can be used more efficiently.

This study begins with descriptions of the test area's historical usage and stratigraphy. A discussion of preparatory work follows and includes soil coring, aquifer testing, and laboratory studies done to select tracers and surfactants. Chapter 7 describes the development of the numerical model of the test area and test design work. Chapters 8 through 10 describe the PITTs and solubilization test. Summary and conclusions are given in Chapter 11. This report concludes with recommendations for future work presented in Chapter 12.



Extent of Aqueous TCE Contamination, 1994

Figure 1.2

2.0 WASTE DISPOSAL HISTORY

The area of study is the Solid Waste Management Unit (SWMU) identified as the X-701B Plume Area (X-701B), as shown in Figure 1.1. Area X-701B contained an unlined holding pond used to treat wastes from the X-700 Chemical Cleaning Building, X-705 Decontamination Building, and X-710 Laboratory Building from the mid-1950's to the late 1970's. The holding pond was used for solids settling and pH adjustment. Chlorinated solvents were used at the facilities listed above and have been identified as components of the DNAPL found in the sub-surface at X-701B. The DNAPL consists predominantly of TCE, although several other components were identified in a DNAPL sample collected from a well located 150 feet from the test area, i.e., PCBs, CFC-113, PCE, etc. which together comprise less than 10% of the DNAPL.

The source for the DNAPL in the immediate vicinity of well BW2G has been thought to be from leaks in the effluent discharge lines which drained to the X-701B holding pond, and from disposal into the holding pond. There are no historical records to indicate how much solvent waste was disposed. For the purpose of developing a numerical model of the X-701B area, SAIC (SAIC, 1995 and Beard and Anderson, 1996) estimated that 80,000 gallons of DNAPL could have been released over a 30-year period. The SAIC model assumed that both the holding pond and the process effluent piping around well BW2G were source areas.

3.0 REGIONAL HYDROSTRATIGRAPHY

There are four geologic formations of importance to the following discussion at PORTS. Beginning from the uppermost, they are: 1) the Minford Member of the Teays Formation; 2) the Gallia Member of the Teays Formation; 3) the Sunbury Formation; and 4) the Berea Formation. A hydrostratigraphic cross section of the study area is shown in Figure 3.1.

3.1 Minford Member

The Teays Formation consists of unconsolidated Quaternary-Age glacio-lacustrine deposits consisting of the (upper) Minford Member and the (lower) Gallia Member. The Minford is a lacustrine deposit which is composed of an upper clay unit averaging 4.6 m (15 feet) in thickness, and a lower silt unit, which averages 3 m (10 feet) in thickness. The Minford clay is composed primarily of illite and chlorite.

The Minford sediments are thought to be deposits from lakes that were formed when the ancient Teays River system was dammed by Quaternary glaciation. Some coarse-grained material was deposited as glacial outwash.

3.2 Gallia Member

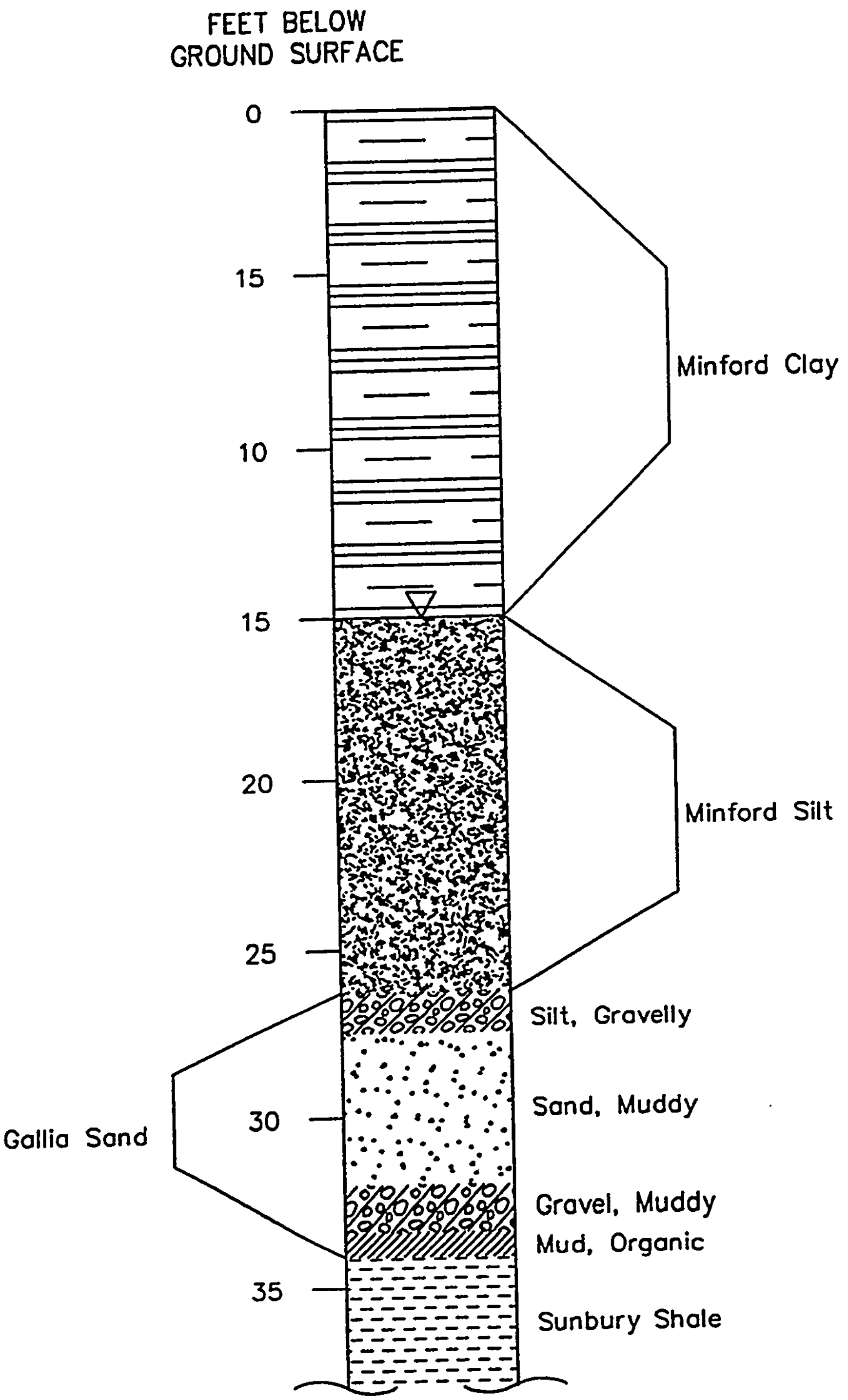
The Gallia Member of the Teays Formation, located beneath the Minford Member, is of variable thickness across the PORTS site and is locally discontinuous. The Gallia is composed of unconsolidated silt, sand, and gravel which was deposited as alluvium from Quaternary-age meandering river channels. The gravel units are discontinuous and are considered to be point-bar deposits which resulted from winnowing of finer-grained sediments. The Gallia displays a fining-upward sequence in the study area, grading from muddy gravel at the base, to silt or sandy silt at the top of the unit. Cobbles are found throughout the unit. The Gallia overlies the Sunbury Shale in the X-701B area, and overlies the Berea Sandstone in the western portion of the PORTS site.

3.3 Sunbury Formation

The Sunbury Shale is a competent black shale of Mississippian age which is 3 to 4.6 m (10 to 15 feet) thick beneath the X-701B area. Beneath the western portion of the PORTS site, the Sunbury is missing and Teays sediments directly overlie the Berea Sandstone.

3.4 Berea Formation

The Berea Formation is a hard, fine-grained sandstone of Mississippian age. The Berea is approximately 9 m (30 feet) thick beneath the study area. The lower 3 m (10 feet) of the formation



FILE: Lithex.dwg		
DATE: 2/13/97	**Geologic Cross Section of Test Area**	
REF: 1125-005		
	PORTSMOUTH GASEOUS DIFFUSSION PLANT	Figure 3.1

contains numerous shale laminations. The Berea is continuous across the PORTS site. Pumping tests have shown no hydraulic connection through the Sunbury Shale to the Gallia alluvium in the vicinity of the test area.

3.5 The Ground-Water Flow System

The two upper-most aquifers beneath PORTS are the Gallia alluvium and the Berea Sandstone. The Minford Member and Gallia Member of the Teays Formation are hydraulically connected. The Minford serves as a vertical pathway to the Gallia, the most permeable unit at PORTS and the primary pathway of contaminant migration. The ground-water flow system in the Gallia transports these contaminants down-gradient, following areas where the Gallia is most permeable. Data suggest that a buried paleochannel running east-west through the study area (approximately parallel to and beneath 18th Street) controls local ground-water movement (SAIC, 1995).

Where present, the Sunbury Shale provides an effective hydraulic barrier which limits vertical movement of ground-water between the Gallia and the Berea Sandstone. This limitation is attributed to the Sunbury's low vertical hydraulic conductivity, substantial thickness, lack of fracturing, and wide areal extent. In the study area, the hydraulic head in the Berea Formation is typically 3.7 m (12 feet) lower than in the Gallia alluvium.

In the test area, the water table is typically encountered about 4.6 m (15 feet) below ground surface in the Minford Member. The underlying Gallia alluvium is fully water saturated. The saturated section is typically about 5.5 m (18 feet) thick, which includes the 1.8 m (6 feet) of Gallia alluvium and 3.7 m (12 feet) of the Minford Silt.

4.0 INVESTIGATIVE METHODS

4.1 Soil Borings

INTERA completed four soil borings (INT-1 through INT-4) in the X-701B area during December 4 through 8, 1995 The purpose of the work was to acquire samples of the Gallia for laboratory analysis by UT and SUNY, and to confirm sediment textures. Soil boring locations are indicated in Figure 4.1 (Piezometers INT-1 through INT-4). Logs for the borings are included as Appendix A.

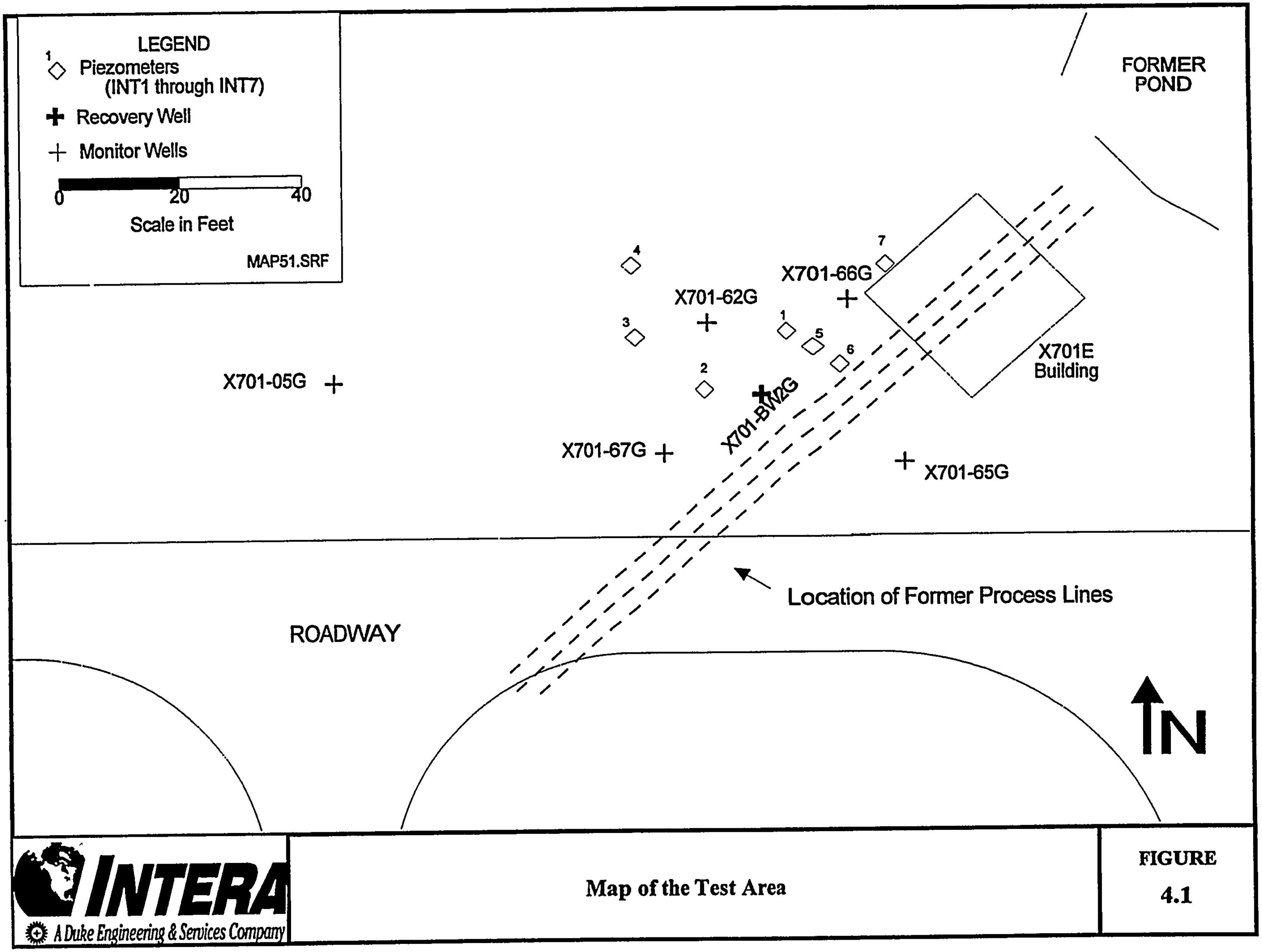
The drilling work was subcontracted to Alliance Drilling from Marietta, Ohio. Alliance used an Acker truck-mounted auger rig for drilling. Health & Safety support was provided by Diaz Construction of Piketon, Ohio. Due to PORTS concerns about volatile organic compound (VOC) concentrations, in particular trichloroethene, work was conducted using Level B personal protective equipment.

Borings were begun by first hand-augering from ground surface to 2.1 m (7 ft) BGS as a precaution against striking subsurface utilities. Soil cores at INT-1 were collected continuously to bedrock. Soil cores from INT-2, INT-3, and INT-4 were collected from 7.9 m (26 ft) BGS to bedrock. All soil cores were acquired using a split-spoon which was advanced using a 63.5 kg (140 lb) slide hammer. The split-spoons were 0.6 m (2 ft) long and contained eight 3-inch-diameter, 3-inch-long brass inserts. After each split-spoon advance, boreholes were widened using 8.3 cm (3.25 inch) inside diameter augers. During the continuous sampling, when the split-spoons met refusal above bedrock, the augers were advanced 0.15 to 0.3 m (6 inches to 1 foot) below the point of refusal, and boring was recommenced. The soil borings were converted to piezometers, as discussed in Section 4.3.

The soil cores were preserved intact for analysis by UT and SUNY by sealing the ends of the brass inserts with plastic caps and wrapping the ends in tape. Soil cores from boring INT-3 (sometimes referred to as B-3) were subsampled and the subsamples were preserved in methanol for determination of VOC content. Subsamples were collected using a 2 cm^3 microcoring device and immersed in 40-ml vials with methanol preservative. All samples were shipped on ice to the university laboratories.

4.2 Laboratory Analysis of Soil Samples

Cores from borings INT-2 and INT-4 were shipped to UT and cores from INT-1 and INT-3 plus methanol-preserved subcores from INT-3 were shipped to SUNY. UT tested the compatibility of soil samples with candidate tracers and conducted permeability studies with soil samples. SUNY studied the compatibility of soil samples with candidate surfactants. The following work was also performed by SUNY:



Map of the Test Area

FIGURE 4.1

- Grain size analysis of core samples
- Particle size analysis of fine-fractions using a laser particle size analyzer
- GC analysis of microcores from boring INT-3
- Sorption isotherms using candidate surfactants and core samples
- Permeability modification of core samples by surfactants
- Saturation/capillary pressure curve development

4.3 Piezometers

As shown in Figure 4.1, INTERA installed seven piezometers in order to provide additional monitoring points in the test area. Four piezometers were installed in soil borings INT-1 through INT-4 in December 1995. Three additional piezometers, numbered INT-5 through INT-7, were installed immediately before PITT-1 in July 1996.

Piezometers INT-1 through INT-4 were constructed of 1.25-inch-diameter 'sand points' and galvanized pipe. The screened interval of the sand points was two feet long, and the cased section was approximately 32 feet long. They were installed in open boreholes with the screened interval in contact with the lower gravel unit. Sand was added to the boreholes around the piezometers to a depth of ~30 feet BGS. The remainder of the annular space was filled with auger cuttings.

Piezometers INT-5 through INT-7 were driven into place using a Geoprobe™ unit. Piezometers INT-5 and INT-6 were installed in the middle and upper Gallia, respectively, to complement INT-1, which was installed in the lower Gallia. The piezometers lay on a line transverse to and mid-way between the injection and extraction wells. Piezometer INT-7 was installed 10 feet northeast of X701-66G, directly opposite from BW2G, and was completed in the middle sand unit of the Gallia. INT-7 was used for injection of potable water in order to constrain northerly migration of tracers.

An initial attempt was made at installing 1.25-inch-diameter piezometers at INT-5 through INT-7; however these borings met refusal at approximately 27 feet BGS, the approximate level of the upper unit of the Gallia (gravelly silt). When construction of INT-5 through INT-7 was changed to 0.75-inch points and casing, the piezometers could be placed at the target depths. The screened section of these piezometers was 1 foot long. INT-5 was emplaced at 30.5 feet , INT-6 at 29 feet, and INT-7 at 30.5 feet total depth BGS.

All piezometers were developed by bailing before the start of PITT-1. INT-1 through 4 could be bailed until the purged water cleared. INT-5, 6, and 7 could not be bailed clear even after multiple casing volumes of water were removed from each. These piezometers were then alternately surged and jetted. All three piezometers continued to produce minor amounts of silt.

All piezometers were again developed before the start of the solubilization test. The piezometers were first jetted by advancing 1/4" tubing to the depth of the screens and introducing potable water under pressure. After jetting, the piezometers were bailed until the purge water cleared. The process had to be repeated several times on piezometers INT-5 and INT-6.

At the conclusion of field work on October 4, 1996, piezometers INT-1 through INT-7 were plugged and abandoned. A hydraulic jack was used to pull casing and screens from the subsurface. Bentonite pellets were then forced into the open holes with an iron rod. Approximately 2 kg (4 lbs) of bentonite were driven into each boring. The upper six inches of each boring was filled with native soil.

4.4 Aquifer Tests

Aquifer testing activities took place from March 4 through 15, 1996. The first week was devoted to equipment installation and well development. The Health and Safety Plan and Quality Assurance Project Plan were approved on March 6, 1996. A readiness review was conducted on March 4, 1996.

Wells BW2G, -65G, and -66G were re-developed on March 5 and March 6, 1996. (Re-development was done to improve the efficiency of each well.) Fine-grained materials were removed from the sand pack around the screen in order to improve hydraulic communication with the formation. A drilling crew from Alliance Environmental developed BW2G, since that well has a large (6-inch) diameter. The two remaining wells were developed by hand. Development was performed by a surge-block and bailing technique. Well BW2G was surged with a Teflon surge block for a period of 90 minutes. Initial total depth of the well was 10.6 m (34.8 ft) below top of casing (BTOC) with a soft contact at the bottom. Total depth after surging was 10.64 m (34.9 ft) BTOC with a firm contact at the bottom. Ground water was bailed from the well until turbidity was substantially reduced. A total of 190 liters (50 gallons) of fluids was bailed. A hydrocarbon sheen was evident on the surface of the produced ground water. No DNAPL was encountered.

Wells X-701B-65G and -66G were surged by hand using a surge block and bailer. Each well was surged for approximately 90 minutes. Approximately 95 liters (25 gallons) of fluid was bailed from each well. Produced fluids from all three wells were pumped to the PORTS treatment facility at building X-623.

Initial assumptions about the geometry of the aquifer include that the Gallia is 1.8 m (6 ft) thick at BW2G, extending from 7.9 to 9.8 m (26 to 32 ft) below ground surface (BGS). The pump was installed in well BW2G at 8.989 m (29.49 ft) BGS, near the center of the aquifer. Each of the wells screened in the Gallia aquifer is fully-penetrating. A well screened in the Berea aquifer (X705-11B) was monitored in order to determine whether there was any affect due to pumping.

Aquifer testing consisted of three phases: a step draw-down test, a hydraulic interference (pumping) test, and an injection test. All pumping was performed from well BW2G. The purpose of the step draw-down test was to determine the optimal flow rate for the pump test. The step draw-down test derives its name from the fact that the well is pumped at an initially low rate, followed by a rate that is increased in steps until a maximum pumping rate is achieved. Each step is maintained until the cone of water-table depression stabilizes. The maximum flow rate is reached at the point beyond which the cone of water-table depression will no longer equilibrate and the water level in the well is drawn down to the top of the formation in a confined aquifer, or to the pump intake in an unconfined aquifer.

A pump test was conducted in order to determine aquifer characteristics such as hydraulic conductivity and storativity. Boundary conditions, and well-bore storage effects may also be derived. Water table drawdown was monitored in the pumping well, six observation wells and one piezometer. Water table elevations were measured using pressure transducers and a data logger, and were verified using manually-operated electronic tapes. An injection test was conducted by introducing potable water into observation well X701-65G at the same time that groundwater was extracted from BW2G; this test provided information concerning sustainable injection and extraction rates.

4.4.1 Step Drawdown Test

The step test was begun on Monday, March 11, 1996 at 10:30 hrs. Flow rates and corresponding drawdown in the pumping well are shown in Table 4.1. Pumping had to be stopped at 12:15 hrs when a crack was noticed in the effluent piping in the X701E treatment building. Repairs were completed and the step test resumed at 16:00 hrs. By 19:00 hrs, a pumping rate of 3.1E-1 l/s (4.9 gpm) was being maintained with consequent drawdown in the pumping well of 2.24 m (7.36 ft) BTOC. Pumping was completed for the day. A pumping rate of 4.7E-1 l/s (7.5 gpm) was attempted on Tuesday, March 12, 1996. Drawdown increased to 3.755 m (12.32 ft) BTOC, but did not stabilize.

Table 4.1 Pumping Rate vs. Drawdown: Step Drawdown Test

Pumping Rate at BW2G l/s (gpm)	Drawdown at BW2G m BTOC (ft BTOC)
8.8E-2 (1.4)	0.3 (1.1)
1.3E-1 (2.0)	0.5 (1.7)
1.5E-1 (2.4)	0.6 (2.1)
2.8E-1 (4.5)	1.8 (5.9)
3.1E-1 (4.9)	2.2 (7.4)
3.3E-1 (5.2)	2.0 (6.7)
4.7E-1 (7.5)	3.8 (12.3) *

* Water level was unsteady at this pumping rate

4.4.2 Pump Test

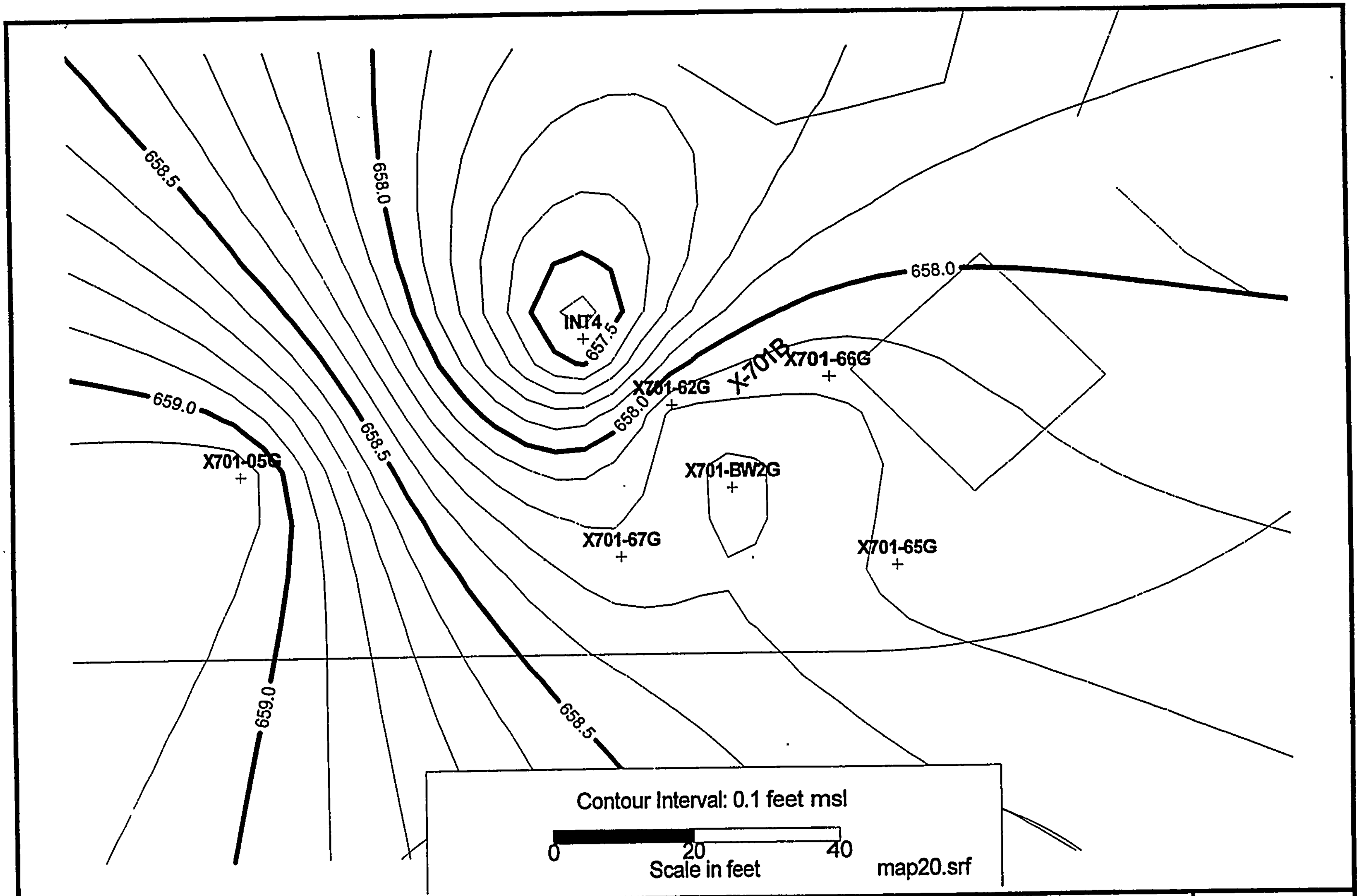
The pump test was begun on Wednesday, March 13, 1996. Pressure transducers were placed in wells as listed in Table 4.2. All wells monitoring the Gallia alluvium fully penetrate the aquifer. A pressure transducer was also placed in well X705-11B to monitor water pressure in the Berea aquifer. A contour map of the static (pre-test) piezometric surface is shown in Figure 4.2.

Table 4.2 Wells Used During Pumping Test

Well No.	Total Depth m (ft) BTOC	Casing Diameter m (inches)	Radius from Pumping Well m (ft)
BW2G	10.64 (34.91)	0.15 (6)	0.0
X701-62G	10.82 (35.50)	0.05 (2)	4.66 (15.3)
X701-65G	10.28 (33.73)	0.05 (2)	7.62 (25.0)
X701-66G	10.63 (34.89)	0.05 (2)	6.71 (22.0)
X701-67G	10.14 (33.28)	0.05 (2)	5.70 (18.7)
X701-05G	8.96 (29.40)	0.05 (2)	21.09 (69.2)
X705-11B	15.94 (52.29)	0.05 (2)	141 (464)
INT-4 (INTERA Piezometer)	10.67 (35.00)	0.03 (1.25)	9.30 (30.5)

A constant pumping rate of 3.2E-1 l/s (5.1 gpm) was maintained throughout the 25.5 hours of the test. Drawdown reached steady-state after 14.4 hours of pumping. Drawdown in the pumping well extended to 2.04 m (6.7 ft) below static water level. At a radius of 21 m (69 ft), drawdown leveled off at 0.64 m (2.1 ft) below static water level. A contour map of the drawdown achieved after 25 hours of pumping is included as Figure 4.3.

Ground water was sampled at hourly intervals during the test as an aid to site characterization. Sampling parameters included temperature, pH, specific conductance, and TCE concentration. Furthermore, the separation tank was checked for DNAPL on a hourly basis; however, none was detected.



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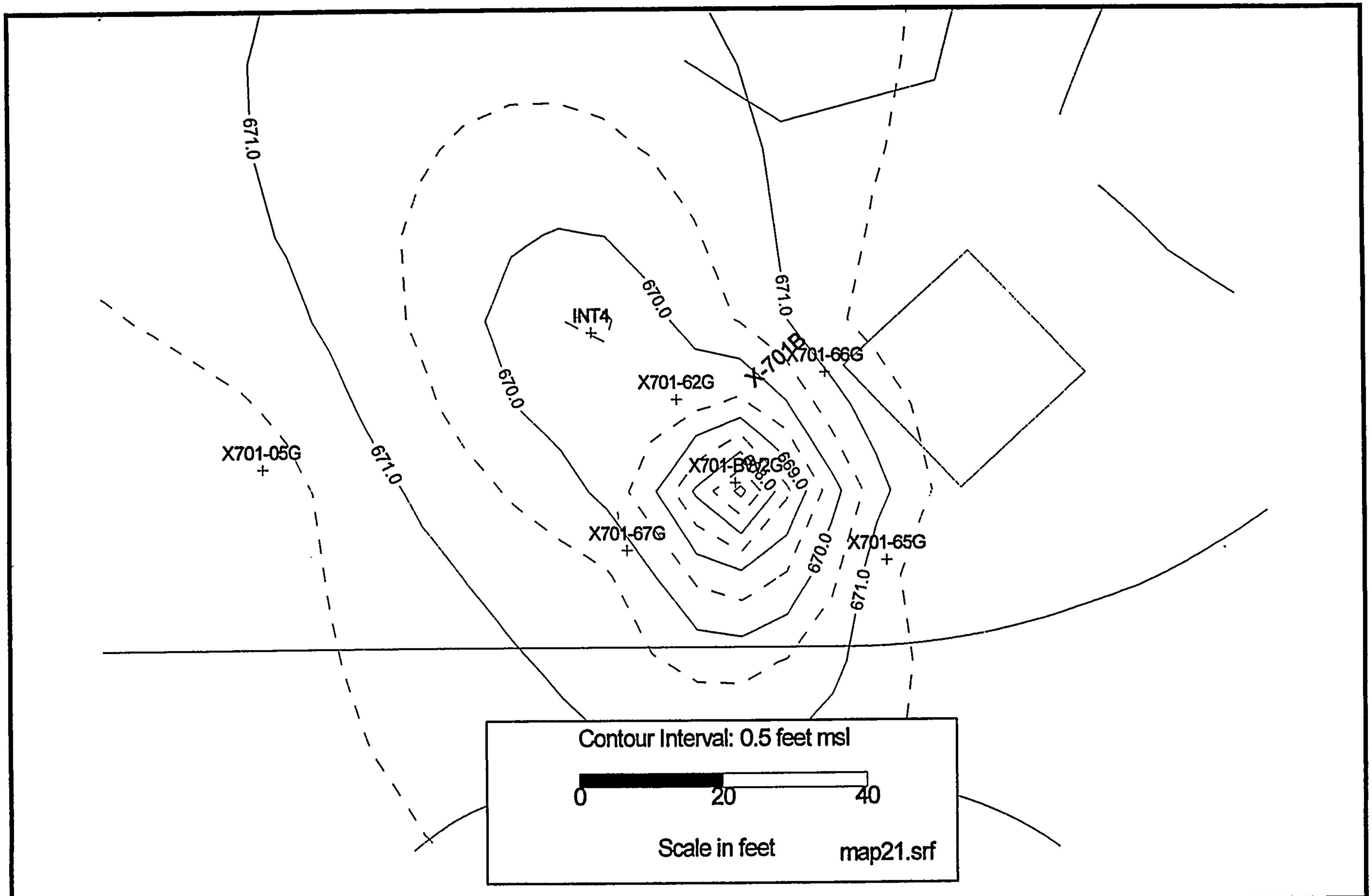
Pumping Test:
Piezometric Surface Contours at Time T-zero

FIGURE
4.2



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Pumping Test:
Piezometric Surface Contours at 25 Hours

FIGURE
4.3

4.4.3 Injection Test

The injection test was begun on March 14, 1996 immediately after the pumping test. Pumping from BW2G was continued at 5.1 gpm during the injection test. Potable water was injected into the Gallia alluvium at well X701-65G at the following rates: 0.36, 0.83, 1.65, 2.38, 3.16, and 7.15 gpm. Figure 4.4 shows a graph of injection rate versus drawdown in the injection well. A straight-line fit shows that the maximum sustainable injection rate would be 2.5E-1 l/s (4 gpm) under the given pumping conditions.

4.4.4 Aquifer Test Conclusions

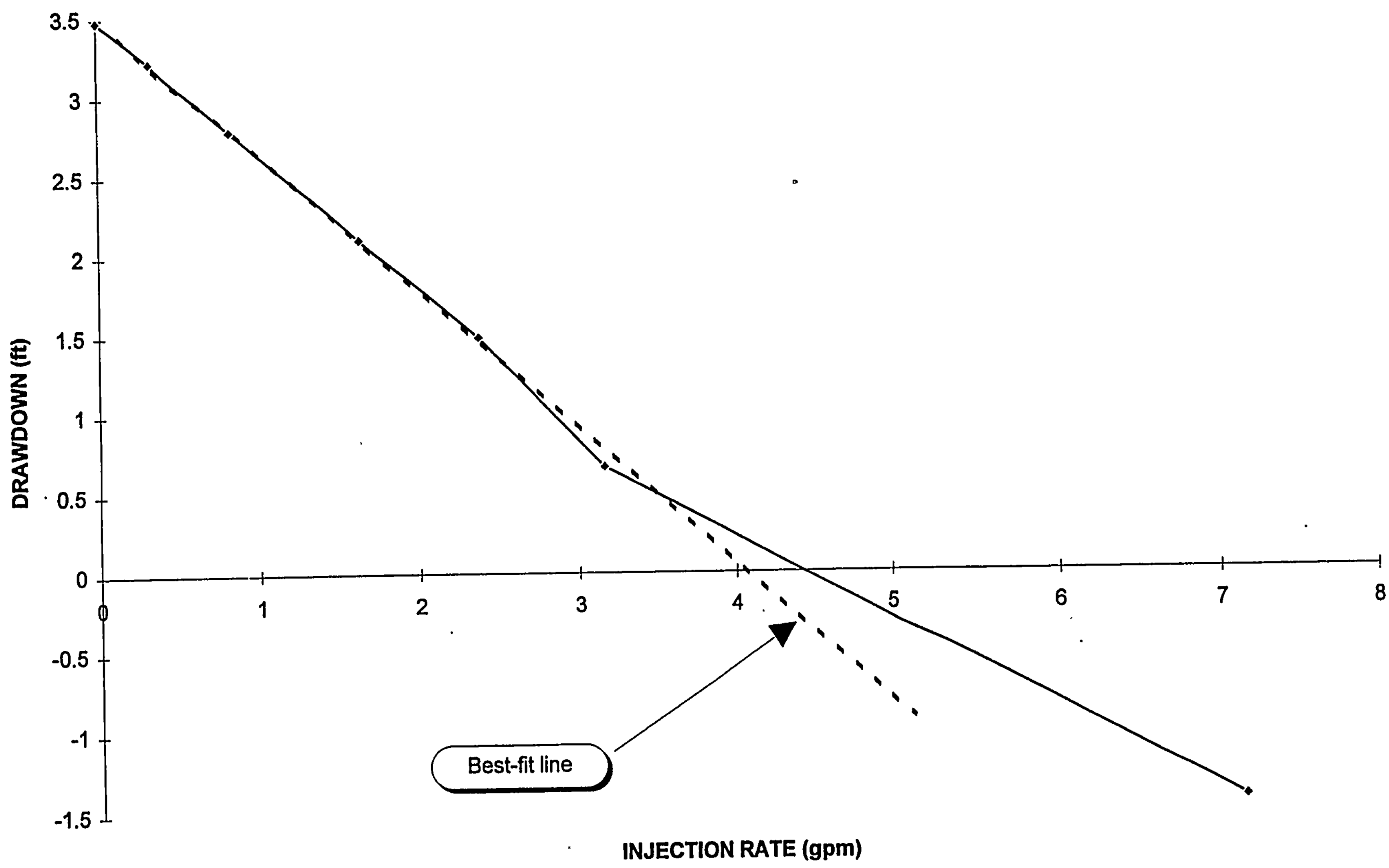
As indicated in Figure 4.5, the results of the step drawdown test indicate that the aquifer should have a maximum sustainable pumping rate of 3.2E-1 to 3.8E-1 l/s (5 to 6 gpm) at well BW2G. A 3.8E-1 l/s (6 gpm) rate would draw water down to approximately 8 m (26 ft) BGS, which is the depth of the top of the Gallia alluvium below ground surface.

Figure 4.6 shows drawdown in the pumping well and five observation wells over the course of the test. Pumping at 3.2E-1 l/s (5.1 gpm) produced steady-state drawdown in piezometric surface after 860 minutes (14.4 hours). Achieving steady-state conditions after a relatively short pumping duration is characteristic of a 'leaky' aquifer. In this case the Gallia is hydraulically connected to the over-lying Minford sediments. A sharp increase in drawdown is evident immediately before water levels stabilize. This increased drawdown has been correlated with commencement of a pumping test begun at a horizontal well located 150 m (500 ft) to the east.

Solving for the aquifer transmissivity by various methods gives a range of values from 10.4 m^2/d to 13.1 m^2/d. Storativity is estimated to be 5.8E-4. Assuming an aquifer thickness of 1.8 m (6 ft), hydraulic conductivity ranges from 6.6 E-3 to 8.3 E-3 cm/s. Using a steady-state solution of the pump test data, the hydraulic conductivity of the Gallia equals 8.3E-3 cm/s, and the vertical hydraulic conductivity of the Minford aquitard is 4.6 E-6 cm/s (i.e., hydraulic resistance of 844 days).

A gauge placed in the lower Berea aquifer at a radius of 141 m (464 ft) showed fluctuations due to barometric pressure changes. No change was evident due to pumping, indicating no hydraulic connection between the Gallia and underlying Berea aquifers. High barometric efficiency is characteristic of confined aquifers. A graph of atmospheric pressure and the Berea piezometric response is included as Figure 4.7. Piezometric data are included as Appendix B.

Aqueous TCE concentrations averaged 76 mg/l at well BW2G. Specific conductance and pH averaged 585 μS/cm and 5.7, respectively. Ground water quality data are included as Appendix C. TCE data are included as Appendix D.



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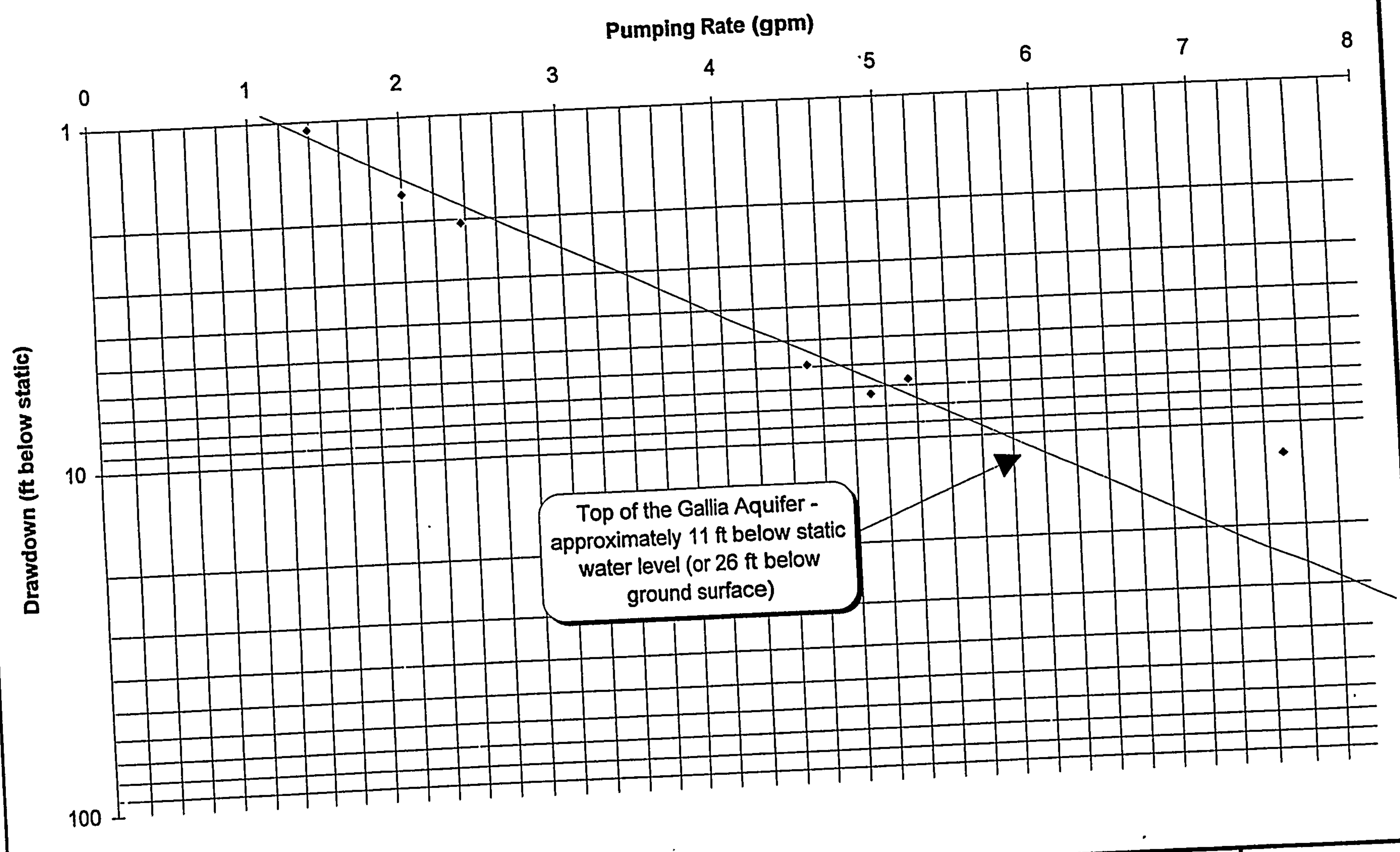
Injection Test: Injection Rate vs. Drawdown

FIGURE 4.4



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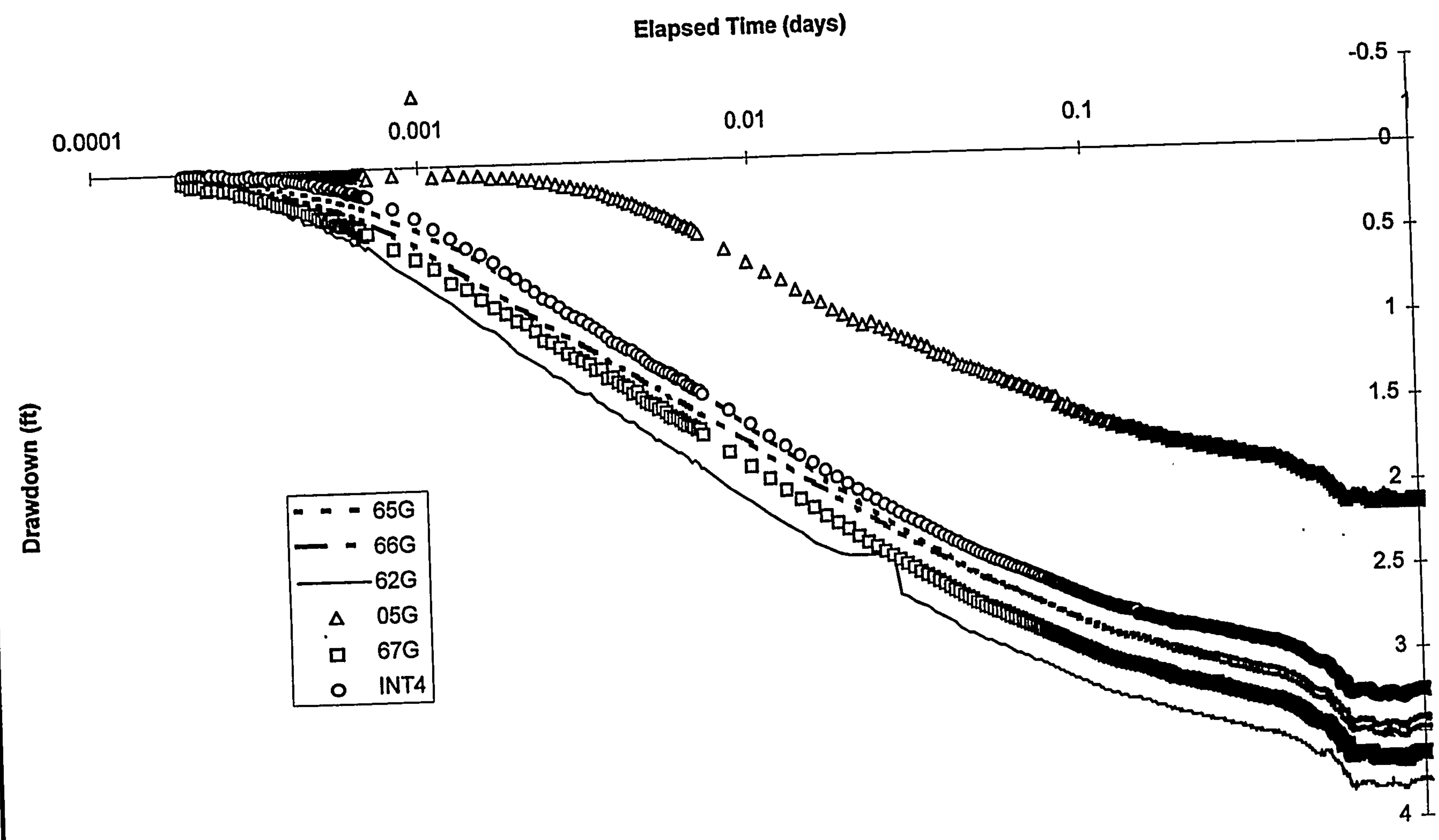
Step Drawdown Test: Pumping Rate vs. Drawdown

FIGURE 4.5



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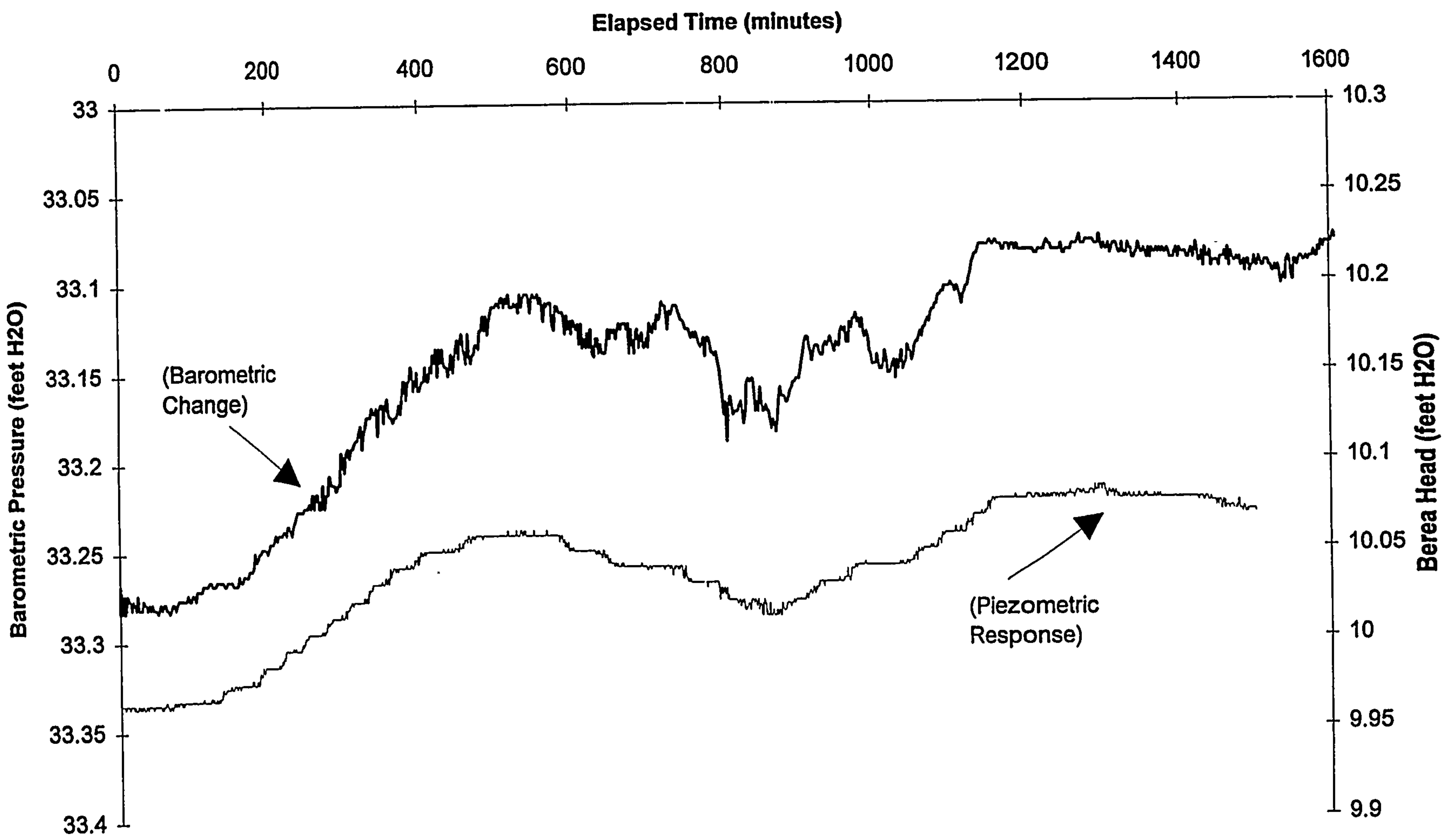
Pumping Test: Time vs. Drawdown

FIGURE
4.6



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Pumping Test: Barometric Pressure & Piezometric Response in the Berea Formation

FIGURE 4.7

5.0 HYDROGEOLOGY OF THE TEST AREA

5.1 Textures

The upper Minford in Area X-701B has largely been replaced by cut-and-fill deposits composed of silts and clays to a depth of approximately 4.6 m (15 feet) below ground surface (BGS). In the test area, the Gallia is 1.8 m (6 feet) thick. Gallia sediments consist of gravelly silt from 8.2 to 8.8 m (27 to 29 ft) BGS, grading into muddy sand from 8.8 to 9.4 m (29 to 31 ft) BGS, which grades into muddy gravel from 9.4 to 10 m (31 to 33 ft) BGS. A basal clay layer, approximately 5 cm (2 inches) thick, exists below the gravel layer. The clay, which is organic, is probably the result of weathering of the underlying Sunbury Shale.

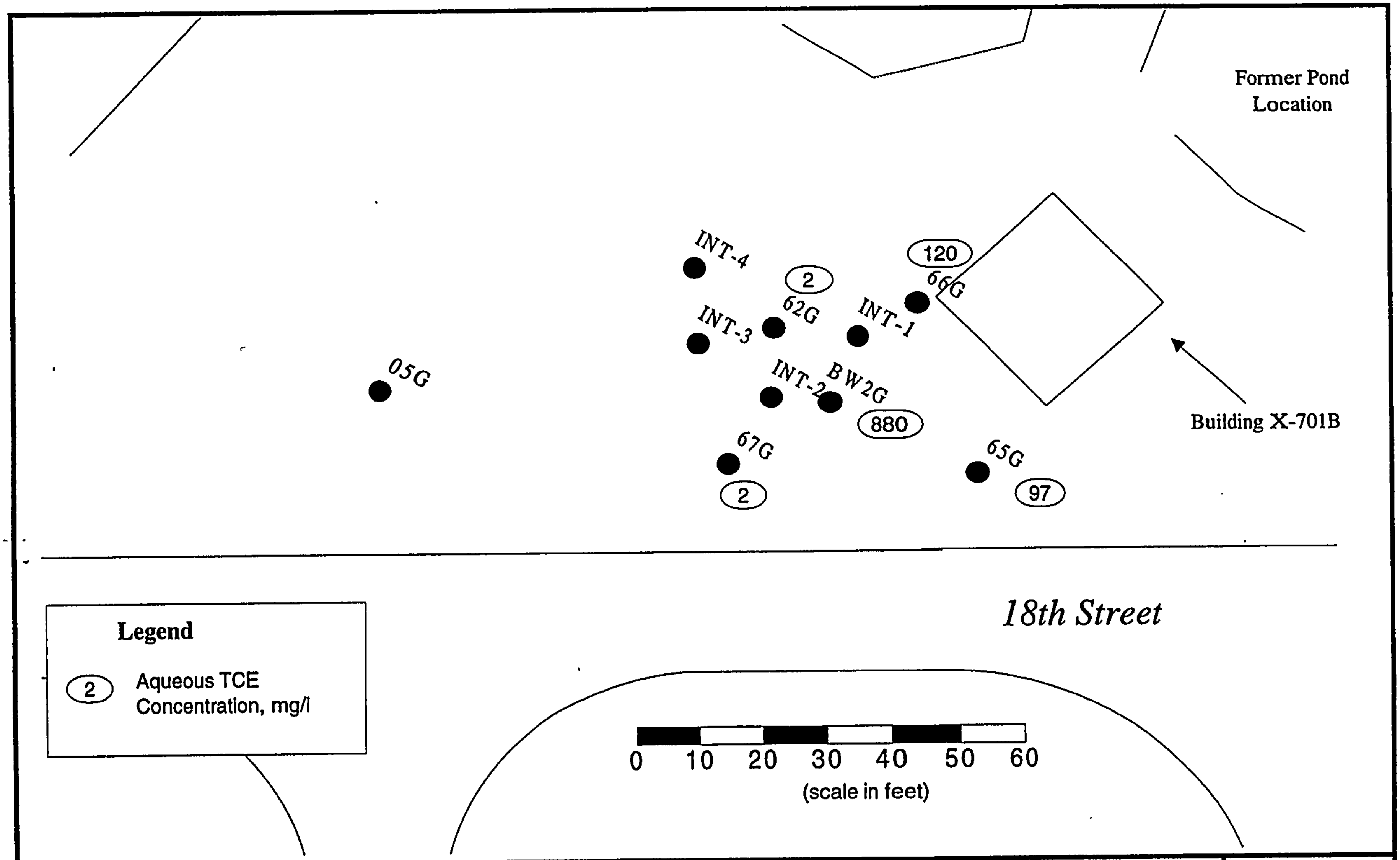
The distribution of coarse-grained sediments in the Gallia indicates a fining-upward depositional sequence. Gravels are predominant at the base of the unit, where the they are clast-supported. These basal gravels are probably lag-deposits created by winnowing of the finer-grained materials. Cobble-size fragments were also encountered in the upper Gallia, which is matrix-supported. The presence of cobbles at both the top and base of the unit is evident from the blow-counts taken to push sampling equipment through the unit. Blow counts are markedly lower in the sandy middle unit. Core-loss due to blockage from cobbles was also more common in the upper and lower Gallia than in the middle sand.

Grain-size frequency analyses from samples collected in the test area indicate that soil textures in the Gallia Member in the vicinity of X-701B are highly variable, with textural classifications ranging from sandy silt to poorly graded gravels. The predominant soil type was muddy sand. Mud (or 'fines'), composed of silt and clay, comprised greater than 15% of all samples and greater than 20% of most soil samples from the Gallia (SUNY Final Report, Appendix W). Analysis of clays by x-ray diffraction indicated the presence of expandable clays, although literature suggest that the predominant clay types in the Gallia are illite and kaolinite (Bigham, 1991).

5.2 Ground-Water Quality

Wells in the test area were sampled by PORTS for VOCs, semi-volatiles, and major ions during April 1996. The wells were bailed before sampling. Analysis results are summarized in Table 5.1.

Aqueous TCE concentrations in the test area ranged from approximately 2 to 880 mg/l, as shown in Figure 5.1. Recovery well BW2G had the highest concentration in the test area, at 880 mg/l, which is 63% of the aqueous solubility of TCE. Wells 67G and 62G, to the west and upgradient of the recovery well, had 2 and 3.1 mg/l TCE concentrations, while wells, 65G and 66G had 97 and 120 mg/l concentrations, respectively.



Aqueous TCE Concentrations, April 1996

FIGURE 5.1

Water quality parameters were measured during aquifer testing in March 1996. The aqueous TCE concentration at well BW2G was measured under pumping conditions, and ranged from 84 to 130 mg/l. Other parameters are shown in Table 5.2.

Table 5.1 Ground-Water Quality in the X-701B Area, April 1996

Analyte	X701-62G (mg/l)	X701-65G (mg/l)	X701-66G (mg/l)	X701-67G (mg/l)	BW2G (mg/l)
Anions:					
Cl	31.9	36.9	18.9	35.8	39.4
SO_4	175	136	93.3	166	178
HCO_3	57	73	41	58	61
Cations:					
Ca	41.6	36	20.4	39.1	41.4
Fe	0.04	0.086	0.044	0.601	0.24
Mg	25.2	23.1	11.4	23.8	24
K	2.18	2.16	1.00	1.93	1.85
Na	40.5	42.7	36.1	34.4	36.1
VOCs:					
1,2-DCE	0.1	2.0	2.0	0.05	40
TCE	3.1	97	120	2	880

Table 5.2 Ground-Water Quality during March Aquifer Tests

Parameter	Result
Temperature	14.8° Celsius
Specific Conductance	585 μSiemens/cm
pH	5.7 [-]
Dissolved Oxygen	5.4 mg/l
TCE Concentration	84 to 130 mg/l
PCB Concentration	not detected (quantitative limit 5 mg/l)

5.3 Ground-Water Flow and Velocity

The natural direction of ground-water flow in the Gallia Sand is partially controlled by the topography of the base of the aquifer and partially by local stream control. The regional flow direction is to the east and southeast, toward a local drainage feature named Little Beaver Creek. In the X-701B area, eastward flow has been enhanced by pumping from a french drain installed to capture the dissolved-phase plume emanating from the study area. The coarse-grained deposits in the channel represent preferred pathways for ground-water flow and DNAPL migration. Although the usual ground water flow gradient in the test area is to the east, the ambient gradient was to the west immediately before the pre-surfactant flood PITT as indicated in Figure 5.2.

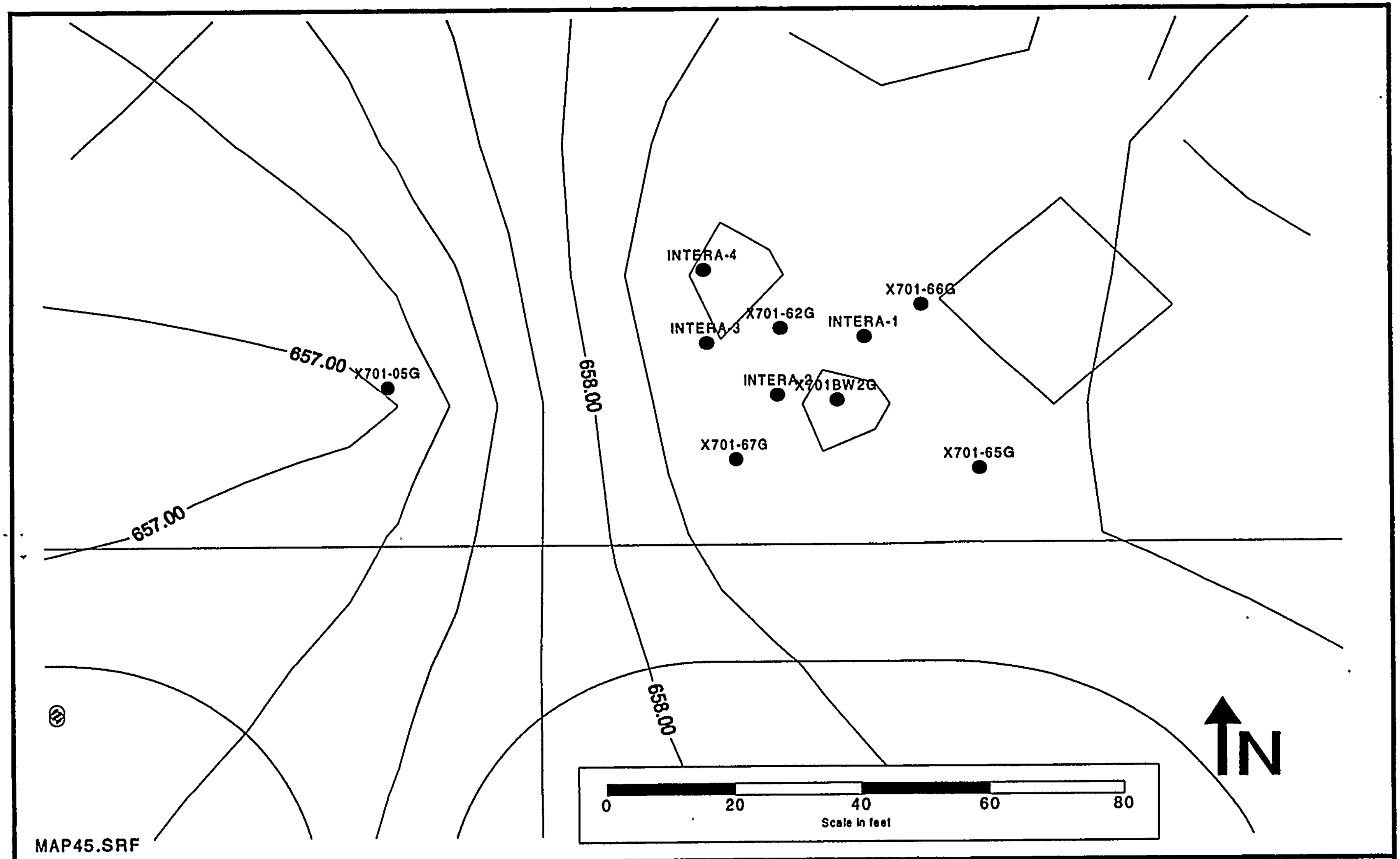
The hydraulic-head gradient in the Gallia sand was measured from quarterly compliance monitoring of the 26 wells in the X-701B area. Hydraulic gradients of the Gallia Sand in the X-701B area range from 0.2% to 0.5%. Ground-water velocity is usually estimated based on the following equation (Freeze and Cherry, 1979):

$$V = K*I/n_e$$

where:

V = average linear velocity (cm/s)
K = hydraulic conductivity (cm/s)
I = hydraulic gradient (drop/distance)
n_e = effective porosity of the sediments, estimated to be approximately 25%

Based on the range of values for hydraulic conductivity, gradient, and effective porosity, average linear velocity in the area of study is estimated to be approximately 0.06 to 0.18 m/d (0.2 to 0.6 ft/day).



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Ambient Piezometric Surface, July 16, 1996

FIGURE 5.2

6.0 SURFACTANT AND TRACER SCREENING

Researchers at two universities were subcontracted to select suitable tracers and surfactants for this project. Dr. Gary Pope and his students at the Department of Petroleum and Geosystems Engineering at the University of Texas at Austin (UT) selected appropriate tracers for PITT-1 and PITT-2. Dr. John Fountain and his students at the Department of Geology at the State University of New York at Buffalo (SUNY) selected the surfactant solution to be used in the solubilization study. Reports from UT and SUNY are included as Appendices M and N, respectively.

Both groups required samples of Gallia sand, ground water and DNAPL in order to assure compatible matches. Soil samples were acquired during soil boring work in early December 1995. Ground-water samples were collected by PORTS personnel and sent to the two universities. PORTS also supplied results of inorganic chemical analyses of water samples collected from wells in the test area. PORTS personnel attempted to collect DNAPL samples for study on three separate occasions in April 1996, but were only able to collect DNAPL-clay emulsions. Neither UT nor SUNY were able to use the emulsions for screening tests, but rather were required to use a commercial TCE sample instead. Analysis of a DNAPL sample collected in 1994 by PORTS from nearby well PW-1 showed that the principal component of the sample was TCE. Analysis results were only semi-quantitative owing to the difficulties in analyzing non-aqueous samples. The measured concentrations accounted for only 1% of the sample mass.

6.1 Tracer Selection

Researchers at UT were tasked with selecting appropriate tracers and testing their compatibility with source water and soils. Tracers were selected according to the following criteria:

- tracers should be non-toxic to humans and biodegradable by soil microbes;
- the tracers should be readily available and relatively inexpensive;
- they should have a low analytical detection limit, i.e. in the range of 1 mg/l;
- they should display partition coefficients which yield a retardation factor in the range of 1.2 to 4.0 with respect to the DNAPL at the X-701B area;
- The tracers should be insensitive to the exact composition of the DNAPL, i.e., the tracers should have robust partition coefficients;
- tracers should show low sorption to Gallia aquifer materials.

UT selected a series of simple, biodegradable alcohols with the TCE partition coefficients shown in Table 6.1.

Table 6.1 Tracers and their Partition TCE Coefficients

Tracer Name	Abbreviation	TCE Partition Coefficient (Volume Ratio)
bromide	---	0.0
2-propanol	IPA	0.0
3-methyl-3-pentanol	3M3P	4.5
1-hexanol	---	18.6
2,4-dimethyl-3-pentanol	2,4DM3P	38.2
1-heptanol	---	163.1
1-octanol	---	389

6.1.1 Pre-surfactant flood PITT

A number of alcohol tracers, such 1-hexanol, 1-pentanol, and 1-heptanol, that partition between DNAPL and water phases have been identified and successfully used in a recent field PITT test at Operable Unit 2, Hill AFB, Utah (Brown et al. 1996). Because the physical properties of these tracers have been extensively studied and are well understood, they were screened for use in both pre- and post-surfactant flood PITTs.

The first step in the tracer selection process is to determine the partition coefficients between TCE and source water for these alcohol tracers. The static partition coefficients for 3-methyl-3-pentanol, 1-hexanol, 2,4-dimethyl-3-pentanol, 1-heptanol, and n-octanol were determined by mixing these tracers, source water and TCE. Tracer concentrations in both aqueous and TCE phases were measured using gas chromatography after the mixture had reached equilibrium. The measured static partition coefficients are shown in Table 6.1. Column tests (see appendix M) confirmed that the TCE saturation in soil obtained from the Portsmouth site using these partition coefficients could be estimated within about 6% of the saturation values estimated from a direct mass balance on the column. The column test also indicated that no separation of water containing tritium and alcohol tracers occurred in the initial tracer flood, which indicates no sorption of the alcohols on the Portsmouth soil. These tests indicate that these alcohol tracers are suitable for PITTs at the Portsmouth site.

The second step in the tracer selection process is to determine the number of tracers to be used. Theoretically, at least two tracers, one nonpartitioning and one partitioning, are required for the interwell test. Practically, however, a suite of tracers with different partition coefficients is preferred to improve the estimation accuracy. This is especially true when there is a large range of uncertainty in the quantity and distribution of the NAPL such as the case for the pre-flood PITT. If the residual saturation is relatively high, tracers with smaller partition coefficients are sufficient, and it is not mandatory to continue the test to obtain the response curves for the tracers with larger partition coefficients. If the residual saturation is lower than expected, the tracers with larger partition coefficients can ensure good separation of the tracer response curves.

The partition coefficients of the partitioning tracers should also be within a certain range such that the retardation factor is in the range of 1.2 to 4 to obtain the response curve of the partitioning tracer in a reasonably short time and yet ensure good separation of the nonpartitioning and partitioning tracers. The UTCHEM simulation results indicated that the tracers tested in Table 6.2 would give a retardation factor in the range of 1.2 to 2.6 assuming the average NAPL saturations are in the range from 0.001 to 0.01, i.e., 0.1 to 1%.

It was therefore recommended that both bromide and isopropanol be used as the nonpartitioning tracers and 3-methyl-3-pentanol, 2,4-dimethyl-3-pentanol, 1-hexanol, and 1-heptanol be used as partitioning tracers for the pre-surfactant flood PITT.

The final step in the tracer selection process is determining the mass of each tracer to be used. The UTCHEM simulation results indicated that 14 kg is an adequate amount to use for the pre-flood PITT based on the fact that the concentrations of each tracer can be accurately measured to about 1 to 10 mg/l using the available gas chromatography equipment (direct injection method).

6.1.2 Post-surfactant flood PITT

The tracer selection and the design of the post-flood PITT was based upon the results from the pre-flood PITT and the numerical simulation of the surfactant flood. Bromide and 1-propanol were recommended as nonpartitioning tracers in the pre-flood PITT. For the post-PITT, however, because the DNAPL mass was expected to be much lower after the surfactant flood, it was necessary to use partitioning tracers with higher partition coefficients in order to reasonably quantify the remaining DNAPL volume. Laboratory experiments indicate that the partition coefficient of 1-octanol between TCE and water is 389. Therefore, 1-octanol was chosen as the primary partitioning tracer. However, only 4 kg of n-octanol could be used because of its lower solubility in water. Heptanol and hexanol were also included as partitioning tracers for the post-flood PITT to allow a direct comparison with the pre-flood PITT.

6.2 Surfactant Selection

Dr. John Fountain and his graduate students at the Department of Geology at the State University of New York (SUNY) at Buffalo conducted the laboratory work required to select the surfactant for the SEAR. For a detailed account of the selection process, refer to Appendix N which contains SUNY's final report.

The criteria used in the selection of the surfactant for the PORTS site are listed in Table 6.2 along with their rationale. Two cores taken from the site and analyzed at SUNY indicated that fines comprise more than 15% of the sediments. As a result, nonionic surfactants, which tend to sorb extensively when clay contents exceed 10% (Lagowski, 1996), were not investigated further. The anionic surfactants that had previously been studied at SUNY were also not pursued because they either had limited chemical stability or a limited tolerance for salt. At the suggestion of Dr. Gary Pope at the University of Texas (UT), SUNY limited its evaluation to sulfosuccinates, a group of food-grade, environmentally acceptable anionic surfactants. UT had shown that sulfosuccinates, with the addition of salt, have excellent TCE solubilization properties. Of the sulfosuccinates investigated by UT, SUNY found that dihexyl sulfosuccinate "exhibited excellent handling properties (poured easily and mixed well), produced a low viscosity liquid and exhibited good phase behavior." Addition of electrolyte greatly enhanced the surfactant's ability to solubilize TCE.

Soil from the site was exposed to water containing various ratios of sodium to calcium concentration to study the effects of electrolyte addition on clay dispersion. A 1:1 ratio by mass of sodium chloride to calcium chloride provided minimal clay dispersion. In addition, isopropanol was added to the surfactant solution to minimize sorption of surfactant to the soils, and improve the phase behavior of the mixture.

Several additional salinity scans and concentration ratio scans revealed the optimal surfactant solution composition to use in the field test: 4% dihexyl sulfosuccinate, 4% isopropanol, 0.1% sodium chloride, and 0.1% calcium chloride, all by mass fraction. This solution was found to solubilize 49,464 mg/L TCE, which is equivalent to about 35 times the solubilization potential of natural ground water.

Table 6.2 Criteria for Surfactant Selection

Parameter	Rationale	Data
Solubilization	The more a surfactant increases aqueous solubility of a compound, (termed solubilization in a micellar solution) the more efficient the surfactant is at dissolving DNAPL.	Solubilization from vial test
Sorption	Higher sorption means greater loss of surfactant and reduced hydraulic conductivity.	Sorption batch and column tests
Toxicity	Permitting of injection is difficult for toxic compounds.	Published data
Bio-degradability	Permitting of injection is difficult for persistent compounds.	Published data
Viscosity	Increased viscosity decreases flow rate in an aquifer.	Direct viscosity measurements
Interfacial Tension	Lower interfacial tensions create greater risk of DNAPL mobilization, but also generally correlate with higher solubility.	IFT measurement
Site Water Chemistry	Surfactants have various ranges of compatibility to ionic strength, pH and temperature.	Water/surfactant tests
Contaminant Distribution	The distribution of contaminants, as a function of rock type and spatial distribution affect the method of removal and hence surfactant selection.	Site Characterization

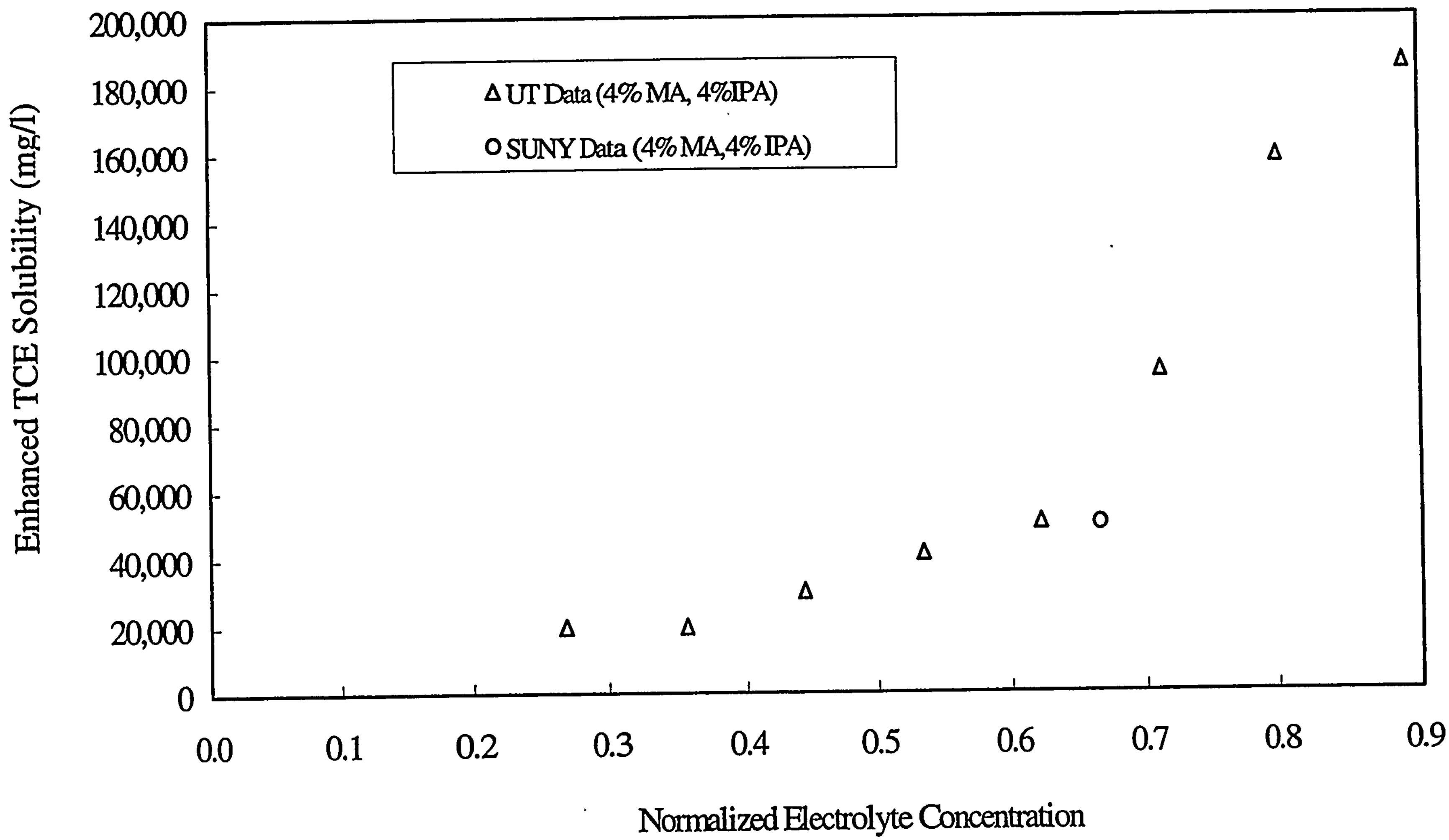
6.3 Design of the Surfactant Flood

The pre-flood PITT data yielded the volume and average distribution of TCE DNAPL within the test area. Since the model was calibrated to match the tracer data, minimal changes were required in the model parameters for the solubilization test and post-flood PITT simulations. The simulation domain, finite-difference grid, and the porous medium and fluid physical properties were kept the same except for changes in the hydraulic conductivities of the different units of the Gallia (see Section 8.6). The physical properties of the surfactant solution were incorporated as well. Based on hydraulic conductivity and TCE distribution information from the pre-flood PITT, it was decided that the fluid injection and extraction would target the bottom 1.5 ft of the Gallia formation (the gravel unit).

Data on the physical properties of the surfactant and its phase behavior were provided by Dr. John Fountain of SUNY and Dr. Gary Pope of UT. The surfactants considered for this test were sodium dihexyl and dioctyl sulfosuccinate mixtures. A large number of surfactant phase behavior experiments were carried out with different surfactant, alcohol co-surfactant, and electrolyte mixtures. Volume fraction diagrams were developed by varying the electrolyte concentrations, temperature, and surfactant mass ratio. Based upon these experimental studies, a 4 wt % sodium dihexyl sulfosuccinate (Aerosol MA) was chosen as the primary surfactant, a 4 wt % isopropyl alcohol (IPA) as the co-surfactant, and a 1:1 ratio of NaCl and $CaCl_2$ as the electrolytes for the solubilization test. Figure 6.1 shows the solubility of the TCE contaminant in microemulsion containing 4% MA and 4% IPA as a function of electrolyte concentration which was normalized by optimum electrolyte concentration.

The UTCHEM parameters were derived to match the experimentally observed fluid and phase behavior. The critical micelle concentration (CMC) of the surfactant solution is 0.2%. The viscosity and interfacial tension of the microemulsion (i.e., a micellar surfactant solution containing solubilized TCE above the CMC) is 1.5 cp and 0.15 dyne/cm, respectively. The relative permeability and capillary pressure data for the microemulsion were the same as for water (shown in Figures 6.2 and 6.3).

Simulations were conducted to determine the duration of the solubilization test, the mass of surfactant, IPA and electrolyte required, the predicted extraction-well effluent TCE and surfactant concentrations and the surfactant recovery at the end of test. Based upon the results of UTCHEM simulation studies, an optimum operational design was chosen with the major pertinent design variables as listed in Table 6.3. The simulated extraction well effluent TCE and surfactant concentrations as a function of time are shown in Figure 6.4.



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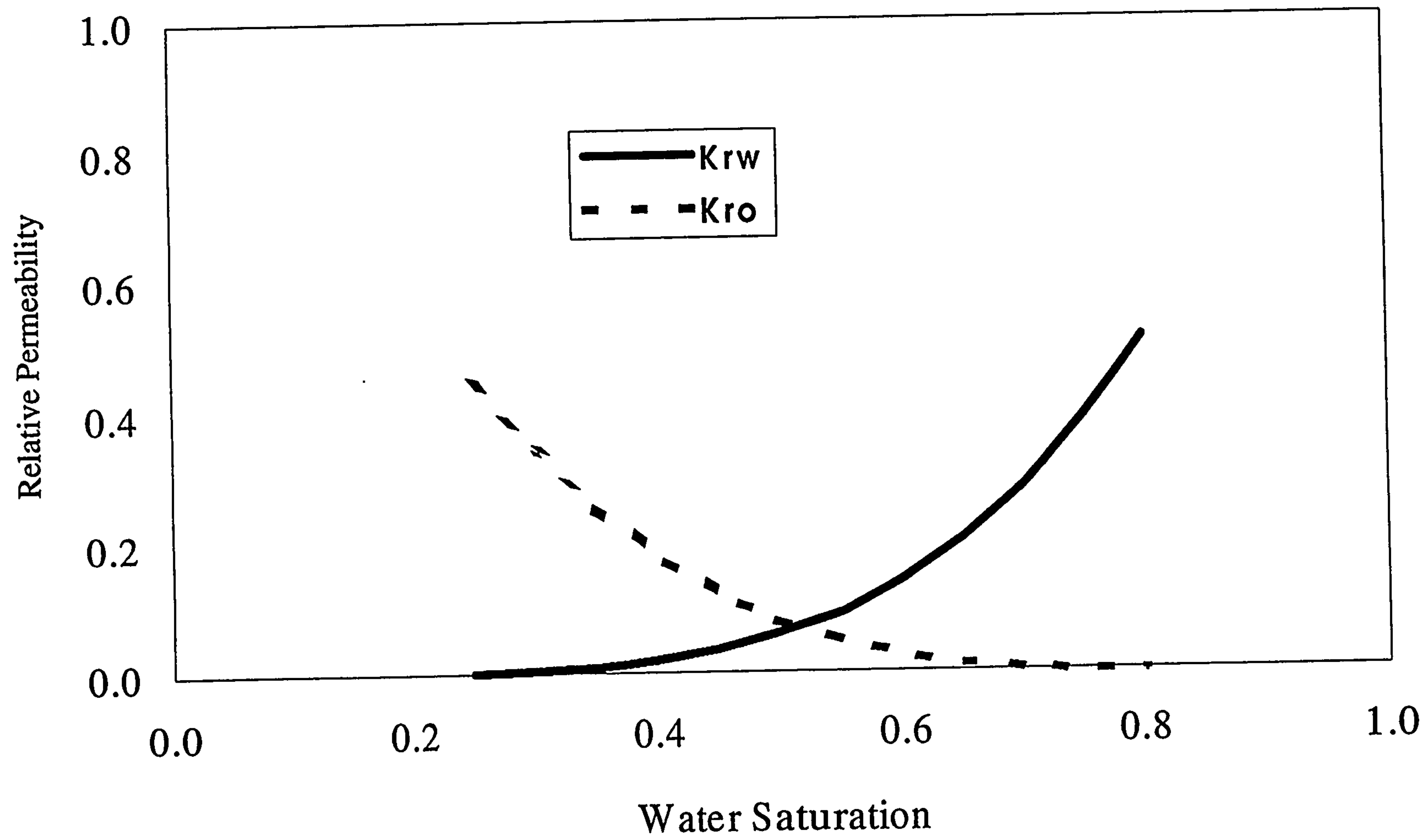
Enhanced Solubility of TCE as a Function of Electrolyte Concentration

FIGURE 6.1



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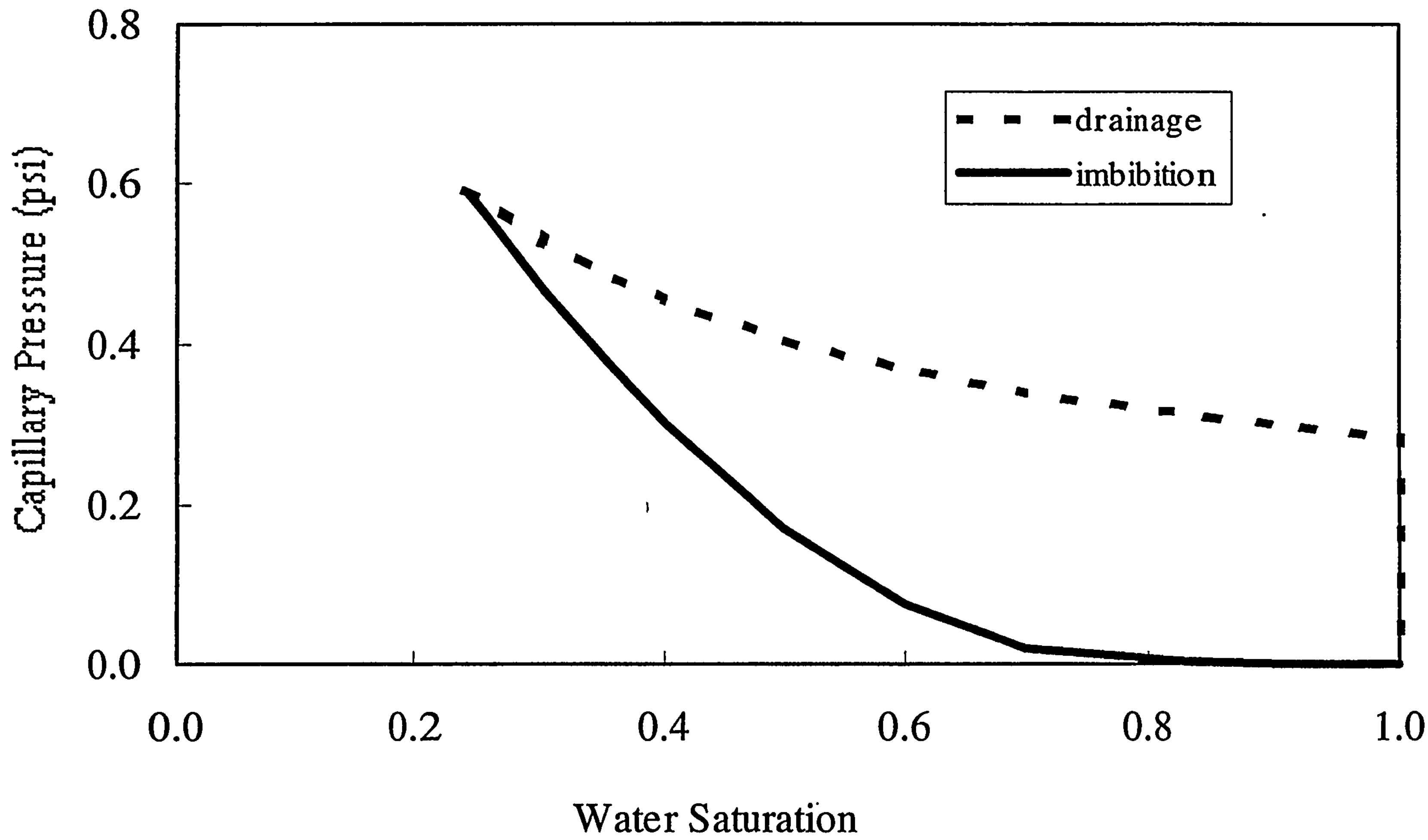
Imbibition Relative Permeability Curves

FIGURE 6.2



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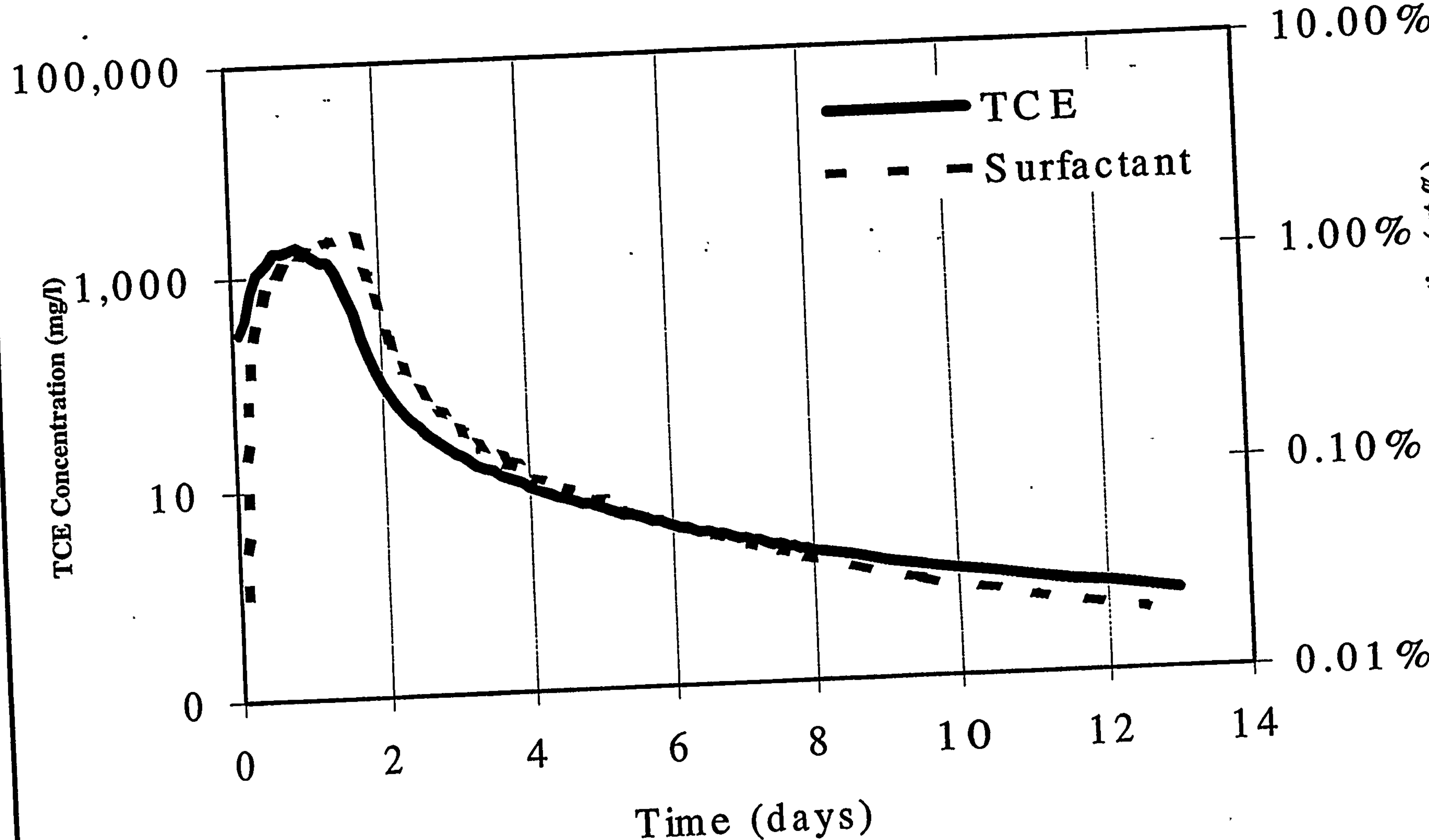
Capillary Pressure Curves

FIGURE
6.3



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Predicted Extraction Well Effluent TCE and Surfactant Concentrations

FIGURE 6.4

Table 6.3 **Summary of Surfactant Flood Design Parameters**

Wells	**Well Name**	**Screen Interval**	**Rate**
Injection Well	BW2G	~32.5 - 34 BGS	3 gpm
Extraction Well	66G	~32.5 - 34 BGS	5 gpm
Surfactant Solution		**Injected Concentration (wt%)**	
Sodium dihexyl sulfosuccinate		4	
IPA		4	
NaCl		0.1	
$CaCl_2$		0.1	
Test Segments	pre-test flush (0.5 days) surfactant injection (1.5 days) post water flush (3 days) --- continued by post-flood PITT		
Sampling Strategy	**Time (days)**	**Sampling Frequency (hrs)**	**Number of Samples**
Extraction Well	1 - 2 3 - 5	1 2	48 36
Monitor Wells	1 2 3 - 5	1 2 6	24 24 12
Injection Well	1.5	4	9

7.0 NUMERICAL MODEL DEVELOPMENT AND TEST DESIGN

7.1 Numerical Model Development

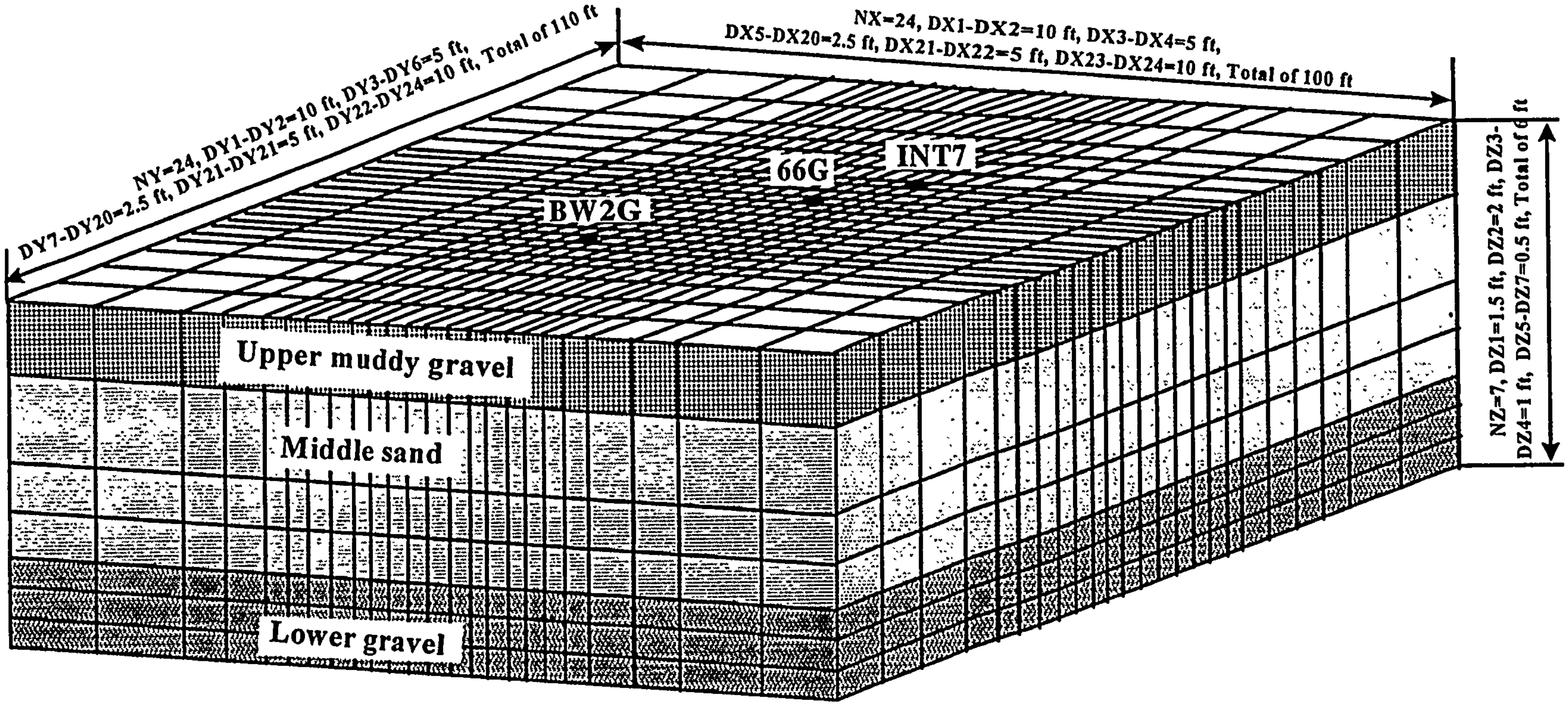
A three-dimensional model of the saturated subsurface was developed using an appropriate geometry and grid and the best available estimates of the hydraulic conductivity, porosity, dispersivity, fluid densities and viscosities, location and quantity of DNAPL, and other properties based upon data from the previous site investigation. Because there was insufficient data to calibrate the model, the second step was to simulate the PITT using the initial choices of the design parameters. The third step was to conduct sensitivity studies of the uncertain parameters which most affect the tracer test results. These parameters include location and quantity of DNAPL, well pattern, injection and extraction rates and hydraulic conductivities. The fourth step was to select the optimum design strategy and predict the performance of the tracer test based on the results of the sensitivity studies.

7.1.1 Selection of Simulation Domain and Finite-Difference Grid

The selection of the simulation domain was primarily based on the well pattern existing at the site and the ground-water TCE concentration data. Wells in the test area were sampled for VOCs, semi-volatiles, and major ions during April 1996. The dissolved TCE concentration was 880 mg/l to 2 mg/l in the five wells, as shown in Figure 5.1. TCE concentration in samples from well BW2G dropped to about 100 mg/l under continued pumping conditions.

Based on this information, well 66G was selected as the injection well and BW2G as the extraction well. The screened intervals for BW2G and 66G were within the Gallia formation only. Because the hydraulic conductivities of the Minford and Sunbury formations are at least three orders of magnitude smaller than in the Gallia formation, the top and the bottom surfaces of the Gallia alluvial were treated as no-flow boundaries. Three monitor wells (INT-1, INT-5 and INT-6) were installed on a line approximately transverse to and mid-way between BW2G and 66G. INT-1 was only screened in the basal gravel of Gallia formation, and INT-5 and INT-6 in the middle sand and upper gravelly silt, respectively. The tracer response data from these monitor wells was used to estimate the vertical TCE DNAPL distribution and the hydraulic conductivity contrast in the three different units of the Gallia formation. In addition, a hydraulic control injection well INT-7 was installed 3 m (10 ft) northeast of 66G and directly in line with BW2G to direct the tracer fluid toward BW2G.

Based on this injection and extraction pattern, the simulation domain and non-uniform model grid were chosen as shown in Figure 7.1. The area simulated was 1,022 m^2 (11,000 ft^2) and was divided into a 24 x 24 grid (NX x NY). The thickness was 1.8 m (6 ft) which was divided into 7 vertical grid blocks or layers. Smaller grid sizes were used for the grid blocks around the injection and extraction wells. The simulation dimensions and the number of grid blocks were chosen to minimize boundary effects. The pressures at two outer boundaries of the simulation domain were kept constant to establish a hydraulic gradient of 0.005 (see Figure 7.1).



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Schematic of the Simulation Grid and Well Locations

FIGURE 7.1

7.1.2 Porous Medium and Fluids Physical Properties

Porous media and fluid physical properties were based upon data from previous site investigations or from similar sites. Some pertinent data are summarized in Table 7.1. The relative permeability data were based on the Hill AFB OU2 experimental data reported by Oolman et al. (1995). The drainage capillary pressure data were matched to Kueper's Borden sand experiment data and the imbibition data were assigned such that the drainage and imbibition curves are consistent (Kueper *et al.*, 1989). The PITTs and the surfactant flood are imbibition processes, i.e, a water flood during which free-phase DNAPL may be displaced. It should be noted, however, that the relative permeability and capillary pressure functions are not very important parameters for the NAPL partitioning tracer test since the process is essentially single-phase water flow with some small reduction in effective permeability to water wherever residual DNAPL is located in the model. The capillary pressure equals zero for these simulations.

Table 7.1 Summary of Porous Medium and Fluid Physical Properties

Parameters	Value
Porosity	0.25
Hydraulic Conductivity	
Upper muddy gravel	
Kh	$8x10^{-3}$ cm/s
Kv	$8x10^{-4}$ cm/s
Middle sand	
Kh	$6x10^{-3}$ cm/s
Kv	$6x10^{-4}$ cm/s
Lower gravel	
Kh	$1x10^{-2}$ cm/s
Kv	$1x10^{-3}$ cm/s
Residual Saturation	
TCE	0 - 0.05
Water	0.24
Dispersivity	
Longitudinal	2.5 ft
transverse	0.0
Density	
TCE	1.47 g/ml
Water	1 g/ml
Viscosity	
TCE	0.566 cp
Water	1 cp
Hydraulic gradient	0.005

7.2 Design of the Partitioning Interwell Tracer Test

The partitioning interwell tracer test (PITT) involves the injection of a suite of conservative and partitioning tracers into one or more wells and the subsequent extraction of the tracer solution from one or more nearby extraction wells. Conservative tracers have a partition coefficient of zero relative to the NAPL; the partitioning tracers will have non-zero partition coefficients relative to the NAPL. The partition coefficient (K_i) is defined as:

$$K_i = \frac{C_{i,N}}{C_{i,GW}} \tag{1}$$

where $C_{i,N}$ is the concentration of the of the "i"th tracer in the NAPL, and $C_{i,GW}$ is the concentration of the of the "i"th tracer in the ground water. The retardation of the tracers in a NAPL contaminated system is given by (Pope et al., 1994):

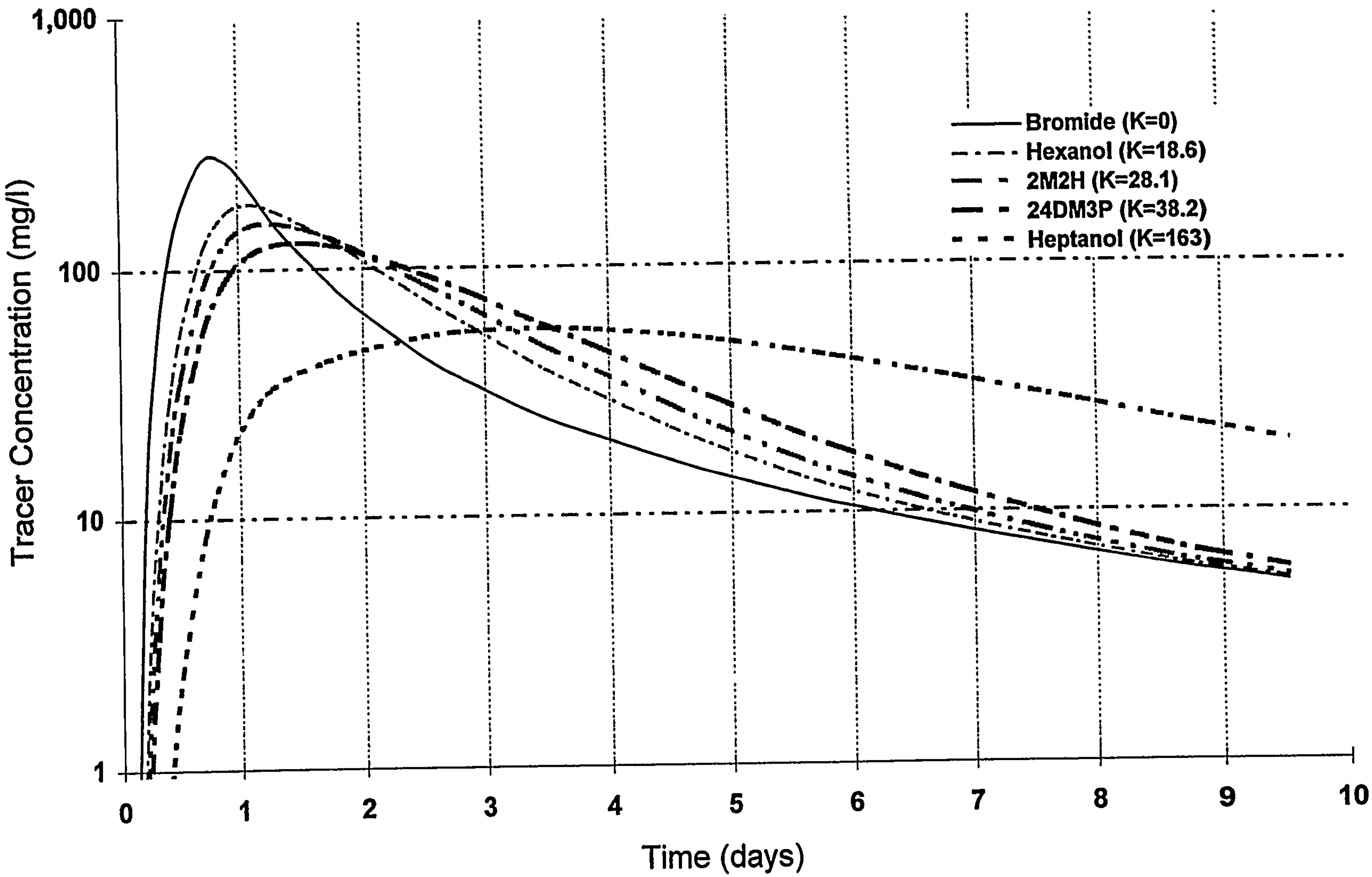
$$R_f = 1 + \frac{K_i\ S_N}{1-S_N} \tag{2}$$

where S_N is the average NAPL saturation, i.e., fraction of pore space occupied by NAPL in the total swept volume. While the conservative tracers will be unaffected by the presence of DNAPL in the subsurface pore spaces, the partitioning tracers undergo retardation by their partitioning into and from the DNAPL. The chromatographic separation of the tracers shown in Figure 7.2 is due to this partitioning and is used to measure the volume of DNAPL in the interwell zone between the two wells (Jin et al., 1995).

7.2.1 UTCHEM Simulations for Preliminary Design of a Partitioning Tracer Test

Computer simulations were performed using a three-dimensional model to obtain initial scoping calculations for preliminary design of a PITT at PORTS. The simulation code used was UTCHEM, a three-dimensional, finite-difference, multi-phase fluid flow and contaminant transport simulator (Delshad et al., 1996).

During a PITT, any DNAPL encountered by the partitioning tracers during their transport through the pore space between the injection and extraction wells (known as the "swept pore volume") will cause the retardation of these tracers. This is caused by the dissolution of the partitioning tracers into the DNAPL until equilibrium partitioning has been achieved, then the exsolution of the same tracers back into the groundwater as dictated by the partition coefficient (see equation (1), Section 7.2). As the partitioning tracer concentration in the ground water adjacent to the DNAPL declines because of continuing injection of tracer-free ground water, the net flux of partitioning tracers is that of dissolution back into the ground water to preserve the equilibrium partitioning dictated by the particular partition coefficient for the tracer. Thus, the recovery of partitioning tracers at the extraction well is delayed relative to the recovery of the conservative tracer (i.e. retarded)



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Simulated Pre-Flood Tracer Response Curves

FIGURE 7.2

which has a zero partition coefficient. Since the retardation factor for each partitioning tracer, R_f (as defined in equation (2) in Section 7.2), is a function of both the partition coefficient (K_i) for the tracer and the residual DNAPL saturation, S_N, of the DNAPL-contaminated aquifer, we can solve for S_N by measuring R_f for tracer pairs with known partition coefficients, K_i.

Thus, prior to the tracer test, the residual DNAPL saturation and the DNAPL volume in the swept pore volume are unknown. As an initial guess, 511 liters (135 gallons) of TCE were randomly distributed in the vicinity of the injection and extraction wells. Because this is a very uncertain estimate, sensitivity cases were run to see the effects of changing the DNAPL saturation and spatial distribution on the tracer test results. Therefore, a suite of partitioning tracers with known partition coefficients for the DNAPL is employed to ensure that at least one tracer response curve will be generated with sufficient separation from the conservative tracer ($K_i = 0$) response curve to calculate the volume of DNAPL in the test zone which is defined by the swept pore volume. If additional tracer response curves are produced with sufficient separation during the test time span, then additional DNAPL volume calculations can be made to increase confidence levels for the PITT results. For reasons of economy and tracer-signal detection, it is desirable to employ tracers which yield retardation factors in the range 1.2-4.0 (Jin et al., 1995). This means that, if the value of S_N is reduced by solubilization, then the pre-flood and post-flood PITTs will require different suites of tracers in order to maintain the value of the retardation factors within this range.

7.2.2 Optimum PITT Design Parameters

To develop an optimum design strategy for the PITT, a number of sensitivity studies were run to simulate the performance of the test. These sensitivity studies included varying the injection and extraction rates, amount and distribution of DNAPL and hydraulic conductivity distribution. The results from these sensitivity studies were then used to determine the duration of the tracer test, the mass of each tracer needed, the injection and extraction rates, the extraction well effluent tracer concentrations and the amount of tracer recoverable at the end of the tracer test. Based upon the results of these sensitivity studies, an optimum operation design was chosen with the major pertinent design variables listed in Table 7.2.

Table 7.2 Summary of Pre-Flood PITT Design Parameters

Wells	Well Name	Screen Interval	Rate	
Injection Well	66G	~27 - 34 BGS	3 gpm	
Extraction Well	BW2G	~27 - 34 BGS	5 gpm	
Tracers		Mass (kg)	Injected Concentration (mg/l)	
bromide		14	700	
2-propanol		14	700	
3-methyl-3-pentanol		14	700	
1-hexanol		14	700	
2,4-dimethyl-3-pentanol		14	700	
1-heptanol		14	700	
Test Segments	pre-test flush (0.5 days) tracer injection (1.3 days) water flush (8 days)			
Sampling Strategy	Well	Time (days)	Sampling frequency (hrs)	Number of samples
	Extraction Well	1 - 2 3 - 4 5 - 10	1 2 6	48 24 24
	Monitor Wells	1 2 3 - 4 5 - 10	1 2 6 12	24 24 8 12
	Injection Well	1 - 2	4	6

8.0 PRE-FLOOD PARTITIONING INTERWELL TRACER TEST

8.1 Test Configuration

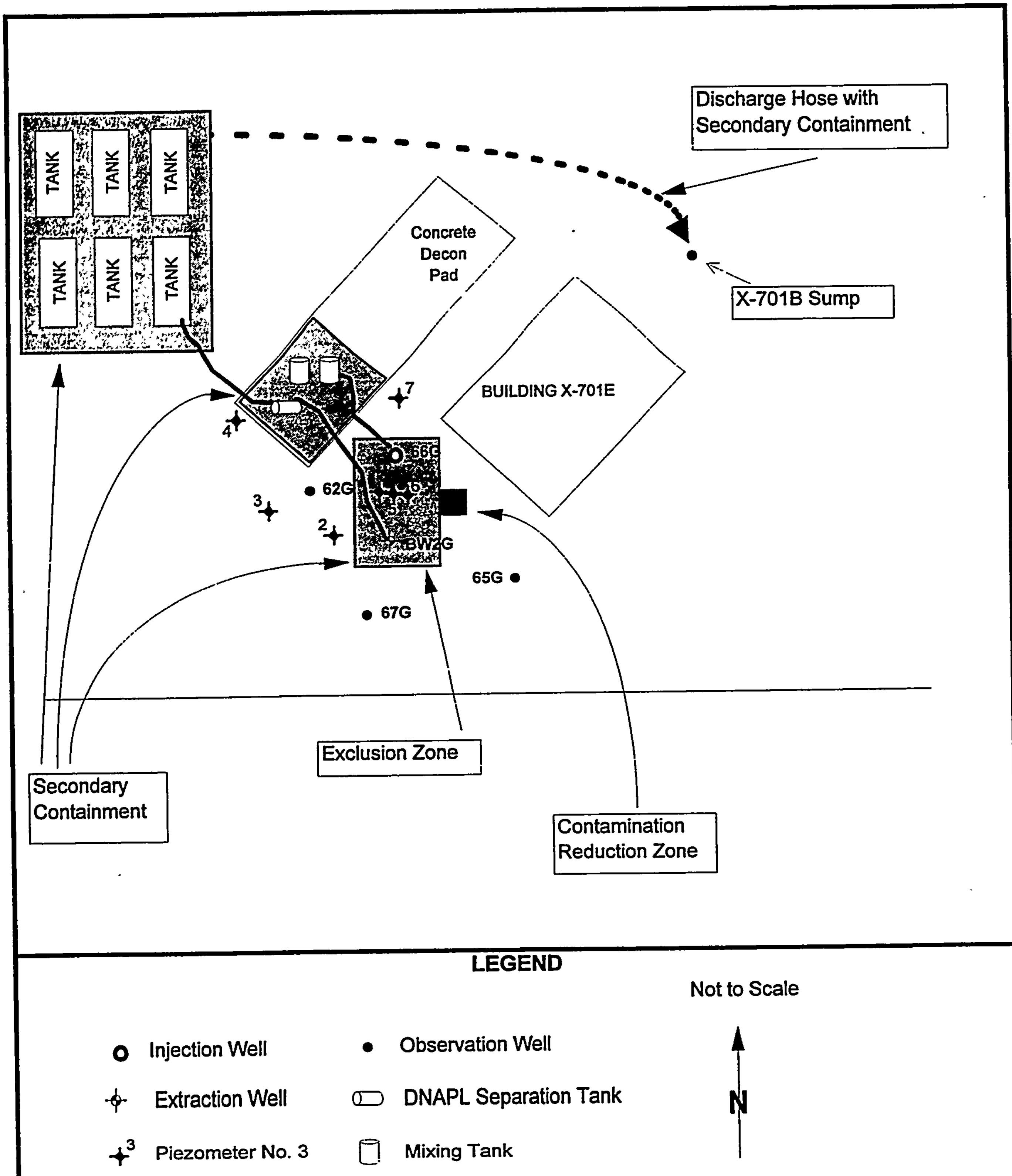
The pre-flood PITT (PITT-1) was conducted in July 1996. Monitoring well X701-66G was designated as an injection well and well BW2G was designated as the extraction well. Piezometer INT-7 was installed north of X701-66G, opposite from BW2G, as a hydraulic control well. Potable water was injected in this piezometer in order to divert southward the injectate at X701-66G. Three piezometers (INT-1, INT-5, and INT-6) were also installed midway within the test area as sampling points. Figure 8.1 shows the configuration of the testing equipment. Figures 8.2 and 8.3 show process flow diagrams for the injection and extraction systems.

A tracer solution was injected at a rate of 11 l/m (3gpm) in X701-66G, and potable water was injected at 3 l/m (0.8 gpm) in INT-7. Ground-water was produced from BW2G at 19 l/m (5 gpm). Ground-water was extracted from the three intermediate piezometers at a rate of approximately 50 ml per minute for sampling purposes. The extraction well was equipped with a Clean Environment™ pneumatically-operated stainless steel total-fluids pump. The intermediate piezometers were equipped with 0.75-inch-diameter stainless steel pneumatically-operated double-valve pumps for sampling. Pumping from piezometers INT-5 and INT-6 could not be maintained at 50 ml/min, and had to be sampled manually using 0.5-inch-diameter stainless steel bailers.

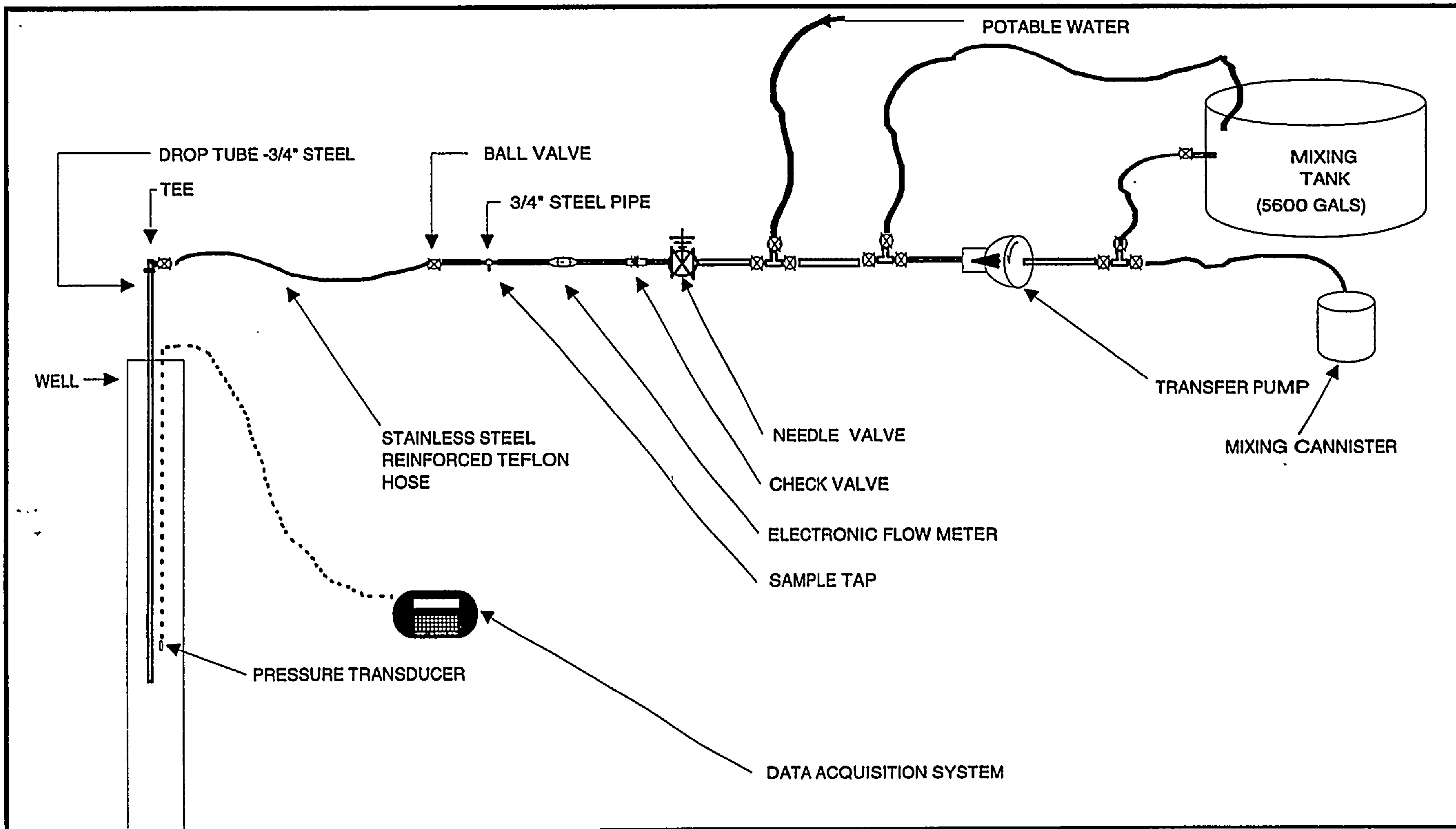
Injection and extraction lines were equipped with electronic totalizing flow meters in order to maintain flow rates according to test design parameters. Fluid levels were monitored to ensure that hydraulic control was maintained. Pressure transducers were installed in the wells so that fluid levels could be automatically recorded by an electronic data acquisition system. The fluid levels were periodically verified manually with an interface probe.

The PITT schedule called for continuous tracer or water injection in well X701-66G and continuous water injection in piezometer INT-7, which acted as a hydraulic control well. Fluids were continuously extracted from well BW2G. The duration of the tracer test was 10.24 days. Initially, potable water was injected into 66G for 1.91 days, then tracers were injected for 1.23 days, followed by a water flood, which lasted for 7.1 days. A time line for the test is shown in Figure 8.4. A total volume of 94,087.1 gallons of water was produced from well BW2G during the test. A minor amount of water, which totaled less than 55 gallons, was also produced from the intermediate piezometers for sampling purposes.

Ground-water samples were collected into 40-ml VOA bottles and stored in a refrigerator at 4 degrees centigrade. Ground-water samples were analyzed on-site using a portable gas chromatograph. Analysis parameters included the tracer alcohols and TCE.



INTERA A Duke Engineering & Services Company	Configuration of the Test Equipment	FIGURE 8.1



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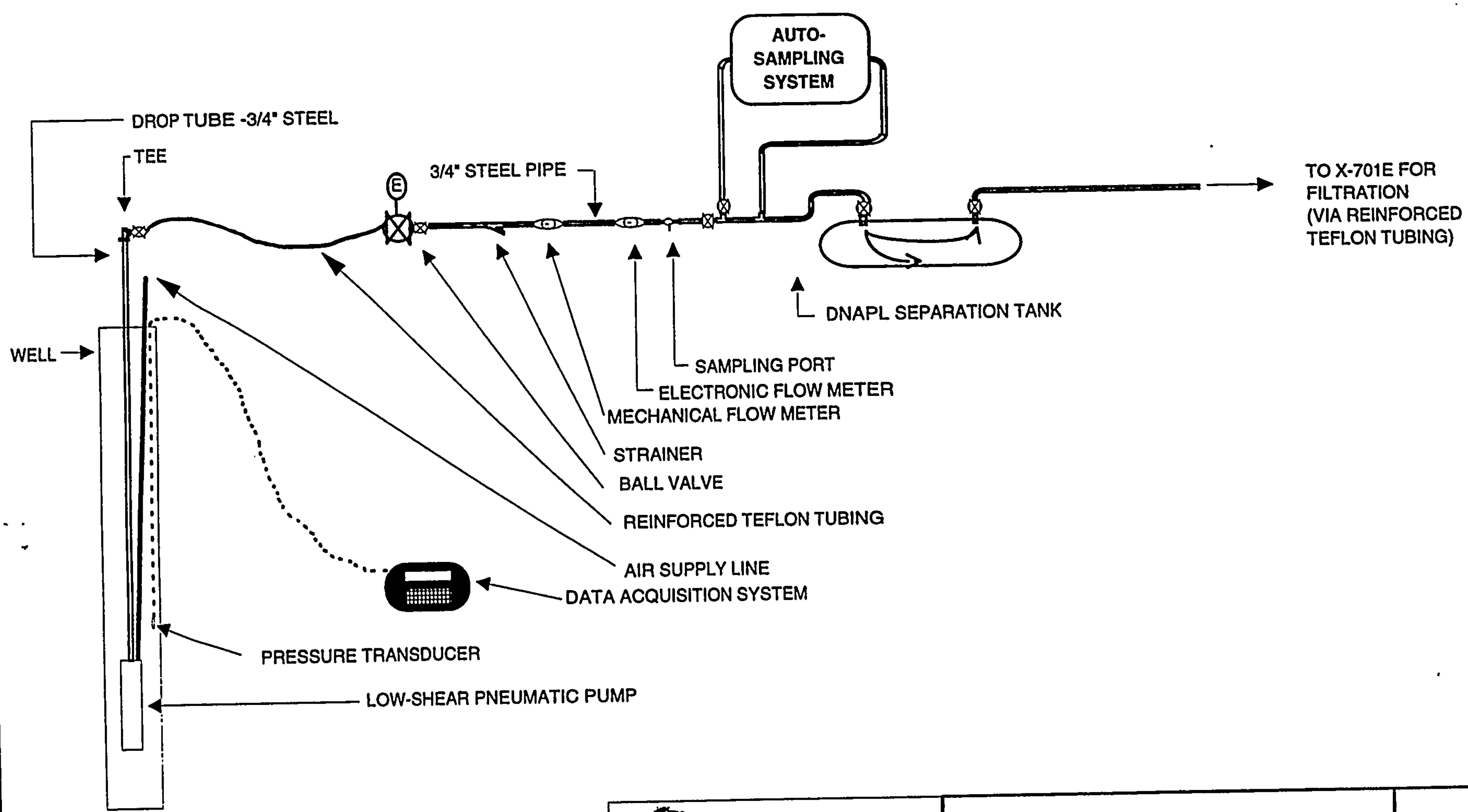
PROCESS FLOW DIAGRAM: TRACER INJECTION SYSTEM

FIGURE 8.2



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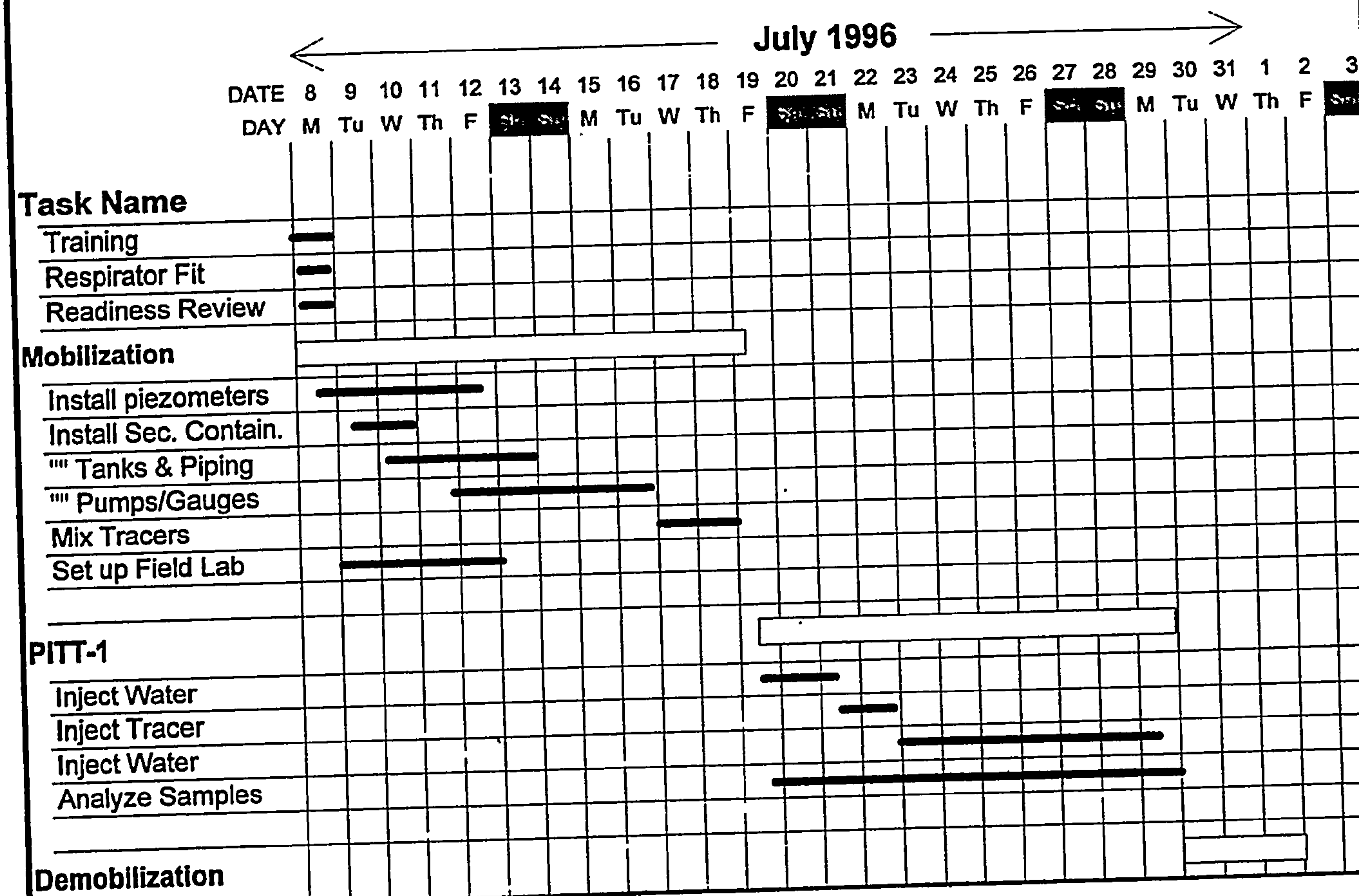
PROCESS FLOW DIAGRAM:
EXTRACTION SYSTEM

FIGURE
8.3



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Schedule for PITT-1

FIGURE 8.4

8.2 Results of Pre-flood PITT

Data obtained during the PITT include time-series concentrations of all tracers for extraction well BW2G and monitor wells INT-1, INT-5 and INT-6. Figure 8.5 shows a comparison of the nonpartitioning IPA tracer response in INT-6 (gravelly silt), INT-5 (middle sand) and INT-1 (lower gravel). The very low IPA concentration in the gravelly silt indicates that the hydraulic conductivity in this unit is extremely small compared with the middle sand and lower gravel zones. Therefore, fluid flow through the upper unit during the PITT was not significant. The faster tracer breakthrough time in the lower gravel than in the middle sand unit and subsequent numerical simulation indicate the hydraulic conductivity in the lower gravel is approximately an order of magnitude higher than in the middle sand unit. Consequently, the numerical simulation model was modified to reflect the fining-upward sequence with the following hydraulic conductivities:

upper gravelly silt:	3.5E-4 cm/s
middle sand:	2.1E-3 cm/s
basal sand and gravel:	2.1E-2 cm/s

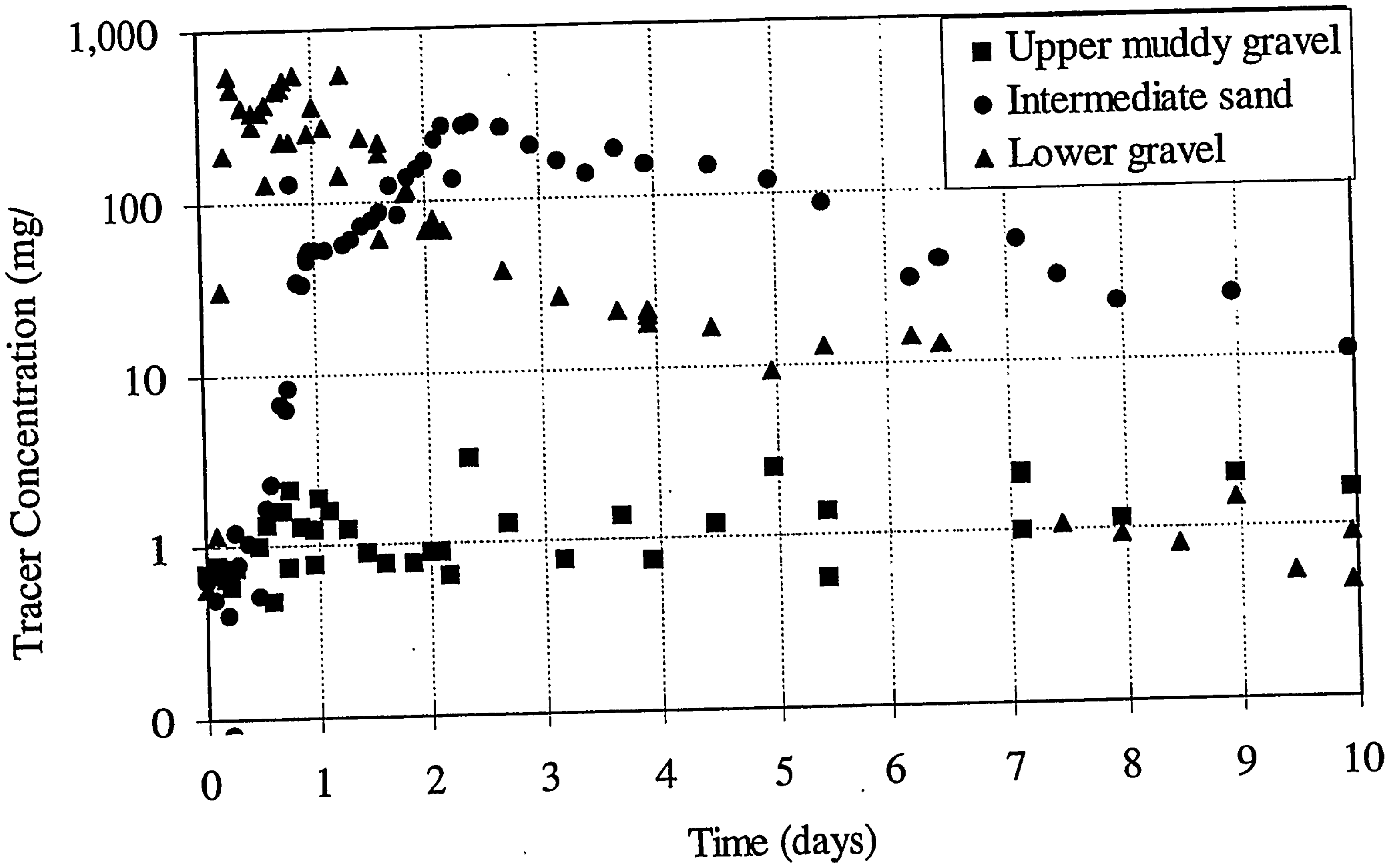
Figure 8.6 illustrates the normalized tracer response data of IPA and 1-heptanol in the middle sand unit. The simultaneous arrival of both the non-partitioning and partitioning tracers indicates that little or no residual TCE is present in the middle sand unit of the Gallia formation.

The amount of TCE in the tracer swept volume of the Gallia formation is much smaller than the estimate used in the pre-flood tracer test design. As a result, the tracer data for tracers with lower partition coefficients (i.e., 3-methyl-3-pentanol, 1-hexanol and 2,4-dimethyl-3-pentanol) did not render sufficient separation to estimate the TCE volume. Therefore, the tracer response data of IPA and 1-heptanol, as shown in Figure 8.7, were analyzed using both the method of first moment analysis and the method of inverse modeling to determine the quantity and distribution of TCE (Jin *et al.* 1995). Figure 8.7 also shows the best matches of actual and simulated tracer response data using inverse modeling.

During the pre-flood PITT, the average residual saturation of DNAPL in the test zone was determined to be between 0.2 to 0.4%. All residual saturation was found in the lower gravel unit of the Gallia, and none in the middle sand or upper gravelly silt. The average residual saturation of 0.2 to 0.4% equates to a volume of approximately 15 liters (four gallons) of DNAPL in the test area. The fact that DNAPL is only present in the basal gravel suggests that it migrated laterally into the BW2G area from the area of the pond, not vertically from the effluent lines.

Graphs of ground water quality parameters during testing are included as Figures 8.8 through 8.12. All plots show approximately 6 hours of lag time between an injection event and a corresponding response in the ground water from the extraction well, reflecting the travel time through the test zone flow path.

Figure 8.8 shows changes in the temperature of extracted ground water during testing. The long-phase trend is from warming of the aquifer by injection of potable water. Ambient ground water was



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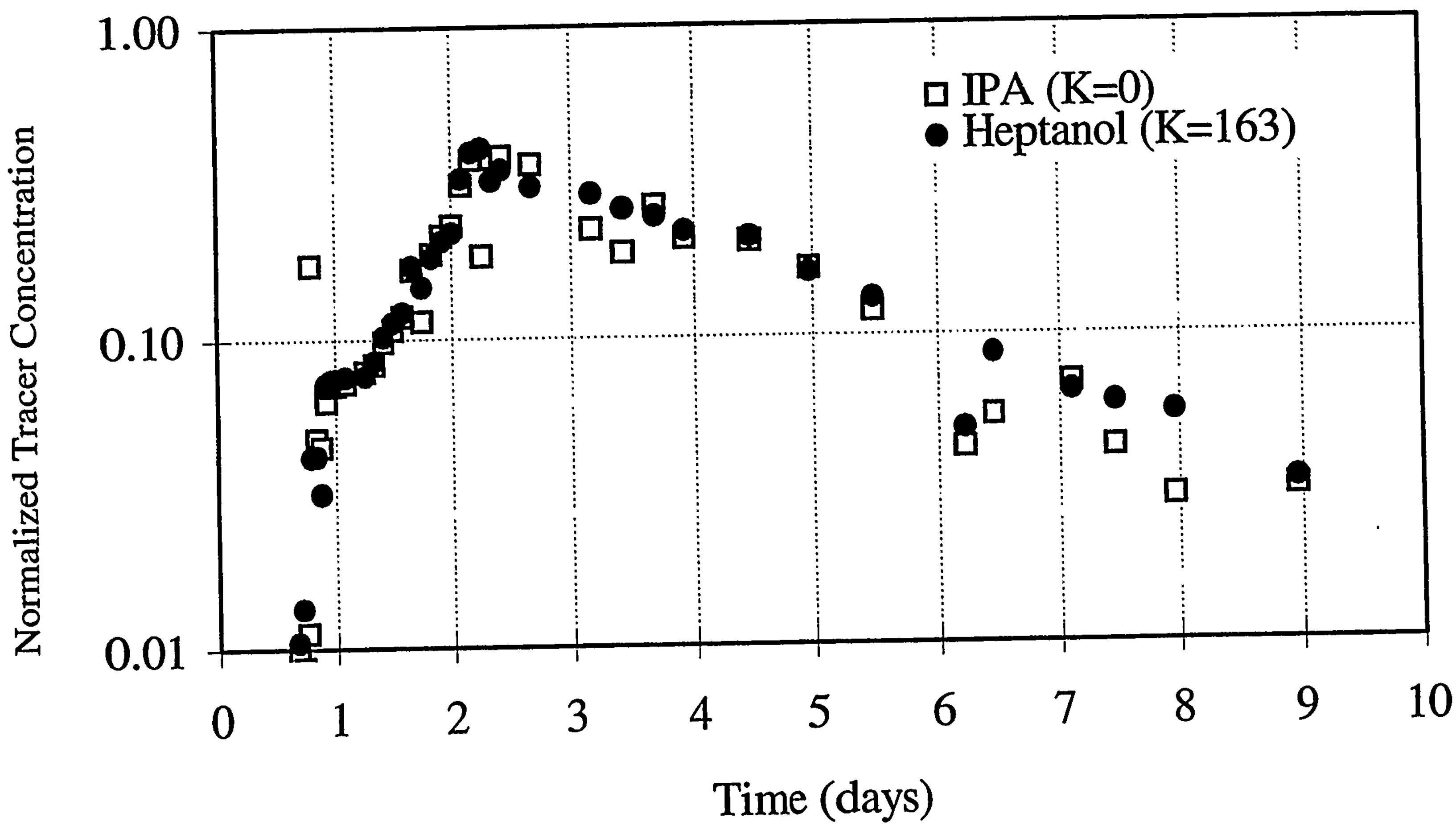
IPA Tracer Response Data from Monitoring Wells in Different Zones

FIGURE 8.5



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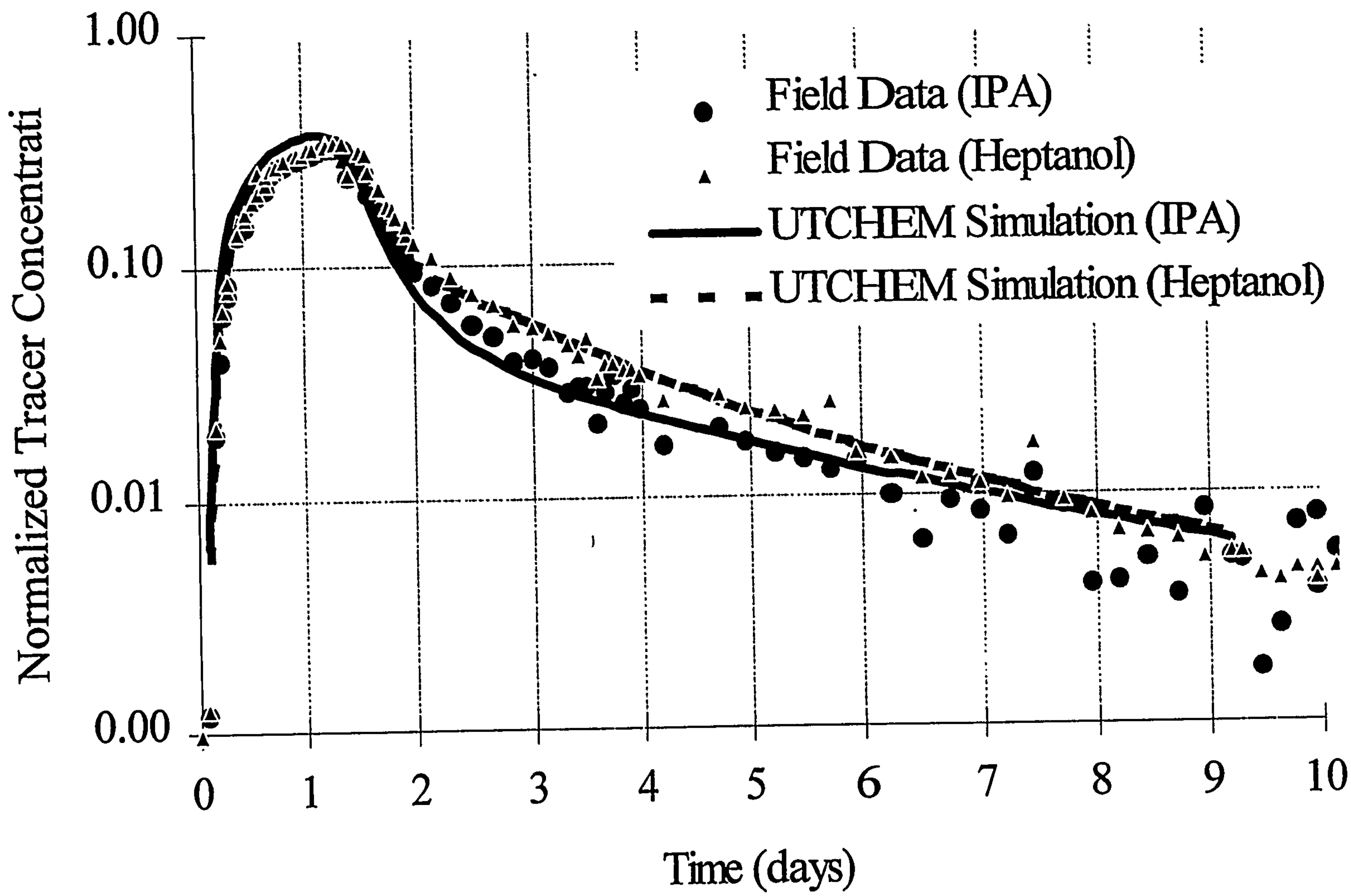
Normalized Tracer Response in the Middle Sand Unit

FIGURE 8.6



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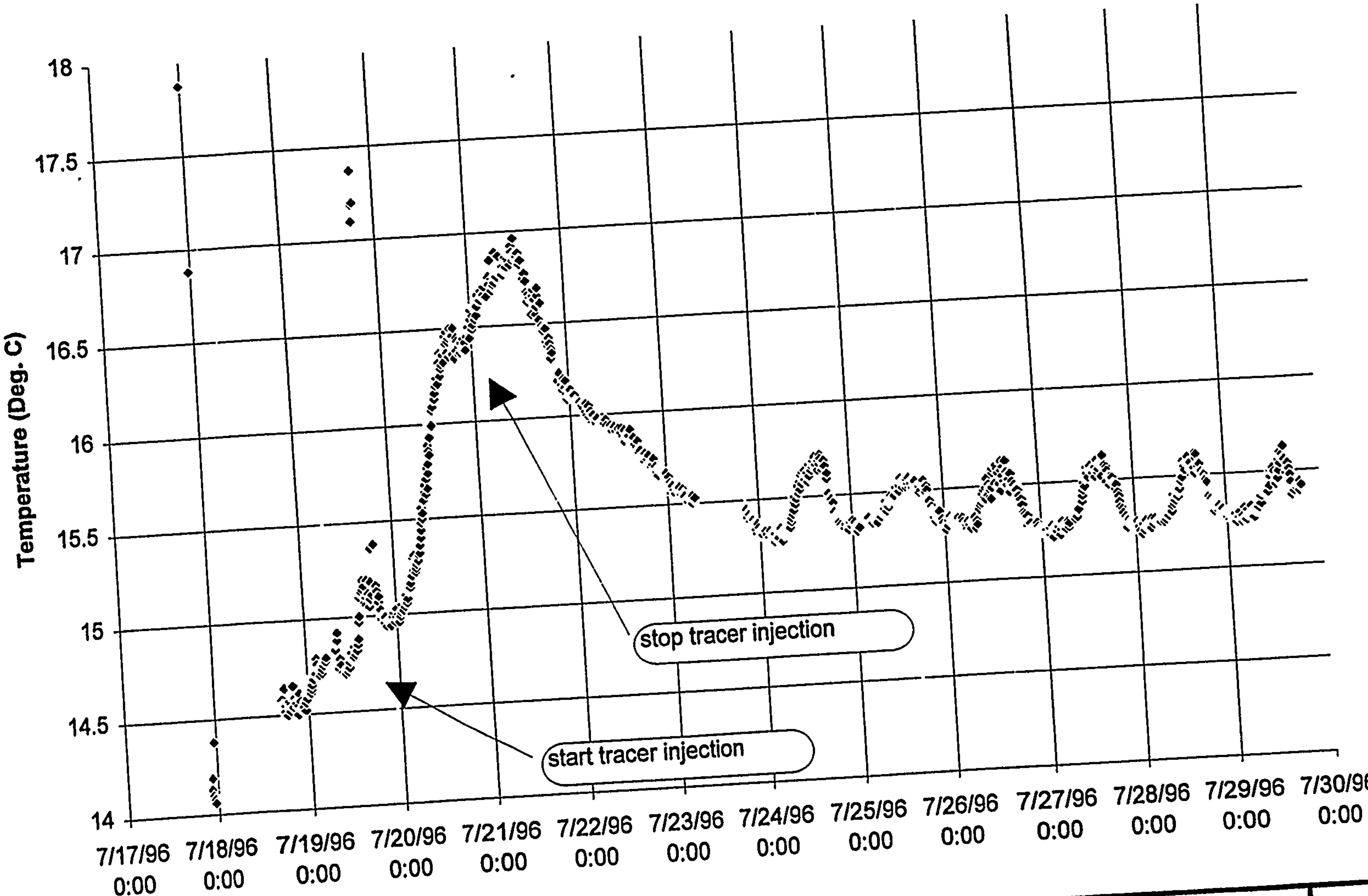
Test Effluent IPA and 1-Heptanol and UTCHEM Simulation Results

FIGURE 8.7



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PITT-1: Test Effluent Temperature

FIGURE 8.8

approximately 14°C, and was warmed to approximately 17 °C during tracer injection. The second trend over-prints the warming trend and probably reflects diurnal heating and cooling of the test process piping rather than any subsurface effect.

Figure 8.9 shows changes in pH during testing. The range of pH was between 5.7 and 5.8. The effect of diurnal temperature changes is evident.

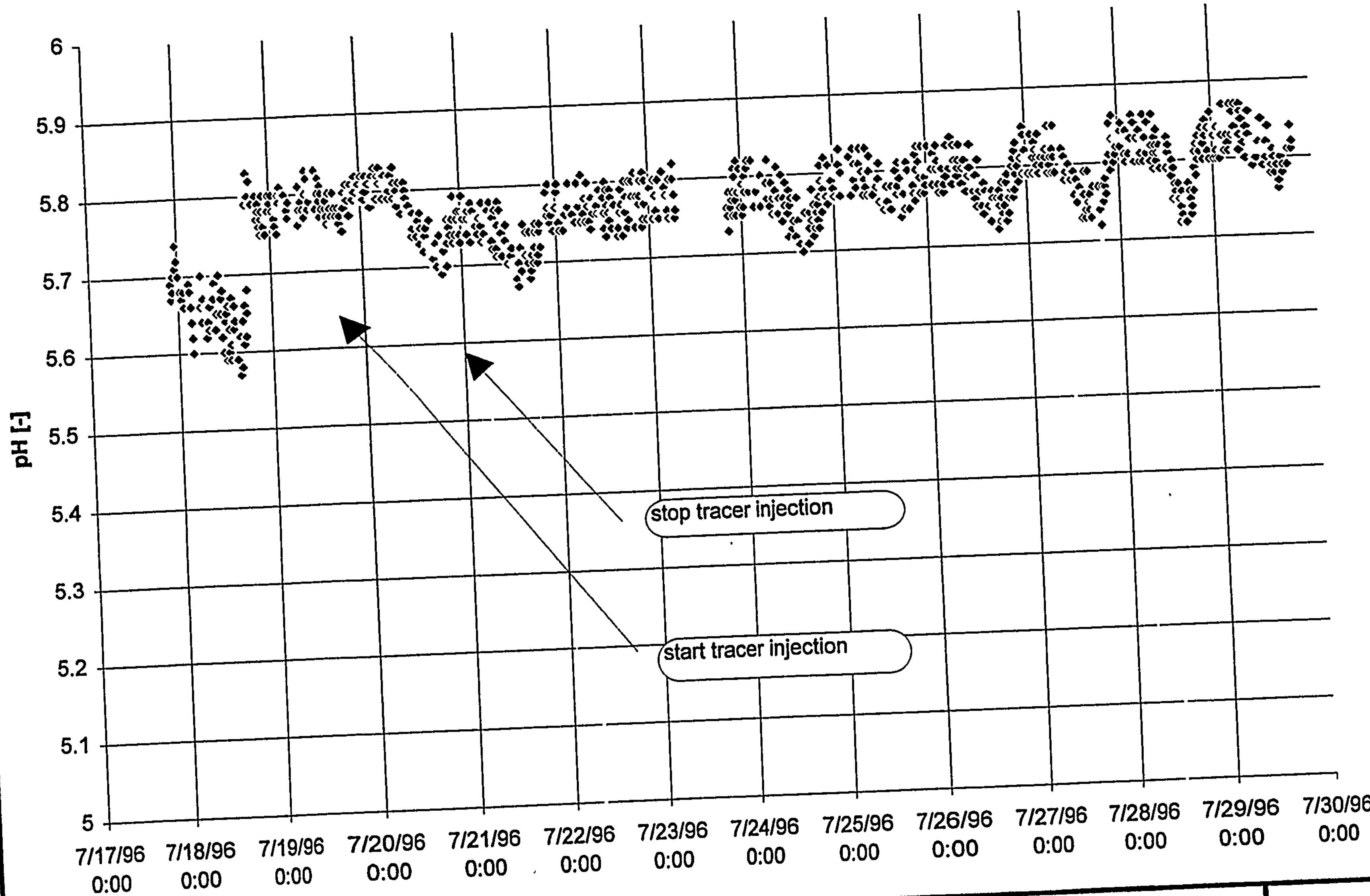
Figure 8.10 shows changes in dissolved oxygen (DO) concentrations. Ambient dissolved oxygen concentrations were near zero mg/l, which is typical for conditions in the center of an organic contaminant plume containing dissolved grease.

Figure 8.11 shows the response of specific conductance, which responded strongly to tracer injection, but seemed insensitive to temperature changes. Ambient specific conductance was approximately 500 micro Siemens per centimeter (μS/cm) and rose to 800 μS/cm during tracer injection.

Figure 8.12 shows changes in measured platinum electrode potential corrected to an E_h measurement by adding 250 mV to the field-measured reading.

Figure 8.13 shows piezometric response in monitoring wells during testing. Water levels within the test area remained fairly constant until Day 6 of the test (July 25, 1996), when approximately 0.4 m of drawdown was observed without a corresponding increase in test extraction rates. The head change was later correlated with a pumping test conducted in horizontal wells located some 150 meters downgradient.

Piezometric data are included as Appendix E. Ground water quality data and GC analysis data are included as Appendices F and G, respectively.



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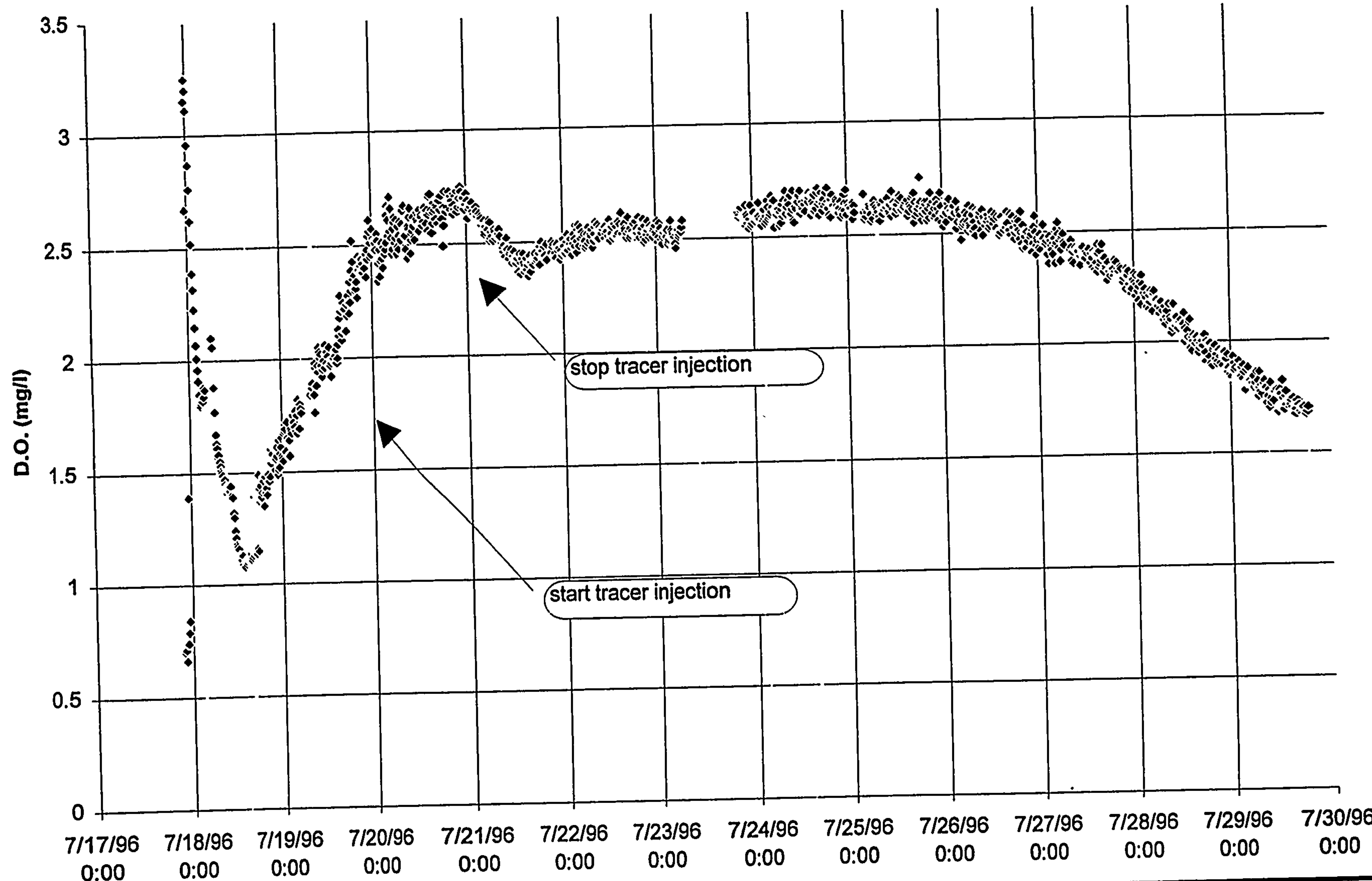
PITT-1: Test Effluent pH

FIGURE
8.9



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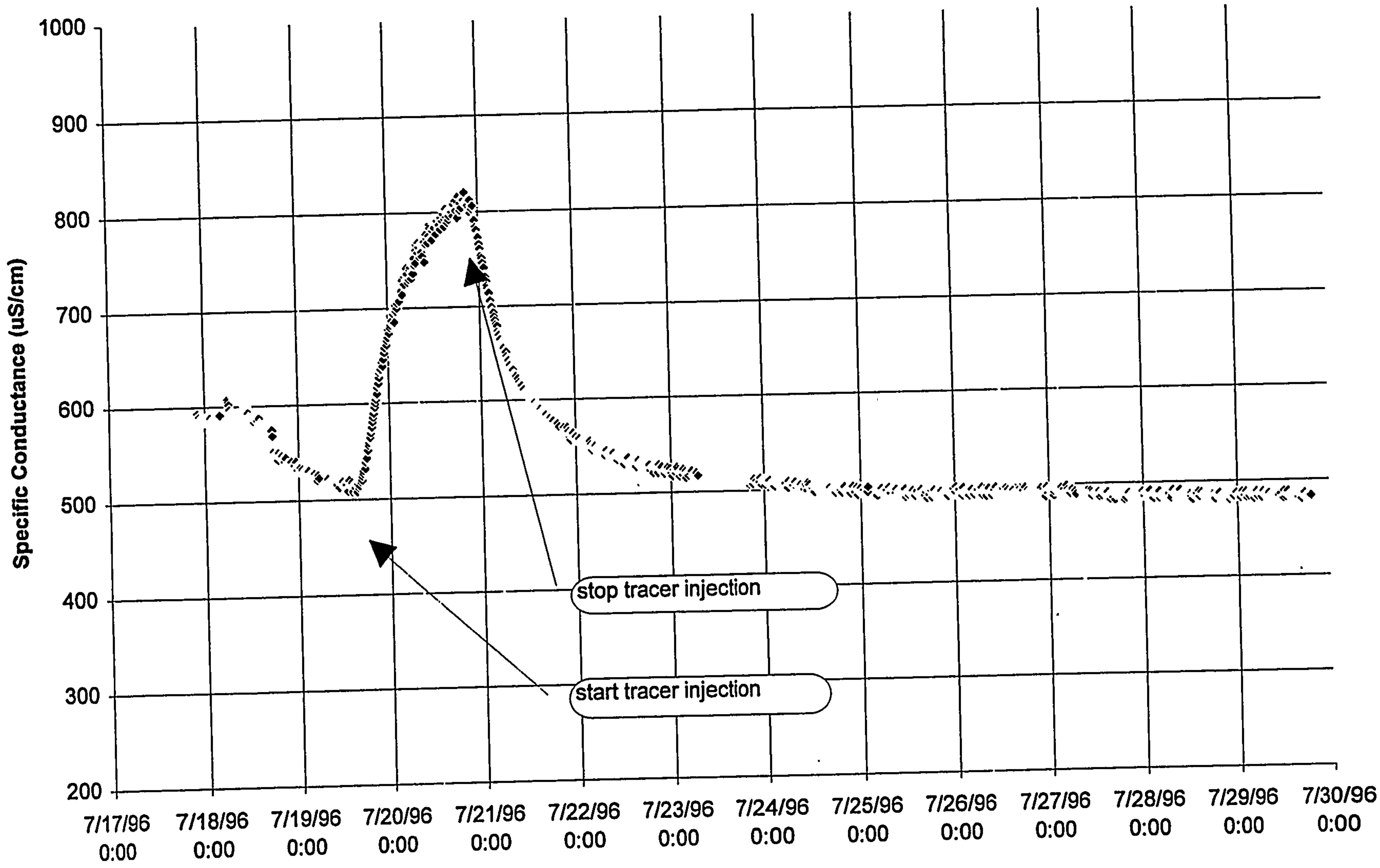
PITT-1: Test Effluent Dissolved Oxygen Concentration

FIGURE 8.10



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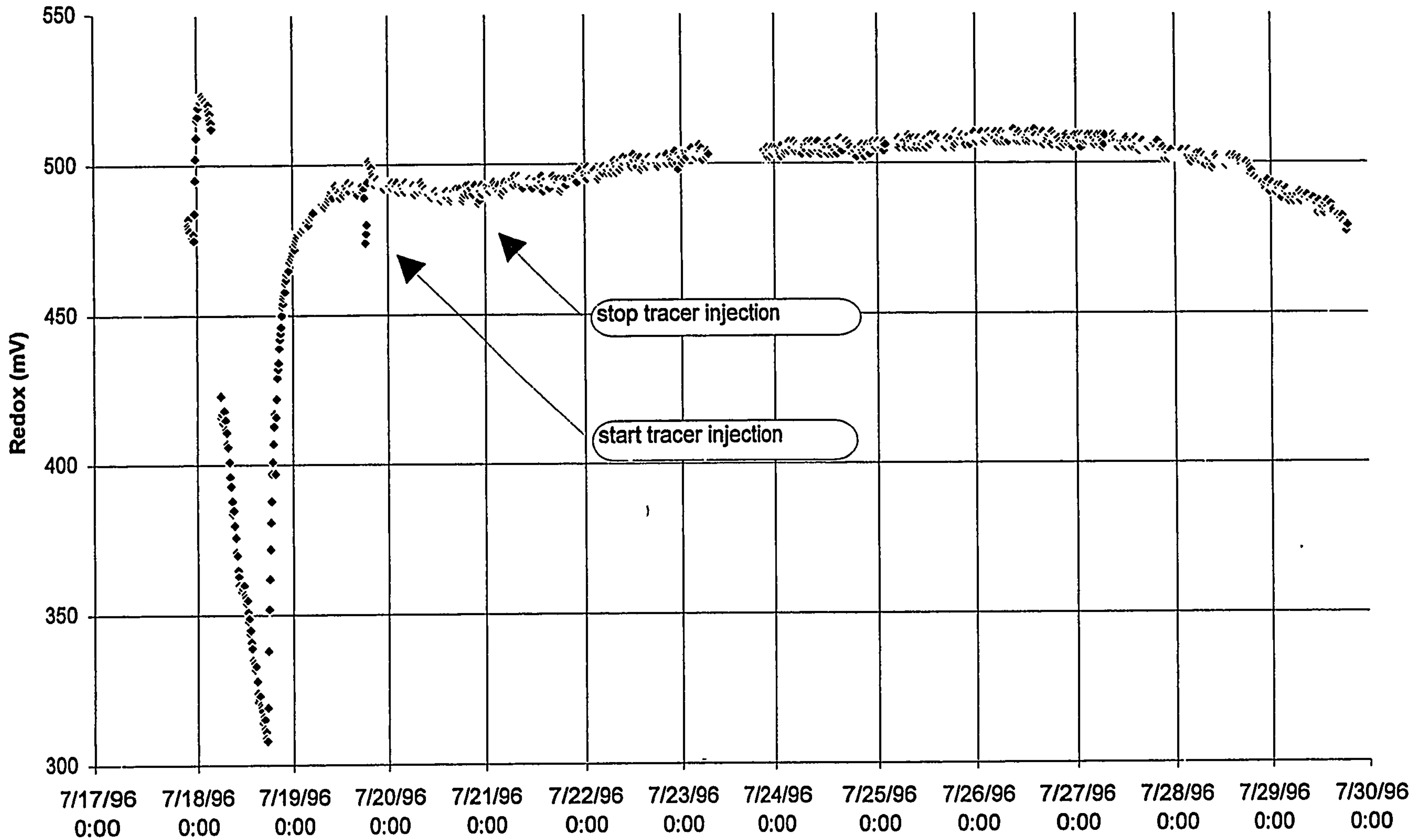
PITT-1: Test Effluent Specific Conductance

FIGURE 8.11



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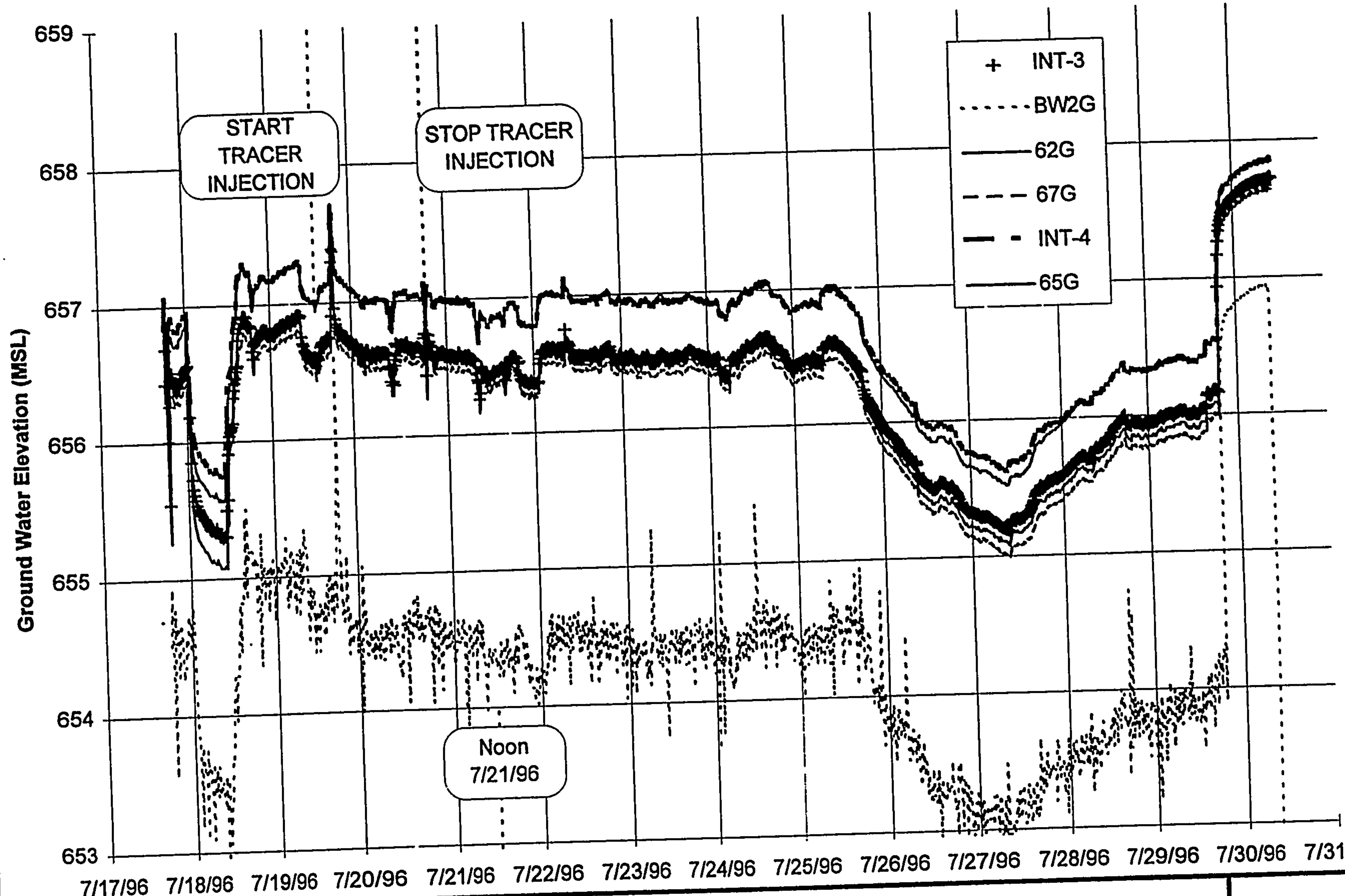
PITT-1: Test Effluent Measured Platinum Electrode Potential

FIGURE 8.12



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PITT-1: Piezometric Response

FIGURE 8.13

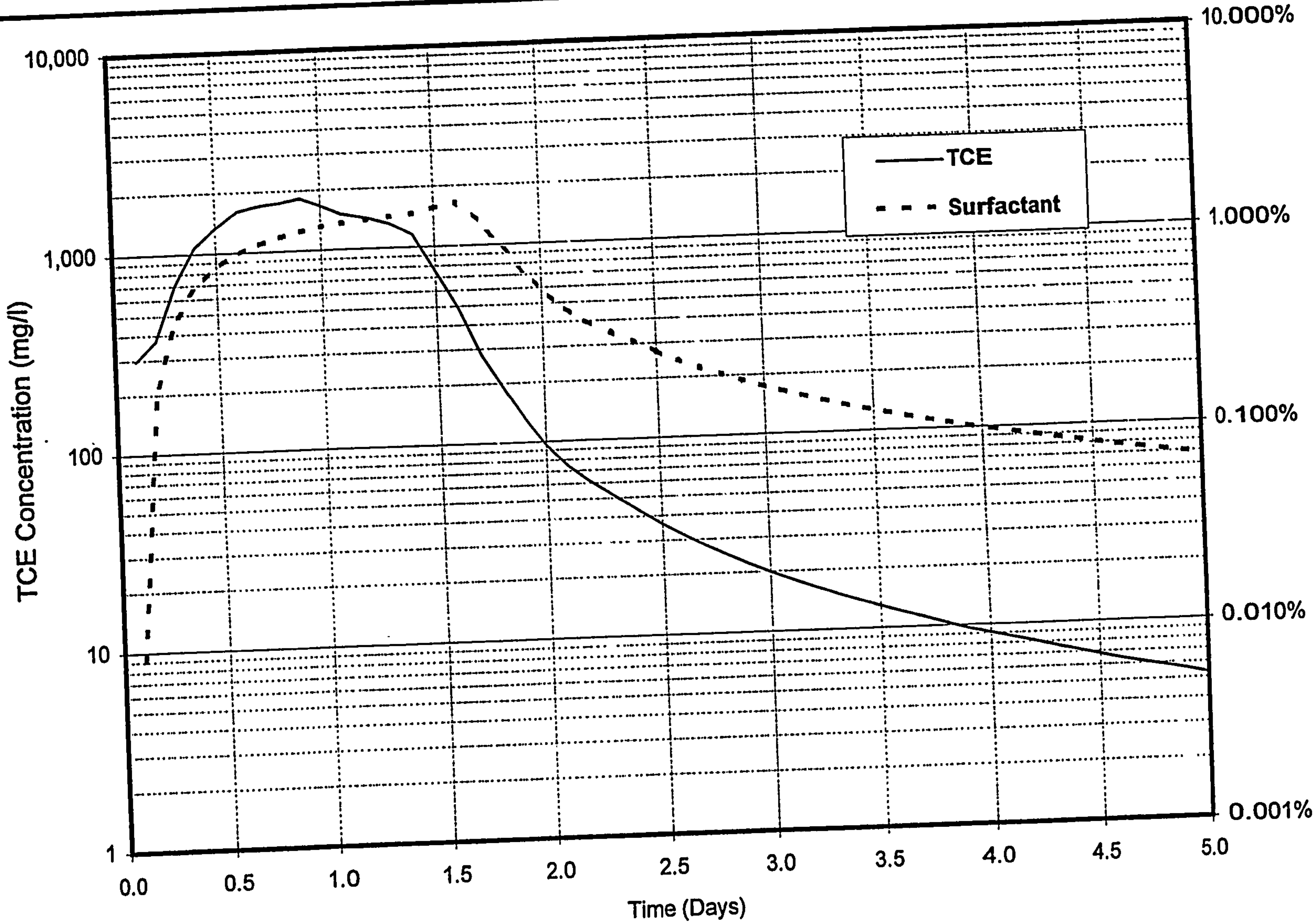
9.0 SOLUBILIZATION TEST

The pre-flood PITT data yielded the volume and average distribution of TCE DNAPL within the test area. Since the model was calibrated to match the tracer data, minimal changes were required in the model parameters for the solubilization test and post-flood PITT simulations. The simulation domain, finite-difference grid, and the porous medium and fluid physical properties were kept the same except for changes in the hydraulic conductivities of the different units (see Section 8.6). The physical properties of the surfactant solution were incorporated as well. Based on hydraulic conductivity and TCE distribution information from the pre-flood PITT, it was decided that the fluid injection and extraction would be targeted toward the bottom 1.5 ft of the Gallia formation (the gravel unit).

As discussed in Section 6.2, the surfactant solution consisted 4% sodium dihexyl sulfosuccinate (Aerosol MA-80I), a 4% isopropyl alcohol (IPA) as the co-surfactant, and a 0.1% each of NaCl and $CaCl_2$ as the electrolytes for the solubilization test.

The UTCHEM parameters were derived to match the experimentally observed fluid and phase behavior. The critical micelle concentration (CMC) of the surfactant solution is 0.2%. The viscosity and interfacial tension of the microemulsion (i.e., a micellar surfactant solution containing solubilized TCE above the CMC) is 1.5 cp and 0.15 dyne/cm, respectively. The relative permeability and capillary pressure data for the microemulsion were the same as for water (as shown in Figures 6.2 and 6.3).

Simulations were conducted to determine the duration of the solubilization test, the mass of surfactant, IPA and salts required, the predicted extraction-well effluent TCE and surfactant concentrations and the surfactant recovery at the end of test. Based upon the results of UTCHEM simulation studies, an optimum operational design was chosen with the major pertinent design variables as listed in Table 9.1. The simulated extraction well effluent TCE and surfactant concentrations as a function of time are shown in Figure 9.1.



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Simulated Effluent TCE and Surfactant Concentrations

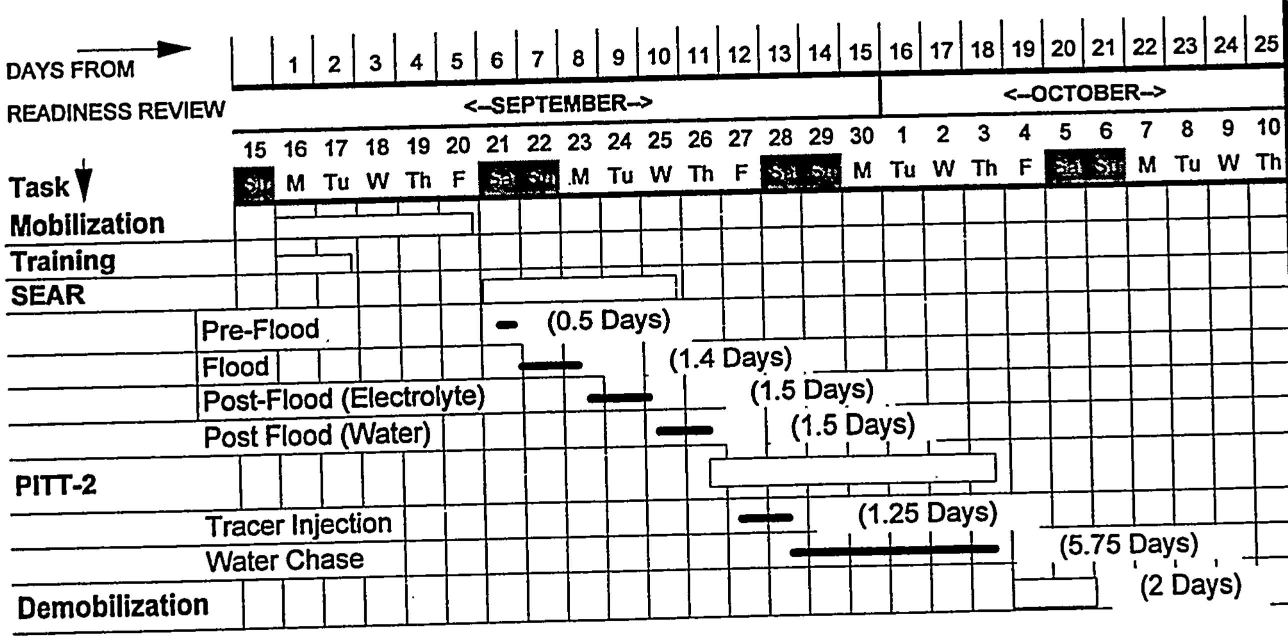
FIGURE 9.1

Table 9.1 Summary of Surfactant Flood Design Parameters

Wells	Well Name	Screen Interval	Rate
Injection Well	BW2G	~32.5 - 34 BGS	3 gpm
Extraction Well	66G	~32.5 - 34 BGS	5 gpm
Surfactant Solution		**Injected Concentration (wt%)**	
Sodium dihexyl sulfosuccinate		4	
IPA		4	
NaCl		0.1	
$CaCl_2$		0.1	
Test Segments	pre-test flush (0.5 days) surfactant injection (1.5 days) post water flush (3 days) --- continued by post-flood PITT		
Sampling Strategy	**Time (days)**	**Sampling Frequency (hrs)**	**Number of Samples**
Extraction Well	1 - 2 3 - 5	1 2	48 36
Monitor Wells	1 2 3 - 5	1 2 6	24 24 12
Injection Well	1.5	4	9

9.1 Test Configuration

Mobilization for the solubilization test commenced on Monday, September 16, 1996. The schedule for testing is illustrated in Figure 9.2. Wells used during the solubilization test were the same as during PITT-1. A surfactant solution was injected into well X701-66G at 3 gpm. Fluids were extracted from observation well BW2G at a rate of 5 gpm. Potable water was continuously injected into piezometer INT-7 at 0.8 gpm. In order to direct as much surfactant solution as possible into the lowest unit of the Gallia, packers were installed into both the injection and the extraction wells. Figure 9.3 is a schematic showing packer placement. Sampling points included the extraction well and the three temporary piezometers (INT-1, INT-5, INT-6) placed within the flow path. The injectate composition was periodically monitored to assure quality control. The duration of the solubilization test was 5 days. Samples collected during the solubilization test were sent to the



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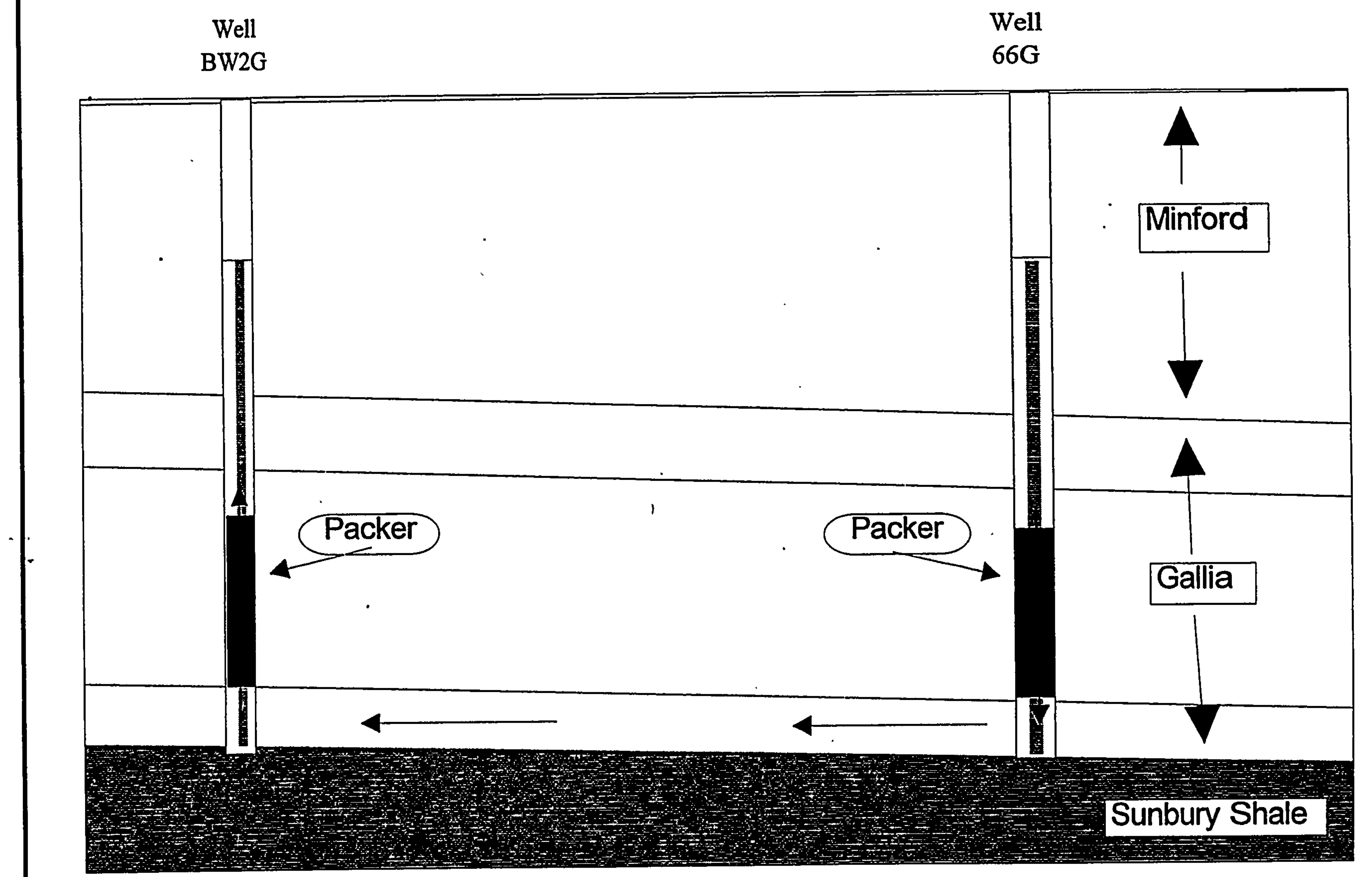
Schedule for Solubilization Test and PITT-2

FIGURE 9.2



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Packer Placement for Solubilization Test / PITT-2

FIGURE 9.3

analytical laboratory at SUNY for analysis and were analyzed for surfactant, TCE, TCA, and PCE concentrations.

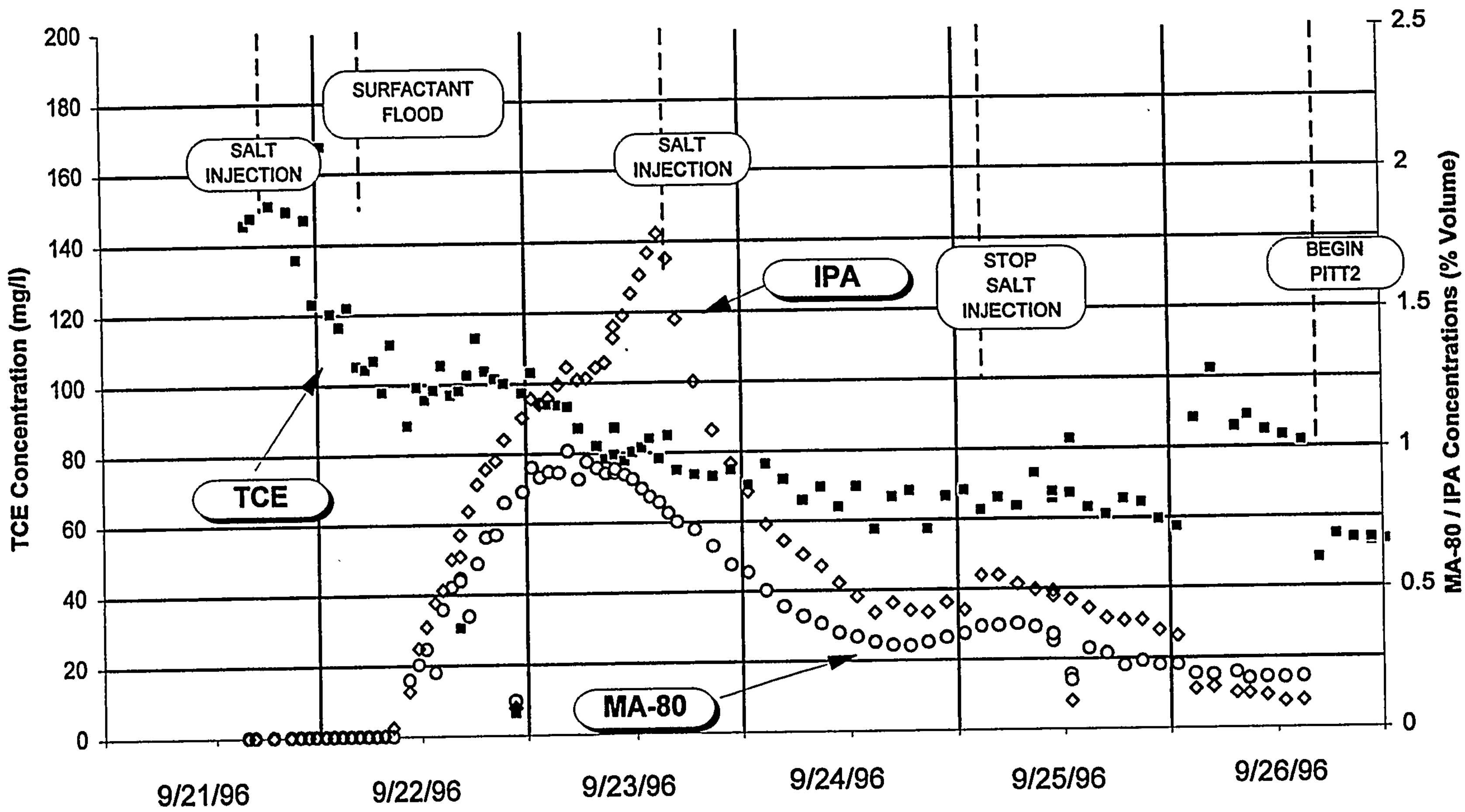
Water quality parameters at the extraction well were measured using electrodes installed in a flow-through cell. The water quality parameters included pH, temperature, redox potential, dissolved oxygen, and specific conductance. Injection and extraction lines were equipped with flow meters in order to maintain flow rates according to test design parameters. Fluid levels were monitored using pressure transducers to ensure that hydraulic control was maintained. The fluid levels were periodically verified manually with an interface probe.

9.2 Results of the Solubilization Test

Aqueous TCE concentrations at extraction well BW2G did not show a significant increase as a result of the surfactant flood. Figure 9.4 shows aqueous concentrations of TCE and the surfactant components MA-80 and IPA. A mass balance of injectate showed recovery of approximately 70% of the surfactant; thus, the majority of surfactant was recovered. Only 20% of the available DNAPL was solubilized and recovered, although a total of 50% was solubilized according to the post-flood PITT. Figure 9.4 shows that surfactant concentration in the injectate decreased while the IPA concentration increased toward the end of tracer injection, which suggests that there appears to have been a problem mixing the surfactant injectate.

Aqueous TCE concentration was increased from a background concentration of approximately 20 mg/L during PITT-1 to 180 mg/L immediately before the surfactant flood. Aqueous TCE concentrations then decreased to approximately 60 mg/L before rising to approximately 100 mg/L during the surfactant flood, as indicated in Figure 9.5. Following the flood, aqueous TCE concentrations at INT-1 decreased to approximately 5 mg/L. There is a spike in aqueous TCE concentrations at INT-1 corresponding to the solubilization of TCE. Aqueous TCE concentrations rose from approximately 50 mg/L to approximately 90 mg/L. A concentration increase is apparent in the well BW2G breakthrough curve, but it is less-pronounced due to dilution effects.

Aqueous TCE concentrations during the solubilization test were unaccountably higher than was observed during PITT-1, as indicated in Figure 9.6. TCE concentrations maintained a consistent level of 40 mg/L or less during PITT-1. However, during the surfactant flood, aqueous TCE concentrations were initially near 180 mg/L and rapidly decreased over the course of the test.



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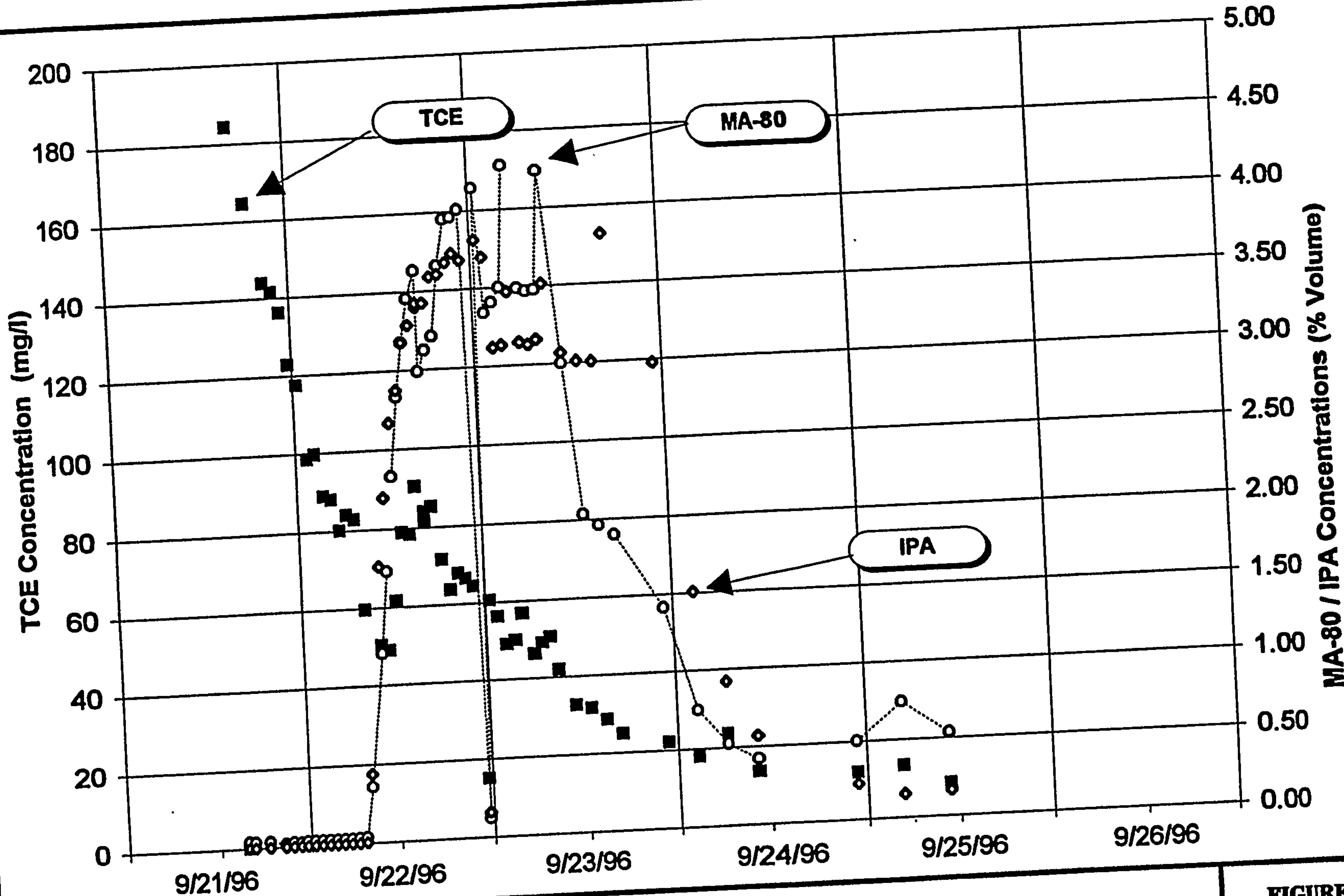
Aqueous TCE and Surfactant Concentrations at BW2G during Solubilization Test

FIGURE 9.4



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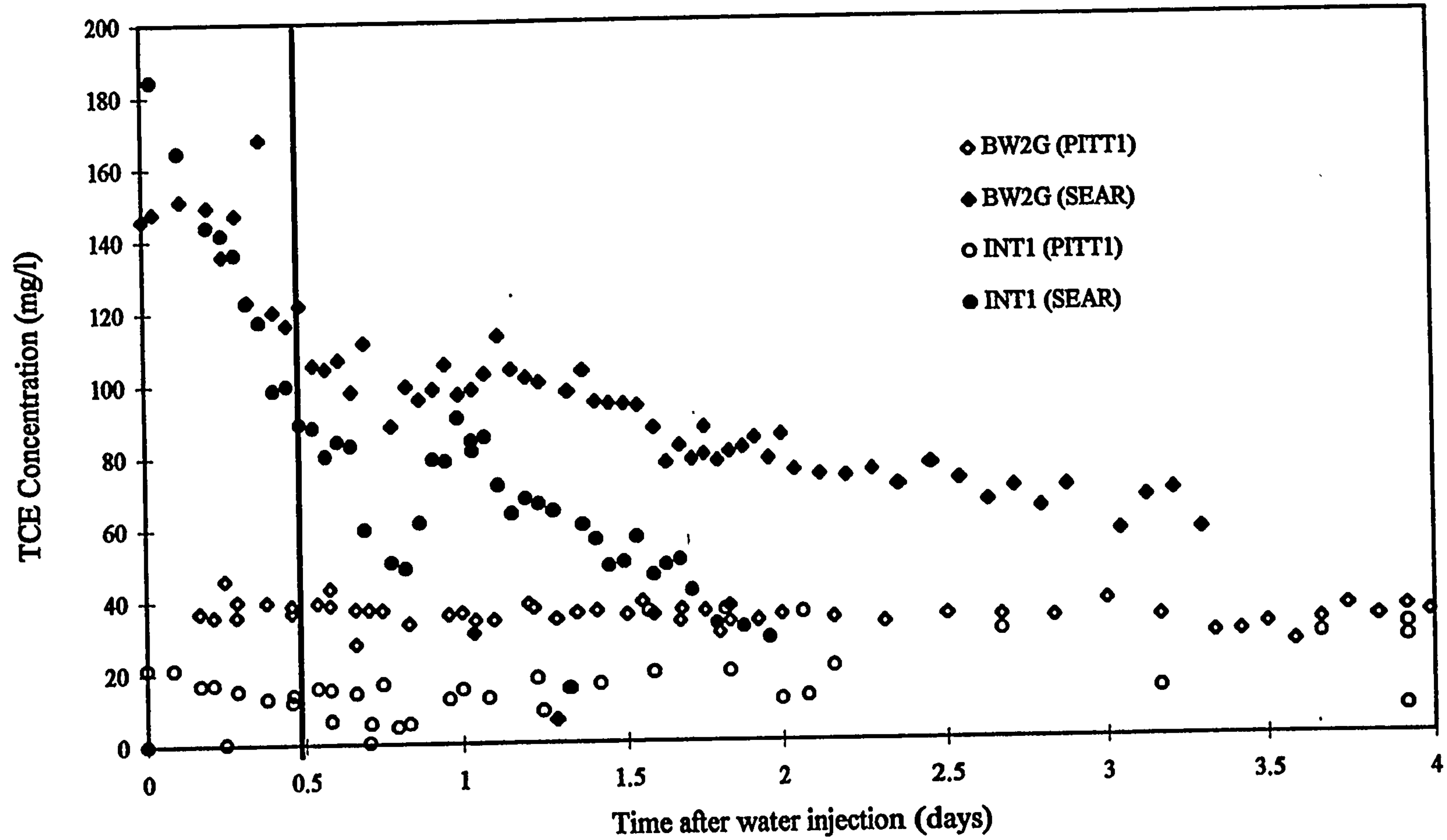
Aqueous TCE and Surfactant Concentrations at INT-1
during Solubilization Test

FIGURE
9.5



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Aqueous TCE Concentrations at BW2G & INT-1 during Solubilization Test and PITT-1

FIGURE 9.6

10.0 POST-FLOOD PARTITIONING INTERWELL TRACER TEST

10.1 Test Configuration

The design of the post-flood PITT was based upon the simulation studies for the pre-flood PITT and the solubilization test itself. However, because the expected DNAPL mass will be much lower after the solubilization test, it was necessary to use partitioning tracers with larger partition coefficients in order to accurately quantify the remaining DNAPL volume, if any (see Section 8). Laboratory experiments indicate that the partition coefficient of 1-octanol between TCE and water is 389. Therefore, 1-octanol was chosen as the primary partitioning tracer. Only 4 kg (9 lbs) of n-octanol were used because of its lower solubility in water. Heptanol and ethanol were included as partitioning tracers for the post-flood PITT to allow a direct comparison with the pre-flood PITT. Based upon the results of the UTCHEM simulation studies, the major design variables for the post-SEAR PITT test are listed in Table 10.1. The UTCHEM simulated post-flood tracer response curve is shown in Figure 10.1.

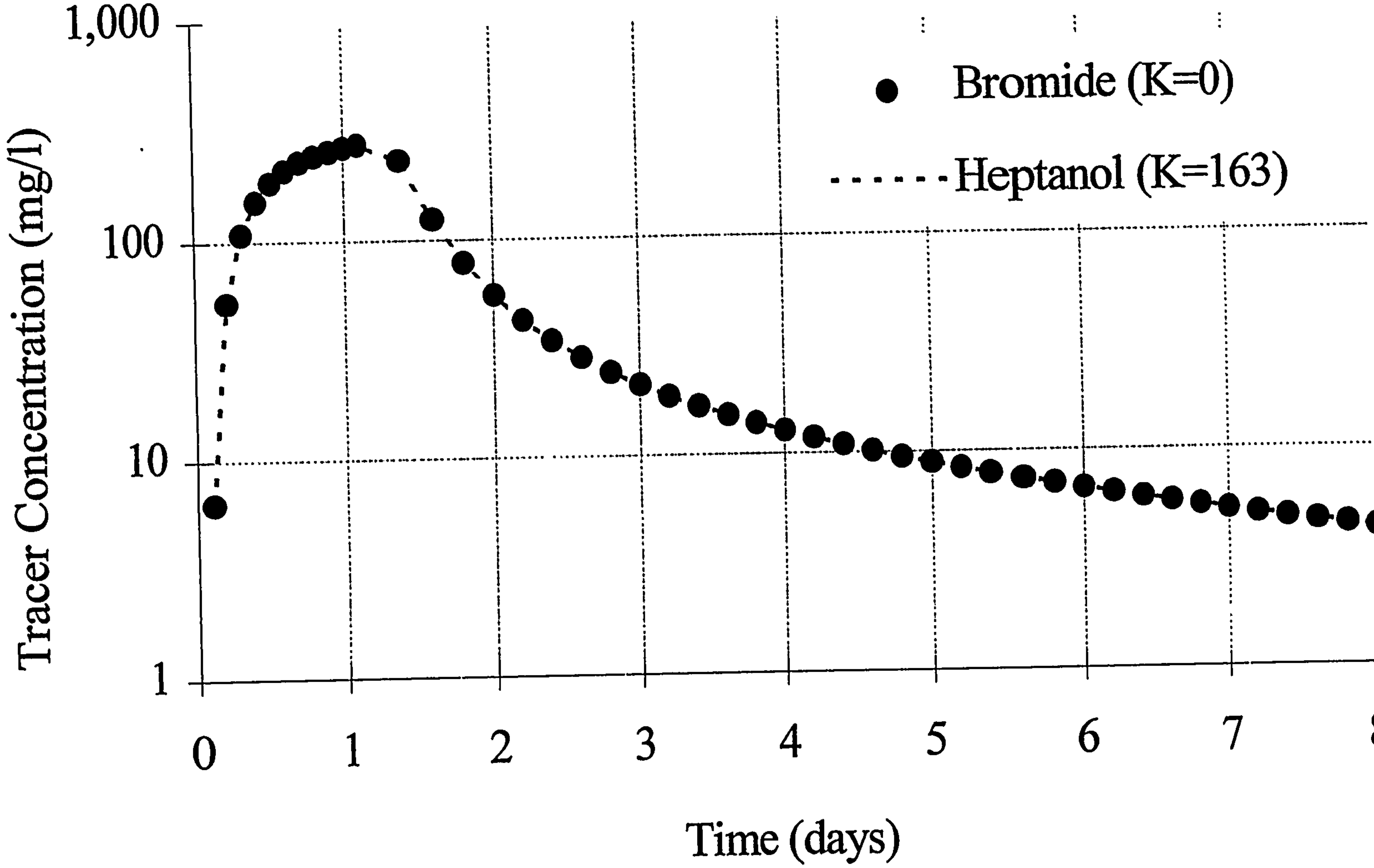
The well configuration used during the solubilization test was the same as that used for the post-flood PITT (PITT-2). Tracers were injected into well X701-66G at 700 mg/L concentration at 11 l/m (3 gpm) for 30 hours, followed by approximately 6 days of potable water injection at the same rate. The total mass of each tracer totaled 14 kg (31 lbs), and the mass of all tracers totaled 56 kg (123 lbs). The estimated swept pore volume of the lower gravel is approximately 4,900 liters (1,300 gallons). Water was continually injected at 3 l/m (0.8 gpm) at INT-7 for the entire duration of the test. Samples were collected from extraction well BW2G and the three intermediate piezometers (INT-1, INT-5, and INT-6).

10.2 Results of PITT-2

Recovery data for heptanol and octanol from well BW2G during PITT-2 are shown in Figures 10.2 and 10.3, respectively. A mass balance of tracer components shows that approximately 80% of tracers were recovered. The estimated volume of remaining DNAPL is approximately 7.5 liters (2 gallons). The use of 1-octanol proved to be very effective.

Figures 10.4 through 10.8 show changes in ground -water quality during both the solubilization test and PITT-2. Figure 10.9 shows piezometric response during testing.

Figure 10.4 shows temperature variations, which exhibit temperature trends similar to those in PITT-1.



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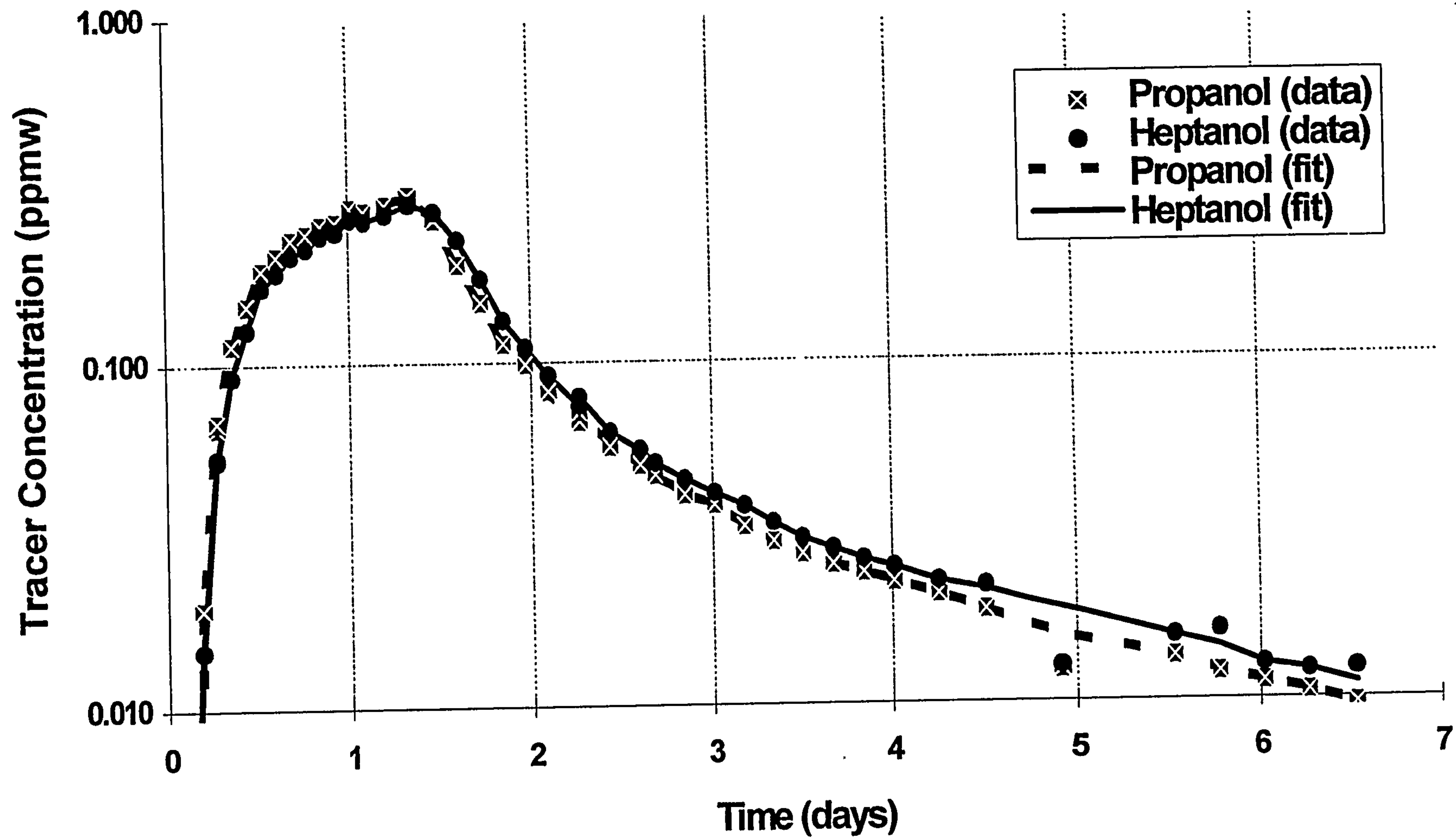
Simulated Post-Flood Tracer Response Curves

FIGURE 10.1



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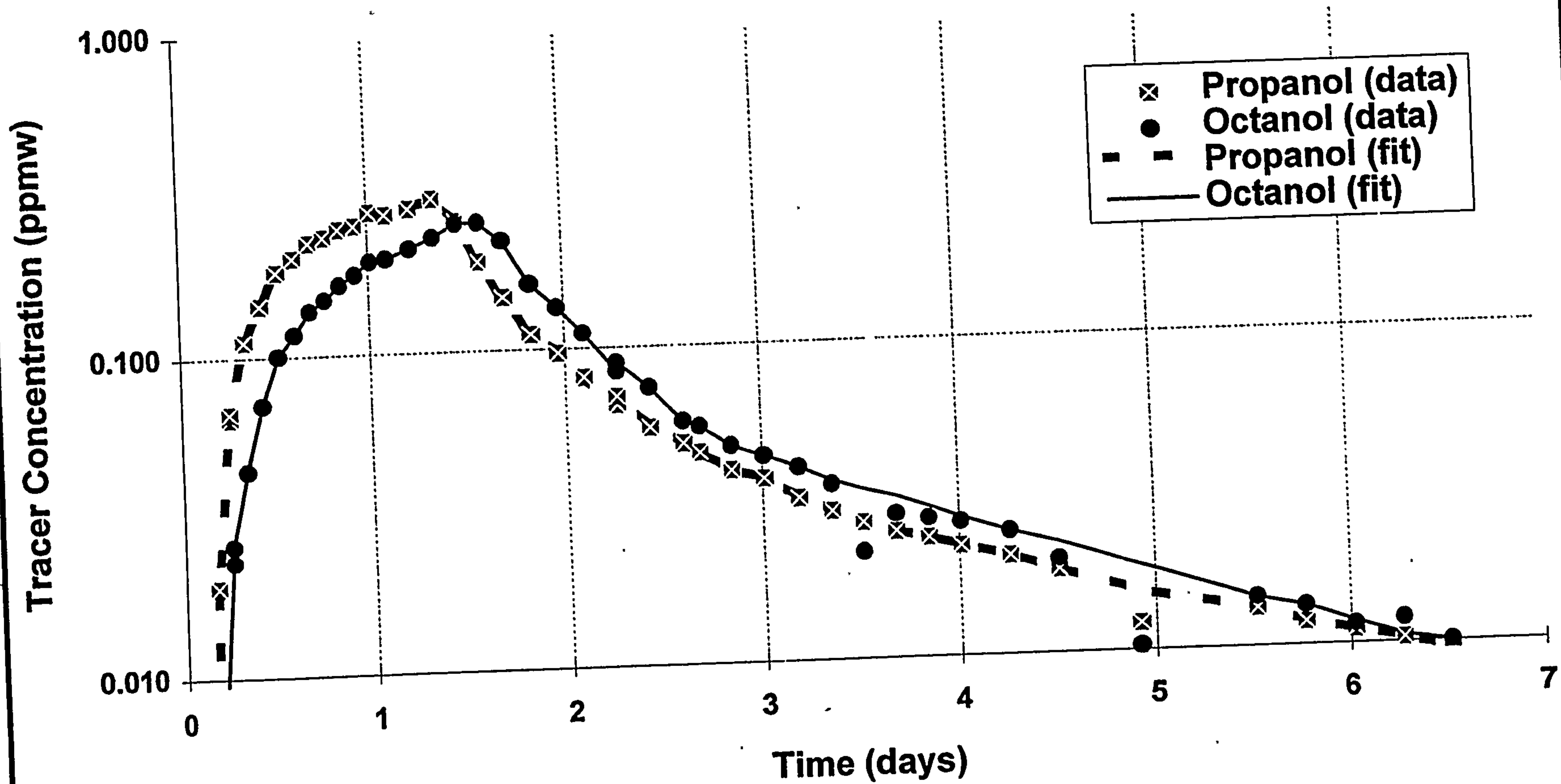
PITT-2: Test Effluent Heptanol Concentrations

FIGURE 10.2



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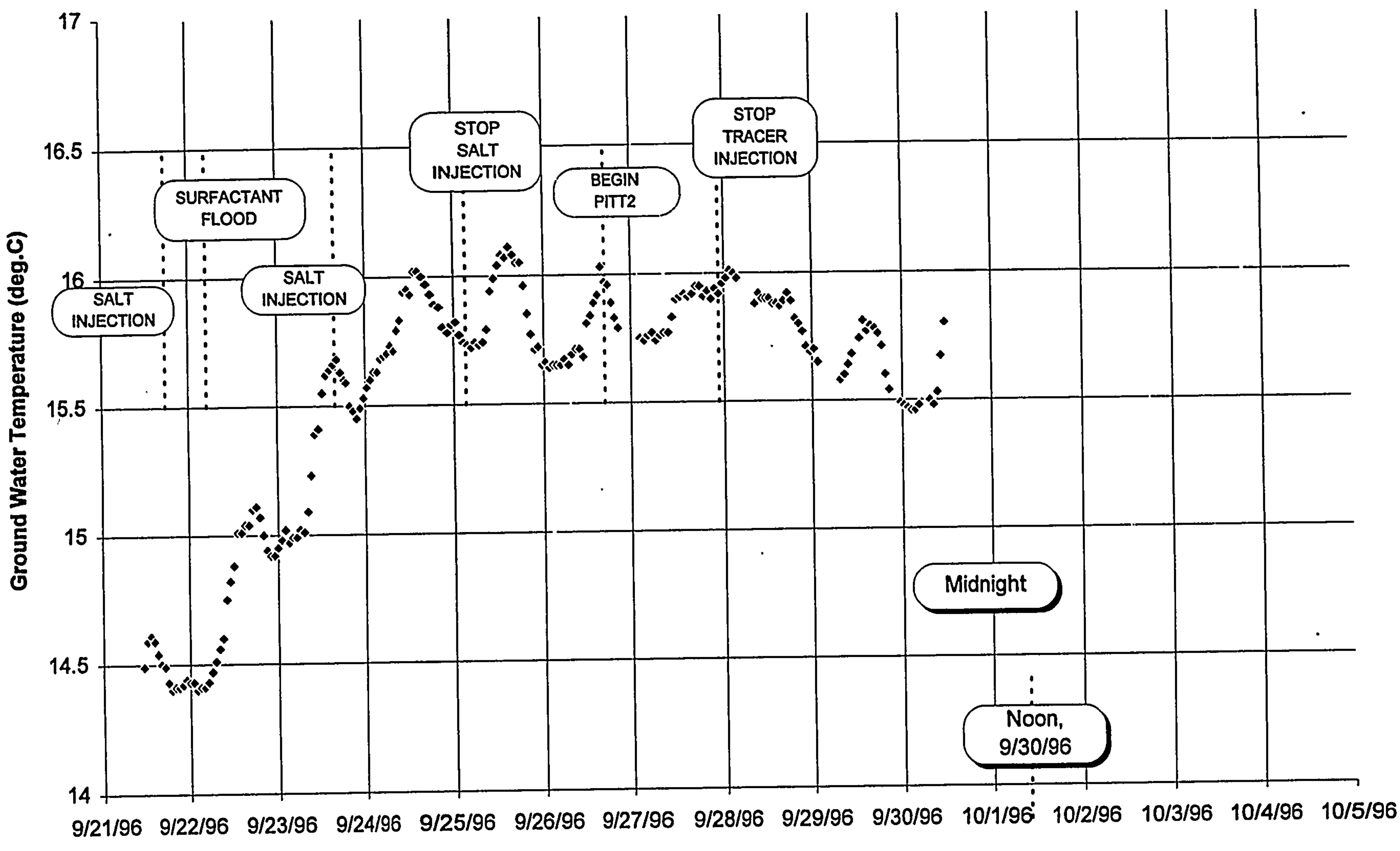
PITT-2: Test Effluent Octanol Concentrations

FIGURE 10.3



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Solubilization Test / PITT-2: Test Effluent Temperature

FIGURE 10.4

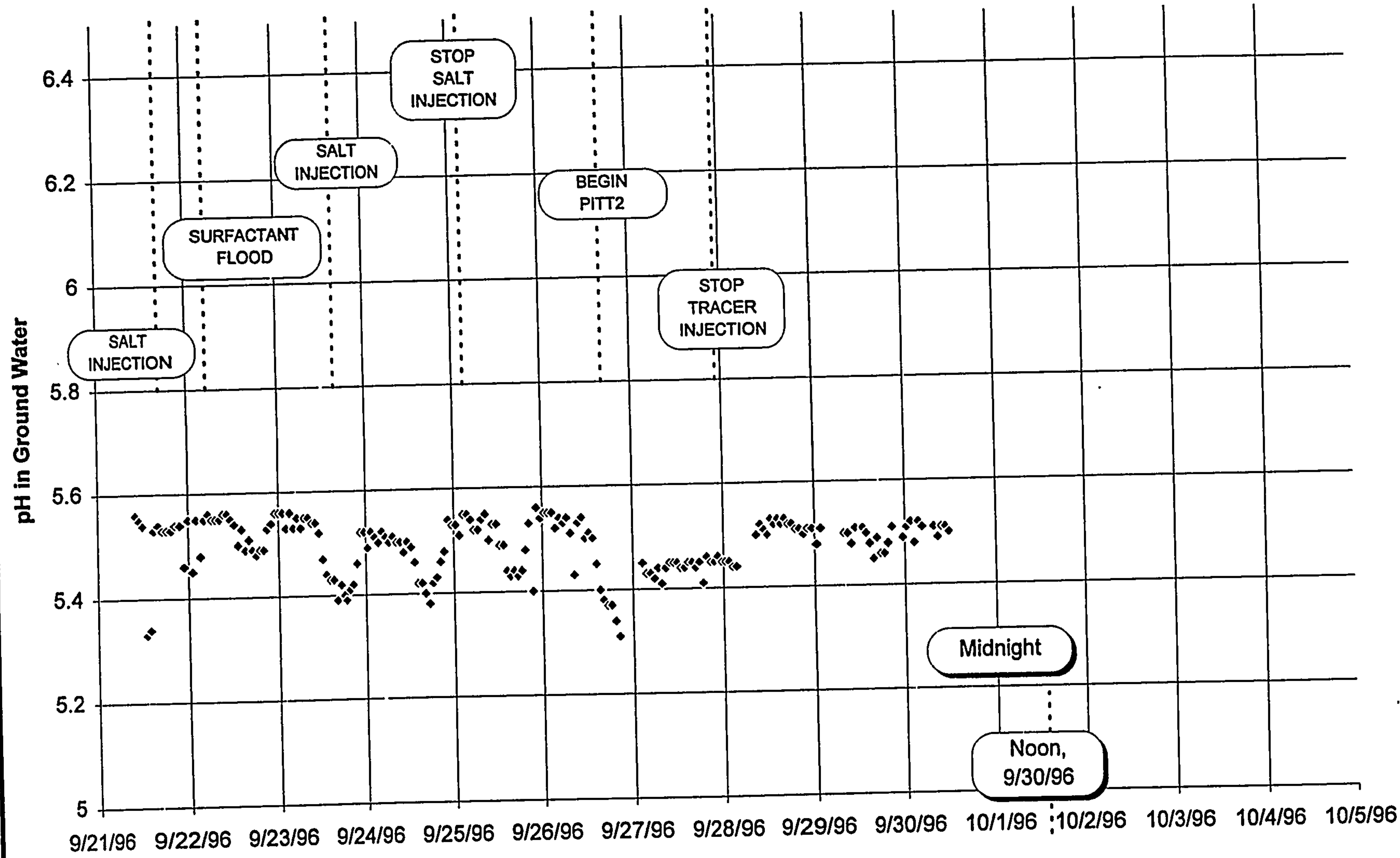
Table 10.1 Summary of Post-Flood PITT Design Parameters

Wells	Well Name	Screen Interval	Rate
Injection Well	BW2G	~32.5 - 34 BGS	11 l/m (3 gpm)
Extraction Well	66G	~32.5 - 34 BGS	19 l/m (5 gpm)
Tracers	**Mass (kg)**		**Injected Concentration (mg/l)**
bromide	14		700
ethanol	14		700
1-heptanol	14		700
1-octanol	4		200
Test Segments	pre-test flush (0.5 days) tracer injection (1.3 days) water flush (5 days)		
Sampling Strategy	**Time (days)**	**Sampling Frequency (hrs)**	**Number of Samples**
Extraction Well	1 - 2 3 - 4 5 - 7	1 2 6	48 24 12
Monitor Wells	1 2 3 - 4 5 - 7	1 2 6 12	24 24 8 6
Injection Well	1.5	4	9

Figure 10.5 shows pH changes, which did not vary significantly over the course of testing. This result was expected, because the pH of the potable water closely matched that of the ground water.

Changes in DO are shown in Figure 10.6. DO concentrations were approximately 1 mg/l during the potable water injection phases, probably reflecting DO concentrations in the PORTS potable water supply. DO rose significantly during the surfactant, salt, and tracer injections, probably because these injectates were mixed in tanks, subjecting them to aeration.

Specific conductance changes are shown in Figure 10.7. Significant noise is evident in the plots, possibly due to malfunction of the probe. Ambient specific conductance was approximately 500 μS/cm. Specific conductance rose to 2,500 μS/cm during the surfactant flood, but began to drop before the flood was finished, reflecting the (unintentional) change in injectate chemistry over time. During salt injection, specific conductance stabilized at approximately 2,000 μS/cm.



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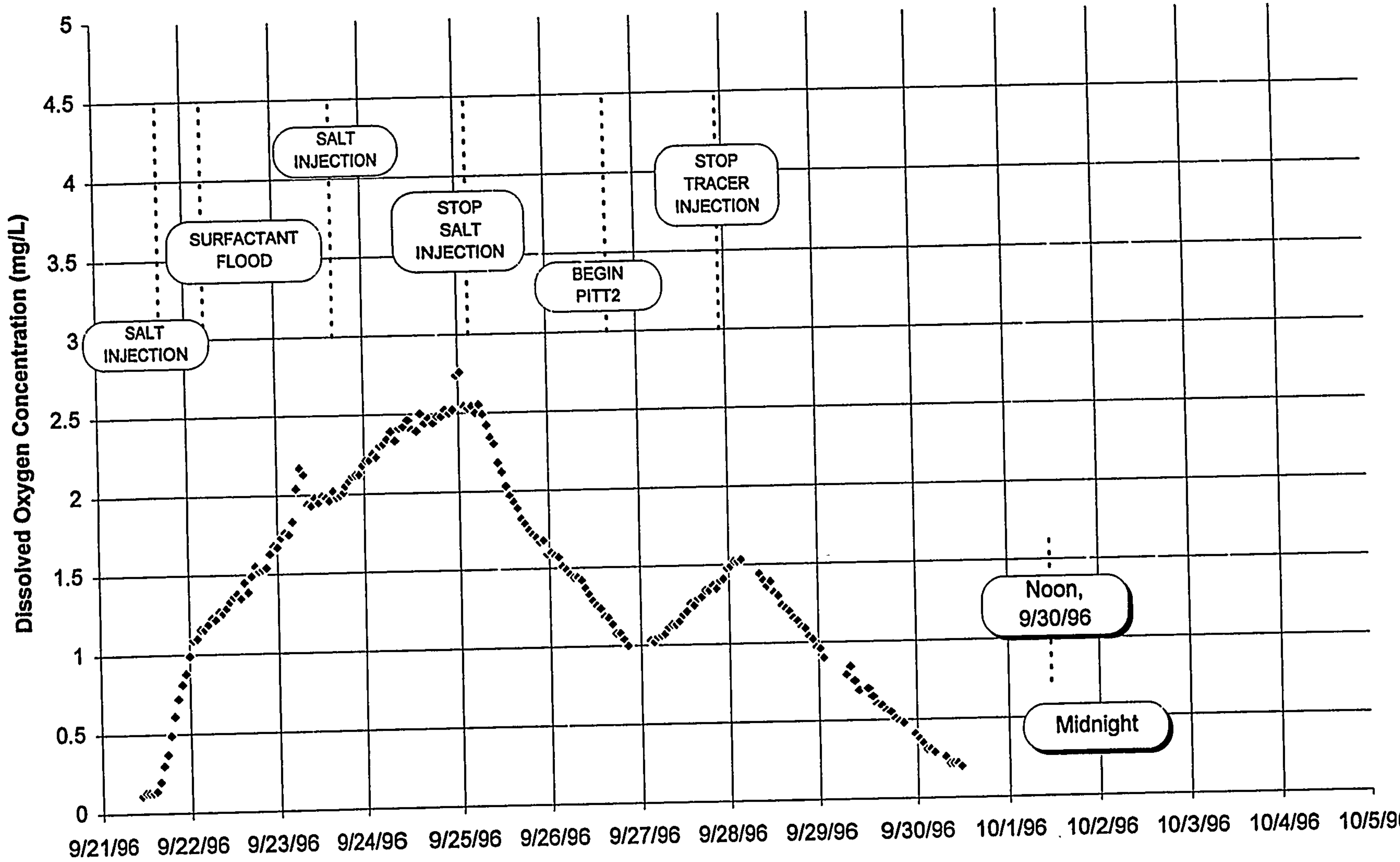
Solubilization Test / PITT-2: Test Effluent pH

FIGURE 10.5



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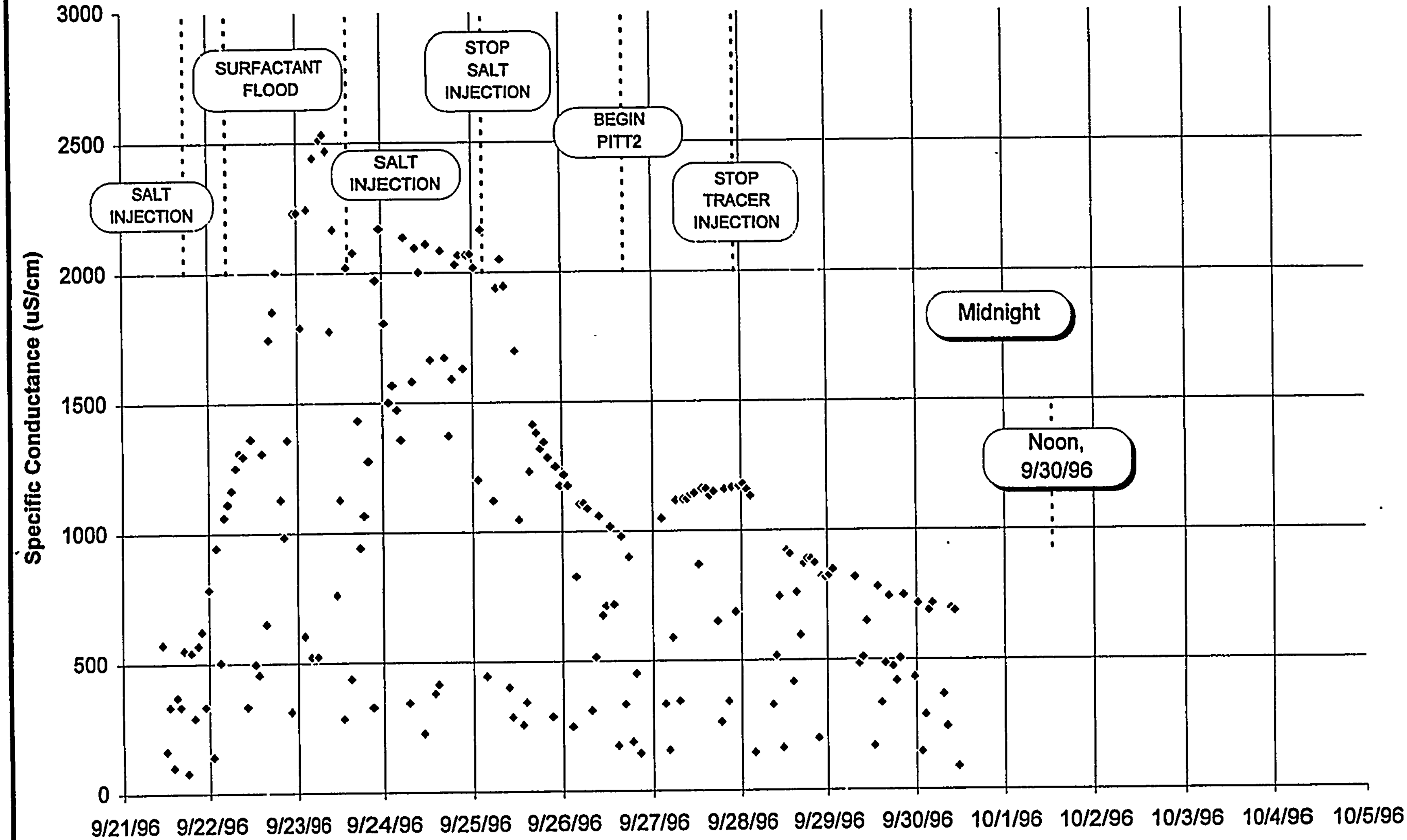
Solubilization Test / PITT-2: Test Effluent
Dissolved Oxygen Concentration

FIGURE 10.6



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Solubilization Test / PITT-2: Test Effluent
Specific Conductance

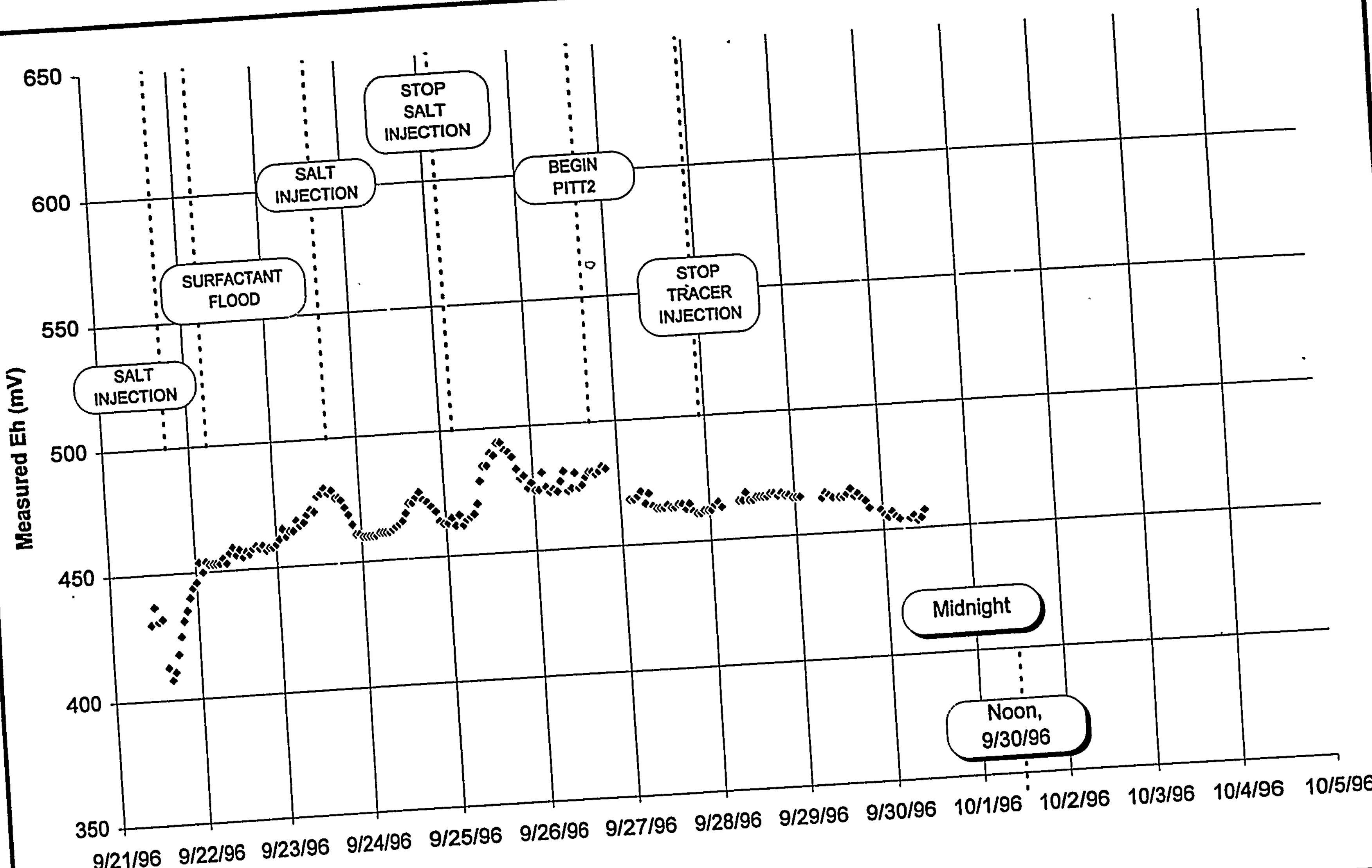
FIGURE 10.7

Changes in measured platinum-electrode redox potential (E_h) are shown in Figure 10.8. Ambient E_h was approximately 400 mV, and rose to 450-500 mV over the course of injection.

A graph of piezometric response within the test area is shown in Figure 10.9. The static water level at recovery well BW2G was approximately 657.7 ft AMSL before testing, and during testing was lowered to approximately 654 ft AMSL. There are two discernable trends in the piezometric response: a trend of two long-term cycles spanning the test and a trend of at least five diurnal cycles toward the end of the test. The two long-term cycles show head loss in the test zone beginning September 22 and September 28. The diurnal cycles indicate several-hour-long periods of head increase mid-day on September 28 through October 2, 1996. These changes in water levels are not due to changes in extraction/injection rates associated with the test.

Figure 10.10 is a contour map of the piezometric surface on October 10, 1996, toward the end of the post-surfactant flood tracer test. The contour lines indicate closure around recovery well BW2G.

Piezometric data are included as Appendix H. Ground water quality and GC analysis data are included as Appendices I and J, respectively. Pumping late data are included as Appendix K.



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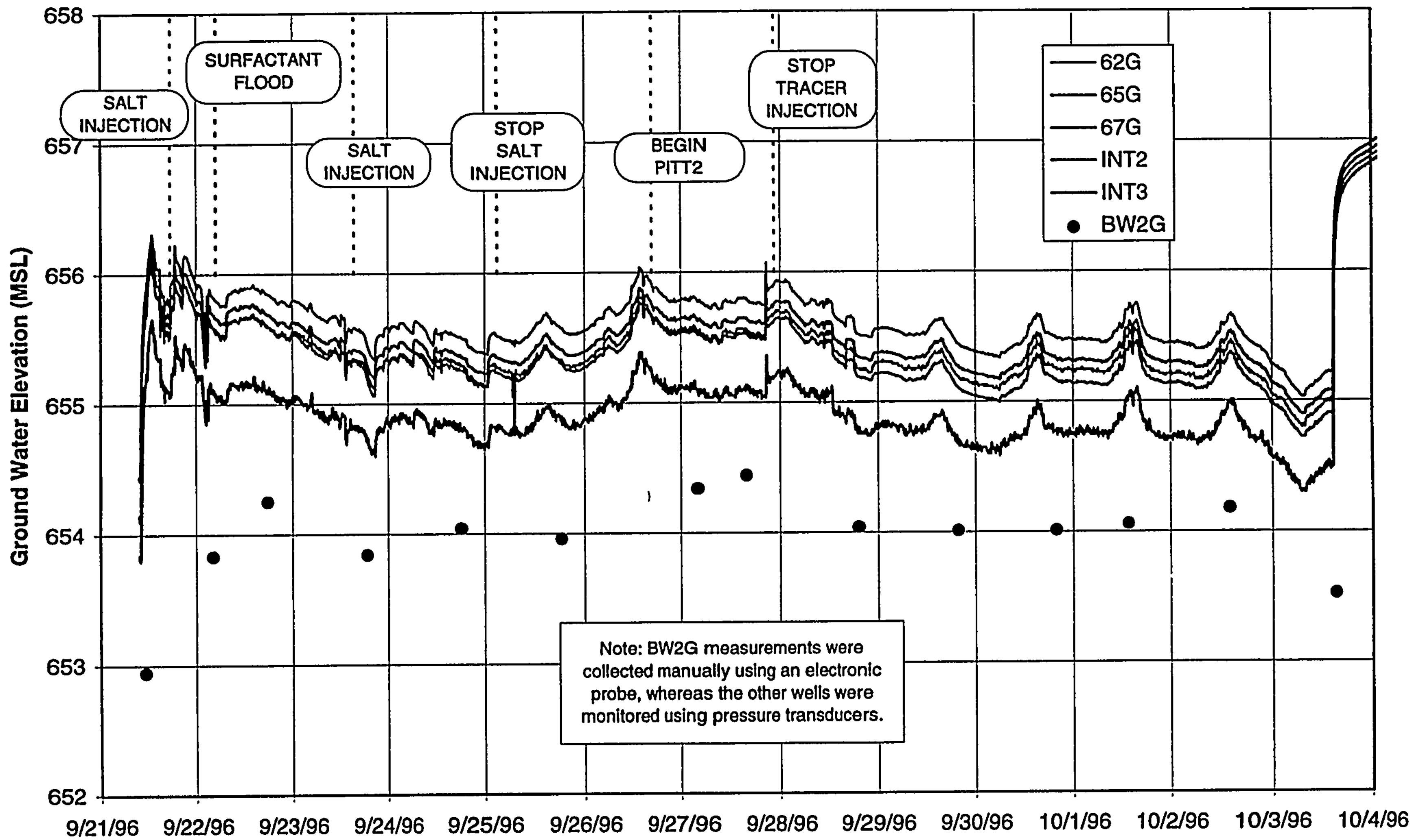
Solubilization Test / PITT-2: Test Effluent
Measured Platinum Electrode Potential

FIGURE 10.8



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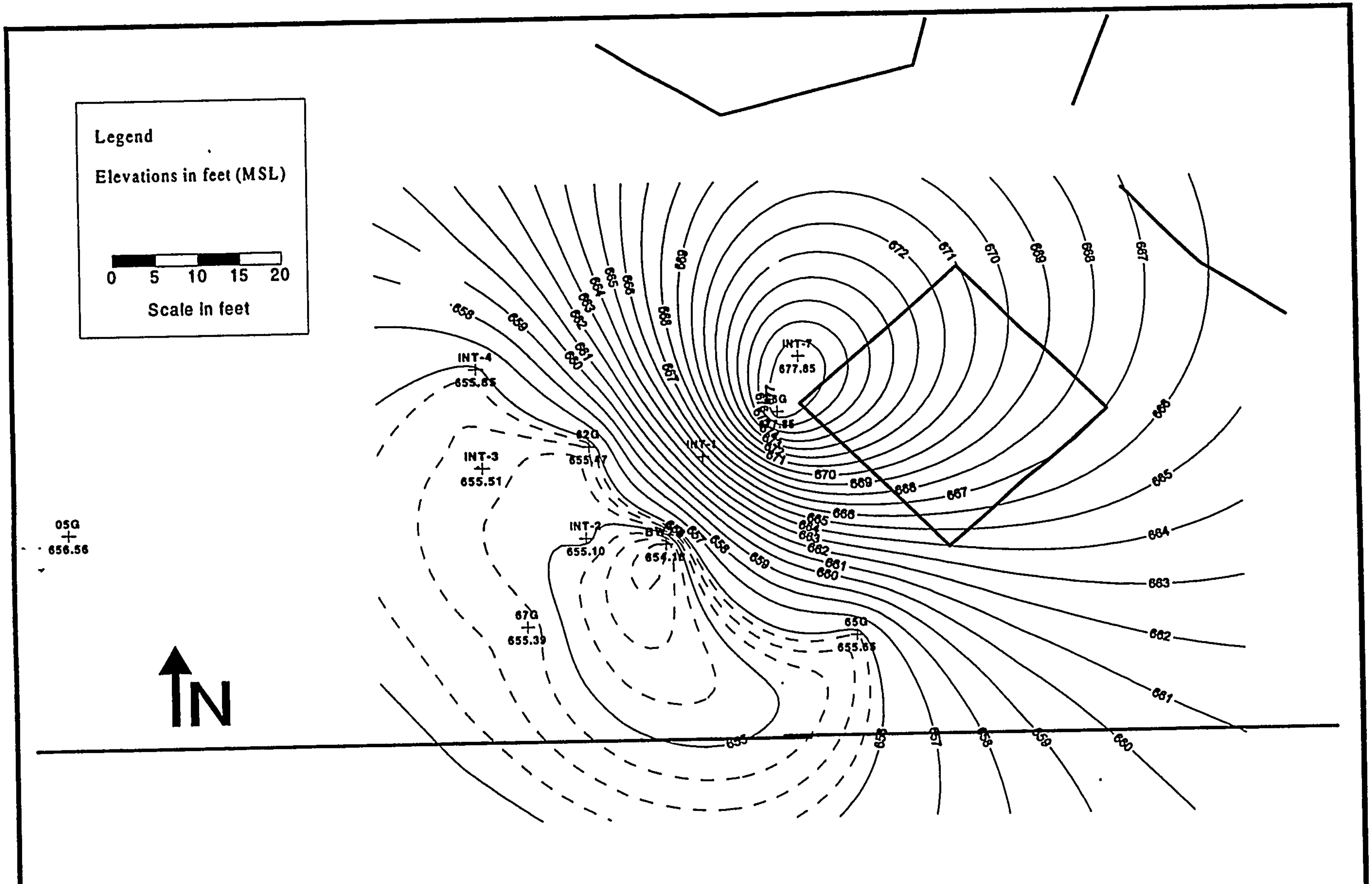
Solubilization Test / PITT-2: Piezometric Response

FIGURE 10.9



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Piezometric Surface during PITT-2 (10/02/96)

Figure 10.10

11.0 SUMMARY AND CONCLUSIONS

Field work at the X701B area at PORTS began in December 1995 with the hydraulic testing of the Gallia formation, an alluvial point-bar deposit of Quarternary age contaminated with a DNAPL composed primarily of TCE with some minor chlorinated components such as PCBs. Design and permitting for an initial partitioning interwell tracer test were undertaken in April and May; the test itself was completed in July following the successful set up of a injection-extraction and wastewater-storage system at the site. The hydraulic and tracer tests lead to the development of a model of the DNAPL zone, known as a geosystem model, which incorporated its hydrogeological and capillary properties and the spatial distribution of the residual DNAPL saturation. These preliminary tests lead to a number of conclusions concerning the X701B site at PORTS:

1. The Gallia formation beneath the site is a fining upward sequence of alluvium with a basal gravel ($K \sim 2 \times 10^{-2}$ cm/s) which is overlain by a middle sandy unit ($K \sim 2 \times 10^{-3}$ cm/s) and an upper gravelly silt ($K \sim 2 \times 10^{-4}$ cm/s).

2. The total swept volume of the Gallia during the first PITT was approximately 14 m^3 or 500 ft^3 with an overall, average residual DNAPL saturation of 0.08%.

3. The first PITT showed conclusively that DNAPL was present only in the basal gravel at an average residual saturation of ~0.2 to 0.4% and not in the middle sand or upper gravelly silt. This indicates that the DNAPL migrated into the Gallia laterally from the direction of the X701B pond and not through the overlying Minford silt. Furthermore, the aqueous TCE concentrations measured during the PITT suggest that the DNAPL was predominantly trapped on the southeast side of the injection-extraction well axis.

4. The volume of trichloroethene DNAPL in the basal gravel of the Gallia was initially of the order of 20- 40 liters (5-10 gallons) as estimated by history matching of the tracer signals; inverse modeling of these same signals indicated approximately 20 liters (4 gals) of DNAPL.

5. Following the completion of the pre-flood PITT and the cessation of injection and extraction at the test site, water levels at the test site were unexpectedly drawn down by pumping of a horizontal well some 150 m (500 ft) east of BW2G and hydraulically downgradient. The pronounced hydraulic response to this pumping, causing 0.3 m (1 foot) of drawdown, indicates that a high-permeability paleochannel exists in the Gallia which is undoubtedly important in controlling the spatial distribution and migration of DNAPL beneath the X701B site.

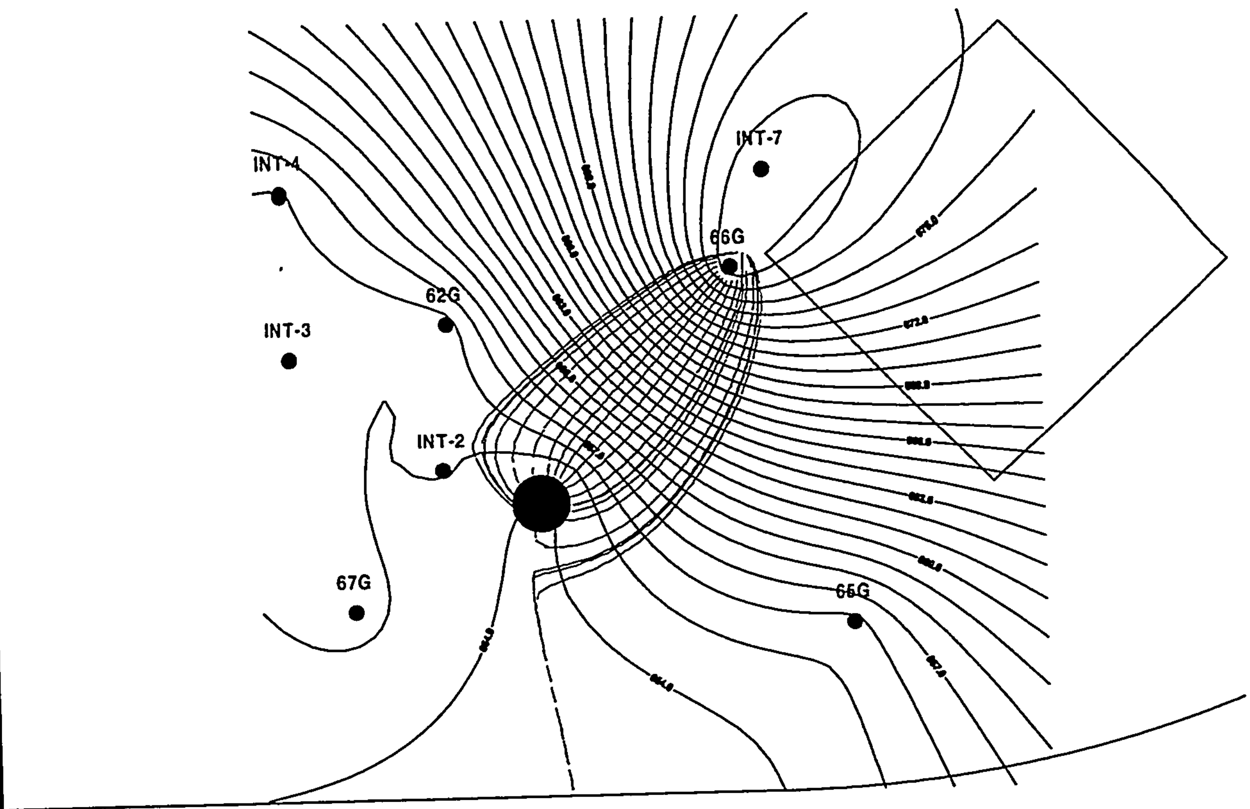
Because of these results, it was decided to reconfigure the injection and extraction operations for the solubilization test conducted in September 1996 by installing packers in the injection (66G) and extraction (BW2G) wells to limit, to the degree possible, the surfactant solution to the basal gravel unit of the Gallia. This reduced the volume of surfactant needed to flood the DNAPL zone in the basal gravel.

The solubilization test and the subsequent second PITT were conducted over a twelve-day period in September 1996. The surfactant injection was preceded by the injection of an electrolyte solution for twelve hours to prevent mobilization of clays, which was apparently successful in that there was no loss of efficiency at BW2G during the September tests. The solubilization test itself involved the injection of an aqueous solution containing 4% MA-80 surfactant, 4% isopropyl alcohol ("cosurfactant") and 0.2% electrolyte (0.2% NaCl/$CaCl_2$) at 0.2 L/s (3 gpm). The extraction well BW2G was pumped at 0.3 L/s (5 gpm). To assist in the recovery of the surfactant solution, fresh water was injected into the hydraulic control well (INT7) northeast of the injector at 0.05 L/s (0.8 gpm).

The hydraulic control well, INT7, the purpose of which was to force the micellar-surfactant solution toward the extraction well by forming a hydraulic mound behind the injection well, failed to work as intended. The well screen of INT7 did not penetrate to the lower gravel due to its installation with a Geoprobe™ system which was unable to penetrate the basal gravel. The use of packers to seal off the injection and extraction wells in the basal gravel probably resulted in surfactant moving radially away from the test zone, particularly in an easterly direction. This would result in some surfactant being pumped from the Gallia by the sump beneath the X701B pond which was the probable cause of foaming in the Building X-623 pump and treat system. This loss of surfactant was further indicated by an estimated recovery of only 70% as opposed to an 80% recovery of tracers during the PITTs.

Furthermore, as was the case during the first PITT, a number of pressure transducers were installed in monitoring wells and small-diameter piezometers around the X701B site to record the piezometric response of the alluvium during injection and extraction operations. Despite the fact that the horizontal wells were not actively pumping during the solubilization test in late September, the piezometric response recorded by the transducers indicated considerable hydraulic interference in the test zone by other, unidentified sources of pumping and/or recharge. This produced a somewhat random pattern of water-level variation of 0.2-0.3 m (1 ft) in the hydrographs for the wells and piezometers at the site during the 12-day period of the test. This interference, coupled with the inadequate capture provided by pumping just one extraction well (BW2G) resulted in the recovery of only about 70% of the injected surfactant. The remaining surfactant either moved eastwards from the injection well (66G) towards the X701B pond to be captured by the sump and/or some nearby well or was transported as intended towards BW2G but captured by other pumping sources aided by the high permeability of the paleochannel which evidently passes very close to BW2G. This streamtube divergence around BW2G is shown in Figure 11.1.

The pathlines shown in Figure 11.1 were developed by incorporating the observed water level surface during the surfactant flood into a general particle-tracking module of the EPA code WHPA (Well Head Protection Area). Kriging was used to develop the head surface. The area shown in Figure 11.1 was discretized into a 51 x 51 grid (1.2 feet grid blocks). This head field was incorporated into WHPA to gain insight into the general nature of the flow between the injection and extraction well during the surfactant flood. Based on permeability estimates for each of these units, most of the flow occurred in the Basal Gravel. Therefore, all the flow from the Upper Silt, the Middle Sand, and the Basal Gravel were lumped into one model layer. Twenty particles were tracked from a starting location in a circular pattern around the injection well (well 66G) through the flow



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Simulated Streamlines from Solubilization Test Based on Observed Head Measurements

FIGURE 11.1

path. Because of the difficulty in estimating the water level directly downgradient from the extraction well (BW-2G), it was assumed that all particles which entered this area which exhibited a very low hydraulic gradient and thus very low velocity (shown by the solid circle) were captured by the extraction well.

As shown in Figure 11.1, seventeen of the particles tracked are drawn toward the extraction well (well BW-2G), while three of the particles are drawn downgradient and away from the extraction well. Particle-tracking only considers the advective component of the surfactant transport and does not consider the effects of mechanical dispersion, diffusion and other factors that serve to "spread" and disperse the surfactant flood. Therefore, particle-tracking can only be used to estimate the general nature of the surfactant travel paths. However, the pathlines show that, based on these model assumptions and the observed water levels, potentially 15 to 20 percent of the injected surfactant was not captured by the extraction well.

A further complication encountered at the site was the change in aqueous TCE concentrations between the end of the first PITT in July and the beginning of the solubilization test at the end of September. During this period of 50 days, there was a marked increase in the aqueous TCE concentrations measured at BW2G and INT1, the piezometer in the basal gravel layer of the Gallia. These aqueous TCE concentrations were about 160 ± 20 mg/L during the electrolyte flood which preceded the solubilization test in late September, however the aqueous TCE concentrations recorded in BW2G and INT1 in late July were almost constant values of 30 and 15 mg/L, respectively. The most plausible explanation for this occurrence is that the testing of the horizontal wells 150 m east of the BW2G area and the subsequent hydraulic stresses imposed on the paleochannel in the Gallia caused migration of DNAPL and/or ground-water transport of high aqueous TCE concentrations towards the BW2G area. If DNAPL did move into the test zone, then it is apparent that PITT1 would be an underestimate of the DNAPL volume in the test zone at the beginning of the solubilization test. However, it is probable that only high concentrations of aqueous TCE were involved as these concentrations dropped rapidly during the electrolyte flood prior to the solubilization test.

The final PITT indicates that only 8 L (2 gals) of DNAPL remained in the basal gravel layer of the Gallia following the solubilization test (see Figures 10.3 and 10.4). Hydraulic interference during the PITT was characterized by a periodic rise and fall in the piezometric surface of the Gallia at about noon each day (see Figure 10.10), however tracer recovery was about 80% and was sufficient to measure DNAPL volume accurately. Indeed, the heptanol and octanol tracer response curves from BW2G produce identical estimates of DNAPL volume remaining and have the highest signal-to-noise ratios of any of the six PITTs conducted by INTERA during 1996. This remaining DNAPL volume of 8 L contrasts with the estimated volume of 15 L (4 gals) measured by the first PITT in July. Thus it appears that ~ 50% of the DNAPL was solubilized and removed from the test zone, although only about 20% of the DNAPL (~ 4 L or 1 gal) was actually recovered as solubilized DNAPL at BW2G. The rest was most likely captured by the influence of other pumping sources and moved downgradient into the paleochannel of the Gallia.

In the case of the PORTS surfactant flood, a major depositional feature, the paleochannel, was identified but not before commencement of testing. The hydrologic effect of the paleochannel strongly affected ground water flow behavior in the test area. This structure is a major feature which has determined the size and extent of the source zone, but had not previously been characterized. Pumping at the rate of 9 gpm from a distance of 500 feet caused 1 foot of drawdown in the test area during the first partitioning interwell tracer test. Further unidentified pumping caused similar interference during the surfactant flood and second partitioning interwell tracer test. The characterization problem was magnified for this pilot test because the test area was comparatively small with regard to the suspected size and location of the DNAPL source zone. This size disparity reduces the probability for successful use of PITT technology. As a comparison of size, paleochannel is thought to be in the range of 20 wide and hundreds of feet long. The swept pore volume of the test area was 500 cubic feet, which after adjusting for aquifer thickness and porosity, gives a 'footprint' which is 22 feet long and 15 to 20 feet wide. The loss of one foot of head caused by pumping somewhere along the paleochannel means that a substantial transverse flow was impressed on the test area, thus distorting the shape and location of swept volume. The requirements for careful characterization are thus magnified when the test area is comparatively small relative to the scale of the hydrogeologic structures. The level of characterization required before testing is reduced if the test area is large with respect to the hydrogeologic structures.

In conclusion, this report completes a five-year project funded by the U.S. Department of Energy through the Federal Energy Technology Center at Morgantown, West Virginia, and in collaboration with Lockheed Martin Energy Systems in Paducah KY and Piketon OH. The objectives of the study have been to identify surfactants which will efficiently solubilize multicomponent DNAPL in alluvial aquifers, and then to test and demonstrate their use *in situ* using existing wells at a Federal site.

While surfactants have been identified which will allow the efficient solubilization of chlorinated solvent DNAPLS from the subsurface, the demonstration of their efficacy at both the Paducah and Portsmouth Gaseous Diffusion Plants has been strongly hindered by the poor state of site characterization at both sites. Because only the most limited site characterization work was provided for by this contract and because both sites had used the standard (and thus inadequate) methods of characterizing the DNAPL-contaminated aquifers, the Paducah and Portsmouth solubilization tests were conducted without sufficient knowledge to allow successful demonstrations. A complementary study of surfactant-enhanced aquifer remediation of a similar chlorinated solvent DNAPL in a similar alluvial aquifer conducted at Hill AFB, Utah, one month before the Portsmouth test, demonstrated that 99% of the DNAPL could be recovered with only three pore volumes of surfactant flooding. The Hill AFB results, which were achieved by the same team of INTERA and the University of Texas at Austin, indicate that the necessary conditions for the successful employment of SEAR are:

- the DNAPL zone is well characterized in terms of the spatial distribution and total volume of DNAPL and the hydraulic and capillary properties of the alluvium trapping the DNAPL, and
- such characterization is incorporated into a robust design of solubilization using predictive, numerical simulation and laboratory experimentation which result in the efficient sweeping of the DNAPL zone by the surfactant flood.

Therefore, the first lesson of this study is that there can be no successful removal of DNAPL without the most detailed of site characterizations using innovative (e.g., PITTs) as well as traditional methods (e.g., aquifer tests) and the collection and preservation of soil cores to prevent VOC volatilization. The results of this site characterization are incorporated into a "geosystem" model of the DNAPL zone which is then used for the design and analysis of the solubilization test.

The second lesson learned was that the use of existing wells for injection-extraction operations, as incorporated into our contract, was a false economy. These wells, both at Paducah and Portsmouth, were inadequate for the purposes used in this solubilization test, and had poor driller's logs. For any field study of this kind, it is critically important that the study team be able to drill its own wells, inspect and collect its own soil samples which it can then preserve properly, and install injection, extraction and monitoring wells to its own specifications.

The third and final lesson was that a single well pair cannot achieve the level of hydraulic control and injectate recovery required for successful solubilization. A line-drive geometry of three injectors and three extractors would have been preferable so that hydraulic interferences could be overcome and higher surfactant and tracer recoveries obtained. Nevertheless, the solubilization test did show that a significant volume of DNAPL was recovered from the Gallia and the two PITTs were critical in showing how it might be possible to map the DNAPL zone beneath the X701B area at PORTS.

12.0 RECOMMENDATIONS

The previous discussion has made clear that it is quite impossible to undertake DNAPL remediation of any kind without a very thorough site characterization such that those matters which affect DNAPL migration and trapping are addressed in detail. Unless such characterization is undertaken at PORTS and at Paducah, it will not be possible to remove the bulk of the DNAPL from the alluvium at these two sites at which we have worked on behalf of DOE. Furthermore, it may not even be possible to contain the dissolved-phase plumes generated by the DNAPLS at these two sites without causing enormous quantities of previously-uncontaminated ground water to become contaminated during streamtube convergence and subsequent mixing at the extraction wells. Therefore, even if hydraulic containment were to become the only goal for site remediation at Paducah and PORTS, it is essential that the geometry and volume of DNAPL at both sites become better defined so that various remedial options, not necessarily SEAR, may be considered.

With respect to the X701B site at PORTS, we recommend the following program of DNAPL-specific site characterization:

1. The drilling of 6 boreholes along the suspected path of the paleochannel and the collection and preservation of continuous cores from these boreholes such that in-situ contaminant concentrations can be determined by laboratory analysis. The boreholes should be drilled with a tool which can easily penetrate gravel and cobble layers, e.g., hollow-stem augers. Some of these boreholes should be used to install three monitoring wells in the Gallia, completed only in the most permeable part of the alluvium, i.e., that part which most likely is the migration pathway for the DNAPL.

2. A major pump test of approximately 72 hours should be undertaken in the Gallia using one of the horizontal wells as the extraction well while monitoring, with pressure transducers, the hydraulic response in wells throughout the X701B site. This data should then be used to incorporate the paleochannel within a recalibrated model of the site (e.g., Beard and Anderson, 1996).

3. At least three additional PITTs should be undertaken in the X701B area. These will likely require additional injection and extraction wells, the siting of which will be decided following hydraulic testing. The first should measure the volume of DNAPL in the BW2G-PW1 area, i.e., along the suspected paleochannel. The second should be undertaken between PW1 and the horizontal wells. The third PITT should measure the volume of DNAPL eastwards from the horizontal wells to some point beyond the perimeter road. Each of these tests are likely to take one month to set up and execute, although the second and third tests can perhaps be conducted simultaneously using the horizontal wells as the extraction wells.

4. A detailed sampling and analysis program should be undertaken to characterize the hydrogeochemical conditions in the Gallia with to respect major ions and the redox conditions so that the potential for biological degradation of the dissolved phase contaminants can be assessed.

With respect to the C-400 site at Paducah, we recommend the following program of DNAPL-specific site characterization:

1. The drilling of 6 exploratory boreholes into the Regional Gravel Aquifer [RGA] around Bldg C-400 and the collection and preservation of continuous cores from the RGA such that in-situ contaminant concentrations can be determined by laboratory analysis. The boreholes should be drilled with a tool which can easily penetrate gravel and cobble layers, e.g., hollow-stem augers. At least three additional piezometer nests of two piezometers each as well as a large diameter injection well [not necessarily fully penetrating the RGA] should be completed within the RGA. These will allow the performance of hydraulic and tracer tests to measure the hydraulic properties of the RGA and the DNAPL distribution and volume beneath the C-400 building.

2. A program of pump testing should be conducted in the RGA with observation of responses not only in the RGA but in the upper continental deposits as well. This data should be used to develop a numerical model of the hydrogeology of the RGA and overlying deposits.

3. Three PITTs should be undertaken in the areas instrumented with piezometer nests and injection wells to determine the spatial geometry and volume of DNAPL in the RGA.

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APPENDICES

APPENDIX A

Soil Boring Logs

INTERA, Inc.
Environmental Consulting

Log of Boring INT-1

PROJECT: *PORTSMOUTH*	LOCATION: *10277.5E, 10615.5N*
PROJECT NO.: *1125-005*	DRILLING CO.: *Alliance*
DATE STARTED: *12/5/95*	SURFACE ELEVATION: *672.3 feet AMSL*
DATE FINISHED: *12/5/95*	TOC ELEVATION: *feet*
DRILLING METHOD: *Augers*	TOTAL DEPTH: *33.7 feet*
SAMPLING METHOD: *2'x3" ID Split Spoon, Brass liners*	GEOLOGIST: *Carl Young*

DEPTH feet	SAMPLE NO.	SAMPLE INTERVAL	RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	REMARKS
						ML	SILT w/ gravel, color 10YR 7/3, stiff, fissile, cut/fill? very pale brown.	
								Minford Mbr.
				0				
5				0		OH	Gray silty CLAY, 5 GY 5/1, stiff, greenish gray.	
				0				
10								
							Gray silty CLAY, stiff, plastic, buff mottling, moist.	
				0				
				0		OH	Buff silty CLAY, 2.5 Y 6/4, moist, soft, plastic, lt. yellowish brown.	Distinct color change
15								
				0				
							Wet	
20							Buff silty CLAY, 2.5 Y 6/4, moist, soft, plastic.	
				0				

INTERA, Inc.
Environmental Consulting

Log of Boring INT-1

PROJECT: *PORTSMOUTH*

LOCATION: *10277.5E, 10615.5N*

DEPTH feet	SAMPLE NO.	PID (ppm)	SOIL CLASS	GEOLOGIC DESCRIPTION	REMARKS
			OH		Auger down to 24', then Push Spoons
	BIC1, BIC2, BIC3, BIC4, BIC5, BIC6, BIC7, BIC8	0, 0	ML	Inorganic muddy SILT w/ gravel and cobbles, color 2.5 YR 6/8, lt. red.	1110 hrs.
					1127 hrs.
26		0		Gravel content increases.	
	BIC14, BIC15, BIC16			Missing – cobble obstructed core barrel. No recovery.	Gallia Mbr.
		0, 0	GM	Gravel – silty-muddy, lt. red (2.5 YR 6/8), clast supported, stiff.	1210 hrs.
	BIC18, BIC19, BIC20, BIC21, BIC24, BIC25, BIC26, BIC27, BIC28	0	ML	Inorganic muddy SILT w/ pebbles and cobbles, lt. red (2.5 YR 6/8), stiff.	
31					
	BIC30, BIC31, BIC32	0	CL	Mud, gravelly, matrix supported, plastic.	
	BIC33, BIC34	150	SH	SHALE, dk. gray.	Sunbury Fm.
				Total Depth of Boring = 33.7 feet	
36					
41					

INTERA, Inc.
Environmental Consulting

Log of Boring INT-2

PROJECT: *PORTSMOUTH*	LOCATION: *10264.0E, 10605.5N*
PROJECT NO.: *1125-005*	DRILLING CO.: *Alliance*
DATE STARTED: *12/5/95*	SURFACE ELEVATION: *672.3 feet AMSL*
DATE FINISHED: *12/5/95*	TOC ELEVATION: *feet*
DRILLING METHOD: *Augers*	TOTAL DEPTH: *33.7 feet*
SAMPLING METHOD: *2"x3" ID Split Spoon, Brass liners*	GEOLOGIST: *Carl Young*

DEPTH feet	SAMPLE NO.	SAMPLE INTERVAL	RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	REMARKS
						ML	Silty CLAY, stiff, color 10 YR 5/6, rather fissle, yellowish-brown.	10.2 ev lamp
				0				
5								
						OH	Silty CLAY, soft, plastic, color 5 GY 5/1 (gray).	
				0				
10								
				3			Gray silty CLAY, 5 GY 5/1, soft, plastic, methane?	10.2 ev lamp
						ML		
				2				
15							Silty CLAY, 25 Y 6/4, increasing silt, lt. yellowish-brown, moist.	
				0				
20						ML	Siltier, possibly clayey SILT, some pebbles.	

INTERA, Inc. Environmental Consulting	**Log of Boring INT-2**
PROJECT: *PORTSMOUTH*	LOCATION: *10264.0E, 10605.5N*

DEPTH feet	SAMPLE NO.	SAMPLE INTERVAL	RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	REMARKS
				0		ML	Clayey SILT, some pebbles, 2.5 Y 6/4, soft, moist.	
							Wet	
				0				Augered through this interval
26	B2C1 B2C2 B2C3			0			Switch to using Split-Spoons here. Clayey SILT w/ gravel, lt. red (2.5 YR 6/6)	
								Gallia Mbr.
	B2C4 B2C5 B2C6					GM	GRAVEL, muddy, lt. red (2.5 YR 6/8), clast-supported, stiff.	1123 hrs.
	B2C7 B2C8 B2C9 B2C10			0		ML	Sandy SILT w/ gravel, stiff.	
31	B2C11 B2C12			2		ML	SILT, poorly sorted sand and pebbles present, large cobble obstruction in tube.	
	B2C13 B2C14 B2C15			200		SH	SHALE	Sunbury Fm.
							Total Depth of Boring = 33.7 feet	
36								
41								

INTERA, Inc.
Environmental Consulting

Log of Boring INT-3

PROJECT: *PORTSMOUTH*

LOCATION: *10252.5E, 10814.5N*

DEPTH feet	SAMPLE NO.	SAMPLE INTERVAL	RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	REMARKS
						ML	Clayey SILT, buff colored (2.5 YR 7/3), moist.	
	B3C1 B3C2 B3C3 B3C4 B3C5			0			Inorganic muddy SILT, w/ gravel and cobbles, lt. red (2.5 YR 6/8).	
26	B3C6 B3C7 B3C8 B3C9 B3C10 B3C11 B3C12			0				
	B3C30 B3C31			0		GM	Muddy GRAVEL, lt. red (2.5 YR 6/8), clast supported, stiff.	Gallia Mbr.
	B3C32 B3C33			0			GRAVEL w/ mud.	
	B3C34 B3C35 B3C22 B3C23 B3C24					ML	SAND, gravelly.	
31	B3C25 BIC26 B3C27 B3C28 B3C29			0				
	B3C12 B3C13			0		GM	GRAVEL w/ mud.	
	B3C14			10		CL	CLAY mixed w/ dark gray SHALE.	Sunbury Fm.
	B3C15 B3C16			150		SH	*Total Depth of Boring = 33.7 feet*	
	B3C17 B3C18 B3C19 B3C20 B3C21							
36								
41								

INTERA, Inc.
Environmental Consulting

Log of Boring INT-4

PROJECT: PORTSMOUTH	LOCATION: 10252E, 10627N
PROJECT NO.: 1125-005	DRILLING CO.: Alliance
DATE STARTED: 12/7/96	SURFACE ELEVATION: 671.7 feet AMSL
DATE FINISHED: 12/8/96	TOC ELEVATION: feet
DRILLING METHOD: Augers	TOTAL DEPTH: 33.3 feet
SAMPLING METHOD: 2'x3" ID Split Spoon, Brass liners	GEOLOGIST: Carl Young

DEPTH feet	SAMPLE NO.	SAMPLE INTERVAL	RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	REMARKS
						GR	GRAVEL, black.	
				0		CL ML	Silty CLAY, plastic, buff 2.5 Y 7/3.	
5						ML	Becomes very silty, clayey SILT?	
				0				Minford Mbr.
						CL ML	Silty CLAY, gray 5 GY 6/1, soft.	
10				0				
						CL ML	Silty CLAY, buff 2.5 GY 6/4, soft.	
15								
20				0			Silty CLAY, ochre 2.5 Y 6/8, soft.	Augered to 24 ft. BGS on 12/7. Cored to 33.3 ft. BGS on 12/8.

INTERA, Inc.
Environmental Consulting

Log of Boring INT-4

PROJECT: *PORTSMOUTH*

LOCATION: *10252E, 10627N*

DEPTH feet	SAMPLE NO.	SAMPLE INTERVAL	RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	REMARKS
						CL ML		
	B4B1 B4B2			0		ML	SILT w/ pebbles.	
26	B4B3 B4B4 B4B5 B4B6			0			MUD, inorganic, w/ pebbles.	
	B4B7 B4B8 B4B9 B4B10 B4B11			0		GR	GRAVEL, matrix supported.	Gallia Mbr.
							GRAVEL w/ mud.	
	B4B12					ML CL	Clayey SILT w/ gravel, 2.5 YR 6/4.	
	B4B13 B4B14 B4B15 B4B16 B4B17 B4B18 B4B19			0				
31	B4B20 B4B21 B4B22 B4B23 B4B24			0				
	B4B25			10		ML	Muddy SILT w/ gravel, stiff.	
	B4B26 B4B27 B4B28			100		GR	*Total Depth of Boring = 33.3 feet*	Sunbury Fm.
36								
41								

APPENDIX B

Aquifer Test Piezometric Data

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Aquifer Test 1
Piezometric Data - March 11, 1996

Date and Time	Minutes	BW2G	Well ID 65G	66G
3/11/96 10:30	0.00	15.128	17.145	16.971
3/11/96 10:30	0.01	15.141	17.141	16.971
3/11/96 10:30	0.02	15.134	17.141	16.971
3/11/96 10:30	0.03	15.141	17.145	16.971
3/11/96 10:30	0.03	15.141	17.141	16.977
3/11/96 10:30	0.04	15.153	17.145	16.977
3/11/96 10:30	0.05	15.160	17.145	16.971
3/11/96 10:30	0.06	15.166	17.145	16.977
3/11/96 10:30	0.07	15.166	17.145	16.977
3/11/96 10:30	0.08	15.166	17.145	16.971
3/11/96 10:30	0.08	15.178	17.145	16.977
3/11/96 10:30	0.09	15.178	17.145	16.977
3/11/96 10:30	0.10	15.185	17.150	16.971
3/11/96 10:30	0.11	15.191	17.145	16.977
3/11/96 10:30	0.12	15.191	17.145	16.977
3/11/96 10:30	0.13	15.191	17.150	16.977
3/11/96 10:30	0.13	15.197	17.155	16.977
3/11/96 10:30	0.14	15.191	17.150	16.977
3/11/96 10:30	0.15	15.191	17.150	16.977
3/11/96 10:30	0.16	15.197	17.145	16.977
3/11/96 10:30	0.17	15.197	17.150	16.977
3/11/96 10:30	0.18	15.204	17.150	16.977
3/11/96 10:30	0.18	15.204	17.150	16.977
3/11/96 10:30	0.19	15.204	17.145	16.977
3/11/96 10:30	0.20	15.204	17.155	16.977
3/11/96 10:30	0.21	15.197	17.150	16.977
3/11/96 10:30	0.22	15.197	17.150	16.977
3/11/96 10:30	0.23	15.197	17.150	16.977
3/11/96 10:30	0.23	15.197	17.155	16.977
3/11/96 10:30	0.24	15.204	17.155	16.983
3/11/96 10:30	0.25	15.197	17.150	16.977
3/11/96 10:30	0.26	15.191	17.150	16.977
3/11/96 10:30	0.27	15.197	17.150	16.977
3/11/96 10:30	0.28	15.191	17.160	16.977
3/11/96 10:30	0.28	15.191	17.155	16.977
3/11/96 10:30	0.29	15.197	17.155	16.977
3/11/96 10:30	0.30	15.191	17.155	16.977
3/11/96 10:30	0.31	15.191	17.155	16.977
3/11/96 10:30	0.32	15.191	17.160	16.983
3/11/96 10:30	0.33	15.185	17.150	16.977
3/11/96 10:30	0.33	15.191	17.155	16.983
3/11/96 10:30	0.35	15.185	17.150	16.983

Date and Time	Minutes	BW2G	Well ID 65G	66G
3/11/96 10:30	0.37	15.185	17.155	16.983
3/11/96 10:30	0.38	15.178	17.160	16.977
3/11/96 10:30	0.40	15.185	17.150	16.983
3/11/96 10:30	0.42	15.178	17.160	16.983
3/11/96 10:30	0.43	15.178	17.155	16.983
3/11/96 10:30	0.45	15.178	17.160	16.983
3/11/96 10:30	0.47	15.178	17.155	16.990
3/11/96 10:30	0.48	15.178	17.155	16.983
3/11/96 10:30	0.50	15.172	17.155	16.983
3/11/96 10:30	0.52	15.178	17.155	16.983
3/11/96 10:30	0.53	15.172	17.160	16.990
3/11/96 10:30	0.55	15.166	17.160	16.983
3/11/96 10:30	0.57	15.166	17.155	16.983
3/11/96 10:30	0.58	15.172	17.155	16.990
3/11/96 10:30	0.60	15.172	17.155	16.983
3/11/96 10:30	0.62	15.166	17.150	16.990
3/11/96 10:30	0.63	15.166	17.155	16.990
3/11/96 10:30	0.65	15.172	17.150	16.990
3/11/96 10:30	0.67	15.166	17.160	16.983
3/11/96 10:30	0.68	15.166	17.160	16.983
3/11/96 10:30	0.70	15.166	17.155	16.990
3/11/96 10:30	0.72	15.166	17.155	16.983
3/11/96 10:30	0.73	15.166	17.160	16.990
3/11/96 10:30	0.75	15.160	17.160	16.983
3/11/96 10:30	0.77	15.166	17.155	16.983
3/11/96 10:30	0.78	15.166	17.160	16.983
3/11/96 10:30	0.80	15.160	17.155	16.983
3/11/96 10:30	0.82	15.160	17.160	16.983
3/11/96 10:30	0.83	15.160	17.155	16.983
3/11/96 10:30	0.85	15.160	17.160	16.983
3/11/96 10:30	0.87	15.160	17.155	16.983
3/11/96 10:30	0.88	15.160	17.160	16.990
3/11/96 10:30	0.90	15.153	17.160	16.990
3/11/96 10:30	0.92	15.160	17.155	16.983
3/11/96 10:30	0.93	15.153	17.160	16.983
3/11/96 10:30	0.95	15.160	17.155	16.983
3/11/96 10:31	0.97	15.160	17.155	16.983
3/11/96 10:31	0.98	15.153	17.155	16.983
3/11/96 10:31	1.00	15.153	17.155	16.990
3/11/96 10:31	1.20	15.147	17.155	16.983
3/11/96 10:31	1.40	15.178	17.155	16.983
3/11/96 10:31	1.60	15.172	17.160	16.990
3/11/96 10:31	1.80	15.166	17.155	16.990
3/11/96 10:32	2.00	15.153	17.160	16.990
3/11/96 10:32	2.20	15.153	17.160	16.983
3/11/96 10:32	2.40	15.305	17.160	16.996
3/11/96 10:32	2.60	15.400	17.178	17.008

Date and Time	Minutes	BW2G	Well ID 65G	66G
3/11/96 10:32	2.80	15.450	17.188	17.027
3/11/96 10:33	3.00	15.482	17.202	17.046
3/11/96 10:33	3.20	15.501	17.216	17.059
3/11/96 10:33	3.40	15.444	17.216	17.072
3/11/96 10:33	3.60	15.526	17.226	17.078
3/11/96 10:33	3.80	15.609	17.245	17.097
3/11/96 10:34	4.00	15.672	17.254	17.116
3/11/96 10:34	4.20	15.716	17.278	17.129
3/11/96 10:34	4.40	15.760	17.282	17.148
3/11/96 10:34	4.60	15.786	17.297	17.160
3/11/96 10:34	4.80	15.817	17.311	17.179
3/11/96 10:35	5.00	15.843	17.320	17.192
3/11/96 10:35	5.20	15.861	17.330	17.204
3/11/96 10:35	5.40	15.880	17.349	17.217
3/11/96 10:35	5.60	15.899	17.353	17.230
3/11/96 10:35	5.80	15.912	17.368	17.242
3/11/96 10:36	6.00	15.925	17.382	17.249
3/11/96 10:36	6.20	15.944	17.386	17.261
3/11/96 10:36	6.40	15.950	17.396	17.274
3/11/96 10:36	6.60	15.963	17.405	17.280
3/11/96 10:36	6.80	15.969	17.410	17.287
3/11/96 10:37	7.00	15.975	17.420	17.293
3/11/96 10:37	7.20	15.988	17.424	17.299
3/11/96 10:37	7.40	15.994	17.429	17.306
3/11/96 10:37	7.60	16.001	17.438	17.312
3/11/96 10:37	7.80	16.007	17.443	17.318
3/11/96 10:38	8.00	16.013	17.453	17.325
3/11/96 10:38	8.20	16.020	17.453	17.331
3/11/96 10:38	8.40	16.026	17.453	17.331
3/11/96 10:38	8.60	16.032	17.472	17.337
3/11/96 10:38	8.80	16.032	17.472	17.344
3/11/96 10:39	9.00	16.039	17.476	17.350
3/11/96 10:39	9.20	16.051	17.476	17.356
3/11/96 10:39	9.40	16.051	17.481	17.356
3/11/96 10:39	9.60	16.058	17.490	17.356
3/11/96 10:39	9.80	16.058	17.490	17.363
3/11/96 10:40	10.00	16.064	17.495	17.369
3/11/96 10:42	12.00	16.102	17.533	17.407
3/11/96 10:44	14.00	16.127	17.566	17.432
3/11/96 10:46	16.00	16.159	17.599	17.457
3/11/96 10:48	18.00	16.171	17.618	17.476
3/11/96 10:50	20.00	16.190	17.632	17.495
3/11/96 10:52	22.00	16.203	17.656	17.508
3/11/96 10:54	24.00	16.197	17.665	17.521
3/11/96 10:56	26.00	16.197	17.675	17.521
3/11/96 10:58	28.00	16.203	17.679	17.527
3/11/96 11:00	30.00	16.216	17.689	17.540

Date and Time	Minutes	BW2G	Well ID 65G	66G
3/11/96 11:02	32.00	16.228	17.703	17.546
3/11/96 11:04	34.00	16.235	17.708	17.552
3/11/96 11:06	36.00	16.228	17.713	17.565
3/11/96 11:08	38.00	16.235	17.713	17.565
3/11/96 11:10	40.00	16.222	17.717	17.571
3/11/96 11:12	42.00	16.216	17.722	17.565
3/11/96 11:14	44.00	16.386	17.741	17.590
3/11/96 11:16	46.00	16.570	17.812	17.672
3/11/96 11:18	48.00	16.620	17.850	17.717
3/11/96 11:20	50.00	16.658	17.883	17.742
3/11/96 11:22	52.00	16.677	17.897	17.754
3/11/96 11:24	54.00	16.696	17.921	17.780
3/11/96 11:26	56.00	16.715	17.939	17.792
3/11/96 11:28	58.00	16.728	17.949	17.805
3/11/96 11:30	60.00	16.740	17.963	17.818
3/11/96 11:32	62.00	16.753	17.977	17.830
3/11/96 11:34	64.00	16.766	17.987	17.837
3/11/96 11:36	66.00	16.772	17.996	17.849
3/11/96 11:38	68.00	16.785	18.006	17.862
3/11/96 11:40	70.00	16.791	18.015	17.868
3/11/96 11:42	72.00	16.797	18.025	17.875
3/11/96 11:44	74.00	16.810	18.029	17.881
3/11/96 11:46	76.00	16.810	18.034	17.887
3/11/96 11:48	78.00	16.816	18.043	17.894
3/11/96 11:50	80.00	16.823	18.048	17.900
3/11/96 11:52	82.00	16.829	18.053	17.894
3/11/96 11:54	84.00	17.031	18.095	17.950
3/11/96 11:56	86.00	17.107	18.133	17.995
3/11/96 11:58	88.00	17.139	18.157	18.014
3/11/96 12:00	90.00	17.113	18.171	18.026
3/11/96 12:02	92.00	17.158	18.185	18.045
3/11/96 12:04	94.00	17.158	18.199	18.052
3/11/96 12:06	96.00	17.196	18.214	18.064
3/11/96 12:08	98.00	17.202	18.218	18.071
3/11/96 12:10	100.00	17.215	18.232	18.083
3/11/96 12:15	105.00	15.963	17.973	17.748
3/11/96 12:20	110.00	15.646	17.703	17.489
3/11/96 12:25	115.00	15.514	17.575	17.369
3/11/96 12:30	120.00	15.431	17.490	17.293
3/11/96 12:35	125.00	15.368	17.429	17.230
3/11/96 12:40	130.00	15.330	17.386	17.198
3/11/96 12:45	135.00	15.292	17.344	17.160
3/11/96 12:50	140.00	15.261	17.316	17.129
3/11/96 12:55	145.00	15.242	17.287	17.110
3/11/96 13:00	150.00	15.223	17.268	17.091
3/11/96 13:05	155.00	15.204	17.254	17.078
3/11/96 13:10	160.00	15.191	17.235	17.059

Date and Time	Minutes	Well ID BW2G	65G	66G
3/11/96 13:15	165.00	15.172	17.216	17.040
3/11/96 13:20	170.00	15.153	17.197	17.021
3/11/96 13:25	175.00	15.147	17.193	17.021
3/11/96 13:30	180.00	15.141	17.178	17.008
3/11/96 13:35	185.00	15.128	17.169	17.002
3/11/96 13:40	190.00	15.115	17.160	16.990
3/11/96 13:45	195.00	15.109	17.155	16.983
3/11/96 13:50	200.00	15.103	17.141	16.971
3/11/96 13:55	205.00	15.096	17.136	16.964
3/11/96 14:00	210.00	15.084	17.126	16.958
3/11/96 14:05	215.00	15.077	17.122	16.952
3/11/96 14:10	220.00	15.077	17.117	16.945
3/11/96 14:15	225.00	15.071	17.107	16.939
3/11/96 14:20	230.00	15.065	17.103	16.939
3/11/96 14:25	235.00	15.065	17.103	16.933
3/11/96 14:30	240.00	15.058	17.098	16.933
3/11/96 14:35	245.00	15.052	17.089	16.926
3/11/96 14:40	250.00	15.052	17.089	16.920
3/11/96 14:45	255.00	15.046	17.079	16.914
3/11/96 14:50	260.00	15.039	17.074	16.907
3/11/96 14:55	265.00	15.033	17.070	16.901
3/11/96 15:00	270.00	15.027	17.065	16.901
3/11/96 15:05	275.00	15.020	17.060	16.895
3/11/96 15:10	280.00	15.020	17.055	16.895
3/11/96 15:15	285.00	15.020	17.055	16.888
3/11/96 15:20	290.00	15.014	17.051	16.882
3/11/96 15:25	295.00	15.008	17.046	16.876
3/11/96 15:30	300.00	15.001	17.041	16.876
3/11/96 15:35	305.00	14.995	17.037	16.863
3/11/96 15:40	310.00	14.995	17.032	16.869
3/11/96 15:45	315.00	14.976	17.027	16.863

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Aquifer Test 2
Piezometric Data - March 11, 1996

Date and Time	Minutes	BW2G (Well ID)	65G (Well ID)	66G (Well ID)
3/11/96 16:00	0.00	15.191	17.080	16.887
3/11/96 16:00	0.01	15.210	17.075	16.887
3/11/96 16:00	0.02	15.229	17.075	16.887
3/11/96 16:00	0.03	15.248	17.075	16.887
3/11/96 16:00	0.03	15.267	17.075	16.887
3/11/96 16:00	0.04	15.280	17.080	16.887
3/11/96 16:00	0.05	15.299	17.080	16.893
3/11/96 16:00	0.06	15.318	17.080	16.893
3/11/96 16:00	0.07	15.330	17.084	16.893
3/11/96 16:00	0.08	15.343	17.084	16.893
3/11/96 16:00	0.08	15.362	17.080	16.900
3/11/96 16:00	0.09	15.375	17.084	16.900
3/11/96 16:00	0.10	15.387	17.084	16.900
3/11/96 16:00	0.11	15.406	17.084	16.900
3/11/96 16:00	0.12	15.419	17.089	16.900
3/11/96 16:00	0.13	15.432	17.089	16.900
3/11/96 16:00	0.13	15.444	17.089	16.906
3/11/96 16:00	0.14	15.457	17.094	16.906
3/11/96 16:00	0.15	15.476	17.089	16.906
3/11/96 16:00	0.16	15.476	17.094	16.906
3/11/96 16:00	0.17	15.489	17.094	16.912
3/11/96 16:00	0.18	15.495	17.094	16.912
3/11/96 16:00	0.18	15.508	17.098	16.912
3/11/96 16:00	0.19	15.508	17.098	16.912
3/11/96 16:00	0.20	15.520	17.098	16.918
3/11/96 16:00	0.21	15.533	17.098	16.918
3/11/96 16:00	0.22	15.539	17.103	16.918
3/11/96 16:00	0.23	15.552	17.103	16.918
3/11/96 16:00	0.23	15.558	17.103	16.925
3/11/96 16:00	0.24	15.571	17.108	16.925
3/11/96 16:00	0.25	15.577	17.108	16.925
3/11/96 16:00	0.26	15.583	17.108	16.931
3/11/96 16:00	0.27	15.596	17.108	16.931
3/11/96 16:00	0.28	15.602	17.108	16.931
3/11/96 16:00	0.28	15.609	17.113	16.937
3/11/96 16:00	0.29	15.615	17.113	16.937
3/11/96 16:00	0.30	15.621	17.117	16.937
3/11/96 16:00	0.31	15.634	17.117	16.944
3/11/96 16:00	0.32	15.634	17.117	16.944
3/11/96 16:00	0.33	15.647	17.117	16.944
3/11/96 16:00	0.33	15.653	17.122	16.944
3/11/96 16:00	0.35	15.659	17.122	16.950

Date and Time	Minutes	BW2G	65G	66G
		Well ID		
3/11/96 16:00	0.37	15.678	17.127	16.956
3/11/96 16:00	0.38	15.691	17.127	16.956
3/11/96 16:00	0.40	15.697	17.132	16.963
3/11/96 16:00	0.42	15.710	17.136	16.963
3/11/96 16:00	0.43	15.723	17.136	16.969
3/11/96 16:00	0.45	15.735	17.141	16.969
3/11/96 16:00	0.47	15.748	17.146	16.975
3/11/96 16:00	0.48	15.754	17.146	16.982
3/11/96 16:00	0.50	15.767	17.150	16.988
3/11/96 16:00	0.52	15.773	17.150	16.988
3/11/96 16:00	0.53	15.779	17.155	16.994
3/11/96 16:00	0.55	15.792	17.155	16.994
3/11/96 16:00	0.57	15.798	17.160	17.001
3/11/96 16:00	0.58	15.811	17.165	17.001
3/11/96 16:00	0.60	15.817	17.165	17.007
3/11/96 16:00	0.62	15.824	17.165	17.013
3/11/96 16:00	0.63	15.836	17.169	17.013
3/11/96 16:00	0.65	15.843	17.174	17.020
3/11/96 16:00	0.67	15.849	17.174	17.020
3/11/96 16:00	0.68	15.862	17.179	17.026
3/11/96 16:00	0.70	15.868	17.184	17.026
3/11/96 16:00	0.72	15.874	17.184	17.032
3/11/96 16:00	0.73	15.881	17.188	17.039
3/11/96 16:00	0.75	15.887	17.188	17.039
3/11/96 16:00	0.77	15.900	17.193	17.045
3/11/96 16:00	0.78	15.906	17.193	17.045
3/11/96 16:00	0.80	15.912	17.198	17.045
3/11/96 16:00	0.82	15.919	17.198	17.051
3/11/96 16:00	0.83	15.925	17.202	17.058
3/11/96 16:00	0.85	15.931	17.202	17.058
3/11/96 16:00	0.87	15.938	17.207	17.064
3/11/96 16:00	0.88	15.944	17.207	17.083
3/11/96 16:01	0.90	15.950	17.212	17.077
3/11/96 16:01	0.92	15.957	17.212	17.077
3/11/96 16:01	0.93	15.963	17.217	17.077
3/11/96 16:01	0.95	15.963	17.217	17.077
3/11/96 16:01	0.97	15.975	17.221	17.077
3/11/96 16:01	0.98	15.975	17.226	17.083
3/11/96 16:01	1.00	15.982	17.226	17.083
3/11/96 16:01	1.20	16.039	17.254	17.121
3/11/96 16:01	1.40	16.089	17.278	17.152
3/11/96 16:01	1.60	16.134	17.302	17.171
3/11/96 16:01	1.80	16.165	17.321	17.197
3/11/96 16:02	2.00	16.203	17.340	17.222
3/11/96 16:02	2.20	16.235	17.363	17.241
3/11/96 16:02	2.40	16.266	17.382	17.260
3/11/96 16:02	2.60	16.285	17.382	17.279

Date and Time	Minutes	BW2G	Well ID 65G	66G
3/11/96 16:02	2.80	16.311	17.410	17.298
3/11/96 16:03	3.00	16.336	17.434	17.310
3/11/96 16:03	3.20	16.355	17.448	17.323
3/11/96 16:03	3.40	16.374	17.458	17.342
3/11/96 16:03	3.60	16.393	17.472	17.355
3/11/96 16:03	3.80	16.405	17.481	17.367
3/11/96 16:04	4.00	16.418	17.496	17.374
3/11/96 16:04	4.20	16.431	17.505	17.386
3/11/96 16:04	4.40	16.450	17.514	17.399
3/11/96 16:04	4.60	16.456	17.524	17.412
3/11/96 16:04	4.80	16.475	17.533	17.418
3/11/96 16:05	5.00	16.481	17.548	17.431
3/11/96 16:05	5.20	16.494	17.557	17.437
3/11/96 16:05	5.40	16.507	17.566	17.450
3/11/96 16:05	5.60	16.513	17.576	17.456
3/11/96 16:05	5.80	16.526	17.581	17.462
3/11/96 16:06	6.00	16.532	17.590	17.469
3/11/96 16:06	6.20	16.545	17.600	17.475
3/11/96 16:06	6.40	16.551	17.604	17.487
3/11/96 16:06	6.60	16.557	17.614	17.494
3/11/96 16:06	6.80	16.570	17.618	17.500
3/11/96 16:07	7.00	16.576	17.628	17.506
3/11/96 16:07	7.20	16.583	17.637	17.506
3/11/96 16:07	7.40	16.589	17.642	17.519
3/11/96 16:07	7.60	16.595	17.647	17.525
3/11/96 16:07	7.80	16.601	17.656	17.525
3/11/96 16:08	8.00	16.608	17.661	17.532
3/11/96 16:08	8.20	16.620	17.670	17.538
3/11/96 16:08	8.40	16.620	17.675	17.544
3/11/96 16:08	8.60	16.633	17.680	17.544
3/11/96 16:08	8.80	16.639	17.685	17.557
3/11/96 16:09	9.00	16.646	17.689	17.557
3/11/96 16:09	9.20	16.652	17.699	17.563
3/11/96 16:09	9.40	16.652	17.703	17.570
3/11/96 16:09	9.60	16.658	17.708	17.570
3/11/96 16:09	9.80	16.665	17.708	17.576
3/11/96 16:10	10.00	16.671	17.718	17.582
3/11/96 16:11	11.00	16.703	17.741	17.608
3/11/96 16:12	12.00	16.728	17.770	17.627
3/11/96 16:13	13.00	16.747	17.789	17.652
3/11/96 16:14	14.00	16.766	17.807	17.665
3/11/96 16:15	15.00	16.785	17.826	17.683
3/11/96 16:16	16.00	16.797	17.845	17.696
3/11/96 16:17	17.00	16.816	17.855	17.709
3/11/96 16:18	18.00	16.829	17.869	17.715
3/11/96 16:19	19.00	16.842	17.883	17.709
3/11/96 16:20	20.00	16.854	17.897	17.728

Date and Time	Minutes	Well ID BW2G	65G	66G
3/11/96 16:21	21.00	16.867	17.911	17.734
3/11/96 16:22	22.00	16.880	17.921	17.740
3/11/96 16:23	23.00	16.886	17.930	17.753
3/11/96 16:24	24.00	16.899	17.940	17.759
3/11/96 16:25	25.00	16.905	17.949	17.766
3/11/96 16:26	26.00	16.918	17.963	17.772
3/11/96 16:27	27.00	16.924	17.968	17.778
3/11/96 16:28	28.00	16.937	17.978	17.791
3/11/96 16:29	29.00	16.943	17.987	17.804
3/11/96 16:30	30.00	16.949	17.997	17.804
3/11/96 16:31	31.00	16.962	18.006	17.816
3/11/96 16:32	32.00	16.968	18.011	17.823
3/11/96 16:33	33.00	16.974	18.020	17.829
3/11/96 16:34	34.00	16.981	18.025	17.835
3/11/96 16:35	35.00	16.987	18.034	17.842
3/11/96 16:36	36.00	16.993	18.039	17.854
3/11/96 16:37	37.00	17.000	18.044	17.854
3/11/96 16:38	38.00	17.006	18.053	17.854
3/11/96 16:39	39.00	17.012	18.058	17.860
3/11/96 16:40	40.00	17.019	18.063	17.867
3/11/96 16:41	41.00	17.019	18.067	17.873
3/11/96 16:42	42.00	17.025	18.077	17.879
3/11/96 16:43	43.00	17.031	18.082	17.886
3/11/96 16:44	44.00	17.038	18.086	17.886
3/11/96 16:45	45.00	17.044	18.086	17.892
3/11/96 16:46	46.00	17.044	18.091	17.898
3/11/96 16:47	47.00	17.050	18.096	17.898
3/11/96 16:48	48.00	17.057	18.119	17.905
3/11/96 16:49	49.00	17.063	18.105	17.911
3/11/96 16:50	50.00	17.063	18.110	17.911
3/11/96 16:51	51.00	17.069	18.119	17.917
3/11/96 16:52	52.00	17.076	18.119	17.917
3/11/96 16:53	53.00	17.076	18.124	17.924
3/11/96 16:54	54.00	17.082	18.129	17.930
3/11/96 16:55	55.00	17.088	18.134	17.930
3/11/96 16:56	56.00	17.088	18.134	17.930
3/11/96 16:57	57.00	17.095	18.138	17.936
3/11/96 16:58	58.00	17.095	18.143	17.936
3/11/96 16:59	59.00	17.101	18.143	17.943
3/11/96 17:00	60.00	17.853	18.214	18.031
3/11/96 17:01	61.00	18.352	18.318	18.158
3/11/96 17:02	62.00	18.681	18.403	18.252
3/11/96 17:03	63.00	18.902	18.469	18.322
3/11/96 17:04	64.00	19.104	18.531	18.379
3/11/96 17:05	65.00	19.250	18.583	18.429
3/11/96 17:06	66.00	19.370	18.625	18.467
3/11/96 17:07	67.00	19.471	18.663	18.505

Date and Time	Minutes	BW2G	Well ID 65G	66G
3/11/96 17:08	68.00	19.566	18.696	18.537
3/11/96 17:09	69.00	19.654	18.729	18.575
3/11/96 17:10	70.00	19.724	18.762	18.587
3/11/96 17:11	71.00	19.781	18.781	18.619
3/11/96 17:12	72.00	19.844	18.805	18.638
3/11/96 17:13	73.00	19.907	18.833	18.657
3/11/96 17:14	74.00	19.970	18.847	18.676
3/11/96 17:15	75.00	20.027	18.871	18.695
3/11/96 17:16	76.00	20.077	18.890	18.714
3/11/96 17:17	77.00	20.122	18.909	18.726
3/11/96 17:18	78.00	20.172	18.923	18.739
3/11/96 17:19	79.00	20.216	18.942	18.758
3/11/96 17:20	80.00	20.248	18.961	18.777
3/11/96 17:21	81.00	20.280	18.970	18.783
3/11/96 17:22	82.00	20.324	18.984	18.796
3/11/96 17:23	83.00	20.349	19.003	18.809
3/11/96 17:24	84.00	20.381	19.017	18.821
3/11/96 17:25	85.00	20.412	19.027	18.834
3/11/96 17:26	86.00	20.444	19.041	18.847
3/11/96 17:27	87.00	20.469	19.050	18.859
3/11/96 17:28	88.00	20.494	19.064	18.865
3/11/96 17:29	89.00	20.520	19.074	18.878
3/11/96 17:30	90.00	20.539	19.083	18.884
3/11/96 17:31	91.00	20.564	19.098	18.897
3/11/96 17:32	92.00	20.589	19.107	18.903
3/11/96 17:33	93.00	20.614	19.112	18.910
3/11/96 17:34	94.00	20.640	19.121	18.922
3/11/96 17:35	95.00	20.652	19.131	18.929
3/11/96 17:36	96.00	20.678	19.140	18.935
3/11/96 17:37	97.00	20.696	19.150	18.941
3/11/96 17:38	98.00	20.703	19.154	18.954
3/11/96 17:39	99.00	20.728	19.164	18.954
3/11/96 17:40	100.00	20.747	19.173	18.967
3/11/96 17:41	101.00	20.760	19.178	18.973
3/11/96 17:42	102.00	20.779	19.187	18.979
3/11/96 17:43	103.00	20.785	19.192	18.986
3/11/96 17:44	104.00	20.804	19.201	18.992
3/11/96 17:45	105.00	20.816	19.206	18.998
3/11/96 17:46	106.00	20.842	19.211	19.005
3/11/96 17:47	107.00	20.854	19.220	19.005
3/11/96 17:48	108.00	20.861	19.230	19.017
3/11/96 17:49	109.00	20.873	19.235	19.023
3/11/96 17:50	110.00	20.880	19.244	19.030
3/11/96 17:51	111.00	20.892	19.249	19.036
3/11/96 17:52	112.00	20.899	19.258	19.036
3/11/96 17:53	113.00	20.911	19.258	19.042
3/11/96 17:54	114.00	20.918	19.268	19.049

Date and Time	Minutes	BW2G	Well ID 65G	66G
3/11/96 17:55	115.00	20.930	19.272	19.055
3/11/96 17:56	116.00	20.943	19.277	19.061
3/11/96 17:57	117.00	20.962	19.282	19.061
3/11/96 17:58	118.00	20.968	19.287	19.068
3/11/96 17:59	119.00	20.974	19.291	19.074
3/11/96 18:00	120.00	20.987	19.296	19.080
3/11/96 18:01	121.00	20.589	19.263	19.030
3/11/96 18:02	122.00	21.012	19.272	19.055
3/11/96 18:03	123.00	21.233	19.305	19.093
3/11/96 18:04	124.00	21.360	19.334	19.125
3/11/96 18:05	125.00	21.448	19.357	19.150
3/11/96 18:06	126.00	21.511	19.376	19.169
3/11/96 18:07	127.00	21.562	19.390	19.181
3/11/96 18:08	128.00	21.612	19.405	19.194
3/11/96 18:09	129.00	21.669	19.419	19.207
3/11/96 18:10	130.00	21.720	19.433	19.219
3/11/96 18:11	131.00	21.757	19.442	19.226
3/11/96 18:12	132.00	21.808	19.447	19.232
3/11/96 18:13	133.00	21.833	19.457	19.238
3/11/96 18:14	134.00	21.865	19.466	19.251
3/11/96 18:15	135.00	21.896	19.475	19.257
3/11/96 18:16	136.00	21.915	19.485	19.264
3/11/96 18:17	137.00	21.941	19.494	19.270
3/11/96 18:18	138.00	21.960	19.499	19.276
3/11/96 18:19	139.00	21.978	19.509	19.283
3/11/96 18:20	140.00	21.978	19.513	19.295
3/11/96 18:21	141.00	21.985	19.523	19.302
3/11/96 18:22	142.00	21.997	19.527	19.302
3/11/96 18:23	143.00	22.029	19.532	19.302
3/11/96 18:24	144.00	22.042	19.537	19.308
3/11/96 18:25	145.00	22.061	19.542	19.314
3/11/96 18:26	146.00	22.061	19.551	19.320
3/11/96 18:27	147.00	22.067	19.556	19.333
3/11/96 18:28	148.00	22.080	19.561	19.327
3/11/96 18:29	149.00	22.098	19.561	19.333
3/11/96 18:30	150.00	22.130	19.570	19.333
3/11/96 18:31	151.00	22.155	19.575	19.339
3/11/96 18:32	152.00	22.181	19.575	19.346
3/11/96 18:33	153.00	22.206	19.579	19.346
3/11/96 18:34	154.00	22.237	19.584	19.352
3/11/96 18:35	155.00	22.244	19.594	19.358
3/11/96 18:36	156.00	22.256	19.594	19.365
3/11/96 18:37	157.00	22.294	19.594	19.365
3/11/96 18:38	158.00	22.301	19.603	19.371
3/11/96 18:39	159.00	22.307	19.608	19.377
3/11/96 18:40	160.00	22.326	19.612	19.371
3/11/96 18:41	161.00	22.332	19.617	19.377

Date and Time	Minutes	Well ID BW2G	65G	66G
3/11/96 18:42	162.00	22.332	19.622	19.384
3/11/96 18:43	163.00	22.332	19.627	19.390
3/11/96 18:44	164.00	22.332	19.631	19.396
3/11/96 18:45	165.00	22.332	19.636	19.403
3/11/96 18:46	166.00	22.338	19.641	19.403
3/11/96 18:47	167.00	22.357	19.641	19.403
3/11/96 18:48	168.00	22.345	19.650	19.409
3/11/96 18:49	169.00	22.338	19.650	19.415
3/11/96 18:50	170.00	22.345	19.655	19.415
3/11/96 18:51	171.00	22.364	19.655	19.415
3/11/96 18:52	172.00	22.383	19.660	19.422
3/11/96 18:53	173.00	22.395	19.660	19.422
3/11/96 18:54	174.00	22.389	19.664	19.428
3/11/96 18:55	175.00	22.395	19.669	19.428
3/11/96 18:56	176.00	22.389	19.674	19.434
3/11/96 18:57	177.00	21.271	19.655	19.403
3/11/96 18:58	178.00	19.256	19.485	19.194
3/11/96 18:59	179.00	18.068	19.282	18.960
3/11/96 19:00	180.00	17.366	19.093	18.752
3/11/96 19:01	181.00	16.993	18.937	18.581
3/11/96 19:02	182.00	16.778	18.805	18.442
3/11/96 19:03	183.00	16.633	18.696	18.335
3/11/96 19:04	184.00	16.526	18.606	18.252
3/11/96 19:05	185.00	16.437	18.526	18.177
3/11/96 19:06	186.00	16.361	18.460	18.120
3/11/96 19:07	187.00	16.298	18.398	18.063
3/11/96 19:08	188.00	16.216	18.342	18.012
3/11/96 19:09	189.00	16.083	18.256	17.924
3/11/96 19:10	190.00	16.096	18.223	17.898
3/11/96 19:11	191.00	16.077	18.190	17.867
3/11/96 19:12	192.00	16.045	18.153	17.842
3/11/96 19:13	193.00	16.013	18.119	17.810
3/11/96 19:14	194.00	15.988	18.086	17.785
3/11/96 19:15	195.00	15.957	18.053	17.759
3/11/96 19:16	196.00	15.931	18.025	17.734
3/11/96 19:17	197.00	15.900	17.997	17.709
3/11/96 19:18	198.00	15.874	17.973	17.683
3/11/96 19:19	199.00	15.855	17.945	17.665
3/11/96 19:20	200.00	15.830	17.921	17.639
3/11/96 19:21	201.00	15.811	17.902	17.620
3/11/96 19:22	202.00	15.792	17.878	17.601
3/11/96 19:23	203.00	15.773	17.859	17.576
3/11/96 19:24	204.00	15.754	17.845	17.557
3/11/96 19:25	205.00	15.735	17.822	17.544

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Aquifer Test 3
Piezometric Data - March 12, 1996

		Well ID						
Date and Time	Minutes	BW2G	65G	66G	62G	05G	67G	INT4
3/12/96 11:04	0.00	14.926	16.896	16.737	15.580	14.780	15.926	15.405
3/12/96 11:04	0.01	14.913	16.901	16.734	15.580	14.764	15.926	15.405
3/12/96 11:04	0.02	14.920	16.905	16.728	15.580	14.764	15.913	15.400
3/12/96 11:04	0.03	14.945	16.905	16.731	15.580	14.764	15.913	15.410
3/12/96 11:04	0.03	14.970	16.910	16.734	15.596	14.748	15.932	15.400
3/12/96 11:04	0.04	14.989	16.901	16.731	15.580	14.748	15.913	15.405
3/12/96 11:04	0.05	15.027	16.905	16.728	15.580	14.748	15.926	15.405
3/12/96 11:04	0.06	15.052	16.901	16.734	15.580	14.748	15.932	15.410
3/12/96 11:04	0.07	15.078	16.910	16.737	15.580	14.748	15.926	15.419
3/12/96 11:04	0.08	15.128	16.905	16.731	15.596	14.748	15.920	15.405
3/12/96 11:04	0.08	15.166	16.910	16.737	15.596	14.748	15.932	15.405
3/12/96 11:04	0.09	15.198	16.905	16.737	15.596	14.732	15.932	15.410
3/12/96 11:04	0.10	15.248	16.901	16.740	15.596	14.732	15.926	15.405
3/12/96 11:04	0.11	15.286	16.910	16.744	15.596	14.732	15.932	15.405
3/12/96 11:04	0.12	15.331	16.905	16.747	15.596	14.748	15.926	15.410
3/12/96 11:04	0.13	15.350	16.901	16.744	15.596	14.732	15.938	15.395
3/12/96 11:04	0.13	15.394	16.901	16.744	15.628	14.732	15.938	15.400
3/12/96 11:04	0.14	15.432	16.915	16.747	15.612	14.732	15.938	15.405
3/12/96 11:04	0.15	15.463	16.915	16.747	15.612	14.732	15.938	15.410
3/12/96 11:04	0.16	15.489	16.920	16.747	15.628	14.732	15.926	15.405
3/12/96 11:04	0.17	15.533	16.915	16.744	15.628	14.732	15.945	15.410
3/12/96 11:04	0.18	15.577	16.924	16.756	15.628	14.732	15.951	15.405
3/12/96 11:04	0.18	15.596	16.920	16.756	15.644	14.732	15.964	15.410
3/12/96 11:04	0.19	15.622	16.920	16.753	15.644	14.732	15.970	15.410
3/12/96 11:04	0.20	15.666	16.924	16.760	15.644	14.732	15.970	15.405
3/12/96 11:04	0.21	15.691	16.920	16.760	15.644	14.732	15.970	15.414
3/12/96 11:04	0.22	15.729	16.920	16.763	15.660	14.732	15.970	15.414
3/12/96 11:04	0.23	15.761	16.929	16.769	15.660	14.732	15.989	15.405
3/12/96 11:04	0.23	15.792	16.924	16.769	15.675	14.732	15.976	15.414
3/12/96 11:04	0.24	15.824	16.929	16.769	15.675	14.732	15.976	15.410
3/12/96 11:04	0.25	15.843	16.948	16.779	15.675	14.732	15.995	15.414
3/12/96 11:04	0.26	15.874	16.934	16.772	15.691	14.732	15.983	15.410
3/12/96 11:04	0.27	15.906	16.934	16.785	15.707	14.732	15.995	15.410
3/12/96 11:04	0.28	15.944	16.938	16.782	15.707	14.732	16.002	15.405
3/12/96 11:04	0.28	15.957	16.953	16.791	15.723	14.732	16.002	15.424
3/12/96 11:04	0.29	15.982	16.953	16.798	15.707	14.732	16.014	15.419
3/12/96 11:04	0.30	16.014	16.948	16.804	15.723	14.732	16.014	15.424
3/12/96 11:04	0.31	16.039	16.967	16.798	15.739	14.732	16.027	15.424
3/12/96 11:04	0.32	16.064	16.962	16.807	15.739	14.732	16.033	15.419
3/12/96 11:04	0.33	16.089	16.962	16.807	15.755	14.732	16.033	15.419
3/12/96 11:04	0.33	16.127	16.972	16.807	15.755	14.732	16.040	15.428
3/12/96 11:04	0.35	16.184	16.972	16.820	15.771	14.732	16.052	15.424

		Well ID						
Date and Time	Minutes	BW2G	65G	66G	62G	05G	67G	INT4
3/12/96 11:04	0.37	16.229	16.972	16.832	15.786	14.732	16.059	15.428
3/12/96 11:04	0.38	16.279	16.981	16.832	15.786	14.732	16.059	15.428
3/12/96 11:04	0.40	16.330	16.986	16.842	15.802	14.732	16.084	15.433
3/12/96 11:04	0.42	16.368	16.995	16.851	15.818	14.732	16.097	15.433
3/12/96 11:04	0.43	16.425	17.000	16.861	15.818	14.717	16.097	15.433
3/12/96 11:04	0.45	16.463	17.005	16.867	15.850	14.732	16.103	15.443
3/12/96 11:04	0.47	16.507	17.014	16.877	15.850	14.732	16.122	15.447
3/12/96 11:04	0.48	16.557	17.028	16.886	15.866	14.732	16.141	15.452
3/12/96 11:04	0.50	16.595	17.024	16.893	15.882	14.732	16.141	15.452
3/12/96 11:04	0.52	16.652	17.033	16.908	15.898	14.732	16.153	15.462
3/12/96 11:04	0.53	16.697	17.038	16.912	15.913	14.732	16.160	15.466
3/12/96 11:04	0.55	16.728	17.057	16.924	15.929	14.732	16.185	15.471
3/12/96 11:04	0.57	16.785	17.052	16.927	15.929	14.717	16.179	15.466
3/12/96 11:04	0.58	16.817	17.057	16.937	15.961	14.732	16.179	15.476
3/12/96 11:04	0.60	16.848	17.071	16.943	15.961	14.732	16.198	15.480
3/12/96 11:04	0.62	16.905	17.076	16.956	15.977	14.732	16.204	15.485
3/12/96 11:04	0.63	16.924	17.076	16.962	15.993	14.732	16.223	15.495
3/12/96 11:04	0.65	16.987	17.080	16.975	15.993	14.732	16.242	15.504
3/12/96 11:04	0.67	17.006	17.104	16.985	16.009	14.717	16.248	15.504
3/12/96 11:04	0.68	17.051	17.109	16.997	16.040	14.717	16.248	15.509
3/12/96 11:04	0.70	17.088	17.099	17.000	16.040	14.717	16.261	15.509
3/12/96 11:04	0.72	17.133	17.118	17.016	16.040	14.717	16.274	15.518
3/12/96 11:04	0.73	17.171	17.123	17.019	16.072	14.732	16.274	15.514
3/12/96 11:04	0.75	17.202	17.128	17.023	16.072	14.717	16.286	15.523
3/12/96 11:04	0.77	17.240	17.132	17.038	16.088	14.732	16.305	15.537
3/12/96 11:04	0.78	17.259	17.137	17.045	16.104	14.717	16.312	15.542
3/12/96 11:04	0.80	17.297	17.156	17.054	16.120	14.717	16.305	15.547
3/12/96 11:04	0.82	17.335	17.156	17.070	16.120	14.717	16.337	15.547
3/12/96 11:04	0.83	17.373	17.161	17.073	16.136	14.717	16.337	15.551
3/12/96 11:04	0.85	17.405	17.170	17.080	16.136	14.732	16.350	15.561
3/12/96 11:04	0.87	17.430	17.175	17.089	16.167	14.732	16.356	15.566
3/12/96 11:04	0.88	17.461	17.184	17.102	16.167	14.732	16.362	15.575
3/12/96 11:04	0.90	17.499	17.184	17.108	16.183	14.717	16.375	15.580
3/12/96 11:04	0.92	17.531	17.198	17.118	16.183	14.717	16.381	15.580
3/12/96 11:04	0.93	17.575	17.198	17.127	16.199	14.717	16.381	15.584
3/12/96 11:04	0.95	17.601	17.213	17.137	16.199	14.717	16.400	15.599
3/12/96 11:04	0.97	17.638	17.213	17.140	16.215	14.717	16.406	15.599
3/12/96 11:04	0.98	17.664	17.227	17.152	16.231	14.717	16.406	15.608
3/12/96 11:05	1.00	17.689	17.227	17.152	16.247	14.717	16.432	15.613
3/12/96 11:05	1.20	18.037	17.302	17.254	16.374	14.732	16.514	15.688
3/12/96 11:05	1.40	18.346	17.378	17.333	16.453	14.732	16.602	15.769
3/12/96 11:05	1.60	18.637	17.435	17.415	16.532	14.732	16.672	15.840
3/12/96 11:05	1.80	18.890	17.496	17.482	16.627	14.732	16.748	15.911
3/12/96 11:06	2.00	19.155	17.558	17.552	16.723	14.748	16.824	15.977
3/12/96 11:06	2.20	19.389	17.624	17.615	16.770	14.748	16.868	16.048
3/12/96 11:06	2.40	19.616	17.671	17.672	16.834	14.748	16.931	16.104
3/12/96 11:06	2.60	19.838	17.718	17.726	16.913	14.780	16.976	16.152

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3/12/96 11:06	2.80	20.033	17.775	17.780	16.961	14.780	17.032	16.204
3/12/96 11:07	3.00	20.217	17.813	17.818	17.024	14.780	17.083	16.270
3/12/96 11:07	3.20	20.412	17.860	17.869	17.040	14.795	17.121	16.308
3/12/96 11:07	3.40	20.589	17.898	17.910	17.103	14.811	17.165	16.350
3/12/96 11:07	3.60	20.754	17.931	17.954	17.151	14.811	17.203	16.398
3/12/96 11:07	3.80	20.924	17.974	17.986	17.199	14.827	17.247	16.440
3/12/96 11:08	4.00	21.088	18.007	18.027	17.246	14.842	17.298	16.473
3/12/96 11:08	4.20	21.234	18.049	18.059	17.278	14.858	17.330	16.511
3/12/96 11:08	4.40	21.385	18.082	18.090	17.310	14.858	17.368	16.554
3/12/96 11:08	4.60	21.524	18.125	18.122	17.357	14.874	17.393	16.577
3/12/96 11:08	4.80	21.657	18.149	18.157	17.373	14.890	17.437	16.620
3/12/96 11:09	5.00	21.789	18.182	18.192	17.421	14.905	17.469	16.648
3/12/96 11:09	5.20	21.909	18.229	18.220	17.453	14.905	17.494	16.686
3/12/96 11:09	5.40	22.023	18.238	18.249	17.484	14.937	17.532	16.710
3/12/96 11:09	5.60	22.149	18.276	18.280	17.516	14.937	17.564	16.738
3/12/96 11:09	5.80	22.257	18.309	18.306	17.548	14.952	17.589	16.757
3/12/96 11:10	6.00	22.370	18.333	18.334	17.579	14.968	17.608	16.780
3/12/96 11:10	6.20	22.465	18.361	18.353	17.611	14.968	17.639	16.818
3/12/96 11:10	6.40	22.566	18.385	18.385	17.643	14.984	17.677	16.837
3/12/96 11:10	6.60	22.673	18.408	18.410	17.659	15.000	17.696	16.861
3/12/96 11:10	6.80	22.787	18.437	18.423	17.675	15.015	17.722	16.884
3/12/96 11:11	7.00	22.888	18.456	18.448	17.691	15.031	17.734	16.913
3/12/96 11:11	7.20	23.002	18.479	18.467	17.722	15.047	17.747	16.932
3/12/96 11:11	7.40	23.096	18.503	18.483	17.754	15.063	17.772	16.960
3/12/96 11:11	7.60	23.197	18.522	18.502	17.786	15.078	17.797	16.984
3/12/96 11:11	7.80	23.273	18.550	18.524	17.817	15.078	17.823	16.993
3/12/96 11:12	8.00	23.355	18.569	18.546	17.817	15.094	17.842	17.012
3/12/96 11:12	8.20	23.437	18.588	18.572	17.833	15.094	17.873	17.036
3/12/96 11:12	8.40	23.513	18.616	18.591	17.865	15.110	17.899	17.055
3/12/96 11:12	8.60	23.589	18.635	18.610	17.881	15.125	17.911	17.073
3/12/96 11:12	8.80	23.658	18.654	18.638	17.897	15.141	17.943	17.107
3/12/96 11:13	9.00	23.721	18.678	18.651	17.929	15.157	17.962	17.111
3/12/96 11:13	9.20	23.797	18.697	18.667	17.944	15.173	17.962	17.135
3/12/96 11:13	9.40	23.860	18.720	18.686	17.976	15.188	17.993	17.154
3/12/96 11:13	9.60	23.936	18.725	18.698	17.976	15.204	18.012	17.168
3/12/96 11:13	9.80	23.999	18.758	18.721	18.008	15.204	18.038	17.187
3/12/96 11:14	10.00	24.043	18.777	18.740	18.024	15.236	18.050	17.211
3/12/96 11:16	12.00	24.125	18.947	18.885	18.198	15.361	18.221	17.362
3/12/96 11:18	14.00	24.504	19.094	19.018	18.357	15.471	18.360	17.494
3/12/96 11:20	16.00	24.763	19.221	19.138	18.484	15.566	18.486	17.612
3/12/96 11:22	18.00	24.971	19.339	19.249	18.595	15.644	18.600	17.721
3/12/96 11:24	20.00	25.526	19.443	19.341	18.706	15.739	18.701	17.811
3/12/96 11:26	22.00	25.513	19.519	19.414	18.754	15.786	18.758	17.877
3/12/96 11:28	24.00	25.501	19.608	19.490	18.785	15.849	18.847	17.957
3/12/96 11:30	26.00	26.031	19.679	19.550	18.801	15.927	18.916	18.014
3/12/96 11:32	28.00	26.024	19.745	19.607	18.801	15.959	18.973	18.071
3/12/96 11:34	30.00	26.018	19.816	19.670	19.039	16.022	19.036	18.132

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3/12/96 11:36	32.00	26.012	19.873	19.724	19.087	16.053	19.093	18.179
3/12/96 11:38	34.00	26.005	19.925	19.775	19.150	16.100	19.137	18.231
3/12/96 11:40	36.00	25.999	19.982	19.832	19.198	16.132	19.194	18.279
3/12/96 11:42	38.00	26.680	20.019	19.863	19.245	16.179	19.232	18.321
3/12/96 11:44	40.00	26.674	20.067	19.901	19.293	16.195	19.276	18.354
3/12/96 11:46	42.00	26.661	20.109	19.942	19.325	16.226	19.314	18.392
3/12/96 11:48	44.00	26.643	20.137	19.971	19.357	16.258	19.346	18.425
3/12/96 11:50	46.00	26.624	20.166	19.987	19.372	16.289	19.371	18.449
3/12/96 11:52	48.00	26.611	20.194	20.012	19.404	16.305	19.396	18.472
3/12/96 11:54	50.00	26.573	20.227	20.050	19.452	16.336	19.434	18.505
3/12/96 11:56	52.00	26.535	20.260	20.082	19.483	16.368	19.466	18.534
3/12/96 11:58	54.00	26.485	20.284	20.101	19.499	16.384	19.491	18.557
3/12/96 12:00	56.00	26.447	20.303	20.126	19.515	16.399	19.504	18.576
3/12/96 12:02	58.00	26.434	20.317	20.129	19.515	16.415	19.516	18.581
3/12/96 12:04	60.00	26.415	20.336	20.145	19.547	16.431	19.535	18.600
3/12/96 12:06	62.00	26.403	20.359	20.167	19.563	16.446	19.554	18.619
3/12/96 12:08	64.00	26.384	20.378	20.186	19.579	16.462	19.567	18.633
3/12/96 12:10	66.00	26.365	20.402	20.215	19.610	16.494	19.599	18.657
3/12/96 12:12	68.00	26.346	20.421	20.230	19.626	16.494	19.618	18.676
3/12/96 12:14	70.00	26.327	20.435	20.240	19.626	16.509	19.624	18.685
3/12/96 12:16	72.00	26.315	20.463	20.265	19.658	16.541	19.655	18.709
3/12/96 12:18	74.00	26.296	20.473	20.278	19.674	16.541	19.668	18.723
3/12/96 12:20	76.00	26.277	20.487	20.291	19.690	16.557	19.674	18.732
3/12/96 12:22	78.00	26.251	20.506	20.303	19.690	16.572	19.693	18.751
3/12/96 12:24	80.00	26.226	20.520	20.322	19.706	16.572	19.712	18.761
3/12/96 12:26	82.00	26.207	20.534	20.335	19.721	16.588	19.725	18.779
3/12/96 12:28	84.00	26.182	20.539	20.341	19.737	16.604	19.731	18.784
3/12/96 12:30	86.00	26.163	20.553	20.351	19.737	16.604	19.738	18.794
3/12/96 12:32	88.00	26.144	20.572	20.370	19.753	16.619	19.757	18.808
3/12/96 12:34	90.00	26.119	20.586	20.386	19.785	16.635	19.776	18.822
3/12/96 12:36	92.00	26.100	20.610	20.405	19.801	16.651	19.788	18.841
3/12/96 12:38	94.00	26.075	20.614	20.414	19.801	16.651	19.807	18.850
3/12/96 12:40	96.00	26.050	20.629	20.423	19.817	16.651	19.813	18.860
3/12/96 12:42	98.00	26.031	20.638	20.436	19.832	16.682	19.826	18.874
3/12/96 12:44	100.00	26.005	20.647	20.442	19.832	16.667	19.826	18.874
3/12/96 12:46	102.00	25.993	20.662	20.455	19.848	16.682	19.813	18.893
3/12/96 12:48	104.00	26.384	20.666	20.455	19.848	16.698	19.807	18.893
3/12/96 12:50	106.00	26.371	20.681	20.477	19.864	16.682	19.826	18.902
3/12/96 12:52	108.00	26.352	20.690	20.487	19.880	16.714	19.839	18.917
3/12/96 12:54	110.00	26.346	20.704	20.496	19.880	16.714	19.851	18.926
3/12/96 12:56	112.00	26.327	20.718	20.509	19.896	16.729	19.864	18.935
3/12/96 12:58	114.00	26.308	20.728	20.522	19.912	16.729	19.877	18.950
3/12/96 13:00	116.00	26.296	20.737	20.528	19.912	16.745	19.877	18.954
3/12/96 13:02	118.00	26.283	20.751	20.544	19.944	16.761	19.896	18.968
3/12/96 13:04	120.00	26.264	20.761	20.553	19.944	16.761	19.908	18.978
3/12/96 13:06	122.00	26.245	20.770	20.556	19.944	16.761	19.908	18.983
3/12/96 13:08	124.00	26.226	20.775	20.566	19.959	16.777	19.921	18.992

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3/12/96 13:10	126.00	26.214	20.789	20.579	19.975	16.777	19.933	19.002
3/12/96 13:12	128.00	26.201	20.803	20.588	19.975	16.777	19.940	19.011
3/12/96 13:14	130.00	26.636	20.803	20.591	19.991	16.792	19.946	19.016
3/12/96 13:16	132.00	26.617	20.817	20.607	19.991	16.777	19.959	19.025
3/12/96 13:18	134.00	26.605	20.832	20.617	20.007	16.792	19.971	19.039
3/12/96 13:20	136.00	26.586	20.832	20.620	20.007	16.777	19.971	19.039
3/12/96 13:22	138.00	26.573	20.846	20.629	20.023	16.792	19.984	19.054
3/12/96 13:24	140.00	26.554	20.865	20.658	20.055	16.808	20.016	19.068
3/12/96 13:26	142.00	26.542	20.869	20.651	20.039	16.808	20.003	19.068
3/12/96 13:28	144.00	26.516	20.874	20.658	20.055	16.824	20.016	19.077
3/12/96 13:30	146.00	26.504	20.879	20.661	20.055	16.824	20.016	19.077
3/12/96 13:32	148.00	26.485	20.888	20.667	20.055	16.824	20.022	19.087
3/12/96 13:34	150.00	26.472	20.893	20.673	20.070	16.824	20.028	19.091
3/12/96 13:36	152.00	26.453	20.902	20.683	20.086	16.840	20.041	19.096
3/12/96 13:38	154.00	26.441	20.912	20.689	20.070	16.840	20.041	19.110
3/12/96 13:40	156.00	26.422	20.907	20.683	20.086	16.840	20.041	19.101
3/12/96 13:42	158.00	26.415	20.917	20.696	20.086	16.855	20.054	19.110
3/12/96 13:44	160.00	26.403	20.926	20.702	20.102	16.855	20.060	19.115
3/12/96 13:46	162.00	26.390	20.931	20.708	20.102	16.871	20.066	19.129
3/12/96 13:48	164.00	26.725	20.936	20.708	20.102	16.871	20.060	19.124
3/12/96 13:50	166.00	26.712	20.950	20.724	20.118	16.871	20.079	19.139
3/12/96 13:52	168.00	26.706	20.959	20.737	20.134	16.871	20.091	19.153
3/12/96 13:54	170.00	26.693	20.964	20.740	20.134	16.887	20.098	19.157
3/12/96 13:56	172.00	26.680	20.978	20.753	20.150	16.871	20.104	19.157
3/12/96 13:58	174.00	26.668	20.978	20.753	20.150	16.887	20.104	19.162
3/12/96 14:00	176.00	26.655	20.987	20.759	20.150	16.902	20.117	19.172
3/12/96 14:02	178.00	26.649	20.987	20.759	20.150	16.902	20.117	19.176
3/12/96 14:04	180.00	26.636	20.992	20.768	20.166	16.902	20.123	19.181
3/12/96 14:06	182.00	26.630	21.002	20.775	20.166	16.918	20.129	19.186
3/12/96 14:08	184.00	26.617	21.006	20.784	20.182	16.902	20.142	19.191
3/12/96 14:10	186.00	26.605	21.016	20.787	20.182	16.918	20.142	19.200
3/12/96 14:12	188.00	26.592	21.020	20.787	20.182	16.918	20.148	19.200
3/12/96 14:14	190.00	26.579	21.025	20.797	20.197	16.934	20.155	19.205
3/12/96 14:16	192.00	26.573	21.030	20.809	20.197	16.934	20.167	19.214
3/12/96 14:18	194.00	26.561	21.035	20.806	20.197	16.934	20.161	19.219
3/12/96 14:20	196.00	26.554	21.044	20.819	20.213	16.934	20.180	19.228
3/12/96 14:22	198.00	26.542	21.054	20.825	20.213	16.934	20.180	19.228
3/12/96 14:24	200.00	26.535	21.058	20.828	20.213	16.950	20.186	19.238
3/12/96 14:26	202.00	26.523	21.058	20.828	20.229	16.950	20.186	19.238
3/12/96 14:28	204.00	26.939	21.063	20.832	20.229	16.965	20.186	19.243
3/12/96 14:30	206.00	26.933	21.068	20.838	20.229	16.950	20.193	19.243
3/12/96 14:32	208.00	26.926	21.072	20.844	20.229	16.965	20.199	19.247
3/12/96 14:34	210.00	26.920	21.077	20.844	20.229	16.965	20.199	19.252
3/12/96 14:36	212.00	26.920	21.082	20.851	20.245	16.981	20.211	19.261
3/12/96 14:38	214.00	26.907	21.091	20.863	20.245	16.981	20.218	19.266
3/12/96 14:40	216.00	26.901	21.101	20.873	20.261	16.981	20.230	19.271
3/12/96 14:42	218.00	26.889	21.101	20.870	20.261	16.981	20.224	19.271

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3/12/96 14:44	220.00	26.889	21.101	20.870	20.261	16.981	20.230	19.271
3/12/96 14:46	222.00	26.882	21.110	20.876	20.261	16.997	20.237	19.280
3/12/96 14:48	224.00	26.870	21.115	20.879	20.277	16.997	20.237	19.290
3/12/96 14:50	226.00	26.863	21.115	20.882	20.261	16.997	20.243	19.285
3/12/96 14:52	228.00	26.857	21.120	20.892	20.293	16.997	20.249	19.299
3/12/96 14:54	230.00	26.851	21.129	20.895	20.277	17.013	20.256	19.299
3/12/96 14:56	232.00	26.844	21.129	20.898	20.277	16.997	20.256	19.299
3/12/96 14:58	234.00	26.838	21.134	20.901	20.293	17.013	20.256	19.304
3/12/96 15:00	236.00	26.832	21.139	20.908	20.293	17.013	20.262	19.313
3/12/96 15:02	238.00	26.825	21.148	20.914	20.308	17.028	20.275	19.313
3/12/96 15:04	240.00	26.819	21.153	20.917	20.308	17.028	20.275	19.318
3/12/96 15:06	242.00	26.807	21.153	20.920	20.308	17.028	20.275	19.323
3/12/96 15:08	244.00	26.800	21.157	20.923	20.308	17.028	20.281	19.323
3/12/96 15:10	246.00	26.794	21.162	20.930	20.324	17.044	20.294	19.332
3/12/96 15:12	248.00	26.788	21.167	20.933	20.308	17.028	20.287	19.332
3/12/96 15:14	250.00	26.781	21.172	20.936	20.324	17.044	20.294	19.337
3/12/96 15:16	252.00	26.775	21.181	20.942	20.324	17.028	20.300	19.342
3/12/96 15:18	254.00	26.769	21.176	20.942	20.324	17.044	20.300	19.342
3/12/96 15:20	256.00	27.261	21.181	20.946	20.340	17.044	20.306	19.346
3/12/96 15:22	258.00	27.254	21.186	20.952	20.340	17.044	20.313	19.351
3/12/96 15:24	260.00	27.248	21.195	20.958	20.340	17.060	20.319	19.356
3/12/96 15:26	262.00	26.687	21.162	20.917	20.277	17.060	20.262	19.342
3/12/96 15:28	264.00	25.274	21.016	20.740	20.055	17.060	20.085	19.195
3/12/96 15:30	266.00	24.643	20.888	20.601	19.896	17.028	19.940	19.063
3/12/96 15:32	268.00	24.365	20.789	20.503	19.769	16.997	19.832	18.964
3/12/96 15;34	270.00	24.220	20.714	20.433	19.706	16.965	19.757	18.893
3/12/96 15:36	272.00	24.150	20.652	20.379	19.642	16.934	19.700	18.831
3/12/96 15:38	274.00	24.113	20.605	20.335	19.595	16.902	19.655	18.789
3/12/96 15:40	276.00	24.094	20.567	20.300	19.563	16.871	19.618	18.756
3/12/96 15:42	278.00	24.075	20.534	20.268	19.531	16.840	19.586	18.723
3/12/96 15:44	280.00	24.049	20.506	20.246	19.499	16.824	19.561	18.699
3/12/96 15:46	282.00	24.043	20.477	20.221	19.483	16.808	19.535	18.680
3/12/96 15:48	284.00	24.024	20.459	20.202	19.468	16.792	19.516	18.657
3/12/96 15:50	286.00	24.018	20.435	20.183	19.436	16.761	19.498	18.642
3/12/96 15:52	288.00	24.005	20.416	20.167	19.420	16.745	19.485	18.624
3/12/96 15:54	290.00	23.999	20.402	20.155	19.404	16.745	19.466	18.609
3/12/96 15:56	292.00	23.993	20.388	20.139	19.404	16.729	19.453	18.595
3/12/96 15:58	294.00	23.986	20.374	20.126	19.372	16.714	19.441	18.586
3/12/96 16:00	296.00	23.986	20.359	20.117	19.372	16.698	19.428	18.572
3/12/96 16:02	298.00	23.993	20.350	20.101	19.357	16.698	19.415	18.562
3/12/96 16:04	300.00	23.980	20.336	20.098	19.357	16.635	19.396	18.553
3/12/96 16:06	302.00	22.951	20.298	20.044	19.277	16.619	19.333	18.534
3/12/96 16:08	304.00	19.193	19.925	19.588	18.674	16.604	18.840	18.194
3/12/96 16:10	306.00	17.632	19.528	19.161	18.198	16.541	18.385	17.787
3/12/96 16:12	308.00	17.272	19.264	18.895	17.881	16.446	18.113	17.513

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Aquifer Test 4
Piezometric Data - March 13, 1996

		Well ID						
Date and Time	Minutes	BW2G	65G	66G	62G	05G	67G	INT4
3/13/96 7:59	0.00	14.833	16.835	16.650	15.548	14.737	15.833	15.230
3/13/96 7:59	0.01	14.827	16.840	16.650	15.532	14.737	15.827	15.230
3/13/96 8:00	0.02	14.833	16.840	16.647	15.548	14.737	15.827	15.225
3/13/96 8:00	0.03	14.852	16.844	16.644	15.532	14.721	15.833	15.220
3/13/96 8:00	0.03	14.865	16.849	16.653	15.532	14.737	15.846	15.225
3/13/96 8:00	0.04	14.858	16.849	16.653	15.548	14.737	15.833	15.234
3/13/96 8:00	0.05	14.884	16.835	16.650	15.548	14.721	15.833	15.225
3/13/96 8:00	0.06	14.909	16.844	16.653	15.548	14.737	15.840	15.225
3/13/96 8:00	0.07	14.941	16.844	16.653	15.548	14.737	15.852	15.230
3/13/96 8:00	0.08	14.985	16.849	16.647	15.548	14.737	15.821	15.230
3/13/96 8:00	0.08	15.004	16.854	16.653	15.548	14.737	15.821	15.230
3/13/96 8:00	0.09	15.036	16.830	16.653	15.548	14.737	15.840	15.239
3/13/96 8:00	0.10	15.055	16.849	16.650	15.564	14.721	15.846	15.230
3/13/96 8:00	0.11	15.086	16.844	16.653	15.564	14.737	15.846	15.225
3/13/96 8:00	0.12	15.111	16.844	16.653	15.564	14.564	15.852	15.225
3/13/96 8:00	0.13	15.143	16.840	16.653	15.564	14.595	15.846	15.230
3/13/96 8:00	0.13	15.168	16.844	16.656	15.548	14.737	15.833	15.225
3/13/96 8:00	0.14	15.181	16.849	16.656	15.580	14.752	15.846	15.239
3/13/96 8:00	0.15	15.225	16.854	16.663	15.580	14.721	15.840	15.234
3/13/96 8:00	0.16	15.238	16.849	16.660	15.580	14.721	15.858	15.230
3/13/96 8:00	0.17	15.251	16.858	16.666	15.580	14.721	15.865	15.244
3/13/96 8:00	0.18	15.289	16.849	16.666	15.580	14.721	15.858	15.230
3/13/96 8:00	0.18	15.327	16.858	16.666	15.580	14.737	15.877	15.234
3/13/96 8:00	0.19	15.339	16.854	16.672	15.595	14.721	15.865	15.239
3/13/96 8:00	0.20	15.352	16.858	16.666	15.595	14.737	15.871	15.234
3/13/96 8:00	0.21	15.390	16.868	16.672	15.595	14.737	15.871	15.234
3/13/96 8:00	0.22	15.415	16.854	16.679	15.611	14.737	15.877	15.234
3/13/96 8:00	0.23	15.440	16.858	16.682	15.595	14.737	15.884	15.239
3/13/96 8:00	0.23	15.447	16.858	16.685	15.611	14.737	15.877	15.239
3/13/96 8:00	0.24	15.478	16.863	16.682	15.611	14.737	15.890	15.234
3/13/96 8:00	0.25	15.497	16.858	16.682	15.627	14.737	15.896	15.234
3/13/96 8:00	0.26	15.523	16.858	16.682	15.611	14.737	15.884	15.234
3/13/96 8:00	0.27	15.523	16.877	16.685	15.627	14.721	15.903	15.230
3/13/96 8:00	0.28	15.548	16.873	16.688	15.627	14.737	15.896	15.244
3/13/96 8:00	0.28	15.579	16.868	16.691	15.627	14.737	15.903	15.239
3/13/96 8:00	0.29	15.598	16.868	16.698	15.659	14.737	15.922	15.239
3/13/96 8:00	0.30	15.617	16.877	16.701	15.643	14.737	15.915	15.239
3/13/96 8:00	0.31	15.636	16.882	16.701	15.643	14.737	15.922	15.239
3/13/96 8:00	0.32	15.649	16.882	16.713	15.643	14.737	15.909	15.244
3/13/96 8:00	0.33	15.668	16.877	16.710	15.675	14.737	15.941	15.248
3/13/96 8:00	0.33	15.674	16.896	16.707	15.675	14.737	15.934	15.239
3/13/96 8:00	0.35	15.731	16.887	16.710	15.691	14.737	15.934	15.244

		Well ID						
Date and Time	Minutes	BW2G	65G	66G	62G	05G	67G	INT4
3/13/96 8:00	0.37	15.750	16.901	16.723	15.706	14.737	15.947	15.244
3/13/96 8:00	0.38	15.807	16.901	16.726	15.691	14.737	15.941	15.258
3/13/96 8:00	0.40	15.826	16.901	16.742	15.722	14.737	15.953	15.263
3/13/96 8:00	0.42	15.864	16.906	16.742	15.706	14.737	15.972	15.263
3/13/96 8:00	0.43	15.902	16.915	16.748	15.738	14.737	15.972	15.258
3/13/96 8:00	0.45	15.915	16.920	16.755	15.738	14.737	15.979	15.253
3/13/96 8:00	0.47	15.946	16.910	16.758	15.754	14.737	15.991	15.267
3/13/96 8:00	0.48	15.991	16.920	16.767	15.754	14.737	15.998	15.263
3/13/96 8:00	0.50	16.028	16.929	16.770	15.786	14.737	16.017	15.263
3/13/96 8:00	0.52	16.047	16.929	16.783	15.786	14.737	16.004	15.282
3/13/96 8:00	0.53	16.085	16.948	16.786	15.786	14.737	16.023	15.277
3/13/96 8:00	0.55	16.104	16.953	16.789	15.818	14.737	16.036	15.277
3/13/96 8:00	0.57	16.117	16.948	16.805	15.818	14.737	16.042	15.282
3/13/96 8:00	0.58	16.142	16.953	16.805	15.818	14.737	16.042	15.296
3/13/96 8:00	0.60	16.180	16.962	16.818	15.849	14.737	16.055	15.286
3/13/96 8:00	0.62	16.206	16.967	16.824	15.865	14.737	16.061	15.291
3/13/96 8:00	0.63	16.237	16.972	16.831	15.849	14.737	16.074	15.296
3/13/96 8:00	0.65	16.262	16.981	16.843	15.849	14.737	16.074	15.300
3/13/96 8:00	0.67	16.281	16.977	16.843	15.897	14.737	16.080	15.305
3/13/96 8:00	0.68	16.307	16.981	16.850	15.897	14.737	16.099	15.305
3/13/96 8:00	0.70	16.326	16.991	16.856	15.897	14.737	16.099	15.315
3/13/96 8:00	0.72	16.357	17.005	16.862	15.897	14.737	16.105	15.315
3/13/96 8:00	0.73	16.383	17.005	16.869	15.913	14.737	16.124	15.334
3/13/96 8:00	0.75	16.408	17.010	16.881	15.913	14.737	16.137	15.324
3/13/96 8:00	0.77	16.414	17.014	16.881	15.944	14.737	16.130	15.338
3/13/96 8:00	0.78	16.433	17.019	16.894	15.944	14.737	16.149	15.334
3/13/96 8:00	0.80	16.458	17.014	16.904	15.960	14.737	16.137	15.348
3/13/96 8:00	0.82	16.503	17.024	16.900	15.976	14.737	16.168	15.343
3/13/96 8:00	0.83	16.522	17.033	16.910	15.976	14.737	16.162	15.352
3/13/96 8:00	0.85	16.528	17.043	16.923	15.976	14.737	16.175	15.352
3/13/96 8:00	0.87	16.566	17.052	16.926	15.992	14.737	16.181	15.362
3/13/96 8:00	0.88	16.572	17.052	16.932	15.992	14.737	16.175	15.376
3/13/96 8:00	0.90	16.610	17.052	16.938	16.024	14.737	16.181	15.371
3/13/96 8:00	0.92	16.604	17.057	16.948	16.024	14.721	16.194	15.371
3/13/96 8:00	0.93	16.642	17.071	16.954	16.024	14.721	16.213	15.386
3/13/96 8:00	0.95	16.667	17.066	16.954	16.024	14.721	16.200	15.390
3/13/96 8:00	0.97	16.686	17.076	16.964	16.040	14.721	16.238	15.390
3/13/96 8:00	0.98	16.686	17.081	16.976	16.056	14.721	16.225	15.390
3/13/96 8:00	1.00	16.718	17.081	16.980	16.040	14.752	16.225	15.400
3/13/96 8:01	1.20	16.914	17.156	17.056	16.167	14.737	16.320	15.471
3/13/96 8:01	1.40	17.084	17.204	17.125	16.246	14.281	16.383	15.532
3/13/96 8:01	1.60	17.211	17.265	17.198	16.325	14.752	16.440	15.598
3/13/96 8:01	1.80	17.344	17.303	17.252	16.389	14.737	16.529	15.655
3/13/96 8:01	2.00	17.464	17.355	17.315	16.468	14.752	16.567	15.716
3/13/96 8:02	2.20	17.565	17.407	17.363	16.532	14.752	16.630	15.754
3/13/96 8:02	2.40	17.641	17.445	17.411	16.563	14.768	16.681	15.802
3/13/96 8:02	2.60	17.723	17.497	17.455	16.627	14.768	16.719	15.863

		Well ID						
Date and Time	Minutes	BW2G	65G	66G	62G	05G	67G	INT4
3/13/96 8:02	2.80	17.792	17.530	17.499	16.690	14.768	16.763	15.901
3/13/96 8:02	3.00	17.849	17.558	17.531	16.722	14.784	16.782	15.943
3/13/96 8:03	3.20	17.925	17.596	17.569	16.754	14.784	16.826	15.981
3/13/96 8:03	3.40	17.976	17.629	17.604	16.785	14.800	16.883	16.024
3/13/96 8:03	3.60	18.014	17.653	17.632	16.833	14.800	16.896	16.043
3/13/96 8:03	3.80	18.058	17.690	17.664	16.849	14.815	16.927	16.076
3/13/96 8:03	4.00	18.102	17.714	17.689	16.881	14.831	16.965	16.114
3/13/96 8:04	4.20	18.140	17.742	17.712	16.928	14.831	16.990	16.137
3/13/96 8:04	4.40	18.184	17.771	17.737	16.944	14.847	17.009	16.156
3/13/96 8:04	4.60	18.209	17.794	17.759	16.944	14.847	17.028	16.184
3/13/96 8:04	4.80	18.247	17.813	17.781	16.992	14.862	17.066	16.208
3/13/96 8:04	5.00	18.279	17.832	17.810	17.008	14.862	17.060	16.232
3/13/96 8:05	5.20	18.311	17.851	17.829	17.039	14.878	17.117	16.260
3/13/96 8:05	5.40	18.342	17.879	17.851	17.055	14.894	17.111	16.293
3/13/96 8:05	5.60	18.361	17.908	17.870	17.071	14.910	17.142	16.303
3/13/96 8:05	5.80	18.386	17.922	17.883	17.103	14.910	17.161	16.322
3/13/96 8:05	6.00	18.431	17.931	17.895	17.119	14.925	17.174	16.340
3/13/96 8:06	6.20	18.450	17.955	17.914	17.119	14.941	17.212	16.345
3/13/96 8:06	6.40	18.462	17.974	17.933	17.150	14.941	17.199	16.369
3/13/96 8:06	6.60	18.488	17.988	17.952	17.166	14.957	17.237	16.383
3/13/96 8:06	6.80	18.519	18.002	17.971	17.182	14.973	17.262	16.407
3/13/96 8:06	7.00	18.544	18.021	17.978	17.198	14.973	17.275	16.430
3/13/96 8:07	7.20	18.551	18.031	18.000	17.230	14.988	17.281	16.444
3/13/96 8:07	7.40	18.582	18.045	18.003	17.230	15.004	17.307	16.454
3/13/96 8:07	7.60	18.595	18.064	18.022	17.246	15.004	17.300	16.468
3/13/96 8:07	7.80	18.627	18.092	18.031	17.261	15.020	17.325	16.482
3/13/96 8:07	8.00	18.633	18.092	18.057	17.277	15.020	17.351	16.487
3/13/96 8:08	8.20	18.658	18.116	18.063	17.293	15.035	17.363	16.501
3/13/96 8:08	8.40	18.677	18.135	18.073	17.309	15.051	17.363	16.520
3/13/96 8:08	8.60	18.702	18.144	18.088	17.309	15.051	17.376	16.525
3/13/96 8:08	8.80	18.709	18.149	18.098	17.325	15.067	17.395	16.534
3/13/96 8:08	9.00	18.715	18.168	18.114	17.341	15.083	17.408	16.558
3/13/96 8:09	9.20	18.734	18.182	18.123	17.373	15.083	17.408	16.567
3/13/96 8:09	9.40	18.759	18.187	18.136	17.357	15.098	17.420	16.582
3/13/96 8:09	9.60	18.778	18.201	18.152	17.373	15.098	17.433	16.591
3/13/96 8:09	9.80	18.791	18.210	18.161	17.404	15.114	17.433	16.596
3/13/96 8:09	10.00	18.804	18.229	18.174	17.404	15.130	17.465	16.615
3/13/96 8:11	12.00	18.936	18.333	18.263	17.531	15.224	17.572	16.714
3/13/96 8:13	14.00	19.050	18.432	18.345	17.611	15.303	17.661	16.799
3/13/96 8:15	16.00	19.138	18.513	18.427	17.690	15.366	17.736	16.875
3/13/96 8:17	18.00	19.227	18.574	18.481	17.753	15.413	17.806	16.936
3/13/96 8:19	20.00	19.303	18.636	18.545	17.801	15.476	17.863	16.993
3/13/96 8:21	22.00	19.347	18.702	18.589	17.864	15.523	17.913	17.040
3/13/96 8:23	24.00	19.410	18.754	18.636	17.896	15.554	17.964	17.087
3/13/96 8:25	26.00	19.461	18.801	18.681	17.928	15.602	18.008	17.130
3/13/96 8:27	28.00	19.511	18.839	18.716	17.944	15.633	18.046	17.168
3/13/96 8:29	30.00	19.555	18.886	18.754	17.944	15.665	18.090	17.205

Date and Time	Minutes	BW2G	65G	66G	Well ID 62G	05G	67G	INT4
3/13/96 8:31	32.00	19.606	18.924	18.785	17.944	15.696	18.128	17.239
3/13/96 8:33	34.00	19.644	18.962	18.820	17.944	15.680	18.154	17.267
3/13/96 8:35	36.00	19.675	18.985	18.849	17.928	15.712	18.185	17.295
3/13/96 8:37	38.00	19.713	19.023	18.877	17.928	15.727	18.210	17.319
3/13/96 8:39	40.00	19.751	19.047	18.902	18.182	15.759	18.236	17.347
3/13/96 8:41	42.00	19.777	19.075	18.925	18.198	15.775	18.261	17.371
3/13/96 8:43	44.00	19.808	19.103	18.950	18.229	15.790	18.286	17.390
3/13/96 8:45	46.00	19.833	19.127	18.972	18.245	15.806	18.312	17.409
3/13/96 8:47	48.00	19.859	19.146	18.994	18.261	15.822	18.331	17.432
3/13/96 8:49	50.00	19.890	19.170	19.013	18.293	15.837	18.350	17.451
3/13/96 8:51	52.00	19.928	19.188	19.032	18.309	15.869	18.368	17.470
3/13/96 8:53	54.00	19.960	19.207	19.048	18.325	15.885	18.387	17.489
3/13/96 8:55	56.00	19.985	19.226	19.067	18.340	15.885	18.406	17.503
3/13/96 8:57	58.00	20.010	19.245	19.080	18.356	15.900	18.425	17.522
3/13/96 8:59	60.00	20.036	19.264	19.099	18.388	15.916	18.438	17.532
3/13/96 9:01	62.00	20.061	19.278	19.111	18.404	15.948	18.457	17.550
3/13/96 9:03	64.00	20.073	19.292	19.127	18.420	15.948	18.470	17.560
3/13/96 9:05	66.00	20.105	19.307	19.140	18.420	15.963	18.482	17.574
3/13/96 9:07	68.00	20.118	19.325	19.156	18.436	15.963	18.501	17.588
3/13/96 9:09	70.00	20.143	19.335	19.165	18.451	15.979	18.508	17.602
3/13/96 9:11	72.00	20.162	19.349	19.181	18.467	15.979	18.527	17.612
3/13/96 9:13	74.00	20.175	19.358	19.187	18.467	15.995	18.533	17.621
3/13/96 9:15	76.00	20.187	19.377	19.200	18.483	16.010	18.545	17.636
3/13/96 9:17	78.00	20.206	19.387	19.216	18.499	16.010	18.558	17.645
3/13/96 9:19	80.00	20.219	19.396	19.222	18.499	16.026	18.564	17.654
3/13/96 9:21	82.00	20.231	19.410	19.235	18.515	16.026	18.577	17.664
3/13/96 9:23	84.00	20.244	19.420	19.244	18.531	16.042	18.590	17.678
3/13/96 9:25	86.00	20.257	19.429	19.254	18.547	16.058	18.602	17.687
3/13/96 9:27	88.00	20.269	19.444	19.260	18.547	16.058	18.609	17.697
3/13/96 9:29	90.00	20.282	19.453	19.276	18.563	16.073	18.621	17.702
3/13/96 9:31	92.00	20.295	19.458	19.282	18.563	16.073	18.628	17.711
3/13/96 9:33	94.00	20.307	19.472	19.295	18.578	16.089	18.640	17.721
3/13/96 9:35	96.00	20.320	19.477	19.304	18.594	16.089	18.647	17.730
3/13/96 9:37	98.00	20.332	19.486	19.311	18.594	16.105	18.653	17.735
3/13/96 9:39	100.00	20.345	19.495	19.317	18.594	16.105	18.666	17.744
3/13/96 9:41	102.00	20.358	19.505	19.330	18.610	16.121	18.672	17.754
3/13/96 9:43	104.00	20.370	19.514	19.333	18.610	16.121	18.678	17.758
3/13/96 9:45	106.00	20.383	19.524	19.342	18.626	16.136	18.691	17.768
3/13/96 9:47	108.00	20.396	19.529	19.352	18.626	16.136	18.697	17.773
3/13/96 9:49	110.00	20.402	19.538	19.355	18.642	16.136	18.703	17.782
3/13/96 9:51	112.00	20.415	19.547	19.361	18.642	16.152	18.710	17.791
3/13/96 9:53	114.00	20.421	19.557	19.374	18.658	16.152	18.716	17.796
3/13/96 9:55	116.00	20.434	19.562	19.374	18.658	16.152	18.722	17.801
3/13/96 9:57	118.00	20.452	19.571	19.387	18.674	16.199	18.735	17.810
3/13/96 9:59	120.00	20.459	19.576	19.393	18.674	16.199	18.741	17.815
3/13/96 10:01	122.00	20.465	19.585	19.403	18.689	16.199	18.748	17.825
3/13/96 10:03	124.00	20.471	19.590	19.409	18.689	16.215	18.754	17.829

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3/13/96 10:05	126.00	20.478	19.599	19.415	18.705	16.199	18.760	17.834
3/13/96 10:07	128.00	20.484	19.609	19.418	18.705	16.231	18.767	17.843
3/13/96 10:09	130.00	20.497	19.614	19.422	18.705	16.231	18.773	17.848
3/13/96 10:11	132.00	20.503	19.618	19.434	18.721	16.231	18.779	17.853
3/13/96 10:13	134.00	20.509	19.623	19.434	18.721	16.246	18.786	17.858
3/13/96 10:15	136.00	20.516	19.628	19.444	18.721	16.246	18.786	17.862
3/13/96 10:17	138.00	20.522	19.637	19.450	18.737	16.246	18.798	17.872
3/13/96 10:19	140.00	20.528	19.642	19.450	18.737	16.246	18.798	17.877
3/13/96 10:21	142.00	20.528	19.647	19.453	18.753	16.262	18.805	17.881
3/13/96 10:23	144.00	20.535	19.656	19.463	18.753	16.262	18.811	17.886
3/13/96 10:25	146.00	20.541	19.661	19.472	18.753	16.278	18.817	17.891
3/13/96 10:27	148.00	20.547	19.666	19.469	18.753	16.278	18.824	17.895
3/13/96 10:29	150.00	20.554	19.670	19.482	18.769	16.278	18.830	17.900
3/13/96 10:31	152.00	20.560	19.675	19.491	18.769	16.294	18.830	17.905
3/13/96 10:33	154.00	20.566	19.684	19.485	18.785	16.294	18.843	17.910
3/13/96 10:35	156.00	20.566	19.684	19.498	18.785	16.294	18.843	17.914
3/13/96 10:37	158.00	20.573	19.689	19.501	18.785	16.294	18.849	17.919
3/13/96 10:39	160.00	20.579	19.694	19.507	18.785	16.294	18.855	17.919
3/13/96 10:41	162.00	20.579	19.699	19.507	18.801	16.309	18.855	17.929
3/13/96 10:43	164.00	20.585	19.703	19.507	18.801	16.309	18.861	17.929
3/13/96 10:45	166.00	20.591	19.703	19.517	18.801	16.309	18.861	17.933
3/13/96 10:47	168.00	20.598	19.708	19.520	18.801	16.309	18.868	17.938
3/13/96 10:49	170.00	20.598	19.708	19.523	18.801	16.325	18.868	17.938
3/13/96 10:51	172.00	20.604	19.717	19.523	18.816	16.309	18.874	17.938
3/13/96 10:53	174.00	20.610	19.717	19.520	18.816	16.325	18.880	17.947
3/13/96 10:55	176.00	20.610	19.722	19.529	18.816	16.325	18.880	17.952
3/13/96 10:57	178.00	20.610	19.727	19.532	18.816	16.325	18.880	17.952
3/13/96 10:59	180.00	20.623	19.732	19.536	18.816	16.325	18.887	17.952
3/13/96 11:01	182.00	20.610	19.732	19.539	18.832	16.341	18.887	17.957
3/13/96 11:03	184.00	20.610	19.732	19.539	18.832	16.341	18.887	17.957
3/13/96 11:05	186.00	20.617	19.736	19.539	18.832	16.341	18.893	17.957
3/13/96 11:07	188.00	20.623	19.736	19.536	18.832	16.341	18.893	17.962
3/13/96 11:09	190.00	20.623	19.736	19.542	18.832	16.341	18.893	17.962
3/13/96 11:11	192.00	20.629	19.736	19.545	18.832	16.341	18.899	17.962
3/13/96 11:13	194.00	20.636	19.741	19.542	18.832	16.341	18.899	17.966
3/13/96 11:15	196.00	20.636	19.746	19.545	18.832	16.341	18.899	17.966
3/13/96 11:17	198.00	20.642	19.746	19.548	18.832	16.341	18.906	17.990
3/13/96 11:19	200.00	20.648	19.751	19.551	18.848	16.356	18.906	17.990
3/13/96 11:21	202.00	20.648	19.751	19.548	18.848	16.356	18.906	17.990
3/13/96 11:23	204.00	20.655	19.751	19.555	18.848	16.356	18.906	17.990
3/13/96 11:25	206.00	20.655	19.755	19.558	18.848	16.356	18.912	17.995
3/13/96 11:27	208.00	20.661	19.760	19.558	18.848	16.356	18.912	17.999
3/13/96 11:29	210.00	20.661	19.760	19.561	18.848	16.372	18.918	17.995
3/13/96 11:31	212.00	20.667	19.760	19.564	18.848	16.372	18.918	17.999
3/13/96 11:33	214.00	20.667	19.765	19.574	18.864	16.388	18.918	17.999
3/13/96 11:35	216.00	20.667	19.769	19.570	18.864	16.372	18.925	18.004
3/13/96 11:37	218.00	20.667	19.774	19.574	18.864	16.372	18.931	18.004

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3/13/96 11:39	220.00	20.674	19.774	19.574	18.864	16.388	18.931	18.009
3/13/96 11:41	222.00	20.674	19.779	19.580	18.880	16.388	18.937	18.014
3/13/96 11:43	224.00	20.674	19.779	19.580	18.880	16.388	18.937	18.014
3/13/96 11:45	226.00	20.674	19.784	19.583	18.880	16.388	18.937	18.014
3/13/96 11:47	228.00	20.680	19.784	19.586	18.880	16.388	18.937	18.018
3/13/96 11:49	230.00	20.686	19.793	19.586	18.880	16.388	18.944	18.023
3/13/96 11:51	232.00	20.686	19.788	19.589	18.880	16.388	18.944	18.018
3/13/96 11:53	234.00	20.693	19.793	19.599	18.880	16.404	18.950	18.028
3/13/96 11:55	236.00	20.693	19.793	19.593	18.880	16.388	18.944	18.023
3/13/96 11:57	238.00	20.699	19.798	19.596	18.896	16.404	18.956	18.028
3/13/96 11:59	240.00	20.711	19.798	19.602	18.896	16.388	18.950	18.028
3/13/96 12:01	242.00	20.705	19.803	19.612	18.896	16.388	18.956	18.028
3/13/96 12:03	244.00	20.711	19.807	19.605	18.896	16.404	18.956	18.032
3/13/96 12:05	246.00	20.724	19.812	19.612	18.912	16.404	18.963	18.032
3/13/96 12:07	248.00	20.730	19.812	19.612	18.912	16.404	18.969	18.037
3/13/96 12:09	250.00	20.730	19.812	19.612	18.896	16.404	18.969	18.032
3/13/96 12:11	252.00	20.737	19.821	19.621	18.912	16.419	18.975	18.047
3/13/96 12:13	254.00	20.743	19.826	19.615	18.912	16.419	18.982	18.051
3/13/96 12:15	256.00	20.743	19.826	19.615	18.912	16.419	18.982	18.051
3/13/96 12:17	258.00	20.756	19.826	19.627	18.912	16.419	18.982	18.047
3/13/96 12:19	260.00	20.749	19.826	19.631	18.927	16.435	18.982	18.056
3/13/96 12:21	262.00	20.756	19.831	19.621	18.912	16.419	18.982	18.056
3/13/96 12:23	264.00	20.756	19.831	19.624	18.927	16.419	18.982	18.051
3/13/96 12:25	266.00	20.762	19.836	19.634	18.927	16.419	18.988	18.047
3/13/96 12:27	268.00	20.762	19.836	19.640	18.927	16.419	18.988	18.051
3/13/96 12:29	270.00	20.762	19.840	19.640	18.927	16.435	18.994	18.056
3/13/96 12:31	272.00	20.762	19.840	19.631	18.927	16.419	18.988	18.056
3/13/96 12:33	274.00	20.762	19.840	19.640	18.927	16.435	18.994	18.056
3/13/96 12:35	276.00	20.775	19.840	19.640	18.927	16.435	18.988	18.056
3/13/96 12:37	278.00	20.787	19.845	19.634	18.927	16.435	18.994	18.051
3/13/96 12:39	280.00	20.794	19.845	19.634	18.927	16.435	18.994	18.056
3/13/96 12:41	282.00	20.800	19.840	19.637	18.943	16.435	18.994	18.056
3/13/96 12:43	284.00	20.800	19.850	19.643	18.943	16.435	19.001	18.061
3/13/96 12:45	286.00	20.800	19.850	19.640	18.943	16.435	18.994	18.056
3/13/96 12:47	288.00	20.800	19.854	19.650	18.943	16.435	19.001	18.061
3/13/96 12:49	290.00	20.800	19.854	19.646	18.943	16.435	19.001	18.056
3/13/96 12:51	292.00	20.806	19.854	19.646	18.943	16.435	19.007	18.061
3/13/96 12:53	294.00	20.800	19.854	19.653	18.943	16.435	19.007	18.061
3/13/96 12:55	296.00	20.806	19.859	19.656	18.943	16.435	19.007	18.066
3/13/96 12:57	298.00	20.813	19.859	19.650	18.943	16.451	19.007	18.066
3/13/96 12:59	300.00	20.825	19.869	19.656	18.943	16.451	19.013	18.070
3/13/96 13:01	302.00	20.819	19.864	19.653	18.959	16.451	19.013	18.070
3/13/96 13:03	304.00	20.819	19.869	19.659	18.959	16.451	19.019	18.070
3/13/96 13:05	306.00	20.825	19.869	19.662	18.959	16.451	19.013	18.070
3/13/96 13:07	308.00	20.831	19.869	19.665	18.959	16.451	19.019	18.075
3/13/96 13:09	310.00	20.825	19.873	19.662	18.959	16.451	19.019	18.075
3/13/96 13:11	312.00	20.831	19.873	19.665	18.959	16.467	19.026	18.080

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3/13/96 13:13	314.00	20.825	19.873	19.665	18.959	16.451	19.019	18.075
3/13/96 13:15	316.00	20.825	19.878	19.665	18.959	16.451	19.026	18.080
3/13/96 13:17	318.00	20.831	19.873	19.669	18.959	16.467	19.026	18.080
3/13/96 13:19	320.00	20.831	19.878	19.669	18.975	16.467	19.026	18.080
3/13/96 13:21	322.00	20.831	19.878	19.669	18.959	16.451	19.019	18.075
3/13/96 13:23	324.00	20.844	19.878	19.669	18.959	16.467	19.026	18.080
3/13/96 13:25	326.00	20.844	19.883	19.672	18.975	16.451	19.026	18.080
3/13/96 13:27	328.00	20.850	19.883	19.672	18.975	16.467	19.032	18.084
3/13/96 13:29	330.00	20.844	19.883	19.672	18.975	16.467	19.026	18.084
3/13/96 13:31	332.00	20.844	19.883	19.672	18.975	16.451	19.032	18.084
3/13/96 13:33	334.00	20.844	19.888	19.678	18.975	16.467	19.032	18.084
3/13/96 13:35	336.00	20.844	19.883	19.672	18.975	16.451	19.019	18.084
3/13/96 13:37	338.00	20.850	19.888	19.675	18.975	16.467	19.032	18.084
3/13/96 13:39	340.00	20.850	19.888	19.675	18.975	16.467	19.038	18.089
3/13/96 13:41	342.00	20.857	19.892	19.678	18.975	16.482	19.038	18.094
3/13/96 13:43	344.00	20.863	19.897	19.678	18.975	16.467	19.038	18.094
3/13/96 13:45	346.00	20.857	19.906	19.681	18.975	16.467	19.038	18.094
3/13/96 13:47	348.00	20.863	19.902	19.681	18.975	16.467	19.038	18.094
3/13/96 13:49	350.00	20.863	19.902	19.684	18.991	16.467	19.045	18.094
3/13/96 13:51	352.00	20.863	19.902	19.684	18.975	16.467	19.045	18.094
3/13/96 13:53	354.00	20.869	19.897	19.687	18.991	16.467	19.038	18.094
3/13/96 13:55	356.00	20.869	19.902	19.687	18.991	16.467	19.045	18.099
3/13/96 13:57	358.00	20.876	19.906	19.691	18.991	16.467	19.045	18.099
3/13/96 13:59	360.00	20.882	19.906	19.694	18.991	16.467	19.051	18.099
3/13/96 14:01	362.00	20.876	19.906	19.694	18.991	16.482	19.057	18.103
3/13/96 14:03	364.00	20.876	19.906	19.694	18.991	16.467	19.051	18.099
3/13/96 14:05	366.00	20.882	19.911	19.694	18.991	16.482	19.057	18.108
3/13/96 14:07	368.00	20.882	19.911	19.697	19.007	16.482	19.057	18.108
3/13/96 14:09	370.00	20.895	19.916	19.700	18.991	16.498	19.057	18.113
3/13/96 14:11	372.00	20.882	19.911	19.700	18.991	16.482	19.057	18.103
3/13/96 14:13	374.00	20.888	19.916	19.700	19.007	16.482	19.057	18.108
3/13/96 14:15	376.00	20.895	19.921	19.706	19.007	16.498	19.064	18.113
3/13/96 14:17	378.00	20.895	19.921	19.703	19.007	16.498	19.064	18.118
3/13/96 14:19	380.00	20.895	19.921	19.706	19.007	16.498	19.064	18.118
3/13/96 14:21	382.00	20.901	19.921	19.710	19.007	16.482	19.070	18.113
3/13/96 14:23	384.00	20.901	19.921	19.706	19.007	16.498	19.070	18.118
3/13/96 14:25	386.00	20.901	19.925	19.710	19.007	16.498	19.070	18.122
3/13/96 14:27	388.00	20.901	19.925	19.710	19.007	16.498	19.070	18.122
3/13/96 14:29	390.00	20.907	19.925	19.710	19.007	16.482	19.070	18.118
3/13/96 14:31	392.00	20.901	19.930	19.710	19.007	16.498	19.070	18.118
3/13/96 14:33	394.00	20.901	19.925	19.713	19.007	16.498	19.070	18.118
3/13/96 14:35	396.00	20.907	19.930	19.716	19.007	16.498	19.076	18.118
3/13/96 14:37	398.00	20.914	19.930	19.716	19.023	16.482	19.076	18.122
3/13/96 14:39	400.00	20.914	19.930	19.713	19.023	16.498	19.076	18.122
3/13/96 14:41	402.00	20.914	19.935	19.716	19.023	16.482	19.076	18.122
3/13/96 14:43	404.00	20.926	19.935	19.716	19.007	16.498	19.076	18.127
3/13/96 14:45	406.00	20.939	19.935	19.716	19.023	16.498	19.076	18.127

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3/13/96 14:47	408.00	20.945	19.935	19.719	19.023	16.498	19.076	18.127
3/13/96 14:49	410.00	20.945	19.939	19.719	19.023	16.514	19.083	18.132
3/13/96 14:51	412.00	20.951	19.939	19.722	19.023	16.498	19.083	18.132
3/13/96 14:53	414.00	20.951	19.939	19.722	19.023	16.498	19.083	18.132
3/13/96 14:55	416.00	20.951	19.944	19.729	19.023	16.498	19.083	18.132
3/13/96 14:57	418.00	20.951	19.944	19.729	19.023	16.498	19.083	18.132
3/13/96 14:59	420.00	20.964	19.944	19.729	19.039	16.498	19.089	18.132
3/13/96 15:01	422.00	20.964	19.944	19.729	19.023	16.498	19.089	18.136
3/13/96 15:03	424.00	20.958	19.944	19.732	19.023	16.498	19.089	18.136
3/13/96 15:05	426.00	20.958	19.949	19.729	19.039	16.498	19.089	18.136
3/13/96 15:07	428.00	20.964	19.949	19.732	19.039	16.514	19.089	18.136
3/13/96 15:09	430.00	20.964	19.949	19.735	19.039	16.514	19.095	18.141
3/13/96 15:11	432.00	20.951	19.954	19.738	19.039	16.514	19.102	18.146
3/13/96 15:13	434.00	20.945	19.958	19.738	19.039	16.514	19.102	18.146
3/13/96 15:15	436.00	20.958	19.958	19.741	19.054	16.514	19.102	18.151
3/13/96 15:17	438.00	20.977	19.954	19.735	19.039	16.514	19.095	18.146
3/13/96 15:19	440.00	21.021	19.958	19.738	19.039	16.514	19.095	18.141
3/13/96 15:21	442.00	21.034	19.958	19.738	19.039	16.514	19.102	18.146
3/13/96 15:23	444.00	21.034	19.958	19.741	19.039	16.514	19.102	18.146
3/13/96 15:25	446.00	21.046	19.958	19.741	19.039	16.514	19.102	18.151
3/13/96 15:27	448.00	21.046	19.963	19.744	19.054	16.529	19.108	18.151
3/13/96 15:29	450.00	21.053	19.958	19.744	19.039	16.514	19.102	18.151
3/13/96 15:31	452.00	21.046	19.958	19.741	19.039	16.514	19.102	18.146
3/13/96 15:33	454.00	21.053	19.958	19.744	19.039	16.514	19.102	18.151
3/13/96 15:35	456.00	21.046	19.963	19.744	19.054	16.514	19.108	18.151
3/13/96 15:37	458.00	21.046	19.968	19.744	19.054	16.529	19.108	18.151
3/13/96 15:39	460.00	21.046	19.968	19.748	19.054	16.514	19.108	18.155
3/13/96 15:41	462.00	21.053	19.968	19.751	19.054	16.514	19.108	18.155
3/13/96 15:43	464.00	21.053	19.973	19.754	19.054	16.529	19.114	18.160
3/13/96 15:45	466.00	21.053	19.973	19.751	19.054	16.529	19.114	18.155
3/13/96 15:47	468.00	21.053	19.968	19.754	19.054	16.529	19.114	18.160
3/13/96 15:49	470.00	21.059	19.973	19.754	19.054	16.529	19.114	18.160
3/13/96 15:51	472.00	21.065	19.968	19.754	19.054	16.529	19.114	18.160
3/13/96 15:53	474.00	21.071	19.973	19.754	19.054	16.529	19.114	18.160
3/13/96 15:55	476.00	21.071	19.973	19.757	19.054	16.529	19.114	18.160
3/13/96 15:57	478.00	21.078	19.977	19.757	19.054	16.529	19.114	18.160
3/13/96 15:59	480.00	21.078	19.977	19.760	19.054	16.529	19.121	18.165
3/13/96 16:01	482.00	21.078	19.977	19.760	19.054	16.529	19.121	18.165
3/13/96 16:03	484.00	21.071	19.977	19.757	19.054	16.529	19.114	18.165
3/13/96 16:05	486.00	21.078	19.977	19.757	19.054	16.529	19.121	18.165
3/13/96 16:07	488.00	21.078	19.977	19.760	19.054	16.529	19.121	18.165
3/13/96 16:09	490.00	21.078	19.982	19.760	19.070	16.529	19.121	18.165
3/13/96 16:11	492.00	21.078	19.982	19.760	19.054	16.529	19.127	18.170
3/13/96 16:13	494.00	21.078	19.982	19.763	19.070	16.529	19.127	18.170
3/13/96 16:15	496.00	21.078	19.982	19.763	19.054	16.529	19.127	18.170
3/13/96 16:17	498.00	21.084	19.987	19.763	19.054	16.545	19.127	18.174
3/13/96 16:19	500.00	21.084	19.987	19.763	19.070	16.545	19.127	18.174

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3/13/96 16:21	502.00	21.084	19.987	19.763	19.070	16.545	19.127	18.174
3/13/96 16:23	504.00	21.084	19.987	19.763	19.070	16.529	19.127	18.170
3/13/96 16:25	506.00	21.078	19.982	19.763	19.070	16.529	19.127	18.170
3/13/96 16:27	508.00	21.084	19.982	19.763	19.054	16.545	19.121	18.170
3/13/96 16:29	510.00	21.078	19.987	19.767	19.070	16.529	19.127	18.170
3/13/96 16:31	512.00	21.078	19.987	19.767	19.070	16.529	19.127	18.170
3/13/96 16:33	514.00	21.078	19.987	19.767	19.070	16.529	19.127	18.170
3/13/96 16:35	516.00	21.078	19.987	19.770	19.070	16.529	19.127	18.174
3/13/96 16:37	518.00	21.084	19.987	19.770	19.070	16.545	19.133	18.174
3/13/96 16:39	520.00	21.084	19.991	19.770	19.070	16.545	19.133	18.174
3/13/96 16:41	522.00	21.078	19.991	19.776	19.086	16.545	19.140	18.179
3/13/96 16:43	524.00	21.078	19.996	19.779	19.070	16.529	19.140	18.179
3/13/96 16:45	526.00	21.084	19.996	19.776	19.070	16.545	19.140	18.179
3/13/96 16:47	528.00	21.090	20.001	19.779	19.070	16.545	19.140	18.184
3/13/96 16:49	530.00	21.090	20.001	19.779	19.070	16.545	19.146	18.188
3/13/96 16:51	532.00	21.090	20.006	19.779	19.086	16.545	19.146	18.184
3/13/96 16:53	534.00	21.097	20.001	19.782	19.086	16.545	19.140	18.184
3/13/96 16:55	536.00	21.097	20.001	19.782	19.086	16.545	19.146	18.184
3/13/96 16:57	538.00	21.097	20.006	19.782	19.086	16.545	19.146	18.188
3/13/96 16:59	540.00	21.109	20.006	19.786	19.086	16.545	19.146	18.188
3/13/96 17:01	542.00	21.097	20.006	19.786	19.086	16.545	19.152	18.188
3/13/96 17:03	544.00	21.097	20.006	19.786	19.086	16.545	19.152	18.188
3/13/96 17:05	546.00	21.097	20.006	19.786	19.086	16.545	19.152	18.188
3/13/96 17:07	548.00	21.109	20.015	19.792	19.086	16.561	19.152	18.198
3/13/96 17:09	550.00	21.109	20.020	19.795	19.102	16.561	19.158	18.203
3/13/96 17:11	552.00	21.103	20.015	19.795	19.102	16.561	19.158	18.198
3/13/96 17:13	554.00	21.103	20.015	19.795	19.102	16.561	19.158	18.198
3/13/96 17:15	556.00	21.109	20.015	19.795	19.102	16.561	19.165	18.198
3/13/96 17:17	558.00	21.103	20.015	19.795	19.102	16.561	19.158	18.203
3/13/96 17:19	560.00	21.103	20.015	19.795	19.102	16.561	19.158	18.198
3/13/96 17:21	562.00	21.109	20.020	19.798	19.102	16.561	19.158	18.203
3/13/96 17:23	564.00	21.103	20.020	19.798	19.102	16.577	19.165	18.203
3/13/96 17:25	566.00	21.109	20.024	19.801	19.102	16.577	19.165	18.203
3/13/96 17:27	568.00	21.109	20.024	19.805	19.102	16.561	19.165	18.203
3/13/96 17:29	570.00	21.116	20.024	19.801	19.102	16.561	19.165	18.207
3/13/96 17:31	572.00	21.122	20.029	19.805	19.102	16.577	19.171	18.207
3/13/96 17:33	574.00	21.116	20.029	19.808	19.118	16.577	19.171	18.212
3/13/96 17:35	576.00	21.116	20.029	19.808	19.102	16.561	19.171	18.212
3/13/96 17:37	578.00	21.122	20.029	19.811	19.118	16.577	19.177	18.212
3/13/96 17:39	580.00	21.122	20.039	19.814	19.118	16.577	19.177	18.217
3/13/96 17:41	582.00	21.122	20.034	19.814	19.118	16.577	19.177	18.217
3/13/96 17:43	584.00	21.116	20.039	19.817	19.118	16.577	19.177	18.217
3/13/96 17:45	586.00	21.122	20.039	19.817	19.118	16.577	19.177	18.221
3/13/96 17:47	588.00	21.122	20.039	19.817	19.118	16.577	19.184	18.217
3/13/96 17:49	590.00	21.122	20.043	19.820	19.118	16.577	19.184	18.221
3/13/96 17:51	592.00	21.122	20.043	19.824	19.118	16.577	19.184	18.226
3/13/96 17:53	594.00	21.128	20.048	19.824	19.118	16.592	19.190	18.226

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3/13/96 17:55	596.00	21.135	20.048	19.827	19.118	16.592	19.190	18.226
3/13/96 17:57	598.00	21.135	20.048	19.827	19.134	16.592	19.190	18.231
3/13/96 17:59	600.00	21.141	20.053	19.830	19.134	16.592	19.196	18.236
3/13/96 18:01	602.00	21.135	20.058	19.833	19.134	16.592	19.196	18.236
3/13/96 18:03	604.00	21.135	20.058	19.833	19.134	16.592	19.196	18.236
3/13/96 18:05	606.00	21.135	20.058	19.833	19.134	16.592	19.203	18.226
3/13/96 18:07	608.00	21.141	20.058	19.833	19.134	16.608	19.196	18.240
3/13/96 18:09	610.00	21.147	20.058	19.836	19.134	16.608	19.203	18.240
3/13/96 18:11	612.00	21.141	20.062	19.836	19.134	16.608	19.203	18.240
3/13/96 18:13	614.00	21.154	20.067	19.843	19.134	16.608	19.203	18.245
3/13/96 18:15	616.00	21.160	20.067	19.843	19.150	16.608	19.209	18.245
3/13/96 18:17	618.00	21.166	20.067	19.843	19.150	16.608	19.209	18.245
3/13/96 18:19	620.00	21.166	20.067	19.846	19.150	16.608	19.215	18.250
3/13/96 18:21	622.00	21.173	20.072	19.849	19.150	16.608	19.215	18.250
3/13/96 18:23	624.00	21.179	20.072	19.852	19.150	16.608	19.215	18.255
3/13/96 18:25	626.00	21.179	20.076	19.855	19.150	16.608	19.222	18.255
3/13/96 18:27	628.00	21.185	20.081	19.855	19.150	16.608	19.222	18.259
3/13/96 18:29	630.00	21.185	20.081	19.858	19.165	16.608	19.228	18.259
3/13/96 18:31	632.00	21.185	20.081	19.858	19.150	16.624	19.228	18.259
3/13/96 18:33	634.00	21.185	20.086	19.862	19.165	16.624	19.228	18.259
3/13/96 18:35	636.00	21.185	20.086	19.862	19.165	16.608	19.228	18.264
3/13/96 18:37	638.00	21.210	20.086	19.865	19.165	16.624	19.234	18.269
3/13/96 18:39	640.00	21.217	20.095	19.868	19.165	16.624	19.241	18.269
3/13/96 18:41	642.00	21.223	20.095	19.871	19.181	16.624	19.241	18.273
3/13/96 18:43	644.00	21.217	20.095	19.874	19.165	16.624	19.241	18.273
3/13/96 18:45	646.00	21.229	20.100	19.877	19.181	16.624	19.247	18.273
3/13/96 18:47	648.00	21.229	20.100	19.877	19.181	16.624	19.247	18.278
3/13/96 18:49	650.00	21.236	20.100	19.881	19.181	16.624	19.247	18.278
3/13/96 18:51	652.00	21.236	20.105	19.881	19.181	16.640	19.247	18.283
3/13/96 18:53	654.00	21.242	20.110	19.884	19.181	16.640	19.253	18.283
3/13/96 18:55	656.00	21.236	20.110	19.887	19.181	16.640	19.253	18.288
3/13/96 18:57	658.00	21.248	20.114	19.890	19.197	16.640	19.260	18.292
3/13/96 18:59	660.00	21.242	20.114	19.890	19.197	16.640	19.260	18.292
3/13/96 19:01	662.00	21.248	20.119	19.893	19.197	16.640	19.260	18.292
3/13/96 19:03	664.00	21.255	20.119	19.890	19.197	16.640	19.253	18.292
3/13/96 19:05	666.00	21.248	20.119	19.893	19.197	16.640	19.260	18.292
3/13/96 19:07	668.00	21.248	20.119	19.896	19.197	16.640	19.260	18.292
3/13/96 19:09	670.00	21.248	20.119	19.896	19.197	16.640	19.266	18.297
3/13/96 19:11	672.00	21.255	20.124	19.903	19.197	16.640	19.266	18.297
3/13/96 19:13	674.00	21.255	20.119	19.896	19.197	16.640	19.266	18.297
3/13/96 19:15	676.00	21.255	20.124	19.896	19.197	16.640	19.266	18.297
3/13/96 19:17	678.00	21.255	20.124	19.900	19.197	16.655	19.266	18.302
3/13/96 19:19	680.00	21.255	20.124	19.903	19.197	16.640	19.266	18.302
3/13/96 19:21	682.00	21.261	20.124	19.903	19.197	16.655	19.266	18.302
3/13/96 19:23	684.00	21.267	20.128	19.903	19.213	16.655	19.272	18.302
3/13/96 19:25	686.00	21.267	20.124	19.903	19.197	16.655	19.272	18.302
3/13/96 19:27	688.00	21.267	20.128	19.903	19.197	16.655	19.272	18.302

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3/13/96 19:29	690.00	21.261	20.124	19.906	19.181	16.640	19.266	18.302
3/13/96 19:31	692.00	21.267	20.133	19.912	19.213	16.655	19.272	18.307
3/13/96 19:33	694.00	21.274	20.133	19.909	19.213	16.655	19.272	18.307
3/13/96 19:35	696.00	21.274	20.133	19.915	19.213	16.655	19.279	18.307
3/13/96 19:37	698.00	21.274	20.133	19.906	19.213	16.655	19.279	18.311
3/13/96 19:39	700.00	21.274	20.133	19.906	19.197	16.655	19.279	18.307
3/13/96 19:41	702.00	21.280	20.133	19.906	19.213	16.655	19.279	18.311
3/13/96 19:43	704.00	21.274	20.133	19.912	19.213	16.655	19.279	18.307
3/13/96 19:45	706.00	21.274	20.133	19.906	19.213	16.655	19.279	18.307
3/13/96 19:47	708.00	21.274	20.128	19.903	19.197	16.655	19.272	18.307
3/13/96 19:49	710.00	21.274	20.128	19.903	19.181	16.655	19.272	18.307
3/13/96 19:51	712.00	21.280	20.133	19.906	19.181	16.655	19.279	18.307
3/13/96 19:53	714.00	21.286	20.133	19.903	19.181	16.655	19.272	18.307
3/13/96 19:55	716.00	21.286	20.133	19.912	19.181	16.655	19.272	18.307
3/13/96 19:57	718.00	21.286	20.133	19.912	19.181	16.655	19.279	18.307
3/13/96 19:59	720.00	21.286	20.133	19.906	19.181	16.655	19.279	18.311
3/13/96 20:01	722.00	21.299	20.138	19.909	19.181	16.655	19.285	18.311
3/13/96 20:03	724.00	21.293	20.138	19.912	19.181	16.655	19.285	18.311
3/13/96 20:05	726.00	21.299	20.143	19.919	19.181	16.655	19.279	18.316
3/13/96 20:07	728.00	21.311	20.143	19.915	19.197	16.655	19.285	18.316
3/13/96 20:09	730.00	21.311	20.147	19.922	19.197	16.655	19.291	18.321
3/13/96 20:11	732.00	21.311	20.147	19.922	19.197	16.655	19.291	18.321
3/13/96 20:13	734.00	21.311	20.143	19.919	19.197	16.671	19.291	18.321
3/13/96 20:15	736.00	21.311	20.143	19.922	19.197	16.655	19.285	18.321
3/13/96 20:17	738.00	21.311	20.147	19.925	19.181	16.655	19.291	18.321
3/13/96 20:19	740.00	21.318	20.152	19.925	19.197	16.655	19.291	18.325
3/13/96 20:21	742.00	21.337	20.157	19.928	19.213	16.671	19.298	18.325
3/13/96 20:23	744.00	21.356	20.161	19.938	19.213	16.671	19.304	18.335
3/13/96 20:25	746.00	21.362	20.166	19.941	19.213	16.671	19.310	18.340
3/13/96 20:27	748.00	21.375	20.171	19.944	19.229	16.671	19.316	18.344
3/13/96 20:29	750.00	21.381	20.176	19.947	19.229	16.671	19.316	18.344
3/13/96 20:31	752.00	21.387	20.180	19.957	19.229	16.671	19.323	18.349
3/13/96 20:33	754.00	21.387	20.180	19.957	19.229	16.687	19.329	18.354
3/13/96 20:35	756.00	21.387	20.180	19.960	19.229	16.687	19.329	18.359
3/13/96 20:37	758.00	21.394	20.190	19.966	19.245	16.687	19.335	18.359
3/13/96 20:39	760.00	21.394	20.190	19.969	19.245	16.687	19.335	18.363
3/13/96 20:41	762.00	21.400	20.195	19.969	19.245	16.687	19.342	18.368
3/13/96 20:43	764.00	21.406	20.190	19.963	19.245	16.687	19.335	18.363
3/13/96 20:45	766.00	21.413	20.195	19.969	19.245	16.687	19.342	18.368
3/13/96 20:47	768.00	21.413	20.199	19.972	19.245	16.702	19.348	18.373
3/13/96 20:49	770.00	21.425	20.204	19.976	19.245	16.702	19.348	18.373
3/13/96 20:51	772.00	21.425	20.204	19.979	19.261	16.702	19.348	18.377
3/13/96 20:53	774.00	21.425	20.204	19.979	19.245	16.702	19.348	18.377
3/13/96 20:55	776.00	21.425	20.204	19.979	19.261	16.702	19.348	18.373
3/13/96 20:57	778.00	21.425	20.204	19.976	19.261	16.702	19.348	18.377
3/13/96 20:59	780.00	21.431	20.209	19.982	19.261	16.702	19.348	18.377
3/13/96 21:01	782.00	21.431	20.209	19.982	19.261	16.702	19.354	18.377

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3/13/96 21:03	784.00	21.431	20.209	19.985	19.261	16.702	19.354	18.382
3/13/96 21:05	786.00	21.425	20.213	19.988	19.261	16.718	19.361	18.387
3/13/96 21:07	788.00	21.431	20.213	19.988	19.261	16.702	19.361	18.387
3/13/96 21:09	790.00	21.431	20.218	19.994	19.261	16.718	19.367	18.387
3/13/96 21:11	792.00	21.431	20.223	19.991	19.277	16.718	19.367	18.392
3/13/96 21:13	794.00	21.431	20.228	20.007	19.277	16.718	19.373	18.396
3/13/96 21:15	796.00	21.438	20.232	20.007	19.277	16.718	19.373	18.401
3/13/96 21:17	798.00	21.444	20.237	20.007	19.292	16.734	19.380	18.406
3/13/96 21:19	800.00	21.457	20.251	20.023	19.308	16.750	19.399	18.420
3/13/96 21:21	802.00	21.463	20.246	20.013	19.292	16.734	19.392	18.415
3/13/96 21:23	804.00	21.482	20.280	20.039	19.324	16.750	19.418	18.444
3/13/96 21:25	806.00	21.463	20.256	20.032	19.308	16.734	19.399	18.425
3/13/96 21:27	808.00	21.457	20.251	20.026	19.308	16.750	19.405	18.425
3/13/96 21:29	810.00	21.457	20.251	20.026	19.308	16.734	19.399	18.420
3/13/96 21:31	812.00	21.457	20.256	20.032	19.308	16.750	19.399	18.425
3/13/96 21:33	814.00	21.457	20.270	20.036	19.308	16.750	19.411	18.434
3/13/96 21:35	816.00	21.463	20.265	20.036	19.308	16.750	19.405	18.434
3/13/96 21:37	818.00	21.469	20.261	20.032	19.308	16.750	19.405	18.429
3/13/96 21:39	820.00	21.463	20.265	20.036	19.340	16.765	19.411	18.434
3/13/96 21:41	822.00	21.469	20.265	20.032	19.324	16.765	19.411	18.429
3/13/96 21:43	824.00	21.469	20.270	20.042	19.324	16.750	19.418	18.434
3/13/96 21:45	826.00	21.476	20.275	20.045	19.340	16.765	19.418	18.444
3/13/96 21:47	828.00	21.482	20.275	20.051	19.340	16.765	19.418	18.444
3/13/96 21:49	830.00	21.476	20.265	20.032	19.324	16.765	19.411	18.439
3/13/96 21:51	832.00	21.469	20.261	20.036	19.324	16.750	19.405	18.429
3/13/96 21:53	834.00	21.469	20.265	20.032	19.324	16.750	19.405	18.429
3/13/96 21:55	836.00	21.526	20.270	20.042	19.340	16.750	19.418	18.439
3/13/96 21:57	838.00	21.558	20.284	20.051	19.356	16.765	19.430	18.448
3/13/96 21:59	840.00	21.577	20.294	20.067	19.356	16.765	19.443	18.458
3/13/96 22:01	842.00	21.583	20.303	20.077	19.372	16.765	19.455	18.472
3/13/96 22:03	844.00	21.583	20.308	20.080	19.388	16.765	19.455	18.477
3/13/96 22:05	846.00	21.583	20.313	20.083	19.388	16.765	19.462	18.472
3/13/96 22:07	848.00	21.583	20.303	20.077	19.372	16.765	19.455	18.472
3/13/96 22:09	850.00	21.596	20.327	20.093	19.403	16.781	19.474	18.491
3/13/96 22:11	852.00	21.577	20.327	20.089	19.388	16.797	19.468	18.491
3/13/96 22:13	854.00	21.558	20.317	20.093	19.388	16.797	19.462	18.481
3/13/96 22:15	856.00	21.558	20.313	20.086	19.388	16.781	19.462	18.481
3/13/96 22:17	858.00	21.558	20.317	20.093	19.388	16.797	19.468	18.486
3/13/96 22:19	860.00	21.551	20.322	20.093	19.388	16.797	19.468	18.486
3/13/96 22:21	862.00	21.558	20.322	20.096	19.388	16.797	19.468	18.486
3/13/96 22:23	864.00	21.570	20.331	20.108	19.403	16.812	19.481	18.496
3/13/96 22:25	866.00	21.564	20.327	20.096	19.388	16.797	19.474	18.491
3/13/96 22:27	868.00	21.564	20.331	20.102	19.388	16.797	19.474	18.491
3/13/96 22:29	870.00	21.564	20.331	20.105	19.403	16.797	19.474	18.496
3/13/96 22:31	872.00	21.577	20.327	20.096	19.419	16.797	19.474	18.491
3/13/96 22:33	874.00	21.570	20.322	20.093	19.388	16.797	19.468	18.491
3/13/96 22:35	876.00	21.564	20.313	20.086	19.372	16.797	19.455	18.481

		Well ID						
Date and Time	Minutes	BW2G	65G	66G	62G	05G	67G	INT4
3/13/96 22:37	878.00	21.564	20.317	20.089	19.388	16.797	19.462	18.486
3/13/96 22:39	880.00	21.570	20.327	20.093	19.388	16.797	19.468	18.491
3/13/96 22:41	882.00	21.577	20.322	20.096	19.388	16.797	19.468	18.491
3/13/96 22:43	884.00	21.570	20.322	20.096	19.388	16.797	19.474	18.486
3/13/96 22:45	886.00	21.577	20.327	20.099	19.403	16.797	19.474	18.491
3/13/96 22:47	888.00	21.577	20.327	20.096	19.388	16.797	19.474	18.491
3/13/96 22:49	890.00	21.570	20.327	20.096	19.388	16.797	19.474	18.491
3/13/96 22:51	892.00	21.564	20.327	20.096	19.388	16.797	19.474	18.491
3/13/96 22:53	894.00	21.564	20.322	20.093	19.388	16.797	19.468	18.491
3/13/96 22:55	896.00	21.564	20.327	20.093	19.388	16.797	19.474	18.486
3/13/96 22:57	898.00	21.564	20.327	20.096	19.388	16.797	19.468	18.491
3/13/96 22:59	900.00	21.564	20.327	20.093	19.388	16.797	19.468	18.486
3/13/96 23:01	902.00	21.564	20.322	20.096	19.388	16.797	19.468	18.491
3/13/96 23:03	904.00	21.570	20.322	20.093	19.388	16.797	19.468	18.486
3/13/96 23:05	906.00	21.564	20.317	20.086	19.388	16.781	19.462	18.486
3/13/96 23:07	908.00	21.564	20.317	20.083	19.372	16.781	19.462	18.481
3/13/96 23:09	910.00	21.558	20.313	20.083	19.372	16.781	19.455	18.477
3/13/96 23:11	912.00	21.558	20.313	20.080	19.372	16.781	19.455	18.477
3/13/96 23:13	914.00	21.558	20.313	20.083	19.372	16.781	19.455	18.477
3/13/96 23:15	916.00	21.558	20.317	20.083	19.372	16.781	19.462	18.477
3/13/96 23:17	918.00	21.558	20.317	20.086	19.388	16.781	19.462	18.481
3/13/96 23:19	920.00	21.545	20.322	20.089	19.372	16.797	19.462	18.481
3/13/96 23:21	922.00	21.545	20.322	20.089	19.372	16.797	19.462	18.481
3/13/96 23:23	924.00	21.545	20.317	20.083	19.372	16.797	19.462	18.481
3/13/96 23:25	926.00	21.539	20.313	20.086	19.372	16.797	19.462	18.477
3/13/96 23:27	928.00	21.539	20.313	20.083	19.372	16.797	19.455	18.477
3/13/96 23:29	930.00	21.539	20.317	20.086	19.372	16.797	19.462	18.481
3/13/96 23:31	932.00	21.545	20.317	20.089	19.372	16.797	19.462	18.481
3/13/96 23:33	934.00	21.545	20.317	20.089	19.372	16.797	19.462	18.481
3/13/96 23:35	936.00	21.545	20.317	20.086	19.388	16.797	19.462	18.481
3/13/96 23:37	938.00	21.545	20.317	20.089	19.372	16.797	19.462	18.477
3/13/96 23:39	940.00	21.551	20.317	20.086	19.372	16.781	19.462	18.481
3/13/96 23:41	942.00	21.551	20.317	20.089	19.372	16.797	19.462	18.481
3/13/96 23:43	944.00	21.551	20.313	20.083	19.372	16.781	19.455	18.477
3/13/96 23:45	946.00	21.570	20.313	20.080	19.372	16.781	19.455	18.477
3/13/96 23:47	948.00	21.583	20.317	20.083	19.372	16.797	19.462	18.481
3/13/96 23:49	950.00	21.583	20.322	20.089	19.372	16.797	19.462	18.481
3/13/96 23:51	952.00	21.589	20.322	20.093	19.372	16.797	19.462	18.481
3/13/96 23:53	954.00	21.583	20.322	20.083	19.372	16.797	19.462	18.481
3/13/96 23:55	956.00	21.589	20.322	20.096	19.372	16.797	19.462	18.486
3/13/96 23:57	958.00	21.583	20.317	20.083	19.372	16.797	19.462	18.481
3/13/96 23:59	960.00	21.589	20.317	20.086	19.372	16.797	19.462	18.481
3/14/96 0:01	962.00	21.589	20.317	20.086	19.372	16.797	19.462	18.481
3/14/96 0:03	964.00	21.583	20.317	20.089	19.372	16.797	19.462	18.481
3/14/96 0:05	966.00	21.583	20.322	20.089	19.372	16.797	19.468	18.481
3/14/96 0:07	968.00	21.583	20.327	20.096	19.372	16.797	19.468	18.486
3/14/96 0:09	970.00	21.577	20.317	20.086	19.372	16.797	19.462	18.481

Date and Time	Minutes	BW2G	65G	66G	Well ID 62G	05G	67G	INT4
3/14/96 0:11	972.00	21.577	20.322	20.093	19.388	16.797	19.468	18.486
3/14/96 0:13	974.00	21.564	20.317	20.086	19.372	16.797	19.455	18.481
3/14/96 0:15	976.00	21.564	20.317	20.083	19.372	16.781	19.462	18.477
3/14/96 0:17	978.00	21.558	20.317	20.083	19.372	16.797	19.455	18.481
3/14/96 0:19	980.00	21.558	20.313	20.086	19.372	16.797	19.462	18.477
3/14/96 0:21	982.00	21.564	20.317	20.083	19.372	16.781	19.455	18.477
3/14/96 0:23	984.00	21.564	20.313	20.086	19.372	16.797	19.462	18.477
3/14/96 0:25	986.00	21.564	20.317	20.086	19.372	16.781	19.462	18.481
3/14/96 0:27	988.00	21.570	20.322	20.093	19.372	16.797	19.462	18.481
3/14/96 0:29	990.00	21.577	20.322	20.093	19.388	16.797	19.468	18.486
3/14/96 0:31	992.00	21.577	20.327	20.093	19.388	16.797	19.468	18.491
3/14/96 0:33	994.00	21.577	20.331	20.096	19.388	16.797	19.468	18.491
3/14/96 0:35	996.00	21.583	20.336	20.102	19.388	16.797	19.481	18.496
3/14/96 0:37	998.00	21.583	20.336	20.105	19.388	16.812	19.481	18.500
3/14/96 0:39	1000.00	21.589	20.341	20.112	19.388	16.812	19.481	18.500
3/14/96 0:41	1002.00	21.589	20.341	20.108	19.403	16.812	19.487	18.505
3/14/96 0:43	1004.00	21.583	20.346	20.108	19.388	16.812	19.487	18.505
3/14/96 0:45	1006.00	21.583	20.341	20.112	19.403	16.812	19.487	18.505
3/14/96 0:47	1008.00	21.589	20.346	20.112	19.403	16.812	19.487	18.505
3/14/96 0:49	1010.00	21.589	20.346	20.115	19.403	16.812	19.487	18.510
3/14/96 0:51	1012.00	21.583	20.350	20.115	19.403	16.812	19.493	18.510
3/14/96 0:53	1014.00	21.583	20.346	20.112	19.388	16.812	19.493	18.510
3/14/96 0:55	1016.00	21.583	20.346	20.115	19.388	16.812	19.487	18.505
3/14/96 0:57	1018.00	21.589	20.350	20.112	19.403	16.812	19.493	18.510
3/14/96 0:59	1020.00	21.589	20.346	20.115	19.403	16.812	19.493	18.510
3/14/96 1:01	1022.00	21.596	20.350	20.121	19.403	16.828	19.493	18.510
3/14/96 1:03	1024.00	21.589	20.350	20.124	19.403	16.828	19.500	18.514
3/14/96 1:05	1026.00	21.589	20.350	20.124	19.403	16.812	19.493	18.514
3/14/96 1:07	1028.00	21.589	20.355	20.121	19.403	16.828	19.500	18.514
3/14/96 1:09	1030.00	21.589	20.355	20.121	19.403	16.828	19.500	18.514
3/14/96 1:11	1032.00	21.589	20.350	20.121	19.403	16.812	19.500	18.514
3/14/96 1:13	1034.00	21.596	20.355	20.121	19.403	16.812	19.500	18.514
3/14/96 1:15	1036.00	21.589	20.350	20.124	19.403	16.812	19.493	18.514
3/14/96 1:17	1038.00	21.596	20.350	20.121	19.403	16.828	19.493	18.514
3/14/96 1:19	1040.00	21.589	20.355	20.121	19.403	16.828	19.500	18.514
3/14/96 1:21	1042.00	21.589	20.355	20.121	19.403	16.828	19.493	18.514
3/14/96 1:23	1044.00	21.589	20.350	20.118	19.403	16.828	19.493	18.514
3/14/96 1:25	1046.00	21.589	20.350	20.121	19.403	16.828	19.500	18.514
3/14/96 1:27	1048.00	21.596	20.355	20.127	19.403	16.828	19.500	18.514
3/14/96 1:29	1050.00	21.589	20.355	20.124	19.403	16.828	19.500	18.519
3/14/96 1:31	1052.00	21.596	20.355	20.124	19.403	16.828	19.500	18.514
3/14/96 1:33	1054.00	21.596	20.355	20.118	19.403	16.828	19.500	18.514
3/14/96 1:35	1056.00	21.602	20.355	20.121	19.403	16.828	19.500	18.514
3/14/96 1:37	1058.00	21.596	20.355	20.121	19.403	16.828	19.500	18.514
3/14/96 1:39	1060.00	21.602	20.355	20.121	19.403	16.828	19.500	18.514
3/14/96 1:41	1062.00	21.602	20.355	20.118	19.403	16.828	19.493	18.514
3/14/96 1:43	1064.00	21.596	20.355	20.118	19.403	16.828	19.493	18.514

Date and Time	Minutes	BW2G	65G	66G	Well ID 62G	05G	67G	INT4
3/14/96 1:45	1066.00	21.596	20.350	20.118	19.403	16.812	19.493	18.510
3/14/96 1:47	1068.00	21.596	20.350	20.118	19.403	16.812	19.493	18.510
3/14/96 1:49	1070.00	21.596	20.350	20.118	19.403	16.812	19.493	18.510
3/14/96 1:51	1072.00	21.596	20.346	20.118	19.403	16.812	19.493	18.510
3/14/96 1:53	1074.00	21.596	20.346	20.118	19.403	16.812	19.487	18.510
3/14/96 1:55	1076.00	21.596	20.346	20.115	19.403	16.812	19.487	18.510
3/14/96 1:57	1078.00	21.596	20.346	20.115	19.403	16.812	19.487	18.510
3/14/96 1:59	1080.00	21.596	20.346	20.112	19.403	16.812	19.487	18.505
3/14/96 2:01	1082.00	21.596	20.346	20.115	19.403	16.812	19.487	18.505
3/14/96 2:03	1084.00	21.596	20.346	20.115	19.388	16.812	19.487	18.505
3/14/96 2:05	1086.00	21.596	20.346	20.112	19.403	16.812	19.487	18.505
3/14/96 2:07	1088.00	21.596	20.341	20.115	19.388	16.812	19.487	18.505
3/14/96 2:09	1090.00	21.596	20.341	20.112	19.388	16.812	19.487	18.505
3/14/96 2:11	1092.00	21.596	20.341	20.108	19.388	16.812	19.487	18.505
3/14/96 2:13	1094.00	21.589	20.341	20.112	19.388	16.812	19.487	18.500
3/14/96 2:15	1096.00	21.596	20.341	20.105	19.388	16.812	19.487	18.500
3/14/96 2:17	1098.00	21.596	20.341	20.108	19.388	16.797	19.481	18.500
3/14/96 2:19	1100.00	21.602	20.346	20.108	19.388	16.812	19.487	18.500
3/14/96 2:21	1102.00	21.596	20.341	20.108	19.388	16.812	19.487	18.500
3/14/96 2:23	1104.00	21.596	20.341	20.112	19.388	16.812	19.481	18.505
3/14/96 2:25	1106.00	21.602	20.341	20.108	19.388	16.797	19.481	18.500
3/14/96 2:27	1108.00	21.596	20.346	20.112	19.388	16.812	19.487	18.505
3/14/96 2:29	1110.00	21.596	20.346	20.112	19.388	16.812	19.487	18.505
3/14/96 2:31	1112.00	21.589	20.346	20.108	19.388	16.812	19.487	18.505
3/14/96 2:33	1114.00	21.589	20.350	20.115	19.388	16.812	19.493	18.505
3/14/96 2:35	1116.00	21.596	20.350	20.121	19.403	16.812	19.493	18.510
3/14/96 2:37	1118.00	21.634	20.360	20.127	19.403	16.828	19.500	18.519
3/14/96 2:39	1120.00	21.602	20.350	20.153	19.403	16.812	19.493	18.514
3/14/96 2:41	1122.00	21.602	20.350	20.118	19.403	16.797	19.493	18.510
3/14/96 2:43	1124.00	21.602	20.350	20.118	19.403	16.781	19.481	18.510
3/14/96 2:45	1126.00	21.602	20.350	20.118	19.403	16.812	19.487	18.510
3/14/96 2:47	1128.00	21.596	20.346	20.118	19.388	16.812	19.487	18.510
3/14/96 2:49	1130.00	21.602	20.346	20.115	19.388	16.812	19.481	18.505
3/14/96 2:51	1132.00	21.596	20.341	20.108	19.356	16.812	19.487	18.505
3/14/96 2:53	1134.00	21.589	20.341	20.108	19.388	16.812	19.481	18.500
3/14/96 2:55	1136.00	21.589	20.341	20.105	19.388	16.812	19.481	18.500
3/14/96 2:57	1138.00	21.589	20.336	20.105	19.388	16.797	19.481	18.496
3/14/96 2:59	1140.00	21.589	20.336	20.105	19.388	16.797	19.481	18.496
3/14/96 3:01	1142.00	21.596	20.341	20.105	19.388	16.797	19.481	18.500
3/14/96 3:03	1144.00	21.589	20.336	20.105	19.388	16.797	19.481	18.496
3/14/96 3:05	1146.00	21.589	20.341	20.102	19.388	16.797	19.481	18.496
3/14/96 3:07	1148.00	21.589	20.336	20.102	19.388	16.797	19.481	18.496
3/14/96 3:09	1150.00	21.589	20.336	20.105	19.388	16.812	19.481	18.496
3/14/96 3:11	1152.00	21.589	20.341	20.105	19.388	16.812	19.481	18.500
3/14/96 3:13	1154.00	21.596	20.341	20.108	19.388	16.797	19.481	18.500
3/14/96 3:15	1156.00	21.589	20.341	20.105	19.388	16.812	19.487	18.500
3/14/96 3:17	1158.00	21.589	20.341	20.105	19.388	16.812	19.481	18.500

					Well ID			
Date and Time	Minutes	BW2G	65G	66G	62G	05G	67G	INT4
3/14/96 3:19	1160.00	21.589	20.341	20.108	19.388	16.797	19.481	18.500
3/14/96 3:21	1162.00	21.589	20.341	20.105	19.388	16.812	19.481	18.500
3/14/96 3:23	1164.00	21.589	20.341	20.108	19.388	16.797	19.481	18.500
3/14/96 3:25	1166.00	21.589	20.341	20.108	19.388	16.812	19.481	18.500
3/14/96 3:27	1168.00	21.596	20.341	20.112	19.388	16.812	19.487	18.500
3/14/96 3:29	1170.00	21.596	20.346	20.112	19.388	16.812	19.487	18.505
3/14/96 3:31	1172.00	21.596	20.346	20.118	19.388	16.812	19.487	18.505
3/14/96 3:33	1174.00	21.602	20.350	20.105	19.388	16.812	19.487	18.505
3/14/96 3:35	1176.00	21.602	20.346	20.115	19.388	16.812	19.487	18.505
3/14/96 3:37	1178.00	21.602	20.350	20.108	19.403	16.812	19.487	18.505
3/14/96 3:39	1180.00	21.602	20.346	20.112	19.403	16.812	19.493	18.505
3/14/96 3:41	1182.00	21.602	20.350	20.118	19.403	16.812	19.493	18.505
3/14/96 3:43	1184.00	21.608	20.346	20.112	19.403	16.812	19.493	18.510
3/14/96 3:45	1186.00	21.608	20.350	20.112	19.403	16.812	19.493	18.510
3/14/96 3:47	1188.00	21.602	20.350	20.118	19.403	16.812	19.493	18.510
3/14/96 3:49	1190.00	21.608	20.355	20.118	19.388	16.812	19.493	18.510
3/14/96 3:51	1192.00	21.608	20.355	20.118	19.403	16.812	19.493	18.510
3/14/96 3:53	1194.00	21.608	20.355	20.118	19.403	16.812	19.500	18.510
3/14/96 3:55	1196.00	21.608	20.355	20.118	19.403	16.812	19.493	18.514
3/14/96 3:57	1198.00	21.608	20.355	20.118	19.403	16.812	19.500	18.514
3/14/96 3:59	1200.00	21.608	20.355	20.121	19.403	16.812	19.500	18.514
3/14/96 4:01	1202.00	21.615	20.355	20.124	19.403	16.812	19.500	18.514
3/14/96 4:03	1204.00	21.608	20.360	20.127	19.403	16.812	19.500	18.514
3/14/96 4:05	1206.00	21.608	20.360	20.127	19.403	16.812	19.500	18.519
3/14/96 4:07	1208.00	21.602	20.360	20.124	19.403	16.828	19.500	18.514
3/14/96 4:09	1210.00	21.608	20.360	20.127	19.403	16.812	19.500	18.519
3/14/96 4:11	1212.00	21.608	20.365	20.124	19.403	16.828	19.506	18.519
3/14/96 4:13	1214.00	21.608	20.365	20.127	19.403	16.812	19.506	18.519
3/14/96 4:15	1216.00	21.608	20.365	20.131	19.403	16.828	19.506	18.519
3/14/96 4:17	1218.00	21.608	20.365	20.124	19.403	16.828	19.506	18.519
3/14/96 4:19	1220.00	21.615	20.365	20.124	19.403	16.812	19.506	18.519
3/14/96 4:21	1222.00	21.615	20.360	20.127	19.403	16.828	19.506	18.519
3/14/96 4:23	1224.00	21.615	20.365	20.127	19.403	16.828	19.506	18.519
3/14/96 4:25	1226.00	21.615	20.360	20.127	19.403	16.828	19.506	18.519
3/14/96 4:27	1228.00	21.608	20.365	20.127	19.419	16.828	19.506	18.519
3/14/96 4:29	1230.00	21.615	20.365	20.134	19.403	16.828	19.506	18.524
3/14/96 4:31	1232.00	21.621	20.365	20.127	19.403	16.828	19.506	18.524
3/14/96 4:33	1234.00	21.640	20.365	20.131	19.419	16.828	19.506	18.519
3/14/96 4:35	1236.00	21.646	20.365	20.131	19.419	16.828	19.512	18.524
3/14/96 4:37	1238.00	21.646	20.365	20.134	19.403	16.828	19.512	18.524
3/14/96 4:39	1240.00	21.646	20.369	20.134	19.403	16.828	19.512	18.524
3/14/96 4:41	1242.00	21.646	20.369	20.127	19.419	16.828	19.512	18.524
3/14/96 4:43	1244.00	21.646	20.369	20.134	19.403	16.828	19.506	18.524
3/14/96 4:45	1246.00	21.640	20.369	20.131	19.419	16.828	19.512	18.524
3/14/96 4:47	1248.00	21.646	20.369	20.131	19.419	16.828	19.512	18.524
3/14/96 4:49	1250.00	21.646	20.369	20.137	19.419	16.828	19.512	18.529
3/14/96 4:51	1252.00	21.646	20.369	20.131	19.403	16.828	19.506	18.505

					Well ID			
Date and Time	Minutes	BW2G	65G	66G	62G	05G	67G	INT4
3/14/96 4:53	1254.00	21.646	20.365	20.131	19.419	16.828	19.512	18.510
3/14/96 4:55	1256.00	21.640	20.365	20.127	19.419	16.828	19.512	18.510
3/14/96 4:57	1258.00	21.640	20.365	20.134	19.403	16.828	19.512	18.510
3/14/96 4:59	1260.00	21.627	20.365	20.131	19.419	16.828	19.512	18.514
3/14/96 5:01	1262.00	21.627	20.365	20.131	19.419	16.828	19.512	18.514
3/14/96 5:03	1264.00	21.621	20.365	20.131	19.403	16.828	19.512	18.514
3/14/96 5:05	1266.00	21.627	20.365	20.131	19.403	16.828	19.506	18.514
3/14/96 5:07	1268.00	21.627	20.365	20.127	19.403	16.828	19.506	18.514
3/14/96 5:09	1270.00	21.634	20.365	20.131	19.403	16.828	19.506	18.514
3/14/96 5:11	1272.00	21.634	20.360	20.127	19.403	16.828	19.506	18.514
3/14/96 5:13	1274.00	21.634	20.365	20.124	19.403	16.828	19.506	18.514
3/14/96 5:15	1276.00	21.627	20.360	20.124	19.403	16.828	19.506	18.514
3/14/96 5:17	1278.00	21.608	20.355	20.121	19.403	16.828	19.500	18.510
3/14/96 5:19	1280.00	21.596	20.350	20.118	19.403	16.828	19.493	18.505
3/14/96 5:21	1282.00	21.589	20.350	20.118	19.388	16.828	19.493	18.505
3/14/96 5:23	1284.00	21.589	20.346	20.108	19.388	16.828	19.493	18.505
3/14/96 5:25	1286.00	21.589	20.346	20.108	19.388	16.828	19.487	18.500
3/14/96 5:27	1288.00	21.583	20.341	20.105	19.372	16.828	19.487	18.500
3/14/96 5:29	1290.00	21.589	20.346	20.108	19.388	16.828	19.487	18.500
3/14/96 5:31	1292.00	21.583	20.341	20.108	19.388	16.828	19.487	18.500
3/14/96 5:33	1294.00	21.577	20.341	20.105	19.388	16.828	19.487	18.500
3/14/96 5:35	1296.00	21.577	20.341	20.102	19.388	16.828	19.487	18.500
3/14/96 5:37	1298.00	21.577	20.341	20.105	19.388	16.828	19.481	18.496
3/14/96 5:39	1300.00	21.570	20.336	20.102	19.388	16.828	19.487	18.500
3/14/96 5:41	1302.00	21.577	20.336	20.102	19.388	16.828	19.487	18.500
3/14/96 5:43	1304.00	21.577	20.336	20.099	19.388	16.828	19.481	18.500
3/14/96 5:45	1306.00	21.577	20.341	20.102	19.388	16.828	19.487	18.496
3/14/96 5:47	1308.00	21.570	20.341	20.102	19.388	16.828	19.487	18.500
3/14/96 5:49	1310.00	21.564	20.336	20.099	19.388	16.828	19.481	18.496
3/14/96 5:51	1312.00	21.564	20.336	20.102	19.388	16.828	19.481	18.496
3/14/96 5:53	1314.00	21.564	20.336	20.099	19.388	16.828	19.481	18.496
3/14/96 5:55	1316.00	21.564	20.336	20.096	19.388	16.828	19.481	18.496
3/14/96 5:57	1318.00	21.558	20.336	20.096	19.388	16.828	19.481	18.496
3/14/96 5:59	1320.00	21.551	20.336	20.099	19.372	16.812	19.481	18.496
3/14/96 6:01	1322.00	21.558	20.331	20.099	19.372	16.812	19.481	18.496
3/14/96 6:03	1324.00	21.564	20.336	20.102	19.372	16.828	19.481	18.496
3/14/96 6:05	1326.00	21.564	20.331	20.099	19.388	16.828	19.481	18.500
3/14/96 6:07	1328.00	21.558	20.331	20.096	19.372	16.828	19.481	18.496
3/14/96 6:09	1330.00	21.558	20.331	20.089	19.372	16.812	19.481	18.496
3/14/96 6:11	1332.00	21.564	20.331	20.099	19.372	16.828	19.481	18.496
3/14/96 6:13	1334.00	21.558	20.331	20.096	19.372	16.828	19.481	18.496
3/14/96 6:15	1336.00	21.564	20.331	20.096	19.372	16.828	19.481	18.496
3/14/96 6:17	1338.00	21.558	20.331	20.096	19.372	16.828	19.474	18.496
3/14/96 6:19	1340.00	21.558	20.331	20.096	19.372	16.828	19.474	18.496
3/14/96 6:21	1342.00	21.564	20.327	20.093	19.372	16.828	19.474	18.496
3/14/96 6:23	1344.00	21.564	20.327	20.089	19.372	16.828	19.474	18.496
3/14/96 6:25	1346.00	21.564	20.327	20.086	19.372	16.812	19.474	18.491

Date and Time	Minutes	BW2G	65G	66G	Well ID 62G	05G	67G	INT4
3/14/96 6:27	1348.00	21.564	20.327	20.093	19.372	16.812	19.474	18.496
3/14/96 6:29	1350.00	21.558	20.327	20.089	19.372	16.828	19.474	18.491
3/14/96 6:31	1352.00	21.558	20.327	20.089	19.372	16.812	19.474	18.491
3/14/96 6:33	1354.00	21.551	20.327	20.089	19.372	16.812	19.474	18.491
3/14/96 6:35	1356.00	21.551	20.322	20.089	19.372	16.812	19.468	18.491
3/14/96 6:37	1358.00	21.551	20.322	20.086	19.372	16.812	19.468	18.491
3/14/96 6:39	1360.00	21.551	20.322	20.086	19.372	16.812	19.468	18.491
3/14/96 6:41	1362.00	21.558	20.322	20.086	19.372	16.812	19.468	18.491
3/14/96 6:43	1364.00	21.558	20.322	20.086	19.372	16.812	19.468	18.491
3/14/96 6:45	1366.00	21.551	20.322	20.083	19.372	16.812	19.468	18.491
3/14/96 6:47	1368.00	21.558	20.322	20.086	19.372	16.828	19.468	18.491
3/14/96 6:49	1370.00	21.551	20.317	20.083	19.372	16.812	19.468	18.491
3/14/96 6:51	1372.00	21.551	20.322	20.083	19.372	16.812	19.468	18.486
3/14/96 6:53	1374.00	21.551	20.317	20.083	19.372	16.812	19.468	18.486
3/14/96 6:55	1376.00	21.551	20.317	20.083	19.372	16.812	19.468	18.486
3/14/96 6:57	1378.00	21.551	20.317	20.086	19.372	16.812	19.468	18.486
3/14/96 6:59	1380.00	21.551	20.317	20.080	19.372	16.812	19.468	18.491
3/14/96 7:01	1382.00	21.545	20.322	20.083	19.372	16.812	19.468	18.486
3/14/96 7:03	1384.00	21.539	20.317	20.080	19.372	16.812	19.468	18.486
3/14/96 7:05	1386.00	21.545	20.317	20.083	19.372	16.812	19.468	18.486
3/14/96 7:07	1388.00	21.545	20.317	20.083	19.372	16.812	19.462	18.486
3/14/96 7:09	1390.00	21.551	20.317	20.077	19.356	16.812	19.468	18.486
3/14/96 7:11	1392.00	21.551	20.317	20.083	19.372	16.812	19.468	18.486
3/14/96 7:13	1394.00	21.551	20.322	20.083	19.372	16.812	19.468	18.486
3/14/96 7:15	1396.00	21.551	20.317	20.080	19.372	16.812	19.468	18.486
3/14/96 7:17	1398.00	21.551	20.317	20.080	19.372	16.812	19.468	18.486
3/14/96 7:19	1400.00	21.551	20.313	20.077	19.372	16.812	19.468	18.486
3/14/96 7:21	1402.00	21.558	20.317	20.080	19.356	16.812	19.468	18.486
3/14/96 7:23	1404.00	21.551	20.317	20.074	19.356	16.812	19.462	18.486
3/14/96 7:25	1406.00	21.551	20.313	20.074	19.372	16.812	19.462	18.481
3/14/96 7:27	1408.00	21.551	20.317	20.080	19.356	16.812	19.462	18.486
3/14/96 7:29	1410.00	21.551	20.317	20.077	19.372	16.812	19.462	18.486
3/14/96 7:31	1412.00	21.551	20.317	20.080	19.356	16.812	19.468	18.486
3/14/96 7:33	1414.00	21.551	20.317	20.080	19.372	16.812	19.462	18.486
3/14/96 7:35	1416.00	21.545	20.313	20.074	19.356	16.812	19.462	18.481
3/14/96 7:37	1418.00	21.545	20.313	20.077	19.372	16.812	19.462	18.481
3/14/96 7:39	1420.00	21.545	20.313	20.074	19.356	16.812	19.462	18.481
3/14/96 7:41	1422.00	21.545	20.313	20.080	19.356	16.812	19.462	18.481
3/14/96 7:43	1424.00	21.551	20.313	20.074	19.356	16.812	19.462	18.481
3/14/96 7:45	1426.00	21.551	20.313	20.074	19.356	16.812	19.462	18.481
3/14/96 7:47	1428.00	21.558	20.313	20.077	19.356	16.812	19.462	18.481
3/14/96 7:49	1430.00	21.558	20.313	20.077	19.372	16.812	19.462	18.481
3/14/96 7:51	1432.00	21.558	20.313	20.074	19.356	16.812	19.462	18.481
3/14/96 7:53	1434.00	21.558	20.317	20.080	19.356	16.812	19.462	18.481
3/14/96 7:55	1436.00	21.558	20.313	20.083	19.356	16.812	19.462	18.481
3/14/96 7:57	1438.00	21.551	20.317	20.080	19.356	16.812	19.468	18.486
3/14/96 7:59	1440.00	21.551	20.313	20.083	19.356	16.812	19.462	18.486

					Well ID			
Date and Time	Minutes	BW2G	65G	66G	62G	05G	67G	INT4
3/14/96 8:01	1442.00	21.551	20.317	20.080	19.356	16.812	19.462	18.481
3/14/96 8:03	1444.00	21.551	20.313	20.083	19.356	16.812	19.462	18.486
3/14/96 8:05	1446.00	21.558	20.317	20.080	19.372	16.812	19.462	18.481
3/14/96 8:07	1448.00	21.558	20.313	20.077	19.356	16.812	19.462	18.481
3/14/96 8:09	1450.00	21.564	20.313	20.074	19.372	16.812	19.462	18.486
3/14/96 8:11	1452.00	21.564	20.313	20.083	19.372	16.812	19.462	18.486
3/14/96 8:13	1454.00	21.558	20.313	20.080	19.356	16.812	19.462	18.481
3/14/96 8:15	1456.00	21.564	20.313	20.080	19.356	16.812	19.462	18.481
3/14/96 8:17	1458.00	21.564	20.313	20.074	19.356	16.812	19.462	18.481
3/14/96 8:19	1460.00	21.564	20.313	20.080	19.356	16.812	19.462	18.481
3/14/96 8:21	1462.00	21.564	20.313	20.077	19.356	16.812	19.462	18.481
3/14/96 8:23	1464.00	21.570	20.313	20.077	19.356	16.812	19.462	18.481
3/14/96 8:25	1466.00	21.570	20.313	20.077	19.356	16.828	19.462	18.486
3/14/96 8:27	1468.00	21.570	20.313	20.080	19.356	16.812	19.462	18.481
3/14/96 8:29	1470.00	21.564	20.313	20.080	19.356	16.812	19.462	18.481
3/14/96 8:31	1472.00	21.564	20.313	20.096	19.356	16.828	19.462	18.486
3/14/96 8:33	1474.00	21.564	20.313	20.070	19.372	16.828	19.462	18.481
3/14/96 8:35	1476.00	21.564	20.313	20.077	19.356	16.812	19.462	18.486
3/14/96 8:37	1478.00	21.570	20.313	20.077	19.356	16.812	19.468	18.481
3/14/96 8:39	1480.00	21.570	20.317	20.077	19.372	16.828	19.468	18.486
3/14/96 8:41	1482.00	21.570	20.317	20.080	19.356	16.812	19.468	18.486
3/14/96 8:43	1484.00	21.570	20.317	20.083	19.372	16.812	19.468	18.486
3/14/96 8:45	1486.00	21.570	20.313	20.083	19.372	16.812	19.468	18.486
3/14/96 8:47	1488.00	21.577	20.317	20.080	19.372	16.812	19.468	18.486
3/14/96 8:49	1490.00	21.570	20.317	20.083	19.372	16.812	19.468	18.491
3/14/96 8:51	1492.00	21.577	20.317	20.086	19.372	16.828	19.474	18.491
3/14/96 8:53	1494.00	21.577	20.322	20.080	19.372	16.828	19.468	18.491
3/14/96 8:55	1496.00	21.577	20.317	20.083	19.372	16.828	19.468	18.491
3/14/96 8:57	1498.00	21.577	20.322	20.080	19.372	16.828	19.468	18.491
3/14/96 8:59	1500.00	21.577	20.317	20.080	19.372	16.828	19.468	18.491
3/14/96 9:01	1502.00	21.583	20.317	20.077	19.372	16.828	19.474	18.491
3/14/96 9:03	1504.00	21.589	20.317	20.080	19.372	16.828	19.468	18.491
3/14/96 9:05	1506.00	21.583	20.317	20.083	19.372	16.812	19.468	18.491
3/14/96 9:07	1508.00	21.583	20.317	20.083	19.372	16.812	19.468	18.491
3/14/96 9:09	1510.00	21.577	20.317	20.080	19.372	16.812	19.468	18.491
3/14/96 9:11	1512.00	21.577	20.317	20.083	19.372	16.828	19.468	18.491
3/14/96 9:13	1514.00	21.577	20.317	20.077	19.372	16.828	19.468	18.486
3/14/96 9:15	1516.00	21.577	20.317	20.080	19.372	16.828	19.468	18.486
3/14/96 9:17	1518.00	21.583	20.322	20.080	19.372	16.828	19.468	18.491
3/14/96 9:19	1520.00	21.583	20.317	20.083	19.372	16.828	19.468	18.486
3/14/96 9:21	1522.00	21.583	20.313	20.080	19.372	16.828	19.468	18.486
3/14/96 9:23	1524.00	21.602	20.317	20.083	19.372	16.828	19.474	18.491
3/14/96 9:25	1526.00	21.602	20.322	20.086	19.372	16.828	19.474	18.491
3/14/96 9:27	1528.00	21.583	20.317	20.077	19.372	16.828	19.468	18.491
3/14/96 9:29	1530.00	21.583	20.317	20.083	19.372	16.828	19.468	18.486
3/14/96 9:31	1532.00	21.589	20.317	20.077	19.372	16.828	19.468	18.491
3/14/96 9:33	1534.00	21.589	20.317	20.074	19.372	16.828	19.468	18.486

Date and Time	Minutes	BW2G	65G	66G	Well ID 62G	05G	67G	INT4
3/14/96 9:35	1536.00	21.596	20.317	20.077	19.372	16.828	19.468	18.486
3/14/96 9:37	1538.00	21.596	20.317	20.080	19.372	16.828	19.468	18.486
3/14/96 9:39	1540.00	21.596	20.317	20.077	19.372	16.828	19.468	18.486
3/14/96 9:41	1542.00	21.602	20.317	20.077	19.372	16.828	19.468	18.486
3/14/96 9:43	1544.00	21.602	20.317	20.080	19.372	16.828	19.468	18.486
3/14/96 9:45	1546.00	21.602	20.317	20.077	19.372	16.828	19.468	18.486
3/14/96 9:47	1548.00	21.602	20.317	20.074	19.372	16.828	19.468	18.486
3/14/96 9:49	1550.00	21.596	20.223	20.051	19.356	16.828	19.455	18.481
3/14/96 9:51	1552.00	21.583	20.180	20.048	19.356	16.828	19.449	18.472
3/14/96 9:53	1554.00	21.570	20.204	20.036	19.340	16.828	19.437	18.462
3/14/96 9:55	1556.00	21.564	20.190	20.032	19.324	16.828	19.430	18.458
3/14/96 9:57	1558.00	21.558	20.180	20.023	19.324	16.812	19.424	18.453
3/14/96 9:59	1560.00	21.558	20.176	20.017	19.308	16.812	19.418	18.448
3/14/96 10:01	1562.00	21.564	20.100	19.994	19.292	16.812	19.405	18.434
3/14/96 10:03	1564.00	21.558	20.081	19.988	19.277	16.812	19.392	18.425
3/14/96 10:05	1566.00	21.545	20.067	19.979	19.277	16.812	19.386	18.415
3/14/96 10:07	1568.00	21.539	20.067	19.969	19.261	16.797	19.380	18.411
3/14/96 10:09	1570.00	21.526	20.058	19.953	19.261	16.797	19.367	18.401
3/14/96 10:11	1572.00	21.526	20.053	19.950	19.261	16.781	19.361	18.396
3/14/96 10:13	1574.00	21.520	20.043	19.947	19.245	16.781	19.361	18.392
3/14/96 10:15	1576.00	21.514	20.043	19.944	19.245	16.781	19.354	18.387
3/14/96 10:17	1578.00	21.514	20.034	19.941	19.245	16.781	19.348	18.382
3/14/96 10:19	1580.00	21.507	20.039	19.931	19.245	16.781	19.342	18.382
3/14/96 10:21	1582.00	21.501	20.029	19.938	19.245	16.765	19.342	18.377
3/14/96 10:23	1584.00	21.501	20.034	19.934	19.229	16.765	19.342	18.373
3/14/96 10:25	1586.00	21.476	19.812	19.887	19.197	16.765	19.310	18.363
3/14/96 10:27	1588.00	21.438	19.769	19.843	19.165	16.765	19.285	18.335
3/14/96 10:29	1590.00	21.406	19.746	19.820	19.150	16.765	19.266	18.316
3/14/96 10:31	1592.00	21.387	19.727	19.801	19.134	16.750	19.247	18.297
3/14/96 10:33	1594.00	21.368	19.708	19.798	19.102	16.734	19.228	18.283
3/14/96 10:35	1596.00	21.356	19.694	19.782	19.102	16.734	19.215	18.273
3/14/96 10:37	1598.00	21.349	19.680	19.773	19.086	16.734	19.209	18.264
3/14/96 10:39	1600.00	21.337	19.675	19.760	19.070	16.718	19.203	18.255
3/14/96 10:41	1602.00	21.324	19.661	19.751	19.070	16.718	19.196	18.269
3/14/96 10:43	1604.00	21.311	19.656	19.754	19.070	16.702	19.184	18.255
3/14/96 10:45	1606.00	21.299	19.647	19.744	19.054	16.702	19.177	18.245
3/14/96 10:47	1608.00	21.293	19.637	19.738	19.054	16.702	19.171	18.236
3/14/96 10:49	1610.00	21.286	19.628	19.722	19.039	16.687	19.158	18.231
3/14/96 10:51	1612.00	21.280	19.628	19.725	19.039	16.687	19.158	18.226
3/14/96 10:53	1614.00	21.274	19.618	19.719	19.039	16.687	19.152	18.221
3/14/96 10:55	1616.00	21.267	19.614	19.710	19.023	16.687	19.152	18.217
3/14/96 10:57	1618.00	21.267	19.604	19.710	19.023	16.671	19.140	18.212
3/14/96 10:59	1620.00	21.210	19.212	19.602	18.959	16.671	19.089	18.179
3/14/96 11:01	1622.00	21.141	19.141	19.558	18.912	16.655	19.038	18.132
3/14/96 11:03	1624.00	21.103	19.099	19.513	18.880	16.655	19.007	18.094
3/14/96 11:05	1626.00	21.071	19.070	19.494	18.848	16.640	18.982	18.070
3/14/96 11:07	1628.00	21.040	19.042	19.472	18.832	16.624	18.956	18.051

Date and Time	Minutes	BW2G	65G	66G	Well ID 62G	05G	67G	INT4
3/14/96 11:09	1630.00	21.015	19.018	19.447	18.816	16.608	18.937	18.032
3/14/96 11:11	1632.00	20.996	18.999	19.437	18.801	16.592	18.918	18.018
3/14/96 11:13	1634.00	20.977	18.976	19.412	18.769	16.592	18.906	17.999
3/14/96 11:15	1636.00	20.970	18.962	19.399	18.769	16.577	18.893	17.990
3/14/96 11:17	1638.00	20.951	18.947	19.387	18.753	16.561	18.880	17.976
3/14/96 11:19	1640.00	20.939	18.938	19.377	18.737	16.561	18.861	17.962
3/14/96 11:21	1642.00	20.933	18.924	19.371	18.721	16.545	18.855	17.957
3/14/96 11:23	1644.00	20.926	18.910	19.358	18.721	16.529	18.843	17.947
3/14/96 11:25	1646.00	20.920	18.900	19.352	18.705	16.529	18.836	17.938
3/14/96 11:27	1648.00	20.869	18.546	19.270	18.658	16.514	18.786	17.910
3/14/96 11:29	1650.00	20.806	18.480	19.219	18.610	16.514	18.741	17.858
3/14/96 11:31	1652.00	20.756	18.432	19.178	18.563	16.498	18.703	17.829
3/14/96 11:33	1654.00	20.718	18.399	19.153	18.547	16.482	18.678	17.801
3/14/96 11:35	1656.00	20.693	18.380	19.127	18.515	16.482	18.653	17.782
3/14/96 11:37	1658.00	20.667	18.347	19.108	18.499	16.451	18.628	17.758
3/14/96 11:39	1660.00	20.648	18.324	19.086	18.467	16.451	18.609	17.744
3/14/96 11:41	1662.00	20.629	18.305	19.064	18.451	16.419	18.590	17.725
3/14/96 11:43	1664.00	20.617	18.291	19.051	18.451	16.419	18.577	17.711
3/14/96 11:45	1666.00	20.591	17.946	18.997	18.404	16.404	18.545	17.692
3/14/96 11:47	1668.00	20.516	17.837	18.915	18.340	16.388	18.482	17.640
3/14/96 11:49	1670.00	20.446	17.780	18.858	18.277	16.388	18.432	17.598
3/14/96 11:51	1672.00	20.396	17.728	18.830	18.245	16.372	18.394	17.560
3/14/96 11:53	1674.00	20.364	17.690	18.798	18.213	16.341	18.362	17.527
3/14/96 11:55	1676.00	20.339	17.657	18.769	18.182	16.325	18.343	17.508
3/14/96 11:57	1678.00	20.314	17.629	18.744	18.166	16.309	18.312	17.480
3/14/96 11:59	1680.00	20.288	17.605	18.722	18.150	16.294	18.293	17.465
3/14/96 12:01	1682.00	20.269	17.582	18.712	18.118	16.278	18.274	17.442
3/14/96 12:03	1684.00	20.257	17.563	18.681	18.102	16.262	18.255	17.423
3/14/96 12:05	1686.00	20.238	17.544	18.665	18.087	16.246	18.236	17.413
3/14/96 12:07	1688.00	20.219	17.525	18.652	18.071	16.231	18.223	17.394
3/14/96 12:09	1690.00	20.206	17.506	18.640	18.055	16.231	18.210	17.380
3/14/96 12:11	1692.00	20.194	17.497	18.627	18.055	16.231	18.198	17.376
3/14/96 12:13	1694.00	20.181	17.478	18.617	18.039	16.215	18.185	17.366
3/14/96 12:15	1696.00	20.168	17.464	18.602	18.023	16.199	18.173	17.352
3/14/96 12:17	1698.00	20.156	17.449	18.586	18.007	16.183	18.160	17.338
3/14/96 12:19	1700.00	20.099	15.411	18.361	17.880	16.168	18.059	17.300
3/14/96 12:21	1702.00	19.802	18.154	18.348	17.769	16.152	17.939	17.106
3/14/96 12:23	1704.00	20.168	18.825	18.820	18.118	16.136	18.210	17.324
3/14/96 12:25	1706.00	20.446	19.075	19.013	18.309	16.136	18.387	17.494
3/14/96 12:27	1708.00	19.928	19.203	19.086	18.340	16.183	18.438	17.598
3/14/96 12:29	1710.00	17.318	18.862	18.608	17.658	16.183	17.907	17.229
3/14/96 12:31	1712.00	16.705	18.612	18.310	17.309	16.152	17.597	16.903
3/14/96 12:33	1714.00	16.332	18.418	18.098	17.055	16.089	17.370	16.695
3/14/96 12:35	1716.00	16.288	18.324	18.016	16.976	16.010	17.281	16.591
3/14/96 12:37	1718.00	16.206	18.248	17.933	16.897	15.948	17.199	16.515
3/14/96 12:39	1720.00	16.142	18.191	17.883	16.833	15.885	17.129	16.444
3/14/96 12:41	1722.00	16.085	18.135	17.835	16.785	15.837	17.079	16.397

Date and Time	Minutes	BW2G	65G	66G	Well ID 62G	05G	67G	INT4
3/14/96 12:43	1724.00	16.035	18.087	17.791	16.754	15.806	17.035	16.355
3/14/96 12:45	1726.00	15.991	18.045	17.743	16.722	15.759	16.990	16.312
3/14/96 12:47	1728.00	15.953	18.012	17.715	16.674	15.712	16.952	16.279
3/14/96 12:49	1730.00	15.921	17.974	17.677	16.643	15.696	16.921	16.251
3/14/96 12:51	1732.00	15.889	17.941	17.648	16.611	15.665	16.889	16.218
3/14/96 12:53	1734.00	15.864	17.913	17.623	16.595	15.649	16.864	16.184
3/14/96 12:55	1736.00	15.839	17.889	17.607	16.563	15.617	16.839	16.156
3/14/96 12:57	1738.00	15.813	17.865	17.585	16.547	15.602	16.813	16.132
3/14/96 12:59	1740.00	15.788	17.842	17.556	16.516	15.570	16.788	16.137
3/14/96 13:01	1742.00	15.769	17.818	17.531	16.500	15.554	16.769	16.095
3/14/96 13:03	1744.00	15.744	17.794	17.515	16.484	15.523	16.744	16.090
3/14/96 13:05	1746.00	15.725	17.776	17.499	16.452	15.507	16.725	16.057
3/14/96 13:07	1748.00	15.706	17.757	17.487	16.452	15.492	16.712	16.043
3/14/96 13:09	1750.00	15.687	17.738	17.464	16.405	15.476	16.687	16.028

APPENDIX C

Aquifer Test Ground-Water Quality Data

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Aquifer Pump Test - Well BW2G at X701B
Water Quality Data - March 12 - 14, 1996

Date	Time	Barom. Press. (mm Hg)	Temp. (°C)	Conductivity (µS)	pH
3/12/96	12:00	30.00	15.08	588	5.76
3/12/96	12:59	29.97	15.58	586	5.73
3/12/96	13:59	29.91	15.53	579	5.68
3/12/96	15:00	29.90	15.02	581	5.70
3/12/96	16:00	29.87	15.51	577	5.68
3/13/96	9:00	29.90	14.40	595	5.58
3/13/96	10:00	29.85	14.75	591	5.66
3/13/96	11:00	29.84	15.43	589	5.63
3/13/96	12:00	29.80	16.10	586	5.58
3/13/96	13:00	29.77	15.56	589	5.64
3/13/96	14:00	29.75	15.45	588	5.62
3/13/96	15:00	29.75	15.48	588	5.61
3/13/96	16:00	29.73	15.36	585	5.63
3/13/96	17:00	29.70	15.36	585	5.62
3/13/96	18:00	29.70	15.16	586	5.64
3/13/96	19:00	29.72	14.88	583	5.70
3/13/96	20:00	29.70	14.88	585	5.71
3/13/96	21:00	29.72	14.88	584	5.74
3/13/96	22:00	29.76	14.91	584	5.69
3/13/96	23:00	29.76	14.93	585	5.72
3/14/96	0:00	29.76	14.75	585	5.70
3/14/96	1:00	29.45	14.81	585	5.73
3/14/96	2:00	29.75	14.83	584	5.69
3/14/96	3:00	29.44	14.68	586	5.71
3/14/96	4:00	29.44	14.77	583	5.70
3/14/96	5:00	29.44	14.85	584	5.72
3/14/96	6:00	29.44	14.75	586	5.71
3/14/96	7:00	29.44	14.80	585	5.70
3/14/96	8:00	29.70	14.88	586	5.71

APPENDIX D

Aquifer Test GC Analysis Results

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Aquifer Pump Test - Well BW2G at X701B
TCE Concentration Data - March 12 - 14, 1996

Sample ID	Date	Time	TCE (ppm)	Pump Rate
BW2/G/1	3/12/96	12:00	132.0	7.5 gpm
BW2/G/2	3/12/96	13:00	133.0	
BW2/G/3	3/12/96	14:00	112.0	
BW2/G/4	3/12/96	15:00	101.0	
BW2/G/5	3/12/96	16:00	95.6	
BW2/G/6	3/13/96	9:00	73.4	5.1 gpm
BW2/G/7	3/13/96	10:00	63.3	
BW2/G/8	3/13/96	11:00	76.4	
BW2/G/9	3/13/96	12:00	72.8	
BW2/G/10	3/13/96	13:00	61.8	
BW2/G/11	3/13/96	14:00	60.6	
BW2/G/12	3/13/96	15:00	68.8	
BW2/G/13	3/13/96	16:00	50.1	
BW2/G/14	3/13/96	17:00	54.8	
BW2/G/15	3/13/96	18:00	46.6	
BW2/G/16	3/13/96	19:00	65.2	
BW2/G/17	3/13/96	20:00	62.4	
BW2/G/18	3/13/96	21:00	74.9	
BW2/G/19	3/13/96	22:00	85.5	
BW2/G/20	3/13/96	23:00	69.0	
BW2/G/21	3/13/96	23:59	84.0	
BW2/G/22	3/14/96	1:00	76.3	
BW2/G/23	3/14/96	2:00	65.4	
BW2/G/24	3/14/96	3:00	73.6	
BW2/G/25	3/14/96	4:00	64.8	
BW2/G/26	3/14/96	5:00	78.5	
BW2/G/27	3/14/96	6:00	83.7	
BW2/G/28	3/14/96	7:00	80.0	
BW2/G/29	3/14/96	8:00	81.6	
BW2/G/30	3/14/96	9:00	84.4	

APPENDIX E

PITT-1 Piezometric Data

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Partitioning Interwell Tracer Test 1
Piezometric Data - July 17 - 30, 1996

		Well ID						
Date and Time	Minutes	INT3	BW2G	62G	66G	67G	INT4	65G
7/17/96 18:15	0	19.297	18.525	17.462	12.000	17.753	16.785	18.345
7/17/96 18:30	15	19.039	18.113	17.085	6.484	17.545	16.525	18.044
7/17/96 18:45	30	19.719	18.848	18.060	16.459	18.069	17.215	18.757
7/17/96 19:00	45	20.179	19.481	18.547	18.035	18.509	17.658	19.248
7/17/96 19:15	60	19.455	18.265	17.541	5.585	17.932	16.930	18.488
7/17/96 19:30	75	19.310	18.506	17.431	5.727	17.781	16.797	18.330
7/17/96 19:45	90	19.234	18.392	17.337	5.475	17.710	16.722	18.219
7/17/96 20:00	105	19.209	18.405	17.337	5.443	17.686	16.703	18.219
7/17/96 20:15	120	19.241	18.746	17.400	6.941	17.701	16.734	18.250
7/17/96 20:30	135	19.291	18.575	17.447	6.720	17.743	16.778	18.282
7/17/96 20:45	150	19.316	18.392	17.462	6.562	17.767	16.797	18.298
7/17/96 21:00	165	19.316	18.398	17.462	6.405	17.762	16.804	18.298
7/17/96 21:15	180	19.316	18.531	17.478	6.310	17.772	16.804	18.298
7/17/96 21:30	195	19.304	18.772	17.447	6.247	17.753	16.791	18.282
7/17/96 21:45	210	19.310	18.708	17.462	6.168	17.767	16.797	18.298
7/17/96 22:00	225	19.322	18.683	17.462	6.184	17.772	16.810	18.298
7/17/96 22:15	240	19.272	18.468	17.415	6.058	17.720	16.766	18.250
7/17/96 22:30	255	19.260	18.582	17.384	5.995	17.710	16.753	18.234
7/17/96 22:45	270	19.253	18.474	17.400	5.979	17.701	16.747	18.234
7/17/96 23:00	285	19.253	18.316	17.400	5.979	17.701	16.747	18.219
7/17/96 23:15	300	19.215	18.329	17.352	5.916	17.667	16.715	18.203
7/17/96 23:30	315	19.203	18.537	17.337	5.885	17.653	16.703	18.171
7/17/96 23:45	330	19.190	18.373	17.337	5.885	17.644	16.690	18.171
7/18/96 0:00	345	19.178	18.556	17.321	5.869	17.630	16.677	18.155
7/18/96 0:15	360	19.171	18.246	17.305	5.869	17.620	16.671	18.139
7/18/96 0:30	375	19.159	18.354	17.305	5.822	17.611	16.665	18.124
7/18/96 0:45	390	19.537	18.803	17.855	15.640	17.904	17.032	18.535
7/18/96 1:00	405	19.870	19.069	18.186	16.002	18.225	17.354	18.868
7/18/96 1:15	420	19.996	19.196	18.311	16.175	18.348	17.475	19.011
7/18/96 1:30	435	20.065	19.221	18.374	16.238	18.419	17.544	19.090
7/18/96 1:45	450	20.109	19.848	18.437	16.286	18.467	17.588	19.137
7/18/96 2:00	465	20.147	19.348	18.469	16.238	18.504	17.626	19.185
7/18/96 2:15	480	20.185	19.266	18.500	16.317	18.537	17.658	19.217
7/18/96 2:30	495	20.210	19.449	18.531	16.333	18.561	17.683	19.232
7/18/96 2:45	510	20.210	19.418	18.531	16.333	18.571	17.683	19.248
7/18/96 3:00	525	20.223	19.462	18.547	16.333	18.585	17.696	19.264
7/18/96 3:15	540	20.242	19.937	18.563	16.365	18.589	17.715	19.280
7/18/96 3:30	555	20.254	19.297	18.563	16.333	18.608	17.728	19.280
7/18/96 3:45	570	20.260	19.430	18.579	16.380	18.618	17.734	19.296
7/18/96 4:00	585	20.279	19.424	18.594	16.349	18.627	17.740	19.296
7/18/96 4:15	600	20.286	19.525	18.610	16.365	18.641	17.753	19.312
7/18/96 4:30	615	20.286	19.443	18.610	16.333	18.641	17.753	19.312

Date and Time	Minutes	INT3	BW2G	62G	66G	67G	INT4	65G
					Well ID			
7/18/96 4:45	630	20.298	19.614	18.610	16.365	18.656	17.766	19.327
7/18/96 5:00	645	20.311	19.943	18.626	16.365	18.665	17.778	19.343
7/18/96 5:15	660	20.323	19.386	18.642	16.380	18.675	17.785	19.343
7/18/96 5:30	675	20.336	19.544	18.657	16.412	18.689	17.797	19.359
7/18/96 5:45	690	20.355	19.620	18.673	16.365	18.712	17.823	19.375
7/18/96 6:00	705	20.361	19.437	18.689	16.380	18.722	17.829	19.391
7/18/96 6:15	720	20.367	19.620	18.689	16.380	18.727	17.835	19.391
7/18/96 6:30	735	20.361	19.639	18.673	16.396	18.717	17.823	19.391
7/18/96 6:45	750	20.361	19.418	18.689	16.380	18.722	17.829	19.391
7/18/96 7:00	765	20.374	19.608	18.689	16.396	18.727	17.842	19.391
7/18/96 7:15	780	20.380	19.570	18.704	16.412	18.736	17.848	19.407
7/18/96 7:30	795	20.380	19.589	18.704	16.396	18.741	17.848	19.407
7/18/96 7:45	810	20.355	19.538	18.673	16.317	18.712	17.823	19.375
7/18/96 8:00	825	20.386	19.652	18.704	16.412	18.741	17.848	19.407
7/18/96 8:15	840	20.386	19.671	18.704	16.396	18.741	17.854	19.407
7/18/96 8:30	855	20.405	19.722	18.720	16.365	18.760	17.867	19.423
7/18/96 8:45	870	20.412	19.487	18.736	16.396	18.774	17.879	19.438
7/18/96 9:00	885	20.405	20.152	18.736	16.380	18.764	17.867	19.423
7/18/96 9:15	900	20.418	19.633	18.736	16.396	18.779	17.879	19.438
7/18/96 9:30	915	20.424	19.513	18.736	16.443	18.779	17.886	19.438
7/18/96 9:45	930	20.418	19.981	18.736	16.412	18.779	17.886	19.438
7/18/96 10:00	945	20.412	19.741	18.720	16.365	18.774	17.879	19.438
7/18/96 10:15	960	20.412	19.696	18.720	16.412	18.774	17.879	19.438
7/18/96 10:30	975	20.418	19.633	18.736	16.380	18.769	17.879	19.438
7/18/96 10:45	990	20.223	19.373	18.484	13.292	18.608	17.690	19.232
7/18/96 11:00	1005	20.147	19.361	18.406	13.166	18.542	17.620	19.153
7/18/96 11:15	1020	20.147	19.234	18.421	12.173	18.533	17.620	19.153
7/18/96 11:30	1035	19.814	18.962	17.997	8.942	18.249	17.291	18.805
7/18/96 11:45	1050	19.725	18.854	17.903	8.816	18.154	17.209	18.710
7/18/96 12:00	1065	19.681	18.765	17.871	8.816	18.117	17.171	18.662
7/18/96 12:15	1080	19.650	19.082	17.840	8.753	18.079	17.139	18.630
7/18/96 12:30	1095	19.637	18.759	17.824	8.769	18.065	17.120	18.599
7/18/96 12:45	1110	19.618	18.753	17.808	8.690	18.046	17.101	18.583
7/18/96 13:00	1125	19.593	18.753	17.793	8.643	18.032	17.082	18.567
7/18/96 13:15	1140	19.404	18.506	17.541	6.720	17.852	16.892	18.345
7/18/96 13:30	1155	19.348	18.462	17.494	6.499	17.795	16.835	18.298
7/18/96 13:45	1170	19.297	18.227	17.447	6.326	17.757	16.804	18.250
7/18/96 14:00	1185	19.260	18.582	17.384	6.216	17.701	16.766	18.203
7/18/96 14:15	1200	19.209	18.221	17.352	6.121	17.663	16.715	18.155
7/18/96 14:30	1215	19.184	18.221	17.337	6.105	17.639	16.690	18.139
7/18/96 14:45	1230	19.171	18.215	17.305	6.027	17.620	16.677	18.108
7/18/96 15:00	1245	18.982	17.999	17.069	4.119	17.455	16.494	17.918
7/18/96 15:15	1260	18.926	18.126	17.022	3.978	17.393	16.437	17.854
7/18/96 15:30	1275	18.894	17.606	16.975	3.915	17.374	16.411	17.823
7/18/96 15:45	1290	18.894	18.196	16.991	3.883	17.355	16.405	17.807
7/18/96 16:00	1305	18.888	17.543	16.975	3.883	17.355	16.399	17.807
7/18/96 16:15	1320	18.850	17.910	16.944	3.599	17.322	16.361	17.759

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Date and Time	Minutes	INT3	BW2G	62G	66G	67G	INT4	65G
7/18/96 16:30	1335	18.825	17.853	16.912	3.568	17.294	16.335	17.743
7/18/96 16:45	1350	18.806	17.847	16.896	3.442	17.275	16.323	17.712
7/18/96 17:00	1365	18.806	17.860	16.896	3.363	17.275	16.323	17.712
7/18/96 17:15	1380	18.812	17.853	16.912	3.631	17.280	16.323	17.728
7/18/96 17:30	1395	18.869	17.942	16.991	4.624	17.327	16.380	17.775
7/18/96 17:45	1410	18.882	17.968	17.006	4.561	17.341	16.392	17.791
7/18/96 18:00	1425	18.888	17.930	17.006	4.466	17.341	16.399	17.791
7/18/96 18:15	1440	18.875	17.891	16.991	4.340	17.327	16.380	17.775
7/18/96 18:30	1455	18.882	18.284	16.991	4.261	17.336	16.399	17.791
7/18/96 18:45	1470	18.894	17.942	17.022	4.183	17.346	16.405	17.807
7/18/96 19:00	1485	19.064	18.113	17.227	7.256	17.488	16.570	17.965
7/18/96 19:15	1500	19.121	18.272	17.321	8.722	17.549	16.627	18.044
7/18/96 19:30	1515	19.020	18.677	17.148	4.892	17.459	16.525	17.933
7/18/96 19:45	1530	18.995	17.720	17.117	4.860	17.445	16.506	17.918
7/18/96 20:00	1545	18.989	18.094	17.132	4.813	17.431	16.494	17.902
7/18/96 20:15	1560	18.982	18.018	17.117	4.671	17.426	16.494	17.886
7/18/96 20:30	1575	18.976	17.974	17.117	4.624	17.417	16.487	17.886
7/18/96 20:45	1590	18.970	18.208	17.101	4.608	17.407	16.481	17.870
7/18/96 21:00	1605	18.957	18.012	17.101	4.608	17.403	16.462	17.854
7/18/96 21:15	1620	18.945	17.999	17.085	4.561	17.393	16.449	17.854
7/18/96 21:30	1635	18.926	17.980	17.069	4.514	17.374	16.437	17.838
7/18/96 21:45	1650	18.913	18.291	17.054	4.482	17.360	16.424	17.823
7/18/96 22:00	1665	18.913	18.113	17.038	4.450	17.355	16.418	17.807
7/18/96 22:15	1680	18.907	17.961	17.038	4.419	17.351	16.418	17.807
7/18/96 22:30	1695	18.913	18.037	17.038	4.387	17.355	16.424	17.807
7/18/96 22:45	1710	18.920	18.025	17.069	4.403	17.365	16.430	17.823
7/18/96 23:00	1725	18.913	17.917	17.054	4.403	17.360	16.424	17.807
7/18/96 23:15	1740	18.945	18.006	17.085	4.419	17.384	16.449	17.838
7/18/96 23:30	1755	18.938	18.354	17.085	4.419	17.389	16.443	17.838
7/18/96 23:45	1770	18.938	18.037	17.069	4.403	17.379	16.443	17.838
7/19/96 0:00	1785	18.932	18.031	17.085	4.419	17.379	16.443	17.838
7/19/96 0:15	1800	18.932	18.012	17.069	4.419	17.374	16.443	17.823
7/19/96 0:30	1815	18.938	17.949	17.069	4.403	17.379	16.443	17.823
7/19/96 0:45	1830	18.945	18.107	17.085	4.387	17.384	16.449	17.838
7/19/96 1:00	1845	18.932	18.044	17.085	4.387	17.379	16.443	17.838
7/19/96 1:15	1860	18.926	17.993	17.085	4.387	17.374	16.437	17.823
7/19/96 1:30	1875	18.913	17.942	17.054	4.387	17.365	16.424	17.807
7/19/96 1:45	1890	18.907	17.993	17.038	4.356	17.351	16.418	17.807
7/19/96 2:00	1905	18.907	17.968	17.054	4.356	17.351	16.418	17.807
7/19/96 2:15	1920	18.901	17.968	17.038	4.340	17.346	16.411	17.791
7/19/96 2:30	1935	18.901	17.847	17.038	4.309	17.346	16.418	17.807
7/19/96 2:45	1950	18.888	17.758	17.038	4.261	17.327	16.399	17.791
7/19/96 3:00	1965	18.875	18.246	17.006	4.261	17.313	16.386	17.759
7/19/96 3:15	1980	18.875	18.253	17.022	4.246	17.322	16.386	17.775
7/19/96 3:30	1995	18.875	17.999	17.022	4.261	17.318	16.386	17.775
7/19/96 3:45	2010	18.869	18.202	17.006	4.230	17.308	16.386	17.759
7/19/96 4:00	2025	18.875	17.847	16.991	4.214	17.308	16.380	17.759

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7/19/96 4:15	2040	18.882	17.866	17.022	4.214	17.327	16.392	17.775
7/19/96 4:30	2055	18.875	17.891	17.006	4.183	17.313	16.380	17.759
7/19/96 4:45	2070	18.857	17.917	16.991	4.135	17.303	16.367	17.759
7/19/96 5:00	2085	18.850	18.189	16.991	4.119	17.294	16.361	17.743
7/19/96 5:15	2100	18.850	18.063	16.991	4.088	17.280	16.361	17.743
7/19/96 5:30	2115	18.850	18.316	16.975	4.088	17.289	16.361	17.743
7/19/96 5:45	2130	18.850	17.879	17.006	4.104	17.303	16.367	17.743
7/19/96 6:00	2145	18.850	17.879	16.975	4.041	17.294	16.354	17.743
7/19/96 6:15	2160	18.844	17.885	16.975	4.025	17.284	16.348	17.743
7/19/96 6:30	2175	18.831	18.341	16.975	3.993	17.280	16.348	17.728
7/19/96 6:45	2190	18.838	17.841	16.975	4.009	17.275	16.348	17.728
7/19/96 7:00	2205	18.831	18.158	16.959	3.993	17.275	16.348	17.728
7/19/96 7:15	2220	18.838	17.853	16.975	3.978	17.280	16.342	17.728
7/19/96 7:30	2235	18.812	18.139	16.959	3.993	17.261	16.329	17.712
7/19/96 7:45	2250	18.806	17.834	16.944	3.993	17.251	16.323	17.696
7/19/96 8:00	2265	18.825	17.701	16.944	3.993	17.256	16.329	17.712
7/19/96 8:15	2280	18.806	17.822	16.928	3.978	17.247	16.316	17.696
7/19/96 8:30	2295	18.825	17.828	16.959	3.930	17.266	16.335	17.728
7/19/96 8:45	2310	18.812	17.872	16.944	3.899	17.261	16.323	17.712
7/19/96 9:00	2325	18.970	18.151	17.132	4.072	17.417	16.468	17.838
7/19/96 9:15	2340	19.020	18.500	17.179	4.041	17.459	16.513	17.902
7/19/96 9:30	2355	19.033	18.392	17.195	4.009	17.478	16.525	17.902
7/19/96 9:45	2370	19.071	18.120	17.227	3.993	17.511	16.557	17.933
7/19/96 10:00	2385	19.083	18.284	17.242	3.993	17.526	16.570	17.965
7/19/96 10:15	2400	19.096	18.259	17.258	4.009	17.540	16.582	17.965
7/19/96 10:30	2415	19.090	18.139	17.242	3.946	17.530	16.576	17.965
7/19/96 10:45	2430	19.096	18.164	17.242	3.978	17.540	16.582	17.965
7/19/96 11:00	2445	19.102	18.594	17.258	3.993	17.545	16.589	17.981
7/19/96 11:15	2460	19.108	18.303	17.258	3.978	17.554	16.595	17.981
7/19/96 11:30	2475	19.115	18.500	17.274	3.993	17.549	16.595	17.981
7/19/96 11:45	2490	19.127	18.297	17.274	3.962	17.563	16.608	17.997
7/19/96 12:00	2505	19.127	18.322	17.289	3.930	17.573	16.614	17.997
7/19/96 12:15	2520	19.127	18.588	17.289	3.946	17.568	16.608	17.997
7/19/96 12:30	2535	19.121	18.253	17.289	3.915	17.568	16.608	17.997
7/19/96 12:45	2550	19.127	18.310	17.289	3.789	17.568	16.608	17.997
7/19/96 13:00	2565	19.121	18.265	17.274	3.946	17.563	16.608	17.997
7/19/96 13:15	2580	19.184	18.348	17.337	4.293	17.620	16.665	18.060
7/19/96 13:30	2595	19.134	18.297	17.305	4.214	17.582	16.627	18.013
7/19/96 13:45	2610	19.127	18.481	17.289	4.041	17.563	16.608	18.013
7/19/96 14:00	2625	19.115	18.221	17.274	3.962	17.563	16.608	17.997
7/19/96 14:15	2640	19.090	18.474	17.258	4.198	17.535	16.582	17.981
7/19/96 14:30	2655	19.045	18.151	17.195	3.505	17.488	16.538	17.933
7/19/96 14:45	2670	19.027	18.107	17.195	3.489	17.478	16.525	17.918
7/19/96 15:00	2685	19.014	18.335	17.164	3.347	17.464	16.513	17.902
7/19/96 15:15	2700	19.020	18.107	17.164	3.284	17.459	16.506	17.902
7/19/96 15:30	2715	19.027	18.025	17.179	3.253	17.469	16.519	17.918
7/19/96 15:45	2730	19.008	18.082	17.164	3.000	17.455	16.500	17.886

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Date and Time	Minutes	INT3	BW2G	62G	66G	67G	INT4	65G
7/19/96 16:00	2745	19.008	18.291	17.148	2.969	17.450	16.500	17.886
7/19/96 16:15	2760	18.995	18.107	17.148	2.827	17.445	16.494	17.886
7/19/96 16:30	2775	18.995	18.088	17.148	2.859	17.455	16.487	17.886
7/19/96 16:45	2790	18.976	18.373	17.117	2.811	17.426	16.468	17.870
7/19/96 17:00	2805	18.982	18.063	17.132	2.732	17.426	16.481	17.870
7/19/96 17:15	2820	18.982	18.025	17.117	2.732	17.422	16.475	17.870
7/19/96 17:30	2835	18.976	18.183	17.132	2.701	17.426	16.481	17.870
7/19/96 17:45	2850	18.989	18.272	17.148	2.654	17.422	16.481	17.870
7/19/96 18:00	2865	18.819	17.568	16.912	2.480	17.251	16.348	17.743
7/19/96 18:15	2880	18.422	17.359	16.503	2.212	16.873	15.994	17.379
7/19/96 18:30	2895	18.328	16.422	16.409	2.023	16.774	15.905	17.284
7/19/96 18:45	2910	18.346	17.537	16.472	1.897	16.816	15.911	17.300
7/19/96 19:00	2925	18.762	18.164	16.912	2.165	17.204	16.272	17.648
7/19/96 19:15	2940	18.844	17.961	16.991	2.212	17.289	16.354	17.728
7/19/96 19:30	2955	18.882	18.322	17.038	2.260	17.327	16.386	17.775
7/19/96 19:45	2970	18.907	18.240	17.054	2.291	17.351	16.411	17.807
7/19/96 20:00	2985	18.932	18.373	17.085	2.275	17.374	16.437	17.823
7/19/96 20:15	3000	18.951	18.316	17.101	2.165	17.393	16.449	17.838
7/19/96 20:30	3015	18.945	18.303	17.101	2.165	17.389	16.449	17.838
7/19/96 20:45	3030	18.932	17.904	17.085	2.102	17.365	16.443	17.838
7/19/96 21:00	3045	18.938	18.322	17.085	2.134	17.379	16.449	17.838
7/19/96 21:15	3060	18.957	18.613	17.101	2.023	17.398	16.462	17.854
7/19/96 21:30	3075	18.964	18.303	17.117	2.070	17.403	16.468	17.854
7/19/96 21:45	3090	18.964	18.550	17.117	1.992	17.412	16.468	17.854
7/19/96 22:00	3105	18.970	18.417	17.117	1.992	17.417	16.481	17.870
7/19/96 22:15	3120	18.982	18.544	17.132	1.944	17.426	16.487	17.870
7/19/96 22:30	3135	18.982	18.411	17.132	1.913	17.426	16.494	17.870
7/19/96 22:45	3150	18.982	18.417	17.132	1.897	17.422	16.494	17.870
7/19/96 23:00	3165	19.001	18.417	17.148	1.929	17.441	16.506	17.886
7/19/96 23:15	3180	19.014	18.367	17.164	1.850	17.455	16.513	17.902
7/19/96 23:30	3195	19.014	18.613	17.164	1.881	17.455	16.519	17.902
7/19/96 23:45	3210	19.008	18.512	17.148	1.803	17.455	16.519	17.902
7/20/96 0:00	3225	19.014	18.348	17.164	1.818	17.459	16.525	17.918
7/20/96 0:15	3240	19.027	18.430	17.164	1.739	17.459	16.532	17.902
7/20/96 0:30	3255	19.039	19.050	17.195	1.739	17.483	16.544	17.933
7/20/96 0:45	3270	19.039	18.518	17.195	1.755	17.478	16.544	17.918
7/20/96 1:00	3285	19.045	17.987	17.211	1.771	17.474	16.551	17.933
7/20/96 1:15	3300	19.039	18.405	17.195	1.976	17.483	16.551	17.933
7/20/96 1:30	3315	19.058	18.310	17.195	1.866	17.488	16.557	17.933
7/20/96 1:45	3330	19.071	18.506	17.227	1.850	17.507	16.576	17.965
7/20/96 2:00	3345	19.077	18.626	17.242	1.803	17.511	16.582	17.949
7/20/96 2:15	3360	19.083	18.544	17.242	2.559	17.521	16.589	17.981
7/20/96 2:30	3375	19.102	18.512	17.258	2.433	17.540	16.608	17.997
7/20/96 2:45	3390	19.121	18.462	17.274	2.370	17.549	16.627	18.013
7/20/96 3:00	3405	19.140	18.632	17.289	2.307	17.568	16.646	18.029
7/20/96 3:15	3420	19.152	18.506	17.305	1.645	17.587	16.658	18.044
7/20/96 3:30	3435	19.108	18.651	17.242	1.156	17.545	16.608	17.997

Date and Time	Minutes	INT3	BW2G	62G	Well ID 66G	67G	INT4	65G
7/20/96 3:45	3450	19.083	18.443	17.227	1.251	17.521	16.589	17.965
7/20/96 4:00	3465	19.083	18.613	17.227	1.251	17.526	16.589	17.965
7/20/96 4:15	3480	19.102	18.506	17.242	1.361	17.535	16.608	17.981
7/20/96 4:30	3495	19.121	18.525	17.274	1.424	17.563	16.627	17.997
7/20/96 4:45	3510	19.127	18.651	17.274	1.393	17.563	16.627	18.013
7/20/96 5:00	3525	19.127	18.424	17.274	1.330	17.563	16.627	18.013
7/20/96 5:15	3540	19.102	18.417	17.242	1.030	17.545	16.608	17.997
7/20/96 5:30	3555	19.108	18.639	17.242	1.109	17.545	16.614	17.981
7/20/96 5:45	3570	19.121	18.664	17.258	0.983	17.559	16.620	17.997
7/20/96 6:00	3585	19.121	18.620	17.274	1.062	17.545	16.627	17.997
7/20/96 6:15	3600	19.102	18.405	17.242	0.494	17.540	16.608	17.997
7/20/96 6:30	3615	19.096	18.512	17.227	0.668	17.530	16.601	17.981
7/20/96 6:45	3630	19.102	18.424	17.242	0.746	17.540	16.608	17.981
7/20/96 7:00	3645	19.115	18.512	17.258	0.841	17.559	16.620	17.997
7/20/96 7:15	3660	19.108	18.620	17.242	0.699	17.545	16.608	17.981
7/20/96 7:30	3675	19.102	18.360	17.242	0.746	17.545	16.608	17.981
7/20/96 7:45	3690	19.102	18.462	17.227	0.715	17.540	16.608	17.981
7/20/96 8:00	3705	19.108	18.569	17.242	0.683	17.549	16.614	17.981
7/20/96 8:15	3720	19.102	18.537	17.242	0.731	17.545	16.608	17.981
7/20/96 8:30	3735	19.108	18.474	17.227	0.699	17.549	16.614	17.981
7/20/96 8:45	3750	19.108	18.417	17.242	0.731	17.549	16.620	17.997
7/20/96 9:00	3765	19.115	18.537	17.242	0.668	17.554	16.627	17.997
7/20/96 9:15	3780	19.203	18.683	17.368	2.496	17.630	16.703	18.076
7/20/96 9:30	3795	19.222	18.715	17.384	2.449	17.653	16.728	18.108
7/20/96 9:45	3810	19.316	18.708	17.510	4.482	17.729	16.816	18.219
7/20/96 10:00	3825	19.341	18.803	17.510	2.023	17.757	16.848	18.234
7/20/96 10:15	3840	19.197	18.594	17.337	0.400	17.634	16.703	18.076
7/20/96 10:30	3855	19.152	18.405	17.289	0.415	17.592	16.665	18.044
7/20/96 10:45	3870	19.127	18.354	17.258	0.415	17.563	16.639	18.013
7/20/96 11:00	3885	19.039	18.462	17.179	0.337	17.478	16.563	17.933
7/20/96 11:15	3900	19.058	18.392	17.179	0.289	17.493	16.576	17.949
7/20/96 11:30	3915	19.058	18.417	17.211	0.589	17.497	16.576	17.949
7/20/96 11:45	3930	19.052	18.981	17.195	0.447	17.502	16.576	17.949
7/20/96 12:00	3945	19.052	18.316	17.195	0.431	17.493	16.570	17.933
7/20/96 12:15	3960	19.045	18.398	17.179	0.526	17.483	16.563	17.933
7/20/96 12:30	3975	19.052	18.474	17.179	0.337	17.488	16.570	17.949
7/20/96 12:45	3990	19.052	18.525	17.195	0.352	17.488	16.570	17.949
7/20/96 13:00	4005	19.052	18.398	17.195	0.337	17.493	16.570	17.933
7/20/96 13:15	4020	19.039	18.221	17.179	0.352	17.469	16.557	17.933
7/20/96 13:30	4035	19.033	18.227	17.179	0.368	17.474	16.551	17.933
7/20/96 13:45	4050	19.058	18.443	17.211	0.274	17.493	16.576	17.949
7/20/96 14:00	4065	19.071	18.417	17.211	0.321	17.507	16.582	17.965
7/20/96 14:15	4080	19.071	18.208	17.211	0.431	17.502	16.589	17.965
7/20/96 14:30	4095	19.077	18.518	17.227	0.384	17.511	16.595	17.965
7/20/96 14:45	4110	19.090	18.449	17.242	0.258	17.521	16.601	17.981
7/20/96 15:00	4125	19.090	18.348	17.242	0.321	17.521	16.601	17.981
7/20/96 15:15	4140	19.090	18.493	17.242	0.179	17.535	16.601	17.981

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7/20/96 15:30	4155	19.077	18.430	17.227	0.211	17.521	16.589	17.965
7/20/96 15:45	4170	19.077	18.556	17.227	0.289	17.516	16.589	17.965
7/20/96 16:00	4185	19.071	18.436	17.227	0.368	17.507	16.582	17.965
7/20/96 16:15	4200	19.064	18.430	17.227	0.400	17.502	16.582	17.965
7/20/96 16:30	4215	19.071	18.329	17.227	0.415	17.502	16.589	17.965
7/20/96 16:45	4230	19.077	18.367	17.227	0.337	17.507	16.589	17.965
7/20/96 17:00	4245	19.083	18.316	17.242	0.463	17.516	16.595	17.981
7/20/96 17:15	4260	19.090	18.436	17.242	0.415	17.540	16.601	17.981
7/20/96 17:30	4275	19.096	18.297	17.258	0.447	17.526	16.614	17.997
7/20/96 17:45	4290	19.096	18.392	17.258	0.415	17.526	16.608	17.997
7/20/96 18:00	4305	19.001	18.993	17.148	0.195	17.445	16.532	17.918
7/20/96 18:15	4320	18.970	18.354	17.117	0.447	17.398	16.500	17.886
7/20/96 18:30	4335	19.278	18.658	17.541	11.590	17.658	16.797	18.219
7/20/96 18:45	4350	19.096	18.272	17.227	1.613	17.530	16.620	18.029
7/20/96 19:00	4365	18.982	18.329	17.132	0.447	17.417	16.519	17.902
7/20/96 19:15	4380	19.033	18.310	17.195	0.384	17.474	16.557	17.933
7/20/96 19:30	4395	19.058	18.721	17.211	0.384	17.497	16.576	17.965
7/20/96 19:45	4410	19.064	18.348	17.211	0.384	17.497	16.582	17.965
7/20/96 20:00	4425	19.071	18.335	17.227	0.321	17.507	16.589	17.965
7/20/96 20:15	4440	19.102	18.563	17.258	0.463	17.530	16.614	17.981
7/20/96 20:30	4455	19.146	18.898	17.321	0.384	17.582	16.658	18.029
7/20/96 20:45	4470	19.159	18.455	17.321	0.368	17.587	16.665	18.044
7/20/96 21:00	4485	19.165	18.563	17.321	0.510	17.597	16.671	18.060
7/20/96 21:15	4500	19.140	18.392	17.289	-0.561	17.578	16.646	18.013
7/20/96 21:30	4515	19.121	18.544	17.274	-0.529	17.563	16.633	17.997
7/20/96 21:45	4530	19.121	18.594	17.258	-0.592	17.559	16.633	17.997
7/20/96 22:00	4545	19.121	18.569	17.258	-0.687	17.559	16.633	17.997
7/20/96 22:15	4560	19.115	18.474	17.258	-0.640	17.554	16.627	17.997
7/20/96 22:30	4575	19.115	18.582	17.258	-0.734	17.559	16.627	17.981
7/20/96 22:45	4590	19.108	18.462	17.258	-0.781	17.549	16.620	17.981
7/20/96 23:00	4605	19.108	18.411	17.242	-0.750	17.545	16.614	17.981
7/20/96 23:15	4620	19.115	18.556	17.258	-0.845	17.554	16.627	17.981
7/20/96 23:30	4635	19.127	18.500	17.274	-0.797	17.563	16.633	17.997
7/20/96 23:45	4650	19.127	18.575	17.274	-0.797	17.559	16.633	17.997
7/21/96 0:00	4665	19.127	18.721	17.274	-0.845	17.563	16.633	17.997
7/21/96 0:15	4680	19.134	18.626	17.274	-0.876	17.568	16.639	17.997
7/21/96 0:30	4695	19.134	18.613	17.274	-0.939	17.573	16.639	17.997
7/21/96 0:45	4710	19.134	18.550	17.274	-0.892	17.573	16.639	17.997
7/21/96 1:00	4725	19.140	18.398	17.289	-0.781	17.578	16.646	17.997
7/21/96 1:15	4740	19.134	18.537	17.274	-0.860	17.568	16.639	17.997
7/21/96 1:30	4755	19.134	18.556	17.274	-0.939	17.549	16.639	17.997
7/21/96 1:45	4770	19.140	18.512	17.274	-0.908	17.563	16.646	17.997
7/21/96 2:00	4785	19.140	18.525	17.289	-0.923	17.568	16.646	17.997
7/21/96 2:15	4800	19.140	18.398	17.274	-1.002	17.578	16.646	17.997
7/21/96 2:30	4815	19.146	18.398	17.289	-1.002	17.587	16.652	18.013
7/21/96 2:45	4830	19.152	18.424	17.289	-1.018	17.587	16.652	18.013
7/21/96 3:00	4845	19.146	19.050	17.289	-1.018	17.582	16.646	17.997

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7/21/96 3:15	4860	19.121	18.493	17.258	-0.923	17.554	16.639	17.981
7/21/96 3:30	4875	19.121	19.171	17.258	-0.955	17.563	16.633	17.981
7/21/96 3:45	4890	19.140	18.632	17.274	-0.687	17.573	16.646	17.997
7/21/96 4:00	4905	19.152	18.664	17.289	-0.750	17.587	16.652	18.013
7/21/96 4:15	4920	19.146	18.443	17.289	-0.781	17.582	16.652	17.997
7/21/96 4:30	4935	19.159	18.455	17.289	-0.829	17.592	16.658	18.013
7/21/96 4:45	4950	19.152	18.550	17.289	-0.860	17.582	16.652	18.013
7/21/96 5:00	4965	19.146	18.658	17.289	-0.892	17.578	16.652	18.013
7/21/96 5:15	4980	19.140	18.594	17.289	-0.892	17.573	16.646	17.997
7/21/96 5:30	4995	19.146	18.481	17.305	-0.860	17.578	16.652	17.997
7/21/96 5:45	5010	19.146	18.455	17.289	-0.908	17.582	16.652	18.013
7/21/96 6:00	5025	19.140	18.455	17.289	-0.955	17.573	16.646	17.997
7/21/96 6:15	5040	19.140	18.848	17.289	-0.955	17.578	16.646	17.997
7/21/96 6:30	5055	19.165	18.424	17.305	-0.939	17.592	16.665	18.013
7/21/96 6:45	5070	19.159	18.518	17.305	-0.971	17.592	16.665	18.013
7/21/96 7:00	5085	19.171	18.405	17.305	-1.002	17.601	16.671	18.029
7/21/96 7:15	5100	19.165	18.613	17.305	-0.955	17.601	16.671	18.029
7/21/96 7:30	5115	19.171	18.417	17.321	-0.971	17.606	16.677	18.029
7/21/96 7:45	5130	19.178	18.601	17.321	-0.971	17.615	16.684	18.044
7/21/96 8:00	5145	19.184	18.424	17.321	-0.939	17.615	16.690	18.029
7/21/96 8:15	5160	19.278	18.670	17.447	2.922	17.691	16.778	18.139
7/21/96 8:30	5175	19.322	18.715	17.510	2.890	17.738	16.823	18.187
7/21/96 8:45	5190	19.341	18.803	17.525	2.843	17.757	16.842	18.219
7/21/96 9:00	5205	19.467	19.057	17.651	0.132	17.894	16.949	18.314
7/21/96 9:15	5220	19.423	18.772	17.604	-0.041	17.852	16.905	18.282
7/21/96 9:30	5235	19.260	18.715	17.415	-0.198	17.691	16.766	18.139
7/21/96 9:45	5250	19.228	18.601	17.384	-0.261	17.658	16.728	18.092
7/21/96 10:00	5265	19.241	18.664	17.400	1.613	17.667	16.747	18.108
7/21/96 10:15	5280	19.260	18.670	17.431	1.535	17.686	16.766	18.139
7/21/96 10:30	5295	19.266	18.727	17.431	1.361	17.691	16.766	18.139
7/21/96 10:45	5310	19.272	18.639	17.431	1.393	17.701	16.778	18.155
7/21/96 11:00	5325	19.278	18.664	17.447	1.456	17.701	16.778	18.155
7/21/96 11:15	5340	19.278	18.620	17.447	1.361	17.701	16.778	18.155
7/21/96 11:30	5355	19.316	18.639	17.494	1.345	17.743	16.816	18.187
7/21/96 11:45	5370	19.329	18.740	17.494	1.330	17.748	16.823	18.203
7/21/96 12:00	5385	19.329	18.734	17.510	1.188	17.753	16.829	18.203
7/21/96 12:15	5400	19.316	18.689	17.494	1.030	17.743	16.816	18.187
7/21/96 12:30	5415	19.297	18.810	17.462	0.431	17.724	16.797	18.171
7/21/96 12:45	5430	19.285	18.797	17.462	0.447	17.715	16.791	18.171
7/21/96 13:00	5445	19.272	18.569	17.447	0.384	17.701	16.772	18.155
7/21/96 13:15	5460	19.260	18.670	17.431	0.289	17.701	16.760	18.139
7/21/96 13:30	5475	19.266	18.829	17.447	0.242	17.701	16.766	18.139
7/21/96 13:45	5490	19.266	18.727	17.447	0.132	17.705	16.766	18.155
7/21/96 14:00	5505	19.266	18.582	17.431	0.132	17.701	16.766	18.139
7/21/96 14:15	5520	19.260	18.658	17.431	0.021	17.691	16.760	18.139
7/21/96 14:30	5535	19.266	18.677	17.447	-0.025	17.696	16.766	18.139
7/21/96 14:45	5550	19.266	18.537	17.431	-0.088	17.696	16.766	18.139

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7/21/96 15:00	5565	19.247	18.753	17.415	-0.025	17.677	16.747	18.124
7/21/96 15:15	5580	19.253	18.645	17.415	-0.072	17.682	16.753	18.139
7/21/96 15:30	5595	19.234	18.620	17.415	-0.151	17.667	16.734	18.108
7/21/96 15:45	5610	19.278	18.721	17.447	1.030	17.701	16.772	18.139
7/21/96 16:00	5625	19.266	18.677	17.431	-0.624	17.701	16.766	18.139
7/21/96 16:15	5640	19.329	18.936	17.525	0.873	17.762	16.823	18.203
7/21/96 16:30	5655	19.253	18.639	17.431	-0.608	17.686	16.753	18.139
7/21/96 16:45	5670	19.222	18.727	17.400	-0.387	17.658	16.722	18.092
7/21/96 17:00	5685	19.209	18.493	17.384	-0.356	17.644	16.703	18.092
7/21/96 17:15	5700	19.209	18.626	17.384	-0.435	17.649	16.715	18.092
7/21/96 17:30	5715	19.197	18.734	17.368	-0.450	17.630	16.696	18.076
7/21/96 17:45	5730	19.178	18.481	17.337	-0.797	17.611	16.677	18.060
7/21/96 18:00	5745	19.165	18.443	17.321	-0.939	17.597	16.665	18.044
7/21/96 18:15	5760	19.159	18.487	17.321	-0.939	17.592	16.665	18.044
7/21/96 18:30	5775	19.159	18.462	17.321	-0.939	17.592	16.658	18.044
7/21/96 18:45	5790	19.159	18.518	17.337	-0.971	17.597	16.658	18.044
7/21/96 19:00	5805	19.165	18.594	17.337	-1.018	17.601	16.665	18.044
7/21/96 19:15	5820	19.171	18.651	17.337	-0.971	17.611	16.671	18.060
7/21/96 19:30	5835	19.209	18.759	17.368	-0.971	17.649	16.709	18.092
7/21/96 19:45	5850	19.203	18.556	17.368	-0.955	17.644	16.703	18.076
7/21/96 20:00	5865	19.197	18.645	17.368	-0.939	17.634	16.696	18.076
7/21/96 20:15	5880	19.297	18.708	17.478	-0.860	17.729	16.778	18.155
7/21/96 20:30	5895	19.322	18.879	17.494	-0.829	17.753	16.804	18.187
7/21/96 20:45	5910	19.335	18.753	17.510	-0.813	17.767	16.816	18.203
7/21/96 21:00	5925	19.335	18.727	17.510	-0.813	17.772	16.816	18.203
7/21/96 21:15	5940	19.348	18.841	17.525	-0.829	17.781	16.829	18.203
7/21/96 21:30	5955	19.348	18.905	17.525	-0.845	17.781	16.816	18.203
7/21/96 21:45	5970	19.348	18.930	17.525	-0.845	17.781	16.823	18.203
7/21/96 22:00	5985	19.354	18.981	17.525	-0.876	17.786	16.829	18.219
7/21/96 22:15	6000	19.354	18.936	17.525	-0.939	17.790	16.829	18.219
7/21/96 22:30	6015	19.367	18.765	17.541	-0.908	17.800	16.835	18.219
7/21/96 22:45	6030	19.360	19.025	17.525	-0.955	17.795	16.835	18.219
7/21/96 23:00	6045	19.354	18.810	17.525	-0.971	17.786	16.829	18.203
7/21/96 23:15	6060	19.341	18.905	17.510	-1.002	17.776	16.816	18.203
7/21/96 23:30	6075	19.360	18.867	17.541	-0.986	17.795	16.835	18.219
7/21/96 23:45	6090	19.360	18.765	17.541	-1.002	17.800	16.842	18.219
7/22/96 0:00	6105	19.360	18.943	17.541	-0.955	17.795	16.835	18.219
7/22/96 0:15	6120	19.360	18.810	17.541	-0.971	17.795	16.835	18.219
7/22/96 0:30	6135	19.360	18.784	17.525	-0.971	17.790	16.835	18.219
7/22/96 0:45	6150	19.360	18.949	17.525	-0.986	17.790	16.835	18.219
7/22/96 1:00	6165	19.360	18.841	17.525	-0.971	17.795	16.835	18.219
7/22/96 1:15	6180	19.348	18.797	17.510	-0.986	17.776	16.823	18.203
7/22/96 1:30	6195	19.215	18.791	17.368	-1.207	17.649	16.709	18.092
7/22/96 1:45	6210	19.178	18.518	17.337	-1.144	17.611	16.671	18.044
7/22/96 2:00	6225	19.146	18.696	17.305	-1.207	17.573	16.646	18.013
7/22/96 2:15	6240	19.134	18.544	17.274	-1.239	17.559	16.627	17.997
7/22/96 2:30	6255	19.121	18.392	17.274	-1.239	17.554	16.620	17.997

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7/22/96 2:45	6270	19.115	18.620	17.258	-1.223	17.549	16.614	17.981
7/22/96 3:00	6285	19.115	18.373	17.258	-1.286	17.549	16.614	17.981
7/22/96 3:15	6300	19.115	18.778	17.274	-1.239	17.554	16.608	17.981
7/22/96 3:30	6315	19.108	18.474	17.258	-1.223	17.549	16.608	17.981
7/22/96 3:45	6330	19.108	18.588	17.258	-1.239	17.549	16.608	17.981
7/22/96 4:00	6345	19.096	18.601	17.242	-1.302	17.535	16.601	17.965
7/22/96 4:15	6360	19.102	18.430	17.258	-1.302	17.535	16.601	17.965
7/22/96 4:30	6375	19.115	18.601	17.258	-1.286	17.545	16.608	17.981
7/22/96 4:45	6390	19.115	18.386	17.258	-1.317	17.549	16.614	17.981
7/22/96 5:00	6405	19.108	18.632	17.258	-1.302	17.545	16.608	17.965
7/22/96 5:15	6420	19.102	18.594	17.242	-1.349	17.535	16.601	17.965
7/22/96 5:30	6435	19.102	18.443	17.242	-1.333	17.540	16.601	17.965
7/22/96 5:45	6450	19.108	18.613	17.242	-1.317	17.540	16.608	17.965
7/22/96 6:00	6465	19.115	18.379	17.258	-1.349	17.549	16.614	17.981
7/22/96 6:15	6480	19.121	18.594	17.274	-1.317	17.559	16.620	17.981
7/22/96 6:30	6495	19.121	18.632	17.274	-1.365	17.559	16.620	17.997
7/22/96 6:45	6510	19.108	18.569	17.258	-1.365	17.549	16.608	17.981
7/22/96 7:00	6525	19.108	18.443	17.258	-1.365	17.545	16.608	17.981
7/22/96 7:15	6540	19.115	18.613	17.258	-1.286	17.549	16.614	17.981
7/22/96 7:30	6555	19.127	18.886	17.274	-1.286	17.568	16.633	17.997
7/22/96 7:45	6570	19.134	18.398	17.289	-1.349	17.573	16.633	17.997
7/22/96 8:00	6585	19.127	18.582	17.274	-1.349	17.568	16.627	17.997
7/22/96 8:15	6600	19.121	18.632	17.289	-1.412	17.559	16.627	17.997
7/22/96 8:30	6615	19.121	18.417	17.274	-1.270	17.559	16.627	17.997
7/22/96 8:45	6630	18.970	18.411	17.101	-1.317	17.422	16.494	17.870
7/22/96 9:00	6645	19.064	18.360	17.211	-1.349	17.502	16.570	17.933
7/22/96 9:15	6660	19.064	18.398	17.211	-1.365	17.502	16.576	17.933
7/22/96 9:30	6675	19.077	18.531	17.227	-1.239	17.516	16.582	17.949
7/22/96 9:45	6690	19.090	18.468	17.227	-1.380	17.526	16.595	17.949
7/22/96 10:00	6705	19.121	18.367	17.274	-1.333	17.549	16.620	17.981
7/22/96 10:15	6720	19.127	18.645	17.274	-0.939	17.559	16.627	17.997
7/22/96 10:30	6735	19.127	18.493	17.274	-1.428	17.563	16.627	17.997
7/22/96 10:45	6750	19.146	18.639	17.305	-1.160	17.587	16.652	18.013
7/22/96 11:00	6765	19.165	18.512	17.321	-1.254	17.601	16.665	18.029
7/22/96 11:15	6780	19.165	18.443	17.321	-1.286	17.606	16.665	18.029
7/22/96 11:30	6795	19.165	18.588	17.305	-1.270	17.601	16.665	18.029
7/22/96 11:45	6810	19.171	18.506	17.321	-1.270	17.606	16.665	18.029
7/22/96 12:00	6825	19.165	18.417	17.305	-1.365	17.601	16.665	18.029
7/22/96 12:15	6840	19.165	18.436	17.321	-1.302	17.597	16.665	18.029
7/22/96 12:30	6855	19.159	18.696	17.305	-1.302	17.601	16.665	18.029
7/22/96 12:45	6870	19.171	18.468	17.321	-1.302	17.606	16.671	18.029
7/22/96 13:00	6885	19.178	18.683	17.321	-1.333	17.611	16.671	18.044
7/22/96 13:15	6900	19.165	18.879	17.305	-1.349	17.606	16.665	18.029
7/22/96 13:30	6915	19.165	18.443	17.305	-1.239	17.601	16.665	18.029
7/22/96 13:45	6930	19.171	18.512	17.321	-1.349	17.606	16.671	18.029
7/22/96 14:00	6945	19.171	18.556	17.321	-1.349	17.606	16.671	18.044
7/22/96 14:15	6960	19.165	18.259	17.321	-1.333	17.587	16.665	18.029

Date and Time	Minutes	INT3	BW2G	62G	Well ID 66G	67G	INT4	65G
7/22/96 14:30	6975	19.171	18.518	17.321	-1.286	17.606	16.671	18.029
7/22/96 14:45	6990	19.171	18.651	17.321	-1.270	17.601	16.671	18.029
7/22/96 15:00	7005	19.171	18.525	17.321	-1.317	17.601	16.671	18.029
7/22/96 15:15	7020	19.165	18.898	17.337	-1.333	17.597	16.665	18.029
7/22/96 15:30	7035	19.159	18.588	17.305	-1.270	17.597	16.658	18.029
7/22/96 15:45	7050	19.165	18.753	17.321	-1.317	17.601	16.658	18.029
7/22/96 16:00	7065	19.159	18.645	17.305	-1.302	17.592	16.652	18.013
7/22/96 16:15	7080	19.159	18.493	17.305	-1.443	17.597	16.658	18.029
7/22/96 16:30	7095	19.152	18.544	17.305	-1.443	17.597	16.652	18.013
7/22/96 16:45	7110	19.146	18.613	17.289	-1.475	17.582	16.646	18.013
7/22/96 17:00	7125	19.152	18.436	17.305	-1.491	17.597	16.652	18.013
7/22/96 17:15	7140	19.159	18.537	17.305	-1.538	17.592	16.652	18.029
7/22/96 17:30	7155	19.171	18.721	17.321	-1.491	17.606	16.665	18.029
7/22/96 17:45	7170	19.184	18.481	17.337	-1.270	17.620	16.684	18.044
7/22/96 18:00	7185	19.178	18.658	17.337	-1.428	17.615	16.671	18.044
7/22/96 18:15	7200	19.152	18.727	17.321	-1.396	17.592	16.652	18.029
7/22/96 18:30	7215	19.140	18.626	17.289	-1.443	17.582	16.639	18.013
7/22/96 18:45	7230	19.146	18.474	17.289	-1.696	17.582	16.646	18.013
7/22/96 19:00	7245	19.140	18.455	17.289	-1.711	17.578	16.639	17.997
7/22/96 19:15	7260	19.127	18.626	17.274	-1.932	17.573	16.633	17.997
7/22/96 19:30	7275	19.127	18.430	17.274	-1.901	17.568	16.627	17.997
7/22/96 19:45	7290	19.121	18.518	17.258	-1.932	17.559	16.620	17.981
7/22/96 20:00	7305	19.115	18.588	17.274	-1.885	17.559	16.620	17.981
7/22/96 20:15	7320	19.115	18.835	17.258	-1.869	17.559	16.614	17.981
7/22/96 20:30	7335	19.108	18.455	17.242	-1.916	17.549	16.608	17.965
7/22/96 20:45	7350	19.108	18.588	17.258	-1.869	17.554	16.614	17.981
7/22/96 21:00	7365	19.134	18.512	17.289	-1.885	17.568	16.627	17.997
7/22/96 21:15	7380	19.159	18.512	17.321	-2.106	17.606	16.652	18.029
7/22/96 21:30	7395	19.171	18.594	17.321	-2.137	17.615	16.665	18.029
7/22/96 21:45	7410	19.184	18.601	17.337	-2.090	17.630	16.677	18.044
7/22/96 22:00	7425	19.184	18.765	17.337	-2.090	17.630	16.677	18.044
7/22/96 22:15	7440	19.190	18.651	17.337	-2.074	17.630	16.684	18.044
7/22/96 22:30	7455	19.203	18.715	17.352	-2.042	17.644	16.696	18.060
7/22/96 22:45	7470	19.203	18.500	17.352	-2.153	17.639	16.690	18.060
7/22/96 23:00	7485	19.197	19.000	17.368	-2.090	17.649	16.690	18.044
7/22/96 23:15	7500	19.178	18.481	17.337	-2.137	17.620	16.671	18.029
7/22/96 23:30	7515	19.171	18.443	17.321	-2.153	17.615	16.665	18.029
7/22/96 23:45	7530	19.159	18.620	17.321	-2.153	17.606	16.652	18.013
7/23/96 0:00	7545	19.184	18.544	17.337	-2.090	17.625	16.677	18.044
7/23/96 0:15	7560	19.197	18.582	17.352	-2.121	17.644	16.690	18.044
7/23/96 0:30	7575	19.190	18.911	17.368	-2.121	17.634	16.684	18.044
7/23/96 0:45	7590	19.190	18.500	17.337	-2.137	17.630	16.677	18.044
7/23/96 1:00	7605	19.190	18.651	17.337	-2.153	17.630	16.677	18.044
7/23/96 1:15	7620	19.178	18.746	17.337	-2.200	17.615	16.671	18.029
7/23/96 1:30	7635	19.190	18.962	17.337	-2.169	17.634	16.684	18.044
7/23/96 1:45	7650	19.190	18.620	17.337	-2.137	17.625	16.684	18.044
7/23/96 2:00	7665	19.184	18.765	17.337	-2.137	17.620	16.677	18.029

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7/23/96 2:15	7680	19.178	18.588	17.321	-2.153	17.620	16.671	18.029
7/23/96 2:30	7695	19.171	18.715	17.321	-2.074	17.611	16.665	18.029
7/23/96 2:45	7710	19.171	18.689	17.321	-2.090	17.615	16.665	18.029
7/23/96 3:00	7725	19.178	18.664	17.337	-2.042	17.625	16.671	18.029
7/23/96 3:15	7740	19.184	18.702	17.337	-2.011	17.630	16.677	18.044
7/23/96 3:30	7755	19.203	18.639	17.352	-2.011	17.649	16.690	18.044
7/23/96 3:45	7770	19.209	18.607	17.368	-2.011	17.653	16.696	18.060
7/23/96 4:00	7785	19.209	18.677	17.368	-2.058	17.658	16.696	18.060
7/23/96 4:15	7800	19.222	18.594	17.384	-2.027	17.667	16.709	18.060
7/23/96 4:30	7815	19.222	18.873	17.400	-2.074	17.667	16.709	18.076
7/23/96 4:45	7830	19.222	18.727	17.384	-2.074	17.667	16.709	18.076
7/23/96 5:00	7845	19.228	18.822	17.384	-2.090	17.667	16.709	18.076
7/23/96 5:15	7860	19.215	18.759	17.368	-2.027	17.658	16.709	18.060
7/23/96 5:30	7875	19.203	18.905	17.337	-2.042	17.649	16.690	18.044
7/23/96 5:45	7890	19.190	18.613	17.337	-2.153	17.630	16.684	18.044
7/23/96 6:00	7905	19.190	18.664	17.337	-2.074	17.634	16.684	18.044
7/23/96 6:15	7920	19.203	18.550	17.337	-2.137	17.639	16.690	18.044
7/23/96 6:30	7935	19.203	17.771	17.337	-2.169	17.634	16.696	18.044
7/23/96 6:45	7950	19.190	18.525	17.337	-2.216	17.630	16.684	18.044
7/23/96 7:00	7965	19.178	18.563	17.321	-2.184	17.615	16.671	18.029
7/23/96 7:15	7980	19.190	18.531	17.321	-2.137	17.634	16.690	18.044
7/23/96 7:30	7995	19.203	18.715	17.352	-2.137	17.644	16.696	18.060
7/23/96 7:45	8010	19.222	18.683	17.368	-2.232	17.663	16.715	18.076
7/23/96 8:00	8025	19.215	18.746	17.352	-2.216	17.663	16.709	18.060
7/23/96 8:15	8040	19.215	18.531	17.368	-2.342	17.663	16.709	18.076
7/23/96 8:30	8055	19.222	18.607	17.368	-2.295	17.667	16.715	18.076
7/23/96 8:45	8070	19.222	18.778	17.368	-2.090	17.667	16.715	18.076
7/23/96 9:00	8085	19.215	18.550	17.368	-2.310	17.663	16.715	18.060
7/23/96 9:15	8100	19.215	18.582	17.352	-2.374	17.658	16.703	18.060
7/23/96 9:30	8115	19.215	18.537	17.352	-2.405	17.658	16.703	18.060
7/23/96 9:45	8130	19.197	18.626	17.337	-2.421	17.644	16.690	18.044
7/23/96 10:00	8145	19.190	18.886	17.352	-2.437	17.639	16.690	18.044
7/23/96 10:15	8160	19.190	19.291	17.337	-2.437	17.639	16.677	18.029
7/23/96 10:30	8175	19.184	18.689	17.337	-2.547	17.630	16.677	18.029
7/23/96 10:45	8190	19.178	18.651	17.321	-2.578	17.620	16.671	18.013
7/23/96 11:00	8205	19.171	18.601	17.321	-2.531	17.620	16.665	18.013
7/23/96 11:15	8220	19.178	18.639	17.321	-2.610	17.620	16.671	18.013
7/23/96 11:30	8235	19.178	18.537	17.321	-2.610	17.620	16.671	18.013
7/23/96 11:45	8250	19.184	18.493	17.321	-2.783	17.630	16.677	18.029
7/23/96 12:00	8265	19.197	18.620	17.352	-2.468	17.639	16.690	18.044
7/23/96 12:15	8280	19.203	18.594	17.352	-2.421	17.644	16.690	18.044
7/23/96 12:30	8295	19.197	18.765	17.337	-2.547	17.639	16.690	18.044
7/23/96 12:45	8310	19.203	18.506	17.352	-2.626	17.649	16.696	18.044
7/23/96 13:00	8325	19.209	18.556	17.368	-2.610	17.653	16.703	18.060
7/23/96 13:15	8340	19.209	18.664	17.352	-2.626	17.649	16.703	18.060
7/23/96 13:30	8355	19.203	18.746	17.352	-2.547	17.649	16.696	18.044
7/23/96 13:45	8370	19.203	18.550	17.352	-2.547	17.649	16.696	18.060

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7/23/96 14:00	8385	19.203	18.715	17.352	-2.720	17.644	16.696	18.060
7/23/96 14:15	8400	19.203	18.518	17.337	-2.641	17.639	16.696	18.060
7/23/96 14:30	8415	19.197	18.651	17.337	-2.689	17.639	16.690	18.044
7/23/96 14:45	8430	19.197	18.556	17.337	-2.720	17.644	16.690	18.044
7/23/96 15:00	8445	19.184	18.531	17.321	-2.515	17.630	16.684	18.044
7/23/96 15:15	8460	19.190	18.689	17.337	-2.689	17.634	16.684	18.044
7/23/96 15:30	8475	19.184	18.765	17.337	-2.705	17.634	16.684	18.044
7/23/96 15:45	8490	19.190	18.468	17.337	-2.783	17.630	16.684	18.044
7/23/96 16:00	8505	19.190	18.594	17.337	-2.752	17.639	16.684	18.044
7/23/96 16:15	8520	19.190	18.753	17.352	-2.815	17.639	16.690	18.044
7/23/96 16:30	8535	19.197	18.639	17.352	-2.783	17.644	16.684	18.060
7/23/96 16:45	8550	19.197	18.569	17.352	-2.815	17.653	16.690	18.044
7/23/96 17:00	8565	19.197	18.500	17.352	-2.957	17.649	16.684	18.044
7/23/96 17:15	8580	19.184	18.683	17.337	-2.452	17.639	16.677	18.044
7/23/96 17:30	8595	19.190	18.607	17.337	-2.846	17.634	16.684	18.044
7/23/96 17:45	8610	19.171	18.936	17.337	-2.925	17.625	16.671	18.029
7/23/96 18:00	8625	19.171	18.550	17.321	-2.988	17.625	16.665	18.029
7/23/96 18:15	8640	19.171	18.474	17.305	-2.846	17.611	16.665	18.029
7/23/96 18:30	8655	19.159	18.487	17.305	-2.909	17.597	16.652	18.013
7/23/96 18:45	8670	19.152	18.518	17.305	-2.957	17.597	16.652	18.013
7/23/96 19:00	8685	19.152	18.601	17.305	-2.988	17.597	16.646	18.013
7/23/96 19:15	8700	19.152	18.537	17.305	-2.988	17.601	16.652	18.013
7/23/96 19:30	8715	19.159	18.436	17.305	-2.988	17.606	16.658	18.029
7/23/96 19:45	8730	19.165	18.601	17.305	-2.957	17.611	16.658	18.029
7/23/96 20:00	8745	19.165	18.727	17.321	-3.004	17.611	16.665	18.029
7/23/96 20:15	8760	19.171	18.512	17.321	-3.036	17.620	16.665	18.029
7/23/96 20:30	8775	19.178	18.734	17.337	-3.051	17.625	16.671	18.044
7/23/96 20:45	8790	19.184	18.639	17.337	-2.988	17.630	16.677	18.044
7/23/96 21:00	8805	19.184	18.791	17.352	-3.083	17.620	16.677	18.044
7/23/96 21:15	8820	19.184	18.582	17.337	-3.051	17.630	16.677	18.044
7/23/96 21:30	8835	19.184	18.481	17.321	-3.083	17.625	16.677	18.044
7/23/96 21:45	8850	19.184	18.677	17.337	-3.114	17.630	16.684	18.044
7/23/96 22:00	8865	19.190	18.493	17.352	-3.114	17.630	16.684	18.044
7/23/96 22:15	8880	19.197	18.607	17.337	-3.114	17.639	16.690	18.044
7/23/96 22:30	8895	19.190	18.696	17.352	-3.130	17.625	16.690	18.044
7/23/96 22:45	8910	19.197	18.411	17.337	-3.083	17.634	16.684	18.044
7/23/96 23:00	8925	19.197	18.620	17.352	-3.114	17.644	16.690	18.060
7/23/96 23:15	8940	19.203	18.715	17.352	-3.162	17.649	16.696	18.060
7/23/96 23:30	8955	19.209	18.810	17.368	-3.130	17.653	16.703	18.060
7/23/96 23:45	8970	19.203	18.835	17.352	-3.083	17.644	16.696	18.060
7/24/96 0:00	8985	19.215	18.518	17.368	-3.114	17.658	16.703	18.060
7/24/96 0:15	9000	19.197	18.753	17.352	-3.099	17.644	16.690	18.044
7/24/96 0:30	9015	19.209	18.645	17.352	-3.209	17.658	16.703	18.060
7/24/96 0:45	9030	19.222	19.361	17.368	-3.209	17.672	16.709	18.076
7/24/96 1:00	9045	19.228	18.626	17.368	-3.130	17.672	16.715	18.076
7/24/96 1:15	9060	19.228	18.664	17.384	-3.130	17.672	16.715	18.076
7/24/96 1:30	9075	19.222	18.772	17.368	-3.114	17.663	16.715	18.076

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					Well ID			
7/24/96 1:45	9090	19.222	17.796	17.352	-3.130	17.658	16.715	18.076
7/24/96 2:00	9105	19.222	19.278	17.368	-3.130	17.667	16.715	18.076
7/24/96 2:15	9120	19.222	18.582	17.368	-3.114	17.667	16.715	18.076
7/24/96 2:30	9135	19.215	18.772	17.352	-3.130	17.663	16.709	18.076
7/24/96 2:45	9150	19.215	18.500	17.368	-3.177	17.658	16.709	18.060
7/24/96 3:00	9165	19.209	18.563	17.352	-3.114	17.658	16.703	18.060
7/24/96 3:15	9180	19.222	18.632	17.384	-3.177	17.677	16.715	18.076
7/24/96 3:30	9195	19.297	18.556	17.447	-3.083	17.734	16.778	18.124
7/24/96 3:45	9210	19.316	18.829	17.462	-2.941	17.757	16.791	18.155
7/24/96 4:00	9225	19.316	18.715	17.478	-2.988	17.762	16.797	18.155
7/24/96 4:15	9240	19.316	18.867	17.462	-3.004	17.762	16.797	18.155
7/24/96 4:30	9255	19.322	18.879	17.478	-2.988	17.767	16.804	18.155
7/24/96 4:45	9270	19.329	18.962	17.494	-3.004	17.776	16.804	18.171
7/24/96 5:00	9285	19.329	18.879	17.478	-3.020	17.772	16.810	18.171
7/24/96 5:15	9300	19.335	18.930	17.478	-3.036	17.776	16.810	18.171
7/24/96 5:30	9315	19.348	18.835	17.494	-3.020	17.790	16.823	18.187
7/24/96 5:45	9330	19.341	18.715	17.494	-3.004	17.786	16.823	18.187
7/24/96 6:00	9345	19.348	18.829	17.510	-3.036	17.795	16.829	18.187
7/24/96 6:15	9360	19.272	18.563	17.400	-3.146	17.715	16.760	18.124
7/24/96 6:30	9375	19.234	18.537	17.368	-3.083	17.677	16.728	18.092
7/24/96 6:45	9390	19.228	18.746	17.368	-3.083	17.672	16.722	18.076
7/24/96 7:00	9405	19.222	18.563	17.368	-3.114	17.667	16.715	18.076
7/24/96 7:15	9420	19.209	18.601	17.352	-3.083	17.658	16.709	18.060
7/24/96 7:30	9435	19.215	18.658	17.352	-3.083	17.658	16.709	18.060
7/24/96 7:45	9450	19.215	18.746	17.352	-3.114	17.658	16.709	18.060
7/24/96 8:00	9465	19.228	18.550	17.352	-2.862	17.663	16.722	18.076
7/24/96 8:15	9480	19.234	18.594	17.384	-2.941	17.677	16.728	18.092
7/24/96 8:30	9495	19.253	18.727	17.384	-2.925	17.691	16.747	18.092
7/24/96 8:45	9510	19.247	18.575	17.384	-3.193	17.686	16.741	18.092
7/24/96 9:00	9525	19.215	18.481	17.352	-2.925	17.658	16.709	18.060
7/24/96 9:15	9540	19.197	18.772	17.337	-3.083	17.649	16.696	18.044
7/24/96 9:30	9555	19.184	18.683	17.337	-2.941	17.634	16.684	18.044
7/24/96 9:45	9570	19.171	18.563	17.321	-2.988	17.625	16.677	18.029
7/24/96 10:00	9585	19.159	18.468	17.305	-3.036	17.611	16.665	18.013
7/24/96 10:15	9600	19.159	18.664	17.305	-2.973	17.611	16.665	18.013
7/24/96 10:30	9615	19.159	18.677	17.305	-3.036	17.606	16.665	18.013
7/24/96 10:45	9630	19.159	18.588	17.305	-3.130	17.606	16.665	18.013
7/24/96 11:00	9645	19.134	18.392	17.274	-2.831	17.582	16.639	17.997
7/24/96 11:15	9660	19.127	18.329	17.258	-3.209	17.573	16.633	17.981
7/24/96 11:30	9675	19.127	18.677	17.258	-3.114	17.587	16.639	17.997
7/24/96 11:45	9690	19.134	18.436	17.274	-3.162	17.582	16.639	17.997
7/24/96 12:00	9705	19.140	17.619	17.258	-3.225	17.573	16.639	17.997
7/24/96 12:15	9720	19.140	18.379	17.274	-3.240	17.587	16.646	17.997
7/24/96 12:30	9735	19.134	18.398	17.274	-3.209	17.578	16.639	17.997
7/24/96 12:45	9750	19.134	18.462	17.274	-3.193	17.578	16.639	17.981
7/24/96 13:00	9765	19.121	18.677	17.258	-3.288	17.554	16.627	17.981
7/24/96 13:15	9780	19.115	18.474	17.258	-3.177	17.563	16.620	17.981

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					Well ID			
7/24/96 13:30	9795	19.115	18.411	17.242	-2.783	17.568	16.627	17.981
7/24/96 13:45	9810	19.108	18.341	17.242	-3.099	17.563	16.620	17.965
7/24/96 14:00	9825	19.096	18.803	17.242	-3.099	17.563	16.608	17.949
7/24/96 14:15	9840	19.090	18.474	17.242	-3.146	17.549	16.601	17.949
7/24/96 14:30	9855	19.083	18.316	17.227	-3.083	17.535	16.595	17.949
7/24/96 14:45	9870	19.083	18.424	17.227	-3.209	17.535	16.595	17.949
7/24/96 15:00	9885	19.071	18.544	17.211	-3.256	17.516	16.582	17.933
7/24/96 15:15	9900	19.077	18.474	17.227	-3.177	17.530	16.595	17.949
7/24/96 15:30	9915	19.083	18.651	17.242	-3.256	17.530	16.595	17.949
7/24/96 15:45	9930	19.077	18.430	17.227	-3.272	17.530	16.589	17.933
7/24/96 16:00	9945	19.077	18.531	17.227	-3.272	17.530	16.589	17.949
7/24/96 16:15	9960	19.071	18.575	17.227	-3.193	17.502	16.576	17.933
7/24/96 16:30	9975	19.064	18.341	17.211	-3.335	17.516	16.576	17.933
7/24/96 16:45	9990	19.071	18.443	17.227	-3.351	17.526	16.582	17.933
7/24/96 17:00	10005	19.064	18.797	17.211	-3.508	17.516	16.570	17.933
7/24/96 17:15	10020	19.071	18.468	17.211	-3.461	17.521	16.576	17.933
7/24/96 17:30	10035	19.071	18.367	17.211	-3.508	17.521	16.576	17.949
7/24/96 17:45	10050	19.090	18.563	17.242	-3.524	17.535	16.595	17.965
7/24/96 18:00	10065	19.108	18.392	17.258	-3.335	17.559	16.614	17.981
7/24/96 18:15	10080	19.134	18.487	17.289	-3.304	17.587	16.633	17.997
7/24/96 18:30	10095	19.146	18.683	17.289	-3.398	17.597	16.646	18.029
7/24/96 18:45	10110	19.159	18.468	17.305	-3.493	17.611	16.658	18.029
7/24/96 19:00	10125	19.171	18.689	17.321	-3.540	17.625	16.665	18.044
7/24/96 19:15	10140	19.165	18.582	17.321	-3.603	17.625	16.665	18.044
7/24/96 19:30	10155	19.165	18.670	17.321	-3.619	17.620	16.665	18.044
7/24/96 19:45	10170	19.159	18.430	17.321	-3.666	17.615	16.665	18.044
7/24/96 20:00	10185	19.171	18.487	17.337	-3.698	17.630	16.671	18.044
7/24/96 20:15	10200	19.171	18.594	17.321	-3.682	17.625	16.671	18.044
7/24/96 20:30	10215	19.171	18.424	17.321	-3.698	17.630	16.671	18.044
7/24/96 20:45	10230	19.171	18.544	17.321	-3.698	17.630	16.671	18.044
7/24/96 21:00	10245	19.178	18.594	17.321	-3.808	17.634	16.677	18.044
7/24/96 21:15	10260	19.197	18.601	17.337	-3.745	17.649	16.690	18.060
7/24/96 21:30	10275	19.203	18.506	17.352	-3.808	17.658	16.703	18.076
7/24/96 21:45	10290	19.228	18.588	17.384	-3.776	17.682	16.722	18.092
7/24/96 22:00	10305	19.241	18.759	17.400	-3.713	17.696	16.734	18.108
7/24/96 22:15	10320	19.247	18.664	17.400	-3.745	17.705	16.741	18.108
7/24/96 22:30	10335	19.253	18.607	17.415	-3.761	17.705	16.747	18.108
7/24/96 22:45	10350	19.260	18.594	17.415	-3.666	17.715	16.753	18.124
7/24/96 23:00	10365	19.266	18.620	17.415	-3.745	17.720	16.760	18.124
7/24/96 23:15	10380	19.272	18.734	17.431	-3.745	17.729	16.766	18.139
7/24/96 23:30	10395	19.297	18.791	17.447	-3.698	17.748	16.791	18.155
7/24/96 23:45	10410	19.304	18.702	17.462	-3.729	17.757	16.797	18.171
7/25/96 0:00	10425	19.291	18.898	17.462	-3.745	17.748	16.791	18.155
7/25/96 0:15	10440	19.291	18.727	17.431	-3.713	17.738	16.778	18.155
7/25/96 0:30	10455	19.285	18.594	17.431	-3.808	17.738	16.778	18.139
7/25/96 0:45	10470	19.278	19.031	17.431	-3.776	17.738	16.778	18.139
7/25/96 1:00	10485	19.278	18.664	17.431	-3.792	17.729	16.772	18.139

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7/25/96 1:15	10500	19.278	18.537	17.415	-3.808	17.724	16.766	18.124
7/25/96 1:30	10515	19.272	18.525	17.415	-3.839	17.720	16.766	18.124
7/25/96 1:45	10530	19.272	18.677	17.415	-3.887	17.720	16.766	18.124
7/25/96 2:00	10545	19.266	18.791	17.415	-3.871	17.715	16.760	18.124
7/25/96 2:15	10560	19.266	18.525	17.431	-3.792	17.710	16.760	18.124
7/25/96 2:30	10575	19.266	18.639	17.415	-3.776	17.720	16.760	18.124
7/25/96 2:45	10590	19.253	18.746	17.415	-3.256	17.710	16.747	18.108
7/25/96 3:00	10605	19.253	18.721	17.415	-3.808	17.705	16.741	18.108
7/25/96 3:15	10620	19.253	18.575	17.400	-3.776	17.705	16.741	18.108
7/25/96 3:30	10635	19.241	18.696	17.400	-3.792	17.701	16.734	18.092
7/25/96 3:45	10650	19.247	18.500	17.400	-3.855	17.696	16.734	18.092
7/25/96 4:00	10665	19.241	18.582	17.400	-3.792	17.682	16.734	18.092
7/25/96 4:15	10680	19.247	18.544	17.400	-3.839	17.691	16.734	18.092
7/25/96 4:30	10695	19.253	18.791	17.400	-3.824	17.701	16.741	18.108
7/25/96 4:45	10710	19.260	18.550	17.415	-3.761	17.710	16.747	18.108
7/25/96 5:00	10725	19.247	18.525	17.400	-3.335	17.696	16.741	18.108
7/25/96 5:15	10740	19.241	18.607	17.400	-3.288	17.696	16.734	18.092
7/25/96 5:30	10755	19.228	18.727	17.368	-3.398	17.682	16.722	18.076
7/25/96 5:45	10770	19.222	18.493	17.368	-3.430	17.672	16.715	18.076
7/25/96 6:00	10785	19.241	18.702	17.400	-3.414	17.696	16.734	18.092
7/25/96 6:15	10800	19.234	18.734	17.384	-3.430	17.686	16.728	18.092
7/25/96 6:30	10815	19.241	18.778	17.400	-3.398	17.691	16.734	18.092
7/25/96 6:45	10830	19.253	18.531	17.400	-3.430	17.701	16.747	18.108
7/25/96 7:00	10845	19.247	18.601	17.400	-3.351	17.701	16.741	18.092
7/25/96 7:15	10860	19.253	18.670	17.400	-3.256	17.705	16.747	18.108
7/25/96 7:30	10875	19.253	18.525	17.400	-3.461	17.705	16.747	18.108
7/25/96 7:45	10890	19.253	18.651	17.400	-3.414	17.710	16.753	18.108
7/25/96 8:00	10905	19.260	18.791	17.415	-3.288	17.710	16.760	18.108
7/25/96 8:15	10920	19.178	18.189	17.321	-3.335	17.615	16.684	18.044
7/25/96 8:30	10935	19.159	18.449	17.289	-3.335	17.606	16.665	18.013
7/25/96 8:45	10950	19.159	19.025	17.289	-3.382	17.611	16.665	18.013
7/25/96 9:00	10965	19.152	18.373	17.289	-3.430	17.601	16.658	18.013
7/25/96 9:15	10980	19.146	18.594	17.289	-3.367	17.597	16.652	17.997
7/25/96 9:30	10995	19.127	18.575	17.274	-3.493	17.582	16.639	17.997
7/25/96 9:45	11010	19.121	18.462	17.258	-3.382	17.573	16.627	17.981
7/25/96 10:00	11025	19.115	18.386	17.258	-3.398	17.568	16.627	17.981
7/25/96 10:15	11040	19.127	18.443	17.258	-3.430	17.578	16.633	17.981
7/25/96 10:30	11055	19.121	18.512	17.258	-3.256	17.568	16.627	17.981
7/25/96 10:45	11070	19.134	18.594	17.274	-3.225	17.582	16.639	17.981
7/25/96 11:00	11085	19.127	18.487	17.274	-3.209	17.578	16.633	17.981
7/25/96 11:15	11100	19.121	18.500	17.258	-3.304	17.573	16.627	17.981
7/25/96 11:30	11115	19.115	18.797	17.258	-3.272	17.573	16.627	17.981
7/25/96 11:45	11130	19.115	18.721	17.274	-3.272	17.573	16.627	17.981
7/25/96 12:00	11145	19.121	18.569	17.258	-3.240	17.573	16.633	17.981
7/25/96 12:15	11160	19.127	18.544	17.258	-3.209	17.573	16.633	17.981
7/25/96 12:30	11175	19.146	18.582	17.289	-3.367	17.597	16.652	17.997
7/25/96 12:45	11190	19.152	18.348	17.289	-3.414	17.601	16.658	18.013

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7/25/96 13:00	11205	19.152	18.436	17.289	-3.493	17.606	16.665	18.013
7/25/96 13:15	11220	19.159	18.677	17.289	-3.477	17.606	16.665	18.013
7/25/96 13:30	11235	19.165	18.550	17.305	-3.445	17.615	16.671	18.029
7/25/96 13:45	11250	19.171	18.373	17.305	-3.477	17.620	16.677	18.029
7/25/96 14:00	11265	19.178	18.487	17.321	-3.445	17.634	16.684	18.044
7/25/96 14:15	11280	19.190	18.525	17.337	-3.414	17.644	16.690	18.060
7/25/96 14:30	11295	19.197	18.481	17.337	-3.461	17.649	16.696	18.060
7/25/96 14:45	11310	19.203	18.525	17.352	-3.461	17.658	16.696	18.060
7/25/96 15:00	11325	19.209	18.145	17.368	-3.461	17.653	16.703	18.076
7/25/96 15:15	11340	19.222	18.518	17.368	-3.493	17.682	16.722	18.092
7/25/96 15:30	11355	19.222	18.955	17.368	-3.524	17.686	16.722	18.092
7/25/96 15:45	11370	19.234	18.651	17.384	-3.367	17.691	16.728	18.108
7/25/96 16:00	11385	19.241	18.493	17.400	-3.556	17.701	16.741	18.108
7/25/96 16:15	11400	19.260	18.689	17.415	-3.556	17.720	16.753	18.139
7/25/96 16:30	11415	19.266	18.101	17.400	-3.493	17.724	16.760	18.139
7/25/96 16:45	11430	19.266	18.626	17.415	-3.587	17.729	16.760	18.139
7/25/96 17:00	11445	19.278	18.468	17.431	-3.587	17.738	16.772	18.155
7/25/96 17:15	11460	19.285	18.651	17.447	-3.635	17.748	16.778	18.171
7/25/96 17:30	11475	19.310	18.841	17.462	-3.351	17.772	16.804	18.187
7/25/96 17:45	11490	19.322	18.759	17.478	-3.304	17.786	16.810	18.203
7/25/96 18:00	11505	19.316	18.797	17.478	-3.367	17.786	16.816	18.203
7/25/96 18:15	11520	19.335	18.677	17.494	-3.319	17.800	16.829	18.219
7/25/96 18:30	11535	19.329	18.563	17.478	-3.367	17.790	16.823	18.219
7/25/96 18:45	11550	19.341	18.582	17.510	-3.382	17.809	16.835	18.234
7/25/96 19:00	11565	19.417	18.797	17.588	-3.304	17.885	16.892	18.298
7/25/96 19:15	11580	19.480	18.898	17.651	-3.240	17.951	16.956	18.361
7/25/96 19:30	11595	19.511	18.968	17.682	-3.225	17.984	16.994	18.409
7/25/96 19:45	11610	19.537	19.088	17.714	-3.288	18.013	17.019	18.425
7/25/96 20:00	11625	19.537	18.974	17.714	-3.256	18.013	17.019	18.440
7/25/96 20:15	11640	19.549	19.038	17.730	-3.256	18.022	17.032	18.440
7/25/96 20:30	11655	19.562	18.968	17.745	-3.209	18.032	17.044	18.456
7/25/96 20:45	11670	19.574	18.981	17.745	-3.288	18.050	17.057	18.472
7/25/96 21:00	11685	19.587	19.139	17.761	-3.304	18.060	17.063	18.488
7/25/96 21:15	11700	19.593	18.962	17.777	-3.272	18.074	17.082	18.504
7/25/96 21:30	11715	19.606	19.190	17.777	-3.240	18.084	17.089	18.504
7/25/96 21:45	11730	19.625	19.019	17.808	-3.288	18.102	17.108	18.535
7/25/96 22:00	11745	19.637	18.278	17.808	-3.351	18.112	17.114	18.535
7/25/96 22:15	11760	19.656	19.145	17.824	-3.288	18.136	17.133	18.551
7/25/96 22:30	11775	19.669	19.399	17.855	-3.398	18.150	17.146	18.567
7/25/96 22:45	11790	19.681	19.012	17.855	-3.272	18.159	17.158	18.583
7/25/96 23:00	11805	19.694	19.107	17.871	-3.240	18.178	17.171	18.599
7/25/96 23:15	11820	19.706	19.215	17.887	-3.272	18.192	17.183	18.615
7/25/96 23:30	11835	19.719	19.323	17.903	-3.288	18.202	17.196	18.615
7/25/96 23:45	11850	19.732	19.177	17.903	-3.272	18.211	17.202	18.630
7/26/96 0:00	11865	19.738	19.126	17.918	-3.225	18.221	17.215	18.646
7/26/96 0:15	11880	19.751	19.361	17.934	-3.272	18.230	17.221	18.646
7/26/96 0:30	11895	19.763	19.183	17.950	-3.177	18.249	17.234	18.662

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7/26/96 0:45	11910	19.776	19.335	17.950	-3.083	18.259	17.247	18.678
7/26/96 1:00	11925	19.782	19.107	17.965	-3.067	18.273	17.253	18.678
7/26/96 1:15	11940	19.788	19.335	17.965	-3.099	18.263	17.259	18.694
7/26/96 1:30	11955	19.795	19.519	17.950	-3.099	18.282	17.266	18.694
7/26/96 1:45	11970	19.801	19.297	17.965	-3.051	18.282	17.272	18.710
7/26/96 2:00	11985	19.807	19.354	17.981	-3.193	18.292	17.278	18.710
7/26/96 2:15	12000	19.807	19.139	17.981	-2.878	18.292	17.285	18.726
7/26/96 2:30	12015	19.814	19.171	17.997	-2.909	18.301	17.285	18.726
7/26/96 2:45	12030	19.826	19.354	17.997	-2.909	18.311	17.297	18.741
7/26/96 3:00	12045	19.832	19.215	17.997	-2.815	18.315	17.304	18.741
7/26/96 3:15	12060	19.839	19.259	18.028	-2.862	18.329	17.310	18.741
7/26/96 3:30	12075	19.845	19.234	18.028	-2.799	18.334	17.316	18.757
7/26/96 3:45	12090	19.851	19.348	18.028	-2.752	18.344	17.329	18.773
7/26/96 4:00	12105	19.864	19.215	18.044	-2.846	18.353	17.335	18.773
7/26/96 4:15	12120	19.876	19.266	18.060	-2.736	18.367	17.348	18.789
7/26/96 4:30	12135	19.889	18.601	18.060	-2.673	18.377	17.361	18.805
7/26/96 4:45	12150	19.908	19.437	18.091	-2.673	18.396	17.373	18.821
7/26/96 5:00	12165	19.914	19.513	18.091	-2.799	18.405	17.380	18.821
7/26/96 5:15	12180	19.927	19.405	18.107	-2.705	18.415	17.392	18.836
7/26/96 5:30	12195	19.933	19.354	18.123	-2.689	18.424	17.399	18.852
7/26/96 5:45	12210	19.933	19.494	18.123	-2.657	18.429	17.405	18.852
7/26/96 6:00	12225	19.952	19.297	18.138	-2.720	18.443	17.418	18.868
7/26/96 6:15	12240	19.952	19.373	18.123	-2.752	18.443	17.424	18.868
7/26/96 6:30	12255	19.965	19.335	18.138	-2.689	18.457	17.437	18.884
7/26/96 6:45	12270	19.977	19.525	18.154	-2.657	18.467	17.449	18.884
7/26/96 7:00	12285	19.990	19.373	18.170	-2.705	18.481	17.456	18.900
7/26/96 7:15	12300	20.002	19.449	18.186	-2.783	18.495	17.468	18.916
7/26/96 7:30	12315	20.002	19.342	18.186	-2.657	18.495	17.475	18.931
7/26/96 7:45	12330	20.015	19.627	18.186	-2.578	18.509	17.481	18.931
7/26/96 8:00	12345	20.021	19.703	18.217	-2.610	18.514	17.487	18.947
7/26/96 8:15	12360	20.034	19.449	18.217	-2.626	18.533	17.506	18.963
7/26/96 8:30	12375	20.040	19.576	18.217	-2.452	18.537	17.506	18.963
7/26/96 8:45	12390	20.015	19.386	18.186	-2.594	18.509	17.487	18.931
7/26/96 9:00	12405	20.034	19.639	18.233	-2.578	18.533	17.494	18.947
7/26/96 9:15	12420	20.103	19.532	18.296	-2.452	18.599	17.563	19.027
7/26/96 9:30	12435	20.122	19.551	18.311	-2.468	18.623	17.582	19.042
7/26/96 9:45	12450	20.141	19.766	18.327	-2.547	18.637	17.601	19.058
7/26/96 10:00	12465	20.153	19.627	18.343	-2.358	18.651	17.607	19.074
7/26/96 10:15	12480	20.160	19.747	18.343	-2.310	18.656	17.620	19.074
7/26/96 10:30	12495	20.153	19.804	18.343	-2.200	18.656	17.620	19.074
7/26/96 10:45	12510	20.172	19.728	18.359	-2.200	18.670	17.633	19.090
7/26/96 11:00	12525	20.166	19.810	18.359	-2.295	18.670	17.633	19.090
7/26/96 11:15	12540	20.172	19.589	18.359	-2.326	18.670	17.639	19.090
7/26/96 11:30	12555	20.179	19.785	18.374	-2.184	18.684	17.645	19.106
7/26/96 11:45	12570	20.191	19.779	18.374	-2.295	18.689	17.645	19.122
7/26/96 12:00	12585	20.191	19.829	18.390	-2.295	18.693	17.652	19.122
7/26/96 12:15	12600	20.204	19.658	18.390	-2.247	18.698	17.658	19.137

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7/26/96 12:30	12615	20.204	19.848	18.390	-2.374	18.708	17.664	19.137
7/26/96 12:45	12630	20.197	19.595	18.390	-2.342	18.698	17.652	19.122
7/26/96 13:00	12645	20.223	19.867	18.421	-2.295	18.731	17.690	19.153
7/26/96 13:15	12660	20.223	20.095	18.421	-2.342	18.727	17.683	19.153
7/26/96 13:30	12675	20.223	19.709	18.421	-2.200	18.722	17.683	19.153
7/26/96 13:45	12690	20.223	19.690	18.406	-2.247	18.717	17.677	19.153
7/26/96 14:00	12705	20.216	19.817	18.406	-2.232	18.717	17.677	19.153
7/26/96 14:15	12720	20.216	19.791	18.406	-2.200	18.712	17.677	19.153
7/26/96 14:30	12735	20.210	19.810	18.406	-2.232	18.712	17.671	19.153
7/26/96 14:45	12750	20.197	19.823	18.390	-2.216	18.698	17.664	19.137
7/26/96 15:00	12765	20.191	19.684	18.374	-2.484	18.689	17.658	19.122
7/26/96 15:15	12780	20.172	19.760	18.359	-2.437	18.675	17.639	19.122
7/26/96 15:30	12795	20.172	19.772	18.359	-2.578	18.675	17.645	19.122
7/26/96 15:45	12810	20.179	19.728	18.374	-2.531	18.684	17.645	19.122
7/26/96 16:00	12825	20.172	19.709	18.374	-2.437	18.684	17.645	19.122
7/26/96 16:15	12840	20.185	19.722	18.390	-2.641	18.693	17.658	19.122
7/26/96 16:30	12855	20.179	19.665	18.390	-2.626	18.689	17.652	19.122
7/26/96 16:45	12870	20.185	19.538	18.374	-2.641	18.689	17.652	19.122
7/26/96 17:00	12885	20.204	19.779	18.390	-2.673	18.708	17.664	19.137
7/26/96 17:15	12900	20.210	19.810	18.406	-2.673	18.712	17.671	19.153
7/26/96 17:30	12915	20.216	19.886	18.421	-2.736	18.727	17.683	19.153
7/26/96 17:45	12930	20.223	19.836	18.421	-2.736	18.727	17.677	19.153
7/26/96 18:00	12945	20.216	20.070	18.421	-2.768	18.727	17.683	19.169
7/26/96 18:15	12960	20.216	19.620	18.406	-2.783	18.722	17.683	19.169
7/26/96 18:30	12975	20.204	19.551	18.374	-2.815	18.727	17.671	19.137
7/26/96 18:45	12990	20.204	19.715	18.390	-2.862	18.717	17.671	19.153
7/26/96 19:00	13005	20.216	19.544	18.421	-2.831	18.731	17.690	19.169
7/26/96 19:15	13020	20.229	19.779	18.421	-2.705	18.736	17.696	19.185
7/26/96 19:30	13035	20.235	20.006	18.437	-2.752	18.745	17.702	19.185
7/26/96 19:45	13050	20.248	19.677	18.437	-2.783	18.760	17.715	19.201
7/26/96 20:00	13065	20.248	19.766	18.453	-2.673	18.760	17.715	19.201
7/26/96 20:15	13080	20.260	19.665	18.453	-2.752	18.769	17.728	19.217
7/26/96 20:30	13095	20.279	19.766	18.484	-2.783	18.793	17.747	19.232
7/26/96 20:45	13110	20.298	20.089	18.500	-2.689	18.812	17.766	19.248
7/26/96 21:00	13125	20.323	19.722	18.516	-2.689	18.831	17.785	19.264
7/26/96 21:15	13140	20.323	19.899	18.516	-2.705	18.831	17.791	19.280
7/26/96 21:30	13155	20.336	19.760	18.531	-2.673	18.849	17.804	19.296
7/26/96 21:45	13170	20.349	19.772	18.547	-2.626	18.859	17.810	19.296
7/26/96 22:00	13185	20.361	19.911	18.563	-2.657	18.878	17.829	19.312
7/26/96 22:15	13200	20.374	20.215	18.579	-2.641	18.887	17.835	19.327
7/26/96 22:30	13215	20.374	19.924	18.563	-2.673	18.887	17.842	19.327
7/26/96 22:45	13230	20.386	19.968	18.579	-2.673	18.897	17.848	19.327
7/26/96 23:00	13245	20.393	19.848	18.594	-2.578	18.906	17.854	19.343
7/26/96 23:15	13260	20.399	20.057	18.594	-2.736	18.911	17.867	19.343
7/26/96 23:30	13275	20.393	19.779	18.594	-2.673	18.901	17.854	19.343
7/26/96 23:45	13290	20.393	19.804	18.579	-2.673	18.897	17.854	19.327
7/27/96 0:00	13305	20.399	19.987	18.594	-2.752	18.906	17.860	19.343

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					Well ID			
7/27/96 0:15	13320	20.399	19.829	18.594	-2.752	18.906	17.860	19.343
7/27/96 0:30	13335	20.405	20.025	18.594	-2.846	18.920	17.867	19.343
7/27/96 0:45	13350	20.405	19.836	18.594	-2.815	18.916	17.867	19.343
7/27/96 1:00	13365	20.412	20.063	18.610	-2.799	18.925	17.873	19.359
7/27/96 1:15	13380	20.418	20.038	18.610	-2.799	18.930	17.879	19.359
7/27/96 1:30	13395	20.412	19.975	18.594	-2.799	18.925	17.873	19.359
7/27/96 1:45	13410	20.418	19.867	18.610	-2.815	18.935	17.879	19.359
7/27/96 2:00	13425	20.430	19.905	18.626	-2.909	18.944	17.886	19.375
7/27/96 2:15	13440	20.430	19.968	18.626	-2.783	18.944	17.892	19.375
7/27/96 2:30	13455	20.437	19.962	18.626	-2.768	18.953	17.898	19.391
7/27/96 2:45	13470	20.430	19.892	18.610	-2.783	18.920	17.886	19.375
7/27/96 3:00	13485	20.430	19.892	18.610	-2.783	18.930	17.892	19.375
7/27/96 3:15	13500	20.437	20.006	18.626	-2.815	18.939	17.898	19.375
7/27/96 3:30	13515	20.430	19.804	18.610	-2.752	18.935	17.892	19.375
7/27/96 3:45	13530	20.430	19.918	18.626	-2.705	18.944	17.892	19.375
7/27/96 4:00	13545	20.437	19.798	18.626	-2.736	18.944	17.898	19.375
7/27/96 4:15	13560	20.437	19.867	18.626	-2.831	18.953	17.905	19.391
7/27/96 4:30	13575	20.449	20.057	18.642	-2.768	18.958	17.905	19.391
7/27/96 4:45	13590	20.449	19.899	18.642	-2.752	18.963	17.911	19.391
7/27/96 5:00	13605	20.456	19.791	18.642	-2.752	18.972	17.917	19.407
7/27/96 5:15	13620	20.468	19.892	18.642	-2.752	18.982	17.930	19.407
7/27/96 5:30	13635	20.474	20.234	18.673	-2.799	18.991	17.936	19.423
7/27/96 5:45	13650	20.474	20.000	18.673	-2.783	18.991	17.936	19.423
7/27/96 6:00	13665	20.474	20.032	18.673	-2.768	18.996	17.943	19.423
7/27/96 6:15	13680	20.481	19.823	18.673	-2.799	18.996	17.949	19.423
7/27/96 6:30	13695	20.487	20.139	18.689	-2.768	19.005	17.949	19.438
7/27/96 6:45	13710	20.500	20.133	18.704	-2.768	19.020	17.962	19.454
7/27/96 7:00	13725	20.500	19.563	18.673	-2.768	19.015	17.962	19.438
7/27/96 7:15	13740	20.506	19.994	18.689	-2.736	19.020	17.968	19.454
7/27/96 7:30	13755	20.512	20.076	18.704	-2.815	19.029	17.981	19.454
7/27/96 7:45	13770	20.519	20.063	18.704	-2.705	19.034	17.981	19.470
7/27/96 8:00	13785	20.512	20.051	18.704	-2.736	19.029	17.981	19.470
7/27/96 8:15	13800	20.525	20.000	18.704	-2.720	19.039	17.987	19.470
7/27/96 8:30	13815	20.525	20.051	18.704	-2.626	19.039	17.987	19.470
7/27/96 8:45	13830	20.531	19.994	18.720	-2.641	19.048	17.993	19.486
7/27/96 9:00	13845	20.531	19.949	18.720	-2.515	19.053	18.000	19.486
7/27/96 9:15	13860	20.537	19.829	18.736	-2.421	19.057	18.006	19.486
7/27/96 9:30	13875	20.506	19.956	18.689	-2.452	19.024	17.981	19.470
7/27/96 9:45	13890	20.474	19.829	18.657	-2.468	18.991	17.949	19.438
7/27/96 10:00	13905	20.462	19.772	18.642	-2.515	18.982	17.936	19.423
7/27/96 10:15	13920	20.456	19.962	18.642	-2.547	18.977	17.936	19.423
7/27/96 10:30	13935	20.456	19.829	18.642	-2.578	18.982	17.936	19.423
7/27/96 10:45	13950	20.456	19.766	18.642	-2.547	18.977	17.930	19.423
7/27/96 11:00	13965	20.456	19.728	18.642	-2.484	18.977	17.930	19.423
7/27/96 11:15	13980	20.449	19.930	18.626	-2.515	18.968	17.924	19.407
7/27/96 11:30	13995	20.449	20.000	18.642	-2.515	18.972	17.930	19.407
7/27/96 11:45	14010	20.456	19.968	18.642	-2.421	18.972	17.936	19.423

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					Well ID			
7/27/96 12:00	14025	20.456	19.962	18.642	-2.405	18.972	17.930	19.407
7/27/96 12:15	14040	20.449	19.715	18.642	-2.374	18.968	17.930	19.423
7/27/96 12:30	14055	20.449	19.722	18.642	-2.358	18.972	17.930	19.423
7/27/96 12:45	14070	20.443	19.873	18.626	-2.437	18.968	17.924	19.407
7/27/96 13:00	14085	20.437	19.975	18.626	-2.421	18.958	17.911	19.407
7/27/96 13:15	14100	20.443	19.987	18.610	-2.358	18.958	17.917	19.407
7/27/96 13:30	14115	20.424	19.734	18.610	-2.389	18.949	17.905	19.391
7/27/96 13:45	14130	20.418	19.829	18.610	-2.389	18.944	17.905	19.391
7/27/96 14:00	14145	20.412	19.892	18.594	-2.374	18.935	17.892	19.375
7/27/96 14:15	14160	20.405	19.949	18.594	-2.421	18.935	17.892	19.375
7/27/96 14:30	14175	20.405	19.684	18.579	-2.437	18.925	17.879	19.359
7/27/96 14:45	14190	20.399	19.956	18.579	-2.468	18.925	17.879	19.359
7/27/96 15:00	14205	20.386	19.880	18.579	-2.484	18.906	17.867	19.343
7/27/96 15:15	14220	20.361	19.905	18.547	-2.547	18.883	17.848	19.327
7/27/96 15:30	14235	20.349	19.728	18.531	-2.594	18.864	17.829	19.312
7/27/96 15:45	14250	20.330	19.386	18.484	-2.578	18.854	17.816	19.280
7/27/96 16:00	14265	20.317	19.639	18.500	-2.626	18.831	17.804	19.264
7/27/96 16:15	14280	20.292	19.779	18.469	-2.641	18.807	17.778	19.248
7/27/96 16:30	14295	20.273	19.576	18.469	-2.673	18.793	17.766	19.232
7/27/96 16:45	14310	20.254	19.696	18.437	-2.720	18.774	17.747	19.201
7/27/96 17:00	14325	20.248	19.741	18.437	-3.871	18.764	17.747	19.201
7/27/96 17:15	14340	20.242	19.608	18.406	-2.705	18.755	17.728	19.185
7/27/96 17:30	14355	20.235	19.494	18.421	-2.689	18.745	17.721	19.185
7/27/96 17:45	14370	20.216	19.646	18.406	-2.720	18.731	17.709	19.169
7/27/96 18:00	14385	20.235	19.690	18.421	-2.831	18.750	17.721	19.169
7/27/96 18:15	14400	20.242	19.595	18.421	-2.878	18.755	17.728	19.185
7/27/96 18:30	14415	20.229	19.620	18.421	-2.925	18.750	17.721	19.169
7/27/96 18:45	14430	20.229	19.639	18.421	-2.925	18.741	17.715	19.169
7/27/96 19:00	14445	20.223	19.582	18.406	-3.036	18.731	17.709	19.153
7/27/96 19:15	14460	20.204	19.595	18.390	-3.020	18.712	17.696	19.137
7/27/96 19:30	14475	20.197	19.614	18.374	-3.099	18.708	17.690	19.137
7/27/96 19:45	14490	20.185	19.614	18.374	-3.083	18.698	17.677	19.122
7/27/96 20:00	14505	20.185	19.842	18.390	-3.162	18.698	17.677	19.122
7/27/96 20:15	14520	20.191	19.411	18.374	-3.177	18.693	17.677	19.122
7/27/96 20:30	14535	20.185	19.392	18.359	-3.209	18.698	17.677	19.122
7/27/96 20:45	14550	20.179	19.544	18.374	-3.193	18.689	17.664	19.106
7/27/96 21:00	14565	20.185	19.671	18.374	-3.225	18.689	17.677	19.106
7/27/96 21:15	14580	20.179	19.627	18.359	-3.288	18.684	17.671	19.106
7/27/96 21:30	14595	20.172	19.595	18.359	-3.177	18.679	17.671	19.090
7/27/96 21:45	14610	20.172	19.589	18.359	-3.272	18.684	17.664	19.090
7/27/96 22:00	14625	20.160	19.557	18.343	-3.162	18.675	17.658	19.090
7/27/96 22:15	14640	20.172	19.791	18.359	-3.288	18.665	17.658	19.090
7/27/96 22:30	14655	20.166	19.696	18.343	-3.335	18.670	17.658	19.074
7/27/96 22:45	14670	20.160	19.570	18.343	-3.319	18.665	17.652	19.074
7/27/96 23:00	14685	20.160	19.937	18.359	-3.367	18.665	17.652	19.074
7/27/96 23:15	14700	20.153	19.646	18.343	-3.367	18.660	17.645	19.058
7/27/96 23:30	14715	20.153	19.386	18.343	-3.304	18.656	17.645	19.058

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7/27/96 23:45	14730	20.153	19.690	18.327	-3.367	18.651	17.645	19.058
7/28/96 0:00	14745	20.141	19.519	18.311	-3.367	18.641	17.633	19.042
7/28/96 0:15	14760	20.135	19.639	18.311	-3.445	18.637	17.626	19.042
7/28/96 0:30	14775	20.128	19.570	18.296	-3.414	18.618	17.620	19.027
7/28/96 0:45	14790	20.116	19.418	18.295	-3.477	18.613	17.614	19.027
7/28/96 1:00	14805	20.116	19.557	18.296	-3.414	18.618	17.614	19.027
7/28/96 1:15	14820	20.116	19.551	18.280	-3.461	18.613	17.607	19.011
7/28/96 1:30	14835	20.109	19.411	18.280	-3.477	18.613	17.607	19.011
7/28/96 1:45	14850	20.090	19.544	18.264	-3.540	18.599	17.588	18.995
7/28/96 2:00	14865	20.097	19.500	18.280	-3.540	18.604	17.588	18.995
7/28/96 2:15	14880	20.090	19.671	18.280	-3.524	18.594	17.582	18.995
7/28/96 2:30	14895	20.072	19.627	18.248	-3.540	18.575	17.563	18.979
7/28/96 2:45	14910	20.072	19.563	18.248	-3.556	18.575	17.569	18.963
7/28/96 3:00	14925	20.072	19.361	18.248	-3.587	18.566	17.563	18.963
7/28/96 3:15	14940	20.059	19.462	18.233	-3.635	18.561	17.557	18.947
7/28/96 3:30	14955	20.053	19.570	18.217	-3.603	18.552	17.550	18.947
7/28/96 3:45	14970	20.046	19.487	18.217	-3.556	18.547	17.544	18.931
7/28/96 4:00	14985	20.034	19.418	18.186	-3.635	18.537	17.531	18.931
7/28/96 4:15	15000	20.028	19.367	18.186	-3.572	18.528	17.525	18.916
7/28/96 4:30	15015	20.021	19.582	18.201	-3.619	18.523	17.519	18.916
7/28/96 4:45	15030	20.021	19.500	18.186	-3.682	18.523	17.519	18.916
7/28/96 5:00	15045	20.015	19.589	18.186	-3.666	18.514	17.513	18.900
7/28/96 5:15	15060	20.015	19.342	18.186	-3.682	18.514	17.506	18.900
7/28/96 5:30	15075	20.002	19.475	18.170	-3.635	18.504	17.500	18.900
7/28/96 5:45	15090	20.015	19.196	18.186	-3.682	18.509	17.513	18.900
7/28/96 6:00	15105	20.009	19.785	18.201	-3.713	18.519	17.506	18.900
7/28/96 6:15	15120	20.009	19.392	18.186	-3.650	18.509	17.506	18.900
7/28/96 6:30	15135	20.034	19.392	18.201	-3.603	18.528	17.525	18.916
7/28/96 6:45	15150	20.028	19.639	18.217	-3.729	18.523	17.525	18.900
7/28/96 7:00	15165	20.028	19.525	18.201	-3.682	18.523	17.525	18.900
7/28/96 7:15	15180	20.028	19.380	18.201	-3.650	18.528	17.525	18.916
7/28/96 7:30	15195	20.028	19.430	18.201	-3.635	18.528	17.525	18.916
7/28/96 7:45	15210	20.021	19.544	18.201	-3.666	18.523	17.519	18.900
7/28/96 8:00	15225	20.028	19.620	18.217	-3.666	18.528	17.525	18.916
7/28/96 8:15	15240	20.021	19.418	18.201	-3.619	18.523	17.519	18.900
7/28/96 8:30	15255	19.983	19.367	18.154	-3.650	18.485	17.481	18.868
7/28/96 8:45	15270	19.971	19.272	18.154	-3.603	18.471	17.475	18.852
7/28/96 9:00	15285	19.958	19.367	18.123	-3.698	18.462	17.468	18.852
7/28/96 9:15	15300	19.946	19.405	18.107	-3.745	18.443	17.449	18.821
7/28/96 9:30	15315	19.952	19.500	18.123	-3.682	18.452	17.456	18.836
7/28/96 9:45	15330	19.952	19.506	18.138	-3.603	18.452	17.456	18.836
7/28/96 10:00	15345	19.946	19.443	18.123	-3.824	18.448	17.456	18.836
7/28/96 10:15	15360	19.933	19.380	18.107	-3.761	18.438	17.443	18.821
7/28/96 10:30	15375	19.946	19.424	18.107	-3.745	18.448	17.449	18.836
7/28/96 10:45	15390	19.939	19.430	18.107	-3.666	18.443	17.443	18.821
7/28/96 11:00	15405	19.933	19.278	18.107	-3.650	18.433	17.437	18.821
7/28/96 11:15	15420	19.914	19.278	18.091	-3.635	18.415	17.418	18.789

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7/28/96 11:30	15435	19.914	19.240	18.091	-3.635	18.419	17.424	18.805
7/28/96 11:45	15450	19.902	19.449	18.076	-3.603	18.405	17.418	18.789
7/28/96 12:00	15465	19.883	19.190	18.060	-3.556	18.381	17.399	18.773
7/28/96 12:15	15480	19.889	19.164	18.060	-3.540	18.391	17.399	18.773
7/28/96 12:30	15495	19.883	19.297	18.060	-3.524	18.386	17.392	18.773
7/28/96 12:45	15510	19.870	19.430	18.060	-3.240	18.377	17.386	18.757
7/28/96 13:00	15525	19.864	19.183	18.044	-3.351	18.367	17.373	18.757
7/28/96 13:15	15540	19.845	19.183	18.013	-3.240	18.344	17.348	18.741
7/28/96 13:30	15555	19.845	19.266	18.028	-3.288	18.348	17.354	18.741
7/28/96 13:45	15570	19.839	19.323	18.013	-3.162	18.339	17.348	18.726
7/28/96 14:00	15585	19.820	19.044	17.997	-3.256	18.315	17.335	18.710
7/28/96 14:15	15600	19.807	19.114	17.981	-3.288	18.325	17.329	18.710
7/28/96 14:30	15615	19.795	19.164	17.965	-3.319	18.306	17.316	18.694
7/28/96 14:45	15630	19.788	19.076	17.965	-3.367	18.292	17.310	18.678
7/28/96 15:00	15645	19.782	19.285	17.965	-3.430	18.287	17.304	18.678
7/28/96 15:15	15660	19.782	19.272	17.965	-3.508	18.282	17.297	18.678
7/28/96 15:30	15675	19.776	19.291	17.965	-3.603	18.277	17.291	18.662
7/28/96 15:45	15690	19.776	19.329	17.950	-3.619	18.277	17.291	18.662
7/28/96 16:00	15705	19.769	19.247	17.934	-3.650	18.273	17.285	18.662
7/28/96 16:15	15720	19.757	19.665	17.934	-3.603	18.249	17.266	18.646
7/28/96 16:30	15735	19.738	19.025	17.918	-3.635	18.263	17.259	18.630
7/28/96 16:45	15750	19.732	18.316	17.903	-3.698	18.235	17.247	18.630
7/28/96 17:00	15765	19.725	19.468	17.918	-3.713	18.230	17.240	18.615
7/28/96 17:15	15780	19.719	19.278	17.903	-3.729	18.221	17.234	18.615
7/28/96 17:30	15795	19.776	18.487	17.950	-3.729	18.273	17.285	18.662
7/28/96 17:45	15810	19.782	19.399	17.965	-3.682	18.282	17.291	18.662
7/28/96 18:00	15825	19.782	19.101	17.965	-3.698	18.282	17.291	18.678
7/28/96 18:15	15840	19.788	19.304	17.981	-3.682	18.287	17.297	18.678
7/28/96 18:30	15855	19.788	19.247	17.981	-3.635	18.292	17.297	18.678
7/28/96 18:45	15870	19.788	19.139	17.981	-3.682	18.292	17.297	18.678
7/28/96 19:00	15885	19.795	19.386	17.997	-3.650	18.296	17.304	18.694
7/28/96 19:15	15900	19.757	19.158	17.950	-3.745	18.249	17.272	18.662
7/28/96 19:30	15915	19.763	19.202	17.965	-3.729	18.268	17.278	18.662
7/28/96 19:45	15930	19.769	19.126	17.950	-3.776	18.273	17.285	18.662
7/28/96 20:00	15945	19.776	19.361	17.965	-3.808	18.273	17.285	18.662
7/28/96 20:15	15960	19.776	19.183	17.965	-3.903	18.268	17.285	18.662
7/28/96 20:30	15975	19.776	19.297	17.965	-3.871	18.277	17.285	18.662
7/28/96 20:45	15990	19.776	19.266	17.965	-3.871	18.277	17.291	18.662
7/28/96 21:00	16005	19.776	19.335	17.950	-3.950	18.273	17.291	18.662
7/28/96 21:15	16020	19.776	19.158	17.965	-3.981	18.277	17.285	18.662
7/28/96 21:30	16035	19.782	19.253	17.965	-3.966	18.282	17.285	18.662
7/28/96 21:45	16050	19.776	19.430	17.981	-3.981	18.277	17.285	18.662
7/28/96 22:00	16065	19.782	19.380	17.981	-4.060	18.277	17.285	18.662
7/28/96 22:15	16080	19.788	19.532	17.981	-4.013	18.296	17.297	18.678
7/28/96 22:30	16095	19.795	19.133	17.981	-3.966	18.292	17.304	18.678
7/28/96 22:45	16110	19.788	19.158	17.965	-3.981	18.282	17.297	18.662
7/28/96 23:00	16125	19.782	19.190	17.965	-4.060	18.277	17.291	18.662

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7/28/96 23:15	16140	19.776	19.171	17.950	-4.044	18.273	17.285	18.662
7/28/96 23:30	16155	19.776	19.152	17.965	-4.107	18.282	17.291	18.662
7/28/96 23:45	16170	19.788	19.405	17.981	-4.107	18.292	17.297	18.662
7/29/96 0:00	16185	19.795	19.544	17.965	-4.171	18.296	17.297	18.678
7/29/96 0:15	16200	19.788	19.158	17.965	-4.123	18.282	17.291	18.662
7/29/96 0:30	16215	19.776	19.335	17.965	-4.155	18.268	17.285	18.646
7/29/96 0:45	16230	19.769	19.848	17.965	-4.171	18.277	17.285	18.646
7/29/96 1:00	16245	19.776	19.304	17.965	-4.123	18.273	17.285	18.646
7/29/96 1:15	16260	19.776	19.101	17.950	-4.092	18.277	17.278	18.646
7/29/96 1:30	16275	19.776	19.323	17.965	-4.123	18.273	17.285	18.646
7/29/96 1:45	16290	19.769	19.215	17.950	-4.013	18.268	17.278	18.646
7/29/96 2:00	16305	19.769	19.259	17.965	-4.092	18.254	17.278	18.646
7/29/96 2:15	16320	19.769	19.570	17.950	-4.139	18.259	17.278	18.646
7/29/96 2:30	16335	19.769	19.285	17.934	-4.218	18.249	17.272	18.630
7/29/96 2:45	16350	19.751	19.120	17.918	-4.139	18.240	17.259	18.630
7/29/96 3:00	16365	19.751	19.272	17.934	-4.155	18.240	17.259	18.615
7/29/96 3:15	16380	19.738	19.202	17.918	-4.155	18.235	17.247	18.615
7/29/96 3:30	16395	19.732	19.000	17.903	-4.155	18.221	17.234	18.599
7/29/96 3:45	16410	19.744	19.304	17.934	-4.171	18.244	17.253	18.615
7/29/96 4:00	16425	19.751	19.297	17.934	-4.218	18.249	17.253	18.615
7/29/96 4:15	16440	19.732	19.468	17.934	-4.171	18.235	17.240	18.615
7/29/96 4:30	16455	19.732	19.050	17.918	-4.249	18.230	17.240	18.615
7/29/96 4:45	16470	19.719	19.133	17.903	-4.234	18.216	17.234	18.599
7/29/96 5:00	16485	19.719	19.310	17.903	-4.123	18.225	17.234	18.599
7/29/96 5:15	16500	19.719	19.114	17.903	-4.123	18.221	17.234	18.599
7/29/96 5:30	16515	19.713	19.272	17.903	-4.202	18.216	17.228	18.599
7/29/96 5:45	16530	19.713	19.082	17.903	-4.249	18.216	17.228	18.583
7/29/96 6:00	16545	19.719	19.139	17.903	-4.171	18.221	17.228	18.599
7/29/96 6:15	16560	19.713	19.304	17.903	-4.281	18.216	17.221	18.583
7/29/96 6:30	16575	19.732	19.069	17.903	-4.312	18.230	17.240	18.599
7/29/96 6:45	16590	19.719	19.221	17.887	-4.297	18.216	17.228	18.583
7/29/96 7:00	16605	19.713	19.044	17.887	-4.265	18.211	17.228	18.583
7/29/96 7:15	16620	19.706	19.114	17.887	-4.171	18.211	17.221	18.583
7/29/96 7:30	16635	19.706	19.114	17.887	-4.218	18.211	17.215	18.583
7/29/96 7:45	16650	19.700	19.215	17.887	-4.218	18.202	17.215	18.567
7/29/96 8:00	16665	19.694	19.266	17.887	-4.123	18.197	17.209	18.567
7/29/96 8:15	16680	19.694	19.006	17.871	-4.139	18.192	17.202	18.567
7/29/96 8:30	16695	19.694	19.240	17.871	-4.186	18.197	17.209	18.567
7/29/96 8:45	16710	19.700	18.734	17.871	-4.092	18.202	17.209	18.567
7/29/96 9:00	16725	19.694	19.133	17.871	-3.981	18.192	17.202	18.567
7/29/96 9:15	16740	19.694	19.240	17.871	-4.044	18.192	17.209	18.567
7/29/96 9:30	16755	19.700	19.120	17.887	-4.060	18.202	17.215	18.583
7/29/96 9:45	16770	19.719	19.278	17.903	-4.060	18.221	17.228	18.599
7/29/96 10:00	16785	19.725	19.266	17.903	-3.966	18.225	17.234	18.599
7/29/96 10:15	16800	19.719	19.209	17.918	-4.107	18.225	17.234	18.599
7/29/96 10:30	16815	19.719	19.088	17.903	-3.855	18.221	17.228	18.583
7/29/96 10:45	16830	19.725	19.272	17.918	-3.855	18.230	17.234	18.599

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7/29/96 11:00	16845	19.719	19.310	17.903	-3.997	18.221	17.234	18.599
7/29/96 11:15	16860	19.719	19.202	17.903	-3.871	18.225	17.234	18.599
7/29/96 11:30	16875	19.706	19.253	17.887	-3.855	18.211	17.221	18.599
7/29/96 11:45	16890	19.706	19.069	17.903	-3.934	18.216	17.228	18.599
7/29/96 12:00	16905	19.719	19.399	17.918	-4.044	18.230	17.234	18.615
7/29/96 12:15	16920	19.719	19.481	17.903	-4.139	18.230	17.234	18.599
7/29/96 12:30	16935	19.719	19.095	17.918	-4.044	18.235	17.234	18.599
7/29/96 12:45	16950	19.725	19.196	17.918	-4.123	18.230	17.228	18.615
7/29/96 13:00	16965	19.719	19.126	17.903	-4.123	18.221	17.228	18.599
7/29/96 13:15	16980	19.700	19.076	17.887	-4.107	18.207	17.215	18.583
7/29/96 13:30	16995	19.688	18.955	17.871	-4.155	18.202	17.196	18.567
7/29/96 13:45	17010	19.688	19.177	17.871	-4.013	18.192	17.202	18.567
7/29/96 14:00	17025	19.681	19.190	17.871	-4.076	18.192	17.196	18.567
7/29/96 14:15	17040	19.681	18.936	17.871	-4.155	18.183	17.190	18.567
7/29/96 14:30	17055	19.675	19.044	17.871	-3.934	18.178	17.183	18.567
7/29/96 14:45	17070	19.681	19.107	17.871	-4.029	18.197	17.190	18.567
7/29/96 15:00	17085	19.669	19.335	17.855	-4.076	18.178	17.183	18.551
7/29/96 15:15	17100	19.581	18.955	17.745	-4.171	18.088	17.101	18.488
7/29/96 15:30	17115	19.568	18.860	17.745	-4.186	18.079	17.095	18.472
7/29/96 15:45	17130	19.568	18.886	17.745	-4.234	18.079	17.095	18.472
7/29/96 16:00	17145	19.587	19.101	17.761	-4.312	18.093	17.108	18.488
7/29/96 16:15	17160	19.587	19.171	17.761	-4.391	18.102	17.108	18.488
7/29/96 16:30	17175	19.587	18.797	17.745	-4.407	18.098	17.108	18.488
7/29/96 16:45	17190	19.574	18.822	17.761	-3.950	18.084	17.101	18.472
7/29/96 17:00	17205	19.562	18.930	17.745	-4.454	18.074	17.082	18.456
7/29/96 17:15	17220	19.549	18.854	17.745	-4.486	18.060	17.070	18.456
7/29/96 17:30	17235	19.543	19.025	17.730	-4.470	18.050	17.070	18.440
7/29/96 17:45	17250	19.555	18.791	17.730	-4.502	18.060	17.076	18.456
7/29/96 18:00	17265	19.543	18.772	17.730	-4.549	18.050	17.070	18.440
7/29/96 18:15	17280	19.549	18.829	17.730	-4.502	18.060	17.070	18.456
7/29/96 18:30	17295	19.562	18.727	17.745	-4.643	18.074	17.082	18.456
7/29/96 18:45	17310	19.562	19.133	17.745	-4.533	18.069	17.082	18.456
7/29/96 19:00	17325	18.787	16.897	16.959	16.979	17.195	16.513	17.949
7/29/96 19:15	17340	18.554	16.656	16.739	16.774	16.953	16.291	17.712
7/29/96 19:30	17355	18.454	16.555	16.629	16.680	16.849	16.196	17.601
7/29/96 19:45	17370	18.378	16.472	16.551	16.601	16.778	16.127	17.522
7/29/96 20:00	17385	18.334	16.422	16.503	16.569	16.726	16.082	17.474
7/29/96 20:15	17400	18.302	16.396	16.488	16.538	16.703	16.057	17.442
7/29/96 20:30	17415	18.271	16.365	16.440	16.506	16.670	16.025	17.411
7/29/96 20:45	17430	18.246	16.339	16.425	16.475	16.641	16.006	17.379
7/29/96 21:00	17445	18.233	16.320	16.409	16.475	16.627	15.994	17.379
7/29/96 21:15	17460	18.221	16.314	16.393	16.459	16.618	15.981	17.363
7/29/96 21:30	17475	18.208	16.301	16.393	16.443	16.603	15.968	17.347
7/29/96 21:45	17490	18.195	16.289	16.378	16.443	16.589	15.956	17.331
7/29/96 22:00	17505	18.195	16.282	16.362	16.443	16.589	15.956	17.331
7/29/96 22:15	17520	18.195	16.282	16.362	16.443	16.585	15.956	17.331
7/29/96 22:30	17535	18.189	16.276	16.362	16.428	16.580	15.949	17.331

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7/29/96 22:45	17550	18.176	16.270	16.346	16.428	16.570	15.943	17.316
7/29/96 23:00	17565	18.170	16.263	16.346	16.428	16.566	15.937	17.316
7/29/96 23:15	17580	18.164	16.251	16.330	16.412	16.556	15.924	17.300
7/29/96 23:30	17595	18.158	16.238	16.315	16.396	16.542	15.918	17.284
7/29/96 23:45	17610	18.145	16.232	16.315	16.396	16.537	15.905	17.284
7/30/96 0:00	17625	18.139	16.225	16.315	16.380	16.528	15.899	17.268
7/30/96 0:15	17640	18.132	16.219	16.299	16.380	16.518	15.892	17.268
7/30/96 0:30	17655	18.126	16.213	16.299	16.380	16.518	15.886	17.252
7/30/96 0:45	17670	18.126	16.213	16.299	16.365	16.514	15.886	17.252
7/30/96 1:00	17685	18.120	16.206	16.283	16.365	16.509	15.880	17.252
7/30/96 1:15	17700	18.107	16.194	16.283	16.349	16.499	15.873	17.236
7/30/96 1:30	17715	18.107	16.194	16.268	16.349	16.495	15.873	17.236
7/30/96 1:45	17730	18.101	16.187	16.268	16.349	16.495	15.867	17.236
7/30/96 2:00	17745	18.095	16.181	16.268	16.349	16.485	15.861	17.236
7/30/96 2:15	17760	18.088	16.175	16.268	16.333	16.481	15.854	17.221
7/30/96 2:30	17775	18.082	16.175	16.252	16.333	16.476	15.848	17.221
7/30/96 2:45	17790	18.082	16.168	16.252	16.333	16.471	15.848	17.205
7/30/96 3:00	17805	18.076	16.162	16.252	16.317	16.466	15.842	17.205
7/30/96 3:15	17820	18.069	16.156	16.236	16.317	16.462	15.835	17.205
7/30/96 3:30	17835	18.069	16.156	16.236	16.317	16.457	15.835	17.205
7/30/96 3:45	17850	18.063	16.149	16.236	16.317	16.452	15.829	17.189
7/30/96 4:00	17865	18.057	16.143	16.236	16.302	16.447	15.823	17.189
7/30/96 4:15	17880	18.057	16.137	16.220	16.302	16.443	15.823	17.189
7/30/96 4:30	17895	18.051	16.137	16.220	16.286	16.443	15.816	17.189
7/30/96 4:45	17910	18.051	16.137	16.220	16.302	16.443	15.816	17.173
7/30/96 5:00	17925	18.051	16.130	16.220	16.286	16.438	15.816	17.173
7/30/96 5:15	17940	18.044	16.130	16.205	16.286	16.433	15.810	17.173
7/30/96 5:30	17955	18.038	16.124	16.205	16.286	16.428	15.804	17.173
7/30/96 5:45	17970	18.038	16.124	16.205	16.286	16.428	15.804	17.173
7/30/96 6:00	17985	18.032	16.118	16.205	16.270	16.424	15.797	17.173
7/30/96 6:15	18000	18.032	16.118	16.205	16.270	16.419	15.797	17.157
7/30/96 6:30	18015	18.025	16.111	16.189	16.270	16.414	15.791	17.157
7/30/96 6:45	18030	18.025	16.111	16.205	16.270	16.414	15.791	17.157
7/30/96 7:00	18045	18.025	16.111	16.205	16.270	16.419	15.797	17.157
7/30/96 7:15	18060	18.025	16.111	16.189	16.270	16.410	15.791	17.157
7/30/96 7:30	18075	18.019	16.105	16.189	16.270	16.410	15.785	17.141
7/30/96 7:45	18090	18.019	16.105	16.189	16.254	16.410	15.785	17.157
7/30/96 8:00	18105	18.019	16.105	16.189	16.254	16.410	15.785	17.141
7/30/96 8:15	18120	18.019	16.105	16.189	16.270	16.405	15.785	17.141
7/30/96 8:30	18135	18.025	16.111	16.189	16.270	16.410	15.791	17.157
7/30/96 8:45	18150	18.013	16.099	16.189	16.254	16.400	15.778	17.141
7/30/96 9:00	18165	18.013	16.175	16.173	16.270	16.400	15.778	17.141
7/30/96 9:15	18180	18.019	27.571	16.189	16.270	16.410	15.791	17.157
7/30/96 9:30	18195	18.013	27.571	16.189	16.270	16.405	15.785	17.141
7/30/96 9:45	18210	18.006	27.571	16.173	16.254	16.400	15.778	17.141
7/30/96 10:00	18225	18.000	27.571	16.173	16.254	16.386	15.766	17.126
7/30/96 10:15	18240	17.994	27.571	16.173	16.254	16.386	15.760	17.126

		Well ID						
Date and Time	Minutes	INT3	BW2G	62G	66G	67G	INT4	65G
7/30/96 10:30	18255	18.000	27.571	16.173	16.254	16.386	15.766	17.126

APPENDIX F

PITT-1 Ground-Water Quality Data

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Partitioning Interwell Tracer Test 1 - Well BW2G
Extraction Data, Groundwater Quality - July 17 - 29, 1996

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/17/96 21:48	14.09	5.69	592	7.40	0.70	481
7/17/96 21:58	14.09	5.67	592	7.30	0.70	482
7/17/96 22:01	14.12	5.67	590	7.40	0.70	480
7/17/96 22:11	14.10	5.68	589	7.50	0.71	479
7/17/96 22:21	14.13	5.68	593	7.00	0.66	478
7/17/96 22:31	14.19	5.70	590	7.80	0.74	476
7/17/96 22:41	14.10	5.72	589	7.80	0.74	476
7/17/96 22:51	14.08	5.71	587	7.80	0.74	476
7/17/96 23:01	14.08	5.72	586	8.30	0.79	476
7/17/96 23:11	14.06	5.71	583	8.90	0.84	477
7/17/96 23:21	14.38	5.74	585	14.70	1.39	475
7/17/96 23:31	16.88	5.72	587	29.90	2.67	484
7/17/96 23:41	17.87	5.72	588	36.00	3.15	495
7/17/96 23:51	18.41	5.70	588	37.60	3.25	502
7/18/96 0:01	18.60	5.70	585	37.00	3.20	509
7/18/96 0:11	18.76	5.67	587	36.10	3.11	515
7/18/96 0:21	18.74	5.68	586	34.40	2.96	516
7/18/96 0:31	18.77	5.68	586	33.30	2.87	519
7/18/96 0:41	18.79	5.67	585	32.10	2.76	521
7/18/96 0:51	18.72	5.67	587	30.40	2.62	523
7/18/96 1:01	18.62	5.66	587	29.20	2.52	523
7/18/96 1:11	18.58	5.69	585	27.70	2.39	521
7/18/96 1:21	18.60	5.68	587	26.80	2.32	522
7/18/96 1:31	18.60	5.66	588	25.80	2.23	523
7/18/96 1:41	18.53	5.69	585	24.90	2.15	522
7/18/96 1:51	18.54	5.69	586	23.90	2.07	522
7/18/96 2:01	18.55	5.69	586	23.20	2.01	521
7/18/96 2:11	18.56	5.69	587	22.70	1.96	521
7/18/96 2:21	18.65	5.69	586	22.10	1.91	521
7/18/96 2:31	18.75	5.69	587	21.50	1.85	520
7/18/96 2:41	18.95	5.69	587	21.10	1.81	520
7/18/96 2:51	19.19	5.69	588	21.10	1.80	520
7/18/96 3:01	19.45	5.68	588	21.30	1.81	520
7/18/96 3:11	19.73	5.66	589	21.50	1.82	518
7/18/96 3:21	20.02	5.66	589	21.60	1.82	517
7/18/96 3:31	20.32	5.64	590	22.10	1.84	515
7/18/96 3:41	20.62	5.62	591	22.60	1.88	514
7/18/96 3:51	20.64	5.60	591	22.50	1.87	512
7/18/96 5:51	23.05	5.66	607	26.50	2.10	423
7/18/96 6:01	22.78	5.70	605	25.90	2.06	416
7/18/96 6:11	21.97	5.64	602	23.30	1.88	417
7/18/96 6:21	21.02	5.67	597	21.50	1.77	414

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/18/96 6:31	20.49	5.67	593	20.10	1.67	414
7/18/96 6:41	20.25	5.62	593	19.50	1.63	418
7/18/96 6:51	20.18	5.66	591	19.30	1.61	415
7/18/96 7:01	20.24	5.62	591	18.80	1.57	415
7/18/96 7:11	20.39	5.66	591	19.00	1.58	412
7/18/96 7:21	20.44	5.62	591	18.60	1.55	411
7/18/96 7:31	20.48	5.66	591	18.70	1.55	407
7/18/96 7:41	20.60	5.64	591	18.40	1.53	406
7/18/96 7:51	20.59	5.63	591	18.20	1.51	401
7/18/96 8:01	20.68	5.63	591	18.10	1.50	401
7/18/96 8:11	20.76	5.66	590	18.00	1.49	396
7/18/96 8:21	20.90	5.67	591	17.80	1.47	393
7/18/96 8:41	21.24	5.67	592	18.00	1.47	388
7/18/96 8:51	21.39	5.67	592	17.80	1.45	384
7/18/96 9:01	21.56	5.63	593	17.70	1.44	385
7/18/96 9:11	21.70	5.67	593	17.80	1.44	380
7/18/96 9:21	21.85	5.69	594	17.50	1.41	376
7/18/96 9:31	22.05	5.63	594	17.70	1.42	376
7/18/96 9:41	22.23	5.68	595	17.90	1.44	371
7/18/96 9:51	22.48	5.65	596	17.90	1.43	370
7/18/96 10:01	22.78	5.70	597	17.90	1.42	365
7/18/96 10:11	23.03	5.68	598	18.20	1.44	363
7/18/96 10:21	23.34	5.68	599	17.80	1.40	360
7/18/96 10:31	23.78	5.70	600	18.00	1.40	359
7/18/96 10:41	23.81	5.68	599	17.80	1.39	359
7/18/96 10:51	23.73	5.65	597	16.80	1.32	359
7/18/96 11:01	23.63	5.67	595	16.60	1.30	358
7/18/96 11:11	23.53	5.62	593	15.90	1.24	359
7/18/96 11:21	23.22	5.68	589	15.40	1.21	356
7/18/96 11:31	23.10	5.60	588	15.00	1.18	360
7/18/96 11:41	23.16	5.64	587	15.00	1.18	357
7/18/96 11:51	23.71	5.64	587	15.00	1.17	357
7/18/96 12:01	24.39	5.64	587	15.00	1.16	356
7/18/96 12:11	24.82	5.65	585	14.80	1.13	354
7/18/96 12:21	25.10	5.59	586	14.60	1.11	355
7/18/96 12:31	25.30	5.63	587	14.90	1.13	351
7/18/96 12:41	25.55	5.66	584	14.70	1.11	348
7/18/96 12:51	25.76	5.60	586	14.70	1.11	349
7/18/96 13:01	25.94	5.63	586	15.00	1.13	344
7/18/96 13:11	26.15	5.59	587	14.60	1.09	345
7/18/96 13:21	26.60	5.61	587	14.60	1.08	341
7/18/96 13:31	26.70	5.67	586	14.70	1.08	339
7/18/96 13:41	27.11	5.66	585	14.80	1.08	335
7/18/96 13:51	27.83	5.64	588	15.30	1.11	335
7/18/96 14:01	27.78	5.63	587	15.20	1.10	334
7/18/96 14:11	26.66	5.66	582	14.70	1.09	334
7/18/96 14:21	25.86	5.64	580	14.60	1.10	332

Date and Time	Temp (ºC)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/18/96 14:31	25.53	5.59	580	14.70	1.11	333
7/18/96 14:41	25.85	5.61	579	14.80	1.11	328
7/18/96 14:51	25.92	5.59	580	14.80	1.11	328
7/18/96 15:01	26.13	5.61	580	15.00	1.12	324
7/18/96 15:11	26.07	5.61	578	15.10	1.13	321
7/18/96 15:21	25.78	5.61	578	15.20	1.14	322
7/18/96 15:31	25.59	5.57	578	14.80	1.11	323
7/18/96 15:41	25.39	5.62	577	14.80	1.12	319
7/18/96 15:51	25.22	5.61	575	15.10	1.15	320
7/18/96 16:01	24.99	5.58	573	14.80	1.13	319
7/18/96 16:11	25.16	5.61	574	15.10	1.15	318
7/18/96 16:21	25.79	5.64	573	15.10	1.14	314
7/18/96 16:31	26.01	5.61	573	15.30	1.15	316
7/18/96 16:41	25.92	5.61	572	15.30	1.15	315
7/18/96 16:51	25.95	5.66	571	15.20	1.14	312
7/18/96 17:01	26.23	5.62	573	15.50	1.16	311
7/18/96 17:11	26.73	5.62	574	15.60	1.16	309
7/18/96 17:21	26.75	5.65	568	15.60	1.15	308
7/18/96 17:31	14.57	5.68	549	15.90	1.49	319
7/18/96 17:41	14.58	5.79	551	15.30	1.43	338
7/18/96 17:51	14.56	5.80	546	14.60	1.37	352
7/18/96 18:01	14.55	5.82	545	15.30	1.44	362
7/18/96 18:11	14.55	5.83	550	14.70	1.38	372
7/18/96 18:21	14.64	5.80	546	14.80	1.39	381
7/18/96 18:31	14.52	5.82	549	15.00	1.41	388
7/18/96 18:41	14.55	5.79	544	15.70	1.48	397
7/18/96 18:51	14.50	5.82	543	15.50	1.46	401
7/18/96 19:01	14.50	5.79	550	14.40	1.35	407
7/18/96 19:11	14.56	5.77	548	15.00	1.41	413
7/18/96 19:21	14.54	5.79	546	15.70	1.48	417
7/18/96 19:31	14.57	5.77	544	15.00	1.41	397
7/18/96 19:41	14.52	5.77	545	15.20	1.43	416
7/18/96 19:51	14.56	5.78	547	14.80	1.40	422
7/18/96 20:01	14.54	5.77	545	15.50	1.46	429
7/18/96 20:11	14.59	5.78	542	15.90	1.49	432
7/18/96 20:21	14.65	5.80	540	15.50	1.46	434
7/18/96 20:31	14.54	5.77	541	15.60	1.46	439
7/18/96 20:41	14.58	5.78	545	15.70	1.48	442
7/18/96 20:51	14.59	5.79	537	17.10	1.60	444
7/18/96 21:01	14.57	5.78	539	16.40	1.54	446
7/18/96 21:11	14.56	5.76	540	16.50	1.56	450
7/18/96 21:21	14.54	5.75	539	16.80	1.58	453
7/18/96 21:31	14.50	5.75	538	17.10	1.61	454
7/18/96 21:41	14.55	5.77	537	17.10	1.61	456
7/18/96 21:51	14.61	5.78	538	16.60	1.56	457
7/18/96 22:01	14.53	5.80	540	17.10	1.61	458
7/18/96 22:11	14.57	5.76	541	16.10	1.51	461

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/18/96 22:21	14.53	5.75	537	16.60	1.56	462
7/18/96 22:31	14.54	5.75	535	16.70	1.57	464
7/18/96 22:41	14.52	5.75	535	17.10	1.61	465
7/18/96 22:51	14.54	5.77	537	15.80	1.49	465
7/18/96 23:01	14.54	5.78	537	16.00	1.51	465
7/18/96 23:11	14.57	5.77	534	17.50	1.64	468
7/18/96 23:21	14.52	5.77	541	16.10	1.52	468
7/18/96 23:31	14.56	5.78	533	16.90	1.58	469
7/18/96 23:41	14.61	5.80	536	17.20	1.61	469
7/18/96 23:51	14.58	5.77	533	17.60	1.65	471
7/19/96 0:01	14.61	5.79	537	16.80	1.57	470
7/19/96 0:11	14.61	5.77	535	16.60	1.56	471
7/19/96 0:21	14.61	5.77	534	16.50	1.55	473
7/19/96 0:31	14.64	5.80	530	17.80	1.67	472
7/19/96 0:41	14.63	5.78	532	17.90	1.68	474
7/19/96 0:51	14.61	5.76	529	18.00	1.69	474
7/19/96 1:01	14.63	5.77	533	17.00	1.59	475
7/19/96 1:11	14.65	5.77	528	17.50	1.64	476
7/19/96 1:21	14.68	5.76	529	18.30	1.72	478
7/19/96 1:31	14.70	5.78	529	17.60	1.65	477
7/19/96 1:41	14.68	5.78	531	16.80	1.57	478
7/19/96 1:51	14.72	5.75	533	17.50	1.64	479
7/19/96 2:01	14.71	5.79	533	17.50	1.64	478
7/19/96 2:11	14.70	5.78	528	16.80	1.57	479
7/19/96 2:21	14.71	5.80	532	18.00	1.69	478
7/19/96 2:31	14.79	5.79	528	18.00	1.68	479
7/19/96 2:41	14.76	5.78	531	17.80	1.67	479
7/19/96 2:51	14.73	5.81	527	18.80	1.76	479
7/19/96 3:01	14.73	5.80	527	18.70	1.75	480
7/19/96 3:11	14.73	5.78	528	18.30	1.72	481
7/19/96 3:21	14.70	5.80	529	18.90	1.77	480
7/19/96 3:31	14.73	5.80	529	18.20	1.70	480
7/19/96 3:41	14.72	5.79	527	18.90	1.77	481
7/19/96 3:51	14.71	5.78	528	17.90	1.68	482
7/19/96 4:01	14.73	5.80	530	18.60	1.75	480
7/19/96 4:11	14.76	5.78	528	17.80	1.67	483
7/19/96 4:21	14.75	5.79	524	19.50	1.82	482
7/19/96 4:31	14.77	5.78	526	18.10	1.69	483
7/19/96 4:41	14.78	5.78	526	18.10	1.69	483
7/19/96 4:51	14.78	5.77	521	19.30	1.80	483
7/19/96 5:01	14.77	5.79	526	19.10	1.78	483
7/19/96 5:11	14.79	5.79	523	18.80	1.76	484
7/19/96 7:38	14.83	5.77	522	19.70	1.84	487
7/19/96 7:48	14.86	5.76	519	20.00	1.87	488
7/19/96 7:58	14.87	5.81	520	20.00	1.87	486
7/19/96 8:08	14.88	5.78	518	20.00	1.87	488
7/19/96 8:18	14.92	5.77	518	20.30	1.89	488

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/19/96 8:28	14.73	5.77	520	19.60	1.84	487
7/19/96 8:38	14.75	5.79	519	19.70	1.84	488
7/19/96 8:48	14.78	5.77	517	18.80	1.76	489
7/19/96 8:58	14.75	5.78	518	21.20	1.98	488
7/19/96 9:08	14.70	5.80	521	20.90	1.96	489
7/19/96 9:18	14.70	5.77	520	20.10	1.88	490
7/19/96 9:28	14.71	5.77	519	20.80	1.94	491
7/19/96 9:38	14.68	5.80	521	21.00	1.97	490
7/19/96 9:48	14.69	5.80	518	20.70	1.94	491
7/19/96 9:58	14.70	5.83	516	21.90	2.05	489
7/19/96 10:08	14.70	5.78	520	21.70	2.03	492
7/19/96 10:18	14.72	5.82	519	21.40	2.00	492
7/19/96 10:28	14.73	5.78	513	21.60	2.02	492
7/19/96 10:38	14.72	5.78	521	21.00	1.97	493
7/19/96 10:48	14.71	5.80	519	20.50	1.92	491
7/19/96 10:58	14.73	5.79	517	20.80	1.95	492
7/19/96 11:08	14.73	5.80	520	21.20	1.99	491
7/19/96 11:18	14.76	5.80	518	21.20	1.99	491
7/19/96 11:28	14.79	5.80	519	21.00	1.96	490
7/19/96 11:38	14.80	5.80	516	22.00	2.06	491
7/19/96 11:48	14.81	5.83	514	21.60	2.02	489
7/19/96 11:58	14.77	5.80	517	21.20	1.98	492
7/19/96 12:08	14.78	5.78	514	21.70	2.03	493
7/19/96 12:18	14.79	5.83	516	21.50	2.01	490
7/19/96 12:28	14.79	5.80	516	21.10	1.97	493
7/19/96 12:38	14.84	5.83	511	22.00	2.05	490
7/19/96 12:48	14.80	5.78	509	21.10	1.97	493
7/19/96 12:58	14.82	5.80	518	21.10	1.97	492
7/19/96 13:08	14.82	5.82	520	20.50	1.92	491
7/19/96 13:18	14.82	5.77	515	21.10	1.98	493
7/19/96 13:28	14.86	5.80	514	21.40	2.00	492
7/19/96 13:38	14.85	5.82	514	21.30	1.99	492
7/19/96 13:48	14.88	5.79	518	21.40	1.99	491
7/19/96 13:58	14.98	5.77	508	21.40	2.00	494
7/19/96 14:08	14.97	5.81	515	21.20	1.98	491
7/19/96 14:18	15.00	5.80	515	21.50	2.01	491
7/19/96 14:28	15.13	5.78	516	21.90	2.04	493
7/19/96 14:38	15.10	5.76	514	21.30	1.98	493
7/19/96 14:48	15.12	5.76	512	21.60	2.00	493
7/19/96 14:58	15.13	5.76	507	22.20	2.06	493
7/19/96 15:08	15.13	5.76	508	23.00	2.13	493
7/19/96 15:18	15.19	5.76	514	22.70	2.10	492
7/19/96 15:28	15.14	5.78	516	23.50	2.18	492
7/19/96 15:38	15.19	5.79	512	24.60	2.28	490
7/19/96 15:48	15.16	5.77	514	23.80	2.21	491
7/19/96 15:58	15.07	5.76	520	22.40	2.08	492
7/19/96 16:08	15.10	5.80	521	22.80	2.11	491

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/19/96 16:18	15.06	5.80	518	23.90	2.22	490
7/19/96 16:28	15.10	5.80	520	24.20	2.25	492
7/19/96 16:38	15.19	5.78	524	22.90	2.12	492
7/19/96 16:48	15.11	5.78	527	23.90	2.22	492
7/19/96 16:58	15.12	5.76	530	22.80	2.12	492
7/19/96 17:08	15.05	5.77	533	22.80	2.12	492
7/19/96 17:18	15.08	5.76	532	24.10	2.24	492
7/19/96 17:28	15.09	5.76	539	23.50	2.19	493
7/19/96 17:38	15.18	5.80	542	24.60	2.28	491
7/19/96 17:48	15.11	5.76	543	24.20	2.25	492
7/19/96 17:58	15.36	5.78	551	23.80	2.20	489
7/19/96 18:08	17.10	5.76	551	26.30	2.34	474
7/19/96 18:18	17.19	5.77	556	25.30	2.25	474
7/19/96 18:28	17.37	5.76	559	26.00	2.30	477
7/19/96 18:38	17.20	5.76	562	26.90	2.39	480
7/19/96 18:48	15.38	5.76	564	27.30	2.52	494
7/19/96 18:58	15.16	5.78	569	26.20	2.43	499
7/19/96 19:08	15.13	5.76	573	25.30	2.35	501
7/19/96 19:18	15.10	5.77	575	24.80	2.31	499
7/19/96 19:28	15.07	5.75	580	25.50	2.37	500
7/19/96 19:38	15.10	5.75	585	24.80	2.30	499
7/19/96 19:48	15.02	5.75	589	24.80	2.31	499
7/19/96 19:58	15.03	5.78	594	25.20	2.34	497
7/19/96 20:08	14.98	5.78	596	24.30	2.27	497
7/19/96 20:18	15.00	5.78	600	25.60	2.39	496
7/19/96 20:28	14.96	5.80	604	26.30	2.45	494
7/19/96 20:38	14.99	5.79	608	25.60	2.39	495
7/19/96 20:48	15.00	5.79	610	25.50	2.38	495
7/19/96 20:58	14.96	5.81	617	26.20	2.44	493
7/19/96 21:08	14.99	5.81	620	25.90	2.41	494
7/19/96 21:18	14.94	5.79	621	25.60	2.38	494
7/19/96 21:28	14.94	5.77	627	26.20	2.44	495
7/19/96 21:38	14.97	5.80	632	26.00	2.42	494
7/19/96 21:48	14.97	5.80	634	25.50	2.38	494
7/19/96 21:58	14.96	5.80	636	25.70	2.40	494
7/19/96 22:08	14.97	5.81	639	25.70	2.40	492
7/19/96 22:18	14.97	5.80	643	26.20	2.44	494
7/19/96 22:28	14.94	5.79	639	25.40	2.36	493
7/19/96 22:38	14.98	5.82	646	26.40	2.46	492
7/19/96 22:48	14.98	5.80	655	26.60	2.48	493
7/19/96 22:58	14.98	5.80	653	26.20	2.44	494
7/19/96 23:08	14.99	5.82	658	27.30	2.54	492
7/19/96 23:18	15.01	5.81	664	28.10	2.61	494
7/19/96 23:28	15.03	5.81	666	27.50	2.56	493
7/19/96 23:38	14.96	5.81	661	26.30	2.45	493
7/19/96 23:48	14.98	5.79	666	26.90	2.51	494
7/19/96 23:58	14.99	5.81	669	26.50	2.46	493

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/20/96 0:08	15.03	5.80	678	27.60	2.57	493
7/20/96 0:18	14.97	5.79	673	26.70	2.48	494
7/20/96 0:28	15.00	5.82	681	27.20	2.53	492
7/20/96 0:38	14.96	5.80	679	26.70	2.48	493
7/20/96 0:48	14.99	5.79	682	27.10	2.52	494
7/20/96 0:58	14.99	5.81	685	26.90	2.51	492
7/20/96 1:08	14.99	5.80	687	26.70	2.48	494
7/20/96 1:18	15.01	5.82	696	27.10	2.53	492
7/20/96 1:28	15.05	5.81	695	27.40	2.55	493
7/20/96 1:38	15.02	5.81	694	27.10	2.52	493
7/20/96 1:48	15.02	5.81	685	25.20	2.34	493
7/20/96 1:58	15.02	5.81	696	26.00	2.42	492
7/20/96 2:08	15.07	5.78	703	26.70	2.48	493
7/20/96 2:18	15.04	5.79	697	25.40	2.36	494
7/20/96 2:28	15.06	5.79	700	26.10	2.43	492
7/20/96 2:38	15.07	5.83	705	26.10	2.43	491
7/20/96 2:48	15.10	5.82	709	27.00	2.51	491
7/20/96 2:58	15.06	5.81	708	26.20	2.44	492
7/20/96 3:08	15.08	5.79	707	25.90	2.40	493
7/20/96 3:18	15.12	5.83	715	26.90	2.49	493
7/20/96 3:28	15.13	5.81	714	26.50	2.46	492
7/20/96 3:38	15.13	5.79	718	26.50	2.46	493
7/20/96 3:48	15.14	5.81	718	26.70	2.48	492
7/20/96 3:58	15.14	5.81	714	27.00	2.51	492
7/20/96 4:08	15.16	5.82	729	28.40	2.63	491
7/20/96 4:18	15.20	5.83	724	28.80	2.67	491
7/20/96 4:28	15.20	5.81	725	28.20	2.61	493
7/20/96 4:38	15.20	5.79	725	27.40	2.54	494
7/20/96 4:48	15.23	5.82	733	28.80	2.66	492
7/20/96 4:58	15.30	5.79	736	29.30	2.71	493
7/20/96 5:08	15.23	5.81	730	27.60	2.56	493
7/20/96 5:18	15.31	5.81	742	28.70	2.66	492
7/20/96 5:28	15.25	5.82	736	27.30	2.53	492
7/20/96 5:38	15.22	5.81	727	26.60	2.46	493
7/20/96 5:48	15.24	5.81	730	26.80	2.48	492
7/20/96 5:58	15.26	5.81	730	27.80	2.57	492
7/20/96 6:08	15.28	5.79	740	28.10	2.60	493
7/20/96 6:18	15.30	5.81	743	28.30	2.62	492
7/20/96 6:28	15.28	5.80	731	27.10	2.51	493
7/20/96 6:38	15.31	5.81	737	27.40	2.53	492
7/20/96 6:48	15.36	5.82	752	28.30	2.61	490
7/20/96 6:58	15.32	5.81	736	26.70	2.46	492
7/20/96 7:08	15.36	5.81	744	26.90	2.49	491
7/20/96 7:18	15.40	5.79	752	28.00	2.58	493
7/20/96 7:28	15.40	5.83	745	26.90	2.48	491
7/20/96 7:38	15.44	5.81	747	27.50	2.54	492
7/20/96 7:48	15.48	5.78	760	28.30	2.60	492

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/20/96 7:58	15.56	5.80	767	28.80	2.65	493
7/20/96 8:08	15.50	5.80	758	27.40	2.52	493
7/20/96 8:18	15.53	5.78	758	28.10	2.59	494
7/20/96 8:28	15.59	5.79	768	28.90	2.65	492
7/20/96 8:38	15.59	5.79	764	28.80	2.65	493
7/20/96 8:48	15.60	5.81	753	27.60	2.54	491
7/20/96 8:58	15.67	5.79	767	29.10	2.67	492
7/20/96 9:08	15.64	5.77	760	28.00	2.57	492
7/20/96 9:18	15.68	5.79	758	27.70	2.54	492
7/20/96 9:28	15.63	5.79	754	27.00	2.48	491
7/20/96 9:38	15.71	5.79	767	28.10	2.57	491
7/20/96 9:48	15.71	5.79	766	28.10	2.58	491
7/20/96 9:58	15.66	5.81	748	26.60	2.44	490
7/20/96 10:08	15.77	5.80	769	28.20	2.58	490
7/20/96 10:18	15.74	5.79	765	28.10	2.57	491
7/20/96 10:28	15.79	5.78	767	28.60	2.62	491
7/20/96 10:38	15.89	5.78	777	29.10	2.66	491
7/20/96 10:48	15.86	5.77	773	27.00	2.46	489
7/20/96 10:58	15.84	5.78	768	27.60	2.52	490
7/20/96 11:08	15.93	5.77	775	27.90	2.55	490
7/20/96 11:18	15.93	5.75	776	28.10	2.56	491
7/20/96 11:28	16.00	5.77	787	28.80	2.62	490
7/20/96 11:38	15.98	5.74	784	28.30	2.58	491
7/20/96 11:48	15.99	5.75	773	27.80	2.53	491
7/20/96 11:58	15.99	5.77	771	27.70	2.52	490
7/20/96 12:08	16.07	5.76	781	28.60	2.60	490
7/20/96 12:18	16.07	5.76	781	28.60	2.60	490
7/20/96 12:28	16.09	5.76	784	28.80	2.61	490
7/20/96 12:38	16.13	5.74	789	29.10	2.64	490
7/20/96 12:48	16.14	5.76	784	28.60	2.60	489
7/20/96 12:58	16.15	5.76	790	29.00	2.63	489
7/20/96 13:08	16.13	5.76	777	28.20	2.56	488
7/20/96 13:18	16.16	5.75	790	29.20	2.65	489
7/20/96 13:28	16.21	5.73	788	28.60	2.59	491
7/20/96 13:38	16.20	5.77	791	29.00	2.63	491
7/20/96 13:48	16.24	5.75	787	28.90	2.62	489
7/20/96 13:58	16.24	5.72	783	28.60	2.59	491
7/20/96 14:08	16.21	5.74	787	28.40	2.58	489
7/20/96 14:18	16.21	5.72	782	28.70	2.60	491
7/20/96 14:28	16.31	5.72	792	29.40	2.66	491
7/20/96 14:38	16.29	5.74	794	29.00	2.63	489
7/20/96 14:48	16.32	5.74	791	29.00	2.63	490
7/20/96 14:58	16.25	5.75	791	28.60	2.59	490
7/20/96 15:08	16.37	5.73	798	29.30	2.65	490
7/20/96 15:18	16.29	5.73	785	28.30	2.56	490
7/20/96 15:28	16.31	5.76	793	29.10	2.63	488
7/20/96 15:38	16.36	5.73	801	30.00	2.71	489

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/20/96 15:48	16.42	5.73	803	30.20	2.72	490
7/20/96 15:58	16.36	5.76	795	29.20	2.64	491
7/20/96 16:08	16.32	5.72	789	28.20	2.55	491
7/20/96 16:18	16.43	5.73	801	29.40	2.65	490
7/20/96 16:28	16.42	5.73	792	28.70	2.59	490
7/20/96 16:38	16.42	5.72	796	29.30	2.64	490
7/20/96 16:48	16.46	5.71	801	29.70	2.68	492
7/20/96 16:58	16.42	5.73	800	29.40	2.65	490
7/20/96 17:08	16.37	5.72	800	28.90	2.61	490
7/20/96 17:18	16.48	5.70	798	29.60	2.67	490
7/20/96 17:28	16.43	5.73	800	29.50	2.66	490
7/20/96 17:38	16.35	5.70	796	28.70	2.59	492
7/20/96 17:48	16.45	5.72	807	29.90	2.69	490
7/20/96 17:58	16.50	5.72	808	29.90	2.69	490
7/20/96 18:08	16.46	5.72	802	29.40	2.65	490
7/20/96 18:18	16.50	5.72	811	30.10	2.71	490
7/20/96 18:28	16.46	5.74	801	29.00	2.61	488
7/20/96 18:38	16.36	5.72	792	27.60	2.49	489
7/20/96 18:48	16.36	5.72	794	28.60	2.58	490
7/20/96 18:58	16.46	5.69	810	29.60	2.66	490
7/20/96 19:08	16.50	5.72	816	30.30	2.73	491
7/20/96 19:18	16.34	5.70	801	29.30	2.65	493
7/20/96 19:28	16.40	5.72	802	29.30	2.64	491
7/20/96 19:38	16.39	5.73	809	29.70	2.69	491
7/20/96 19:48	16.38	5.73	804	29.50	2.66	490
7/20/96 19:58	16.45	5.70	813	29.90	2.69	493
7/20/96 20:08	16.43	5.70	814	30.30	2.73	492
7/20/96 20:18	16.41	5.70	812	29.80	2.69	492
7/20/96 20:28	16.36	5.73	812	29.40	2.65	492
7/20/96 20:38	16.40	5.76	820	30.00	2.71	490
7/20/96 20:48	16.37	5.74	808	29.80	2.69	491
7/20/96 20:58	16.37	5.75	809	29.20	2.63	490
7/20/96 21:08	16.41	5.74	811	29.60	2.67	493
7/20/96 21:18	16.42	5.74	812	30.20	2.72	493
7/20/96 21:28	16.38	5.76	806	29.40	2.65	493
7/20/96 21:38	16.44	5.76	813	30.10	2.71	491
7/20/96 21:48	16.38	5.76	804	29.20	2.64	491
7/20/96 21:58	16.44	5.73	812	30.30	2.73	491
7/20/96 22:08	16.41	5.79	799	29.50	2.66	491
7/20/96 22:18	16.42	5.77	803	29.90	2.70	491
7/20/96 22:28	16.38	5.74	803	29.90	2.70	487
7/20/96 22:38	16.50	5.77	806	30.60	2.75	488
7/20/96 22:48	16.50	5.77	793	30.30	2.73	490
7/20/96 22:58	16.45	5.76	791	29.50	2.66	491
7/20/96 23:08	16.48	5.73	791	30.00	2.70	493
7/20/96 23:18	16.49	5.77	784	29.60	2.67	490
7/20/96 23:28	16.50	5.74	781	29.90	2.70	492

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/20/96 23:38	16.44	5.74	772	29.40	2.65	492
7/20/96 23:48	16.55	5.73	775	29.70	2.67	491
7/20/96 23:58	16.54	5.76	773	30.20	2.72	492
7/21/96 0:08	16.54	5.77	766	29.70	2.67	491
7/21/96 0:18	16.59	5.79	761	29.90	2.69	491
7/21/96 0:28	16.49	5.76	755	29.00	2.61	493
7/21/96 0:38	16.51	5.76	753	29.50	2.66	492
7/21/96 0:48	16.56	5.77	751	29.50	2.65	492
7/21/96 0:58	16.61	5.77	746	29.70	2.67	491
7/21/96 1:08	16.60	5.74	741	29.60	2.66	493
7/21/96 1:18	16.54	5.77	741	29.80	2.68	491
7/21/96 1:28	16.61	5.74	733	29.30	2.63	494
7/21/96 1:38	16.56	5.76	731	29.40	2.64	492
7/21/96 1:48	16.64	5.77	727	29.10	2.62	492
7/21/96 1:58	16.61	5.78	722	29.20	2.63	493
7/21/96 2:08	16.65	5.73	719	29.10	2.62	494
7/21/96 2:18	16.67	5.73	716	29.60	2.66	494
7/21/96 2:28	16.64	5.76	714	29.40	2.64	492
7/21/96 2:38	16.65	5.78	707	29.20	2.62	493
7/21/96 2:48	16.65	5.77	706	29.10	2.62	492
7/21/96 2:58	16.64	5.77	701	28.80	2.59	492
7/21/96 3:08	16.69	5.76	699	29.30	2.63	492
7/21/96 3:18	16.66	5.75	695	28.90	2.59	491
7/21/96 3:28	16.67	5.75	694	29.20	2.62	493
7/21/96 3:38	16.67	5.76	693	29.10	2.61	491
7/21/96 3:48	16.67	5.75	689	28.70	2.58	490
7/21/96 3:58	16.71	5.76	685	28.90	2.59	490
7/21/96 4:08	16.74	5.74	681	28.90	2.59	490
7/21/96 4:18	16.75	5.76	678	28.90	2.60	491
7/21/96 4:28	16.66	5.76	679	28.30	2.54	490
7/21/96 4:38	16.74	5.76	673	28.50	2.55	492
7/21/96 4:48	16.74	5.78	671	28.70	2.57	491
7/21/96 4:58	16.75	5.75	669	28.60	2.56	493
7/21/96 5:08	16.76	5.73	666	28.90	2.59	494
7/21/96 5:18	16.72	5.78	664	28.50	2.56	492
7/21/96 5:28	16.85	5.76	661	29.00	2.60	492
7/21/96 5:38	16.85	5.74	660	28.90	2.59	492
7/21/96 5:48	16.69	5.76	658	28.00	2.51	493
7/21/96 5:58	16.75	5.76	656	28.10	2.52	493
7/21/96 6:08	16.71	5.73	655	28.40	2.55	494
7/21/96 6:18	16.72	5.76	652	28.20	2.53	494
7/21/96 6:28	16.74	5.76	650	28.00	2.51	493
7/21/96 6:38	16.73	5.73	651	28.60	2.56	495
7/21/96 6:48	16.76	5.77	647	28.60	2.56	493
7/21/96 6:58	16.89	5.76	644	28.50	2.55	493
7/21/96 7:28	16.81	5.76	639	28.40	2.54	493
7/21/96 7:38	16.80	5.73	637	28.30	2.54	496

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/21/96 8:08	16.77	5.75	634	28.20	2.53	494
7/21/96 8:18	16.77	5.75	632	27.50	2.47	494
7/21/96 8:28	16.80	5.77	632	27.70	2.48	493
7/21/96 8:38	16.77	5.72	628	27.60	2.47	495
7/21/96 8:48	16.81	5.71	627	27.70	2.48	496
7/21/96 8:58	16.79	5.75	626	27.60	2.48	495
7/21/96 9:08	16.80	5.75	625	27.40	2.46	495
7/21/96 9:18	16.80	5.78	622	27.70	2.49	493
7/21/96 9:28	16.86	5.74	622	27.30	2.44	493
7/21/96 9:38	16.81	5.77	623	27.60	2.47	492
7/21/96 9:48	16.84	5.71	618	28.20	2.52	495
7/21/96 9:58	16.85	5.74	619	27.70	2.48	494
7/21/96 10:08	16.83	5.71	617	27.60	2.47	495
7/21/96 10:18	16.84	5.73	616	27.20	2.43	494
7/21/96 10:28	16.82	5.73	614	27.10	2.43	494
7/21/96 10:38	16.87	5.75	615	27.40	2.45	495
7/21/96 10:48	16.88	5.73	611	27.50	2.46	494
7/21/96 10:58	16.92	5.73	612	27.60	2.47	494
7/21/96 11:08	16.89	5.75	611	27.00	2.41	495
7/21/96 11:18	16.84	5.72	608	26.90	2.41	494
7/21/96 11:28	16.87	5.72	608	27.20	2.44	495
7/21/96 11:38	16.96	5.70	607	27.50	2.46	493
7/21/96 11:48	16.86	5.72	608	27.10	2.43	494
7/21/96 11:58	16.88	5.72	606	26.90	2.41	492
7/21/96 12:08	16.84	5.71	605	27.20	2.43	495
7/21/96 12:18	16.86	5.71	605	26.90	2.41	494
7/21/96 12:28	16.84	5.70	604	27.00	2.42	495
7/21/96 12:38	16.88	5.72	602	27.10	2.43	494
7/21/96 12:48	16.82	5.70	602	26.50	2.37	494
7/21/96 12:58	16.85	5.70	600	27.20	2.44	494
7/21/96 13:08	16.84	5.70	598	27.40	2.45	495
7/21/96 13:18	16.76	5.70	600	26.30	2.36	493
7/21/96 13:28	16.77	5.67	599	26.90	2.41	494
7/21/96 13:38	16.74	5.70	598	27.10	2.43	494
7/21/96 13:48	16.72	5.68	597	27.10	2.43	496
7/21/96 13:58	16.77	5.70	594	27.30	2.45	494
7/21/96 14:08	16.73	5.67	595	26.90	2.41	496
7/21/96 14:18	16.67	5.70	594	26.40	2.37	494
7/21/96 14:28	16.62	5.69	595	26.70	2.40	491
7/21/96 14:38	16.66	5.69	593	26.50	2.38	493
7/21/96 14:48	16.66	5.72	591	27.00	2.43	493
7/21/96 14:58	16.64	5.69	592	26.50	2.38	495
7/21/96 15:08	16.64	5.71	591	26.70	2.40	494
7/21/96 15:18	16.55	5.71	590	26.10	2.35	495
7/21/96 15:28	16.62	5.75	587	26.80	2.41	492
7/21/96 15:38	16.63	5.71	588	27.10	2.44	494
7/21/96 15:48	16.65	5.68	588	26.30	2.37	496

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/21/96 15:58	16.68	5.71	586	26.90	2.42	492
7/21/96 16:08	16.63	5.71	588	26.80	2.41	494
7/21/96 16:18	16.55	5.74	586	26.70	2.40	496
7/21/96 16:28	16.59	5.68	585	26.70	2.40	494
7/21/96 16:38	16.59	5.68	585	26.90	2.42	496
7/21/96 16:48	16.65	5.70	584	26.90	2.42	496
7/21/96 16:58	16.69	5.71	580	27.30	2.45	494
7/21/96 17:08	16.52	5.74	582	26.80	2.41	494
7/21/96 17:18	16.61	5.68	581	26.80	2.42	495
7/21/96 17:28	16.61	5.69	581	26.90	2.42	494
7/21/96 17:38	16.61	5.71	579	27.00	2.43	494
7/21/96 17:48	16.49	5.71	580	27.10	2.45	494
7/21/96 17:58	16.47	5.72	578	27.10	2.45	494
7/21/96 18:08	16.46	5.70	577	26.60	2.40	495
7/21/96 18:18	16.48	5.75	576	27.50	2.48	493
7/21/96 18:28	16.48	5.72	577	27.30	2.46	493
7/21/96 18:38	16.47	5.74	572	27.70	2.50	491
7/21/96 18:48	16.40	5.75	574	27.20	2.46	492
7/21/96 18:58	16.42	5.71	571	27.20	2.46	493
7/21/96 19:08	16.38	5.70	573	27.00	2.44	495
7/21/96 19:18	16.42	5.71	570	27.40	2.48	495
7/21/96 19:28	16.39	5.74	573	27.00	2.44	493
7/21/96 19:38	16.31	5.74	574	26.80	2.42	493
7/21/96 19:48	16.36	5.75	569	27.60	2.49	493
7/21/96 19:58	16.34	5.72	571	26.70	2.42	495
7/21/96 21:06	16.19	5.79	571	27.00	2.45	494
7/21/96 21:08	16.23	5.76	570	27.60	2.50	496
7/21/96 21:18	16.24	5.79	566	27.50	2.50	495
7/21/96 21:28	16.23	5.76	567	27.30	2.48	495
7/21/96 21:38	16.23	5.79	566	27.50	2.49	494
7/21/96 21:48	16.16	5.74	567	26.90	2.44	497
7/21/96 21:58	16.15	5.76	570	26.70	2.43	496
7/21/96 22:08	16.17	5.77	566	27.00	2.45	494
7/21/96 22:18	16.14	5.80	566	26.70	2.43	494
7/21/96 22:28	16.19	5.74	563	27.30	2.48	497
7/21/96 22:38	16.20	5.75	560	27.40	2.49	498
7/21/96 22:48	16.16	5.76	557	27.20	2.47	498
7/21/96 22:58	16.15	5.74	562	27.00	2.46	498
7/21/96 23:08	16.19	5.77	563	27.20	2.47	496
7/21/96 23:18	16.12	5.74	559	27.10	2.47	496
7/21/96 23:28	16.09	5.77	564	26.60	2.42	496
7/21/96 23:38	16.14	5.77	560	27.10	2.46	496
7/21/96 23:48	16.11	5.77	561	26.90	2.44	496
7/21/96 23:58	16.10	5.77	560	26.80	2.44	497
7/22/96 0:08	16.11	5.77	560	27.00	2.45	497
7/22/96 0:18	16.14	5.79	557	27.60	2.51	496
7/22/96 0:28	16.10	5.80	558	27.30	2.48	495

Date and Time	Temp (ºC)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/22/96 0:38	16.11	5.75	555	27.10	2.46	495
7/22/96 0:48	16.10	5.74	557	26.90	2.45	499
7/22/96 0:58	16.09	5.74	558	27.10	2.46	497
7/22/96 1:08	16.08	5.77	553	27.50	2.50	497
7/22/96 1:18	16.11	5.77	555	27.90	2.53	498
7/22/96 1:28	16.08	5.76	556	27.00	2.46	496
7/22/96 1:38	16.08	5.76	555	27.60	2.51	498
7/22/96 1:48	16.07	5.74	553	27.30	2.48	497
7/22/96 1:58	16.06	5.77	555	27.40	2.49	497
7/22/96 2:08	16.07	5.77	554	27.60	2.51	496
7/22/96 2:18	16.06	5.76	552	27.20	2.47	498
7/22/96 2:28	16.04	5.76	556	26.80	2.44	498
7/22/96 2:38	16.07	5.77	555	27.20	2.48	496
7/22/96 2:48	16.05	5.77	554	27.30	2.49	496
7/22/96 2:58	16.06	5.77	552	27.80	2.53	496
7/22/96 3:08	16.05	5.78	552	27.50	2.51	497
7/22/96 3:18	16.03	5.77	554	27.30	2.48	496
7/22/96 3:28	16.04	5.80	548	28.20	2.57	495
7/22/96 3:38	16.01	5.78	555	26.90	2.45	497
7/22/96 3:48	16.01	5.78	552	27.50	2.50	496
7/22/96 3:58	16.02	5.76	549	28.00	2.55	497
7/22/96 4:08	16.06	5.75	546	28.20	2.57	498
7/22/96 4:18	16.00	5.76	551	27.20	2.48	499
7/22/96 4:28	16.04	5.78	550	27.90	2.54	497
7/22/96 4:38	16.05	5.75	547	28.20	2.56	497
7/22/96 4:48	15.99	5.75	550	27.60	2.51	499
7/22/96 4:58	16.02	5.75	550	27.70	2.53	498
7/22/96 5:08	16.02	5.78	548	27.90	2.54	498
7/22/96 5:18	16.00	5.78	547	27.70	2.52	498
7/22/96 5:28	15.96	5.77	549	27.20	2.48	498
7/22/96 5:38	15.99	5.80	548	27.80	2.53	497
7/22/96 5:48	16.00	5.78	546	27.50	2.50	498
7/22/96 5:58	15.95	5.77	549	27.10	2.47	499
7/22/96 6:08	15.95	5.78	548	27.20	2.48	499
7/22/96 6:18	15.96	5.78	546	27.70	2.53	499
7/22/96 6:28	15.98	5.75	544	27.80	2.53	499
7/22/96 6:38	15.95	5.78	545	27.30	2.49	498
7/22/96 6:48	15.98	5.81	543	28.10	2.56	497
7/22/96 6:58	15.93	5.78	544	27.60	2.52	498
7/22/96 7:08	15.93	5.76	543	27.40	2.50	500
7/22/96 7:18	15.94	5.78	541	27.80	2.53	498
7/22/96 7:28	15.95	5.75	540	27.60	2.52	501
7/22/96 7:38	15.96	5.78	543	28.00	2.55	499
7/22/96 7:48	15.91	5.75	545	27.10	2.47	500
7/22/96 7:58	15.96	5.80	541	28.30	2.58	497
7/22/96 8:08	15.91	5.77	543	27.40	2.50	499
7/22/96 8:18	15.95	5.80	542	27.70	2.53	498

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/22/96 8:28	15.95	5.77	540	28.00	2.56	500
7/22/96 8:38	15.95	5.75	538	28.30	2.58	500
7/22/96 8:48	15.91	5.78	541	27.50	2.51	498
7/22/96 8:58	15.97	5.74	541	28.20	2.57	501
7/22/96 9:08	15.94	5.78	538	28.10	2.57	500
7/22/96 9:18	15.92	5.78	537	27.90	2.55	499
7/22/96 9:28	15.91	5.77	542	27.50	2.51	499
7/22/96 9:38	15.92	5.76	539	27.90	2.55	502
7/22/96 9:48	15.93	5.77	537	28.10	2.56	500
7/22/96 9:58	15.93	5.77	537	27.90	2.55	500
7/22/96 10:08	15.94	5.77	538	27.90	2.54	501
7/22/96 10:18	15.91	5.77	538	27.70	2.53	501
7/22/96 10:28	15.92	5.77	535	27.90	2.55	501
7/22/96 10:38	15.91	5.77	538	27.90	2.55	501
7/22/96 10:48	15.93	5.76	537	28.00	2.56	502
7/22/96 10:58	15.88	5.79	539	27.40	2.51	499
7/22/96 11:08	15.93	5.78	537	28.10	2.56	501
7/22/96 11:18	15.89	5.79	537	27.70	2.53	499
7/22/96 11:28	15.91	5.76	537	27.90	2.55	501
7/22/96 11:38	15.87	5.78	538	27.70	2.54	500
7/22/96 11:48	15.88	5.76	537	27.40	2.50	499
7/22/96 11:58	15.89	5.76	537	27.60	2.52	501
7/22/96 12:08	15.92	5.74	531	28.40	2.59	503
7/22/96 12:18	15.89	5.78	534	28.10	2.56	501
7/22/96 12:28	15.87	5.74	538	27.40	2.50	501
7/22/96 12:38	15.88	5.76	537	27.60	2.52	499
7/22/96 12:48	15.90	5.80	534	27.70	2.53	499
7/22/96 12:58	15.92	5.73	534	28.00	2.56	502
7/22/96 13:08	15.86	5.79	537	27.50	2.51	499
7/22/96 13:18	15.88	5.77	532	28.10	2.57	501
7/22/96 13:28	15.86	5.76	533	27.60	2.52	501
7/22/96 13:38	15.91	5.76	532	28.10	2.57	501
7/22/96 13:48	15.85	5.75	534	27.60	2.52	502
7/22/96 13:58	15.87	5.79	531	28.00	2.56	500
7/22/96 14:08	15.88	5.78	533	27.60	2.53	498
7/22/96 14:18	15.89	5.74	534	27.60	2.52	500
7/22/96 14:28	15.88	5.77	530	28.20	2.58	499
7/22/96 14:38	15.88	5.76	532	27.70	2.53	500
7/22/96 14:48	15.88	5.76	530	28.10	2.57	500
7/22/96 14:58	15.85	5.76	534	27.50	2.51	500
7/22/96 15:08	15.91	5.77	528	28.70	2.62	500
7/22/96 15:18	15.83	5.73	534	27.50	2.51	501
7/22/96 15:28	15.85	5.73	531	27.70	2.53	502
7/22/96 15:38	15.84	5.76	530	27.90	2.55	499
7/22/96 15:48	15.83	5.73	534	27.40	2.51	502
7/22/96 15:58	15.87	5.73	531	28.10	2.57	500
7/22/96 16:08	15.83	5.74	532	27.90	2.55	502

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/22/96 16:18	15.83	5.76	531	27.80	2.54	501
7/22/96 16:28	15.81	5.76	532	27.40	2.51	500
7/22/96 16:38	15.82	5.76	532	27.50	2.51	501
7/22/96 16:48	15.80	5.79	530	27.60	2.53	500
7/22/96 16:58	15.85	5.77	526	28.40	2.60	501
7/22/96 17:08	15.80	5.73	528	27.80	2.54	501
7/22/96 17:18	15.79	5.80	530	27.70	2.54	499
7/22/96 17:28	15.81	5.76	530	27.40	2.51	501
7/22/96 17:38	15.80	5.76	529	27.80	2.55	500
7/22/96 17:48	15.77	5.80	531	27.50	2.52	499
7/22/96 17:58	15.77	5.76	529	27.60	2.53	501
7/22/96 18:08	15.76	5.78	528	27.70	2.54	500
7/22/96 18:18	15.77	5.77	527	28.00	2.57	499
7/22/96 18:28	15.78	5.74	527	28.00	2.57	501
7/22/96 18:38	15.74	5.77	529	27.60	2.53	501
7/22/96 18:48	15.78	5.75	525	28.30	2.59	502
7/22/96 18:58	15.76	5.80	524	28.10	2.58	500
7/22/96 19:08	15.72	5.77	527	27.60	2.53	501
7/22/96 19:18	15.75	5.77	526	27.80	2.55	501
7/22/96 19:28	15.72	5.77	528	27.60	2.53	501
7/22/96 19:38	15.77	5.78	521	28.30	2.60	501
7/22/96 19:48	15.73	5.80	529	27.80	2.54	500
7/22/96 19:58	15.72	5.77	528	27.40	2.51	501
7/22/96 20:08	15.73	5.77	526	27.70	2.54	501
7/22/96 20:18	15.71	5.81	527	27.70	2.54	500
7/22/96 20:28	15.73	5.74	527	27.60	2.53	503
7/22/96 20:38	15.72	5.77	529	27.80	2.55	500
7/22/96 20:48	15.75	5.78	521	28.30	2.59	501
7/22/96 20:58	15.69	5.77	526	27.40	2.51	501
7/22/96 21:08	15.70	5.77	529	27.10	2.49	501
7/22/96 21:18	15.71	5.80	525	27.90	2.56	501
7/22/96 21:28	15.69	5.77	527	27.30	2.50	502
7/22/96 21:38	15.68	5.78	526	27.70	2.54	501
7/22/96 21:48	15.66	5.81	527	27.50	2.52	501
7/22/96 21:58	15.70	5.80	521	28.10	2.58	500
7/22/96 22:08	15.69	5.74	522	27.70	2.54	504
7/22/96 22:18	15.69	5.81	523	27.40	2.51	503
7/22/96 22:28	15.68	5.75	520	27.80	2.55	504
7/22/96 22:38	15.68	5.81	523	27.90	2.56	501
7/22/96 22:48	15.68	5.77	524	27.50	2.52	502
7/22/96 22:58	15.67	5.80	522	27.80	2.55	500
7/22/96 23:08	15.67	5.78	523	27.80	2.55	502
7/22/96 23:18	15.67	5.78	526	27.40	2.51	498
7/22/96 23:28	15.66	5.75	523	27.50	2.53	503
7/22/96 23:38	15.65	5.78	523	27.70	2.54	502
7/22/96 23:48	15.64	5.78	525	27.80	2.55	502
7/22/96 23:58	15.67	5.78	521	27.90	2.56	502

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/23/96 0:08	15.64	5.78	521	27.60	2.53	502
7/23/96 0:18	15.64	5.79	520	27.50	2.52	500
7/23/96 0:28	15.65	5.75	517	28.10	2.58	504
7/23/96 0:38	15.61	5.78	523	27.10	2.49	503
7/23/96 0:48	15.59	5.80	524	27.30	2.51	501
7/23/96 0:58	15.62	5.78	520	27.90	2.57	503
7/23/96 1:08	15.59	5.75	522	27.70	2.54	504
7/23/96 1:18	15.61	5.78	520	27.70	2.55	503
7/23/96 1:28	15.60	5.80	525	27.20	2.50	502
7/23/96 1:38	15.55	5.78	526	27.00	2.48	505
7/23/96 1:48	15.58	5.76	522	27.00	2.48	505
7/23/96 1:58	15.56	5.75	524	27.30	2.51	504
7/23/96 2:08	15.56	5.80	521	27.50	2.53	505
7/23/96 2:18	15.59	5.75	517	27.50	2.53	505
7/23/96 2:28	15.59	5.80	520	27.60	2.54	503
7/23/96 2:38	15.57	5.75	521	27.30	2.51	505
7/23/96 2:48	15.59	5.78	520	27.60	2.54	503
7/23/96 2:58	15.58	5.78	521	27.30	2.51	503
7/23/96 3:08	15.59	5.78	518	27.60	2.54	503
7/23/96 3:18	15.54	5.81	524	27.00	2.48	502
7/23/96 3:28	15.55	5.81	521	27.10	2.49	502
7/23/96 3:38	15.57	5.81	521	27.20	2.50	503
7/23/96 3:48	15.54	5.78	522	27.30	2.51	504
7/23/96 3:58	15.58	5.78	515	28.10	2.58	502
7/23/96 4:08	15.56	5.79	520	27.60	2.54	503
7/23/96 4:18	15.55	5.78	519	27.20	2.51	504
7/23/96 4:28	15.54	5.78	520	27.50	2.53	503
7/23/96 4:38	15.52	5.75	517	27.40	2.52	506
7/23/96 4:48	15.52	5.76	521	27.30	2.51	503
7/23/96 4:58	15.52	5.75	520	27.20	2.51	504
7/23/96 5:08	15.52	5.75	519	26.90	2.48	505
7/23/96 5:18	15.51	5.78	523	26.70	2.46	503
7/23/96 5:28	15.53	5.80	522	27.40	2.52	501
7/23/96 5:38	15.53	5.78	517	27.50	2.53	503
7/23/96 5:48	15.52	5.78	518	27.50	2.53	503
7/23/96 5:58	15.53	5.78	519	27.50	2.54	503
7/23/96 6:08	15.52	5.75	519	27.20	2.51	503
7/23/96 6:18	15.50	5.80	521	27.30	2.52	503
7/23/96 6:28	15.54	5.82	516	27.70	2.55	502
7/23/96 6:38	15.52	5.78	520	27.50	2.53	503
7/23/96 6:48	15.52	5.75	516	27.60	2.55	504
7/23/96 6:58	15.53	5.76	517	28.00	2.58	503
7/23/96 20:15	15.46	5.76	508	28.10	2.60	503
7/23/96 20:25	15.47	5.75	511	28.20	2.60	503
7/23/96 20:35	15.46	5.73	506	28.30	2.61	504
7/23/96 20:45	15.45	5.78	508	28.40	2.61	502
7/23/96 20:55	15.41	5.77	509	28.00	2.59	503

Date and Time	Temp (ºC)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/23/96 21:05	15.43	5.76	511	28.20	2.60	504
7/23/96 21:15	15.42	5.77	508	28.30	2.62	503
7/23/96 21:25	15.42	5.77	507	28.50	2.63	502
7/23/96 21:35	15.39	5.77	511	28.10	2.59	503
7/23/96 21:45	15.41	5.75	512	28.00	2.59	502
7/23/96 21:55	15.40	5.78	509	28.00	2.59	503
7/23/96 22:05	15.37	5.81	510	28.10	2.59	505
7/23/96 22:15	15.40	5.80	510	28.20	2.60	502
7/23/96 22:25	15.39	5.77	507	28.60	2.64	504
7/23/96 22:35	15.37	5.75	508	27.60	2.55	504
7/23/96 22:45	15.38	5.78	508	28.20	2.60	503
7/23/96 22:55	15.37	5.82	509	28.00	2.59	502
7/23/96 23:05	15.34	5.78	509	27.70	2.56	503
7/23/96 23:15	15.32	5.79	513	27.40	2.54	505
7/23/96 23:25	15.37	5.76	506	28.00	2.58	505
7/23/96 23:35	15.37	5.81	506	28.60	2.64	503
7/23/96 23:45	15.35	5.76	511	27.70	2.56	504
7/23/96 23:55	15.33	5.79	511	27.60	2.55	504
7/24/96 0:05	15.31	5.78	509	27.70	2.56	504
7/24/96 0:15	15.33	5.75	507	28.00	2.59	505
7/24/96 0:25	15.34	5.79	506	28.20	2.61	504
7/24/96 0:35	15.30	5.76	510	27.70	2.57	504
7/24/96 0:45	15.31	5.78	508	27.70	2.57	504
7/24/96 0:55	15.33	5.80	507	28.00	2.59	505
7/24/96 1:05	15.34	5.78	509	27.90	2.58	504
7/24/96 1:15	15.33	5.81	508	28.00	2.59	503
7/24/96 1:25	15.32	5.79	510	27.90	2.58	504
7/24/96 1:35	15.33	5.81	505	28.70	2.65	503
7/24/96 1:45	15.31	5.79	506	28.00	2.59	505
7/24/96 1:55	15.29	5.82	508	27.90	2.58	502
7/24/96 2:05	15.28	5.78	507	27.90	2.58	506
7/24/96 2:15	15.29	5.79	509	27.70	2.56	504
7/24/96 2:25	15.30	5.79	509	27.50	2.55	504
7/24/96 2:35	15.33	5.79	504	28.40	2.62	503
7/24/96 2:45	15.31	5.79	508	27.90	2.58	504
7/24/96 2:55	15.28	5.82	509	27.70	2.57	503
7/24/96 3:05	15.31	5.79	506	28.30	2.62	504
7/24/96 3:15	15.31	5.79	509	27.80	2.58	505
7/24/96 3:25	15.28	5.76	507	27.60	2.56	507
7/24/96 3:35	15.28	5.79	508	28.00	2.59	505
7/24/96 3:45	15.27	5.79	506	27.80	2.57	505
7/24/96 3:55	15.31	5.79	504	28.80	2.66	504
7/24/96 4:05	15.29	5.78	506	28.40	2.63	507
7/24/96 4:15	15.28	5.79	507	27.90	2.58	505
7/24/96 4:25	15.29	5.79	507	28.00	2.59	505
7/24/96 4:35	15.30	5.79	509	28.10	2.60	506
7/24/96 4:45	15.29	5.79	507	28.10	2.60	506

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/24/96 4:55	15.33	5.79	505	29.00	2.68	505
7/24/96 5:05	15.32	5.79	507	28.30	2.61	506
7/24/96 5:15	15.33	5.76	504	28.50	2.63	507
7/24/96 5:25	15.34	5.80	503	28.70	2.66	504
7/24/96 5:35	15.32	5.79	502	28.80	2.66	504
7/24/96 5:45	15.27	5.79	509	27.50	2.54	506
7/24/96 5:55	15.32	5.79	506	28.30	2.62	505
7/24/96 6:05	15.31	5.79	506	28.20	2.61	506
7/24/96 6:15	15.30	5.79	506	28.30	2.62	505
7/24/96 6:25	15.30	5.77	507	28.10	2.60	504
7/24/96 6:35	15.31	5.79	506	28.20	2.61	505
7/24/96 6:45	15.32	5.77	504	28.30	2.61	506
7/24/96 6:55	15.33	5.79	505	28.30	2.62	505
7/24/96 7:05	15.32	5.77	508	27.60	2.55	506
7/24/96 7:15	15.31	5.82	508	28.20	2.61	503
7/24/96 7:25	15.31	5.78	508	27.70	2.56	505
7/24/96 7:35	15.32	5.78	503	28.40	2.62	506
7/24/96 7:45	15.33	5.76	502	28.50	2.64	505
7/24/96 7:55	15.34	5.78	506	28.00	2.59	505
7/24/96 8:05	15.38	5.78	504	28.90	2.66	506
7/24/96 8:15	15.37	5.79	506	28.10	2.60	504
7/24/96 8:25	15.39	5.75	503	28.20	2.60	507
7/24/96 8:35	15.42	5.77	501	29.20	2.70	507
7/24/96 8:45	15.41	5.78	505	28.20	2.60	506
7/24/96 8:55	15.44	5.78	503	28.60	2.63	505
7/24/96 9:05	15.43	5.81	501	28.70	2.65	503
7/24/96 9:15	15.47	5.78	501	28.90	2.66	505
7/24/96 9:25	15.50	5.75	501	28.70	2.64	507
7/24/96 9:35	15.46	5.77	505	28.20	2.60	505
7/24/96 9:45	15.53	5.81	500	29.10	2.68	504
7/24/96 9:55	15.49	5.77	503	28.30	2.60	505
7/24/96 10:05	15.52	5.75	506	28.30	2.60	506
7/24/96 10:15	15.54	5.77	503	28.50	2.62	506
7/24/96 10:25	15.56	5.80	499	29.30	2.70	505
7/24/96 10:35	15.53	5.76	507	27.90	2.57	505
7/24/96 10:45	15.52	5.74	502	27.80	2.56	507
7/24/96 10:55	15.54	5.80	505	28.50	2.63	504
7/24/96 11:05	15.58	5.74	501	28.60	2.63	505
7/24/96 11:15	15.61	5.76	501	28.50	2.62	505
7/24/96 11:25	15.62	5.77	497	28.80	2.65	503
7/24/96 11:35	15.57	5.76	499	28.80	2.65	505
7/24/96 11:45	15.63	5.76	501	28.90	2.65	504
7/24/96 11:55	15.63	5.79	498	29.20	2.68	504
7/24/96 12:05	15.59	5.75	504	28.30	2.60	505
7/24/96 12:15	15.65	5.75	497	29.40	2.70	505
7/24/96 12:25	15.64	5.75	503	28.30	2.60	506
7/24/96 12:35	15.59	5.72	502	28.50	2.62	507

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/24/96 12:45	15.62	5.78	503	28.90	2.65	505
7/24/96 12:55	15.63	5.76	501	28.60	2.63	503
7/24/96 13:05	15.63	5.71	499	28.50	2.62	507
7/24/96 13:15	15.58	5.77	499	29.00	2.67	504
7/24/96 13:25	15.60	5.71	502	28.70	2.64	506
7/24/96 13:35	15.61	5.73	502	28.40	2.61	504
7/24/96 13:45	15.67	5.74	499	29.00	2.66	505
7/24/96 13:55	15.64	5.74	501	29.00	2.67	503
7/24/96 14:05	15.65	5.71	498	29.20	2.68	507
7/24/96 14:15	15.64	5.72	499	29.10	2.67	504
7/24/96 14:25	15.66	5.77	500	28.90	2.65	504
7/24/96 14:35	15.68	5.71	498	29.30	2.69	507
7/24/96 14:45	15.67	5.77	498	29.10	2.67	503
7/24/96 14:55	15.69	5.74	497	29.20	2.68	505
7/24/96 15:05	15.71	5.73	502	28.30	2.59	506
7/24/96 15:15	15.71	5.71	497	29.20	2.68	507
7/24/96 15:25	15.67	5.71	500	28.80	2.65	508
7/24/96 15:35	15.67	5.73	501	28.50	2.61	505
7/24/96 15:45	15.69	5.73	502	28.80	2.64	504
7/24/96 15:55	15.64	5.70	497	29.20	2.68	507
7/24/96 16:05	15.70	5.70	501	28.40	2.61	507
7/24/96 16:15	15.69	5.73	497	28.60	2.63	506
7/24/96 16:25	15.67	5.73	499	28.50	2.62	506
7/24/96 16:35	15.72	5.73	496	29.30	2.69	506
7/24/96 16:45	15.70	5.75	497	29.50	2.71	507
7/24/96 16:55	15.64	5.71	498	28.80	2.64	507
7/24/96 17:05	15.64	5.73	500	28.20	2.59	506
7/24/96 17:15	15.68	5.71	500	28.90	2.65	506
7/24/96 17:25	15.69	5.73	497	28.90	2.65	505
7/24/96 17:35	15.65	5.71	496	29.30	2.69	506
7/24/96 17:45	15.66	5.73	501	29.00	2.66	505
7/24/96 17:55	15.59	5.75	501	28.30	2.61	503
7/24/96 18:05	15.59	5.76	499	28.80	2.64	503
7/24/96 18:15	15.62	5.76	497	28.90	2.66	503
7/24/96 18:25	15.51	5.74	498	28.60	2.63	504
7/24/96 18:35	15.48	5.78	496	29.40	2.71	502
7/24/96 18:45	15.47	5.76	496	29.10	2.69	504
7/24/96 18:55	15.49	5.72	498	28.70	2.64	505
7/24/96 19:05	15.48	5.76	494	29.40	2.71	502
7/24/96 19:15	15.42	5.73	496	28.70	2.65	505
7/24/96 19:25	15.46	5.74	501	28.40	2.62	505
7/24/96 19:35	15.42	5.75	501	28.10	2.59	504
7/24/96 19:45	15.41	5.75	499	28.60	2.64	504
7/24/96 19:55	15.39	5.76	502	27.90	2.58	504
7/24/96 20:05	15.39	5.74	497	28.80	2.66	506
7/24/96 20:15	15.38	5.73	497	29.00	2.68	506
7/24/96 20:25	15.37	5.77	497	28.60	2.64	504

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/24/96 20:35	15.36	5.79	499	28.50	2.64	503
7/24/96 20:45	15.35	5.81	498	28.40	2.63	505
7/24/96 20:55	15.33	5.79	498	28.30	2.62	502
7/24/96 21:05	15.34	5.75	498	28.40	2.62	505
7/24/96 21:15	15.34	5.78	498	28.80	2.66	504
7/24/96 21:25	15.32	5.78	495	28.60	2.65	504
7/24/96 21:35	15.33	5.77	499	28.50	2.63	506
7/24/96 21:45	15.32	5.82	498	28.40	2.62	503
7/24/96 21:55	15.32	5.79	497	28.40	2.62	503
7/24/96 22:05	15.31	5.79	502	28.10	2.60	505
7/24/96 22:15	15.32	5.77	496	28.30	2.62	503
7/24/96 22:25	15.34	5.79	499	28.60	2.65	505
7/24/96 22:35	15.29	5.76	496	27.90	2.58	506
7/24/96 22:45	15.30	5.81	500	28.20	2.61	505
7/24/96 22:55	15.30	5.79	499	28.10	2.60	505
7/24/96 23:05	15.31	5.79	501	28.00	2.59	507
7/24/96 23:15	15.34	5.77	493	29.00	2.68	506
7/24/96 23:25	15.36	5.80	497	28.50	2.64	505
7/24/96 23:35	15.35	5.79	500	28.20	2.61	505
7/24/96 23:45	15.33	5.77	496	29.20	2.70	505
7/24/96 23:55	15.33	5.78	497	28.00	2.59	507
7/25/96 0:05	15.36	5.80	500	28.50	2.63	506
7/25/96 0:15	15.36	5.77	497	28.60	2.64	507
7/25/96 0:25	15.34	5.80	497	28.50	2.63	506
7/25/96 0:35	15.34	5.83	497	28.50	2.63	505
7/25/96 0:45	15.35	5.80	499	28.30	2.62	506
7/25/96 0:55	15.31	5.83	498	28.20	2.61	505
7/25/96 1:05	15.33	5.77	495	28.30	2.62	505
7/25/96 1:15	15.33	5.80	501	28.10	2.60	506
7/25/96 1:25	15.30	5.81	500	27.80	2.57	506
7/25/96 1:35	15.33	5.83	495	28.50	2.64	504
7/25/96 1:45	15.32	5.77	496	28.40	2.63	507
7/25/96 1:55	15.32	5.80	501	28.10	2.60	506
7/25/96 4:15	15.37	5.82	492	29.00	2.68	507
7/25/96 4:25	15.34	5.80	496	28.10	2.60	507
7/25/96 4:35	15.33	5.77	498	27.80	2.57	506
7/25/96 4:45	15.33	5.80	498	27.90	2.58	506
7/25/96 4:55	15.35	5.80	500	27.90	2.58	507
7/25/96 5:05	15.33	5.80	496	28.20	2.61	506
7/25/96 5:15	15.34	5.83	499	28.10	2.60	508
7/25/96 5:25	15.34	5.79	499	28.30	2.62	505
7/25/96 5:35	15.36	5.81	496	28.40	2.62	507
7/25/96 5:45	15.37	5.80	496	28.50	2.63	506
7/25/96 5:55	15.37	5.78	497	28.30	2.62	507
7/25/96 6:05	15.37	5.80	498	28.00	2.59	507
7/25/96 6:15	15.34	5.80	498	27.70	2.56	507
7/25/96 6:25	15.38	5.80	497	28.70	2.65	507

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/25/96 6:35	15.34	5.80	498	27.80	2.57	507
7/25/96 6:45	15.38	5.81	497	28.40	2.62	507
7/25/96 6:55	15.39	5.80	494	28.70	2.65	506
7/25/96 7:05	15.39	5.83	495	28.50	2.63	505
7/25/96 7:15	15.37	5.77	500	28.30	2.61	509
7/25/96 7:25	15.38	5.80	494	28.40	2.62	507
7/25/96 7:35	15.37	5.80	498	28.00	2.59	506
7/25/96 7:45	15.39	5.77	494	28.30	2.61	509
7/25/96 7:55	15.40	5.79	499	28.20	2.60	508
7/25/96 8:05	15.39	5.79	498	27.80	2.56	508
7/25/96 8:15	15.39	5.79	496	27.90	2.58	506
7/25/96 8:25	15.40	5.78	496	27.70	2.56	507
7/25/96 8:35	15.41	5.83	493	28.60	2.64	505
7/25/96 8:45	15.44	5.80	495	28.60	2.63	506
7/25/96 8:55	15.45	5.77	494	28.30	2.61	508
7/25/96 9:05	15.40	5.80	498	28.10	2.59	506
7/25/96 9:15	15.42	5.80	491	28.70	2.65	506
7/25/96 9:25	15.44	5.80	493	28.30	2.61	506
7/25/96 9:35	15.42	5.82	496	28.30	2.61	505
7/25/96 9:45	15.44	5.77	495	28.40	2.62	508
7/25/96 9:55	15.45	5.79	494	28.40	2.62	506
7/25/96 10:05	15.46	5.77	492	28.40	2.62	508
7/25/96 10:15	15.48	5.77	495	28.90	2.66	508
7/25/96 10:25	15.46	5.79	493	28.50	2.63	507
7/25/96 10:35	15.47	5.79	493	28.30	2.60	505
7/25/96 10:45	15.46	5.79	495	28.20	2.60	506
7/25/96 10:55	15.47	5.79	496	28.10	2.59	507
7/25/96 11:05	15.48	5.79	494	28.50	2.63	506
7/25/96 11:15	15.48	5.78	498	28.00	2.58	508
7/25/96 11:25	15.51	5.79	490	29.30	2.69	507
7/25/96 11:35	15.51	5.81	493	28.70	2.64	508
7/25/96 11:45	15.52	5.79	495	28.30	2.61	506
7/25/96 11:55	15.52	5.81	491	28.70	2.64	505
7/25/96 12:05	15.50	5.76	492	28.60	2.63	508
7/25/96 12:15	15.50	5.78	494	28.30	2.60	506
7/25/96 12:25	15.51	5.78	495	28.10	2.59	507
7/25/96 12:35	15.50	5.78	494	28.60	2.63	507
7/25/96 12:45	15.53	5.78	495	28.30	2.61	506
7/25/96 12:55	15.56	5.76	495	28.60	2.63	508
7/25/96 13:05	15.57	5.75	491	29.00	2.67	509
7/25/96 13:15	15.55	5.78	496	28.80	2.65	507
7/25/96 13:25	15.54	5.76	493	29.00	2.67	508
7/25/96 13:35	15.52	5.78	494	28.30	2.61	507
7/25/96 13:45	15.56	5.78	491	28.90	2.66	507
7/25/96 13:55	15.54	5.76	495	28.40	2.61	508
7/25/96 14:05	15.54	5.75	495	28.40	2.62	509
7/25/96 14:15	15.57	5.75	495	28.50	2.62	508

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/25/96 14:25	15.56	5.75	492	28.40	2.62	508
7/25/96 14:35	15.52	5.75	493	28.50	2.62	508
7/25/96 14:45	15.54	5.75	492	28.60	2.63	508
7/25/96 14:55	15.56	5.78	491	28.70	2.64	506
7/25/96 15:05	15.54	5.80	494	28.10	2.58	505
7/25/96 15:15	15.57	5.77	492	28.80	2.65	505
7/25/96 15:25	15.52	5.77	497	28.00	2.58	506
7/25/96 15:35	15.55	5.80	491	28.50	2.62	507
7/25/96 15:45	15.53	5.77	492	28.20	2.60	506
7/25/96 15:55	15.54	5.80	492	28.50	2.63	505
7/25/96 16:05	15.51	5.74	496	28.40	2.62	508
7/25/96 16:15	15.52	5.77	495	28.40	2.62	506
7/25/96 16:25	15.55	5.78	491	28.90	2.66	506
7/25/96 16:35	15.53	5.81	495	28.30	2.61	505
7/25/96 16:45	15.54	5.74	494	29.00	2.67	508
7/25/96 16:55	15.55	5.79	488	29.10	2.68	506
7/25/96 17:05	15.51	5.74	496	27.70	2.55	508
7/25/96 17:15	15.52	5.74	491	28.70	2.64	507
7/25/96 17:25	15.51	5.77	496	28.00	2.58	506
7/25/96 17:35	15.51	5.75	492	28.40	2.61	507
7/25/96 17:45	15.50	5.77	496	28.40	2.61	507
7/25/96 17:55	15.49	5.77	494	28.10	2.59	506
7/25/96 18:05	15.52	5.81	495	28.40	2.61	505
7/25/96 18:15	15.50	5.75	489	28.70	2.64	508
7/25/96 18:25	15.53	5.78	493	29.80	2.75	506
7/25/96 18:35	15.53	5.78	491	28.40	2.62	506
7/25/96 18:45	15.54	5.81	491	28.70	2.64	505
7/25/96 18:55	15.54	5.78	496	27.90	2.56	506
7/25/96 19:05	15.55	5.80	493	28.30	2.61	510
7/25/96 19:15	15.52	5.75	492	28.10	2.59	510
7/25/96 19:25	15.49	5.75	494	28.30	2.61	509
7/25/96 19:35	15.49	5.78	493	28.20	2.60	507
7/25/96 19:45	15.52	5.78	493	28.70	2.64	508
7/25/96 19:55	15.50	5.77	494	28.50	2.63	509
7/25/96 20:05	15.46	5.78	495	28.20	2.60	508
7/25/96 20:15	15.45	5.77	495	27.80	2.56	508
7/25/96 20:25	15.44	5.78	495	28.60	2.64	508
7/25/96 20:35	15.41	5.77	491	28.30	2.61	509
7/25/96 20:45	15.41	5.76	495	27.90	2.57	509
7/25/96 20:55	15.41	5.76	492	28.50	2.63	509
7/25/96 21:05	15.39	5.82	491	29.00	2.68	507
7/25/96 21:15	15.38	5.80	492	28.30	2.62	506
7/25/96 21:25	15.37	5.83	493	28.50	2.63	508
7/25/96 21:35	15.35	5.83	495	28.00	2.59	506
7/25/96 21:45	15.37	5.77	496	28.60	2.64	509
7/25/96 21:55	15.33	5.81	495	27.80	2.57	509
7/25/96 22:05	15.36	5.77	491	28.30	2.61	509

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/25/96 22:15	15.34	5.79	495	27.90	2.57	508
7/25/96 22:25	15.35	5.77	490	28.00	2.58	508
7/25/96 22:35	15.36	5.80	494	28.60	2.65	509
7/25/96 22:45	15.37	5.83	493	28.40	2.63	506
7/25/96 22:55	15.38	5.80	495	28.30	2.61	508
7/25/96 23:05	15.33	5.80	496	27.70	2.56	508
7/25/96 23:15	15.32	5.80	494	27.70	2.56	508
7/25/96 23:25	15.32	5.77	493	28.00	2.59	510
7/25/96 23:35	15.34	5.79	493	29.00	2.68	508
7/25/96 23:45	15.32	5.78	495	28.40	2.62	510
7/25/96 23:55	15.29	5.80	497	27.60	2.55	508
7/26/96 0:05	15.30	5.80	492	27.90	2.58	507
7/26/96 0:15	15.30	5.80	494	28.00	2.59	508
7/26/96 0:25	15.28	5.83	499	27.30	2.53	507
7/26/96 0:35	15.31	5.80	496	27.90	2.58	508
7/26/96 0:45	15.31	5.80	496	28.00	2.59	508
7/26/96 0:55	15.30	5.80	495	27.90	2.59	508
7/26/96 1:05	15.33	5.80	495	27.60	2.55	508
7/26/96 1:15	15.35	5.80	496	28.00	2.59	508
7/26/96 1:25	15.34	5.80	491	28.30	2.61	508
7/26/96 1:35	15.35	5.78	490	28.40	2.63	510
7/26/96 1:45	15.32	5.82	494	28.20	2.61	508
7/26/96 1:55	15.34	5.81	490	28.70	2.65	508
7/26/96 2:05	15.33	5.81	498	28.10	2.60	507
7/26/96 2:15	15.31	5.83	492	28.00	2.59	507
7/26/96 2:25	15.30	5.81	494	28.10	2.60	507
7/26/96 2:35	15.31	5.80	494	27.80	2.57	508
7/26/96 2:45	15.33	5.83	494	28.00	2.59	508
7/26/96 2:55	15.34	5.81	492	28.20	2.61	509
7/26/96 3:05	15.33	5.78	493	28.30	2.62	510
7/26/96 3:15	15.31	5.77	494	27.30	2.52	510
7/26/96 3:25	15.33	5.80	495	28.00	2.59	509
7/26/96 3:35	15.34	5.80	490	28.50	2.64	509
7/26/96 3:45	15.30	5.80	494	27.20	2.52	509
7/26/96 3:55	15.31	5.80	494	27.60	2.55	509
7/26/96 4:05	15.31	5.80	494	27.60	2.55	509
7/26/96 4:15	15.32	5.77	496	28.00	2.59	510
7/26/96 4:25	15.33	5.78	490	28.10	2.60	510
7/26/96 4:35	15.34	5.81	491	28.00	2.59	508
7/26/96 4:45	15.32	5.81	491	27.90	2.58	508
7/26/96 4:55	15.29	5.79	494	26.70	2.47	510
7/26/96 5:05	15.30	5.81	494	27.60	2.55	507
7/26/96 5:15	15.31	5.83	495	27.40	2.53	507
7/26/96 5:25	15.30	5.81	497	27.40	2.54	509
7/26/96 5:35	15.30	5.81	496	27.50	2.54	509
7/26/96 5:45	15.28	5.80	495	27.50	2.55	509
7/26/96 5:55	15.31	5.81	491	28.00	2.59	509

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/26/96 6:05	15.32	5.84	493	28.00	2.59	507
7/26/96 6:15	15.27	5.78	498	27.50	2.54	510
7/26/96 6:25	15.30	5.81	492	27.90	2.58	508
7/26/96 6:35	15.28	5.81	492	27.50	2.55	508
7/26/96 6:45	15.28	5.83	498	27.20	2.51	508
7/26/96 6:55	15.32	5.81	490	28.40	2.62	507
7/26/96 7:05	15.31	5.80	493	27.40	2.54	508
7/26/96 7:15	15.31	5.80	495	27.40	2.53	510
7/26/96 7:25	15.30	5.79	494	27.20	2.52	510
7/26/96 7:35	15.31	5.80	497	27.20	2.51	509
7/26/96 7:45	15.32	5.81	493	27.90	2.58	509
7/26/96 7:55	15.34	5.83	489	28.20	2.61	507
7/26/96 8:05	15.28	5.78	496	27.10	2.51	509
7/26/96 8:15	15.32	5.78	495	27.60	2.55	511
7/26/96 8:25	15.32	5.77	493	27.30	2.52	511
7/26/96 8:35	15.30	5.80	497	27.00	2.49	509
7/26/96 8:45	15.40	5.77	492	28.20	2.60	511
7/26/96 8:55	15.39	5.81	490	28.10	2.59	509
7/26/96 9:05	15.39	5.77	493	28.10	2.59	511
7/26/96 9:15	15.38	5.77	493	27.80	2.57	511
7/26/96 9:25	15.41	5.80	490	28.10	2.59	509
7/26/96 9:35	15.40	5.80	493	27.90	2.57	509
7/26/96 9:45	15.43	5.80	492	28.10	2.59	509
7/26/96 9:55	15.41	5.79	497	27.20	2.51	507
7/26/96 10:05	15.43	5.80	495	27.60	2.55	507
7/26/96 10:15	15.46	5.83	492	28.20	2.60	507
7/26/96 10:25	15.43	5.76	498	26.90	2.49	509
7/26/96 10:35	15.48	5.76	492	27.90	2.57	510
7/26/96 10:45	15.44	5.79	494	27.70	2.56	508
7/26/96 10:55	15.42	5.77	491	27.60	2.55	507
7/26/96 11:05	15.43	5.78	493	27.40	2.53	508
7/26/96 11:15	15.49	5.76	493	27.70	2.55	509
7/26/96 11:25	15.54	5.79	495	27.70	2.55	508
7/26/96 11:35	15.46	5.75	495	27.60	2.55	508
7/26/96 11:45	15.45	5.78	493	27.90	2.58	507
7/26/96 11:55	15.51	5.81	495	27.70	2.56	507
7/26/96 12:05	15.49	5.77	495	27.30	2.52	508
7/26/96 12:15	15.44	5.77	497	27.40	2.53	509
7/26/96 12:25	15.48	5.78	496	27.60	2.55	508
7/26/96 12:35	15.43	5.78	493	28.00	2.59	507
7/26/96 12:45	15.49	5.75	491	27.80	2.56	509
7/26/96 12:55	15.49	5.74	492	27.90	2.57	509
7/26/96 13:05	15.57	5.74	497	27.60	2.54	510
7/26/96 13:15	15.59	5.78	495	27.80	2.56	507
7/26/96 13:25	15.61	5.77	492	28.10	2.58	508
7/26/96 13:35	15.61	5.77	495	27.10	2.49	509
7/26/96 13:45	15.51	5.76	492	27.30	2.52	509

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/26/96 13:55	15.61	5.76	493	28.00	2.57	509
7/26/96 14:05	15.60	5.73	492	27.20	2.50	510
7/26/96 14:15	15.61	5.76	494	27.10	2.49	509
7/26/96 14:25	15.59	5.75	495	27.20	2.50	509
7/26/96 14:35	15.57	5.73	492	27.10	2.49	511
7/26/96 14:45	15.50	5.76	492	27.90	2.57	508
7/26/96 14:55	15.51	5.73	494	27.10	2.50	509
7/26/96 15:05	15.63	5.76	492	28.00	2.57	507
7/26/96 15:15	15.47	5.77	492	27.50	2.54	507
7/26/96 15:25	15.58	5.76	492	27.70	2.55	508
7/26/96 15:35	15.63	5.75	491	27.60	2.54	508
7/26/96 15:45	15.55	5.75	493	27.30	2.51	508
7/26/96 15:55	15.60	5.75	494	27.60	2.54	508
7/26/96 16:05	15.52	5.75	494	27.50	2.54	508
7/26/96 16:15	15.50	5.75	492	27.40	2.52	508
7/26/96 16:25	15.63	5.76	491	28.20	2.59	509
7/26/96 16:35	15.58	5.75	491	27.60	2.54	508
7/26/96 16:45	15.57	5.72	490	27.30	2.51	510
7/26/96 16:55	15.50	5.77	491	27.00	2.49	506
7/26/96 17:05	15.56	5.75	493	27.30	2.51	508
7/26/96 17:15	15.53	5.76	489	28.00	2.58	507
7/26/96 17:25	15.46	5.73	493	27.00	2.49	509
7/26/96 17:35	15.56	5.76	490	27.90	2.57	508
7/26/96 17:45	15.50	5.78	491	27.90	2.57	507
7/26/96 17:55	15.52	5.74	497	26.80	2.47	508
7/26/96 18:05	15.49	5.73	492	27.40	2.52	509
7/26/96 18:15	15.49	5.75	493	26.80	2.47	509
7/26/96 18:25	15.50	5.73	494	27.10	2.50	510
7/26/96 18:35	15.47	5.79	494	27.70	2.55	506
7/26/96 18:45	15.48	5.78	492	27.30	2.51	506
7/26/96 18:55	15.47	5.73	491	27.70	2.56	510
7/26/96 19:05	15.44	5.79	492	27.40	2.53	507
7/26/96 19:15	15.44	5.76	491	27.60	2.55	508
7/26/96 19:25	15.44	5.74	492	27.30	2.51	509
7/26/96 19:35	15.39	5.76	494	26.80	2.47	508
7/26/96 19:45	15.42	5.77	491	28.10	2.59	508
7/26/96 19:55	15.39	5.77	493	27.10	2.50	508
7/26/96 20:05	15.32	5.77	494	26.50	2.45	507
7/26/96 20:15	15.35	5.77	493	27.40	2.53	508
7/26/96 20:25	15.31	5.80	496	26.30	2.43	506
7/26/96 20:35	15.34	5.76	492	27.10	2.50	507
7/26/96 20:45	15.32	5.81	490	27.10	2.50	505
7/26/96 20:55	15.33	5.77	492	26.80	2.48	506
7/26/96 21:05	15.28	5.82	496	26.30	2.43	506
7/26/96 21:15	15.30	5.79	493	27.00	2.50	506
7/26/96 21:25	15.29	5.83	491	27.00	2.50	506
7/26/96 21:35	15.29	5.80	495	26.60	2.46	507

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/26/96 21:45	15.29	5.80	496	26.90	2.49	507
7/26/96 21:55	15.26	5.78	491	26.10	2.41	509
7/26/96 22:05	15.27	5.78	496	26.80	2.48	508
7/26/96 22:15	15.26	5.84	489	26.80	2.48	506
7/26/96 22:25	15.27	5.81	492	26.90	2.49	506
7/26/96 22:35	15.24	5.81	494	26.00	2.41	507
7/26/96 22:45	15.27	5.81	489	27.10	2.51	507
7/26/96 22:55	15.24	5.84	492	26.50	2.45	508
7/26/96 23:05	15.26	5.79	490	27.20	2.52	508
7/26/96 23:15	15.29	5.85	487	27.70	2.57	506
7/26/96 23:25	15.27	5.84	492	27.00	2.50	505
7/26/96 23:35	15.24	5.81	497	25.90	2.40	507
7/26/96 23:45	15.26	5.82	491	26.30	2.44	507
7/26/96 23:55	15.25	5.79	490	26.70	2.47	509
7/27/96 0:05	15.25	5.81	495	26.60	2.46	507
7/27/96 0:15	15.24	5.81	494	26.30	2.43	507
7/27/96 0:25	15.24	5.81	494	26.20	2.43	508
7/27/96 0:35	15.24	5.79	489	26.90	2.49	509
7/27/96 0:45	15.23	5.81	493	26.10	2.42	507
7/27/96 0:55	15.24	5.81	490	26.60	2.46	507
7/27/96 1:05	15.25	5.81	493	26.60	2.47	507
7/27/96 1:15	15.25	5.84	488	26.70	2.47	505
7/27/96 1:25	15.25	5.79	492	27.30	2.53	509
7/27/96 1:35	15.23	5.79	494	26.60	2.47	509
7/27/96 1:45	15.23	5.81	494	25.90	2.40	508
7/27/96 1:55	15.22	5.83	495	25.90	2.40	507
7/27/96 2:05	15.26	5.82	493	26.50	2.45	508
7/27/96 2:15	15.26	5.82	492	26.50	2.46	508
7/27/96 2:25	15.22	5.79	494	25.90	2.40	509
7/27/96 2:35	15.24	5.81	495	25.90	2.40	507
7/27/96 2:45	15.27	5.80	491	26.70	2.47	508
7/27/96 2:55	15.21	5.84	496	25.40	2.36	509
7/27/96 3:05	15.26	5.79	492	26.80	2.48	509
7/27/96 3:15	15.24	5.82	496	26.10	2.42	508
7/27/96 3:25	15.26	5.81	493	26.50	2.46	507
7/27/96 3:35	15.25	5.82	491	26.40	2.44	507
7/27/96 3:45	15.26	5.81	493	26.20	2.42	507
7/27/96 3:55	15.24	5.80	494	25.90	2.40	509
7/27/96 4:05	15.26	5.82	491	26.40	2.45	507
7/27/96 4:15	15.27	5.82	490	26.70	2.47	507
7/27/96 4:25	15.26	5.79	490	26.60	2.47	508
7/27/96 4:35	15.22	5.81	498	25.40	2.36	506
7/27/96 4:45	15.25	5.82	494	26.30	2.44	507
7/27/96 4:55	15.25	5.79	489	26.50	2.45	507
7/27/96 5:05	15.28	5.79	491	27.10	2.51	509
7/27/96 5:15	15.29	5.79	493	27.40	2.54	509
7/27/96 5:25	15.27	5.85	488	26.90	2.49	506

Date and Time	Temp (ºC)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/27/96 5:35	15.26	5.80	490	26.20	2.43	506
7/27/96 5:45	15.26	5.82	493	26.50	2.46	507
7/27/96 5:55	15.24	5.81	496	25.60	2.37	507
7/27/96 6:05	15.25	5.79	494	26.10	2.42	509
7/27/96 6:15	15.27	5.79	491	26.70	2.47	508
7/27/96 6:25	15.28	5.82	490	26.80	2.48	507
7/27/96 6:35	15.29	5.81	491	26.90	2.49	505
7/27/96 6:45	15.26	5.85	492	26.40	2.45	506
7/27/96 6:55	15.28	5.79	489	26.40	2.44	509
7/27/96 8:28	15.30	5.81	491	26.10	2.42	507
7/27/96 8:38	15.33	5.81	491	26.60	2.46	507
7/27/96 8:48	15.33	5.82	493	26.30	2.43	506
7/27/96 8:58	15.31	5.81	492	25.70	2.37	507
7/27/96 9:08	15.34	5.78	490	26.00	2.41	509
7/27/96 9:18	15.34	5.81	493	25.60	2.36	508
7/27/96 9:28	15.35	5.78	491	26.20	2.42	506
7/27/96 9:38	15.40	5.80	488	26.20	2.42	508
7/27/96 9:48	15.41	5.79	488	26.40	2.43	507
7/27/96 9:58	15.42	5.80	492	26.20	2.41	506
7/27/96 10:08	15.40	5.80	493	26.20	2.42	506
7/27/96 10:18	15.39	5.80	489	26.10	2.41	506
7/27/96 10:28	15.39	5.80	490	26.30	2.43	505
7/27/96 10:38	15.42	5.78	492	26.10	2.41	506
7/27/96 10:48	15.45	5.78	487	26.40	2.43	508
7/27/96 10:58	15.47	5.79	493	25.50	2.35	507
7/27/96 11:08	15.49	5.78	487	25.90	2.39	508
7/27/96 11:18	15.47	5.79	491	26.00	2.40	506
7/27/96 11:28	15.51	5.79	489	26.40	2.43	508
7/27/96 11:38	15.52	5.79	488	26.40	2.43	506
7/27/96 11:48	15.52	5.79	490	25.90	2.39	507
7/27/96 11:58	15.57	5.76	488	26.10	2.40	508
7/27/96 12:08	15.54	5.78	490	25.90	2.39	505
7/27/96 12:18	15.52	5.75	489	25.90	2.38	508
7/27/96 12:28	15.56	5.78	489	26.20	2.41	506
7/27/96 12:38	15.56	5.75	486	26.10	2.40	506
7/27/96 12:48	15.56	5.77	488	26.10	2.40	507
7/27/96 12:58	15.58	5.77	491	25.60	2.35	506
7/27/96 13:08	15.56	5.77	486	26.30	2.42	506
7/27/96 13:18	15.56	5.77	489	25.60	2.35	505
7/27/96 13:28	15.55	5.76	490	25.60	2.36	506
7/27/96 13:38	15.54	5.73	487	26.10	2.40	507
7/27/96 13:48	15.51	5.76	490	25.80	2.38	505
7/27/96 13:58	15.56	5.73	490	25.80	2.38	507
7/27/96 14:08	15.52	5.76	490	25.40	2.34	506
7/27/96 14:18	15.57	5.76	488	26.20	2.41	506
7/27/96 14:28	15.55	5.76	488	26.10	2.40	506
7/27/96 14:38	15.55	5.79	490	25.30	2.33	505

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/27/96 14:48	15.61	5.73	486	26.10	2.40	508
7/27/96 14:58	15.54	5.74	488	25.70	2.36	506
7/27/96 15:08	15.56	5.75	490	25.20	2.32	506
7/27/96 15:18	15.59	5.75	486	26.60	2.44	507
7/27/96 15:28	15.58	5.79	486	26.10	2.40	504
7/27/96 15:38	15.52	5.75	487	25.40	2.34	505
7/27/96 15:48	15.52	5.74	483	26.20	2.41	507
7/27/96 15:58	15.58	5.76	488	25.60	2.35	505
7/27/96 16:08	15.64	5.73	486	25.80	2.37	505
7/27/96 16:18	15.63	5.73	486	26.60	2.44	507
7/27/96 16:28	15.57	5.75	484	25.80	2.38	505
7/27/96 16:38	15.58	5.75	489	25.20	2.32	505
7/27/96 16:48	15.58	5.77	489	25.20	2.32	505
7/27/96 16:58	15.49	5.75	482	25.80	2.38	506
7/27/96 17:08	15.57	5.75	487	25.50	2.34	506
7/27/96 17:18	15.55	5.74	489	25.40	2.34	505
7/27/96 17:28	15.52	5.74	488	25.30	2.33	506
7/27/96 17:38	15.52	5.74	487	24.70	2.28	506
7/27/96 17:48	15.47	5.75	487	25.60	2.36	505
7/27/96 17:58	15.51	5.74	487	25.20	2.32	506
7/27/96 18:08	15.52	5.75	489	25.30	2.33	506
7/27/96 18:18	15.50	5.77	490	25.20	2.32	507
7/27/96 18:28	15.51	5.74	489	24.90	2.30	506
7/27/96 18:38	15.48	5.74	488	25.30	2.33	507
7/27/96 18:48	15.48	5.75	487	25.30	2.33	506
7/27/96 18:58	15.48	5.72	486	25.20	2.32	506
7/27/96 19:08	15.47	5.75	485	25.30	2.33	506
7/27/96 19:18	15.45	5.75	488	25.00	2.30	507
7/27/96 19:28	15.47	5.77	482	25.70	2.37	504
7/27/96 19:38	15.42	5.76	485	25.10	2.32	505
7/27/96 19:48	15.43	5.75	484	25.60	2.36	507
7/27/96 19:58	15.41	5.76	488	24.80	2.29	504
7/27/96 20:08	15.38	5.77	490	25.20	2.33	504
7/27/96 20:18	15.35	5.78	488	25.00	2.31	504
7/27/96 20:28	15.33	5.76	486	25.10	2.32	505
7/27/96 20:38	15.32	5.79	489	24.80	2.29	504
7/27/96 20:48	15.34	5.80	485	25.30	2.34	504
7/27/96 20:58	15.32	5.81	487	25.10	2.33	503
7/27/96 21:08	15.29	5.79	487	24.70	2.29	505
7/27/96 21:18	15.29	5.81	488	24.70	2.29	503
7/27/96 21:28	15.30	5.81	489	24.50	2.27	503
7/27/96 21:38	15.28	5.85	489	24.80	2.29	501
7/27/96 21:48	15.24	5.79	489	24.10	2.24	504
7/27/96 21:58	15.28	5.82	491	24.90	2.30	503
7/27/96 22:08	15.26	5.82	489	24.20	2.24	502
7/27/96 22:18	15.28	5.83	487	25.10	2.33	502
7/27/96 22:28	15.26	5.86	485	25.00	2.32	501

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/27/96 22:38	15.27	5.80	483	24.80	2.30	503
7/27/96 22:48	15.26	5.82	485	25.00	2.32	504
7/27/96 22:58	15.25	5.83	487	24.40	2.26	502
7/27/96 23:08	15.25	5.81	488	24.20	2.24	504
7/27/96 23:18	15.24	5.83	488	24.60	2.28	502
7/27/96 23:28	15.24	5.82	488	23.90	2.22	502
7/27/96 23:38	15.24	5.83	491	24.20	2.24	502
7/27/96 23:48	15.25	5.83	486	24.60	2.28	502
7/27/96 23:58	15.26	5.83	490	24.60	2.28	502
7/28/96 0:08	15.26	5.83	486	25.00	2.31	502
7/28/96 0:18	15.26	5.83	487	24.50	2.27	502
7/28/96 0:28	15.25	5.82	489	23.80	2.21	502
7/28/96 0:38	15.27	5.84	485	24.80	2.30	502
7/28/96 0:48	15.24	5.85	488	24.40	2.26	502
7/28/96 0:58	15.24	5.83	489	24.10	2.23	502
7/28/96 1:08	15.22	5.83	491	23.60	2.19	502
7/28/96 1:18	15.22	5.83	484	24.30	2.25	502
7/28/96 1:28	15.27	5.83	485	24.90	2.30	502
7/28/96 1:38	15.26	5.81	486	24.60	2.27	504
7/28/96 1:48	15.20	5.80	491	23.40	2.17	504
7/28/96 1:58	15.26	5.84	484	24.90	2.30	502
7/28/96 2:08	15.25	5.83	485	24.40	2.26	502
7/28/96 2:18	15.22	5.83	487	23.90	2.22	502
7/28/96 2:28	15.24	5.81	486	24.10	2.23	503
7/28/96 2:38	15.24	5.81	483	23.90	2.22	503
7/28/96 2:48	15.27	5.83	487	24.20	2.24	502
7/28/96 2:58	15.25	5.83	487	23.80	2.21	502
7/28/96 3:08	15.25	5.83	488	23.80	2.20	503
7/28/96 3:18	15.24	5.80	489	23.30	2.16	502
7/28/96 3:28	15.25	5.80	485	24.00	2.22	504
7/28/96 3:38	15.25	5.86	490	23.50	2.18	501
7/28/96 3:48	15.25	5.80	491	23.20	2.15	503
7/28/96 3:58	15.24	5.85	485	23.90	2.21	500
7/28/96 4:08	15.23	5.80	490	23.50	2.18	503
7/28/96 4:18	15.28	5.81	483	24.10	2.23	502
7/28/96 4:28	15.26	5.81	485	24.00	2.22	503
7/28/96 4:38	15.26	5.83	486	23.20	2.14	501
7/28/96 4:48	15.25	5.81	487	23.60	2.19	503
7/28/96 4:58	15.27	5.81	485	24.00	2.22	503
7/28/96 5:08	15.28	5.81	485	24.10	2.23	503
7/28/96 5:18	15.26	5.84	487	23.60	2.19	502
7/28/96 5:28	15.26	5.80	484	23.60	2.18	503
7/28/96 5:38	15.26	5.81	486	23.60	2.18	503
7/28/96 5:48	15.26	5.83	486	23.60	2.19	501
7/28/96 5:58	15.27	5.83	487	23.50	2.17	502
7/28/96 6:08	15.27	5.86	487	23.40	2.16	502
7/28/96 6:18	15.27	5.80	486	23.60	2.18	503

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/28/96 6:28	15.26	5.86	487	23.10	2.13	500
7/28/96 6:38	15.26	5.83	487	23.30	2.15	501
7/28/96 6:48	15.28	5.83	484	23.50	2.18	501
7/28/96 6:58	15.28	5.81	484	23.60	2.18	502
7/28/96 7:08	15.29	5.81	483	23.10	2.14	501
7/28/96 7:18	15.28	5.82	486	23.10	2.14	502
7/28/96 7:28	15.26	5.85	489	22.80	2.11	499
7/28/96 7:38	15.29	5.82	491	22.70	2.10	501
7/28/96 7:48	15.30	5.80	487	23.40	2.16	501
7/28/96 7:58	15.27	5.82	488	22.40	2.08	501
7/28/96 8:08	15.29	5.80	487	22.80	2.11	502
7/28/96 8:18	15.31	5.82	485	23.10	2.14	501
7/28/96 8:28	15.32	5.82	486	22.80	2.10	501
7/28/96 8:38	15.29	5.86	485	22.70	2.10	499
7/28/96 8:48	15.33	5.79	488	23.50	2.17	502
7/28/96 8:58	15.31	5.81	486	22.60	2.09	502
7/28/96 9:08	15.32	5.83	486	22.80	2.11	498
7/28/96 9:18	15.33	5.82	487	22.70	2.10	500
7/28/96 9:28	15.31	5.80	491	22.10	2.04	502
7/28/96 9:38	15.34	5.84	485	22.40	2.07	499
7/28/96 9:48	15.37	5.81	487	22.30	2.06	501
7/28/96 9:58	15.40	5.79	485	23.50	2.17	502
7/28/96 10:08	15.35	5.79	487	22.40	2.07	502
7/28/96 10:18	15.37	5.82	485	22.80	2.11	500
7/28/96 10:28	15.37	5.79	487	22.40	2.07	501
7/28/96 10:38	15.39	5.81	486	22.40	2.07	500
7/28/96 10:48	15.39	5.81	484	22.90	2.11	500
7/28/96 10:58	15.41	5.81	488	22.50	2.08	500
7/28/96 11:08	15.39	5.81	485	22.30	2.06	500
7/28/96 11:18	15.41	5.81	487	22.50	2.08	499
7/28/96 11:28	15.42	5.81	487	22.50	2.08	500
7/28/96 11:38	15.43	5.81	486	22.60	2.09	499
7/28/96 11:48	15.46	5.81	484	22.80	2.10	499
7/28/96 11:58	15.47	5.79	484	22.40	2.07	500
7/28/96 12:08	15.47	5.82	485	22.50	2.08	499
7/28/96 12:18	15.49	5.83	487	22.30	2.06	499
7/28/96 12:28	15.49	5.81	484	22.60	2.08	500
7/28/96 12:38	15.58	5.82	481	23.20	2.13	499
7/28/96 12:48	15.53	5.80	486	21.80	2.00	500
7/28/96 12:58	15.58	5.80	486	22.40	2.06	500
7/28/96 13:08	15.55	5.79	485	21.90	2.02	500
7/28/96 13:18	15.53	5.78	485	22.00	2.02	501
7/28/96 13:28	15.57	5.80	484	22.20	2.05	500
7/28/96 13:38	15.57	5.75	487	21.90	2.01	502
7/28/96 13:48	15.57	5.79	487	22.00	2.02	500
7/28/96 13:58	15.58	5.77	483	22.70	2.09	501
7/28/96 14:08	15.60	5.77	484	22.80	2.10	500

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/28/96 14:18	15.57	5.76	489	21.50	1.97	501
7/28/96 14:28	15.57	5.75	484	22.00	2.02	500
7/28/96 14:38	15.53	5.75	487	21.30	1.96	500
7/28/96 14:48	15.57	5.74	486	22.00	2.02	502
7/28/96 14:58	15.53	5.77	488	21.70	2.00	499
7/28/96 15:08	15.53	5.74	485	22.00	2.03	501
7/28/96 15:18	15.54	5.75	485	21.60	1.99	500
7/28/96 15:28	15.53	5.72	485	22.00	2.02	499
7/28/96 15:38	15.54	5.74	485	21.70	1.99	500
7/28/96 15:48	15.54	5.76	485	21.80	2.01	499
7/28/96 15:58	15.51	5.73	484	21.90	2.02	501
7/28/96 16:08	15.62	5.75	483	21.80	2.00	499
7/28/96 16:18	15.59	5.72	484	21.30	1.95	500
7/28/96 16:28	15.61	5.72	483	21.60	1.99	499
7/28/96 16:38	15.56	5.75	487	21.40	1.97	498
7/28/96 16:48	15.55	5.75	484	21.70	1.99	498
7/28/96 16:58	15.52	5.72	486	21.50	1.98	500
7/28/96 17:08	15.56	5.75	482	21.80	2.01	498
7/28/96 17:18	15.56	5.75	481	21.80	2.00	498
7/28/96 17:28	15.52	5.77	485	21.50	1.98	498
7/28/96 17:38	15.52	5.75	480	22.00	2.02	500
7/28/96 17:48	15.52	5.76	481	22.10	2.03	498
7/28/96 17:58	15.49	5.76	485	21.10	1.95	498
7/28/96 18:08	15.49	5.75	487	20.70	1.91	498
7/28/96 18:18	15.51	5.73	483	21.70	2.00	499
7/28/96 18:28	15.50	5.74	481	21.60	1.99	499
7/28/96 18:38	15.48	5.80	486	21.60	1.99	498
7/28/96 18:48	15.47	5.80	486	21.60	1.99	496
7/28/96 18:58	15.45	5.76	486	21.00	1.93	497
7/28/96 19:08	15.46	5.79	483	21.60	1.99	494
7/28/96 19:18	15.37	5.80	487	20.60	1.90	495
7/28/96 19:28	15.38	5.81	483	21.30	1.97	494
7/28/96 19:38	15.35	5.78	487	20.50	1.89	495
7/28/96 19:48	15.36	5.82	482	21.30	1.96	493
7/28/96 19:58	15.37	5.80	483	21.30	1.97	494
7/28/96 20:08	15.37	5.80	484	21.40	1.98	494
7/28/96 20:18	15.35	5.83	484	21.40	1.98	493
7/28/96 20:28	15.34	5.81	481	20.70	1.92	494
7/28/96 20:38	15.33	5.81	484	20.90	1.94	493
7/28/96 20:48	15.33	5.82	482	20.50	1.90	493
7/28/96 20:58	15.30	5.82	484	20.60	1.91	493
7/28/96 21:08	15.33	5.82	485	21.20	1.96	493
7/28/96 21:18	15.32	5.84	484	21.20	1.96	493
7/28/96 21:28	15.32	5.80	484	20.90	1.93	492
7/28/96 21:38	15.31	5.82	486	20.50	1.90	493
7/28/96 21:48	15.31	5.83	484	21.10	1.95	493
7/28/96 21:58	15.32	5.83	482	21.10	1.95	492

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/28/96 22:08	15.30	5.83	484	20.40	1.89	492
7/28/96 22:18	15.33	5.85	480	20.90	1.93	490
7/28/96 22:28	15.31	5.81	482	20.70	1.92	492
7/28/96 22:38	15.31	5.84	484	21.00	1.95	491
7/28/96 22:48	15.31	5.81	485	20.70	1.92	493
7/28/96 22:58	15.29	5.84	485	20.80	1.92	490
7/28/96 23:08	15.31	5.80	487	20.30	1.88	494
7/28/96 23:18	15.29	5.86	484	20.90	1.94	490
7/28/96 23:28	15.27	5.86	487	20.10	1.86	490
7/28/96 23:38	15.29	5.86	486	20.40	1.88	490
7/28/96 23:48	15.28	5.83	487	20.00	1.85	492
7/28/96 23:58	15.28	5.84	487	20.00	1.85	492
7/29/96 0:08	15.27	5.83	484	20.20	1.87	492
7/29/96 0:18	15.29	5.80	485	19.90	1.84	493
7/29/96 0:28	15.28	5.83	485	20.20	1.87	491
7/29/96 0:38	15.30	5.84	484	20.80	1.93	491
7/29/96 0:48	15.29	5.84	483	20.20	1.87	491
7/29/96 0:58	15.29	5.81	482	20.50	1.90	491
7/29/96 1:08	15.28	5.80	485	20.20	1.87	492
7/29/96 1:18	15.28	5.84	485	20.30	1.88	490
7/29/96 1:28	15.28	5.83	488	19.70	1.83	491
7/29/96 1:38	15.27	5.83	483	19.90	1.84	491
7/29/96 1:48	15.26	5.80	485	19.90	1.84	492
7/29/96 1:58	15.27	5.83	487	19.80	1.83	491
7/29/96 2:08	15.28	5.81	484	20.60	1.91	491
7/29/96 2:18	15.28	5.84	487	20.40	1.88	490
7/29/96 2:28	15.24	5.83	488	19.70	1.83	490
7/29/96 2:38	15.26	5.81	482	19.80	1.83	492
7/29/96 2:48	15.27	5.87	486	19.90	1.84	488
7/29/96 2:58	15.27	5.84	485	20.30	1.88	490
7/29/96 3:08	15.26	5.81	483	19.70	1.83	491
7/29/96 3:18	15.29	5.84	483	20.50	1.89	491
7/29/96 3:28	15.25	5.84	486	20.10	1.86	490
7/29/96 3:38	15.25	5.83	487	19.60	1.81	490
7/29/96 3:48	15.24	5.82	488	19.20	1.78	490
7/29/96 3:58	15.27	5.81	486	20.20	1.87	491
7/29/96 4:08	15.25	5.84	483	19.60	1.81	489
7/29/96 4:18	15.25	5.84	485	19.50	1.81	489
7/29/96 4:28	15.31	5.84	481	20.30	1.88	487
7/29/96 4:38	15.26	5.87	484	19.60	1.81	487
7/29/96 4:48	15.25	5.83	486	19.50	1.81	490
7/29/96 4:58	15.27	5.84	485	19.60	1.82	488
7/29/96 5:08	15.30	5.86	484	19.70	1.82	488
7/29/96 5:18	15.27	5.81	488	19.60	1.81	490
7/29/96 5:28	15.28	5.84	483	19.40	1.80	489
7/29/96 5:38	15.27	5.83	485	19.40	1.79	489
7/29/96 5:48	15.28	5.87	487	19.50	1.81	487

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/29/96 5:58	15.32	5.81	484	19.90	1.84	490
7/29/96 6:08	15.27	5.83	487	19.50	1.80	488
7/29/96 6:18	15.25	5.83	486	19.30	1.79	488
7/29/96 6:28	15.27	5.81	482	19.60	1.81	490
7/29/96 6:38	15.26	5.83	486	18.90	1.75	489
7/29/96 6:48	15.29	5.87	485	20.10	1.86	487
7/29/96 6:58	15.29	5.86	488	19.40	1.79	487
7/29/96 7:08	15.31	5.85	484	19.60	1.82	490
7/29/96 7:18	15.29	5.80	486	18.90	1.75	490
7/29/96 7:28	15.31	5.82	485	20.10	1.86	487
7/29/96 7:38	15.30	5.80	484	19.40	1.79	489
7/29/96 7:48	15.31	5.80	485	19.10	1.77	489
7/29/96 7:58	15.33	5.83	484	19.40	1.80	488
7/29/96 8:08	15.33	5.84	485	19.00	1.76	488
7/29/96 8:18	15.33	5.86	487	19.40	1.79	488
7/29/96 8:28	15.37	5.83	486	19.60	1.81	488
7/29/96 8:38	15.39	5.83	483	19.60	1.81	488
7/29/96 8:48	15.41	5.86	483	19.70	1.82	487
7/29/96 8:58	15.42	5.82	482	19.40	1.79	489
7/29/96 9:08	15.39	5.82	483	19.40	1.79	487
7/29/96 9:18	15.42	5.82	484	19.40	1.79	487
7/29/96 9:28	15.39	5.79	485	18.60	1.72	487
7/29/96 9:38	15.42	5.80	486	18.90	1.75	487
7/29/96 9:48	15.42	5.82	486	19.00	1.75	487
7/29/96 9:58	15.42	5.82	484	19.30	1.78	487
7/29/96 10:08	15.39	5.82	484	18.40	1.70	486
7/29/96 10:18	15.44	5.80	483	19.60	1.81	488
7/29/96 10:28	15.43	5.81	486	18.70	1.72	488
7/29/96 10:38	15.42	5.82	485	18.80	1.74	486
7/29/96 10:48	15.48	5.82	483	19.20	1.77	486
7/29/96 10:58	15.47	5.82	484	19.20	1.77	486
7/29/96 11:08	15.50	5.81	487	18.80	1.73	486
7/29/96 11:18	15.52	5.81	486	19.20	1.77	486
7/29/96 11:28	15.49	5.81	485	19.40	1.78	486
7/29/96 11:38	15.52	5.85	481	19.20	1.77	483
7/29/96 11:48	15.49	5.79	481	19.50	1.79	487
7/29/96 11:58	15.50	5.81	480	19.30	1.78	485
7/29/96 12:08	15.45	5.81	481	19.10	1.76	485
7/29/96 12:18	15.43	5.81	488	18.20	1.68	485
7/29/96 12:28	15.47	5.80	483	19.10	1.76	483
7/29/96 12:38	15.45	5.82	482	19.30	1.78	485
7/29/96 12:48	15.46	5.81	485	19.10	1.76	485
7/29/96 12:58	15.50	5.81	484	19.10	1.76	486
7/29/96 13:08	15.50	5.84	488	18.40	1.69	483
7/29/96 13:18	15.56	5.79	483	19.70	1.82	486
7/29/96 13:28	15.54	5.81	484	18.90	1.74	484
7/29/96 13:38	15.60	5.78	483	18.40	1.69	487

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)
7/29/96 13:48	15.57	5.79	485	18.40	1.69	487
7/29/96 13:58	15.58	5.80	482	19.10	1.75	485
7/29/96 14:08	15.59	5.81	483	19.30	1.77	484
7/29/96 14:18	15.56	5.80	486	18.60	1.71	484
7/29/96 14:28	15.63	5.78	484	18.80	1.73	484
7/29/96 14:38	15.57	5.76	485	18.80	1.73	486
7/29/96 14:48	15.56	5.79	485	18.80	1.73	484
7/29/96 14:58	15.49	5.79	484	18.50	1.70	484
7/29/96 15:08	15.54	5.77	483	18.70	1.72	484
7/29/96 15:18	15.51	5.76	484	18.60	1.71	484
7/29/96 15:28	15.54	5.77	480	18.80	1.73	483
7/29/96 15:38	15.50	5.80	484	18.40	1.70	482
7/29/96 15:48	15.51	5.81	481	18.90	1.74	481
7/29/96 15:58	15.48	5.80	484	18.30	1.69	481
7/29/96 16:08	15.44	5.81	484	18.60	1.71	481
7/29/96 16:18	15.37	5.78	484	18.10	1.67	482
7/29/96 16:28	15.39	5.79	480	18.30	1.69	482
7/29/96 16:38	15.39	5.81	484	18.70	1.73	481
7/29/96 16:48	15.40	5.81	483	18.50	1.71	481
7/29/96 16:58	15.39	5.81	484	18.50	1.71	480
7/29/96 17:08	15.41	5.81	482	18.20	1.68	481
7/29/96 17:18	15.41	5.84	486	18.20	1.68	480
7/29/96 17:28	15.41	5.79	481	18.40	1.70	482
7/29/96 17:38	15.40	5.82	483	18.10	1.67	480
7/29/96 17:48	15.40	5.81	483	18.30	1.69	480
7/29/96 17:58	15.42	5.84	482	18.40	1.70	479
7/29/96 18:08	15.41	5.82	483	18.00	1.66	479
7/29/96 18:18	15.39	5.82	481	18.00	1.66	479
7/29/96 18:28	15.44	5.84	482	18.10	1.67	477
7/29/96 18:38	15.41	5.81	482	18.20	1.68	479
7/29/96 18:48	15.42	5.82	483	18.40	1.70	479

APPENDIX G
PITT-1 GC Analysis Results

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

PITT-1 - Well 66G
GC Data for tracers and TCE - July 18 - 20, 1996

7/18/96 Sample Number	66G Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
171	15:00	0.1	ND	ND	ND	1.8	10.5
178	16:49	ND	ND	ND	2.0	2.1	4.4
183	18:56	ND	ND	ND	ND	1.0	4.3
190	21:02	0.1	ND	ND	1.6	1.1	3.8

7/19/96 Sample Number	66G Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
268	01:03	0.5	ND	ND	0.3	1.1	3.1
270	13:03	544.7	0.4	587.2	679.4	680.0	699.1
277	14:52	755.9	0.7	772.2	816.5	958.5	915.5
322	17:08	746.7	0.7	754.8	777.8	854.4	909.3
327	19:00	720.5	0.7	728.5	782.9	827.6	877.9
330	22:03	740.3	0.7	750.0	771.4	827.5	879.8

7/20/96 Sample Number	66G Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
205	00:00	757.3	0.7	750.9	783.4	866.0	910.5
302	00:02	729.8	0.6	747.6	779.2	825.6	900.5
286	02:00	736.7	0.7	780.5	772.3	848.5	905.0
219	03:00	733.2	0.7	740.5	766.6	868.6	908.5
216	03:00	758.6	0.6	761.5	778.0	866.8	919.1
242	06:00	693.3	0.7	700.2	711.4	817.5	847.5
230	09:00	745.9	0.7	746.6	744.8	874.0	898.7

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

PITT-1 - Well BW2G
GC Data for tracers and TCE - July 18 - 29, 1996

7/18/96 Sample Number	BW2G Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
172	15:00	ND	3.7	ND	2.3	1.5	8.0
179	16:55	ND	3.8	ND	1.9	1.8	8.6
184	18:54	ND	5.1	ND	2.1	1.2	3.8
264	21:02	0.6	41.5	ND	1.3	0.6	0.7

7/19/96 Sample Number	BW2G Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
269	01:03	0.3	39.0	ND	0.4	0.8	3.1
271	13:02	0.4	34.0	ND	1.5	0.8	0.8
278	14:50	0.9	ND	0.2	1.3	1.6	1.1
323	16:59	13.6	36.8	16.6	18.3	20.0	18.1
194	18:02	28.7	35.8	37.3	40.7	45.9	43.3
328	18:56	44.5	45.8	54.8	60.8	62.8	58.5
279	19:48	54.8	35.6	66.6	72.9	80.1	71.5
223	19:50	61.6	40.0	74.7	81.0	88.0	77.9
331	22:03	98.7	39.7	114.5	124.0	136.9	124.7

7/20/96	BW2G						
Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
304	00:00	108.8	36.8	129.3	141.7	156.1	142.4
198	00:00	130.8	38.6	151.1	163.3	179.6	153.6
287	02:00	145.5	39.4	162.9	176.4	181.5	168.1
218	03:00	148.2	38.7	167.3	180.2	201.1	185.7
217	03:00	164.2	43.5	185.0	200.5	197.7	224.1
244	05:00	158.4	27.9	188.0	191.3	215.1	200.4
337	05:00	171.9	37.5	193.7	208.4	235.1	222.4
204	06:00	181.8	37.3	203.1	219.4	246.8	233.5
347	07:00	189.1	37.3	208.0	222.9	250.9	238.2
231	09:00	198.1	33.4	219.1	234.0	267.4	254.6
210	12:00	209.7	35.9	237.9	245.5	281.6	268.0
351	13:00	215.2	36.3	233.1	245.5	281.7	267.5
235	14:00	218.0	34.2	239.1	252.9	290.2	279.6
305	15:24	221.5	34.3	240.5	253.3	276.3	280.9
241	18:00	234.7	38.7	253.0	264.2	305.9	297.2
307	18:24	230.5	37.5	249.1	259.2	301.2	293.7
295	20:00	230.0	34.4	251.7	262.7	307.9	299.9
310	21:24	231.9	36.0	251.9	261.9	307.2	299.2
353	22:48	174.2	36.5	192.2	205.2	231.7	220.0

7/21/96	BW2G						
Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
253	01:00	183.7	35.3	200.8	215.6	257.5	274.8
257	02:09	180.3	39.0	196.2	210.0	250.4	267.3
363	03:00	148.5	35.4	165.2	177.3	211.6	225.9
372	05:00	120.3	33.4	136.2	142.7	176.1	190.3
312	05:09	125.0	36.6	138.0	149.6	177.8	191.0
373	07:00	103.6	36.2	117.4	127.2	140.6	162.5
355	08:09	103.1	30.2	115.8	124.8	144.0	158.2
374	08:58	88.5	33.2	101.0	109.7	130.8	140.6
517	08:58	92.67	37.56	104.32	112.99	136.5	141.72
375	11:06	76.5	33.3	88.3	95.9	114.2	122.1
358	11:09	85.8	33.6	97.1	105.0	124.8	133.3
376	12:59	69.7	35.1	79.7	86.9	104.4	110.9
263	17:00	59.3	34.1	67.5	69.6	89.0	95.5
301	21:00	50.9	32.6	57.5	63.3	72.7	79.9

7/22/96 BW2G

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
383	01:05	40.3	34.5	46.8	51.4	61.6	66.9
384	05:00	36.0	34.1	41.9	45.7	54.8	60.2
385	09:00	27.6	33.5	35.6	38.7	47.0	49.0
386	13:00	28.6	38.2	33.1	36.9	44.1	48.2
387	17:00	26.1	33.4	30.3	33.3	39.5	44.9
389	21:00	20.6	28.6	27.3	30.1	38.2	40.7
450	23:00	21.5	29.0	26.6	29.2	34.5	36.1

7/23/96 BW2G

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
392	01:00	21.4	31.0	23.8	28.5	33.6	42.2
451	03:00	14.9	25.9	21.2	23.0	30.3	28.7
316	05:00	20.2	32.0	22.0	27.3	29.9	33.2
452	07:00	24.2	35.7	24.4	27.1	31.1	33.3
393	09:00	18.0	32.6	20.9	23.6	27.4	31.0
453	11:00	20.9	35.2	24.0	26.1	30.2	31.1
394	12:40	17.2	33.5	19.1	23.1	27.9	29.7
395	18:00	11.8	21.4	10.1	18.6	23.2	23.1

7/24/96 BW2G

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
339	06:00	14.0	33.3	15.1	18.7	21.2	24.0
396	12:03	12.4	27.6	13.2	15.7	18.7	21.2
397	18:00	10.9	28.2	11.7	15.9	16.9	20.2

7/25/96 BW2G

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
398	00:00	10.4	28.6	11.9	13.7	15.9	19.3
399	06:00	9.2	25.3	10.4	12.2	15.7	22.4
449	12:00	10.2	28.3	9.9	10.8	12.6	13.3
448	18:00	7.2	28.7	9.2	10.2	11.7	12.5

7/26/96 BW2G

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
447	00:00	4.6	17.1	3.8	7.0	9.6	10.3
446	06:00	6.7	25.1	8.6	8.9	10.4	10.7
440	12:00	6.1	24.3	7.2	7.8	8.6	9.2
441	12:00	7.9	27.7	7.6	9.0	8.4	9.8
439	18:05	4.7	23.5	6.6	6.9	7.8	8.6

7/27/96 BW2G

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
438	00:00	8.8	21.6	10.3	11.5	12.2	14.4
437	06:00	6.4	25.1	6.5	6.7	7.5	8.1
495	12:00	2.9	13.1	5.8	5.8	7.2	7.1
496	18:00	3.0	21.1	4.8	5.6	5.9	6.0

7/28/96 BW2G

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
497	00:00	3.7	22.1	5.2	5.4	6.0	5.8
498	06:00	2.6	22.5	4.8	5.0	5.5	5.5
499	12:00	6.1	20.9	4.7	4.8	2.3	4.6
520	18:00	3.68	26.26	5.34	5.36	5.08	4.79
521	20:00	3.6	25.29	5.13	5.15	4.53	4.85

7/29/96 BW2G

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
512	00:00	1.3	8.3	3.2	2.8	3.3	3.8
511	04:00	1.9	15.7	4.1	3.9	4.0	3.7
510	08:00	5.2	23.9	4.2	4.2	0.8	4.0
509	12:00	2.7	24.7	4.4	4.5	4.2	4.0
508	12:01	5.6	14.5	3.7	3.5	3.6	3.6
507	16:00	4.0	25.9	4.0	4.1	3.8	4.0

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

PITT-1 - Well INT-1
GC Data for tracers and TCE - July 18 - 29, 1996

7/18/96 INT1

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
170	15:00	0.3	6.0	ND	2.0	3.1	13.0
175	16:56	ND	4.7	ND	2.6	0.9	2.2
182	18:55	ND	0.9	ND	2.2	0.9	1.0
187	21:03	ND	21.6	ND	1.9	0.9	3.8

7/19/96 INT1

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
267	01:03	0.2	25.2	0.0	0.4	1.0	2.8
247	13:01	0.6	21.4	ND	1.3	1.8	2.6
276	15:00	1.2	21.1	0.7	1.2	1.2	0.5
319	17:01	30.7	16.7	39.0	41.3	44.9	37.3
193	17:59	189.4	16.9	266.2	294.8	308.7	257.9
326	18:54	551.6	0.4	569.3	599.3	613.8	611.2
222	19:51	456.9	15.1	477.0	520.2	565.6	540.5
329	22:03	356.2	12.7	381.1	408.9	451.2	434.1

7/20/96 INT1

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
197	00:00	273.6	11.9	318.0	335.6	362.9	311.2
303	00:06	336.6	13.7	359.0	388.6	435.3	438.3
283	02:00	331.8	15.6	360.1	376.1	406.7	341.9
215	03:00	368.4	15.3	394.4	407.0	440.2	367.5
220	03:05	128.9	6.6	146.9	162.7	186.5	190.4
336	05:00	435.3	14.3	455.1	466.4	503.4	424.8
203	06:00	465.0	0.3	486.0	499.0	540.5	455.7
243	06:05	224.8	5.8	243.9	261.5	300.1	295.1
346	07:00	516.7	16.7	532.9	550.1	608.5	548.4
352	08:06	227.3	4.8	244.8	259.9	301.2	293.8
229	09:00	539.9	5.5	538.8	472.0	621.3	538.2
209	12:00	245.5	12.5	268.1	285.4	333.7	319.2
350	13:00	351.3	15.0	367.2	369.4	420.3	366.1
234	15:00	264.4	12.6	283.8	293.8	332.8	298.0
306	18:38	141.8	18.1	186.0	196.9	233.1	219.4
240	19:00	548.1	8.8	544.4	465.6	500.0	333.9
294	23:00	231.9	16.2	254.8	275.4	326.5	306.9

7/21/96 INT1

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
256	02:38	215.5	36.2	233.3	244.4	290.3	296.0
300	03:00	59.8	19.3	70.1	79.6	97.3	110.3
361	03:00	185.7	19.2	205.4	226.4	271.3	278.6
311	08:38	111.2	36.6	125.0	135.7	161.3	174.0
252	08:57	115.1	19.3	133.2	157.7	195.3	214.0
364	13:00	66.5	11.5	79.3	94.4	116.6	128.5
354	14:38	76.8	35.5	90.2	97.3	115.0	123.9
371	15:00	69.3	12.3	81.8	94.2	115.2	127.1
262	17:00	66.3	20.4	76.1	88.2	107.6	122.4

7/22/96 INT1

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
382	05:00	38.1	30.2	44.2	48.8	58.8	64.4
419	17:00	26.7	13.6	30.8	34.0	38.0	43.4

7/23/96 INT1

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
315	05:00	21.4	28.0	23.7	28.6	33.0	37.8
420	11:00	17.8	7.6	20.8	23.1	25.1	27.9
459	11:01	21.4	30.2	24.0	26.9	32.1	37.6
460	11:02	20.2	26.7	21.3	23.7	27.9	29.9

7/24/96 INT1

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
338	00:00	16.6	29.5	17.9	20.6	25.6	30.3
421	12:05	9.1	21.8	13.2	15.0	15.6	20.1

7/25/96 INT1

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
553	00:00	12.39	17.58	15.35	22.57	26.05	38.49
528	18:00	14.04	14.57	17.55	25.55	33.66	45.35

7/26/96 INT1

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
552	00:00	12.67	13.84	15.75	23.48	30.43	44.4
527	15:20	2.1	11.01	3.27	6.66	9.84	21.13

7/27/96 INT1

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
551	00:00	1.1	7.56	1	2.55	1.97	3.55
526	12:00	0.94	4.92	1.57	1.76	1.2	2.41

7/28/96 INT1

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
550	00:00	0.82	6.76	1.08	3.29	3.07	7.75
523	12:00	1.49	8.31	1.58	3.29	2.56	5.33

7/29/96 INT1

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
549	00:00	0.56	5.28	1.2	3.66	3.21	3.21
529	12:00	0.48	5.39	1.23	2.08	1.11	2.22
524	12:01	0.91	6.47	1.11	3.01	2.15	4.39

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

PITT-1 - Well INT- 5
GC Data for tracers and TCE - July 18 - 29, 1996

7/18/96 INT5

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
169	15:00	ND	ND	ND	1.8	1.4	4.4
174	17:01	ND	ND	ND	ND	2.0	0.9
181	18:58	0.1	0.1	ND	1.7	1.3	1.2
186	21:04	ND	ND	ND	2.0	0.9	3.9

7/19/96 INT5

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
266	01:03	0.7	0.4	0.1	0.5	0.8	3.1
246	13:04	0.6	0.7	ND	1.3	1.9	0.6
275	14:53	0.5	0.7	ND	0.6	1.2	0.4
192	17:14	ND	0.7	ND	1.6	0.9	1.2
318	17:15	0.4	1.1	ND	0.4	0.9	0.3
206	18:08	0.1	0.2	ND	ND	2.0	1.7
325	18:59	1.2	0.5	ND	0.7	1.8	0.6
221	19:52	0.8	0.5	ND	1.4	0.8	0.6
281	22:03	1.1	0.6	0.1	1.6	1.3	0.6

7/20/96	INT5						
Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
196	00:00	0.5	0.3	ND	2.0	1.5	1.0
282	02:00	1.7	0.4	0.8	1.8	2.2	1.8
214	03:00	2.3	0.7	2.5	3.8	4.1	2.4
335	05:00	6.8	0.5	7.3	10.1	8.2	9.2
202	06:00	6.3	0.5	7.9	10.4	9.9	11.8
341	07:00	8.1	0.6	9.1	12.1	10.1	7.6
464	08:00	125.0	0.9	39.7	45.7	40.7	36.6
228	09:00	34.5	0.7	36.9	43.5	41.6	36.9
465	10:00	32.5	0.5	37.9	41.7	35.1	27.8
289	11:00	47.9	0.7	60.8	72.0	71.1	62.6
290	11:01	47.8	0.6	60.2	70.5	70.1	62.8
291	11:02	45.6	0.7	60.8	68.7	68.7	62.2
208	12:00	51.3	ND	66.8	76.7	76.0	64.6
349	13:00	51.7	0.7	66.5	76.1	76.2	65.0
233	15:00	52.3	0.7	66.1	76.4	75.2	66.2
239	19:00	56.8	0.7	72.9	83.7	82.5	66.9
466	21:00	59.9	0.5	80.9	83.1	88.6	74.3
293	23:00	70.8	0.6	90.4	102.4	101.8	89.4

7/21/96	INT5						
Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
468	01:00	77.5	0.7	102.1	113.2	115.9	99.3
360	03:00	85.4	0.6	107.0	119.1	120.9	106.4
469	05:00	120.5	0.7	143.1	155.4	162.6	149.8
470	07:00	82.4	ND	128.7	142.7	148.0	128.5
251	09:00	135.2	0.2	158.7	170.9	182.2	159.8
365	11:01	154.2	0.6	181.9	195.6	207.8	180.8
471	13:03	166.3	0.7	191.3	204.4	217.5	191.7
370	15:00	224.7	0.6	247.5	266.0	297.4	284.8
259	17:00	270.6	0.7	289.6	307.8	354.2	347.1
467	19:00	132.4	7.8	127.2	300.9	366.4	356.3
299	21:00	272.3	0.4	289.1	291.1	329.4	280.6
480	23:00	275.8	0.7	285.8	297.8	337.7	304.4

7/22/96	INT5						
Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
381	05:00	259.9	0.5	273.5	280.1	312.7	268.4
481	11:00	223.3	ND	253.9	267.7	313.6	288.1
415	17:00	161.1	ND	230.4	236.3	281.0	253.7
458	23:00	135.2	ND	196.9	208.3	244.0	226.5

7/23/96 INT5

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
314	05:00	189.4	0.4	203.8	212.1	242.4	214.5
416	11:00	149.4	0.2	162.1	165.5	198.9	191.5

7/24/96 INT5

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
343	00:00	145.9	0.4	164.2	166.5	193.9	182.6
417	12:07	118.7	0.1	128.6	130.2	149.4	140.1

7/25/96 INT5

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
418	00:00	86.0	0.1	97.7	105.1	112.4	114.7
454	18:00	31.2	0.2	35.2	36.4	43.5	43.6

7/26/96 INT5

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
455	00:00	39.5	0.2	44.6	50.9	65.4	75.7
456	15:20	50.2	0.2	49.2	51.6	59.7	57.3

7/27/96 INT5

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
457	00:00	31.1	0.1	31.2	35.3	43.7	52.5
534	12:00	21.42	4.5	37.72	39.05	50.29	48.76

7/28/96 INT5

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
533	12:00	22.82	0.12	25.54	27.09	31.09	29.28

7/29/96 INT5

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
532	12:00	10.42	1.24	0.76	20.14	26.32	25.04

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

PITT-1 - Well INT- 6
GC Data for tracers and TCE - July 18 - 29, 1996

7/18/96 Sample Number	INT6 Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
168	15:00	0.1	ND	ND	0.6	6.8	3.8
173	17:01	ND	ND	ND	0.8	2.4	4.4
180	19:01	ND	ND	ND	1.9	1.1	1.8
185	21:05	ND	ND	ND	1.8	1.0	1.0

7/19/96 Sample Number	INT6 Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
265	01:03	0.8	0.1	0.1	0.4	1.2	3.2
245	13:13	0.7	0.4	ND	1.4	2.1	2.8
274	14:59	0.8	0.4	ND	0.5	1.1	0.8
317	17:05	0.7	0.5	ND	2.0	0.3	3.1
191	17:58	ND	0.5	ND	2.1	0.9	3.6
324	19:00	0.8	0.4	ND	1.6	1.1	0.8

7/20/96 Sample Number	INT6 Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
195	00:00	ND	0.7	ND	1.8	2.6	2.5
280	02:00	1.3	0.7	ND	1.6	1.3	0.6
211	03:00	0.5	0.8	ND	1.5	2.4	0.9
334	05:00	1.6	0.8	0.1	1.7	1.2	0.5
199	06:00	0.8	0.7	ND	1.6	1.7	1.1
340	07:00	2.1	0.8	0.7	0.9	2.3	4.0
227	09:00	1.3	0.6	ND	1.5	2.4	0.6
207	12:00	0.8	0.8	0.1	0.5	1.7	3.4
288	12:01	1.2	0.7	0.1	0.7	1.6	1.3
348	13:00	1.9	0.7	ND	1.2	3.3	1.9
232	15:00	1.6	0.6	0.1	1.5	1.2	3.2
238	19:00	1.3	0.6	ND	1.4	1.4	0.6
292	23:00	0.9	ND	ND	1.5	0.9	0.6

7/21/96 Sample Number	INT6 Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
359	03:00	0.8	0.6	1.0	0.5	0.8	2.6
250	09:02	ND	ND	1.3	0.3	0.7	3.1
366	13:05	0.9	0.4	0.8	0.5	0.8	3.0
367	15:00	0.9	0.5	ND	0.4	0.7	0.5
258	17:00	0.7	0.3	ND	0.5	1.4	0.5
298	21:00	3.1	0.6	0.1	0.8	1.2	0.4

7/22/96 Sample Number	INT6 Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
380	05:00	1.3	0.7	0.1	0.5	1.0	1.5
400	17:00	0.8	0.7	0.1	1.5	1.5	1.8

7/23/96 Sample Number	INT6 Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
313	05:00	1.4	0.9	ND	1.9	0.5	0.4
401	11:00	0.8	0.7	ND	2.6	1.2	2.1

7/24/96 Sample Number	INT6 Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
342	00:00	1.2	0.9	0.4	2.2	1.0	3.7
412	12:01	2.5	0.2	0.9	1.0	1.0	0.5

7/25/96 Sample Number	INT6 Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
413	00:00	1.4	0.2	0.1	0.8	0.6	0.7
414	00:01	0.6	0.2	0.4	0.4	0.3	0.4

7/26/96 Sample Number	INT6 Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
472	15:20	2.2	0.6	1.3	0.6	0.9	0.6
473	15:21	ND	0.7	0.0	0.3	0.8	0.3

7/27/96 INT6

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
537	12:00	1.18	0.68	1.66	1.19	1.04	0.86

7/28/96 INT6

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
536	12:00	2.06	0.83	2.47	2.23	2.01	1.68

7/29/96 INT6

Sample Number	Sample Time	IPA Conc. (mg/L)	TCE Conc. (mg/L)	3M3P Conc. (mg/L)	24D3P Conc. (mg/L)	Hex. Conc. (mg/L)	Hept. Conc. (mg/L)
535	12:00	1.66	0.74	2.39	2.73	2.41	1.99

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio — Partitioning Interwell Tracer Test 1
GC Calibration - 7/13/96

Standard	IPA Expected Conc. (mg/L)	IPA Area	IPA CF	TCE Expected Conc. (mg/L)	TCE Area	TCE CF	3M3P Expected Conc. (mg/L)	3M3P Area	3M3P CF
2	3.51	29.97	8.5	3	52.82		4.44	50.36	11.3
3	8.78	67.46	7.7	10	86.5	8.7	11.1	112.19	10.1
4	23.4	211.22	9.0	30	199.32	6.6	29.6	373.36	12.6
5	87.8	593.38	6.8	100	609.09	6.1	111	1289.95	11.6
6	234	2171.1	9.3	300	1756.67	5.9	296	3992.12	13.5
Average			8.26			6.81			11.83
RSD			12.5%			18.7%			10.9%
Precision 7/13/1996									
Standard	IPA Determined Conc. (mg/L)	IPA Area	IPA %R	TCE Determined Conc. (mg/L)	TCE Area	TCE %R	3M3P Determined Conc. (mg/L)	3M3P Area	3M3P %R
5	64.378	481.89	91%	89.359	608	100%	107.439	1253.29	99%
5	64.378	491.96	93%	89.359			107.439	1284.61	101%
5	64.378	559.05	105%	89.359			107.439	1257.99	99%
Average		531.6	100%		608.5	100%		1271.5	100%
St. Dev.		53.6	10.1%		0.8	0.1%		18.5	1.5%
		Low	High		Low	High		Low	High
%R +/- 3s		70%	130%		100%	100%		96%	104%
CC Control Range		80%	120%		80%	120%		80%	120%
(mg/L)		52	77		71	107		86	129

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio
Partitioning Interwell Tracer Test 1
GC Calibration - 7/13/96

Standard	24D3P Expected Conc. (mg/L)	24D3P Area	24D3P CF	Hexanol Expected Conc. (mg/L)	Hexanol Area	Hexanol CF	Heptanol Expected Conc. (mg/L)	Heptanol Area	Heptanol CF
2	4.62	40.14	8.7	4.67	34.4	7.4	4.67	31.43	6.7
3	11.6	111.67	9.6	11.7	97.33	8.3	11.7	118.12	10.1
4	30.8	297.79	9.7	31.1	288.94	9.3	31.1	282.67	9.1
5	115.5	1262.82	10.9	116.6	1299.91	11.1	116.7	1340.72	11.5
6	308	3244.04	10.5	311	3274.07	10.5	311	3221.61	10.4
Average			9.89			9.33			9.55
RSD			8.8%			16.6%			18.8%

Precision 7/13/1996

Standard	24D3P Determined Conc. (mg/L)	24D3P Area	24D3P %R	Hexanol Determined Conc. (mg/L)	Hexanol Area	Hexanol %R	Heptanol Determined Conc. (mg/L)	Heptanol Area	Heptanol %R
5	127.164	1275.65	101%	139.223	1322.11	102%	140.595	1367.82	102%
5	127.164	1274.92	101%	139.223	1317.81	101%	140.595	1370.41	102%
5	127.164	1217.19	97%	139.223	1256.16	97%	140.595	1293.18	96%
Average		1257.6	100%		1299.0	100%		1343.0	100%
St. Dev.		27.6	2.2%		30.1	2.3%		35.8	2.7%
		Low	High		Low	High		Low	High
%R +/- 3s		93%	107%		93%	107%		92%	108%
CC Control Range		80%	120%		80%	120%		80%	120%
(mg/L)		102	153		111	167		112	169

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio Partitioning Interwell Tracer Test 2
GC Calibration - 10/4/96

Standard	TCE Expected Conc. (mg/L)	TCE Height	TCE CF	Propanol Expected Conc. (mg/L)	Propanol Area	Propanol CF	Heptanol Expected Conc. (mg/L)	Heptanol Area	Heptanol CF	Octanol Expected Conc. (mg/L)	Octanol Area	Octanol CF
i	10.2	5.687	0.6	10.2	141.23	13.8	10.2	99.39	9.7	5.1	68.67	13.5
h	51.0	19.827	0.4	51.0	634.28	12.4	51.0	747.74	14.7	25.0	389.06	15.6
g	250	95.465	0.4	250	3090.28	12.4	250	4071.59	16.3	125	2015.6	16.1
f	1000	378.397	0.4	1000	12322.62	12.3	1000	16276.21	16.3	500	8397.89	16.8
Average			0.38			12.74			15.74			15.49
RSD			1.4%			5.8%			5.9%			9.3%

Precision
10/4/1996

Standard	TCE Determined Conc. (mg/L)	TCE Height	TCE %R	Propanol Determined Conc. (mg/L)	Propanol Area	Propanol %R	Heptanol Determined Conc. (mg/L)	Heptanol Area	Heptanol %R	Octanol Determined Conc. (mg/L)	Octanol Area	Octanol %R
h	43.675	17.407	104%	37.701	477.56	99%	30.200	456.71	96%	11.024	173.61	102%
h	43.675	16.645	100%	37.701	494.02	103%	30.200	512.6	108%	11.024	155.34	91%
h	43.675	16.132	96%	37.701	469.55	98%	30.200	456.85	96%	11.024	183.24	107%
Average		16.7	100%		480.4	100%		475.4	100%		170.7	100%
St. Dev.		0.6	3.8%		12.5	2.6%		32.2	6.8%		14.2	8.3%
		Low	High		Low	High		Low	High		Low	High
%R +/- 3s		88%	112%		92%	108%		80%	120%		75%	125%
CC Control Range		80%	120%		80%	120%		80%	120%		80%	120%
(mg/L)		35	52		30	45		24	36		9	13

APPENDIX H

Solubilization Test and PITT-2 Piezometric Data

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Surfactant Flood and Partitioning Interwell Tracer Test 2
Piezometric Data - September 21 - October 4, 1996

Date and Time	Minutes	62G	65G	66G	67G	INT2	INT3
9/21/96 9:43	0	19.664	20.569	33.762	19.604	21.588	21.281
9/21/96 9:53	10	19.711	20.593	33.762	19.629	21.635	21.306
9/21/96 10:03	20	19.695	20.583	33.762	19.617	21.604	21.294
9/21/96 10:13	30	18.981	20.045	33.762	19.233	21.069	20.826
9/21/96 10:23	40	18.632	19.683	33.762	18.899	20.738	20.453
9/21/96 10:33	50	18.474	19.516	33.762	18.742	20.565	20.302
9/21/96 10:43	60	18.378	19.407	33.762	18.648	20.471	20.207
9/21/96 10:53	70	18.299	19.331	33.762	18.566	20.392	20.131
9/21/96 11:03	80	18.204	19.235	33.762	18.472	20.298	20.030
9/21/96 11:13	90	18.172	19.183	33.762	18.434	20.251	19.992
9/21/96 11:23	100	18.109	19.135	33.762	18.377	20.188	19.948
9/21/96 11:33	110	18.125	19.121	33.762	18.377	20.235	19.935
9/21/96 11:43	120	18.045	19.078	12.654	18.314	20.156	19.891
9/21/96 11:53	130	17.902	18.959	12.512	18.182	19.983	19.758
9/21/96 12:03	140	17.855	18.902	12.449	18.119	19.967	19.714
9/21/96 12:13	150	17.807	18.859	12.055	18.081	19.904	19.676
9/21/96 12:23	160	17.776	18.807	11.992	18.037	19.841	19.625
9/21/96 12:33	170	17.744	18.783	11.913	18.018	19.826	19.600
9/21/96 12:43	180	17.712	18.749	11.834	17.981	19.794	19.562
9/21/96 12:53	190	17.664	18.707	11.755	17.943	19.779	19.524
9/21/96 13:03	200	17.744	18.745	11.755	18.000	19.841	19.575
9/21/96 13:13	210	17.807	18.807	11.787	18.063	19.936	19.644
9/21/96 13:23	220	17.807	18.811	11.771	18.063	19.889	19.650
9/21/96 13:33	230	17.839	18.835	11.740	18.088	19.936	19.676
9/21/96 13:43	240	17.902	18.883	12.275	18.132	20.015	19.720
9/21/96 13:53	250	17.966	18.940	11.661	18.182	20.062	19.777
9/21/96 14:03	260	17.982	18.954	11.724	18.201	20.062	19.796
9/21/96 14:13	270	17.982	18.964	11.724	18.214	20.077	19.802
9/21/96 14:23	280	17.998	18.969	11.677	18.220	20.093	19.809
9/21/96 14:33	290	17.982	18.964	11.661	18.214	20.093	19.802
9/21/96 14:43	300	17.998	18.973	11.472	18.220	20.077	19.809
9/21/96 14:53	310	17.982	18.964	11.440	18.214	20.077	19.802
9/21/96 15:03	320	18.283	19.169	16.986	18.333	20.282	19.935
9/21/96 15:13	330	18.172	19.126	1.895	18.339	20.235	19.948
9/21/96 15:23	340	18.188	19.140	-0.047	18.358	20.251	19.967
9/21/96 15:33	350	18.236	19.183	-0.062	18.396	20.282	20.011
9/21/96 15:43	360	18.220	19.173	-0.062	18.396	20.313	19.992
9/21/96 15:53	370	18.204	19.169	-0.078	18.383	20.282	19.992
9/21/96 16:03	380	18.331	19.302	5.557	18.516	20.408	20.125
9/21/96 16:13	390	18.236	19.212	0.821	18.434	20.313	20.030
9/21/96 16:23	400	18.252	19.212	1.784	18.427	20.298	20.030
9/21/96 16:33	410	18.283	19.240	2.258	18.440	20.329	20.055

(Column header "Well ID" spans 62G through INT3.)

		Well ID					
Date and Time	Minutes	62G	65G	66G	67G	INT2	INT3
9/21/96 16:43	420	18.267	19.216	0.521	18.434	20.313	20.036
9/21/96 16:53	430	18.236	19.193	0.679	18.415	20.329	20.017
9/21/96 17:03	440	18.267	19.221	1.532	18.440	20.361	20.036
9/21/96 17:13	450	18.315	19.250	4.894	18.453	20.376	20.055
9/21/96 17:23	460	18.252	19.226	1.184	18.453	20.345	20.049
9/21/96 17:33	470	18.299	19.245	0.995	18.459	20.361	20.055
9/21/96 17:43	480	18.109	19.088	-1.263	18.333	20.188	19.910
9/21/96 17:53	490	18.077	19.069	-0.568	18.321	20.203	19.897
9/21/96 18:03	500	18.093	19.064	-0.773	18.308	20.203	19.891
9/21/96 18:13	510	18.077	19.050	-0.457	18.295	20.140	19.884
9/21/96 18:23	520	18.061	19.040	-1.089	18.295	20.172	19.872
9/21/96 18:33	530	18.077	19.059	-0.694	18.302	20.188	19.891
9/21/96 18:43	540	17.744	18.788	-6.654	18.088	19.904	19.638
9/21/96 18:53	550	17.871	18.849	-1.184	18.119	19.999	19.695
9/21/96 19:03	560	17.902	18.888	-1.437	18.157	19.983	19.733
9/21/96 19:13	570	17.918	18.902	-1.721	18.170	20.015	19.745
9/21/96 19:23	580	17.918	18.916	-1.405	18.188	20.077	19.758
9/21/96 19:33	590	17.934	18.911	-1.864	18.182	20.046	19.758
9/21/96 19:43	600	17.950	18.935	-2.006	18.201	20.077	19.777
9/21/96 19:53	610	17.950	18.930	-1.990	18.195	20.062	19.771
9/21/96 20:03	620	17.982	18.945	-1.089	18.201	20.093	19.777
9/21/96 20:13	630	18.014	18.983	-0.394	18.239	20.125	19.821
9/21/96 20:23	640	18.045	19.007	-0.584	18.264	20.093	19.840
9/21/96 20:33	650	18.045	19.016	-0.568	18.264	20.156	19.846
9/21/96 20:43	660	18.061	19.031	-0.647	18.276	20.140	19.859
9/21/96 20:53	670	17.934	18.930	-4.298	18.207	19.999	19.777
9/21/96 21:03	680	17.887	18.883	-4.219	18.151	19.983	19.720
9/21/96 21:13	690	17.871	18.869	-4.092	18.138	19.967	19.714
9/21/96 21:23	700	17.887	18.869	-3.650	18.138	19.999	19.707
9/21/96 21:33	710	17.887	18.873	-3.302	18.144	19.999	19.714
9/21/96 21:43	720	17.887	18.873	-3.460	18.144	19.999	19.714
9/21/96 21:53	730	17.902	18.883	-3.239	18.157	20.030	19.726
9/21/96 22:03	740	17.918	18.907	-2.970	18.182	19.999	19.752
9/21/96 22:13	750	17.934	18.911	-2.796	18.176	20.046	19.752
9/21/96 22:23	760	17.950	18.926	-2.369	18.195	19.999	19.771
9/21/96 22:33	770	17.966	18.950	-2.069	18.214	20.109	19.790
9/21/96 22:43	780	17.998	18.973	-1.010	18.239	20.125	19.815
9/21/96 22:53	790	17.998	18.973	-1.690	18.239	20.109	19.815
9/21/96 23:03	800	18.014	18.997	-1.279	18.258	20.140	19.834
9/21/96 23:13	810	18.014	19.002	-1.484	18.251	20.093	19.840
9/21/96 23:23	820	18.045	19.021	-1.200	18.276	20.140	19.853
9/21/96 23:33	830	18.045	19.031	-1.168	18.289	20.172	19.865
9/21/96 23:43	840	18.061	19.040	-1.153	18.302	20.156	19.878
9/21/96 23:53	850	18.093	19.059	-1.074	18.314	20.188	19.891
9/22/96 0:03	860	18.109	19.073	-0.710	18.327	20.219	19.903
9/22/96 0:13	870	18.140	19.097	-0.315	18.346	20.235	19.929
9/22/96 0:23	880	18.156	19.116	-0.347	18.371	20.251	19.954

Date and Time	Minutes	62G	65G	66G	67G	INT2	INT3
		Well ID					
9/22/96 0:33	890	18.125	19.092	-2.274	18.346	20.203	19.922
9/22/96 0:43	900	18.125	19.083	-1.769	18.339	20.203	19.922
9/22/96 0:53	910	18.109	19.088	-1.516	18.346	20.219	19.922
9/22/96 1:03	920	18.109	19.088	-1.390	18.346	20.235	19.922
9/22/96 1:13	930	18.125	19.097	-1.500	18.352	20.219	19.935
9/22/96 1:23	940	18.140	19.107	-0.884	18.365	20.203	19.941
9/22/96 1:33	950	18.188	19.140	-0.078	18.390	20.266	19.973
9/22/96 1:43	960	18.236	19.178	1.390	18.415	20.298	20.004
9/22/96 1:53	970	18.299	19.240	2.479	18.472	20.376	20.068
9/22/96 2:03	980	18.347	19.293	3.853	18.516	20.424	20.118
9/22/96 2:13	990	18.442	19.369	5.699	18.579	20.518	20.181
9/22/96 2:23	1000	18.490	19.421	6.630	18.616	20.550	20.232
9/22/96 2:33	1010	18.521	19.459	3.584	18.660	20.581	20.276
9/22/96 2:43	1020	18.347	19.312	0.963	18.541	20.455	20.125
9/22/96 2:53	1030	18.188	19.173	-3.602	18.440	20.313	20.004
9/22/96 3:03	1040	18.474	19.416	-1.374	18.629	20.550	20.251
9/22/96 3:13	1050	18.188	19.178	-3.412	18.427	20.298	20.004
9/22/96 3:23	1060	18.156	19.145	-4.377	18.409	20.298	19.979
9/22/96 3:33	1070	18.140	19.126	-4.061	18.390	20.266	19.960
9/22/96 3:43	1080	18.204	19.154	-4.061	18.421	20.313	19.998
9/22/96 3:53	1090	18.220	19.169	-3.602	18.440	20.345	20.017
9/22/96 4:03	1100	18.204	19.169	-3.665	18.440	20.313	20.017
9/22/96 4:13	1110	18.220	19.183	-3.808	18.453	20.313	20.030
9/22/96 4:23	1120	18.220	19.183	-3.855	18.459	20.329	20.030
9/22/96 4:33	1130	18.236	19.193	-3.887	18.465	20.361	20.036
9/22/96 4:43	1140	18.252	19.202	-3.697	18.472	20.345	20.049
9/22/96 4:53	1150	18.252	19.202	-3.713	18.472	20.361	20.055
9/22/96 5:03	1160	18.267	19.212	-3.760	18.484	20.376	20.055
9/22/96 5:13	1170	18.267	19.216	-3.586	18.484	20.408	20.061
9/22/96 5:23	1180	18.267	19.221	-3.412	18.490	20.361	20.068
9/22/96 5:33	1190	18.267	19.221	-3.412	18.497	20.392	20.068
9/22/96 5:43	1200	18.267	19.226	-3.444	18.497	20.361	20.074
9/22/96 5:53	1210	18.283	19.235	-3.412	18.509	20.392	20.087
9/22/96 6:03	1220	18.299	19.245	-3.349	18.516	20.408	20.093
9/22/96 6:13	1230	18.315	19.254	-3.397	18.528	20.361	20.106
9/22/96 6:23	1240	18.315	19.254	-3.460	18.522	20.424	20.106
9/22/96 6:33	1250	18.299	19.250	-3.855	18.522	20.408	20.099
9/22/96 6:43	1260	18.299	19.245	-3.792	18.516	20.392	20.099
9/22/96 6:53	1270	18.299	19.245	-3.808	18.516	20.408	20.093
9/22/96 7:03	1280	18.299	19.245	-3.871	18.522	20.424	20.099
9/22/96 7:13	1290	18.315	19.250	-3.855	18.528	20.408	20.106
9/22/96 7:23	1300	18.299	19.254	-3.808	18.528	20.392	20.106
9/22/96 7:33	1310	18.299	19.254	-3.823	18.534	20.408	20.106
9/22/96 7:43	1320	18.236	19.212	-3.887	18.472	20.361	20.049
9/22/96 7:53	1330	18.204	19.183	-3.887	18.446	20.313	20.023
9/22/96 8:03	1340	18.188	19.169	-3.871	18.434	20.298	20.011
9/22/96 8:13	1350	18.188	19.159	-3.918	18.434	20.298	20.004

Date and Time	Minutes	Well ID 62G	65G	66G	67G	INT2	INT3
9/22/96 8:23	1360	18.172	19.154	-3.760	18.415	20.313	19.998
9/22/96 8:33	1370	18.188	19.154	-3.792	18.421	20.266	19.998
9/22/96 8:43	1380	18.188	19.154	-3.744	18.421	20.266	19.998
9/22/96 8:53	1390	18.188	19.150	-3.570	18.415	20.266	19.992
9/22/96 9:03	1400	18.172	19.140	-3.713	18.409	20.266	19.986
9/22/96 9:13	1410	18.172	19.140	-3.697	18.409	20.282	19.986
9/22/96 9:23	1420	18.172	19.135	-3.650	18.409	20.282	19.979
9/22/96 9:33	1430	18.172	19.135	-3.697	18.402	20.282	19.979
9/22/96 9:43	1440	18.172	19.135	-3.729	18.402	20.282	19.979
9/22/96 9:53	1450	18.156	19.126	-3.507	18.402	20.282	19.973
9/22/96 10:03	1460	18.172	19.135	-3.602	18.415	20.298	19.986
9/22/96 10:13	1470	18.172	19.140	-3.634	18.409	20.282	19.992
9/22/96 10:23	1480	18.172	19.135	-3.697	18.415	20.313	19.992
9/22/96 10:33	1490	18.172	19.140	-3.681	18.415	20.313	19.992
9/22/96 10:43	1500	18.188	19.145	-3.729	18.415	20.282	19.992
9/22/96 10:53	1510	18.172	19.135	-3.729	18.402	20.282	19.986
9/22/96 11:03	1520	18.156	19.121	-3.681	18.402	20.266	19.973
9/22/96 11:13	1530	18.140	19.112	-3.634	18.383	20.251	19.960
9/22/96 11:23	1540	18.156	19.121	-3.602	18.396	20.282	19.973
9/22/96 11:33	1550	18.156	19.121	-3.460	18.396	20.313	19.979
9/22/96 11:43	1560	18.156	19.131	-3.523	18.396	20.282	19.979
9/22/96 11:53	1570	18.156	19.121	-3.476	18.396	20.298	19.973
9/22/96 12:03	1580	18.140	19.112	-3.460	18.383	20.282	19.960
9/22/96 12:13	1590	18.156	19.121	-3.365	18.390	20.251	19.967
9/22/96 12:23	1600	18.156	19.116	-3.381	18.390	20.282	19.967
9/22/96 12:33	1610	18.140	19.112	-3.349	18.377	20.251	19.960
9/22/96 12:43	1620	18.140	19.112	-3.381	18.383	20.298	19.960
9/22/96 12:53	1630	18.156	19.112	-3.333	18.390	20.266	19.967
9/22/96 13:03	1640	18.156	19.116	-3.318	18.377	20.266	19.967
9/22/96 13:13	1650	18.156	19.112	-3.223	18.383	20.266	19.967
9/22/96 13:23	1660	18.140	19.112	-3.286	18.390	20.298	19.967
9/22/96 13:33	1670	18.156	19.116	-3.333	18.390	20.282	19.979
9/22/96 13:43	1680	18.156	19.116	-3.191	18.383	20.282	19.967
9/22/96 13:53	1690	18.140	19.107	-3.191	18.365	20.282	19.960
9/22/96 14:03	1700	18.140	19.097	-3.254	18.371	20.266	19.954
9/22/96 14:13	1710	18.125	19.092	-3.302	18.358	20.219	19.948
9/22/96 14:23	1720	18.125	19.092	-3.239	18.358	20.219	19.954
9/22/96 14:33	1730	18.140	19.112	-3.239	18.390	20.313	19.967
9/22/96 14:43	1740	18.140	19.112	-3.033	18.377	20.266	19.967
9/22/96 14:53	1750	18.156	19.121	-3.017	18.396	20.313	19.979
9/22/96 15:03	1760	18.156	19.121	-3.049	18.390	20.329	19.979
9/22/96 15:13	1770	18.156	19.112	-3.049	18.383	20.313	19.967
9/22/96 15:23	1780	18.172	19.126	-3.080	18.396	20.282	19.986
9/22/96 15:33	1790	18.172	19.121	-3.144	18.396	20.313	19.979
9/22/96 15:43	1800	18.172	19.135	-3.160	18.396	20.313	19.992
9/22/96 15:53	1810	18.172	19.135	-3.112	18.409	20.313	19.998
9/22/96 16:03	1820	18.172	19.140	-3.160	18.409	20.298	20.004

Date and Time	Minutes	62G	65G	66G	67G	INT2	INT3
		Well ID					
9/22/96 16:13	1830	18.204	19.154	-3.160	18.427	20.329	20.017
9/22/96 16:23	1840	18.204	19.145	-3.160	18.409	20.282	20.004
9/22/96 16:33	1850	18.172	19.126	-4.424	18.402	20.251	19.986
9/22/96 16:43	1860	18.188	19.131	-3.902	18.409	20.282	19.998
9/22/96 16:53	1870	18.188	19.140	-3.997	18.421	20.298	19.998
9/22/96 17:03	1880	18.188	19.140	-4.013	18.421	20.329	20.011
9/22/96 17:13	1890	18.204	19.150	-4.013	18.434	20.313	20.017
9/22/96 17:23	1900	18.204	19.159	-4.045	18.446	20.345	20.023
9/22/96 17:33	1910	18.220	19.164	-3.997	18.440	20.345	20.030
9/22/96 17:43	1920	18.204	19.159	-3.966	18.440	20.329	20.030
9/22/96 17:53	1930	18.220	19.164	-3.950	18.453	20.345	20.036
9/22/96 18:03	1940	18.220	19.164	-3.950	18.459	20.298	20.030
9/22/96 18:13	1950	18.220	19.169	-4.329	18.459	20.345	20.036
9/22/96 18:23	1960	18.220	19.169	-4.108	18.459	20.329	20.036
9/22/96 18:33	1970	18.220	19.173	-4.155	18.472	20.329	20.042
9/22/96 18:43	1980	18.236	19.183	-4.155	18.478	20.361	20.049
9/22/96 18:53	1990	18.236	19.188	-4.076	18.484	20.345	20.055
9/22/96 19:03	2000	18.236	19.188	-4.171	18.478	20.329	20.055
9/22/96 19:13	2010	18.236	19.193	-4.171	18.484	20.329	20.061
9/22/96 19:23	2020	18.252	19.197	-4.076	18.484	20.361	20.068
9/22/96 19:33	2030	18.252	19.197	-4.092	18.484	20.392	20.068
9/22/96 19:43	2040	18.267	19.202	-4.108	18.503	20.392	20.074
9/22/96 19:53	2050	18.267	19.216	-3.823	18.509	20.361	20.087
9/22/96 20:03	2060	18.267	19.221	-3.871	18.516	20.408	20.087
9/22/96 20:13	2070	18.267	19.226	-3.918	18.522	20.376	20.099
9/22/96 20:23	2080	18.283	19.235	-3.902	18.528	20.408	20.106
9/22/96 20:33	2090	18.283	19.240	-3.902	18.534	20.376	20.112
9/22/96 20:43	2100	18.267	19.231	-4.756	18.534	20.408	20.099
9/22/96 20:53	2110	18.267	19.221	-4.804	18.528	20.424	20.093
9/22/96 21:03	2120	18.267	19.221	-4.709	18.522	20.376	20.093
9/22/96 21:13	2130	18.267	19.216	-4.645	18.516	20.408	20.093
9/22/96 21:23	2140	18.267	19.221	-4.329	18.522	20.392	20.093
9/22/96 21:33	2150	18.252	19.216	-4.140	18.516	20.376	20.093
9/22/96 21:43	2160	18.267	19.221	-4.029	18.522	20.392	20.093
9/22/96 21:53	2170	18.267	19.221	-4.140	18.522	20.408	20.093
9/22/96 22:03	2180	18.267	19.226	-4.155	18.528	20.392	20.099
9/22/96 22:13	2190	18.267	19.226	-4.171	18.522	20.408	20.099
9/22/96 22:23	2200	18.267	19.231	-4.155	18.528	20.392	20.106
9/22/96 22:33	2210	18.315	19.240	-4.187	18.534	20.455	20.118
9/22/96 22:43	2220	18.299	19.250	-4.092	18.541	20.408	20.118
9/22/96 22:53	2230	18.299	19.250	-4.061	18.547	20.439	20.125
9/22/96 23:03	2240	18.299	19.250	-4.124	18.541	20.392	20.125
9/22/96 23:13	2250	18.299	19.254	-4.140	18.553	20.439	20.131
9/22/96 23:23	2260	18.299	19.250	-4.155	18.547	20.408	20.131
9/22/96 23:33	2270	18.299	19.259	-3.902	18.560	20.424	20.137
9/22/96 23:43	2280	18.283	19.235	-5.262	18.528	20.424	20.112
9/22/96 23:53	2290	18.267	19.226	-5.009	18.528	20.376	20.106

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9/23/96 0:03	2300	18.252	19.216	-5.183	18.528	20.424	20.093
9/23/96 0:13	2310	18.252	19.212	-5.199	18.516	20.361	20.093
9/23/96 0:23	2320	18.252	19.212	-4.946	18.522	20.392	20.093
9/23/96 0:33	2330	18.267	19.212	-4.962	18.522	20.408	20.093
9/23/96 0:43	2340	18.252	19.212	-5.025	18.516	20.392	20.093
9/23/96 0:53	2350	18.252	19.216	-5.136	18.522	20.361	20.099
9/23/96 1:03	2360	18.267	19.221	-4.914	18.522	20.376	20.106
9/23/96 1:13	2370	18.252	19.216	-4.898	18.522	20.376	20.099
9/23/96 1:23	2380	18.267	19.221	-4.930	18.522	20.392	20.099
9/23/96 1:33	2390	18.267	19.221	-4.946	18.528	20.376	20.106
9/23/96 1:43	2400	18.267	19.221	-4.867	18.534	20.392	20.099
9/23/96 1:53	2410	18.267	19.226	-4.851	18.541	20.392	20.112
9/23/96 2:03	2420	18.267	19.231	-4.835	18.541	20.408	20.112
9/23/96 2:13	2430	18.283	19.235	-4.883	18.553	20.408	20.112
9/23/96 2:23	2440	18.283	19.240	-4.851	18.560	20.424	20.118
9/23/96 2:33	2450	18.299	19.245	33.762	18.572	20.424	20.125
9/23/96 2:43	2460	18.283	19.245	33.762	18.572	20.439	20.125
9/23/96 2:53	2470	18.299	19.250	33.762	18.566	20.439	20.131
9/23/96 3:03	2480	18.283	19.254	33.762	18.579	20.439	20.131
9/23/96 3:13	2490	18.315	19.259	33.762	18.585	20.424	20.144
9/23/96 3:23	2500	18.315	19.269	33.762	18.591	20.424	20.150
9/23/96 3:33	2510	18.315	19.269	33.762	18.604	20.424	20.150
9/23/96 3:43	2520	18.315	19.273	33.762	18.597	20.471	20.156
9/23/96 3:53	2530	18.331	19.283	33.762	18.604	20.439	20.163
9/23/96 4:03	2540	18.331	19.293	33.762	18.616	20.455	20.169
9/23/96 4:13	2550	18.315	19.278	33.762	18.610	20.455	20.163
9/23/96 4:23	2560	18.283	19.254	33.762	18.591	20.439	20.137
9/23/96 4:33	2570	18.267	19.245	33.762	18.579	20.424	20.125
9/23/96 4:43	2580	18.267	19.235	33.762	18.572	20.392	20.125
9/23/96 4:53	2590	18.267	19.240	33.762	18.585	20.345	20.131
9/23/96 5:03	2600	18.315	19.278	33.762	18.610	20.455	20.163
9/23/96 5:13	2610	18.331	19.293	33.762	18.629	20.487	20.175
9/23/96 5:23	2620	18.347	19.297	33.762	18.629	20.471	20.181
9/23/96 5:33	2630	18.347	19.307	33.762	18.635	20.502	20.188
9/23/96 5:43	2640	18.347	19.312	33.762	18.635	20.502	20.194
9/23/96 5:53	2650	18.347	19.316	33.762	18.641	20.502	20.194
9/23/96 6:03	2660	18.363	19.321	33.762	18.660	20.487	20.200
9/23/96 6:13	2670	18.363	19.326	33.762	18.654	20.471	20.207
9/23/96 6:23	2680	18.378	19.331	33.762	18.660	20.487	20.207
9/23/96 6:33	2690	18.378	19.335	33.762	18.667	20.502	20.213
9/23/96 6:43	2700	18.378	19.340	33.762	18.667	20.518	20.213
9/23/96 6:53	2710	18.378	19.340	33.762	18.673	20.534	20.219
9/23/96 7:03	2720	18.394	19.340	33.762	18.667	20.487	20.219
9/23/96 7:13	2730	18.378	19.350	33.762	18.673	20.487	20.226
9/23/96 7:23	2740	18.394	19.354	33.762	18.679	20.518	20.232
9/23/96 7:33	2750	18.410	19.359	33.762	18.685	20.550	20.238
9/23/96 7:43	2760	18.394	19.354	33.762	18.679	20.487	20.238

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9/23/96 7:53	2770	18.410	19.359	33.762	18.685	20.518	20.238
9/23/96 8:03	2780	18.426	19.364	33.762	18.685	20.565	20.245
9/23/96 8:13	2790	18.410	19.364	33.762	18.692	20.518	20.245
9/23/96 8:23	2800	18.410	19.369	33.762	18.692	20.534	20.245
9/23/96 8:33	2810	18.426	19.369	33.762	18.692	20.565	20.251
9/23/96 8:43	2820	18.426	19.374	33.762	18.698	20.534	20.257
9/23/96 8:53	2830	18.426	19.383	33.762	18.704	20.565	20.257
9/23/96 9:03	2840	18.426	19.378	33.762	18.692	20.581	20.257
9/23/96 9:13	2850	18.410	19.364	33.762	18.692	20.518	20.251
9/23/96 9:23	2860	18.394	19.354	33.762	18.679	20.518	20.238
9/23/96 9:33	2870	18.394	19.354	33.762	18.679	20.550	20.232
9/23/96 9:43	2880	18.394	19.350	33.762	18.673	20.534	20.232
9/23/96 9:53	2890	18.410	19.350	33.762	18.673	20.518	20.232
9/23/96 10:03	2900	18.394	19.340	33.762	18.667	20.455	20.226
9/23/96 10:13	2910	18.394	19.335	-4.313	18.648	20.487	20.226
9/23/96 10:23	2920	18.394	19.345	-4.298	18.654	20.534	20.226
9/23/96 10:33	2930	18.394	19.340	-4.187	18.654	20.550	20.226
9/23/96 10:43	2940	18.394	19.340	-4.108	18.641	20.518	20.219
9/23/96 10:53	2950	18.378	19.331	-4.140	18.641	20.487	20.213
9/23/96 11:03	2960	18.394	19.335	-4.076	18.648	20.518	20.219
9/23/96 11:13	2970	18.394	19.350	-3.981	18.660	20.550	20.232
9/23/96 11:23	2980	18.410	19.350	-3.966	18.654	20.518	20.238
9/23/96 11:33	2990	18.410	19.354	-3.966	18.660	20.550	20.232
9/23/96 11:43	3000	18.458	19.388	-2.480	18.685	20.550	20.270
9/23/96 11:53	3010	18.458	19.397	-2.480	18.698	20.612	20.283
9/23/96 12:03	3020	18.474	19.402	-2.496	18.698	20.597	20.283
9/23/96 12:13	3030	18.474	19.407	-2.559	18.704	20.534	20.283
9/23/96 12:23	3040	18.378	19.326	-6.053	18.635	20.534	20.213
9/23/96 12:33	3050	18.410	19.354	-4.013	18.654	20.502	20.238
9/23/96 12:43	3060	18.426	19.359	-3.981	18.654	20.518	20.238
9/23/96 12:53	3070	18.410	19.354	-3.918	18.654	20.518	20.238
9/23/96 13:03	3080	18.410	19.345	-3.966	18.648	20.518	20.232
9/23/96 13:13	3090	18.410	19.354	-3.397	18.654	20.534	20.238
9/23/96 13:23	3100	18.569	19.488	1.658	18.748	20.675	20.365
9/23/96 13:33	3110	18.616	19.540	-6.480	18.811	20.738	20.422
9/23/96 13:43	3120	18.537	19.474	-5.689	18.748	20.628	20.346
9/23/96 13:53	3130	18.521	19.459	-5.547	18.742	20.644	20.333
9/23/96 14:03	3140	18.505	19.445	-4.977	18.736	20.644	20.321
9/23/96 14:13	3150	18.490	19.431	-5.563	18.717	20.628	20.314
9/23/96 14:23	3160	18.505	19.435	-5.120	18.711	20.612	20.308
9/23/96 14:33	3170	18.490	19.440	-4.519	18.723	20.550	20.314
9/23/96 14:43	3180	18.521	19.450	-4.487	18.723	20.597	20.321
9/23/96 14:53	3190	18.521	19.459	-4.329	18.730	20.628	20.333
9/23/96 15:03	3200	18.490	19.440	-5.389	18.717	20.597	20.314
9/23/96 15:13	3210	18.490	19.435	-5.199	18.704	20.597	20.308
9/23/96 15:23	3220	18.490	19.431	-5.151	18.711	20.597	20.302
9/23/96 15:33	3230	18.490	19.426	-5.104	18.704	20.597	20.302

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9/23/96 15:43	3240	18.474	19.426	-4.851	18.711	20.628	20.302
9/23/96 15:53	3250	18.490	19.435	-4.804	18.711	20.597	20.308
9/23/96 16:03	3260	18.490	19.435	-4.661	18.711	20.628	20.308
9/23/96 16:13	3270	18.490	19.435	-4.614	18.711	20.628	20.314
9/23/96 16:23	3280	18.505	19.445	-4.582	18.717	20.597	20.314
9/23/96 16:33	3290	18.505	19.445	-4.456	18.723	20.644	20.314
9/23/96 16:43	3300	18.490	19.440	-4.472	18.723	20.612	20.314
9/23/96 16:53	3310	18.505	19.440	-4.456	18.717	20.612	20.314
9/23/96 17:03	3320	18.521	19.455	-4.440	18.723	20.644	20.327
9/23/96 17:13	3330	18.505	19.450	-4.282	18.723	20.628	20.321
9/23/96 17:23	3340	18.521	19.455	-4.250	18.723	20.612	20.327
9/23/96 17:33	3350	18.521	19.459	-3.966	18.730	20.644	20.333
9/23/96 17:43	3360	18.537	19.459	-3.871	18.723	20.628	20.333
9/23/96 17:53	3370	18.537	19.469	-3.792	18.736	20.628	20.340
9/23/96 18:03	3380	18.537	19.478	-3.491	18.742	20.660	20.346
9/23/96 18:13	3390	18.553	19.488	-3.128	18.755	20.675	20.358
9/23/96 18:23	3400	18.585	19.512	-2.685	18.767	20.660	20.377
9/23/96 18:33	3410	18.601	19.535	-2.053	18.792	20.707	20.403
9/23/96 18:43	3420	18.616	19.550	-2.148	18.805	20.723	20.415
9/23/96 18:53	3430	18.632	19.569	-1.737	18.818	20.691	20.434
9/23/96 19:03	3440	18.664	19.583	-1.548	18.836	20.738	20.447
9/23/96 19:13	3450	18.664	19.597	-1.058	18.849	20.770	20.460
9/23/96 19:23	3460	18.680	19.612	-0.852	18.862	20.754	20.472
9/23/96 19:33	3470	18.696	19.626	33.762	18.880	20.770	20.485
9/23/96 19:43	3480	18.712	19.636	33.762	18.893	20.801	20.491
9/23/96 19:53	3490	18.712	19.640	33.762	18.899	20.817	20.498
9/23/96 20:03	3500	18.727	19.650	33.762	18.906	20.786	20.504
9/23/96 20:13	3510	18.743	19.659	33.762	18.918	20.801	20.510
9/23/96 20:23	3520	18.743	19.664	33.762	18.925	20.770	20.516
9/23/96 20:33	3530	18.743	19.669	33.762	18.925	20.801	20.523
9/23/96 20:43	3540	18.743	19.669	33.762	18.925	20.833	20.516
9/23/96 20:53	3550	18.601	19.564	33.762	18.849	20.707	20.422
9/23/96 21:03	3560	18.553	19.526	33.762	18.811	20.691	20.384
9/23/96 21:13	3570	18.553	19.507	33.762	18.792	20.628	20.371
9/23/96 21:23	3580	18.553	19.497	33.762	18.786	20.644	20.358
9/23/96 21:33	3590	18.537	19.493	33.762	18.786	20.660	20.358
9/23/96 21:43	3600	18.537	19.488	33.762	18.767	20.612	20.346
9/23/96 21:53	3610	18.537	19.483	33.762	18.767	20.644	20.346
9/23/96 22:03	3620	18.537	19.483	33.762	18.761	20.612	20.346
9/23/96 22:13	3630	18.537	19.483	33.762	18.767	20.644	20.346
9/23/96 22:23	3640	18.521	19.478	33.762	18.761	20.628	20.340
9/23/96 22:33	3650	18.537	19.488	33.762	18.761	20.628	20.346
9/23/96 22:43	3660	18.537	19.483	33.762	18.767	20.644	20.346
9/23/96 22:53	3670	18.553	19.493	33.762	18.767	20.612	20.352
9/23/96 23:03	3680	18.505	19.455	33.762	18.736	20.612	20.314
9/23/96 23:13	3690	18.490	19.435	33.762	18.717	20.597	20.302
9/23/96 23:23	3700	18.474	19.431	33.762	18.717	20.565	20.289

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9/23/96 23:33	3710	18.474	19.426	33.762	18.711	20.581	20.289
9/23/96 23:43	3720	18.458	19.421	33.762	18.698	20.534	20.283
9/23/96 23:53	3730	18.474	19.426	33.762	18.704	20.565	20.289
9/24/96 0:03	3740	18.474	19.426	33.762	18.711	20.581	20.289
9/24/96 0:13	3750	18.490	19.445	33.762	18.717	20.597	20.302
9/24/96 0:23	3760	18.505	19.455	33.762	18.736	20.581	20.314
9/24/96 0:33	3770	18.490	19.440	33.762	18.723	20.612	20.302
9/24/96 0:43	3780	18.474	19.426	33.762	18.711	20.550	20.289
9/24/96 0:53	3790	18.458	19.416	33.762	18.704	20.581	20.276
9/24/96 1:03	3800	18.474	19.426	33.762	18.704	20.534	20.283
9/24/96 1:13	3810	18.474	19.416	33.762	18.698	20.565	20.276
9/24/96 1:23	3820	18.458	19.416	33.762	18.692	20.534	20.276
9/24/96 1:33	3830	18.474	19.416	33.762	18.692	20.565	20.276
9/24/96 1:43	3840	18.458	19.416	33.762	18.692	20.518	20.276
9/24/96 1:53	3850	18.474	19.421	33.762	18.698	20.565	20.276
9/24/96 2:03	3860	18.474	19.416	33.762	18.692	20.534	20.276
9/24/96 2:13	3870	18.474	19.426	33.762	18.698	20.550	20.283
9/24/96 2:23	3880	18.474	19.426	33.762	18.704	20.534	20.283
9/24/96 2:33	3890	18.490	19.431	33.762	18.704	20.550	20.289
9/24/96 2:43	3900	18.474	19.431	33.762	18.704	20.581	20.289
9/24/96 2:53	3910	18.442	19.402	33.762	18.685	20.518	20.257
9/24/96 3:03	3920	18.442	19.393	33.762	18.679	20.550	20.251
9/24/96 3:13	3930	18.442	19.393	33.762	18.667	20.502	20.251
9/24/96 3:23	3940	18.442	19.393	33.762	18.673	20.534	20.251
9/24/96 3:33	3950	18.442	19.393	33.762	18.673	20.550	20.251
9/24/96 3:43	3960	18.442	19.393	33.762	18.673	20.502	20.251
9/24/96 3:53	3970	18.458	19.397	33.762	18.673	20.534	20.251
9/24/96 4:03	3980	18.426	19.393	33.762	18.679	20.518	20.251
9/24/96 4:13	3990	18.442	19.402	33.762	18.679	20.518	20.257
9/24/96 4:23	4000	18.442	19.407	33.762	18.685	20.550	20.264
9/24/96 4:33	4010	18.474	19.416	33.762	18.685	20.518	20.270
9/24/96 4:43	4020	18.474	19.421	33.762	18.698	20.565	20.276
9/24/96 4:53	4030	18.474	19.426	33.762	18.692	20.534	20.283
9/24/96 5:03	4040	18.490	19.435	33.762	18.711	20.581	20.289
9/24/96 5:13	4050	18.490	19.440	33.762	18.711	20.550	20.295
9/24/96 5:23	4060	18.490	19.440	33.762	18.711	20.581	20.295
9/24/96 5:33	4070	18.490	19.445	33.762	18.711	20.534	20.295
9/24/96 5:43	4080	18.505	19.455	33.762	18.723	20.581	20.302
9/24/96 5:53	4090	18.505	19.455	33.762	18.717	20.565	20.308
9/24/96 6:03	4100	18.505	19.464	33.762	18.730	20.581	20.314
9/24/96 6:13	4110	18.521	19.464	33.762	18.730	20.565	20.314
9/24/96 6:23	4120	18.521	19.469	33.762	18.736	20.581	20.321
9/24/96 6:33	4130	18.521	19.469	33.762	18.730	20.612	20.321
9/24/96 6:43	4140	18.442	19.407	33.762	18.685	20.534	20.257
9/24/96 6:53	4150	18.426	19.388	33.762	18.660	20.487	20.238
9/24/96 7:03	4160	18.410	19.378	33.762	18.660	20.518	20.232
9/24/96 7:13	4170	18.426	19.378	33.762	18.667	20.502	20.232

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				Well ID			
9/24/96 7:23	4180	18.426	19.378	33.762	18.660	20.471	20.232
9/24/96 7:33	4190	18.426	19.383	33.762	18.660	20.487	20.238
9/24/96 7:43	4200	18.442	19.388	33.762	18.673	20.518	20.238
9/24/96 7:53	4210	18.442	19.393	33.762	18.673	20.502	20.245
9/24/96 8:03	4220	18.426	19.393	33.762	18.673	20.487	20.251
9/24/96 8:13	4230	18.442	19.397	33.762	18.679	20.518	20.251
9/24/96 8:23	4240	18.458	19.407	33.762	18.692	20.534	20.264
9/24/96 8:33	4250	18.458	19.412	-5.199	18.673	20.518	20.264
9/24/96 8:43	4260	18.458	19.412	-5.199	18.667	20.502	20.264
9/24/96 8:53	4270	18.458	19.412	-4.677	18.673	20.518	20.264
9/24/96 9:03	4280	18.474	19.426	-4.345	18.685	20.550	20.276
9/24/96 9:13	4290	18.474	19.426	-4.329	18.679	20.518	20.276
9/24/96 9:23	4300	18.474	19.435	-4.234	18.685	20.550	20.283
9/24/96 9:33	4310	18.490	19.440	-4.140	18.698	20.534	20.295
9/24/96 9:43	4320	18.490	19.445	-4.124	18.698	20.550	20.295
9/24/96 9:53	4330	18.505	19.450	-3.650	18.704	20.565	20.295
9/24/96 10:03	4340	18.505	19.459	-3.697	18.711	20.581	20.308
9/24/96 10:13	4350	18.521	19.474	-2.796	18.723	20.612	20.321
9/24/96 10:23	4360	18.537	19.488	-2.733	18.736	20.581	20.340
9/24/96 10:33	4370	18.553	19.507	-2.622	18.748	20.628	20.352
9/24/96 10:43	4380	18.585	19.512	-2.638	18.748	20.660	20.358
9/24/96 10:53	4390	18.569	19.512	-2.575	18.755	20.628	20.358
9/24/96 11:03	4400	18.585	19.531	-2.274	18.767	20.660	20.371
9/24/96 11:13	4410	18.585	19.535	-2.227	18.774	20.644	20.377
9/24/96 11:23	4420	18.601	19.545	-2.243	18.780	20.660	20.390
9/24/96 11:33	4430	18.601	19.545	-2.227	18.786	20.612	20.390
9/24/96 11:43	4440	18.616	19.555	-2.243	18.792	20.644	20.403
9/24/96 11:53	4450	18.616	19.564	-2.037	18.799	20.675	20.403
9/24/96 12:03	4460	18.537	19.512	-8.156	18.767	20.644	20.365
9/24/96 12:13	4470	18.490	19.459	-5.689	18.711	20.565	20.308
9/24/96 12:23	4480	18.490	19.450	-5.341	18.698	20.550	20.295
9/24/96 12:33	4490	18.474	19.440	-5.151	18.692	20.581	20.289
9/24/96 12:43	4500	18.521	19.474	-3.776	18.717	20.581	20.321
9/24/96 12:53	4510	18.521	19.474	-4.108	18.711	20.612	20.321
9/24/96 13:03	4520	18.537	19.478	-4.345	18.730	20.597	20.327
9/24/96 13:13	4530	18.521	19.483	-4.645	18.723	20.565	20.327
9/24/96 13:23	4540	18.537	19.478	-4.867	18.730	20.612	20.327
9/24/96 13:33	4550	18.521	19.474	-4.946	18.717	20.581	20.314
9/24/96 13:43	4560	18.521	19.469	-4.772	18.704	20.597	20.314
9/24/96 13:53	4570	18.537	19.478	-4.740	18.723	20.612	20.327
9/24/96 14:03	4580	18.569	19.516	-3.254	18.748	20.612	20.352
9/24/96 14:13	4590	18.505	19.474	-6.132	18.717	20.597	20.321
9/24/96 14:23	4600	18.521	19.469	-5.958	18.717	20.581	20.314
9/24/96 14:33	4610	18.505	19.464	-5.768	18.711	20.550	20.314
9/24/96 14:43	4620	18.521	19.464	-5.752	18.711	20.597	20.308
9/24/96 14:53	4630	18.505	19.459	-5.736	18.711	20.565	20.308
9/24/96 15:03	4640	18.505	19.455	-5.736	18.698	20.565	20.302

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9/24/96 15:13	4650	18.505	19.459	-5.768	18.704	20.597	20.308
9/24/96 15:23	4660	18.505	19.464	-5.642	18.711	20.565	20.308
9/24/96 15:33	4670	18.505	19.464	-5.657	18.704	20.581	20.308
9/24/96 15:43	4680	18.521	19.474	-5.610	18.723	20.597	20.321
9/24/96 15:53	4690	18.521	19.474	-5.610	18.717	20.565	20.321
9/24/96 16:03	4700	18.537	19.474	-5.594	18.723	20.565	20.321
9/24/96 16:13	4710	18.521	19.478	-5.673	18.730	20.597	20.327
9/24/96 16:23	4720	18.505	19.464	-6.369	18.711	20.597	20.314
9/24/96 16:33	4730	18.521	19.474	-6.322	18.723	20.581	20.321
9/24/96 16:43	4740	18.521	19.478	-6.353	18.730	20.612	20.327
9/24/96 16:53	4750	18.521	19.478	-6.353	18.717	20.565	20.327
9/24/96 17:03	4760	18.537	19.478	-6.337	18.723	20.612	20.327
9/24/96 17:13	4770	18.537	19.483	-6.337	18.730	20.612	20.333
9/24/96 17:23	4780	18.537	19.488	-6.401	18.730	20.628	20.340
9/24/96 17:33	4790	18.537	19.488	-6.369	18.736	20.581	20.340
9/24/96 17:43	4800	18.553	19.497	-6.353	18.748	20.612	20.346
9/24/96 17:53	4810	18.537	19.497	-6.353	18.748	20.628	20.346
9/24/96 18:03	4820	18.553	19.497	-6.353	18.742	20.628	20.352
9/24/96 18:13	4830	18.553	19.502	-6.211	18.748	20.644	20.352
9/24/96 18:23	4840	18.537	19.497	-6.701	18.742	20.581	20.352
9/24/96 18:33	4850	18.553	19.497	-6.685	18.742	20.612	20.346
9/24/96 18:43	4860	18.553	19.507	-6.749	18.755	20.628	20.358
9/24/96 18:53	4870	18.553	19.507	-6.669	18.761	20.644	20.358
9/24/96 19:03	4880	18.553	19.512	-6.685	18.761	20.644	20.365
9/24/96 19:13	4890	18.553	19.516	-6.606	18.761	20.628	20.371
9/24/96 19:23	4900	18.553	19.516	-6.685	18.767	20.612	20.371
9/24/96 19:33	4910	18.569	19.521	-6.590	18.761	20.628	20.377
9/24/96 19:43	4920	18.569	19.516	33.762	18.786	20.628	20.371
9/24/96 19:53	4930	18.569	19.521	33.762	18.792	20.644	20.377
9/24/96 20:03	4940	18.569	19.526	33.762	18.780	20.644	20.377
9/24/96 20:13	4950	18.616	19.555	33.762	18.830	20.691	20.409
9/24/96 20:23	4960	18.616	19.564	33.762	18.843	20.691	20.422
9/24/96 20:33	4970	18.632	19.574	33.762	18.849	20.675	20.434
9/24/96 20:43	4980	18.632	19.578	33.762	18.849	20.675	20.434
9/24/96 20:53	4990	18.632	19.578	33.762	18.855	20.675	20.434
9/24/96 21:03	5000	18.632	19.578	-7.587	18.836	20.675	20.441
9/24/96 21:13	5010	18.632	19.583	-7.634	18.843	20.707	20.441
9/24/96 21:23	5020	18.632	19.588	-7.539	18.849	20.691	20.447
9/24/96 21:33	5030	18.648	19.593	-7.539	18.862	20.754	20.453
9/24/96 21:43	5040	18.632	19.597	-7.571	18.868	20.754	20.453
9/24/96 21:53	5050	18.664	19.602	-7.571	18.874	20.738	20.460
9/24/96 22:03	5060	18.664	19.607	-7.508	18.874	20.723	20.466
9/24/96 22:13	5070	18.664	19.612	33.762	18.887	20.723	20.466
9/24/96 22:23	5080	18.664	19.612	33.762	18.887	20.723	20.472
9/24/96 22:33	5090	18.664	19.612	33.762	18.899	20.770	20.472
9/24/96 22:43	5100	18.680	19.616	33.762	18.899	20.754	20.479
9/24/96 22:53	5110	18.664	19.612	33.762	18.893	20.723	20.472

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9/24/96 23:03	5120	18.664	19.616	33.762	18.899	20.770	20.472
9/24/96 23:13	5130	18.664	19.612	33.762	18.893	20.738	20.472
9/24/96 23:23	5140	18.664	19.612	33.762	18.893	20.770	20.479
9/24/96 23:33	5150	18.680	19.621	33.762	18.899	20.754	20.479
9/24/96 23:43	5160	18.664	19.616	33.762	18.899	20.754	20.479
9/24/96 23:53	5170	18.680	19.621	33.762	18.899	20.738	20.479
9/25/96 0:03	5180	18.680	19.626	33.762	18.906	20.786	20.485
9/25/96 0:13	5190	18.680	19.626	33.762	18.912	20.738	20.491
9/25/96 0:23	5200	18.680	19.626	33.762	18.912	20.754	20.485
9/25/96 0:33	5210	18.680	19.626	33.762	18.912	20.754	20.491
9/25/96 0:43	5220	18.680	19.631	33.762	18.912	20.723	20.491
9/25/96 0:53	5230	18.680	19.636	33.762	18.918	20.770	20.491
9/25/96 1:03	5240	18.553	19.535	33.762	18.849	20.691	20.403
9/25/96 1:13	5250	18.537	19.512	33.762	18.824	20.660	20.384
9/25/96 1:23	5260	18.521	19.497	33.762	18.811	20.612	20.371
9/25/96 1:33	5270	18.521	19.488	33.762	18.799	20.597	20.358
9/25/96 1:43	5280	18.521	19.483	33.762	18.799	20.612	20.352
9/25/96 1:53	5290	18.521	19.478	33.762	18.792	20.612	20.346
9/25/96 2:03	5300	18.505	19.474	33.762	18.792	20.612	20.346
9/25/96 2:13	5310	18.521	19.474	33.762	18.792	20.612	20.346
9/25/96 2:23	5320	18.505	19.469	33.762	18.792	20.612	20.346
9/25/96 2:33	5330	18.505	19.469	33.762	18.792	20.612	20.346
9/25/96 2:43	5340	18.537	19.493	33.762	18.811	20.644	20.365
9/25/96 2:53	5350	18.521	19.488	33.762	18.805	20.644	20.365
9/25/96 3:03	5360	18.537	19.497	33.762	18.811	20.597	20.365
9/25/96 3:13	5370	18.537	19.497	33.762	18.811	20.628	20.371
9/25/96 3:23	5380	18.537	19.497	33.762	18.811	20.597	20.371
9/25/96 3:33	5390	18.537	19.502	33.762	18.818	20.612	20.371
9/25/96 3:43	5400	18.537	19.502	33.762	18.818	20.612	20.377
9/25/96 3:53	5410	18.553	19.502	33.762	18.818	20.612	20.377
9/25/96 4:03	5420	18.553	19.512	33.762	18.824	20.628	20.377
9/25/96 4:13	5430	18.553	19.516	33.762	18.830	20.628	20.384
9/25/96 4:23	5440	18.553	19.516	33.762	18.836	20.644	20.390
9/25/96 4:33	5450	18.553	19.521	33.762	18.836	20.644	20.390
9/25/96 4:43	5460	18.569	19.526	33.762	18.843	20.644	20.396
9/25/96 4:53	5470	18.553	19.521	33.762	18.843	20.660	20.390
9/25/96 5:03	5480	18.569	19.531	33.762	18.849	20.660	20.396
9/25/96 5:13	5490	18.569	19.531	33.762	18.849	20.660	20.396
9/25/96 5:23	5500	18.569	19.526	33.762	18.843	20.660	20.396
9/25/96 5:33	5510	18.569	19.526	33.762	18.849	20.660	20.396
9/25/96 5:43	5520	18.569	19.526	33.762	18.843	20.675	20.396
9/25/96 5:53	5530	18.553	19.526	33.762	18.849	20.675	20.403
9/25/96 6:03	5540	18.569	19.535	33.762	18.849	20.660	20.403
9/25/96 6:13	5550	18.569	19.531	33.762	18.862	20.628	20.403
9/25/96 6:23	5560	18.569	19.535	33.762	18.862	20.675	20.403
9/25/96 6:33	5570	18.569	19.535	33.762	18.855	20.660	20.409
9/25/96 6:43	5580	18.759	19.555	33.762	18.862	20.612	20.403

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9/25/96 6:53	5590	18.585	19.540	33.762	18.862	20.644	20.409
9/25/96 7:03	5600	18.585	19.540	33.762	18.862	20.675	20.409
9/25/96 7:13	5610	18.981	19.569	33.762	18.862	20.660	20.403
9/25/96 7:23	5620	18.585	19.531	33.762	18.849	20.612	20.403
9/25/96 7:33	5630	18.553	19.531	33.762	18.849	20.628	20.409
9/25/96 7:43	5640	18.585	19.540	33.762	18.862	20.660	20.409
9/25/96 7:53	5650	18.585	19.545	33.762	18.868	20.675	20.409
9/25/96 8:03	5660	18.585	19.550	33.762	18.880	20.644	20.422
9/25/96 8:13	5670	18.585	19.550	33.762	18.874	20.691	20.422
9/25/96 8:23	5680	18.585	19.545	33.762	18.868	20.691	20.422
9/25/96 8:33	5690	18.601	19.545	33.762	18.868	20.660	20.422
9/25/96 8:43	5700	18.585	19.540	33.762	18.862	20.660	20.415
9/25/96 8:53	5710	18.585	19.535	33.762	18.862	20.675	20.409
9/25/96 9:03	5720	18.569	19.531	33.762	18.855	20.675	20.403
9/25/96 9:13	5730	18.585	19.526	33.762	18.855	20.675	20.403
9/25/96 9:23	5740	18.569	19.521	33.762	18.849	20.675	20.403
9/25/96 9:33	5750	18.553	19.516	33.762	18.849	20.675	20.396
9/25/96 9:43	5760	18.569	19.507	33.762	18.830	20.628	20.384
9/25/96 9:53	5770	18.553	19.502	33.762	18.824	20.612	20.377
9/25/96 10:03	5780	18.553	19.502	33.762	18.824	20.628	20.377
9/25/96 10:13	5790	18.569	19.507	33.762	18.830	20.660	20.384
9/25/96 10:23	5800	18.553	19.497	33.762	18.818	20.628	20.377
9/25/96 10:33	5810	18.553	19.493	33.762	18.811	20.612	20.371
9/25/96 10:43	5820	18.521	19.483	33.762	18.811	20.644	20.365
9/25/96 10:53	5830	18.537	19.474	33.762	18.792	20.597	20.352
9/25/96 11:03	5840	18.521	19.469	33.762	18.786	20.644	20.346
9/25/96 11:13	5850	18.505	19.459	33.762	18.780	20.581	20.340
9/25/96 11:23	5860	18.505	19.455	33.762	18.780	20.628	20.333
9/25/96 11:33	5870	18.505	19.450	33.762	18.767	20.581	20.327
9/25/96 11:43	5880	18.490	19.440	33.762	18.767	20.581	20.321
9/25/96 11:53	5890	18.474	19.435	33.762	18.748	20.597	20.314
9/25/96 12:03	5900	18.474	19.426	33.762	18.742	20.565	20.308
9/25/96 12:13	5910	18.474	19.416	33.762	18.730	20.534	20.295
9/25/96 12:23	5920	18.458	19.407	33.762	18.723	20.550	20.283
9/25/96 12:33	5930	18.426	19.393	33.762	18.711	20.487	20.276
9/25/96 12:43	5940	18.442	19.402	33.762	18.717	20.565	20.283
9/25/96 12:53	5950	18.442	19.397	33.762	18.711	20.518	20.276
9/25/96 13:03	5960	18.458	19.397	33.762	18.711	20.550	20.270
9/25/96 13:13	5970	18.442	19.388	33.762	18.698	20.550	20.270
9/25/96 13:23	5980	18.442	19.388	33.762	18.698	20.518	20.264
9/25/96 13:33	5990	18.426	19.383	33.762	18.685	20.518	20.257
9/25/96 13:43	6000	18.426	19.374	33.762	18.679	20.502	20.245
9/25/96 13:53	6010	18.410	19.369	33.762	18.673	20.471	20.245
9/25/96 14:03	6020	18.394	19.350	33.762	18.654	20.502	20.219
9/25/96 14:13	6030	18.363	19.335	33.762	18.635	20.471	20.207
9/25/96 14:23	6040	18.378	19.335	33.762	18.641	20.471	20.207
9/25/96 14:33	6050	18.378	19.335	33.762	18.641	20.471	20.200

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9/25/96 14:43	6060	18.378	19.335	33.762	18.641	20.455	20.207
9/25/96 14:53	6070	18.363	19.321	33.762	18.610	20.455	20.188
9/25/96 15:03	6080	18.378	19.326	33.762	18.635	20.471	20.200
9/25/96 15:13	6090	18.394	19.335	33.762	18.629	20.455	20.200
9/25/96 15:23	6100	18.410	19.354	33.762	18.648	20.471	20.219
9/25/96 15:33	6110	18.410	19.350	33.762	18.654	20.439	20.213
9/25/96 15:43	6120	18.410	19.354	33.762	18.648	20.502	20.226
9/25/96 15:53	6130	18.426	19.369	33.762	18.667	20.471	20.238
9/25/96 16:03	6140	18.442	19.388	33.762	18.685	20.502	20.257
9/25/96 16:13	6150	18.442	19.402	33.762	18.698	20.534	20.270
9/25/96 16:23	6160	18.426	19.383	33.762	18.679	20.502	20.251
9/25/96 16:33	6170	18.442	19.388	33.762	18.685	20.487	20.264
9/25/96 16:43	6180	18.442	19.388	33.762	18.685	20.518	20.264
9/25/96 16:53	6190	18.458	19.397	33.762	18.698	20.534	20.270
9/25/96 17:03	6200	18.458	19.397	33.762	18.704	20.565	20.276
9/25/96 17:13	6210	18.458	19.407	33.762	18.704	20.518	20.283
9/25/96 17:23	6220	18.474	19.412	33.762	18.711	20.534	20.289
9/25/96 17:33	6230	18.474	19.416	33.762	18.711	20.518	20.289
9/25/96 17:43	6240	18.474	19.416	33.762	18.711	20.518	20.289
9/25/96 17:53	6250	18.474	19.421	33.762	18.717	20.534	20.295
9/25/96 18:03	6260	18.474	19.426	33.762	18.736	20.534	20.302
9/25/96 18:13	6270	18.490	19.435	33.762	18.742	20.565	20.308
9/25/96 18:23	6280	18.490	19.435	33.762	18.736	20.534	20.308
9/25/96 18:33	6290	18.474	19.435	33.762	18.748	20.597	20.308
9/25/96 18:43	6300	18.490	19.440	33.762	18.742	20.565	20.308
9/25/96 18:53	6310	18.490	19.445	33.762	18.748	20.550	20.314
9/25/96 19:03	6320	18.505	19.455	33.762	18.767	20.597	20.321
9/25/96 19:13	6330	18.505	19.459	33.762	18.767	20.565	20.327
9/25/96 19:23	6340	18.521	19.469	33.762	18.780	20.612	20.340
9/25/96 19:33	6350	18.521	19.469	33.762	18.780	20.597	20.340
9/25/96 19:43	6360	18.521	19.474	33.762	18.792	20.597	20.346
9/25/96 19:53	6370	18.521	19.478	33.762	18.792	20.612	20.352
9/25/96 20:03	6380	18.521	19.474	33.762	18.786	20.612	20.346
9/25/96 20:13	6390	18.521	19.483	33.762	18.792	20.628	20.352
9/25/96 20:23	6400	18.521	19.478	33.762	18.792	20.612	20.352
9/25/96 20:33	6410	18.521	19.478	33.762	18.792	20.628	20.352
9/25/96 20:43	6420	18.537	19.488	33.762	18.799	20.628	20.352
9/25/96 20:53	6430	18.537	19.483	33.762	18.799	20.612	20.352
9/25/96 21:03	6440	18.537	19.483	33.762	18.799	20.597	20.352
9/25/96 21:13	6450	18.537	19.483	33.762	18.799	20.597	20.352
9/25/96 21:23	6460	18.521	19.483	33.762	18.805	20.565	20.352
9/25/96 21:33	6470	18.521	19.478	33.762	18.799	20.628	20.352
9/25/96 21:43	6480	18.521	19.483	33.762	18.805	20.628	20.352
9/25/96 21:53	6490	18.537	19.483	33.762	18.805	20.612	20.352
9/25/96 22:03	6500	18.521	19.483	33.762	18.799	20.597	20.352
9/25/96 22:13	6510	18.521	19.478	33.762	18.792	20.581	20.346
9/25/96 22:23	6520	18.521	19.474	33.762	18.792	20.597	20.346

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9/25/96 22:33	6530	18.521	19.478	33.762	18.799	20.597	20.346
9/25/96 22:43	6540	18.521	19.474	33.762	18.799	20.612	20.346
9/25/96 22:53	6550	18.521	19.474	33.762	18.799	20.612	20.340
9/25/96 23:03	6560	18.505	19.474	33.762	18.799	20.612	20.340
9/25/96 23:13	6570	18.521	19.469	33.762	18.792	20.597	20.340
9/25/96 23:23	6580	18.505	19.469	33.762	18.792	20.581	20.340
9/25/96 23:33	6590	18.505	19.464	33.762	18.786	20.581	20.333
9/25/96 23:43	6600	18.505	19.464	33.762	18.786	20.565	20.333
9/25/96 23:53	6610	18.505	19.455	33.762	18.774	20.565	20.327
9/26/96 0:03	6620	18.505	19.455	33.762	18.774	20.550	20.327
9/26/96 0:13	6630	18.490	19.459	33.762	18.774	20.550	20.327
9/26/96 0:23	6640	18.490	19.450	33.762	18.767	20.550	20.321
9/26/96 0:33	6650	18.490	19.450	33.762	18.774	20.565	20.321
9/26/96 0:43	6660	18.490	19.450	33.762	18.774	20.565	20.321
9/26/96 0:53	6670	18.490	19.445	33.762	18.767	20.581	20.308
9/26/96 1:03	6680	18.474	19.440	33.762	18.755	20.565	20.308
9/26/96 1:13	6690	18.474	19.435	33.762	18.755	20.518	20.302
9/26/96 1:23	6700	18.474	19.431	33.762	18.748	20.550	20.302
9/26/96 1:33	6710	18.458	19.431	33.762	18.748	20.565	20.295
9/26/96 1:43	6720	18.458	19.416	33.762	18.736	20.534	20.289
9/26/96 1:53	6730	18.458	19.416	33.762	18.736	20.534	20.283
9/26/96 2:03	6740	18.442	19.412	33.762	18.736	20.565	20.283
9/26/96 2:13	6750	18.442	19.407	33.762	18.723	20.502	20.276
9/26/96 2:23	6760	18.458	19.416	33.762	18.736	20.534	20.276
9/26/96 2:33	6770	18.442	19.407	33.762	18.730	20.534	20.276
9/26/96 2:43	6780	18.458	19.412	33.762	18.730	20.518	20.276
9/26/96 2:53	6790	18.426	19.388	33.762	18.717	20.518	20.257
9/26/96 3:03	6800	18.410	19.374	33.762	18.704	20.502	20.245
9/26/96 3:13	6810	18.410	19.374	33.762	18.698	20.471	20.245
9/26/96 3:23	6820	18.410	19.369	33.762	18.698	20.502	20.238
9/26/96 3:33	6830	18.410	19.364	33.762	18.692	20.502	20.238
9/26/96 3:43	6840	18.394	19.364	33.762	18.685	20.455	20.238
9/26/96 3:53	6850	18.394	19.364	33.762	18.685	20.487	20.232
9/26/96 4:03	6860	18.394	19.359	33.762	18.679	20.471	20.232
9/26/96 4:13	6870	18.394	19.364	33.762	18.685	20.471	20.232
9/26/96 4:23	6880	18.394	19.359	33.762	18.685	20.502	20.232
9/26/96 4:33	6890	18.394	19.359	33.762	18.679	20.455	20.232
9/26/96 4:43	6900	18.394	19.364	33.762	18.685	20.502	20.232
9/26/96 4:53	6910	18.378	19.354	33.762	18.679	20.487	20.226
9/26/96 5:03	6920	18.347	19.321	33.762	18.654	20.439	20.194
9/26/96 5:13	6930	18.331	19.307	33.762	18.641	20.455	20.181
9/26/96 5:23	6940	18.331	19.297	33.762	18.629	20.408	20.169
9/26/96 5:33	6950	18.331	19.297	33.762	18.635	20.439	20.169
9/26/96 5:43	6960	18.315	19.293	33.762	18.629	20.439	20.169
9/26/96 5:53	6970	18.315	19.293	33.762	18.629	20.424	20.163
9/26/96 6:03	6980	18.299	19.278	33.762	18.610	20.376	20.150
9/26/96 6:13	6990	18.315	19.288	33.762	18.616	20.424	20.156

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				Well ID			
9/26/96 6:23	7000	18.299	19.278	33.762	18.623	20.392	20.156
9/26/96 6:33	7010	18.315	19.288	33.762	18.623	20.424	20.163
9/26/96 6:43	7020	18.331	19.293	33.762	18.629	20.408	20.169
9/26/96 6:53	7030	18.331	19.302	33.762	18.629	20.455	20.175
9/26/96 7:03	7040	18.347	19.312	33.762	18.635	20.455	20.181
9/26/96 7:13	7050	18.347	19.312	33.762	18.635	20.424	20.181
9/26/96 7:23	7060	18.347	19.316	33.762	18.641	20.439	20.181
9/26/96 7:33	7070	18.347	19.321	33.762	18.641	20.439	20.188
9/26/96 7:43	7080	18.363	19.326	33.762	18.648	20.424	20.194
9/26/96 7:53	7090	18.378	19.340	33.762	18.660	20.439	20.207
9/26/96 8:03	7100	18.378	19.335	33.762	18.654	20.455	20.207
9/26/96 8:13	7110	18.363	19.335	33.762	18.667	20.487	20.207
9/26/96 8:23	7120	18.363	19.335	33.762	18.654	20.471	20.200
9/26/96 8:33	7130	18.363	19.326	33.762	18.648	20.455	20.194
9/26/96 8:43	7140	18.363	19.326	33.762	18.648	20.439	20.194
9/26/96 8:53	7150	18.363	19.326	33.762	18.648	20.455	20.188
9/26/96 9:03	7160	18.347	19.316	33.762	18.641	20.471	20.181
9/26/96 9:13	7170	18.347	19.312	33.762	18.629	20.408	20.175
9/26/96 9:23	7180	18.331	19.302	33.762	18.629	20.424	20.169
9/26/96 9:33	7190	18.331	19.302	33.762	18.623	20.392	20.169
9/26/96 9:43	7200	18.331	19.293	33.762	18.616	20.408	20.156
9/26/96 9:53	7210	18.299	19.278	33.762	18.610	20.392	20.150
9/26/96 10:03	7220	18.315	19.278	33.762	18.604	20.408	20.144
9/26/96 10:13	7230	18.299	19.264	33.762	18.591	20.392	20.131
9/26/96 10:23	7240	18.299	19.264	33.762	18.585	20.392	20.131
9/26/96 10:33	7250	18.267	19.250	33.762	18.579	20.345	20.118
9/26/96 10:43	7260	18.299	19.254	33.762	18.572	20.345	20.125
9/26/96 10:53	7270	18.283	19.250	33.762	18.566	20.345	20.112
9/26/96 11:03	7280	18.267	19.240	33.762	18.560	20.329	20.112
9/26/96 11:13	7290	18.283	19.240	33.762	18.560	20.329	20.112
9/26/96 11:23	7300	18.236	19.212	33.762	18.522	20.298	20.068
9/26/96 11:33	7310	18.220	19.193	33.762	18.509	20.313	20.055
9/26/96 11:43	7320	18.109	19.112	33.762	18.415	20.188	19.967
9/26/96 11:53	7330	18.172	19.126	33.762	18.446	20.219	19.992
9/26/96 12:03	7340	18.125	19.107	33.762	18.427	20.188	19.973
9/26/96 12:13	7350	18.125	19.102	33.762	18.421	20.188	19.967
9/26/96 12:23	7360	18.125	19.092	33.762	18.415	20.203	19.960
9/26/96 12:33	7370	18.109	19.083	33.762	18.402	20.203	19.954
9/26/96 12:43	7380	18.093	19.069	33.762	18.383	20.172	19.935
9/26/96 12:53	7390	18.077	19.054	33.762	18.365	20.109	19.922
9/26/96 13:03	7400	18.061	19.040	33.762	18.358	20.140	19.910
9/26/96 13:13	7410	18.061	19.045	33.762	18.358	20.140	19.910
9/26/96 13:23	7420	18.029	19.011	33.762	18.327	20.062	19.872
9/26/96 13:33	7430	17.998	18.973	33.762	18.276	20.046	19.840
9/26/96 13:43	7440	17.998	18.978	33.762	18.289	20.077	19.846
9/26/96 13:53	7450	17.998	18.983	33.762	18.289	20.046	19.853
9/26/96 14:03	7460	18.014	18.992	33.762	18.295	20.093	19.853

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				Well ID			
9/26/96 14:13	7470	18.014	18.997	33.762	18.302	20.109	19.859
9/26/96 14:23	7480	18.029	19.007	33.762	18.308	20.109	19.865
9/26/96 14:33	7490	18.156	19.107	33.762	18.396	20.172	19.979
9/26/96 14:43	7500	18.125	19.097	33.762	18.383	20.203	19.954
9/26/96 14:53	7510	18.061	19.045	33.762	18.339	20.093	19.910
9/26/96 15:03	7520	18.061	19.040	33.762	18.333	20.109	19.897
9/26/96 15:13	7530	18.061	19.035	33.762	18.333	20.140	19.897
9/26/96 15:23	7540	18.061	19.031	33.762	18.327	20.140	19.891
9/26/96 15:33	7550	18.061	19.035	33.762	18.327	20.156	19.897
9/26/96 15:43	7560	18.093	19.059	33.762	18.358	20.156	19.916
9/26/96 15:53	7570	18.093	19.069	33.762	18.352	20.172	19.929
9/26/96 16:03	7580	18.109	19.069	33.762	18.358	20.156	19.929
9/26/96 16:13	7590	18.109	19.069	33.762	18.371	20.188	19.935
9/26/96 16:23	7600	18.125	19.088	33.762	18.377	20.172	19.948
9/26/96 16:33	7610	18.125	19.092	33.762	18.390	20.203	19.960
9/26/96 16:43	7620	18.140	19.112	33.762	18.396	20.235	19.973
9/26/96 16:53	7630	18.172	19.131	33.762	18.421	20.251	19.992
9/26/96 17:03	7640	18.204	19.154	33.762	18.446	20.282	20.017
9/26/96 17:13	7650	18.156	19.126	33.762	18.427	20.251	19.992
9/26/96 17:23	7660	18.156	19.126	33.762	18.421	20.235	19.992
9/26/96 17:33	7670	18.156	19.126	33.762	18.427	20.266	19.992
9/26/96 17:43	7680	18.156	19.126	33.762	18.421	20.219	19.992
9/26/96 17:53	7690	18.156	19.126	33.762	18.421	20.235	19.992
9/26/96 18:03	7700	18.172	19.131	33.762	18.427	20.282	19.992
9/26/96 18:13	7710	18.172	19.140	33.762	18.427	20.251	20.004
9/26/96 18:23	7720	18.188	19.150	33.762	18.446	20.266	20.011
9/26/96 18:33	7730	18.188	19.154	33.762	18.446	20.282	20.011
9/26/96 18:43	7740	18.188	19.159	33.762	18.446	20.298	20.023
9/26/96 18:53	7750	18.204	19.169	33.762	18.459	20.251	20.030
9/26/96 19:03	7760	18.220	19.173	33.762	18.472	20.298	20.036
9/26/96 19:13	7770	18.204	19.169	33.762	18.465	20.298	20.030
9/26/96 19:23	7780	18.220	19.183	33.762	18.472	20.329	20.042
9/26/96 19:33	7790	18.220	19.183	33.762	18.478	20.298	20.042
9/26/96 19:43	7800	18.236	19.193	33.762	18.478	20.329	20.055
9/26/96 19:53	7810	18.236	19.197	33.762	18.497	20.251	20.061
9/26/96 20:03	7820	18.236	19.202	33.762	18.497	20.345	20.061
9/26/96 20:13	7830	18.236	19.202	33.762	18.497	20.298	20.061
9/26/96 20:23	7840	18.236	19.202	33.762	18.490	20.298	20.061
9/26/96 20:33	7850	18.252	19.212	33.762	18.509	20.329	20.068
9/26/96 20:43	7860	18.236	19.221	33.762	18.516	20.361	20.080
9/26/96 20:53	7870	18.267	19.226	33.762	18.522	20.361	20.087
9/26/96 21:03	7880	18.252	19.226	33.762	18.522	20.345	20.087
9/26/96 21:13	7890	18.267	19.235	33.762	18.522	20.313	20.093
9/26/96 21:23	7900	18.267	19.235	33.762	18.534	20.345	20.093
9/26/96 21:33	7910	18.283	19.235	33.762	18.534	20.361	20.093
9/26/96 21:43	7920	18.252	19.226	33.762	18.516	20.313	20.074
9/26/96 21:53	7930	18.267	19.235	33.762	18.522	20.361	20.093

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9/26/96 22:03	7940	18.267	19.231	33.762	18.528	20.313	20.093
9/26/96 22:13	7950	18.267	19.235	33.762	18.528	20.345	20.093
9/26/96 22:23	7960	18.267	19.231	33.762	18.522	20.313	20.087
9/26/96 22:33	7970	18.252	19.216	33.762	18.503	20.298	20.068
9/26/96 22:43	7980	18.283	19.235	33.762	18.528	20.345	20.093
9/26/96 22:53	7990	18.283	19.240	33.762	18.534	20.361	20.099
9/26/96 23:03	8000	18.267	19.235	33.762	18.528	20.361	20.093
9/26/96 23:13	8010	18.267	19.231	33.762	18.522	20.329	20.087
9/26/96 23:23	8020	18.267	19.231	33.762	18.522	20.345	20.087
9/26/96 23:33	8030	18.252	19.226	33.762	18.516	20.298	20.087
9/26/96 23:43	8040	18.267	19.231	33.762	18.522	20.329	20.087
9/26/96 23:53	8050	18.252	19.226	33.762	18.503	20.329	20.080
9/27/96 0:03	8060	18.252	19.226	33.762	18.522	20.313	20.080
9/27/96 0:13	8070	18.252	19.221	33.762	18.509	20.298	20.074
9/27/96 0:23	8080	18.236	19.212	33.762	18.503	20.313	20.068
9/27/96 0:33	8090	18.252	19.216	33.762	18.509	20.313	20.074
9/27/96 0:43	8100	18.252	19.216	33.762	18.509	20.313	20.074
9/27/96 0:53	8110	18.252	19.216	33.762	18.509	20.329	20.068
9/27/96 1:03	8120	18.252	19.221	33.762	18.509	20.329	20.074
9/27/96 1:13	8130	18.236	19.207	33.762	18.497	20.329	20.061
9/27/96 1:23	8140	18.267	19.221	33.762	18.509	20.298	20.074
9/27/96 1:33	8150	18.252	19.221	33.762	18.516	20.313	20.080
9/27/96 1:43	8160	18.267	19.226	33.762	18.516	20.329	20.080
9/27/96 1:53	8170	18.252	19.216	33.762	18.503	20.313	20.074
9/27/96 2:03	8180	18.267	19.231	33.762	18.516	20.329	20.087
9/27/96 2:13	8190	18.267	19.231	33.762	18.522	20.345	20.087
9/27/96 2:23	8200	18.236	19.221	33.762	18.509	20.282	20.080
9/27/96 2:33	8210	18.236	19.202	33.762	18.490	20.298	20.061
9/27/96 2:43	8220	18.252	19.212	33.762	18.509	20.313	20.068
9/27/96 2:53	8230	18.252	19.207	33.762	18.509	20.329	20.068
9/27/96 3:03	8240	18.236	19.202	33.762	18.503	20.298	20.061
9/27/96 3:13	8250	18.220	19.197	33.762	18.490	20.266	20.049
9/27/96 3:23	8260	18.236	19.207	33.762	18.503	20.313	20.061
9/27/96 3:33	8270	18.236	19.207	33.762	18.509	20.329	20.068
9/27/96 3:43	8280	18.252	19.216	33.762	18.516	20.329	20.074
9/27/96 3:53	8290	18.252	19.221	33.762	18.516	20.329	20.080
9/27/96 4:03	8300	18.283	19.235	33.762	18.534	20.361	20.099
9/27/96 4:13	8310	18.283	19.235	33.762	18.534	20.376	20.093
9/27/96 4:23	8320	18.267	19.231	33.762	18.522	20.329	20.087
9/27/96 4:33	8330	18.252	19.226	33.762	18.516	20.329	20.080
9/27/96 4:43	8340	18.283	19.240	33.762	18.534	20.361	20.093
9/27/96 4:53	8350	18.283	19.240	33.762	18.541	20.345	20.099
9/27/96 5:03	8360	18.299	19.250	33.762	18.547	20.345	20.106
9/27/96 5:13	8370	18.283	19.254	33.762	18.547	20.361	20.112
9/27/96 5:23	8380	18.283	19.250	33.762	18.541	20.329	20.106
9/27/96 5:33	8390	18.299	19.264	33.762	18.566	20.376	20.125
9/27/96 5:43	8400	18.299	19.264	33.762	18.560	20.392	20.125

Date and Time	Minutes	Well ID 62G	65G	66G	67G	INT2	INT3
9/27/96 5:53	8410	18.315	19.273	33.762	18.572	20.361	20.131
9/27/96 6:03	8420	18.299	19.269	33.762	18.566	20.392	20.125
9/27/96 6:13	8430	18.299	19.273	33.762	18.566	20.361	20.125
9/27/96 6:23	8440	18.315	19.273	33.762	18.572	20.392	20.131
9/27/96 6:33	8450	18.315	19.283	33.762	18.572	20.392	20.137
9/27/96 6:43	8460	18.331	19.288	33.762	18.585	20.392	20.144
9/27/96 6:53	8470	18.331	19.288	33.762	18.591	20.392	20.150
9/27/96 7:03	8480	18.331	19.293	33.762	18.591	20.392	20.150
9/27/96 7:13	8490	18.315	19.278	33.762	18.585	20.392	20.137
9/27/96 7:23	8500	18.299	19.269	33.762	18.572	20.392	20.131
9/27/96 7:33	8510	18.299	19.269	33.762	18.560	20.376	20.125
9/27/96 7:43	8520	18.315	19.264	33.762	18.560	20.345	20.125
9/27/96 7:53	8530	18.299	19.254	33.762	18.547	20.376	20.112
9/27/96 8:03	8540	18.299	19.259	33.762	18.553	20.329	20.118
9/27/96 8:13	8550	18.299	19.264	33.762	18.566	20.392	20.118
9/27/96 8:23	8560	18.315	19.278	33.762	18.579	20.392	20.137
9/27/96 8:33	8570	18.315	19.283	33.762	18.579	20.361	20.144
9/27/96 8:43	8580	18.331	19.293	33.762	18.591	20.408	20.150
9/27/96 8:53	8590	18.347	19.297	33.762	18.604	20.424	20.156
9/27/96 9:03	8600	18.331	19.293	33.762	18.591	20.392	20.156
9/27/96 9:13	8610	18.331	19.293	33.762	18.591	20.392	20.150
9/27/96 9:23	8620	18.331	19.288	33.762	18.585	20.376	20.150
9/27/96 9:33	8630	18.331	19.293	33.762	18.591	20.392	20.144
9/27/96 9:43	8640	18.283	19.254	33.762	18.560	20.361	20.112
9/27/96 9:53	8650	18.267	19.240	33.762	18.547	20.361	20.099
9/27/96 10:03	8660	18.267	19.235	33.762	18.547	20.329	20.099
9/27/96 10:13	8670	18.267	19.235	33.762	18.541	20.361	20.093
9/27/96 10:23	8680	18.267	19.226	33.762	18.534	20.313	20.087
9/27/96 10:33	8690	18.252	19.226	33.762	18.534	20.345	20.093
9/27/96 10:43	8700	18.267	19.231	33.762	18.541	20.313	20.099
9/27/96 10:53	8710	18.283	19.240	33.762	18.547	20.345	20.106
9/27/96 11:03	8720	18.283	19.240	33.762	18.553	20.376	20.099
9/27/96 11:13	8730	18.283	19.240	33.762	18.547	20.376	20.106
9/27/96 11:23	8740	18.267	19.240	33.762	18.547	20.376	20.106
9/27/96 11:33	8750	18.267	19.235	33.762	18.547	20.361	20.106
9/27/96 11:43	8760	18.283	19.240	33.762	18.547	20.376	20.112
9/27/96 11:53	8770	18.283	19.245	33.762	18.553	20.376	20.106
9/27/96 12:03	8780	18.283	19.250	33.762	18.560	20.376	20.112
9/27/96 12:13	8790	18.283	19.245	33.762	18.553	20.376	20.106
9/27/96 12:23	8800	18.283	19.245	33.762	18.553	20.376	20.112
9/27/96 12:33	8810	18.299	19.250	33.762	18.560	20.392	20.112
9/27/96 12:43	8820	18.283	19.250	33.762	18.560	20.392	20.112
9/27/96 12:53	8830	18.283	19.240	33.762	18.547	20.329	20.106
9/27/96 13:03	8840	18.267	19.235	33.762	18.541	20.345	20.093
9/27/96 13:13	8850	18.252	19.226	33.762	18.541	20.361	20.093
9/27/96 13:23	8860	18.252	19.216	33.762	18.534	20.329	20.087
9/27/96 13:33	8870	18.252	19.212	33.762	18.522	20.313	20.074

Date and Time	Minutes	Well ID 62G	65G	66G	67G	INT2	INT3
9/27/96 13:43	8880	18.252	19.216	33.762	18.528	20.313	20.080
9/27/96 13:53	8890	18.252	19.212	33.762	18.522	20.345	20.074
9/27/96 14:03	8900	18.252	19.212	33.762	18.528	20.345	20.074
9/27/96 14:13	8910	18.252	19.212	33.762	18.528	20.345	20.074
9/27/96 14:23	8920	18.252	19.216	33.762	18.528	20.345	20.080
9/27/96 14:33	8930	18.252	19.212	33.762	18.522	20.329	20.074
9/27/96 14:43	8940	18.252	19.212	33.762	18.522	20.329	20.074
9/27/96 14:53	8950	18.252	19.207	33.762	18.516	20.329	20.074
9/27/96 15:03	8960	18.267	19.216	33.762	18.528	20.313	20.080
9/27/96 15:13	8970	18.252	19.216	33.762	18.522	20.345	20.080
9/27/96 15:23	8980	18.252	19.212	33.762	18.522	20.298	20.074
9/27/96 15:33	8990	18.252	19.216	33.762	18.522	20.298	20.080
9/27/96 15:43	9000	18.267	19.226	33.762	18.534	20.329	20.087
9/27/96 15:53	9010	18.267	19.231	33.762	18.534	20.313	20.093
9/27/96 16:03	9020	18.283	19.240	33.762	18.547	20.345	20.099
9/27/96 16:13	9030	18.267	19.235	33.762	18.541	20.313	20.099
9/27/96 16:23	9040	18.299	19.245	33.762	18.553	20.361	20.106
9/27/96 16:33	9050	18.283	19.250	33.762	18.560	20.345	20.112
9/27/96 16:43	9060	18.283	19.245	33.762	18.547	20.345	20.106
9/27/96 16:53	9070	18.283	19.245	33.762	18.553	20.345	20.106
9/27/96 17:03	9080	18.283	19.250	33.762	18.553	20.329	20.106
9/27/96 17:13	9090	18.299	19.254	33.762	18.560	20.376	20.112
9/27/96 17:23	9100	18.283	19.250	33.762	18.560	20.345	20.112
9/27/96 17:33	9110	18.299	19.254	33.762	18.560	20.376	20.112
9/27/96 17:43	9120	18.299	19.254	33.762	18.560	20.361	20.112
9/27/96 17:53	9130	18.299	19.254	33.762	18.560	20.345	20.112
9/27/96 18:03	9140	18.299	19.259	33.762	18.566	20.361	20.118
9/27/96 18:13	9150	18.283	19.254	33.762	18.560	20.392	20.112
9/27/96 18:23	9160	18.283	19.245	33.762	18.547	20.361	20.106
9/27/96 18:33	9170	18.283	19.250	33.762	18.547	20.345	20.106
9/27/96 18:43	9180	18.283	19.245	33.762	18.547	20.345	20.099
9/27/96 18:53	9190	18.283	19.245	33.762	18.547	20.345	20.099
9/27/96 19:03	9200	18.299	19.254	33.762	18.560	20.345	20.112
9/27/96 19:13	9210	18.299	19.259	33.762	18.572	20.408	20.118
9/27/96 19:23	9220	18.299	19.259	33.762	18.566	20.392	20.118
9/27/96 19:33	9230	18.315	19.269	33.762	18.572	20.392	20.125
9/27/96 19:43	9240	18.299	19.269	33.762	18.566	20.376	20.118
9/27/96 19:53	9250	18.299	19.264	33.762	18.566	20.392	20.118
9/27/96 20:03	9260	18.299	19.264	33.762	18.566	20.392	20.118
9/27/96 20:13	9270	18.283	19.259	33.762	18.572	20.392	20.118
9/27/96 20:23	9280	18.315	19.269	33.762	18.572	20.392	20.125
9/27/96 20:33	9290	17.823	18.945	33.762	18.371	20.077	19.891
9/27/96 20:43	9300	18.172	19.150	33.762	18.472	20.251	20.017
9/27/96 20:53	9310	18.172	19.150	33.762	18.472	20.282	20.017
9/27/96 21:03	9320	18.188	19.154	33.762	18.478	20.282	20.017
9/27/96 21:13	9330	18.172	19.145	33.762	18.465	20.235	20.011
9/27/96 21:23	9340	18.156	19.135	33.762	18.465	20.282	20.004

		Well ID					
Date and Time	Minutes	62G	65G	66G	67G	INT2	INT3
9/27/96 21:33	9350	18.156	19.131	33.762	18.459	20.251	19.998
9/27/96 21:43	9360	18.156	19.131	33.762	18.453	20.251	19.998
9/27/96 21:53	9370	18.156	19.126	33.762	18.453	20.251	19.992
9/27/96 22:03	9380	18.140	19.121	33.762	18.440	20.235	19.979
9/27/96 22:13	9390	18.156	19.126	33.762	18.446	20.251	19.992
9/27/96 22:23	9400	18.140	19.112	33.762	18.434	20.235	19.979
9/27/96 22:33	9410	18.140	19.107	33.762	18.427	20.235	19.967
9/27/96 22:43	9420	18.125	19.097	33.762	18.421	20.235	19.960
9/27/96 22:53	9430	18.125	19.088	33.762	18.415	20.219	19.954
9/27/96 23:03	9440	18.109	19.083	33.762	18.409	20.219	19.948
9/27/96 23:13	9450	18.125	19.083	33.762	18.409	20.203	19.948
9/27/96 23:23	9460	18.109	19.078	33.762	18.409	20.203	19.948
9/27/96 23:33	9470	18.109	19.083	33.762	18.409	20.188	19.948
9/27/96 23:43	9480	18.109	19.083	33.762	18.402	20.188	19.948
9/27/96 23:53	9490	18.109	19.083	33.762	18.402	20.188	19.948
9/28/96 0:03	9500	18.125	19.088	33.762	18.415	20.235	19.954
9/28/96 0:13	9510	18.125	19.088	33.762	18.415	20.203	19.954
9/28/96 0:23	9520	18.125	19.092	33.762	18.421	20.251	19.960
9/28/96 0:33	9530	18.125	19.092	33.762	18.415	20.203	19.960
9/28/96 0:43	9540	18.125	19.088	33.762	18.409	20.188	19.954
9/28/96 0:53	9550	18.125	19.092	33.762	18.415	20.219	19.954
9/28/96 1:03	9560	18.125	19.088	33.762	18.409	20.235	19.954
9/28/96 1:13	9570	18.125	19.088	33.762	18.409	20.188	19.954
9/28/96 1:23	9580	18.125	19.092	33.762	18.415	20.203	19.960
9/28/96 1:33	9590	18.109	19.073	33.762	18.396	20.203	19.948
9/28/96 1:43	9600	18.109	19.078	33.762	18.402	20.188	19.948
9/28/96 1:53	9610	18.109	19.088	33.762	18.409	20.172	19.954
9/28/96 2:03	9620	18.125	19.088	33.762	18.415	20.219	19.954
9/28/96 2:13	9630	18.125	19.092	33.762	18.415	20.188	19.954
9/28/96 2:23	9640	18.125	19.092	33.762	18.415	20.203	19.954
9/28/96 2:33	9650	18.140	19.102	33.762	18.415	20.219	19.967
9/28/96 2:43	9660	18.156	19.116	33.762	18.440	20.235	19.986
9/28/96 2:53	9670	18.172	19.135	33.762	18.459	20.266	20.004
9/28/96 3:03	9680	18.172	19.135	33.762	18.459	20.251	20.004
9/28/96 3:13	9690	18.188	19.154	33.762	18.472	20.235	20.017
9/28/96 3:23	9700	18.204	19.164	33.762	18.484	20.313	20.030
9/28/96 3:33	9710	18.188	19.159	33.762	18.484	20.282	20.023
9/28/96 3:43	9720	18.204	19.164	33.762	18.484	20.266	20.030
9/28/96 3:53	9730	18.204	19.173	33.762	18.497	20.298	20.042
9/28/96 4:03	9740	18.220	19.178	33.762	18.503	20.298	20.042
9/28/96 4:13	9750	18.220	19.183	33.762	18.509	20.313	20.055
9/28/96 4:23	9760	18.220	19.188	33.762	18.516	20.298	20.055
9/28/96 4:33	9770	18.236	19.202	33.762	18.522	20.313	20.068
9/28/96 4:43	9780	18.252	19.202	33.762	18.528	20.329	20.068
9/28/96 4:53	9790	18.236	19.207	33.762	18.528	20.298	20.074
9/28/96 5:03	9800	18.252	19.212	33.762	18.541	20.329	20.080
9/28/96 5:13	9810	18.252	19.216	33.762	18.547	20.361	20.087

		Well ID					
Date and Time	Minutes	62G	65G	66G	67G	INT2	INT3
9/28/96 5:23	9820	18.252	19.226	33.762	18.553	20.345	20.093
9/28/96 5:33	9830	18.267	19.235	33.762	18.566	20.361	20.099
9/28/96 5:43	9840	18.267	19.235	33.762	18.566	20.345	20.106
9/28/96 5:53	9850	18.267	19.240	33.762	18.572	20.329	20.112
9/28/96 6:03	9860	18.283	19.254	33.762	18.585	20.361	20.118
9/28/96 6:13	9870	18.299	19.264	33.762	18.591	20.392	20.131
9/28/96 6:23	9880	18.299	19.273	33.762	18.604	20.361	20.144
9/28/96 6:33	9890	18.299	19.259	33.762	18.585	20.376	20.125
9/28/96 6:43	9900	18.299	19.259	33.762	18.585	20.361	20.125
9/28/96 6:53	9910	18.299	19.264	33.762	18.597	20.392	20.131
9/28/96 7:03	9920	18.283	19.259	33.762	18.597	20.376	20.131
9/28/96 7:13	9930	18.299	19.254	33.762	18.591	20.392	20.125
9/28/96 7:23	9940	18.283	19.250	33.762	18.585	20.345	20.125
9/28/96 7:33	9950	18.283	19.245	33.762	18.585	20.329	20.118
9/28/96 7:43	9960	18.267	19.235	33.762	18.572	20.361	20.106
9/28/96 7:53	9970	18.252	19.221	33.762	18.553	20.329	20.093
9/28/96 8:03	9980	18.267	19.226	33.762	18.553	20.361	20.099
9/28/96 8:13	9990	18.267	19.226	33.762	18.566	20.361	20.093
9/28/96 8:23	10000	18.267	19.231	33.762	18.566	20.329	20.099
9/28/96 8:33	10010	18.267	19.235	33.762	18.579	20.392	20.112
9/28/96 8:43	10020	18.283	19.231	33.762	18.572	20.361	20.106
9/28/96 8:53	10030	18.283	19.240	33.762	18.579	20.345	20.112
9/28/96 9:03	10040	18.299	19.259	33.762	18.604	20.408	20.131
9/28/96 9:13	10050	18.299	19.269	33.762	18.604	20.376	20.137
9/28/96 9:23	10060	18.315	19.269	33.762	18.604	20.376	20.144
9/28/96 9:33	10070	18.315	19.273	33.762	18.616	20.392	20.144
9/28/96 9:43	10080	18.315	19.273	33.762	18.610	20.439	20.150
9/28/96 9:53	10090	18.299	19.259	33.762	18.604	20.392	20.137
9/28/96 10:03	10100	18.283	19.245	33.762	18.585	20.376	20.125
9/28/96 10:13	10110	18.299	19.259	33.762	18.597	20.361	20.131
9/28/96 10:23	10120	18.283	19.254	33.762	18.604	20.408	20.131
9/28/96 10:33	10130	18.283	19.240	33.762	18.585	20.345	20.118
9/28/96 10:43	10140	18.283	19.240	33.762	18.585	20.376	20.112
9/28/96 10:53	10150	18.315	19.288	33.762	18.629	20.392	20.156
9/28/96 11:03	10160	18.331	19.283	33.762	18.635	20.439	20.163
9/28/96 11:13	10170	18.283	19.250	33.762	18.591	20.361	20.125
9/28/96 11:23	10180	18.283	19.250	33.762	18.604	20.345	20.125
9/28/96 11:33	10190	18.267	19.226	33.762	18.572	20.329	20.106
9/28/96 11:43	10200	18.299	19.264	33.762	18.604	20.392	20.131
9/28/96 11:53	10210	18.283	19.245	33.762	18.585	20.345	20.125
9/28/96 12:03	10220	18.267	19.226	33.762	18.579	20.376	20.106
9/28/96 12:13	10230	18.299	19.254	33.762	18.597	20.361	20.131
9/28/96 12:23	10240	18.267	19.235	33.762	18.579	20.361	20.106
9/28/96 12:33	10250	18.283	19.240	33.762	18.585	20.361	20.112
9/28/96 12:43	10260	18.283	19.240	33.762	18.585	20.345	20.112
9/28/96 12:53	10270	18.299	19.250	33.762	18.604	20.313	20.125
9/28/96 13:03	10280	18.299	19.259	33.762	18.610	20.392	20.131

		Well ID					
Date and Time	Minutes	62G	65G	66G	67G	INT2	INT3
9/28/96 13:13	10290	18.378	19.326	33.762	18.692	20.518	20.213
9/28/96 13:23	10300	18.394	19.335	33.762	18.698	20.487	20.219
9/28/96 13:33	10310	18.410	19.345	33.762	18.698	20.534	20.232
9/28/96 13:43	10320	18.426	19.354	33.762	18.711	20.518	20.238
9/28/96 13:53	10330	18.426	19.364	33.762	18.723	20.534	20.251
9/28/96 14:03	10340	18.426	19.364	33.762	18.723	20.502	20.251
9/28/96 14:13	10350	18.426	19.369	33.762	18.730	20.534	20.251
9/28/96 14:23	10360	18.426	19.374	33.762	18.723	20.518	20.251
9/28/96 14:33	10370	18.442	19.383	33.762	18.742	20.534	20.264
9/28/96 14:43	10380	18.442	19.383	33.762	18.748	20.471	20.270
9/28/96 14:53	10390	18.442	19.383	33.762	18.742	20.550	20.264
9/28/96 15:03	10400	18.458	19.388	33.762	18.748	20.550	20.264
9/28/96 15:13	10410	18.458	19.397	33.762	18.755	20.534	20.276
9/28/96 15:23	10420	18.458	19.397	33.762	18.755	20.518	20.283
9/28/96 15:33	10430	18.458	19.402	33.762	18.755	20.518	20.276
9/28/96 15:43	10440	18.458	19.397	33.762	18.755	20.518	20.276
9/28/96 15:53	10450	18.458	19.402	33.762	18.755	20.534	20.283
9/28/96 16:03	10460	18.474	19.412	33.762	18.767	20.550	20.283
9/28/96 16:13	10470	18.474	19.421	33.762	18.774	20.565	20.295
9/28/96 16:23	10480	18.490	19.421	33.762	18.774	20.550	20.302
9/28/96 16:33	10490	18.490	19.435	33.762	18.792	20.597	20.314
9/28/96 16:43	10500	18.426	19.383	33.762	18.742	20.518	20.264
9/28/96 16:53	10510	18.410	19.364	33.762	18.730	20.534	20.245
9/28/96 17:03	10520	18.410	19.364	33.762	18.730	20.487	20.251
9/28/96 17:13	10530	18.410	19.364	33.762	18.730	20.518	20.251
9/28/96 17:23	10540	18.410	19.359	33.762	18.730	20.518	20.245
9/28/96 17:33	10550	18.410	19.369	33.762	18.736	20.534	20.251
9/28/96 17:43	10560	18.410	19.364	33.762	18.730	20.550	20.245
9/28/96 17:53	10570	18.394	19.354	33.762	18.723	20.502	20.245
9/28/96 18:03	10580	18.410	19.364	33.762	18.730	20.518	20.251
9/28/96 18:13	10590	18.426	19.369	33.762	18.736	20.534	20.257
9/28/96 18:23	10600	18.410	19.369	33.762	18.736	20.565	20.257
9/28/96 18:33	10610	18.426	19.378	33.762	18.748	20.534	20.264
9/28/96 18:43	10620	18.521	19.445	33.762	18.805	20.612	20.327
9/28/96 18:53	10630	18.537	19.464	33.762	18.811	20.644	20.346
9/28/96 19:03	10640	18.521	19.474	33.762	18.830	20.612	20.358
9/28/96 19:13	10650	18.553	19.488	33.762	18.849	20.644	20.371
9/28/96 19:23	10660	18.553	19.493	33.762	18.855	20.675	20.371
9/28/96 19:33	10670	18.553	19.493	33.762	18.855	20.660	20.377
9/28/96 19:43	10680	18.553	19.497	33.762	18.855	20.628	20.377
9/28/96 19:53	10690	18.553	19.497	33.762	18.862	20.675	20.377
9/28/96 20:03	10700	18.569	19.502	33.762	18.862	20.660	20.384
9/28/96 20:13	10710	18.569	19.507	33.762	18.868	20.660	20.384
9/28/96 20:23	10720	18.569	19.507	33.762	18.868	20.675	20.384
9/28/96 20:33	10730	18.553	19.502	33.762	18.862	20.675	20.384
9/28/96 20:43	10740	18.569	19.507	33.762	18.868	20.660	20.390
9/28/96 20:53	10750	18.569	19.507	33.762	18.868	20.675	20.390

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		Well ID					
9/28/96 21:03	10760	18.553	19.502	33.762	18.868	20.675	20.384
9/28/96 21:13	10770	18.553	19.502	33.762	18.868	20.644	20.390
9/28/96 21:23	10780	18.569	19.507	33.762	18.874	20.660	20.390
9/28/96 21:33	10790	18.569	19.507	33.762	18.874	20.691	20.390
9/28/96 21:43	10800	18.569	19.512	33.762	18.874	20.675	20.396
9/28/96 21:53	10810	18.585	19.512	33.762	18.880	20.691	20.396
9/28/96 22:03	10820	18.585	19.516	33.762	18.880	20.691	20.403
9/28/96 22:13	10830	18.585	19.516	33.762	18.887	20.691	20.403
9/28/96 22:23	10840	18.585	19.516	33.762	18.887	20.675	20.403
9/28/96 22:33	10850	18.585	19.516	33.762	18.880	20.644	20.403
9/28/96 22:43	10860	18.569	19.512	33.762	18.874	20.675	20.396
9/28/96 22:53	10870	18.537	19.478	33.762	18.849	20.644	20.371
9/28/96 23:03	10880	18.537	19.469	33.762	18.843	20.660	20.358
9/28/96 23:13	10890	18.521	19.464	33.762	18.843	20.644	20.352
9/28/96 23:23	10900	18.505	19.455	33.762	18.830	20.612	20.346
9/28/96 23:33	10910	18.521	19.455	33.762	18.830	20.597	20.346
9/28/96 23:43	10920	18.505	19.455	33.762	18.836	20.628	20.346
9/28/96 23:53	10930	18.505	19.455	33.762	18.836	20.644	20.346
9/29/96 0:03	10940	18.505	19.455	33.762	18.830	20.597	20.346
9/29/96 0:13	10950	18.505	19.450	33.762	18.830	20.628	20.346
9/29/96 0:23	10960	18.505	19.455	33.762	18.836	20.628	20.346
9/29/96 0:33	10970	18.505	19.450	33.762	18.830	20.612	20.340
9/29/96 0:43	10980	18.505	19.450	33.762	18.824	20.597	20.340
9/29/96 0:53	10990	18.505	19.450	33.762	18.824	20.597	20.340
9/29/96 1:03	11000	18.505	19.445	33.762	18.824	20.581	20.333
9/29/96 1:13	11010	18.490	19.445	33.762	18.824	20.628	20.340
9/29/96 1:23	11020	18.505	19.450	33.762	18.830	20.628	20.340
9/29/96 1:33	11030	18.505	19.450	33.762	18.830	20.597	20.346
9/29/96 1:43	11040	18.505	19.450	33.762	18.824	20.581	20.340
9/29/96 1:53	11050	18.505	19.445	33.762	18.830	20.628	20.340
9/29/96 2:03	11060	18.505	19.450	33.762	18.830	20.628	20.340
9/29/96 2:13	11070	18.505	19.450	33.762	18.830	20.612	20.346
9/29/96 2:23	11080	18.505	19.450	33.762	18.830	20.581	20.340
9/29/96 2:33	11090	18.505	19.450	33.762	18.824	20.612	20.340
9/29/96 2:43	11100	18.505	19.455	33.762	18.836	20.612	20.346
9/29/96 2:53	11110	18.505	19.455	33.762	18.836	20.612	20.346
9/29/96 3:03	11120	18.505	19.455	33.762	18.836	20.628	20.346
9/29/96 3:13	11130	18.505	19.455	33.762	18.836	20.628	20.346
9/29/96 3:23	11140	18.505	19.455	33.762	18.836	20.597	20.346
9/29/96 3:33	11150	18.521	19.459	33.762	18.843	20.612	20.352
9/29/96 3:43	11160	18.521	19.464	33.762	18.843	20.612	20.352
9/29/96 3:53	11170	18.521	19.464	33.762	18.843	20.612	20.352
9/29/96 4:03	11180	18.521	19.464	33.762	18.843	20.612	20.352
9/29/96 4:13	11190	18.521	19.469	33.762	18.849	20.612	20.358
9/29/96 4:23	11200	18.521	19.469	33.762	18.855	20.628	20.358
9/29/96 4:33	11210	18.521	19.469	33.762	18.849	20.628	20.358
9/29/96 4:43	11220	18.521	19.469	33.762	18.849	20.644	20.358

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		Well ID					
9/29/96 4:53	11230	18.521	19.474	33.762	18.855	20.660	20.365
9/29/96 5:03	11240	18.537	19.474	33.762	18.855	20.628	20.365
9/29/96 5:13	11250	18.537	19.474	33.762	18.855	20.612	20.365
9/29/96 5:23	11260	18.537	19.478	33.762	18.855	20.612	20.365
9/29/96 5:33	11270	18.537	19.478	33.762	18.862	20.612	20.371
9/29/96 5:43	11280	18.537	19.483	33.762	18.862	20.628	20.371
9/29/96 5:53	11290	18.537	19.488	33.762	18.868	20.628	20.377
9/29/96 6:03	11300	18.553	19.488	33.762	18.868	20.628	20.377
9/29/96 6:13	11310	18.553	19.497	33.762	18.880	20.660	20.384
9/29/96 6:23	11320	18.553	19.493	33.762	18.880	20.675	20.384
9/29/96 6:33	11330	18.569	19.497	33.762	18.880	20.691	20.384
9/29/96 6:43	11340	18.553	19.507	33.762	18.887	20.644	20.396
9/29/96 6:53	11350	18.569	19.502	33.762	18.893	20.691	20.396
9/29/96 7:03	11360	18.569	19.502	33.762	18.893	20.675	20.396
9/29/96 7:13	11370	18.553	19.502	33.762	18.887	20.675	20.390
9/29/96 7:23	11380	18.553	19.502	33.762	18.887	20.675	20.390
9/29/96 7:33	11390	18.537	19.497	33.762	18.880	20.660	20.384
9/29/96 7:43	11400	18.553	19.493	33.762	18.874	20.612	20.384
9/29/96 7:53	11410	18.553	19.497	33.762	18.874	20.628	20.384
9/29/96 8:03	11420	18.553	19.497	33.762	18.880	20.660	20.384
9/29/96 8:13	11430	18.553	19.497	33.762	18.880	20.660	20.384
9/29/96 8:23	11440	18.569	19.502	33.762	18.887	20.675	20.390
9/29/96 8:33	11450	18.553	19.502	33.762	18.893	20.691	20.390
9/29/96 8:43	11460	18.553	19.502	33.762	18.887	20.660	20.390
9/29/96 8:53	11470	18.553	19.507	33.762	18.887	20.644	20.396
9/29/96 9:03	11480	18.569	19.502	33.762	18.887	20.675	20.390
9/29/96 9:13	11490	18.553	19.497	33.762	18.880	20.628	20.384
9/29/96 9:23	11500	18.553	19.497	33.762	18.887	20.675	20.384
9/29/96 9:33	11510	18.553	19.493	33.762	18.874	20.644	20.377
9/29/96 9:43	11520	18.553	19.497	33.762	18.874	20.660	20.384
9/29/96 9:53	11530	18.553	19.497	33.762	18.880	20.644	20.384
9/29/96 10:03	11540	18.537	19.497	33.762	18.874	20.644	20.384
9/29/96 10:13	11550	18.553	19.502	33.762	18.880	20.660	20.384
9/29/96 10:23	11560	18.553	19.497	33.762	18.874	20.628	20.377
9/29/96 10:33	11570	18.553	19.497	33.762	18.880	20.675	20.384
9/29/96 10:43	11580	18.569	19.493	33.762	18.868	20.675	20.377
9/29/96 10:53	11590	18.537	19.488	33.762	18.868	20.612	20.371
9/29/96 11:03	11600	18.553	19.483	33.762	18.855	20.628	20.365
9/29/96 11:13	11610	18.537	19.483	33.762	18.855	20.644	20.365
9/29/96 11:23	11620	18.553	19.497	33.762	18.880	20.660	20.384
9/29/96 11:33	11630	18.553	19.493	33.762	18.874	20.660	20.377
9/29/96 11:43	11640	18.553	19.497	33.762	18.868	20.644	20.377
9/29/96 11:53	11650	18.537	19.488	33.762	18.862	20.644	20.365
9/29/96 12:03	11660	18.521	19.474	33.762	18.843	20.628	20.352
9/29/96 12:13	11670	18.537	19.474	33.762	18.843	20.612	20.352
9/29/96 12:23	11680	18.521	19.464	33.762	18.836	20.644	20.346
9/29/96 12:33	11690	18.505	19.455	33.762	18.836	20.597	20.346

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9/29/96 12:43	11700	18.490	19.440	33.762	18.818	20.612	20.321
9/29/96 12:53	11710	18.474	19.431	33.762	18.805	20.581	20.308
9/29/96 13:03	11720	18.474	19.431	33.762	18.805	20.581	20.314
9/29/96 13:13	11730	18.474	19.426	33.762	18.805	20.597	20.308
9/29/96 13:23	11740	18.458	19.416	33.762	18.780	20.565	20.295
9/29/96 13:33	11750	18.458	19.412	33.762	18.780	20.565	20.289
9/29/96 13:43	11760	18.442	19.402	33.762	18.767	20.534	20.283
9/29/96 13:53	11770	18.442	19.402	33.762	18.774	20.565	20.283
9/29/96 14:03	11780	18.426	19.388	33.762	18.755	20.550	20.264
9/29/96 14:13	11790	18.442	19.393	33.762	18.761	20.534	20.270
9/29/96 14:23	11800	18.442	19.393	33.762	18.767	20.550	20.276
9/29/96 14:33	11810	18.442	19.388	33.762	18.761	20.550	20.264
9/29/96 14:43	11820	18.442	19.393	33.762	18.761	20.550	20.276
9/29/96 14:53	11830	18.442	19.393	33.762	18.761	20.550	20.270
9/29/96 15:03	11840	18.426	19.383	33.762	18.755	20.534	20.264
9/29/96 15:13	11850	18.426	19.378	33.762	18.748	20.550	20.257
9/29/96 15:23	11860	18.442	19.388	33.762	18.755	20.534	20.264
9/29/96 15:33	11870	18.426	19.388	33.762	18.748	20.534	20.264
9/29/96 15:43	11880	18.410	19.374	33.762	18.736	20.502	20.245
9/29/96 15:53	11890	18.410	19.374	33.762	18.736	20.534	20.245
9/29/96 16:03	11900	18.426	19.378	33.762	18.742	20.518	20.251
9/29/96 16:13	11910	18.442	19.393	33.762	18.761	20.550	20.270
9/29/96 16:23	11920	18.458	19.412	33.762	18.780	20.581	20.289
9/29/96 16:33	11930	18.474	19.426	33.762	18.792	20.581	20.308
9/29/96 16:43	11940	18.474	19.426	33.762	18.792	20.565	20.308
9/29/96 16:53	11950	18.474	19.431	33.762	18.792	20.565	20.308
9/29/96 17:03	11960	18.505	19.450	33.762	18.818	20.612	20.333
9/29/96 17:13	11970	18.505	19.450	33.762	18.818	20.660	20.333
9/29/96 17:23	11980	18.505	19.459	33.762	18.824	20.612	20.340
9/29/96 17:33	11990	18.521	19.464	33.762	18.830	20.628	20.346
9/29/96 17:43	12000	18.521	19.469	33.762	18.830	20.644	20.346
9/29/96 17:53	12010	18.521	19.478	33.762	18.843	20.660	20.358
9/29/96 18:03	12020	18.521	19.483	33.762	18.849	20.644	20.371
9/29/96 18:13	12030	18.553	19.497	33.762	18.868	20.691	20.377
9/29/96 18:23	12040	18.553	19.502	33.762	18.874	20.691	20.384
9/29/96 18:33	12050	18.569	19.516	33.762	18.887	20.691	20.396
9/29/96 18:43	12060	18.569	19.521	33.762	18.887	20.675	20.409
9/29/96 18:53	12070	18.585	19.531	33.762	18.899	20.707	20.415
9/29/96 19:03	12080	18.585	19.540	33.762	18.912	20.738	20.428
9/29/96 19:13	12090	18.601	19.550	33.762	18.918	20.738	20.434
9/29/96 19:23	12100	18.601	19.559	33.762	18.925	20.691	20.441
9/29/96 19:33	12110	18.616	19.564	33.762	18.937	20.754	20.447
9/29/96 19:43	12120	18.616	19.569	33.762	18.937	20.738	20.447
9/29/96 19:53	12130	18.616	19.569	33.762	18.937	20.723	20.447
9/29/96 20:03	12140	18.632	19.574	33.762	18.943	20.770	20.460
9/29/96 20:13	12150	18.632	19.583	33.762	18.956	20.738	20.460
9/29/96 20:23	12160	18.632	19.583	33.762	18.956	20.770	20.466

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9/29/96 20:33	12170	18.648	19.588	33.762	18.962	20.754	20.466
9/29/96 20:43	12180	18.648	19.593	33.762	18.962	20.770	20.466
9/29/96 20:53	12190	18.648	19.597	33.762	18.975	20.770	20.472
9/29/96 21:03	12200	18.632	19.597	33.762	18.975	20.770	20.479
9/29/96 21:13	12210	18.632	19.593	33.762	18.969	20.786	20.472
9/29/96 21:23	12220	18.648	19.602	33.762	18.975	20.770	20.479
9/29/96 21:33	12230	18.648	19.602	33.762	18.981	20.754	20.485
9/29/96 21:43	12240	18.648	19.602	33.762	18.981	20.786	20.485
9/29/96 21:53	12250	18.648	19.607	33.762	18.981	20.738	20.485
9/29/96 22:03	12260	18.648	19.602	33.762	18.981	20.770	20.485
9/29/96 22:13	12270	18.648	19.607	33.762	18.981	20.770	20.479
9/29/96 22:23	12280	18.648	19.607	33.762	18.987	20.786	20.491
9/29/96 22:33	12290	18.664	19.616	33.762	18.994	20.786	20.491
9/29/96 22:43	12300	18.664	19.616	33.762	18.994	20.770	20.491
9/29/96 22:53	12310	18.664	19.616	33.762	18.994	20.801	20.491
9/29/96 23:03	12320	18.664	19.621	33.762	18.994	20.754	20.498
9/29/96 23:13	12330	18.664	19.621	33.762	19.000	20.801	20.498
9/29/96 23:23	12340	18.680	19.621	33.762	19.000	20.754	20.504
9/29/96 23:33	12350	18.664	19.621	33.762	19.000	20.801	20.498
9/29/96 23:43	12360	18.680	19.626	33.762	19.006	20.786	20.504
9/29/96 23:53	12370	18.664	19.631	33.762	19.006	20.801	20.510
9/30/96 0:03	12380	18.680	19.636	33.762	19.013	20.801	20.510
9/30/96 0:13	12390	18.680	19.636	33.762	19.006	20.770	20.510
9/30/96 0:23	12400	18.664	19.626	33.762	19.000	20.754	20.504
9/30/96 0:33	12410	18.664	19.631	33.762	19.013	20.817	20.510
9/30/96 0:43	12420	18.680	19.640	33.762	19.019	20.801	20.516
9/30/96 0:53	12430	18.696	19.640	33.762	19.019	20.786	20.516
9/30/96 1:03	12440	18.680	19.640	33.762	19.013	20.770	20.516
9/30/96 1:13	12450	18.680	19.640	33.762	19.019	20.786	20.516
9/30/96 1:23	12460	18.680	19.640	33.762	19.019	20.817	20.516
9/30/96 1:33	12470	18.680	19.640	33.762	19.019	20.817	20.516
9/30/96 1:43	12480	18.680	19.645	33.762	19.019	20.786	20.516
9/30/96 1:53	12490	18.680	19.640	33.762	19.019	20.786	20.516
9/30/96 2:03	12500	18.680	19.640	33.762	19.019	20.786	20.516
9/30/96 2:13	12510	18.696	19.645	33.762	19.025	20.786	20.516
9/30/96 2:23	12520	18.696	19.645	33.762	19.025	20.786	20.523
9/30/96 2:33	12530	18.680	19.650	33.762	19.025	20.786	20.523
9/30/96 2:43	12540	18.696	19.650	33.762	19.031	20.801	20.523
9/30/96 2:53	12550	18.696	19.650	33.762	19.025	20.817	20.523
9/30/96 3:03	12560	18.680	19.650	33.762	19.025	20.817	20.523
9/30/96 3:13	12570	18.696	19.655	33.762	19.038	20.833	20.535
9/30/96 3:23	12580	18.696	19.655	33.762	19.038	20.833	20.535
9/30/96 3:33	12590	18.696	19.650	33.762	19.025	20.801	20.529
9/30/96 3:43	12600	18.696	19.655	33.762	19.031	20.817	20.529
9/30/96 3:53	12610	18.696	19.659	33.762	19.038	20.833	20.535
9/30/96 4:03	12620	18.696	19.655	33.762	19.038	20.754	20.529
9/30/96 4:13	12630	18.696	19.650	33.762	19.025	20.786	20.529

Date and Time	Minutes	62G	65G	66G	67G	INT2	INT3
				Well ID			
9/30/96 4:23	12640	18.696	19.655	33.762	19.038	20.801	20.529
9/30/96 4:33	12650	18.696	19.659	33.762	19.031	20.786	20.529
9/30/96 4:43	12660	18.712	19.669	33.762	19.044	20.801	20.542
9/30/96 4:53	12670	18.712	19.664	33.762	19.044	20.817	20.542
9/30/96 5:03	12680	18.712	19.669	33.762	19.044	20.833	20.542
9/30/96 5:13	12690	18.712	19.664	33.762	19.038	20.801	20.535
9/30/96 5:23	12700	18.696	19.664	33.762	19.038	20.770	20.542
9/30/96 5:33	12710	18.712	19.669	33.762	19.044	20.786	20.542
9/30/96 5:43	12720	18.712	19.669	33.762	19.044	20.801	20.542
9/30/96 5:53	12730	18.712	19.674	33.762	19.050	20.817	20.542
9/30/96 6:03	12740	18.727	19.674	33.762	19.050	20.848	20.548
9/30/96 6:13	12750	18.712	19.678	33.762	19.057	20.801	20.554
9/30/96 6:23	12760	18.680	19.655	33.762	19.025	20.754	20.523
9/30/96 6:33	12770	18.680	19.640	33.762	19.019	20.786	20.510
9/30/96 6:43	12780	18.680	19.640	33.762	19.013	20.770	20.510
9/30/96 6:53	12790	18.664	19.640	33.762	19.006	20.738	20.504
9/30/96 7:03	12800	18.664	19.640	33.762	19.013	20.754	20.504
9/30/96 7:13	12810	18.680	19.645	33.762	19.019	20.723	20.516
9/30/96 7:23	12820	18.680	19.645	33.762	19.019	20.786	20.510
9/30/96 7:33	12830	18.664	19.636	33.762	19.006	20.754	20.504
9/30/96 7:43	12840	18.664	19.631	33.762	19.006	20.770	20.498
9/30/96 7:53	12850	18.664	19.631	33.762	19.000	20.754	20.491
9/30/96 8:03	12860	18.648	19.621	33.762	18.994	20.770	20.485
9/30/96 8:13	12870	18.632	19.616	33.762	18.994	20.723	20.485
9/30/96 8:23	12880	18.648	19.612	33.762	18.987	20.723	20.485
9/30/96 8:33	12890	18.632	19.612	33.762	18.987	20.738	20.472
9/30/96 8:43	12900	18.632	19.607	33.762	18.981	20.691	20.472
9/30/96 8:53	12910	18.616	19.602	33.762	18.969	20.738	20.466
9/30/96 9:03	12920	18.632	19.602	33.762	18.981	20.723	20.472
9/30/96 9:13	12930	18.632	19.597	33.762	18.975	20.707	20.466
9/30/96 9:23	12940	18.616	19.593	33.762	18.962	20.691	20.460
9/30/96 9:33	12950	18.616	19.588	33.762	18.962	20.738	20.453
9/30/96 9:43	12960	18.601	19.583	33.762	18.956	20.675	20.447
9/30/96 9:53	12970	18.601	19.583	33.762	18.962	20.691	20.447
9/30/96 10:03	12980	18.616	19.583	33.762	18.962	20.691	20.447
9/30/96 10:13	12990	18.601	19.578	33.762	18.956	20.723	20.447
9/30/96 10:23	13000	18.616	19.578	33.762	18.956	20.707	20.447
9/30/96 10:33	13010	18.616	19.574	33.762	18.950	20.691	20.441
9/30/96 10:43	13020	18.632	19.583	33.762	18.956	20.707	20.453
9/30/96 10:53	13030	18.616	19.578	33.762	18.956	20.723	20.447
9/30/96 11:03	13040	18.601	19.578	33.762	18.950	20.707	20.447
9/30/96 11:13	13050	18.616	19.578	33.762	18.950	20.723	20.447
9/30/96 11:23	13060	18.601	19.574	33.762	18.943	20.691	20.441
9/30/96 11:33	13070	18.601	19.559	33.762	18.931	20.691	20.428
9/30/96 11:43	13080	18.601	19.559	33.762	18.925	20.691	20.422
9/30/96 11:53	13090	18.585	19.555	33.762	18.925	20.691	20.422
9/30/96 12:03	13100	18.585	19.540	33.762	18.912	20.691	20.409

Date and Time	Minutes	62G	65G	Well ID 66G	67G	INT2	INT3
9/30/96 12:13	13110	18.569	19.531	33.762	18.893	20.644	20.396
9/30/96 12:23	13120	18.569	19.531	33.762	18.893	20.675	20.396
9/30/96 12:33	13130	18.569	19.531	33.762	18.899	20.691	20.396
9/30/96 12:43	13140	18.553	19.521	33.762	18.893	20.660	20.390
9/30/96 12:53	13150	18.521	19.497	33.762	18.862	20.628	20.358
9/30/96 13:03	13160	18.505	19.478	33.762	18.843	20.628	20.346
9/30/96 13:13	13170	18.490	19.464	33.762	18.818	20.581	20.327
9/30/96 13:23	13180	18.442	19.431	33.762	18.786	20.550	20.289
9/30/96 13:33	13190	18.458	19.435	33.762	18.792	20.550	20.289
9/30/96 13:43	13200	18.458	19.435	33.762	18.792	20.565	20.295
9/30/96 13:53	13210	18.458	19.426	33.762	18.786	20.565	20.289
9/30/96 14:03	13220	18.442	19.416	33.762	18.774	20.550	20.276
9/30/96 14:13	13230	18.426	19.407	33.762	18.761	20.550	20.264
9/30/96 14:23	13240	18.410	19.393	33.762	18.748	20.487	20.251
9/30/96 14:33	13250	18.394	19.374	33.762	18.723	20.487	20.226
9/30/96 14:43	13260	18.394	19.369	33.762	18.723	20.487	20.226
9/30/96 14:53	13270	18.410	19.383	33.762	18.742	20.534	20.238
9/30/96 15:03	13280	18.410	19.383	33.762	18.742	20.518	20.245
9/30/96 15:13	13290	18.378	19.359	33.762	18.711	20.455	20.213
9/30/96 15:23	13300	18.347	19.345	33.762	18.692	20.424	20.200
9/30/96 15:33	13310	18.378	19.354	33.762	18.704	20.455	20.213
9/30/96 15:43	13320	18.378	19.359	33.762	18.717	20.487	20.219
9/30/96 15:53	13330	18.394	19.364	33.762	18.723	20.502	20.226
9/30/96 16:03	13340	18.378	19.354	33.762	18.704	20.471	20.207
9/30/96 16:13	13350	18.363	19.354	33.762	18.698	20.455	20.219
9/30/96 16:23	13360	18.410	19.378	33.762	18.742	20.534	20.245
9/30/96 16:33	13370	18.442	19.397	33.762	18.761	20.550	20.264
9/30/96 16:43	13380	18.458	19.421	33.762	18.780	20.534	20.289
9/30/96 16:53	13390	18.474	19.445	33.762	18.811	20.612	20.314
9/30/96 17:03	13400	18.521	19.469	33.762	18.830	20.628	20.340
9/30/96 17:13	13410	18.521	19.474	33.762	18.836	20.644	20.346
9/30/96 17:23	13420	18.537	19.488	33.762	18.849	20.644	20.358
9/30/96 17:33	13430	18.537	19.493	33.762	18.849	20.644	20.358
9/30/96 17:43	13440	18.537	19.493	33.762	18.836	20.644	20.358
9/30/96 17:53	13450	18.537	19.488	33.762	18.843	20.612	20.358
9/30/96 18:03	13460	18.521	19.488	33.762	18.843	20.612	20.358
9/30/96 18:13	13470	18.537	19.493	33.762	18.849	20.628	20.365
9/30/96 18:23	13480	18.537	19.497	33.762	18.855	20.644	20.365
9/30/96 18:33	13490	18.537	19.502	33.762	18.862	20.644	20.371
9/30/96 18:43	13500	18.537	19.502	33.762	18.862	20.644	20.371
9/30/96 18:53	13510	18.537	19.502	33.762	18.862	20.628	20.371
9/30/96 19:03	13520	18.537	19.507	33.762	18.862	20.612	20.377
9/30/96 19:13	13530	18.537	19.512	33.762	18.874	20.675	20.384
9/30/96 19:23	13540	18.553	19.512	33.762	18.874	20.660	20.377
9/30/96 19:33	13550	18.553	19.516	33.762	18.880	20.660	20.384
9/30/96 19:43	13560	18.553	19.512	33.762	18.880	20.660	20.377
9/30/96 19:53	13570	18.553	19.521	33.762	18.887	20.660	20.390

Date and Time	Minutes	Well ID 62G	65G	66G	67G	INT2	INT3
9/30/96 20:03	13580	18.553	19.526	33.762	18.887	20.644	20.396
9/30/96 20:13	13590	18.569	19.531	33.762	18.893	20.691	20.396
9/30/96 20:23	13600	18.569	19.535	33.762	18.899	20.660	20.409
9/30/96 20:33	13610	18.569	19.531	33.762	18.899	20.644	20.403
9/30/96 20:43	13620	18.569	19.531	33.762	18.906	20.660	20.403
9/30/96 20:53	13630	18.569	19.531	33.762	18.899	20.675	20.396
9/30/96 21:03	13640	18.569	19.531	33.762	18.899	20.660	20.396
9/30/96 21:13	13650	18.569	19.535	33.762	18.899	20.644	20.403
9/30/96 21:23	13660	18.585	19.540	33.762	18.912	20.691	20.409
9/30/96 21:33	13670	18.585	19.550	33.762	18.912	20.675	20.415
9/30/96 21:43	13680	18.585	19.545	33.762	18.899	20.707	20.409
9/30/96 21:53	13690	18.569	19.540	33.762	18.906	20.691	20.409
9/30/96 22:03	13700	18.569	19.540	33.762	18.906	20.691	20.409
9/30/96 22:13	13710	18.569	19.540	33.762	18.906	20.691	20.409
9/30/96 22:23	13720	18.569	19.535	33.762	18.899	20.660	20.403
9/30/96 22:33	13730	18.569	19.535	33.762	18.893	20.660	20.403
9/30/96 22:43	13740	18.569	19.540	33.762	18.906	20.707	20.403
9/30/96 22:53	13750	18.569	19.535	33.762	18.899	20.691	20.403
9/30/96 23:03	13760	18.553	19.531	33.762	18.899	20.675	20.396
9/30/96 23:13	13770	18.569	19.531	33.762	18.899	20.644	20.396
9/30/96 23:23	13780	18.569	19.535	33.762	18.899	20.691	20.403
9/30/96 23:33	13790	18.569	19.535	33.762	18.899	20.675	20.403
9/30/96 23:43	13800	18.569	19.540	33.762	18.906	20.675	20.409
9/30/96 23:53	13810	18.569	19.540	33.762	18.906	20.691	20.409
10/1/96 0:03	13820	18.585	19.545	33.762	18.912	20.675	20.415
10/1/96 0:13	13830	18.585	19.550	33.762	18.918	20.691	20.415
10/1/96 0:23	13840	18.569	19.540	33.762	18.912	20.691	20.409
10/1/96 0:33	13850	18.585	19.545	33.762	18.912	20.675	20.415
10/1/96 0:43	13860	18.585	19.545	33.762	18.912	20.707	20.415
10/1/96 0:53	13870	18.569	19.545	33.762	18.912	20.644	20.409
10/1/96 1:03	13880	18.569	19.545	33.762	18.912	20.675	20.409
10/1/96 1:13	13890	18.569	19.535	33.762	18.899	20.675	20.403
10/1/96 1:23	13900	18.569	19.540	33.762	18.906	20.691	20.403
10/1/96 1:33	13910	18.569	19.540	33.762	18.906	20.660	20.403
10/1/96 1:43	13920	18.569	19.535	33.762	18.906	20.628	20.403
10/1/96 1:53	13930	18.569	19.540	33.762	18.906	20.644	20.403
10/1/96 2:03	13940	18.569	19.540	33.762	18.906	20.675	20.403
10/1/96 2:13	13950	18.553	19.540	33.762	18.906	20.644	20.403
10/1/96 2:23	13960	18.553	19.531	33.762	18.906	20.691	20.396
10/1/96 2:33	13970	18.569	19.535	33.762	18.906	20.660	20.396
10/1/96 2:43	13980	18.569	19.540	33.762	18.906	20.691	20.403
10/1/96 2:53	13990	18.569	19.540	33.762	18.906	20.675	20.403
10/1/96 3:03	14000	18.569	19.540	33.762	18.906	20.675	20.403
10/1/96 3:13	14010	18.569	19.540	33.762	18.912	20.644	20.409
10/1/96 3:23	14020	18.569	19.545	33.762	18.912	20.675	20.409
10/1/96 3:33	14030	18.569	19.545	33.762	18.918	20.628	20.409
10/1/96 3:43	14040	18.569	19.545	33.762	18.912	20.660	20.409

Date and Time	Minutes	Well ID 62G	65G	66G	67G	INT2	INT3
10/1/96 3:53	14050	18.569	19.545	33.762	18.912	20.675	20.409
10/1/96 4:03	14060	18.569	19.540	33.762	18.912	20.644	20.409
10/1/96 4:13	14070	18.569	19.540	33.762	18.912	20.675	20.403
10/1/96 4:23	14080	18.569	19.545	33.762	18.906	20.691	20.409
10/1/96 4:33	14090	18.569	19.545	33.762	18.912	20.660	20.409
10/1/96 4:43	14100	18.569	19.540	33.762	18.906	20.660	20.409
10/1/96 4:53	14110	18.585	19.545	33.762	18.918	20.691	20.409
10/1/96 5:03	14120	18.569	19.545	33.762	18.912	20.644	20.409
10/1/96 5:13	14130	18.585	19.545	33.762	18.918	20.691	20.409
10/1/96 5:23	14140	18.585	19.550	33.762	18.925	20.691	20.415
10/1/96 5:33	14150	18.585	19.550	33.762	18.918	20.675	20.415
10/1/96 5:43	14160	18.585	19.550	33.762	18.912	20.660	20.415
10/1/96 5:53	14170	18.585	19.550	33.762	18.918	20.691	20.415
10/1/96 6:03	14180	18.569	19.550	33.762	18.918	20.644	20.415
10/1/96 6:13	14190	18.569	19.555	33.762	18.918	20.707	20.415
10/1/96 6:23	14200	18.585	19.550	33.762	18.925	20.675	20.415
10/1/96 6:33	14210	18.585	19.550	33.762	18.918	20.675	20.415
10/1/96 6:43	14220	18.585	19.550	33.762	18.925	20.675	20.415
10/1/96 6:53	14230	18.585	19.559	33.762	18.925	20.691	20.415
10/1/96 7:03	14240	18.585	19.564	33.762	18.931	20.675	20.422
10/1/96 7:13	14250	18.585	19.564	33.762	18.931	20.660	20.428
10/1/96 7:23	14260	18.585	19.564	33.762	18.925	20.707	20.428
10/1/96 7:33	14270	18.585	19.564	33.762	18.925	20.675	20.422
10/1/96 7:43	14280	18.601	19.564	33.762	18.931	20.691	20.428
10/1/96 7:53	14290	18.585	19.559	33.762	18.925	20.660	20.422
10/1/96 8:03	14300	18.585	19.564	33.762	18.925	20.675	20.422
10/1/96 8:13	14310	18.585	19.559	33.762	18.925	20.675	20.415
10/1/96 8:23	14320	18.585	19.564	33.762	18.931	20.691	20.422
10/1/96 8:33	14330	18.585	19.559	33.762	18.931	20.723	20.415
10/1/96 8:43	14340	18.569	19.550	33.762	18.918	20.675	20.409
10/1/96 8:53	14350	18.569	19.550	33.762	18.918	20.660	20.409
10/1/96 9:03	14360	18.585	19.550	33.762	18.912	20.691	20.403
10/1/96 9:13	14370	18.569	19.540	33.762	18.906	20.675	20.396
10/1/96 9:23	14380	18.553	19.535	33.762	18.899	20.660	20.396
10/1/96 9:33	14390	18.553	19.535	33.762	18.899	20.660	20.396
10/1/96 9:43	14400	18.553	19.526	33.762	18.893	20.675	20.384
10/1/96 9:53	14410	18.537	19.516	33.762	18.880	20.644	20.371
10/1/96 10:03	14420	18.505	19.488	33.762	18.849	20.612	20.346
10/1/96 10:13	14430	18.521	19.497	33.762	18.862	20.628	20.352
10/1/96 10:23	14440	18.505	19.483	33.762	18.849	20.628	20.340
10/1/96 10:33	14450	18.505	19.478	33.762	18.843	20.597	20.340
10/1/96 10:43	14460	18.490	19.474	33.762	18.830	20.612	20.333
10/1/96 10:53	14470	18.505	19.483	33.762	18.849	20.612	20.340
10/1/96 11:03	14480	18.490	19.464	33.762	18.836	20.597	20.327
10/1/96 11:13	14490	18.490	19.459	33.762	18.830	20.534	20.314
10/1/96 11:23	14500	18.474	19.445	33.762	18.805	20.581	20.302
10/1/96 11:33	14510	18.458	19.426	33.762	18.774	20.534	20.283

		Well ID					
Date and Time	Minutes	62G	65G	66G	67G	INT2	INT3
10/1/96 11:43	14520	18.442	19.426	33.762	18.786	20.534	20.283
10/1/96 11:53	14530	18.490	19.450	33.762	18.818	20.581	20.314
10/1/96 12:03	14540	18.490	19.459	33.762	18.818	20.581	20.321
10/1/96 12:13	14550	18.474	19.455	33.762	18.811	20.550	20.314
10/1/96 12:23	14560	18.474	19.445	33.762	18.799	20.565	20.302
10/1/96 12:33	14570	18.442	19.416	33.762	18.774	20.550	20.276
10/1/96 12:43	14580	18.426	19.407	33.762	18.755	20.518	20.264
10/1/96 12:53	14590	18.331	19.350	33.762	18.692	20.424	20.194
10/1/96 13:03	14600	18.315	19.321	33.762	18.673	20.439	20.169
10/1/96 13:13	14610	18.331	19.316	33.762	18.660	20.408	20.163
10/1/96 13:23	14620	18.315	19.316	33.762	18.660	20.439	20.163
10/1/96 13:33	14630	18.331	19.316	33.762	18.660	20.392	20.169
10/1/96 13:43	14640	18.331	19.316	33.762	18.667	20.408	20.175
10/1/96 13:53	14650	18.299	19.302	33.762	18.641	20.408	20.150
10/1/96 14:03	14660	18.267	19.269	33.762	18.597	20.361	20.112
10/1/96 14:13	14670	18.283	19.273	33.762	18.610	20.361	20.125
10/1/96 14:23	14680	18.299	19.283	33.762	18.629	20.361	20.137
10/1/96 14:33	14690	18.315	19.302	33.762	18.648	20.408	20.150
10/1/96 14:43	14700	18.331	19.312	33.762	18.660	20.439	20.169
10/1/96 14:53	14710	18.378	19.345	33.762	18.692	20.471	20.207
10/1/96 15:03	14720	18.299	19.293	33.762	18.635	20.376	20.144
10/1/96 15:13	14730	18.299	19.283	33.762	18.629	20.376	20.131
10/1/96 15:23	14740	18.283	19.273	33.762	18.610	20.361	20.125
10/1/96 15:33	14750	18.252	19.269	33.762	18.610	20.376	20.118
10/1/96 15:43	14760	18.283	19.273	33.762	18.616	20.376	20.125
10/1/96 15:53	14770	18.267	19.259	33.762	18.591	20.329	20.106
10/1/96 16:03	14780	18.283	19.273	33.762	18.616	20.376	20.125
10/1/96 16:13	14790	18.299	19.283	33.762	18.629	20.392	20.131
10/1/96 16:23	14800	18.315	19.302	33.762	18.641	20.392	20.156
10/1/96 16:33	14810	18.363	19.331	33.762	18.679	20.424	20.188
10/1/96 16:43	14820	18.394	19.364	33.762	18.717	20.518	20.219
10/1/96 16:53	14830	18.410	19.378	33.762	18.730	20.518	20.238
10/1/96 17:03	14840	18.442	19.402	33.762	18.748	20.534	20.257
10/1/96 17:13	14850	18.442	19.412	33.762	18.761	20.550	20.283
10/1/96 17:23	14860	18.474	19.440	33.762	18.792	20.581	20.302
10/1/96 17:33	14870	18.505	19.459	33.762	18.811	20.597	20.321
10/1/96 17:43	14880	18.490	19.459	33.762	18.811	20.597	20.321
10/1/96 17:53	14890	18.505	19.474	33.762	18.824	20.581	20.333
10/1/96 18:03	14900	18.521	19.483	33.762	18.830	20.597	20.346
10/1/96 18:13	14910	18.537	19.493	33.762	18.849	20.644	20.358
10/1/96 18:23	14920	18.553	19.507	33.762	18.862	20.660	20.371
10/1/96 18:33	14930	18.553	19.512	33.762	18.862	20.644	20.377
10/1/96 18:43	14940	18.553	19.516	33.762	18.862	20.660	20.377
10/1/96 18:53	14950	18.553	19.516	33.762	18.868	20.581	20.377
10/1/96 19:03	14960	18.553	19.516	33.762	18.862	20.612	20.377
10/1/96 19:13	14970	18.553	19.526	33.762	18.874	20.644	20.384
10/1/96 19:23	14980	18.569	19.531	33.762	18.880	20.660	20.390

Date and Time	Minutes	62G	65G	66G	67G	INT2	INT3
				Well ID			
10/1/96 19:33	14990	18.585	19.540	33.762	18.887	20.675	20.396
10/1/96 19:43	15000	18.569	19.535	33.762	18.887	20.675	20.390
10/1/96 19:53	15010	18.585	19.540	33.762	18.887	20.675	20.403
10/1/96 20:03	15020	18.569	19.540	33.762	18.887	20.675	20.396
10/1/96 20:13	15030	18.585	19.540	33.762	18.893	20.691	20.396
10/1/96 20:23	15040	18.585	19.545	33.762	18.893	20.691	20.403
10/1/96 20:33	15050	18.585	19.550	33.762	18.899	20.707	20.409
10/1/96 20:43	15060	18.585	19.550	33.762	18.899	20.707	20.409
10/1/96 20:53	15070	18.585	19.550	33.762	18.899	20.707	20.409
10/1/96 21:03	15080	18.585	19.550	33.762	18.893	20.675	20.409
10/1/96 21:13	15090	18.585	19.550	33.762	18.899	20.675	20.409
10/1/96 21:23	15100	18.585	19.555	33.762	18.899	20.723	20.409
10/1/96 21:33	15110	18.601	19.559	33.762	18.906	20.707	20.415
10/1/96 21:43	15120	18.601	19.555	33.762	18.899	20.707	20.415
10/1/96 21:53	15130	18.601	19.555	33.762	18.906	20.723	20.415
10/1/96 22:03	15140	18.601	19.564	33.762	18.912	20.707	20.428
10/1/96 22:13	15150	18.601	19.564	33.762	18.912	20.707	20.422
10/1/96 22:23	15160	18.601	19.569	33.762	18.912	20.691	20.428
10/1/96 22:33	15170	18.601	19.569	33.762	18.918	20.738	20.428
10/1/96 22:43	15180	18.616	19.569	33.762	18.918	20.738	20.428
10/1/96 22:53	15190	18.616	19.574	33.762	18.918	20.707	20.434
10/1/96 23:03	15200	18.616	19.574	33.762	18.918	20.723	20.434
10/1/96 23:13	15210	18.601	19.574	33.762	18.918	20.738	20.428
10/1/96 23:23	15220	18.601	19.574	33.762	18.918	20.707	20.428
10/1/96 23:33	15230	18.601	19.569	33.762	18.912	20.707	20.422
10/1/96 23:43	15240	18.601	19.569	33.762	18.912	20.723	20.422
10/1/96 23:53	15250	18.601	19.564	33.762	18.912	20.723	20.415
10/2/96 0:03	15260	18.585	19.559	33.762	18.899	20.707	20.415
10/2/96 0:13	15270	18.585	19.564	33.762	18.906	20.707	20.422
10/2/96 0:23	15280	18.616	19.569	33.762	18.912	20.723	20.428
10/2/96 0:33	15290	18.601	19.569	33.762	18.918	20.738	20.422
10/2/96 0:43	15300	18.601	19.564	33.762	18.912	20.691	20.422
10/2/96 0:53	15310	18.601	19.569	33.762	18.912	20.691	20.422
10/2/96 1:03	15320	18.601	19.569	33.762	18.912	20.691	20.422
10/2/96 1:13	15330	18.601	19.569	33.762	18.912	20.707	20.422
10/2/96 1:23	15340	18.601	19.569	33.762	18.918	20.707	20.422
10/2/96 1:33	15350	18.601	19.564	33.762	18.912	20.723	20.422
10/2/96 1:43	15360	18.585	19.559	33.762	18.912	20.707	20.422
10/2/96 1:53	15370	18.585	19.559	33.762	18.899	20.675	20.415
10/2/96 2:03	15380	18.601	19.569	33.762	18.912	20.707	20.422
10/2/96 2:13	15390	18.601	19.564	33.762	18.912	20.723	20.422
10/2/96 2:23	15400	18.585	19.564	33.762	18.906	20.691	20.415
10/2/96 2:33	15410	18.601	19.569	33.762	18.912	20.723	20.422
10/2/96 2:43	15420	18.601	19.569	33.762	18.912	20.675	20.422
10/2/96 2:53	15430	18.601	19.574	33.762	18.912	20.723	20.428
10/2/96 3:03	15440	18.601	19.574	33.762	18.918	20.675	20.434
10/2/96 3:13	15450	18.601	19.578	33.762	18.925	20.707	20.428

Date and Time	Minutes	62G	65G	66G	67G	INT2	INT3
				Well ID			
10/2/96 3:23	15460	18.601	19.574	33.762	18.918	20.723	20.428
10/2/96 3:33	15470	18.616	19.583	33.762	18.931	20.723	20.441
10/2/96 3:43	15480	18.616	19.583	33.762	18.931	20.723	20.434
10/2/96 3:53	15490	18.616	19.578	33.762	18.925	20.723	20.434
10/2/96 4:03	15500	18.616	19.588	33.762	18.937	20.738	20.441
10/2/96 4:13	15510	18.616	19.588	33.762	18.931	20.723	20.441
10/2/96 4:23	15520	18.601	19.583	33.762	18.925	20.691	20.434
10/2/96 4:33	15530	18.601	19.578	33.762	18.918	20.675	20.428
10/2/96 4:43	15540	18.601	19.578	33.762	18.925	20.707	20.434
10/2/96 4:53	15550	18.632	19.597	33.762	18.943	20.738	20.447
10/2/96 5:03	15560	18.616	19.593	33.762	18.937	20.738	20.441
10/2/96 5:13	15570	18.616	19.583	33.762	18.931	20.723	20.441
10/2/96 5:23	15580	18.616	19.588	33.762	18.931	20.691	20.441
10/2/96 5:33	15590	18.616	19.588	33.762	18.937	20.723	20.441
10/2/96 5:43	15600	18.601	19.588	33.762	18.937	20.738	20.441
10/2/96 5:53	15610	18.632	19.602	33.762	18.950	20.738	20.453
10/2/96 6:03	15620	18.632	19.602	33.762	18.950	20.738	20.460
10/2/96 6:13	15630	18.648	19.612	33.762	18.962	20.738	20.466
10/2/96 6:23	15640	18.648	19.612	33.762	18.962	20.738	20.466
10/2/96 6:33	15650	18.632	19.612	33.762	18.962	20.770	20.466
10/2/96 6:43	15660	18.648	19.616	33.762	18.956	20.738	20.466
10/2/96 6:53	15670	18.648	19.612	33.762	18.956	20.723	20.460
10/2/96 7:03	15680	18.632	19.612	33.762	18.962	20.754	20.460
10/2/96 7:13	15690	18.648	19.616	33.762	18.962	20.723	20.466
10/2/96 7:23	15700	18.632	19.612	33.762	18.956	20.754	20.460
10/2/96 7:33	15710	18.648	19.612	33.762	18.950	20.738	20.460
10/2/96 7:43	15720	18.632	19.607	33.762	18.950	20.723	20.460
10/2/96 7:53	15730	18.648	19.612	33.762	18.962	20.707	20.466
10/2/96 8:03	15740	18.648	19.616	33.762	18.962	20.738	20.466
10/2/96 8:13	15750	18.632	19.607	33.762	18.950	20.723	20.460
10/2/96 8:23	15760	18.632	19.607	33.762	18.943	20.707	20.453
10/2/96 8:33	15770	18.632	19.602	33.762	18.943	20.707	20.453
10/2/96 8:43	15780	18.616	19.597	33.762	18.943	20.723	20.453
10/2/96 8:53	15790	18.632	19.607	33.762	18.956	20.723	20.460
10/2/96 9:03	15800	18.632	19.607	33.762	18.950	20.691	20.460
10/2/96 9:13	15810	18.616	19.588	33.762	18.925	20.675	20.441
10/2/96 9:23	15820	18.585	19.578	33.762	18.918	20.691	20.422
10/2/96 9:33	15830	18.616	19.588	33.762	18.931	20.738	20.441
10/2/96 9:43	15840	18.616	19.593	33.762	18.931	20.738	20.441
10/2/96 9:53	15850	18.616	19.583	33.762	18.931	20.707	20.428
10/2/96 10:03	15860	18.601	19.578	33.762	18.918	20.707	20.422
10/2/96 10:13	15870	18.585	19.574	33.762	18.912	20.675	20.415
10/2/96 10:23	15880	18.585	19.569	33.762	18.912	20.707	20.415
10/2/96 10:33	15890	18.569	19.555	33.762	18.899	20.691	20.403
10/2/96 10:43	15900	18.569	19.545	33.762	18.887	20.691	20.390
10/2/96 10:53	15910	18.569	19.535	33.762	18.880	20.675	20.384
10/2/96 11:03	15920	18.553	19.526	33.762	18.868	20.612	20.377

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Date and Time	Minutes	62G	65G	66G	67G	INT2	INT3
10/2/96 11:13	15930	18.537	19.521	33.762	18.862	20.660	20.365
10/2/96 11:23	15940	18.537	19.516	33.762	18.862	20.612	20.365
10/2/96 11:33	15950	18.505	19.493	33.762	18.830	20.597	20.333
10/2/96 11:43	15960	18.537	19.507	33.762	18.849	20.628	20.352
10/2/96 11:53	15970	18.521	19.502	33.762	18.843	20.597	20.352
10/2/96 12:03	15980	18.521	19.497	33.762	18.843	20.612	20.346
10/2/96 12:13	15990	18.490	19.483	33.762	18.824	20.581	20.327
10/2/96 12:23	16000	18.458	19.450	33.762	18.786	20.550	20.283
10/2/96 12:33	16010	18.426	19.416	33.762	18.748	20.534	20.264
10/2/96 12:43	16020	18.426	19.421	33.762	18.755	20.518	20.264
10/2/96 12:53	16030	18.442	19.431	33.762	18.767	20.550	20.276
10/2/96 13:03	16040	18.426	19.421	33.762	18.755	20.518	20.264
10/2/96 13:13	16050	18.474	19.440	33.762	18.774	20.550	20.289
10/2/96 13:23	16060	18.442	19.421	33.762	18.755	20.534	20.264
10/2/96 13:33	16070	18.442	19.421	33.762	18.761	20.518	20.270
10/2/96 13:43	16080	18.426	19.416	33.762	18.742	20.502	20.264
10/2/96 13:53	16090	18.426	19.412	33.762	18.742	20.502	20.251
10/2/96 14:03	16100	18.394	19.397	33.762	18.723	20.471	20.232
10/2/96 14:13	16110	18.378	19.369	33.762	18.698	20.439	20.207
10/2/96 14:23	16120	18.363	19.359	33.762	18.692	20.455	20.200
10/2/96 14:33	16130	18.378	19.359	33.762	18.692	20.455	20.194
10/2/96 14:43	16140	18.363	19.354	33.762	18.685	20.455	20.194
10/2/96 14:53	16150	18.347	19.345	33.762	18.679	20.424	20.188
10/2/96 15:03	16160	18.378	19.369	33.762	18.698	20.471	20.213
10/2/96 15:13	16170	18.378	19.369	33.762	18.698	20.471	20.213
10/2/96 15:23	16180	18.363	19.359	33.762	18.692	20.424	20.200
10/2/96 15:33	16190	18.378	19.369	33.762	18.704	20.471	20.213
10/2/96 15:43	16200	18.394	19.378	33.762	18.704	20.455	20.219
10/2/96 15:53	16210	18.410	19.397	33.762	18.736	20.518	20.245
10/2/96 16:03	16220	18.426	19.412	33.762	18.742	20.518	20.264
10/2/96 16:13	16230	18.458	19.431	33.762	18.774	20.550	20.276
10/2/96 16:23	16240	18.458	19.440	33.762	18.767	20.565	20.295
10/2/96 16:33	16250	18.474	19.445	33.762	18.792	20.550	20.302
10/2/96 16:43	16260	18.505	19.464	33.762	18.805	20.597	20.314
10/2/96 16:53	16270	18.474	19.455	33.762	18.792	20.565	20.302
10/2/96 17:03	16280	18.490	19.469	33.762	18.805	20.581	20.314
10/2/96 17:13	16290	18.505	19.478	33.762	18.818	20.581	20.327
10/2/96 17:23	16300	18.505	19.483	33.762	18.818	20.597	20.333
10/2/96 17:33	16310	18.521	19.488	33.762	18.830	20.628	20.340
10/2/96 17:43	16320	18.537	19.507	33.762	18.855	20.660	20.358
10/2/96 17:53	16330	18.537	19.512	33.762	18.849	20.597	20.365
10/2/96 18:03	16340	18.553	19.521	33.762	18.862	20.628	20.371
10/2/96 18:13	16350	18.553	19.526	33.762	18.868	20.644	20.377
10/2/96 18:23	16360	18.569	19.531	33.762	18.868	20.644	20.384
10/2/96 18:33	16370	18.569	19.535	33.762	18.874	20.644	20.384
10/2/96 18:43	16380	18.569	19.545	33.762	18.887	20.660	20.396
10/2/96 18:53	16390	18.585	19.550	33.762	18.887	20.660	20.403

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Date and Time	Minutes	62G	65G	66G	67G	INT2	INT3
10/2/96 19:03	16400	18.569	19.559	33.762	18.899	20.723	20.409
10/2/96 19:13	16410	18.601	19.559	33.762	18.899	20.707	20.409
10/2/96 19:23	16420	18.601	19.564	33.762	18.906	20.707	20.415
10/2/96 19:33	16430	18.585	19.564	33.762	18.906	20.723	20.415
10/2/96 19:43	16440	18.601	19.574	33.762	18.912	20.723	20.422
10/2/96 19:53	16450	18.601	19.578	33.762	18.912	20.707	20.428
10/2/96 20:03	16460	18.601	19.578	33.762	18.925	20.738	20.434
10/2/96 20:13	16470	18.616	19.583	33.762	18.925	20.707	20.434
10/2/96 20:23	16480	18.616	19.588	33.762	18.931	20.754	20.441
10/2/96 20:33	16490	18.616	19.593	33.762	18.931	20.723	20.441
10/2/96 20:43	16500	18.616	19.593	33.762	18.931	20.723	20.441
10/2/96 20:53	16510	18.616	19.593	33.762	18.925	20.738	20.441
10/2/96 21:03	16520	18.632	19.597	33.762	18.937	20.738	20.447
10/2/96 21:13	16530	18.632	19.602	33.762	18.943	20.723	20.453
10/2/96 21:23	16540	18.632	19.602	33.762	18.943	20.723	20.447
10/2/96 21:33	16550	18.632	19.607	33.762	18.943	20.707	20.453
10/2/96 21:43	16560	18.648	19.612	33.762	18.956	20.675	20.460
10/2/96 21:53	16570	18.648	19.626	33.762	18.969	20.754	20.472
10/2/96 22:03	16580	18.664	19.631	33.762	18.969	20.754	20.479
10/2/96 22:13	16590	18.648	19.626	33.762	18.969	20.754	20.472
10/2/96 22:23	16600	18.648	19.631	33.762	18.975	20.786	20.485
10/2/96 22:33	16610	18.664	19.640	33.762	18.981	20.770	20.485
10/2/96 22:43	16620	18.664	19.645	33.762	18.987	20.770	20.491
10/2/96 22:53	16630	18.680	19.655	33.762	18.994	20.754	20.504
10/2/96 23:03	16640	18.680	19.664	33.762	19.006	20.754	20.510
10/2/96 23:13	16650	18.712	19.678	33.762	19.025	20.801	20.529
10/2/96 23:23	16660	18.727	19.693	33.762	19.031	20.848	20.542
10/2/96 23:33	16670	18.727	19.697	33.762	19.038	20.801	20.548
10/2/96 23:43	16680	18.743	19.716	33.762	19.063	20.864	20.567
10/2/96 23:53	16690	18.759	19.731	33.762	19.076	20.864	20.580
10/3/96 0:03	16700	18.759	19.736	33.762	19.076	20.864	20.586
10/3/96 0:13	16710	18.775	19.731	33.762	19.063	20.880	20.580
10/3/96 0:23	16720	18.775	19.740	33.762	19.082	20.880	20.592
10/3/96 0:33	16730	18.775	19.745	33.762	19.082	20.864	20.592
10/3/96 0:43	16740	18.775	19.745	33.762	19.094	20.864	20.599
10/3/96 0:53	16750	18.775	19.750	33.762	19.094	20.848	20.599
10/3/96 1:03	16760	18.791	19.755	33.762	19.094	20.896	20.599
10/3/96 1:13	16770	18.791	19.759	33.762	19.101	20.880	20.605
10/3/96 1:23	16780	18.791	19.755	33.762	19.094	20.880	20.605
10/3/96 1:33	16790	18.791	19.769	33.762	19.113	20.896	20.618
10/3/96 1:43	16800	18.807	19.774	33.762	19.113	20.927	20.618
10/3/96 1:53	16810	18.807	19.774	33.762	19.120	20.896	20.624
10/3/96 2:03	16820	18.791	19.774	33.762	19.113	20.927	20.618
10/3/96 2:13	16830	18.807	19.778	33.762	19.126	20.911	20.624
10/3/96 2:23	16840	18.807	19.778	33.762	19.120	20.880	20.624
10/3/96 2:33	16850	18.807	19.788	33.762	19.132	20.927	20.630
10/3/96 2:43	16860	18.807	19.783	33.762	19.132	20.911	20.637

		Well ID					
Date and Time	Minutes	62G	65G	66G	67G	INT2	INT3
10/3/96 2:53	16870	18.823	19.793	33.762	19.138	20.911	20.637
10/3/96 3:03	16880	18.823	19.793	33.762	19.138	20.927	20.643
10/3/96 3:13	16890	18.854	19.821	33.762	19.170	20.974	20.668
10/3/96 3:23	16900	18.854	19.831	33.762	19.176	20.943	20.681
10/3/96 3:33	16910	18.854	19.836	33.762	19.176	20.927	20.687
10/3/96 3:43	16920	18.870	19.845	33.762	19.189	21.006	20.693
10/3/96 3:53	16930	18.886	19.850	33.762	19.201	20.990	20.700
10/3/96 4:03	16940	18.886	19.864	33.762	19.208	20.974	20.706
10/3/96 4:13	16950	18.902	19.869	33.762	19.214	20.990	20.712
10/3/96 4:23	16960	18.902	19.874	33.762	19.220	21.037	20.725
10/3/96 4:33	16970	18.918	19.888	33.762	19.233	21.022	20.731
10/3/96 4:43	16980	18.918	19.893	33.762	19.245	21.053	20.744
10/3/96 4:53	16990	18.934	19.897	33.762	19.245	21.037	20.744
10/3/96 5:03	17000	18.934	19.902	33.762	19.245	21.006	20.750
10/3/96 5:13	17010	18.934	19.912	33.762	19.264	21.069	20.757
10/3/96 5:23	17020	18.950	19.917	33.762	19.264	21.037	20.763
10/3/96 5:33	17030	18.950	19.917	33.762	19.271	21.037	20.769
10/3/96 5:43	17040	18.965	19.931	33.762	19.277	21.053	20.776
10/3/96 5:53	17050	18.965	19.931	33.762	19.271	21.069	20.776
10/3/96 6:03	17060	18.965	19.940	33.762	19.289	21.084	20.782
10/3/96 6:13	17070	18.981	19.945	33.762	19.289	21.053	20.788
10/3/96 6:23	17080	18.981	19.950	33.762	19.302	21.100	20.801
10/3/96 6:33	17090	18.997	19.959	33.762	19.308	21.116	20.807
10/3/96 6:43	17100	18.997	19.969	33.762	19.315	21.116	20.814
10/3/96 6:53	17110	18.997	19.969	33.762	19.321	21.132	20.814
10/3/96 7:03	17120	19.013	19.978	33.762	19.327	21.116	20.820
10/3/96 7:13	17130	18.997	19.974	33.762	19.327	21.132	20.826
10/3/96 7:23	17140	19.013	19.978	33.762	19.327	21.116	20.820
10/3/96 7:33	17150	18.997	19.978	33.762	19.327	21.132	20.826
10/3/96 7:43	17160	18.997	19.974	33.762	19.321	21.116	20.820
10/3/96 7:53	17170	19.013	19.978	33.762	19.327	21.132	20.826
10/3/96 8:03	17180	18.965	19.945	33.762	19.302	21.100	20.788
10/3/96 8:13	17190	18.950	19.936	33.762	19.296	21.069	20.782
10/3/96 8:23	17200	18.934	19.926	33.762	19.283	21.069	20.776
10/3/96 8:33	17210	18.934	19.926	33.762	19.283	21.053	20.769
10/3/96 8:43	17220	18.950	19.926	33.762	19.289	21.084	20.776
10/3/96 8:53	17230	18.934	19.912	33.762	19.271	21.037	20.763
10/3/96 9:03	17240	18.934	19.912	33.762	19.277	21.069	20.763
10/3/96 9:13	17250	18.918	19.907	33.762	19.264	21.022	20.757
10/3/96 9:23	17260	18.918	19.897	33.762	19.271	21.069	20.757
10/3/96 9:33	17270	18.934	19.907	33.762	19.264	21.037	20.757
10/3/96 9:43	17280	18.918	19.902	33.762	19.264	21.069	20.757
10/3/96 9:53	17290	18.918	19.897	33.762	19.258	21.037	20.744
10/3/96 10:03	17300	18.918	19.893	33.762	19.252	21.022	20.744
10/3/96 10:13	17310	18.902	19.878	33.762	19.239	21.006	20.725
10/3/96 10:23	17320	18.886	19.864	33.762	19.220	20.990	20.712
10/3/96 10:33	17330	18.902	19.869	33.762	19.233	21.022	20.719

Date and Time	Minutes	Well ID 62G	65G	66G	67G	INT2	INT3
10/3/96 10:43	17340	18.886	19.874	33.762	19.239	20.990	20.725
10/3/96 10:53	17350	18.886	19.869	33.762	19.227	20.990	20.712
10/3/96 11:03	17360	18.870	19.864	33.762	19.227	21.006	20.712
10/3/96 11:13	17370	18.870	19.855	33.762	19.208	20.959	20.700
10/3/96 11:23	17380	18.870	19.855	33.762	19.214	21.006	20.706
10/3/96 11:33	17390	18.870	19.850	33.762	19.214	21.006	20.700
10/3/96 11:43	17400	18.854	19.840	33.762	19.201	20.959	20.687
10/3/96 11:53	17410	18.854	19.831	33.762	19.189	20.974	20.674
10/3/96 12:03	17420	18.854	19.826	33.762	19.189	20.974	20.674
10/3/96 12:13	17430	18.839	19.817	33.762	19.176	20.990	20.662
10/3/96 12:23	17440	18.839	19.817	33.762	19.176	20.943	20.668
10/3/96 12:33	17450	18.823	19.807	33.762	19.170	20.927	20.656
10/3/96 12:43	17460	18.823	19.802	33.762	19.164	20.959	20.649
10/3/96 12:53	17470	18.807	19.793	33.762	19.157	20.911	20.643
10/3/96 13:03	17480	18.823	19.802	33.762	19.164	20.927	20.656
10/3/96 13:13	17490	18.807	19.793	33.762	19.145	20.943	20.643
10/3/96 13:23	17500	18.807	19.788	33.762	19.145	20.896	20.643
10/3/96 13:33	17510	18.807	19.783	33.762	19.145	20.896	20.637
10/3/96 13:43	17520	18.823	19.788	33.762	19.151	20.943	20.643
10/3/96 13:53	17530	18.823	19.797	33.762	19.157	20.959	20.649
10/3/96 14:03	17540	18.791	19.788	33.762	19.145	20.927	20.643
10/3/96 14:13	17550	18.807	19.783	33.762	19.145	20.911	20.637
10/3/96 14:23	17560	18.807	19.783	33.762	19.138	20.943	20.637
10/3/96 14:33	17570	18.791	19.774	33.762	19.138	20.927	20.630
10/3/96 14:43	17580	18.045	19.350	33.762	18.365	19.841	19.979
10/3/96 14:53	17590	17.680	18.983	33.762	17.937	19.432	19.537
10/3/96 15:03	17600	17.538	18.821	33.762	17.773	19.275	19.379
10/3/96 15:13	17610	17.442	18.716	33.762	17.679	19.181	19.284
10/3/96 15:23	17620	17.379	18.649	33.762	17.609	19.118	19.221
10/3/96 15:33	17630	17.331	18.592	33.762	17.559	19.055	19.170
10/3/96 15:43	17640	17.284	18.549	33.762	17.521	19.023	19.132
10/3/96 15:53	17650	17.252	18.516	33.762	17.484	18.976	19.100
10/3/96 16:03	17660	17.220	18.487	33.762	17.458	18.960	19.075
10/3/96 16:13	17670	17.204	18.464	33.762	17.433	18.929	19.050
10/3/96 16:23	17680	17.188	18.440	33.762	17.414	18.913	19.031
10/3/96 16:33	17690	17.157	18.416	33.762	17.389	18.882	19.006
10/3/96 16:43	17700	17.141	18.397	33.762	17.377	18.866	18.993
10/3/96 16:53	17710	17.125	18.383	33.762	17.358	18.850	18.974
10/3/96 17:03	17720	17.109	18.368	33.762	17.345	18.850	18.961
10/3/96 17:13	17730	17.093	18.354	33.762	17.333	18.834	18.949
10/3/96 17:23	17740	17.077	18.344	33.762	17.320	18.819	18.942
10/3/96 17:33	17750	17.077	18.330	33.762	17.307	18.803	18.930
10/3/96 17:43	17760	17.062	18.321	33.762	17.301	18.803	18.917
10/3/96 17:53	17770	17.046	18.311	33.762	17.288	18.787	18.904
10/3/96 18:03	17780	17.046	18.302	33.762	17.282	18.772	18.898
10/3/96 18:13	17790	17.030	18.292	33.762	17.276	18.772	18.892
10/3/96 18:23	17800	17.030	18.287	33.762	17.270	18.756	18.885

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10/3/96 18:33	17810	17.030	18.283	33.762	17.263	18.756	18.879
10/3/96 18:43	17820	17.030	18.278	33.762	17.257	18.756	18.873
10/3/96 18:53	17830	17.014	18.273	33.762	17.251	18.740	18.867
10/3/96 19:03	17840	17.014	18.263	33.762	17.244	18.740	18.860
10/3/96 19:13	17850	16.998	18.254	33.762	17.238	18.724	18.854
10/3/96 19:23	17860	16.998	18.249	33.762	17.232	18.724	18.848
10/3/96 19:33	17870	16.998	18.244	33.762	17.232	18.724	18.848
10/3/96 19:43	17880	16.998	18.244	33.762	17.226	18.709	18.841
10/3/96 19:53	17890	16.982	18.240	33.762	17.219	18.709	18.835
10/3/96 20:03	17900	16.982	18.230	33.762	17.213	18.709	18.835
10/3/96 20:13	17910	16.966	18.225	33.762	17.207	18.693	18.829
10/3/96 20:23	17920	16.966	18.221	33.762	17.200	18.693	18.822
10/3/96 20:33	17930	16.966	18.216	33.762	17.200	18.693	18.816
10/3/96 20:43	17940	16.966	18.211	33.762	17.194	18.677	18.816
10/3/96 20:53	17950	16.950	18.206	33.762	17.194	18.677	18.810
10/3/96 21:03	17960	16.950	18.206	33.762	17.188	18.677	18.810
10/3/96 21:13	17970	16.950	18.206	33.762	17.188	18.677	18.803
10/3/96 21:23	17980	16.950	18.202	33.762	17.188	18.661	18.803
10/3/96 21:33	17990	16.935	18.197	33.762	17.182	18.661	18.797
10/3/96 21:43	18000	16.935	18.192	33.762	17.175	18.661	18.791
10/3/96 21:53	18010	16.935	18.187	33.762	17.175	18.661	18.791
10/3/96 22:03	18020	16.935	18.187	33.762	17.175	18.646	18.791
10/3/96 22:13	18030	16.935	18.182	33.762	17.169	18.646	18.784
10/3/96 22:23	18040	16.919	18.178	33.762	17.163	18.646	18.778
10/3/96 22:33	18050	16.935	18.173	33.762	17.163	18.646	18.778
10/3/96 22:43	18060	16.919	18.173	33.762	17.163	18.646	18.778
10/3/96 22:53	18070	16.919	18.168	33.762	17.150	18.630	18.772
10/3/96 23:03	18080	16.903	18.163	33.762	17.150	18.630	18.765
10/3/96 23:13	18090	16.903	18.159	33.762	17.150	18.630	18.765
10/3/96 23:23	18100	16.919	18.159	33.762	17.144	18.630	18.765
10/3/96 23:33	18110	16.903	18.154	33.762	17.144	18.614	18.759
10/3/96 23:43	18120	16.903	18.149	33.762	17.137	18.614	18.753
10/3/96 23:53	18130	16.887	18.144	33.762	17.131	18.614	18.753
10/4/96 0:03	18140	16.887	18.140	33.762	17.125	18.598	18.746
10/4/96 0:13	18150	16.887	18.135	33.762	17.125	18.598	18.740
10/4/96 0:23	18160	16.887	18.135	33.762	17.125	18.598	18.740
10/4/96 0:33	18170	16.887	18.130	33.762	17.119	18.598	18.740
10/4/96 0:43	18180	16.887	18.125	33.762	17.119	18.598	18.734
10/4/96 0:53	18190	16.871	18.121	33.762	17.112	18.583	18.727
10/4/96 1:03	18200	16.871	18.116	33.762	17.106	18.583	18.721
10/4/96 1:13	18210	16.855	18.111	33.762	17.106	18.583	18.721
10/4/96 1:23	18220	16.855	18.111	33.762	17.100	18.583	18.715
10/4/96 1:33	18230	16.855	18.106	33.762	17.093	18.567	18.715
10/4/96 1:43	18240	16.855	18.101	33.762	17.093	18.567	18.708
10/4/96 1:53	18250	16.855	18.097	33.762	17.087	18.567	18.702
10/4/96 2:03	18260	16.839	18.092	33.762	17.087	18.551	18.702
10/4/96 2:13	18270	16.855	18.092	33.762	17.087	18.551	18.702

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10/4/96 2:23	18280	16.839	18.092	33.762	17.081	18.551	18.696
10/4/96 2:33	18290	16.839	18.097	33.762	17.081	18.551	18.702
10/4/96 2:43	18300	16.839	18.092	33.762	17.081	18.551	18.702
10/4/96 2:53	18310	16.855	18.092	33.762	17.081	18.551	18.702
10/4/96 3:03	18320	16.839	18.087	33.762	17.081	18.551	18.696
10/4/96 3:13	18330	16.839	18.087	33.762	17.075	18.551	18.696
10/4/96 3:23	18340	16.839	18.082	33.762	17.075	18.551	18.696
10/4/96 3:33	18350	16.839	18.082	33.762	17.075	18.551	18.689
10/4/96 3:43	18360	16.824	18.078	33.762	17.068	18.551	18.689
10/4/96 3:53	18370	16.839	18.078	33.762	17.068	18.535	18.689
10/4/96 4:03	18380	16.824	18.078	33.762	17.075	18.551	18.689
10/4/96 4:13	18390	16.839	18.082	33.762	17.075	18.535	18.689
10/4/96 4:23	18400	16.824	18.082	33.762	17.068	18.535	18.689
10/4/96 4:33	18410	16.839	18.082	33.762	17.075	18.551	18.689
10/4/96 4:43	18420	16.839	18.082	33.762	17.075	18.551	18.696
10/4/96 4:53	18430	16.839	18.087	33.762	17.081	18.551	18.696
10/4/96 5:03	18440	16.839	18.082	33.762	17.075	18.535	18.696
10/4/96 5:13	18450	16.839	18.082	33.762	17.075	18.551	18.696
10/4/96 5:23	18460	16.839	18.082	33.762	17.075	18.551	18.696
10/4/96 5:33	18470	16.839	18.082	33.762	17.075	18.535	18.689
10/4/96 5:43	18480	16.824	18.078	33.762	17.075	18.535	18.689
10/4/96 5:53	18490	16.839	18.082	33.762	17.075	18.535	18.689
10/4/96 6:03	18500	16.824	18.078	33.762	17.075	18.535	18.689
10/4/96 6:13	18510	16.824	18.078	33.762	17.075	18.535	18.689
10/4/96 6:23	18520	16.839	18.087	33.762	17.081	18.535	18.696
10/4/96 6:33	18530	16.824	18.082	33.762	17.075	18.535	18.689
10/4/96 6:43	18540	16.824	18.082	33.762	17.075	18.535	18.683
10/4/96 6:53	18550	16.824	18.082	33.762	17.081	18.535	18.689
10/4/96 7:03	18560	16.824	18.082	33.762	17.081	18.535	18.689
10/4/96 7:13	18570	16.776	18.040	33.762	17.043	18.488	18.645
10/4/96 7:23	18580	16.871	18.125	33.762	17.125	18.583	18.740
10/4/96 7:33	18590	16.839	18.097	33.762	17.093	18.551	18.702
10/4/96 7:43	18600	16.839	18.092	33.762	17.087	18.551	18.702
10/4/96 7:53	18610	16.824	18.082	33.762	17.081	18.551	18.689
10/4/96 8:03	18620	16.824	18.082	33.762	17.081	18.535	18.689
10/4/96 8:13	18630	16.824	18.078	33.762	17.081	18.535	18.689
10/4/96 8:23	18640	16.824	18.078	33.762	17.075	18.535	18.677
10/4/96 8:33	18650	16.824	18.068	33.762	17.068	18.535	18.677
10/4/96 8:43	18660	16.808	18.063	33.762	17.062	18.535	18.677
10/4/96 8:53	18670	16.808	18.068	33.762	17.068	18.520	18.677
10/4/96 9:03	18680	16.808	18.063	33.762	17.062	18.520	18.670
10/4/96 9:13	18690	16.808	18.059	33.762	17.056	18.520	18.664
10/4/96 9:23	18700	16.808	18.054	33.762	17.056	18.520	18.664
10/4/96 9:33	18710	16.808	18.049	33.762	17.049	18.520	18.658
10/4/96 9:43	18720	16.792	18.049	33.762	17.049	18.504	18.658
10/4/96 9:53	18730	16.808	18.044	33.762	17.043	18.504	18.652
10/4/96 10:03	18740	16.808	18.049	33.762	17.049	18.520	18.658

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				Well ID			
10/4/96 10:13	18750	16.792	18.040	33.762	17.049		18.652
10/4/96 10:23	18760	16.792	18.035	33.762	17.037		
10/4/96 10:33	18770	16.792	18.035	33.762	17.037		
10/4/96 10:43	18780	16.728	18.025	33.762	16.986		
10/4/96 10:53	18790	16.776	18.020	33.762	17.018		
10/4/96 11:03	18800	16.776	18.020	33.762	17.024		
10/4/96 11:13	18810	16.760	18.011	33.762	17.012		
10/4/96 11:23	18820	16.776	18.011	33.762	17.012		
10/4/96 11:33	18830	16.760	18.001	33.762	17.005		
10/4/96 11:43	18840	16.760	17.997	33.762	16.999		
10/4/96 11:53	18850	16.744	17.992	33.762	16.993		
10/4/96 12:03	18860	16.744	17.982	33.762	16.986		
10/4/96 12:13	18870	16.728	17.978	33.762	16.974		

APPENDIX I

Solubilization Test and PITT-2 Ground-Water Quality Data

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Surfactant Flood and Partitioning Interwell Tracer Test 2 - Well BW2G
Extraction Data, Groundwater Quality - September 21 - 30, 1996

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)	Adjusted redox
9/21/96 11:00	14.49	5.56	573	1.1	0.11	180	430
9/21/96 12:00	14.59	5.55	163	1.3	0.13	187	437
9/21/96 13:00	14.61	5.54	332	1.3	0.13	181	431
9/21/96 14:00	14.59	5.33	100	1.3	0.13	182	432
9/21/96 15:00	14.54	5.34	370	1.3	0.14	163	413
9/21/96 16:00	14.50	5.53	332	2.0	0.20	158	408
9/21/96 17:00	14.49	5.54	551	2.9	0.30	161	411
9/21/96 18:00	14.43	5.53	79	3.6	0.37	168	418
9/21/96 19:00	14.40	5.53	542	4.8	0.49	175	425
9/21/96 20:00	14.41	5.53	289	5.9	0.61	181	431
9/21/96 21:00	14.41	5.54	569	7.0	0.72	185	435
9/21/96 22:00	14.42	5.54	623	7.9	0.81	190	440
9/21/96 23:00	14.44	5.46	332	8.7	0.88	194	444
9/22/96 0:00	14.43	5.55	783	9.7	0.99	196	446
9/22/96 1:00	14.43	5.45	140	10.7	1.09	204	454
9/22/96 2:00	14.40	5.55	944	10.8	1.10	200	450
9/22/96 3:00	14.41	5.48	503	11.4	1.16	204	454
9/22/96 4:00	14.41	5.55	1061	11.4	1.16	203	453
9/22/96 5:00	14.43	5.56	1112	11.7	1.19	203	453
9/22/96 6:00	14.47	5.55	1164	12.2	1.23	203	453
9/22/96 7:00	14.51	5.55	1251	12.1	1.22	203	453
9/22/96 8:00	14.56	5.55	1307	12.6	1.27	205	455
9/22/96 9:00	14.60	5.56	1295	12.4	1.26	203	453
9/22/96 10:00	14.75	5.56	332	12.7	1.29	207	457
9/22/96 11:00	14.82	5.55	1361	13.2	1.33	209	459
9/22/96 12:00	14.88	5.54	496	13.4	1.36	206	456
9/22/96 13:00	15.01	5.50	454	13.7	1.38	208	458
9/22/96 14:00	15.01	5.53	1306	13.5	1.35	205	455
9/22/96 15:00	15.04	5.49	650	14.4	1.45	207	457
9/22/96 16:00	15.04	5.51	1743	13.9	1.39	206	456
9/22/96 17:00	15.10	5.49	1852	14.9	1.49	208	458
9/22/96 18:00	15.11	5.48	2004	15.5	1.55	209	459
9/22/96 19:00	15.07	5.49	1128	15.1	1.52	208	458
9/22/96 20:00	15.00	5.49	985	15.2	1.53	209	459
9/22/96 21:00	14.94	5.53	1357	15.4	1.54	207	457
9/22/96 22:00	14.92	5.54	311	16.2	1.63	208	458
9/22/96 23:00	14.92	5.56	2231	16.7	1.68	208	458
9/23/96 0:00	14.95	5.56	2233	16.7	1.67	209	459
9/23/96 1:00	14.98	5.56	1790	17.2	1.73	211	461
9/23/96 2:00	15.02	5.53	604	17.5	1.76	215	465
9/23/96 3:00	14.97	5.56	2245	17.5	1.75	212	462
9/23/96 4:00	14.99	5.53	522	18.2	1.83	214	464

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)	Adjusted redox
9/23/96 5:00	14.99	5.55	2443	20.4	2.04	214	464
9/23/96 6:00	15.02	5.53	523	21.5	2.17	218	468
9/23/96 7:00	15.01	5.55	2512	21.3	2.13	216	466
9/23/96 8:00	15.09	5.55	2531	19.5	1.94	217	467
9/23/96 9:00	15.23	5.54	2470	19.4	1.93	220	470
9/23/96 10:00	15.39	5.54	1776	20.0	1.98	222	472
9/23/96 11:00	15.41	5.52	2167	19.6	1.95	221	471
9/23/96 12:00	15.55	5.47	759	20.0	1.99	227	477
9/23/96 13:00	15.62	5.44	1126	20.0	1.98	228	478
9/23/96 14:00	15.64	5.43	283	19.7	1.96	230	480
9/23/96 15:00	15.66	5.43	2020	20.5	2.02	228	478
9/23/96 16:00	15.68	5.39	436	19.9	1.98	229	479
9/23/96 17:00	15.63	5.42	2078	20.2	1.99	226	476
9/23/96 18:00	15.60	5.40	1431	20.3	2.01	226	476
9/23/96 18:30	15.59	5.39	941	20.6	2.05	225	475
9/23/96 19:30	15.50	5.41	1065	20.9	2.08	222	472
9/23/96 20:30	15.48	5.42	1274	21.3	2.11	219	469
9/23/96 21:30	15.45	5.46	327	21.2	2.12	215	465
9/23/96 22:30	15.49	5.52	1971	21.4	2.12	211	461
9/23/96 23:30	15.53	5.52	2170	22.0	2.18	211	461
9/24/96 0:30	15.57	5.49	1806	22.3	2.21	210	460
9/24/96 1:30	15.60	5.52	1501	22.3	2.21	210	460
9/24/96 2:30	15.63	5.51	1565	22.8	2.25	210	460
9/24/96 3:30	15.63	5.50	1472	22.6	2.23	210	460
9/24/96 4:30	15.68	5.52	1356	23.2	2.30	210	460
9/24/96 5:30	15.69	5.51	2136	23.4	2.31	211	461
9/24/96 6:30	15.70	5.50	343	23.5	2.34	211	461
9/24/96 7:30	15.73	5.51	1579	24.2	2.39	211	461
9/24/96 8:30	15.71	5.50	2096	23.6	2.33	211	461
9/24/96 9:30	15.79	5.50	2002	24.5	2.41	212	462
9/24/96 10:30	15.83	5.48	225	24.5	2.42	213	463
9/24/96 11:30	15.94	5.50	2110	25.1	2.46	214	464
9/24/96 12:30	15.95	5.49	1663	24.5	2.40	215	465
9/24/96 13:30	15.93	5.46	379	24.2	2.39	218	468
9/24/96 14:30	16.02	5.42	413	25.3	2.50	222	472
9/24/96 15:30	16.02	5.42	2085	24.9	2.44	222	472
9/24/96 16:30	16.00	5.40	1671	25.1	2.47	224	474
9/24/96 17:30	15.97	5.38	1372	24.8	2.44	226	476
9/24/96 18:30	15.93	5.42	1588	25.2	2.48	223	473
9/24/96 19:30	15.89	5.43	2032	25.3	2.48	222	472
9/24/96 20:30	15.88	5.46	2067	25.6	2.52	220	470
9/24/96 21:30	15.80	5.48	1628	25.3	2.50	218	468
9/24/96 22:30	15.78	5.54	2068	25.6	2.52	214	464
9/24/96 23:30	15.81	5.53	2071	27.9	2.74	213	463
9/25/96 0:30	15.82	5.53	2018	28.0	2.76	213	463
9/25/96 1:30	15.77	5.51	1200	25.7	2.54	215	465
9/25/96 2:30	15.74	5.55	2165	25.6	2.53	212	462

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)	Adjusted redox
9/25/96 3:30	15.73	5.55	443	25.6	2.54	216	466
9/25/96 4:30	15.72	5.54	3550	25.5	2.50	212	462
9/25/96 5:30	15.74	5.52	1120	25.8	2.55	214	464
9/25/96 6:30	15.73	5.52	1940	25.2	2.49	215	465
9/25/96 7:30	15.74	5.54	2051	24.6	2.42	216	466
9/25/96 8:30	15.79	5.55	1947	23.8	2.34	220	470
9/25/96 9:30	15.94	5.50	400	23.3	2.30	229	479
9/25/96 10:30	15.99	5.53	285	22.1	2.18	235	485
9/25/96 11:30	16.04	5.53	1696	21.7	2.12	235	485
9/25/96 12:30	16.08	5.49	1046	20.7	2.03	240	490
9/25/96 13:30	16.07	5.49	255	20.0	1.97	239	489
9/25/96 14:30	16.11	5.44	342	19.6	1.93	244	494
9/25/96 15:30	16.08	5.43	1230	19.2	1.89	244	494
9/25/96 16:30	16.05	5.44	1413	18.5	1.82	241	491
9/25/96 17:30	16.05	5.43	1381	18.2	1.79	240	490
9/25/96 18:30	15.96	5.44	1319	17.8	1.75	238	488
9/25/96 19:30	15.85	5.48	1344	17.5	1.72	233	483
9/25/96 20:30	15.77	5.53	1285	17.2	1.70	229	479
9/25/96 21:30	15.71	5.40	286	16.8	1.67	230	480
9/25/96 22:30	15.72	5.56	1250	16.9	1.68	225	475
9/25/96 23:30	15.65	5.54	1176	16.1	1.59	227	477
9/26/96 0:30	15.66	5.55	1218	16.1	1.60	224	474
9/26/96 1:30	15.64	5.55	1176	15.9	1.58	224	474
9/26/96 2:30	15.65	5.55	247	15.8	1.57	231	481
9/26/96 3:30	15.65	5.52	825	15.2	1.51	225	475
9/26/96 4:30	15.65	5.54	1104	15.0	1.49	223	473
9/26/96 5:30	15.67	5.53	1107	14.8	1.46	224	474
9/26/96 6:30	15.65	5.54	1087	14.5	1.44	223	473
9/26/96 7:30	15.69	5.51	309	14.5	1.44	227	477
9/26/96 8:30	15.71	5.43	515	14.3	1.42	231	481
9/26/96 9:30	15.71	5.53	1058	13.9	1.37	223	473
9/26/96 10:30	15.68	5.54	675	13.4	1.33	224	474
9/26/96 11:30	15.81	5.50	711	13.1	1.29	230	480
9/26/96 12:30	15.84	5.51	1017	12.8	1.26	224	474
9/26/96 13:30	15.89	5.50	716	12.5	1.24	225	475
9/26/96 14:30	15.92	5.45	173	12.1	1.19	228	478
9/26/96 15:30	16.03	5.40	980	12.0	1.18	230	480
9/26/96 16:30	15.97	5.38	333	11.5	1.14	230	480
9/26/96 17:30	15.96	5.37	900	11.0	1.08	229	479
9/26/96 18:30	15.89	5.37	187	10.9	1.08	230	480
9/26/96 19:30	15.83	5.34	450	10.6	1.04	232	482
9/26/96 20:30	15.79	5.31	143	10.1	1.00	231	481
9/27/96 2:30	15.75	5.45	1048	10.5	1.03	218	468
9/27/96 3:30	15.74	5.43	332	10.3	1.02	218	468
9/27/96 4:30	15.76	5.43	155	10.6	1.05	219	469
9/27/96 5:30	15.77	5.42	589	10.7	1.06	221	471
9/27/96 6:30	15.74	5.44	1117	10.8	1.07	216	466

Date and Time	Temp (°C)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)	Adjusted redox
9/27/96 7:30	15.76	5.41	344	11.2	1.11	220	470
9/27/96 8:30	15.77	5.44	1121	11.4	1.13	215	465
9/27/96 9:30	15.77	5.45	1122	11.5	1.13	214	464
9/27/96 10:30	15.83	5.45	1140	11.7	1.15	214	464
9/27/96 11:30	15.90	5.45	1144	12.1	1.19	214	464
9/27/96 12:30	15.91	5.44	870	12.3	1.21	215	465
9/27/96 13:30	15.92	5.44	1162	12.8	1.26	214	464
9/27/96 14:30	15.91	5.45	1161	12.7	1.25	214	464
9/27/96 15:30	15.92	5.45	1135	13.1	1.29	215	465
9/27/96 16:30	15.95	5.44	1150	13.2	1.30	215	465
9/27/96 17:30	15.95	5.45	650	13.6	1.34	213	463
9/27/96 18:30	15.91	5.41	262	13.5	1.34	215	465
9/27/96 19:30	15.93	5.46	1159	13.9	1.37	212	462
9/27/96 20:30	15.90	5.45	342	13.7	1.35	211	461
9/27/96 21:30	15.94	5.45	1166	14.2	1.40	211	461
9/27/96 22:30	15.92	5.46	685	14.3	1.41	212	462
9/27/96 23:30	15.96	5.45	1171	15.0	1.48	212	462
9/28/96 0:30	15.98	5.45	1179	15.1	1.49	212	462
9/28/96 1:30	16.01	5.45	1158	15.5	1.52	214	464
9/28/96 2:30	16.00	5.44	1133	15.5	1.52	215	465
9/28/96 3:30	15.98	5.44	144	15.5	1.53	213	463
9/28/96 8:30	15.88	5.50	328	14.6	1.44	215	465
9/28/96 9:30	15.92	5.52	517	14.2	1.40	215	465
9/28/96 10:30	15.90	5.51	745	13.8	1.36	218	468
9/28/96 11:30	15.90	5.50	161	14.1	1.39	215	465
9/28/96 12:30	15.90	5.53	923	13.4	1.32	215	465
9/28/96 13:30	15.88	5.52	909	13.1	1.30	216	466
9/28/96 14:30	15.88	5.53	415	12.6	1.24	216	466
9/28/96 15:30	15.87	5.52	759	12.4	1.22	216	466
9/28/96 16:30	15.89	5.53	596	12.2	1.20	216	466
9/28/96 17:30	15.92	5.52	872	11.8	1.16	217	467
9/28/96 18:30	15.89	5.52	890	11.6	1.14	217	467
9/28/96 19:30	15.82	5.51	890	11.2	1.10	216	466
9/28/96 20:30	15.80	5.51	874	11.1	1.09	217	467
9/28/96 21:30	15.77	5.50	198	10.5	1.04	216	466
9/28/96 22:30	15.71	5.51	821	10.3	1.02	216	466
9/28/96 23:30	15.69	5.51	818	9.8	0.97	215	465
9/29/96 0:30	15.70	5.48	825	9.7	0.96	215	465
9/29/96 1:30	15.65	5.51	847	9.1	0.90	215	465
9/29/96 7:30	15.58	5.50	818	7.9	0.79	214	464
9/29/96 8:30	15.60	5.50	485	8.5	0.84	216	466
9/29/96 9:30	15.64	5.48	509	7.6	0.75	215	465
9/29/96 10:30	15.68	5.51	648	7.0	0.69	214	464
9/29/96 12:30	15.74	5.51	167	7.1	0.70	214	464
9/29/96 13:30	15.81	5.50	780	6.6	0.65	214	464
9/29/96 14:30	15.77	5.48	333	6.1	0.60	215	465
9/29/96 15:30	15.79	5.45	486	6.0	0.59	217	467

Date and Time	Temp (ºC)	pH	SpCond (uS/cm)	DO (% Sat)	DO (mg/l)	Redox (mV)	Adjusted redox
9/29/96 16:30	15.78	5.49	743	5.7	0.56	214	464
9/29/96 17:30	15.76	5.46	473	5.5	0.55	215	465
9/29/96 18:30	15.71	5.46	417	5.1	0.51	213	463
9/29/96 19:30	15.60	5.48	504	4.9	0.49	212	462
9/29/96 20:30	15.54	5.51	747	4.8	0.48	209	459
9/29/96 23:30	15.49	5.49	431	4.1	0.41	208	458
9/30/96 0:30	15.48	5.51	715	3.8	0.38	206	456
9/30/96 1:30	15.47	5.52	144	3.5	0.35	205	455
9/30/96 2:30	15.46	5.48	286	3.1	0.31	207	457
9/30/96 3:30	15.46	5.52	688	3.1	0.31	205	455
9/30/96 4:30	15.48	5.51	715	2.9	0.29	204	454
9/30/96 7:30	15.50	5.51	365	2.6	0.26	204	454
9/30/96 8:30	15.48	5.49	241	2.2	0.22	205	455
9/30/96 9:30	15.53	5.51	696	2.2	0.22	203	453
9/30/96 10:30	15.67	5.51	686	2.2	0.22	204	454
9/30/96 11:30	15.80	5.50	87	2.0	0.20	207	457

APPENDIX J

Solubilization Test GC Analysis Results

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Surfactant Flood - Well INT1
Extraction Data - September 21 - 25, 1996

Results from SUNY Buffalo Analyses

Sample	Date	Time	Time since Injection	MA-80 conc. (%)	IPA (%)	TCE (mg/L)
INT 1-1	9/21/96	15:45	-0.57	0.039	0.00	0.00
INT 1-2	9/21/96	16:30	-0.54	0.036	0.00	184.30
INT 1-3	9/21/96	18:30	-0.46	0.036	0.00	164.46
INT 1-4	9/21/96	20:36	-0.37	0.019	0.00	143.88
INT 1-5	9/21/96	21:43	-0.32	0.026	0.00	141.46
INT 1-6	9/21/96	22:41	-0.28	0.023	0.00	136.12
INT 1-7	9/21/96	23:33	-0.25	0.029	0.00	122.82
INT 1-8	9/22/96	0:32	-0.21	0.029	0.00	117.48
INT 1-9	9/22/96	1:31	-0.17	0.028	0.00	98.49
INT 1-10	9/22/96	2:33	-0.12	0.029	0.00	99.57
INT 1-11	9/22/96	3:30	-0.08	0.029	0.00	89.01
INT 1-12	9/22/96	4:30	-0.04	0.031	0.00	88.03
INT 1-13	9/22/96	5:30	0.00	0.030	0.00	80.15
INT 1-14	9/22/96	6:29	0.04	0.032	0.00	83.95
INT 1-15	9/22/96	7:29	0.08	0.035	0.00	82.80
INT 1-16	9/22/96	8:30	0.13	0.353	0.44	59.63
INT 1-17	9/22/96	10:30	0.21	1.203	1.76	50.41
INT 1-18	9/22/96	11:30	0.25	1.729	2.20	48.86
INT 1-34	9/22/96	12:37	0.30	2.329	2.67	61.41
INT 1-35	9/22/96	13:40	0.34	2.831	2.88	78.98
INT 1-36	9/22/96	14:35	0.38	3.174	3.18	78.39
INT 1-37	9/22/96	15:33	0.42	3.456	3.28	90.35
INT 1-38	9/22/96	16:36	0.46	3.631	3.40	83.98
INT 1-39	9/22/96	16:37	0.46	2.991	3.42	81.16
INT 1-40	9/22/96	17:33	0.50	3.122	3.42	85.09
INT 1-41	9/22/96	18:35	0.55	3.209	3.59	71.55
INT 1-42	9/22/96	19:35	0.59	3.657	3.60	63.74
INT 1-43	9/22/96	20:37	0.63	3.951	3.68	67.84
INT 1-44	9/22/96	21:35	0.67	3.963	3.73	66.32
INT 1-45	9/22/96	22:35	0.71	4.009	3.68	64.35
INT 1-46	9/22/96	23:35	0.75	0.118	0.16	15.00
INT 1-47	9/23/96	0:36	0.80	4.141	3.81	60.51
INT 1-48	9/23/96	1:31	0.83	3.341	3.70	56.29
INT 1-49	9/23/96	2:31	0.88	3.406	3.12	49.00
INT 1-50	9/23/96	3:35	0.92	3.499	3.13	50.00
INT 1-51	9/23/96	4:33	0.96	4.279	3.47	56.85
INT 1-68	9/23/96	5:47	1.01	3.490	3.14	46.32
INT 1-69	9/23/96	6:46	1.05	3.471	3.12	49.08
INT 1-70	9/23/96	7:47	1.10	3.477	3.16	50.52
INT 1-71	9/23/96	8:42	1.13	4.237	3.51	41.87

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Surfactant Flood - Well INT1

Extraction Data - September 21 - 25, 1996

Results from SUNY Buffalo Analyses

Sample	Date	Time	Time since Injection	MA-80 conc. (%)	IPA (%)	TCE (mg/L)
INT 1-72	9/23/96	10:45	1.22	3.001	3.07	32.59
INT 1-73	9/23/96	12:46	1.30	2.036	3.01	31.69
INT 1-74	9/23/96	14:45	1.39	1.963	3.00	28.51
INT 1-84	9/23/96	16:45	1.47	1.896	3.82	24.73
INT 1-85	9/23/96	22:47	1.72	1.413	2.98	21.92
INT 1-86	9/24/96	2:46	1.89	0.747	1.51	18.02
INT 1-87	9/24/96	6:46	2.05	0.521	0.92	23.37
INT 1-88	9/24/96	10:44	2.22	0.420	0.56	13.45
INT 1-96	9/24/96	16:43	2.47	0.238	0.32	10.00
INT 1-97	9/24/96	16:43	2.47	0.230	0.31	13.94
INT 1-98	9/24/96	22:45	2.72	0.503	0.23	12.00
INT 1-99	9/25/96	4:45	2.97	0.742	0.15	13.33
INT 1-100	9/25/96	0:17	2.78	0.531	0.17	8.08
INT 1-101	9/25/96	0:17	2.78	0.535	0.16	8.33
INT 1-102	9/25/96	16:45	3.47	0.317	0.11	7.11
INT 1-103	9/25/96	22:45	3.72	0.208	0.08	5.96

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Surfactant Flood - Well BW2G
Extraction Data - September 21 - 26, 1996

Results from SUNY Buffalo Analyses

Sample	Date	Time	Time since Injection	MA-80 conc. (%)	IPA (%)	TCE (mg/L)
BW2G-1	9/21/96	15:40	-0.56	0	0	145.71
BW2G-2	9/21/96	16:27	-0.52	0	0	147.69
BW2G-3	9/21/96	18:33	-0.44	0	0	151.20
BW2G-4	9/21/96	20:35	-0.35	0	0	149.44
BW2G-5	9/21/96	21:41	-0.30	0	0	135.75
BW2G-6	9/21/96	22:40	-0.26	0	0	147.06
BW2G-7	9/21/96	23:32	-0.23	0	0	123.16
BW2G-8	9/22/96	0:35	-0.18	0	0	167.88
BW2G-9	9/22/96	1:30	-0.15	0	0	120.27
BW2G-10	9/22/96	2:30	-0.10	0	0	116.43
BW2G-11	9/22/96	3:29	-0.06	0.041	0	121.99
BW2G-12	9/22/96	4:29	-0.02	0.041	0	105.32
	9/22/96	5:00	0.00			
BW2G-13	9/22/96	5:29	0.02	0.035	0	104.36
BW2G-14	9/22/96	6:30	0.06	0.038	0	106.88
BW2G-15	9/22/96	7:30	0.10	0.044	0.00	98.00
BW2G-16	9/22/96	8:30	0.15	0.066	0.04	111.46
BW2G-17	9/22/96	10:28	0.23	0.138	0.18	88.21
BW2G-24	9/22/96	11:36	0.27	0.286	0.35	99.30
BW2G-34	9/22/96	12:33	0.31	0.322	0.44	95.64
BW2G-35	9/22/96	13:36	0.36	0.422	0.53	98.40
BW2G-36	9/22/96	14:31	0.40	0.468	0.58	105.37
BW2G-37	9/22/96	15:34	0.44	0.572	0.71	97.01
BW2G-38	9/22/96	16:33	0.48	0.599	0.72	98.22
BW2G-39	9/22/96	16:33	0.48	0.603	0.81	30.60
BW2G-40	9/22/96	17:32	0.52	0.457	0.90	102.61
BW2G-41	9/22/96	18:33	0.56	0.668	1.01	113.09
BW2G-42	9/22/96	19:31	0.60	0.731	1.07	103.66
BW2G-43	9/22/96	20:38	0.65	0.777	1.11	101.46
BW2G-44	9/22/96	21:35	0.69	0.882	1.19	100.13
BW2G-45	9/22/96	22:36	0.73	0.131	0.11	6.31
BW2G-46	9/22/96	23:35	0.77	0.937	1.28	97.43
BW2G-47	9/23/96	0:36	0.82	1.027	1.36	103.18
BW2G-48	9/23/96	1:30	0.85	0.989	1.33	94.59
BW2G-49	9/23/96	2:30	0.90	1.007	1.36	94.05
BW2G-50	9/23/96	3:36	0.94	1.002	1.41	93.80
BW2G-51	9/23/96	4:37	0.98	1.082	1.48	93.29
BW2G-52	9/23/96	5:46	1.03	0.976	1.26	87.14
BW2G-69	9/23/96	6:42	1.07	1.052	1.27	77.43
BW2G-70	9/23/96	7:46	1.12	1.123	1.31	82.04

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Surfactant Flood - Well BW2G
Extraction Data - September 21 - 26, 1996

Results from SUNY Buffalo Analyses

Sample	Date	Time	Time since Injection	MA-80 conc. (%)	IPA (%)	TCE (mg/L)
BW2G-71	9/23/96	8:42	1.15	1.105	1.32	78.30
BW2G-72	9/23/96	9:40	1.19	1.101	1.41	79.62
BW2G-73	9/23/96	9:43	1.20	1.120	1.45	87.19
BW2G-74	9/23/96	10:47	1.24	1.095	1.49	77.82
BW2G-75	9/23/96	11:41	1.28	1.074	1.57	80.23
BW2G-76	9/23/96	12:43	1.32	1.023	1.63	81.44
BW2G-77	9/23/96	13:38	1.36	0.979	1.71	84.04
BW2G-89	9/23/96	14:43	1.40	0.942	1.78	78.29
BW2G-90	9/23/96	15:45	1.45	0.888	1.69	84.83
BW2G-91	9/23/96	16:45	1.49	0.842	1.47	75.05
BW2G-92	9/23/96	18:42	1.57	0.802	1.25	73.74
BW2G-93	9/23/96	20:44	1.66	0.725	1.08	73.18
BW2G-94	9/23/96	22:46	1.74	0.645	0.96	74.92
BW2G-95	9/24/96	0:43	1.82	0.609	0.86	70.52
BW2G-96	9/24/96	2:47	1.91	0.533	0.74	76.50
BW2G-97	9/24/96	4:43	1.99	0.443	0.68	72.06
BW2G-98	9/24/96	6:45	2.07	0.408	0.63	65.96
BW2G-99	9/24/96	8:43	2.15	0.381	0.59	69.70
BW2G-100	9/24/96	10:44	2.24	0.349	0.53	64.00
BW2G-101	9/24/96	12:43	2.32	0.333	0.48	69.81
BW2G-115	9/24/96	14:44	2.41	0.315	0.42	57.43
BW2G-116	9/24/96	16:46	2.49	0.304	0.45	66.73
BW2G-117	9/24/96	18:43	2.57	0.300	0.43	68.45
BW2G-118	9/24/96	20:44	2.66	0.313	0.42	57.43
BW2G-119	9/24/96	22:45	2.74	0.329	0.45	66.73
BW2G-120	9/25/96	0:45	2.82	0.342	0.43	68.45
BW2G-121	9/25/96	2:45	2.91	0.363		62.70
BW2G-122	9/25/96	4:45	2.99	0.364		66.26
BW2G-123	9/25/96	6:45	3.07	0.369		63.71
BW2G-124	9/25/96	8:43	3.15	0.366		73.08
BW2G-125	9/25/96	10:43	3.24	0.501		65.83
BW2G-126	9/25/96	10:43	3.24	0.303		67.77
BW2G-127	9/25/96	12:42	3.32	0.326		
BW2G-141	9/25/96	14:45	3.41	0.185		
BW2G-143	9/25/96	16:44	3.49	0.273		
BW2G-144	9/25/96	18:42	3.57	0.254		
BW2G-145	9/25/96	20:45	3.66	0.227		
BW2G-146	9/25/96	22:45	3.74	0.211		
BW2G-147	9/26/96	0:45	3.82	0.217		

APPENDIX K

Solubilization Test and PITT-2 Pumping Rate Data

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Surfactant Flood and Partitioning Interwell Tracer Test 2 - Well BW2G
Flow Rate Data - September 21 - October 3, 1996

Date	Time	Flow Total Begin	Flow Total End	Interval (sec)	Flow Rate (gpm)
09/21/96	17:45	2838.6	2843.7	60	5.1
09/21/96	19:18	3300.4	3305.4	60	5.0
09/21/96	20:45	3754.1	3764.1	120	5.0
09/21/96	23:30	4585.1	4590.0	60	5.0
09/22/96		4950.0	4955.2	60	5.2
09/22/96	2:28	5484.4	5489.5	60	5.1
09/22/96	4:30	6110.1	6115.2	60	5.1
09/22/96	6:30	6724.5	6729.7	60	5.2
09/22/96	8:56	7479.7	7484.7	60	5.0
09/22/96	13:27	8853.1	8858.1	60	5.0
09/22/96	14:02	9032.3	9037.3	60	4.9
09/22/96	16:50	9876.6	9881.7	60	5.1
09/22/96	18:23	10343.0	10348.0	60	5.0
09/22/96	20:48	11069.0	11074.1	60	5.1
09/22/96	21:40	11330.9	11336.2	60	5.3
09/22/96	22:35	11614.0	11619.2	60	5.2
09/22/96	23:35	11919.5	11924.7	60	5.2
09/23/96	1:35	12545.0	12550.2	60	5.2
09/23/96	2:35	12847.0	12852.2	60	5.2
09/23/96	7:45	14448.6	14453.0	60	4.4
09/23/96	16:03	17018.4	17028.5	120	5.0
09/23/96	16:51	17260.5	17265.7	60	5.2
09/23/96	17:26	17441.0	17446.3	60	5.3
09/23/96	18:18	17709.0	17714.3	60	5.3
09/23/96	19:20	18028.0	18033.2	60	5.2
09/23/96	22:46	19067.5	19072.6	60	5.1
09/24/96	0:53	19722.8	19728.0	60	5.2
09/24/96	2:39	20268.0	20273.2	60	5.2
09/24/96	4:43	20906.0	20911.1	60	5.1
09/24/96	6:43	21519.0	21524.1	60	5.1
09/24/96	8:38	22126.0	22131.2	60	5.2
09/24/96	14:02	22778.5	22783.6	60	5.1
09/24/96	17:31	24832.0	24837.1	60	5.1
09/24/96	20:44	25792.0	25797.1	60	5.1
09/24/96	22:16	26261.5	26266.2	60	4.7
09/25/96	0:47	27025.0	27030.2	60	5.2
09/25/96	4:34	28192.1	28197.2	60	5.1
09/25/96	6:58	28946.5	28951.6	60	5.1
09/25/96	8:37	29434.3	29439.6	60	5.3
09/25/96	8:41	29456.3	29461.4	60	5.1
09/25/96	12:59	30773.4	30778.5	60	5.1
09/25/96	18:30	32438.7	32443.8	60	5.1

Date	Time	Flow Total Begin	Flow Total End	Interval (sec)	Flow Rate (gpm)
09/25/96	22:10	33557.6	33563.1	60	5.5
09/26/96	2:44	34961.5	34966.7	60	5.2
09/26/96	4:47	35587.5	35592.7	60	5.2
09/26/96	6:45	36213.4	36218.5	60	5.1
09/26/96	8:45	36805.2	36810.3	60	5.1
09/26/96	10:58	37474.0	37479.1	60	5.1
09/26/96	12:54	38057.1	38062.2	60	5.1
09/26/96	15:33	38831.4	38836.5	60	5.1
09/26/96	18:14	39599.4	39604.5	60	5.1
09/26/96	20:15	40205.9	40210.6	60	4.7
09/26/96	22:15	40812.5	40817.5	60	5.0
09/27/96	0:15	41427.4	41432.2	60	4.8
09/27/96	2:15	41995.1	42000.0	60	4.9
09/27/96	4:15	42612.5	42617.3	60	4.8
09/27/96	5:55	43055.9	43060.8	60	4.9
09/27/96	10:03	44255.2	44259.7	60	4.5
09/27/96	10:11	44293.4	44298.2	60	4.8
09/27/96	10:12	44301.7	44306.3	60	4.6
09/27/96	10:14	44309.3	44314.3	60	5.0
09/27/96	10:40	44441.1	44446.0	60	4.9
09/27/96	11:33	44699.5	44704.2	60	4.7
09/27/96	12:48	45070.4	45075.4	60	5.0
09/27/96	14:49	45676.8	45681.7	60	4.9
09/27/96	16:33	46188.4	46193.3	60	4.9
09/27/96	18:28	46761.4	46766.4	60	5.0
09/27/96	20:30	47390.1	47395.2	60	5.1
09/27/96	22:30	48013.9	48018.8	60	4.9
09/28/96	0:45	48651.8	48656.7	60	4.9
09/28/96	2:30	49178.1	49183.2	60	5.1
09/28/96	4:30	49803.6	49808.7	60	5.1
09/28/96	6:30	50386.1	50391.1	60	5.0
09/28/96	8:30	50971.7	50976.8	60	5.1
09/28/96	10:25	51570.6	51575.6	60	5.0
09/28/96	12:28	52194.5	52199.6	60	5.1
09/28/96	14:30	52808.0	52813.1	60	5.1
09/28/96	16:33	53442.4	53447.9	60	5.5
09/28/96	20:30	54676.5	54681.8	60	5.3
09/29/96	0:45	55985.5	55990.6	60	5.1
09/29/96	4:45	57172.8	57178.0	60	5.2
09/29/96	8:42	58431.5	58436.9	60	5.4
09/29/96	8:44	58441.8	58447.0	60	5.2
09/29/96	10:32	59000.5	59005.6	60	5.1
09/29/96	12:23	59571.2	59576.3	60	5.1
09/29/96	14:32	60223.3	60228.3	60	5.0
09/29/96	16:35	60845.2	60850.2	60	5.0
09/29/96	18:38	61455.2	61460.3	60	5.1
09/29/96	20:38	62087.9	62093.0	60	5.1

Date	Time	Flow Total Begin	Flow Total End	Interval (sec)	Flow Rate (gpm)
09/29/96	22:38	62703.5	62708.7	60	5.2
09/30/96	0:45	63337.3	63342.4	60	5.1
09/30/96	2:45	63986.1	63991.5	60	5.4
09/30/96	6:35	65163.3	65168.6	60	5.3
09/30/96	8:33	65755.6	65760.6	60	5.0
09/30/96	10:26	66326.4	66331.5	60	5.1
09/30/96	12:27	66935.7	66940.5	60	4.8
09/30/96	14:26	67536.9	67542.0	60	5.1
09/30/96	16:25	68107.8	68112.8	60	5.0
09/30/96	18:30	68697.5	68702.4	60	4.9
09/30/96	22:35	69945.7	69950.6	60	4.9
10/01/96	4:45	71781.5	71786.6	60	5.1
10/01/96	8:45	72958.5	72964.3	60	5.8
10/01/96	10:45	73615.7	73620.8	60	5.1
10/01/96	12:45	74123.3	74128.2	60	4.9
10/01/96	15:54	75073.0	75077.9	60	4.9
10/01/96	18:00	75641.0	75646.0	60	5.0
10/01/96	22:02	76836.1	76841.1	60	5.0
10/02/96	0:04	77446.6	77451.6	60	5.0
10/02/96	2:00	78051.3	78056.3	60	5.0
10/02/96	4:40	78838.1	78843.1	60	5.0
10/02/96	7:10	79568.0	79573.0	60	5.0
10/02/96	8:11	79882.0	79887.1	60	5.1
10/02/96	9:55	80392.0	80397.0	60	5.0
10/02/96	12:00	81029.0	81034.1	60	5.1
10/02/96	14:35	81765.0	81769.7	60	4.7
10/02/96	18:00	82711.9	82716.7	60	4.8
10/02/96	22:02	83915.6	83920.6	60	5.0
10/03/96	1:49	85044.0	85049.0	60	5.0
10/03/96	4:11	85759.5	85764.5	60	5.0
10/03/96	5:58	86299.1	86304.2	60	5.1
10/03/96	7:10	86666.5	86671.7	60	5.2
10/03/96	8:00	86834.8	86840.0	60	5.2
10/03/96	10:00	87502.0	87507.1	60	5.1
10/03/96	12:00	88222.0	88227.3	60	5.2
10/03/96	14:25	88578.0	88583.0	60	5.0
10/03/96	15:00	89005.0	89010.0	60	5.0
10/03/96	16:00	89475.0	89480.0	60	5.0

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Surfactant Flood and Partitioning Interwell Tracer Test 2 - Well 66G
Flow Rate Data - September 21 - October 3, 1996

Date	Time	Flow Total Begin	Flow Total End	Interval (sec)	Flow Rate (gpm)
09/21/96	17:45	3435.0			3.03
09/21/96	18:20	3515.0			2.52
09/21/96	19:20	3654.0			1.60
09/21/96	19:42	3711.0			3.03
09/21/96	20:50				3.03
09/21/96	23:35	1966.7			3.03
09/22/96	0:39	2180.8			2.78
09/22/96	2:31	2472.2			2.65
09/22/96	4:35	2768.8			1.71
09/22/96	6:34	3116.5			3.03
09/22/96	8:57	3558.0			3.03
09/22/96	14:04	4450.4			2.91
09/22/96	16:53	4929.4			2.91
09/22/96	18:25	5189.3			2.91
09/22/96	20:51	5608.6			3.03
09/22/96	21:42	5758.8			3.03
09/22/96	22:37	5918.0			2.91
09/22/96	2338	6095.4			3.03
09/23/96	1:31	6425.8			2.91
09/23/96	2:31	6607.8			3.03
09/23/96	7:50	7579.6			3.03
09/23/96	16:07	9032.0			2.91
09/23/96	16:55	11612.8			2.78
09/23/96	17:28	9272.4			2.91
09/23/96	18:20	9423.9			2.91
09/23/96	22:48	1009.6			
09/24/96	0:56	10461.9			
09/24/96	2:40	10771.0			
09/24/96	4:46	1113.1			
09/24/96	6:43	11481.9			
09/24/96	8:40	11810.2			
09/24/96	14:05	12704.8			
09/24/96	17:32	13297.6			
09/24/96	20:46	13854.2			
09/24/96	22:17	14115.0			
09/25/96	0:48	14560.6			
09/25/96	4:35	15250.7			
09/25/96	6:59	15687.2			
09/25/96	8:50	18442.8	18445.7	60	2.90
09/25/96	12:58	19179.5			2.91
09/25/96	18:36	20170.1			2.91
09/25/96	22:13	18377.1			2.91
09/26/96	2:46	19166.9			2.91
09/26/96	4:48	19518.9			2.91
09/26/96	6:45	19900.9			3.03

Date	Time	Flow Total Begin	Flow Total End	Interval (sec)	Flow Rate (gpm)
09/26/96	8:45	20268.5			3.16
09/26/96	11:02	23115.8			3.03
09/26/96	12:56	23462.9			3.03
09/26/96	15:37	23954.1			2.91
09/26/96	16:34	24124.9	24127.8	60	2.90
09/26/96	18:16	24427.6	24430.6	60	3.00
09/26/96	20:15	24803.7	24806.6	60	2.90
09/26/96	21:15	22534.1	22537.0	60	2.90
09/26/96	22:15	22723.4	22726.8	60	3.40
09/26/96	23:15	22898.5	22901.4	60	2.90
09/27/96	0:15	23091.0	23093.9	60	2.90
09/27/96	1:15	23225.6	23228.5	60	2.90
09/27/96	2:15	23425.1	23428.0	60	2.90
09/27/96	4:15	23786.2			2.91
09/27/96	5:55	24052.1			3.03
09/27/96	6:55	24201.3			3.03
09/27/96	11:35	27459.6			2.91
09/27/96	12:49	27686.3			3.03
09/27/96	14:52	28050.2			3.03
09/27/96	16:34	25923.4			3.03
09/27/96	18:30	26269.0			3.03
09/27/96	20:30	26639.2			2.91
09/27/96	22:30	26997.2			2.91
09/28/96	0:45	27382.2			3.03
09/28/96	2:30	27694.3			2.91
09/28/96	4:30	28060.3			2.91
09/28/96	6:30	28395.6			3.03
09/28/96	8:30	28736.1		60	2.91
09/28/96	10:26	31520.8		60	3.03
09/28/96	12:28	31880.9		60	3.03
09/28/96	14:30	52803.5		60	3.03
09/28/96	16:32	32589.3		60	3.03
09/28/96	20:30	30885.9			3.16
09/29/96	0:45	316191.6			2.91
09/29/96	4:45	32317.5			3.03
09/29/96	8:45	35502.7			3.03
09/29/96	10:33	35827.6			3.03
09/29/96	12:24	36160.8			3.03
09/29/96	14:33	36546.2			2.91
09/29/96	16:37	36924.9			3.03
09/29/96	18:39	37297.2			3.03
09/29/96	20:40	37678.0			3.16
09/29/96	22:43	38045.0			3.03
09/30/96	0:45	38405.6			3.03
09/30/96	2:45	38787.0			3.03
09/30/96	6:35	39468.7			3.03
09/30/96	8:33	39815.5			3.03
09/30/96	10:26	40152.5			3.03
09/30/96	12:27	40515.7			3.03
09/30/96	14:28	40881.4			3.03

Date	Time	Flow Total Begin	Flow Total End	Interval (sec)	Flow Rate (gpm)
09/30/96	16:26	41233.1			2.91
09/30/96	18:31	41603.5			3.03
09/30/96	22:45	42357.6			3.03
10/01/96	4:45	43447.9			3.03
10/01/96	8:45	44156.8			3.03
10/01/96	10:45	44542.3			3.03
10/01/96	12:45	44851.6			3.03
10/01/96	15:54	45437.7			2.90
10/01/96	18:00	45801.8			3.03
10/01/96	22:00	46505.9	46508.0	60	3.03
10/02/96	0:06	46878.3	46881.3	60	3.00
10/02/96	2:00	47246.1	47249.1	60	3.00
10/02/96	4:43	47692.5	47695.4	60	2.90
10/02/96	7:12	48122.5	48125.5	60	3.00
10/02/96	8:13	48307.6	48310.6	60	3.00
10/02/96	9:57	48608.5	48611.5	60	3.00
10/02/96	12:00	48987.7	48990.6	60	2.90
10/02/96	14:35	49432.8	49435.8	60	3.00
10/02/96	18:00	50018.9	50021.9	60	3.00
10/02/96	22:05	50730.5	50733.4	60	2.90
10/03/96	1:51	51390.5	51393.4	60	2.90
10/03/96	4:13	51805.0	51807.9	60	2.90
10/03/96	6:00	52115.5	52118.4	60	2.90
10/03/96	7:12	52328.4	52331.4	60	3.00
10/03/96	10:00	52803.3	52806.2	60	2.90
10/03/96	12:15	53233.0	53236.0	60	3.00
10/03/96	14:25	53446.2	53449.2	60	3.00
10/03/96	15:00	53714.0	53717.1	60	3.10
10/03/96	16:00	54001.6	54004.6	60	3.00

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Surfactant Flood and Partitioning Interwell Tracer Test 2 - Well INT7
Flow Rate Data - September 21 - October 3, 1996

Date	Time	Flow Total Begin	Flow Total End	Interval (sec)	Flow Rate (gpm)
9/21/96	17:50	56830.0	56830.8	60	0.80
9/21/96	19:25	56916.0	56918.4	180	0.80
9/21/96	20:49	56974.5	56975.3	60	0.80
9/21/96	23:38	57100.0	57100.8	60	0.80
9/22/96	0:48	57150.3	57151.1	60	0.80
9/22/96	2:41	57231.7	57231.8	60	0.08
9/22/96	4:37	57328.8	57329.6	60	0.80
9/22/96	6:36	57458.8	57459.6	60	0.80
9/22/96	8:58	57508.0	57508.7	60	0.70
9/22/96	14:05	57721.0	57721.7	60	0.70
9/22/96	16:53	57854.5	57855.3	60	0.80
9/22/96	18:25	57926.0	57926.8	60	0.79
9/22/96	20:52	58048.5	58049.3	60	0.80
9/22/96	21:45	58089.5	58090.3	60	0.80
9/22/96	22:39	58124.0	58124.8	60	0.80
9/22/96	23:38	58170.6	58171.4	60	0.80
9/23/96	1:39	58266.0	58266.8	60	0.80
9/23/96	2:40	58311.2	58312.0	60	0.80
9/23/96	7:52	58555.5	58556.3	60	0.80
9/23/96	16:07	58930.5	58931.3	60	0.75
9/23/96	16:56	58966.1	58966.8	60	0.70
9/23/96	17:29	58990.1	58990.9	60	0.75
9/23/96	18:20	59034.1	59035.0	60	0.90
9/23/96	19:22	59085.0	59085.9	60	0.85
9/23/96	22:50	59258.7	59259.5	60	0.80
9/24/96	0:58	59347.0	59347.8	60	0.80
9/24/96	2:43	59438.5	59439.3	60	0.80
9/24/96	4:47	59538.5	59539.3	60	0.80
9/24/96	6:46	59624.0	59624.8	60	0.80
9/24/96	8:41	59717.1	59717.9	60	0.80
9/24/96	14:05	599702.8	599703.8	60	1.00
9/24/96	17:33	60129.8	60130.6	60	0.80
9/24/96	20:47	60278.5	60279.3	60	0.80
9/24/96	22:19	60334.5	60335.3	60	0.80
9/25/96	0:50	60441.0	60441.7	60	0.70
9/25/96	2:36	60624.5	60625.3	60	0.80
9/25/96	7:01	60737.2	60738.0	60	0.80
9/25/96	8:52	60819.6	60820.4	60	0.80
9/25/96	12:56	61005.7	61006.5	60	0.80
9/25/96	18:34	61258.2	61260.0	60	1.80
9/25/96	22:11	61419.8	61420.7	60	0.90
9/26/96	2:46	61615.5	61616.3	60	0.80
9/26/96	4:50	61704.0	61704.8	60	0.80
9/26/96	6:45	61789.9	61790.6	60	0.70
9/26/96	8:45	61872.5	61873.2	60	0.70

Date	Time	Flow Total Begin	Flow Total End	Interval (sec)	Flow Rate (gpm)
9/26/96	10:59	61963.1	61963.9	60	0.80
9/26/96	12:54	62042.9	62043.7	60	0.80
9/26/96	15:35	62156.8	62157.6	60	0.80
9/26/96	18:19	62273.9	62274.6	60	0.70
9/26/96	20:28	62365.0	62365.5	60	0.50
9/26/96	22:25	62520.5	62521.9	60	1.40
9/26/96	22:27	62524.5	62525.5	60	1.00
9/27/96	0:27	62604.6	62605.3	60	0.70
9/27/96	2:27	62680.0	62680.7	60	0.70
9/27/96	4:27	62757.2	62757.9	60	0.70
9/27/96	5:55	62804.5	62805.6	60	1.10
9/27/96	11:36	62994.5	62995.1	60	0.60
9/27/96	11:38	62995.8	62996.6	60	0.80
9/27/96	12:51	63046.7	63047.4	60	0.70
9/27/96	14:53	63130.5	63131.2	60	0.70
9/27/96	16:36	63215.9	63216.7	60	0.80
9/27/96	18:31	63310.2	63311.0	60	0.80
9/27/96	20:30	63412.0	63412.8	60	0.80
9/27/96	22:30	63508.0	63508.7	60	0.70
9/28/96	0:45	63612.2	63613.0	60	0.80
9/28/96	2:30	63694.0	63694.8	60	0.80
9/28/96	4:30	63789.3	63790.1	60	0.80
9/28/96	6:30	63877.5	63878.3	60	0.80
9/28/96	8:30	63963.9	63964.7	60	0.80
9/28/96	10:27	64051.4	64052.2	60	0.80
9/28/96	12:29	64141.7	64142.5	60	0.80
9/28/96	14:29	64239.2	64240.0	60	0.80
9/28/96	16:34	64322.8	64323.6	60	0.80
9/28/96	20:30	64502.5	64503.3	60	0.75
9/29/96	0:45	64689.0	64689.8	60	0.80
9/29/96	4:45	64855.7	64856.4	60	0.70
9/29/96	8:52	65048.1	65048.9	60	0.75
9/29/96	10:35	65110.8	65111.5	60	0.70
9/29/96	12:27	65189.5	65190.2	60	0.70
9/29/96	14:34	65280.7	65281.4	60	0.70
9/29/96	14:40	65284.4	65285.2	60	0.80
9/29/96	16:38	65387.5	65388.3	60	0.80
9/29/96	18:40	65492.2	65493.0	60	0.80
9/29/96	20:44	65600.0	65600.8	60	0.80
9/29/96	22:43	65701.2	65702.1	60	0.90
9/30/96	0:45	65801.5	65802.3	60	0.80
9/30/96	2:45	65906.5	65907.3	60	0.80
9/30/96	6:36	66095.5	66096.3	60	0.80
9/30/96	8:34	66198.6	66199.4	60	0.80
9/30/96	10:26	66279.9	66280.8	60	0.90
9/30/96	12:28	66379.1	66379.9	60	0.80
9/30/96	14:30	66477.9	66478.7	60	0.80
9/30/96	16:28	66573.6	66574.4	60	0.80
9/30/96	16:32	66674.5	66675.3	60	0.80
9/30/96	22:45	66882.8	66883.7	60	0.90

Date	Time	Flow Total Begin	Flow Total End	Interval (sec)	Flow Rate (gpm)
10/1/96	4:45	67182.5	67183.3	60	0.80
10/1/96	8:45	67377.5	67378.3	60	0.80
10/1/96	10:45	67480.7	67481.5	60	0.80
10/1/96	12:45	67564.5	67565.3	60	0.80
10/1/96	15:54	67723.7	67724.5	60	0.80
10/1/96	18:00	67822.0	67822.8	60	0.80
10/1/96	22:05	68012.5	68013.3	60	0.80
10/2/96	0:08	68119.5	68120.3	60	0.80
10/2/96	2:06	68221.6	68222.4	60	0.80
10/2/96	4:45	68324.5	68325.3	60	0.80
10/2/96	7:14	68447.5	68448.3	60	0.80
10/2/96	8:16	68487.0	68487.8	60	0.80
10/2/96		68566.0	68566.8	60	0.80
10/2/96	12:00	68665.5	68666.3	60	0.80
10/2/96	14:35	68784.5	68785.3	60	0.80
10/2/96	18:00	68941.6	68942.4	60	0.80
10/2/96	22:07	69132.0	69132.8	60	0.80
10/3/96	1:55	69307.0	69307.8	60	0.80
10/3/96	4:16	69416.6	69417.4	60	0.80
10/3/96	6:02	69497.6	69498.4	60	0.80
10/3/96	7:16	69553.5	69554.3	60	0.80
10/3/96	10:00	69686.5	69687.3	60	0.80
10/3/96	12:15	69781.5	69782.3	60	0.80
10/3/96	14:25	69833.0	69833.8	60	0.80
10/3/96	15:00	69900.0	69900.8	60	0.80
10/3/96	16:00	69979.0	69979.8	60	0.80

APPENDIX L

PITT-2 GC Analysis Results

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Surfactant Flood and PITT- 2 - Well 66G
GC Data for tracers and TCE - Septamber 26 - 28, 1996

9/26/96 66G

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
16	21:00	ND	579.43	579.43	160.45

9/27/96 66G

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
18	05:00	ND	574.40	592.57	164.01
20	13:00	ND	579.43	590.33	161.94
22	17:00	ND	577.63	588.13	160.86
24	21:00	ND	573.22	582.62	159.14

9/28/96 66G

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
26	09:00	ND	ND	1.60	3.94

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Surfactant Flood and PITT- 2 - Well BW2G
GC Data for tracers and TCE - Septamber 26 - October 3, 1996

9/26/96 Sample Number	BW2G Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
172	16:45	48.21	ND	0.79	ND
173	17:51	45.43	0.47	3.89	1.85
174	18:45	54.95	ND	0.99	0.35
176	20:45	53.86	11.28	8.65	0.81
178	22:45	52.99	37.96	31.43	3.72
179	22:45	53.79	39.34	31.02	4.16
180	23:45	37.25	48.87	39.53	4.73

9/27/96 Sample Number	BW2G Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
181	00:45	53.36	65.90	53.91	7.13
191	02:45	50.61	85.59	74.05	11.44
193	04:45	51.62	108.74	98.17	16.27
195	06:45	51.97	119.67	108.35	18.95
196	07:45	37.36	121.09	106.99	17.74
197	08:45	50.50	133.26	121.89	22.45
199	10:45	52.01	138.51	128.21	24.27
201	12:45	47.98	146.33	138.98	26.91
203	14:45	48.24	149.43	142.76	28.90
204	15:45	37.93	157.09	145.75	27.53
205	16:45	46.81	164.09	155.09	31.70
208	18:45	46.75	160.58	152.65	32.17
212	21:45	45.59	167.17	159.50	34.48

9/28/96 Sample Number	BW2G Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
215	0:45	44.32	178.20	170.94	37.19
229	2:45	35.32	163.54	164.04	33.97
230	3:45	45.91	151.39	161.83	40.90
233	6:45	44.87	112.29	134.42	40.95
236	9:45	44.32	86.50	103.22	35.77
239	12:45	36.28	65.76	77.85	26.04
254	15:45	36.76	57.04	65.10	21.89
256	18:45	37.09	47.59	53.84	18.01
258	22:45	35.58	38.83	43.81	13.61
259	22:45	36.49	41.24	46.44	14.44

9/29/96 BW2G

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
261	02:45	34.00	32.75	36.67	12.02
272	06:45	33.75	28.98	32.52	9.36
274	08:45	32.84	27.02	29.69	8.97
276	12:45	33.17	23.62	26.59	7.74
278	16:45	31.25	22.08	24.25	7.15
280	20:45	29.42	19.03	22.19	6.53

9/30/96 BW2G

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
282	00:45	32.02	17.18	19.78	5.74
293	04:45	33.92	15.74	17.83	3.48
296	08:45	33.09	14.66	16.55	4.57
302	12:45	35.58	13.91	15.35	4.40
304	16:45	32.82	13.03	14.63	4.26
305	22:45	35.26	12.00	13.28	3.93

10/1/96 BW2G

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
306	04:45	31.84	10.75	12.88	3.18
312	14:45	24.95	7.14	7.45	1.66

10/2/96 BW2G

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
321	05:00	32.96	7.74	9.04	2.30
324	11:00	31.52	6.95	9.38	2.15
326	17:00	32.03	6.50	7.44	1.85
328	23:00	32.41	6.07	7.12	1.92

10/3/96 BW2G

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
329	05:00	32.62	5.59	7.20	1.62
330	11:00	29.01	5.34	6.35	1.91
332	16:30	29.95	4.67	8.54	2.61

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Surfactant Flood and PITT- 2 - Well INT - 1
GC Data for tracers and TCE - Septamber 26 - October 3, 1996

9/26/96	INT1				
Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
106	16:45	4.92	0.00	0.61	0.90
119	18:45	4.32	0.00	0.00	0.39
121	20:45	4.12	54.67	39.23	3.74
123	22:45	4.24	226.21	178.93	22.14
124	22:45	3.86	222.53	185.68	23.60

9/27/96	INT1				
Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
126	00:45	4.03	349.42	282.91	41.86
135	02:45	4.43	438.64	378.90	63.68
137	04:45	4.02	459.91	406.43	74.46
139	06:45	3.83	492.04	444.88	87.14
142	08:45	3.92	506.00	467.00	97.28
155	10:45	3.95	525.10	485.21	101.82
157	12:45	3.90	527.90	499.69	110.88
159	14:45	3.85	534.77	510.36	117.95
162	16:45	3.92	545.82	526.31	125.96
164	18:45	3.72	547.20	524.96	123.39
166	22:45	3.39	547.49	533.86	129.50

9/28/96	INT1				
Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
168	02:45	3.45	497.62	524.74	136.36
170	06:45	3.23	251.95	336.10	134.87
183	10:45	3.14	130.72	191.20	85.96
185	14:45	2.98	75.03	114.76	54.61
187	22:45	2.98	32.75	56.89	28.91
188	22:45	2.76	31.92	50.71	23.47

9/29/96 INT1

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
189	04:45	2.83	17.28	28.53	13.71
197	10:45	2.55	9.09	14.77	6.96
198	16:45	2.78	4.60	9.04	4.56
199	22:45	2.78	1.75	6.43	2.74

9/30/96 INT1

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
200	04:45	2.76	1.39	5.27	2.28
206	10:45	2.39	0.90	4.45	1.91
207	16:45	2.40	ND	4.31	2.00

10/1/96 INT1

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
208	04:45	2.53	ND	1.81	0.64
212	17:00	2.38	ND	1.05	0.71

10/2/96 INT1

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
214	05:00	2.19	ND	5.03	3.29
216	17:00	1.83	ND	9.24	6.23
217	17:00	1.79	ND	2.77	2.09

10/3/96 INT1

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
218	05:00	2.43	ND	1.25	0.42
219	16:30	1.97	ND	0.91	ND

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Surfactant Flood and PITT- 2 - Well INT - 5
GC Data for tracers and TCE - Septamber 26 - October 3, 1996

9/26/96 INT5

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
110	16:45	5.11	2.57	1.62	ND
112	18:45	5.26	1.70	1.24	ND
114	20:45	5.25	1.94	1.24	ND
116	22:45	4.74	1.67	1.26	ND

9/27/96 INT5

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
119	00:45	4.04	1.41	1.26	ND
129	02:45	4.25	1.12	1.01	ND
131	04:45	4.21	1.12	0.95	ND
133	06:45	3.90	1.50	1.21	ND
135	08:45	3.80	3.95	9.22	5.21
146	10:45	3.78	7.91	4.78	0.49
148	12:45	1.51	ND	1.57	0.34
150	14;45	3.04	13.61	6.96	0.51
152	15:45	2.93	17.67	8.74	ND
155	20:45	2.81	41.55	19.75	0.90

9/28/96 INT5

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
157	00:45	2.68	63.76	36.58	5.57
159	04:45	2.47	94.60	47.44	3.37
161	08:45	2.26	121.02	61.46	4.12
174	12:45	2.03	124.94	63.28	4.61
176	16:45	2.15	168.51	85.33	6.71
177	22:45	1.57	225.20	122.85	10.27
178	22:45	ND	228.56	136.28	12.42

9/29/96 INT5

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
179	04:45	1.74	224.88	131.99	10.80
184	10:45	ND	203.94	114.86	8.84
185	16:45	1.30	209.94	93.63	6.77
186	22:45	1.26	203.74	97.64	7.89

9/30/96 INT5

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
193	10:45	ND	93.96	75.76	9.67
194	16:45	ND	103.38	73.69	7.84

10/1/96 INT5

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
195	04:45	ND	69.45	63.95	8.44
198	17:00	ND	38.12	40.01	5.80

10/2/96 INT5

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
201	17:00	ND	17.54	28.60	7.05

10/3/96 INT5

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
203	5:00	ND	15.78	28.66	5.18
204	16:30	ND	14.77	27.95	4.68

Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

Surfactant Flood and PITT- 2 - Well INT - 6
GC Data for tracers and TCE - Septamber 26 - 28, 1996

9/26/96 INT6

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
88	16:45	1.23	ND	1.55	ND
90	18:45	1.58	ND	1.65	ND
104	20:45	2.20	ND	1.79	ND
106	22:45	1.66	ND	1.73	0.33
107	22:45	2.23	ND	1.85	ND

9/27/96 INT6

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
109	00:45	1.62	ND	1.82	ND
116	02:45	1.51	ND	1.38	ND
118	04:45	2.70	ND	1.97	ND
120	06:45	1.42	ND	1.63	ND
122	08:45	1.53	ND	1.74	ND
124	10:45	1.64	ND	6.88	3.94
137	12:45	3.23	10.43	5.65	0.47
139	14:45	1.34	ND	1.61	ND
143	16:45	1.35	ND	2.35	ND
145	20:45	1.78	ND	1.56	ND

9/28/96 INT6

Sample Number	Sample Time	TCE Conc. (mg/L)	Prop. Conc. (mg/L)	Hept. Conc. (mg/L)	Oct. Conc. (mg/L)
147	00:45	1.48	ND	1.64	ND
156	04:45	1.61	ND	2.13	ND
158	08:45	1.81	ND	2.06	ND
160	12:45	1.08	ND	1.39	ND
173	16:45	1.56	ND	1.82	ND
174	22:45	1.72	ND	1.68	ND
175	22:45	1.47	ND	1.68	ND

APPENDIX M

Reports from the University of Texas at Austin

Report for Column Experiment:

PORTS#5

As Performed by:

Jeff Edgar

Under the Advice of:

Dr. G.A. Pope

University of Texas-Austin
Department of Petroleum and Geosystems Engineering

Background

Ports#5 is a column experiment designed to evaluate the performance of the chosen tracer suite on the field soil obtained from the Portsmouth site saturated with trichloroethylene (TCE). TCE was used as the contaminant because a field DNAPL could not be obtained. Analysis by Dr. Fountain showed that the DNAPL was 99% TCE. A column was prepared using field soil. The suite of tracers were injected into the clean saturated soil column and their response curves were observed in the effluent. The column was then saturated with pure TCE to residual saturations. The tracers were again injected and their response curves were analyzed for the presence of TCE. The TCE saturations computed from the standard method of moments on the tracer data agreed well with a direct mass balance estimate obtained by weighing the column.

Objectives

1. Verify tracer compatibility with the Portsmouth field soil.
2. Assess the performance of the chosen tracer suite.
3. Compare hydraulic conductivity of soil packed dry in column with value from field pump test estimates.

Preliminary Results

Core Preparation

The soil which was used to pack the column was obtained as a field sample from the Portsmouth site. The soil sample used in this experiment was selected with the advise of Carl Young. The soil was placed into the empty column and incrementally packed with an aluminum rod. The wet soil was taken out of the core holder and placed in the oven to dry it out. Then the soil was ground up with a pestle and hammer to get a uniform grain size. This method was used because previous column experiments packed wet gave very low permeabilities.

Initial Column Data

A 2.21 cm diameter, 30.48 cm long stainless steel column was used to enclose the soil. Two stainless steel (304 ss) wire mesh were used to contain the soil in the column and disperse the flow of fluid as it enters the column from the column end pieces. The mesh sizes used were #150 and #60.

A permeability test was performed on the column. A column could not be packed such that the permeability was in the range of the measured field results. A final value obtained for the permeability of the column used in Ports#5 was 0.2 D ($2x10^{-4}$ cm/s). This value is slightly lower than the 0.5 D ($5x10^{-4}$ cm/s) field estimation, but was determined to be adequate for a laboratory study of the tracers.

Initial Tracer Test

An initial tracer test was performed in order to determine the quality of the soil column. The initial tracers used were 200,000 DPM/mL tritium, approximately 2000 mg/L 3-methyl-3-pentanol and 2000 mg/L 1-hexanol. Tritium is the conservative tracer whereas 3-methyl-3-pentanol (K=4.45) and 1-hexanol (K=18.6) were the partitioning tracers used. About 0.11 pore volumes, or 6.4 cc, of tracer mixture was injected at 0.25 cc/min (about 10 ft/day). The sample size collected was about 2.6 cc. The tracer response curves are shown in Figure 1. The pore volume estimate based on an average of the initial tracers used in the test was 63.5 cc.

TCE Flood

An initial weight of the saturated column was found to be 1387.86 g. With the column in a vertical orientation, TCE was injected into the column from the bottom at a flow rate of 1.0 cc/min from the bottom end of the column until no water production was observed (about 30 cc of TCE was injected). 13.7 cc of pore water was displaced by the injected TCE. The weight of the column after the TCE flood was 1392.84 g. Water was then injected into the column from the top at a flow rate of 0.05 cc/min until no TCE production was observed. A total of 72 cc of water was injected into the column. 6.9 cc of TCE was displaced by the water. The weight of the column at this point was 1390.20 g. A summary of the residual saturations and estimated volume of TCE in column at the end of the water flood are presented in Table 1.

Table 1. Material balance estimates of residual TCE saturation.

Material Balance	Residual Saturation (%)	TCE volume in column (mL)
Volume	10.8	6.8
Mass	7.21	4.54
Average	9.0	5.67

The relative permeability at residual TCE saturation was found to be 0.15.

S_{or} Tracer Test

Partitioning tracers were used to determine the residual saturation of TCE in the column. The tracers used were 200,000 DPM/mL Tritium, approximately 1,500 mg/L: 3-Methyl-3-pentanol, and 1-Hexanol. About 0.15 pore volumes or 10.2 cc of tracer was injected at 0.15 cc/min. (4 ft/day). The sample size was about 2.4 cc. The estimates of residual TCE based on the partitioning tracers are shown in the Table 2. The duration of the tracer test lasted 3 days. However, there were problems with the Gas Chromatograph and the samples were not analyzed until 6 days after the tracer test was started. Figure 2 shows a plot of the tracer response curves for the suite of tracers described above.

The weight of the column at the end of the tracer test was determined and found to be 1,389.56 g. This corresponds to a TCE saturation of 7.2 %. The table below shows the residual TCE saturations calculated with the suite of tracers using the method of moments. The average of the tracers is almost identical to the mass balance.

Table 2. Comparison of residual TCE saturations.

S_{or} by mass=	7.2%
S_{or} (Tritium, 3-Methyl-3-pentanol)=	6.8%
S_{or} (Tritium, 1-Hexanol)=	7.1%
S_{or} (3-Methyl-3-pentanol, 1-Hexanol)=	7.4%
S_{or} (Average Tracers)=	7.1%

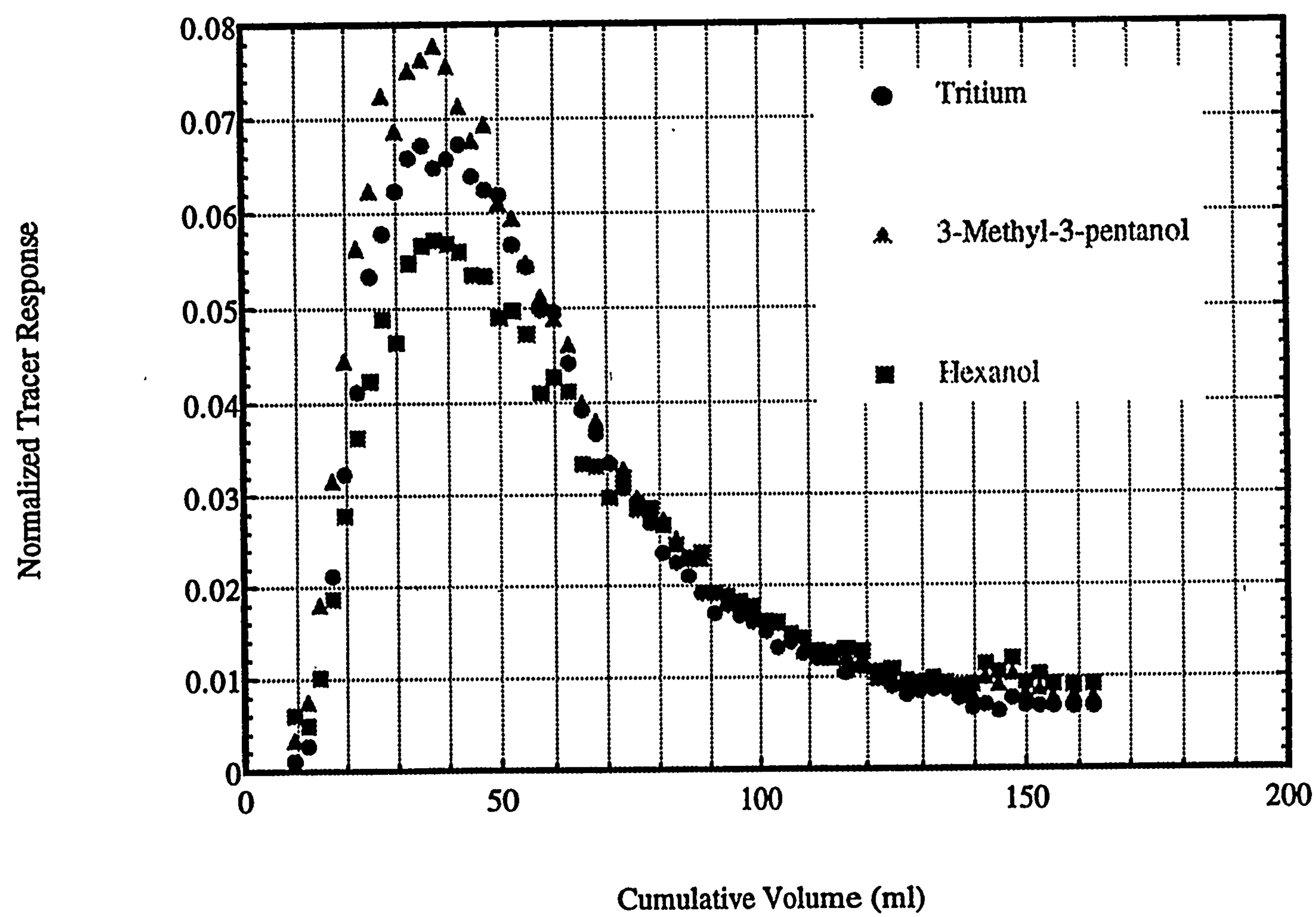
Results/Observations/Discussions/Conclusions

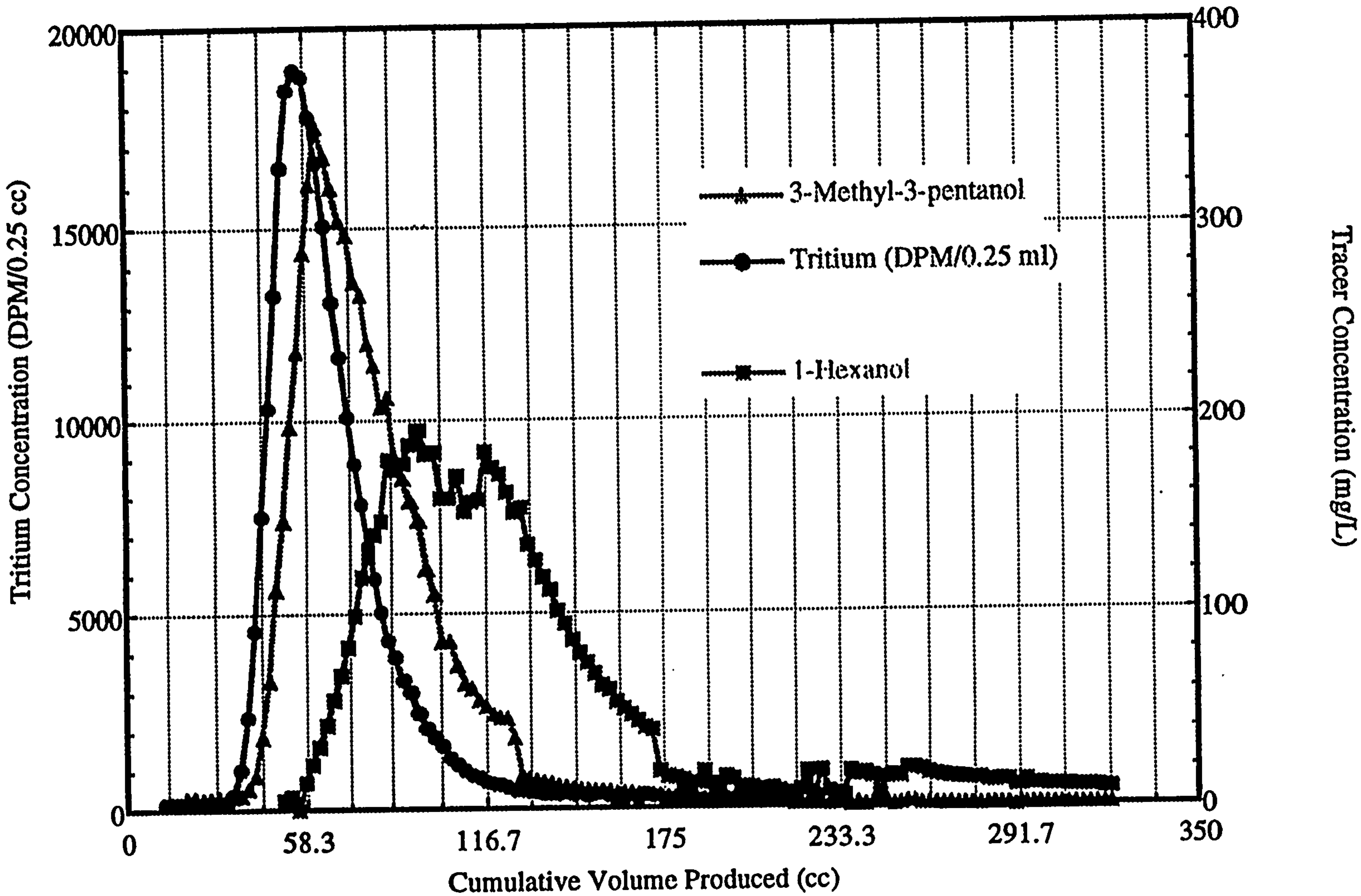
Results

1. The permeability of the soil column at 50 psi back pressure was found to be 0.2 D ($2x10^{-4}$ cm/s).
2. No separation of the tritiated water and the alcohol tracers occurred in the initial tracer flood, which indicates no sorption of the alcohols on the Portsmouth soil.
3. The final tracer test suggests that the residual saturation of TCE can be accurately measured using the chosen tracers. All tracer estimations agree well with the mass balance. However, since the DNAPL saturations in the field may be much lower than in the column, additional tracers with higher partition coefficients (2,4-dimethyl-3-

pentanol, K for TCE =40.5, and n-heptanol, K for TCE=140) will also be evaluated and should be used in the field test if their behavior in Portsmouth soil is acceptable as expected. We will also test several fluorocarbons as alternatives to the high K value alcohols since these are inexpensive and easy to detect with an ECD detector to very low concentrations, which means much less tracer can be used.

Normalized Initial Tracers for PORTS#5





Sor Tracers for Ports#5

Report for Column Experiment:

PORTS#7

As Performed by:

Jeff Edgar

Under the Advice of:

Dr. G.A. Pope

University of Texas-Austin
Department of Petroleum and Geosystems Engineering

Background

Ports#7 is a column experiment designed to evaluate the performance of the chosen tracer suite on the field soil obtained from the Portsmouth site saturated with trichloroethylene (TCE). TCE was used as the contaminant because a field DNAPL could not be obtained. Analysis by Dr. Fountain showed that the DNAPL was 99% TCE. A column was prepared using field soil. The suite of tracers were injected into the clean saturated soil column and their response curves were observed in the effluent. The column was then saturated with pure TCE to residual saturations. The tracers were again injected and their response curves were analyzed for the presence of TCE. The TCE saturations computed from the standard method of moments on the tracer data agreed well with a direct mass balance estimate obtained by weighing the column.

Objectives

1. Verify tracer compatibility with the Portsmouth field soil.
2. Assess the performance of the chosen tracer suite.
3. Compare hydraulic conductivity of soil packed dry in column with value from field pump test estimates.

Preliminary Results

Core Preparation

The soil which was used to pack the column was obtained as a field sample from the Portsmouth site. The soil sample used in this experiment was selected with the advice of Carl Young from Intera, Inc. The soil was placed into the empty column and incrementally packed with an aluminum rod. The wet soil was taken out of the core holder and placed in the oven to dry it out. Then the soil was ground up with a pestle and hammer to get a uniform grain size. This method was used because previous column experiments packed wet gave very low permeabilities.

Initial Column Data

A 2.21 cm diameter, 30.48 cm long stainless steel column was used to enclose the soil. Two stainless steel (304 ss) wire mesh were used to contain the soil in the column and disperse the flow of fluid as it enters the column from the column end pieces. The mesh sizes used were #150 and #60.

A permeability test was performed on the column. A column could not be packed such that the permeability was in the range of the measured field results. A final value obtained for the permeability of the column used in Ports#7 was 0.2 D ($2x10^{-4}$ cm/s). This value is slightly lower than the 0.5 D ($5x10^{-4}$ cm/s) field estimation, but was determined to be adequate for a laboratory study of the tracers.

Initial Tracer Test

An initial tracer test was performed in order to determine the quality of the soil column. The initial tracers used were 200,000 DPM/mL tritium, approximately 2000 mg/L 3-methyl-3-pentanol and 2000 mg/L 1-hexanol. Tritium is the conservative tracer whereas 3-methyl-3-pentanol (K=4.45) and 1-hexanol (K=18.6) were the partitioning tracers used. About 0.11 pore volumes, or 6.4 cc, of tracer mixture was injected at 0.25 cc/min (about 10 ft/day). The sample size collected was about 2.6 cc. The tracer response curves are shown in Figure 1. The pore volume estimate based on an average of the initial tracers used in the test was 65 cc.

TCE flood

An initial weight of the saturated column was found to be 1387.86 g. With the column in a vertical orientation, TCE was injected into the column from the bottom at a flow rate of 1.0 cc/min from the bottom end of the column until no water production was observed (about 30 cc of TCE was injected). 13.7 cc of pore water was displaced by the injected TCE. The weight of the column after the TCE flood was 1392.84 g. Water was then injected into the column from the top at a flow rate of 0.05 cc/min until no TCE production was observed. A total of 72 cc of water was injected into the column. 6.9 cc of TCE was displaced by the water. The weight of the column at this point was 1390.20 g. A summary of the residual saturations and estimated volume of TCE in column at the end of the water flood are presented in Table 1.

Table 1. Material balance estimates of residual TCE saturation.

Material Balance	Residual Saturation (%)	TCE volume in column (mL)
Volume	10.8	6.8
Mass	7.21	4.54
Average	9.0	5.67

The relative permeability at residual TCE saturation was found to be 0.15. The column was then waterflooded over a period of three weeks until a TCE saturation of 3.67 % was reached.

S_{or} Tracer Test

Partitioning tracers were used to determine the residual saturation of TCE in the column. The tracers used were 200,000 DPM/mL tritium, approximately 750 mg/L: 2-propanol (K=0.05), 3-methyl-3-pentanol (K=4.45), 1-hexanol (K=18.6), 2,4-dimethyl-3-pentanol (K=38.2), and 1-heptanol (K=163.1). About 0.25 pore volumes or 16.3 cc of tracer was injected at 0.15 cc/min. (4 ft/day). The sample size was about 2.6 cc. The estimates of residual TCE based on the partitioning tracers are shown in the Table 2. The duration of the tracer test lasted 3 days. However, there were problems with the Gas Chromatograph and the samples were not analyzed for heptanol until 2 days after the tracer test was started. This may account for the discrepancy in Figure 3 which is a normalized plot. Figure 2 shows a plot of the tracer response curves for the suite of tracers described above. Figure 4 is a semi-log plot of Figure 3.

The weight of the column at the end of the tracer test was determined and found to be 1,388.96 g. This corresponds to a TCE saturation of 3.67 %. The table below shows the residual TCE saturations calculated with the suite of tracers using the method of moments. The average of the tracers is almost identical to the mass balance.

Table 2. Comparison of residual TCE saturations.

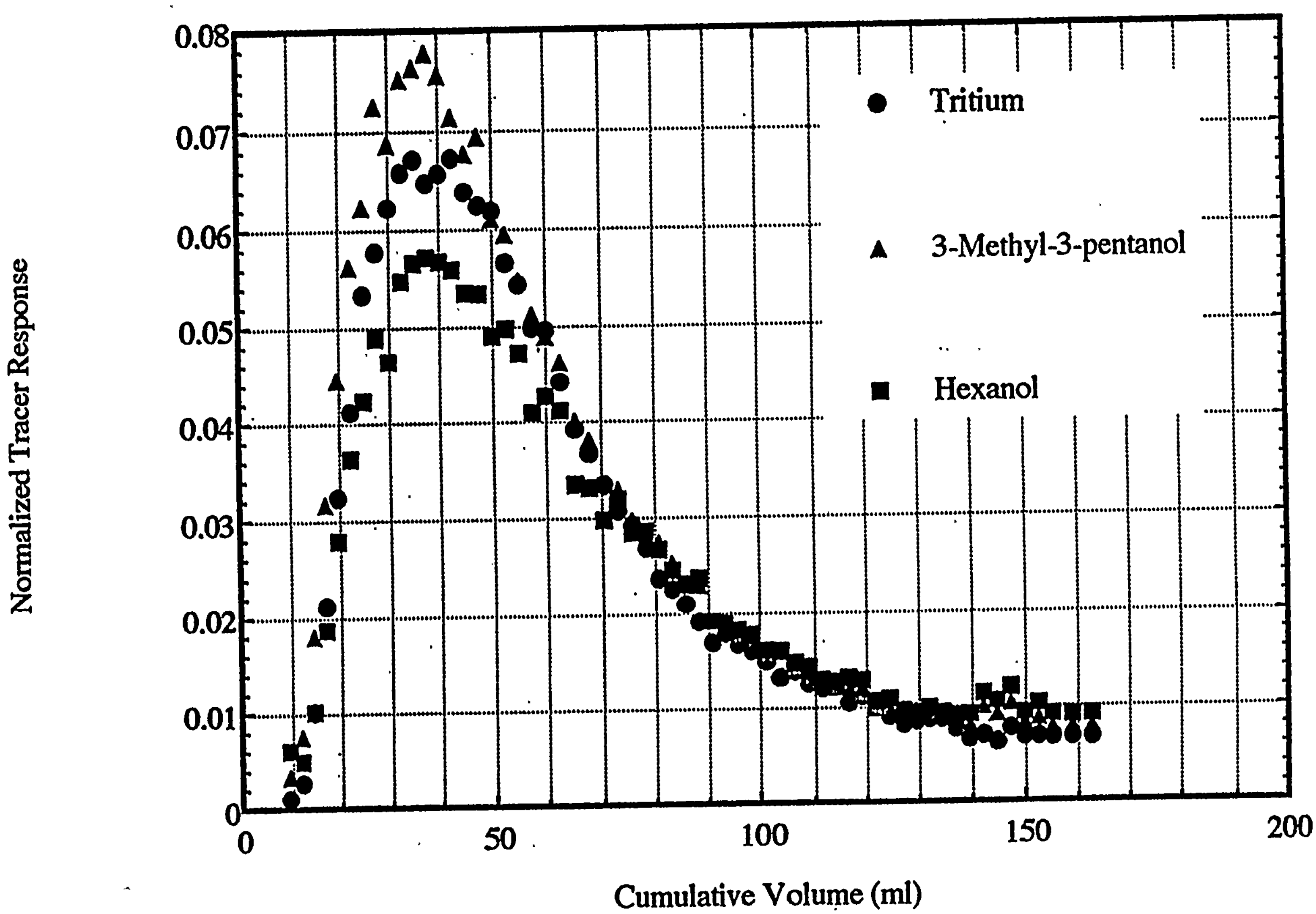
S_{or} by mass=	3.67%
S_{or} (Tritium, 3-Methyl-3-pentanol)=	3.67%
S_{or} (Tritium, 1-Hexanol)=	3.62%
S_{or} (Tritium, 2,4-Dimethyl-3-pentanol)=	3.61%
S_{or} (Tritium, Heptanol)=	3.47%

Results/Observations/Discussions/Conclusions

Results

1. The permeability of the soil column at 50 psi back pressure was found to be 0.2 D ($2x10^{-4}$ cm/s).
2. No separation of the tritiated water and the alcohol tracers occurred in the initial tracer flood, which indicates no sorption of the alcohols on the Portsmouth soil.
3. The final tracer test suggests that the residual saturation of TCE can be accurately measured using the chosen tracers. All tracer estimations agree well with the mass balance.

Figure 1



Normalized Tracer Response
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Tritium
3-Methyl-3-pentanol
Hexanol
0
50
100
150
200
Cumulative Volume (ml)

Figure 2

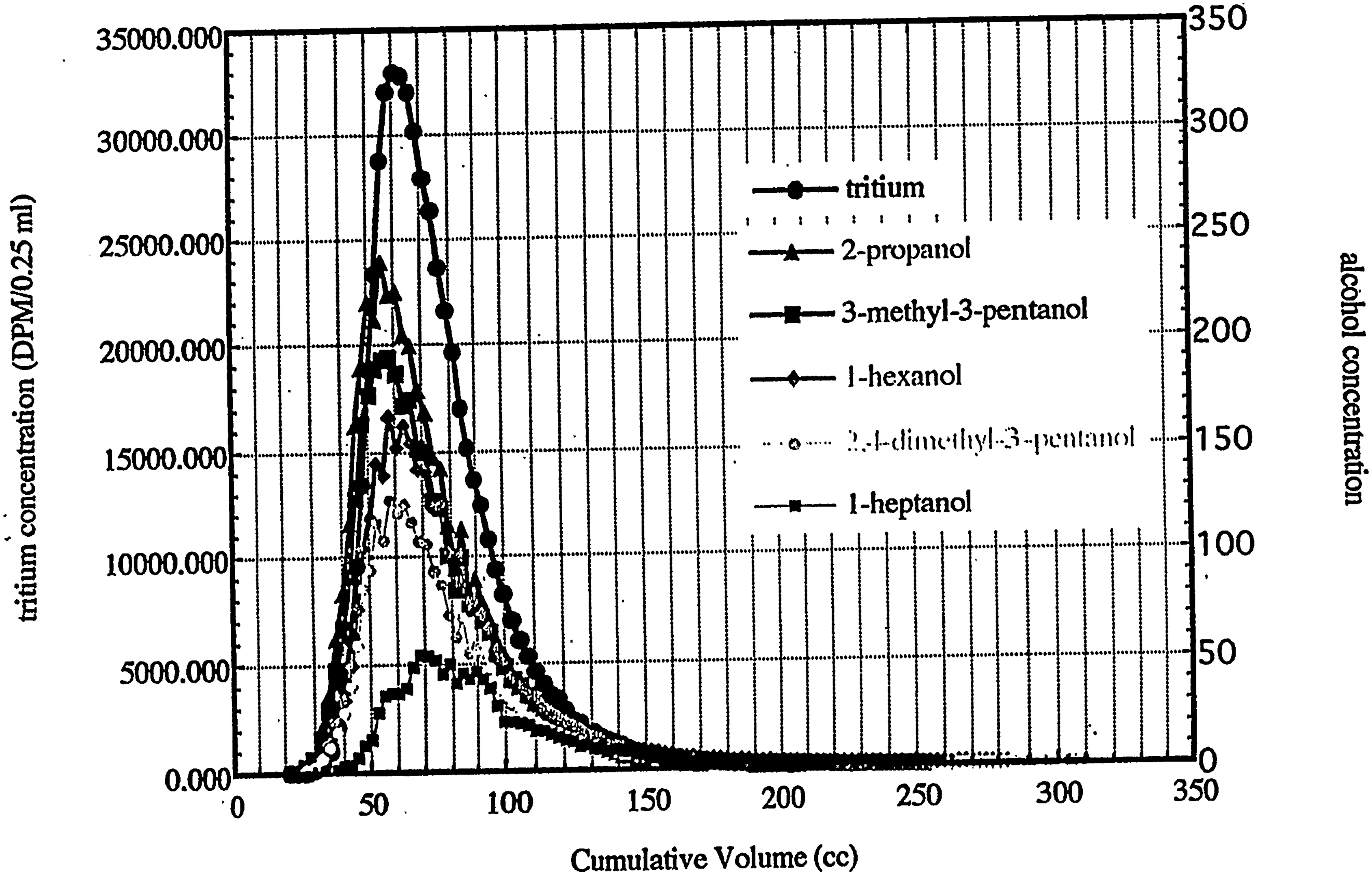

35000.000
30000.000
25000.000
20000.000
15000.000
10000.000
5000.000
0.000
tritium concentration (DPM/0.25 ml)
350
300
250
200
150
100
50
0
alcohol concentration
0
50
100
150
200
250
300
350
Cumulative Volume (cc)
tritium
2-propanol
3-methyl-3-pentanol
1-hexanol
2,4-dimethyl-3-pentanol
1-heptanol

Figure 3

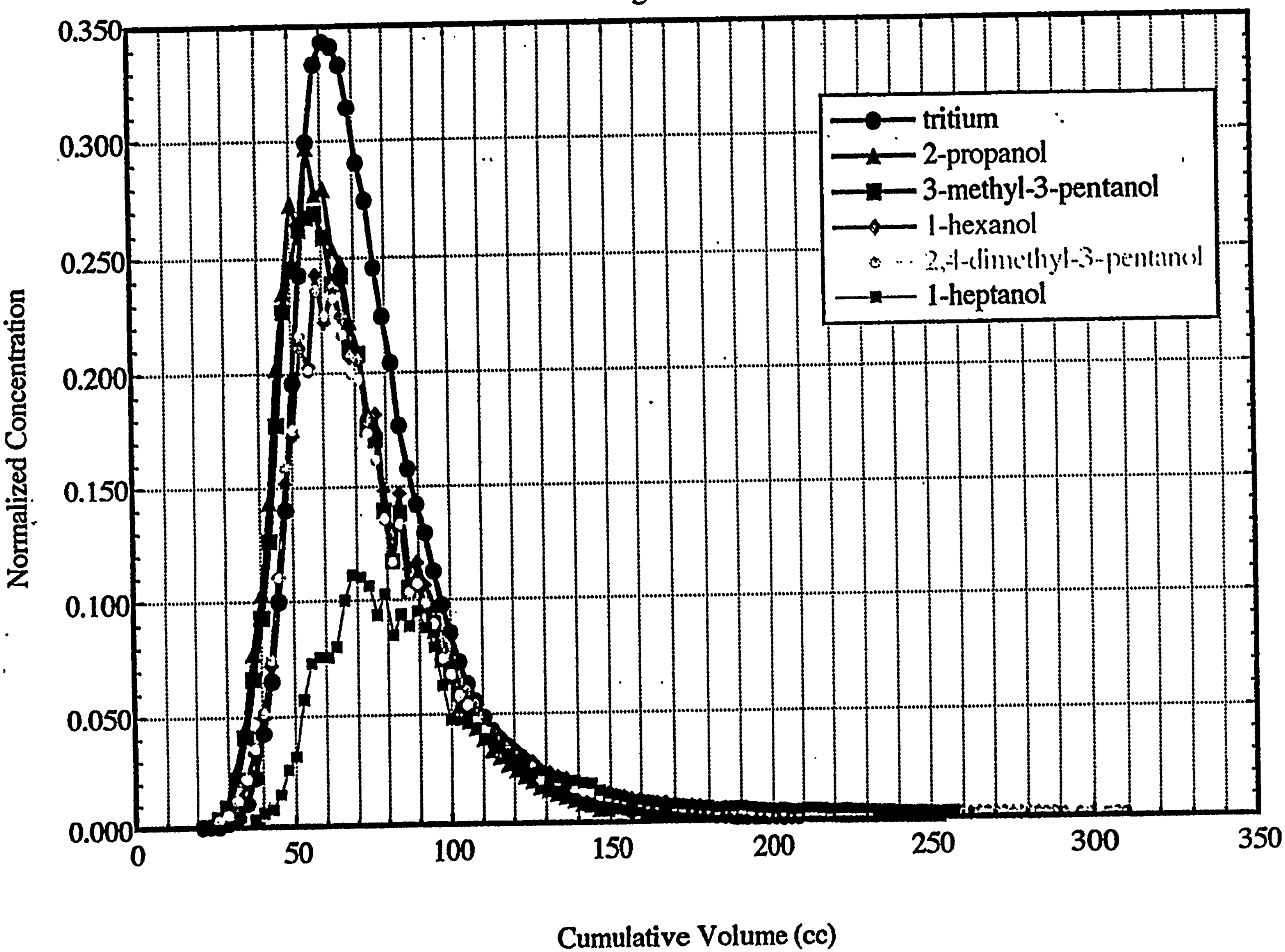
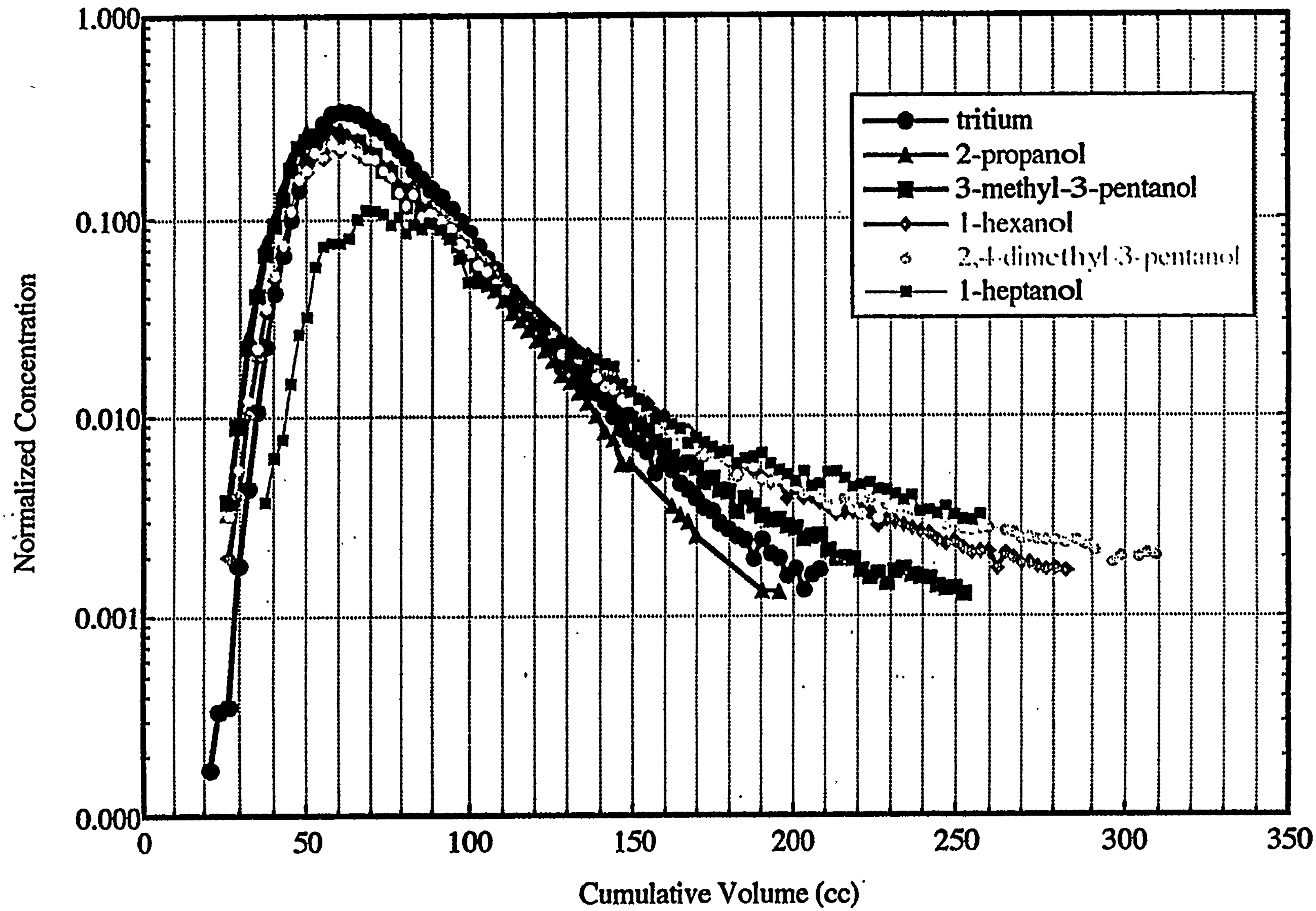

tritium
2-propanol
3-methyl-3-pentanol
1-hexanol
2,4-dimethyl-3-pentanol
1-heptanol
Normalized Concentration
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
0
50
100
150
200
250
300
350
Cumulative Volume (cc)

Figure 4



1.000
0.100
0.010
0.001
0.000
Normalized Concentration
0
50
100
150
200
250
300
350
Cumulative Volume (cc)
tritium
2-propanol
3-methyl-3-pentanol
1-hexanol
2,4-dimethyl-3-pentanol
1-heptanol

APPENDIX N

Final Report from the State University of New York at Buffalo

FINAL REPORT

SELECTION OF SURFACTANTS
FOR
SURFACTANT ENHANCED AQUIFER REMEDIATION
AT
THE PORTSMOUTH, OHIO
U.S. DEPARTMENT OF ENERGY
FACILITY

Submitted by:
Dr. John C. Fountain
Department of Geology
State University of New York at Buffalo
December 10, 1996

INTRODUCTION

Project Background and Scope of the Report

A field test of surfactant-enhanced aquifer remediation was recently completed at the Portsmouth, Ohio, DOE facility. The State University of New York (SUNY) participated in the project as a subcontractor to INTERA Corp. SUNY was tasked with selection of a surfactant system for the project, and for analysis of samples from the field test. This report contains the results of SUNYs portion of this project.

This project has evolved through several phases. Following initial evaluation of DOE sites, work was begun at the Paducah, Kentucky, DOE site. The first area looked at in detail at Paducah was found to have too low a permeability to be suitable for the project. After further work in a deeper unit, it was decided that the shallow, relatively well characterized zone at Portsmouth was more suitable for the field test. Work prior to the Portsmouth site selection was conducted under prior contracts. This report considers only the work done under the current contract, all of which relates to the Portsmouth site.

Project Objectives

The primary objective of SUNYs subcontract was to select the surfactant for use in a field test. This work is described in the next section. The second objective was to analyze samples collected from INTERA's field test. These analyses are presented in the analysis section. Interpretation of the field trial is being done primarily by INTERA; however some interpretation based on our analytical data is included in this report.

SELECTION OF SURFACTANTS

Selection Criteria

Surfactant selection is based upon a combination of factors related to performance of surfactants, environmental suitability of the surfactant solutions and site hydrogeology. The primary criteria used in this study are shown in Table 1. An experimental program was conducted to obtain the data required for evaluation of these parameters.

TABLE 1. CRITERIA FOR SURFACTANT SELECTION

Parameter	Rationale	Data
Solubilization	The more a surfactant increases a compounds solubility (termed solubilization in a micellar solution) the more efficient the surfactant is at dissolving DNAPL	Solubilization from vial test
Sorption	Higher sorption means greater loss of surfactant and reduced hydraulic conductivity	Sorption batch and column tests
Toxicity	Permitting of injection difficult for toxic compounds	Published data
Bio-degradability	Permitting of injection difficult for persistent compounds	Published data
Viscosity	Increased viscosity decreases flow rate in an aquifer	Direct viscosity measurements
Interfacial Tension	Lower interfacial tensions create greater risk of DNAPL mobilization, but also generally correlate with higher solubility	IFT measurement
Site Water Chemistry	Surfactants have various ranges of compatibility to ionic strength, pH and temperature	Water/surfactant tests
Contaminant Distribution	The distribution of contaminants, as a function of rock type and spatial distribution affect the method of removal and hence surfactant selection	Site Characterization

Solubilization

The first, and most fundamental, parameter investigated was solubilization. Surfactants have the ability to increase the apparent solubility of organic compounds in water through the process termed solubilization. Solubilization involves incorporation of contaminant molecules into micelles; oriented aggregates of surfactant molecules. Initial work on solubilization of TCE, the primary component of the target DNAPL, identified a number of surfactants that were good solubilizers of TCE.

Solubilization was measured for candidate surfactants in vial tests. In these tests reagent-grade TCE was added to 40 ml Teflon-sealed glass vials of surfactant solution. The vials were stirred for 48 hours and centrifuged to separate undissolved TCE and surfactant. The surfactant/water phase was then analyzed by gas chromatography using a direct injection method to avoid the problem of altered partitioning due to the presence of surfactants that affects all extraction procedures. Solubilization was determined at two concentrations, since solubilization is linear with increased concentration above the critical micellar concentration (the concentration at which micelles first form in a surfactant solution), solubilization could then be calculated at any surfactant concentration.

Experiments conducted in support of the Paducah phase of this project identified a number of surfactants, including 8 nonionic surfactants and 2 anionic surfactants, that solubilized over 10,000 mg/L at 1% surfactant concentration. A secondary alcohol ethoxylate, a sorbitan monooleate and an oleamide were chosen as the best candidate surfactants based on a combination of solubilization ability and ground water compatibility. These surfactants provide excellent solubilization with minimal lowering of interfacial tension (IFTs for these surfactants range from about 2 to 10 dynes per cm, a reduction of about 1 order of magnitude). Since the same contaminant, TCE, was involved at Portsmouth as at Paducah, the earlier work on solubilization was directly applicable to the Portsmouth site.

Core Analysis

Although the solubilization data previously developed for TCE was applicable to Portsmouth, a suitable surfactant must also be compatible with the site hydrogeology. The first step in beginning selection of a surfactant at Portsmouth was thus to characterize the target zone. Work began with analysis of core samples from the site for mineralogy, size distribution and contaminant distribution.

Two cores were received from the Portsmouth site. These cores were analyzed for grain size distribution as a function of depth. The cores were described, then sampled every 7.5 cm (approximately 8 gram samples). Grain size analysis utilized a sieve equipped with sonic particle agitation suitable for accurate determination of small samples. The clay content was then evaluated with a hydrometer and clay mineralogy determined by X-ray diffraction.

The results of the grain size analyses, shown in Figure 1 determined that the entire interval sampled contained more than 15% fines, and in most cases, more than 20%. Complete analyses are listed in Appendix 1.

The distribution of contamination was then determined as a function of depth by analysis of subsamples from the same cores. Intera personnel had collected the samples immediately after coring, and preserved the core sub-samples in methanol, which serves as an excellent solvent for solvent extraction (Pankow and Cherry, 1996). The concentration of contaminants from samples were then determined by gas chromatography using a flame ionization detector (FID). Only two samples were above the limit of detection (about 2 mg/L). All samples below the limit of detection were then analyzed with an electron capture detector. The resulting profile of concentration versus depth is shown in Figure 2. Two samples with high TCE concentrations were then analyzed on a gas chromatograph using a mass selective detector (GC/MS) to determine if other components were present (the concentrations in all other samples were too low for direct analysis by GC/MS). No peaks other than those associated with TCE were found. Thus the concentration of other components were below the limit of detection (about 0.5 mg/L for chlorinated solvents). As shown in Figure 2, contamination was found to be restricted to a thin zone at the base of cores.

Figure 1

Percentage of Fines in Portsmouth Cores

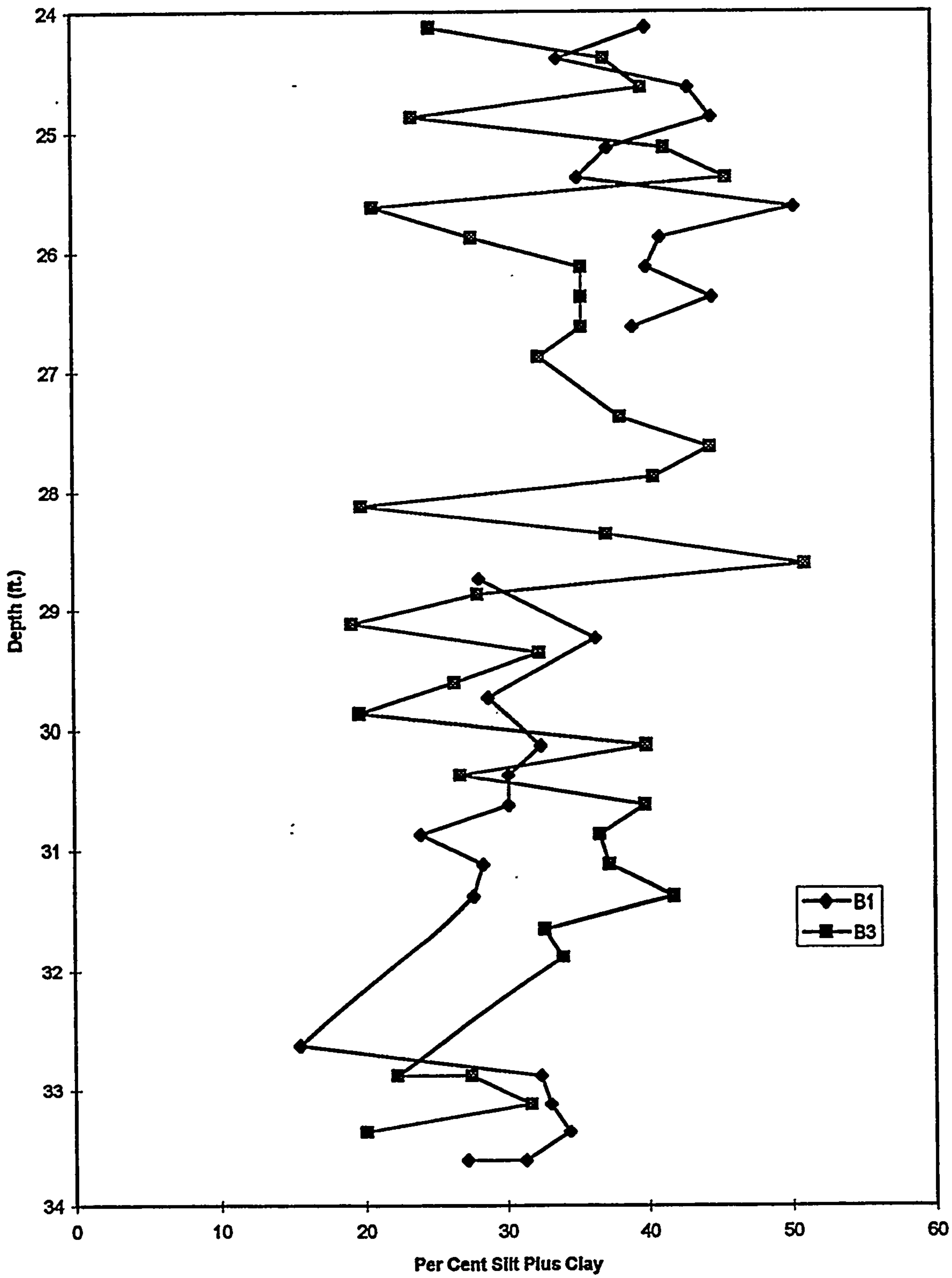
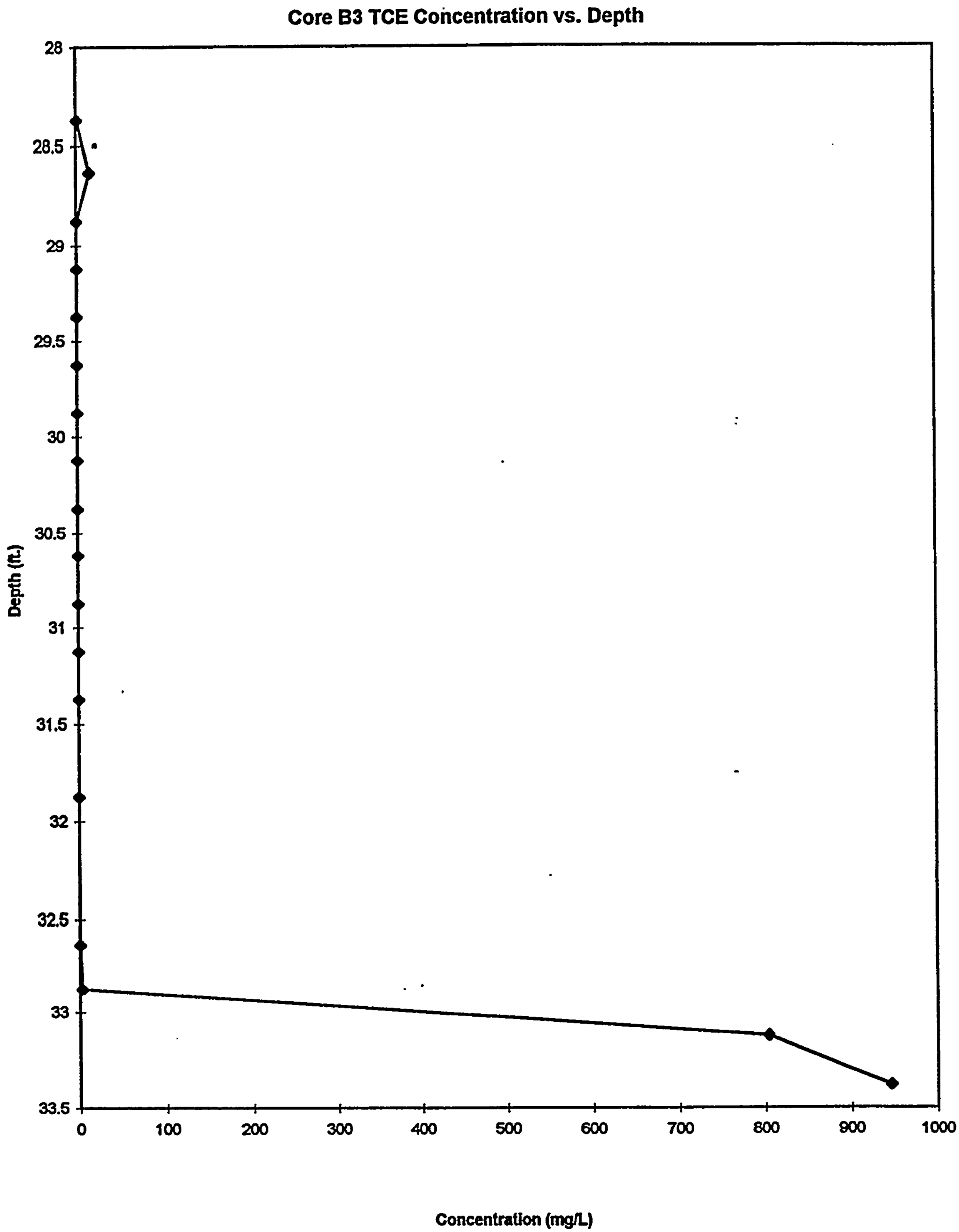


Figure 2



Core B3 TCE Concentration vs. Depth
28
28.5
29
29.5
30
30.5
31
31.5
32
32.5
33
33.5
Depth (ft.)
0
100
200
300
400
500
600
700
800
900
1000
Concentration (mg/L)

Implications of Core Analyses

The extent of surfactant sorption is one of the critical parameters in surfactant selection. If sorption is high, then surfactant is lost to sorption increasing project costs. Surfactant sorption also may reduce the hydraulic conductivity of the target zone. Sorption of surfactants, like that of other organic compounds, is proportional to the amount of solid organic matter and the amount of clay in the soil. The occurrence of such large amounts of fine material (the clay content of every interval measured was over 15%; Appendix 1) indicated that surfactant sorption would be unexpectedly high. Nonionic surfactants exhibit high sorption when clay contents exceed 10% (Lagowski, 1996), thus it was concluded that nonionic surfactants would not be acceptable for this site. This eliminated 7 of the 10 candidate surfactants identified during prior phases of the work, including all the most promising surfactants. Anionic surfactants are known to have substantially less sorption on minerals due to the repulsion of the negatively charged silicate mineral surfaces and the anionic head groups on the surfactants. Hence the high fine content of the Portsmouth site dictated the use of anionic surfactants.

The core analyses also revealed that the contaminated zone, the lower gravel, contained abundant large cobbles distributed heterogeneously in the cores. This suggested that the unit would be heterogeneous in the field (which had also been noted in previous site characterization work) and posed a significant problem for replicating field conditions in the lab. The columns and permeameters used in the lab are of a small enough size to preclude the use of large cobbles, thus the characteristics of site soils used in the lab are significantly different from those in the field due to the exclusion of cobbles. The implications of this is discussed in the discussion of each experiment for which it is relevant.

Relative Performance of Anionic and Nonionic Surfactants

Anionic surfactants generally are not as effective solubilizers of hydrophobic contaminants as the best nonionic surfactants in simple water/surfactant solutions. Optimum solubilization occurs when a surfactant partitions equally between water and NAPL. Since water is an excellent solubilizer of ionic compounds due to the polarity of the water molecule, while non-polar organic liquids like TCE are very poor solvents for ionic compounds, partitioning of anionic surfactants is generally very strongly biased towards the aqueous phase. As a result, solubilization values by anionic surfactant solutions are typically much lower than those for the best nonionic solutions. Nonionic surfactants, on the other hand, are available with a range of polarity. Typically, the hydrophilic group on a nonionic surfactant is ethylene oxide. By selecting a given type of nonionic surfactant (a 12-carbon alcohol for example) with the proper number of ethylene oxide units, the optimum partitioning can be achieved. The ratio of polar to nonpolar affinity in a nonionic surfactant is expressed as the HLB number (hydrophilic lipophilic balance).

In contrast, the hydrophilic nature of anionic surfactants is determined by the anionic head group, thus it is fixed for each surfactant type. To increase the solubilization ability of anionic surfactants, electrolytes may be added to change the partitioning of the surfactant. Addition of an electrolyte "salts out" the surfactant, driving it into the NAPL. When appropriate amounts of salt are added to anionic surfactants, solubilization can equal or exceed that achieved by nonionic surfactants.

Cosolvents, alcohols or nonionic surfactants, may also be used to modify surfactant partitioning. Nonionic cosolvents were not considered at Portsmouth as the high clay content would probably result in selective sorption of the nonionic surfactant.

None of the anionic surfactants identified as good solubilizers of TCE in previous work were suitable for further study as they either had limited chemical stability (phosphates) or they had limited tolerance to electrolytes. Work by Gary Pope and colleagues at the University of Texas had previously established that sulfosuccinates, a group of food-grade anionic surfactants, would produce excellent solubilization of TCE through the addition of salt (Jin, 1995). In addition, they had shown that the sulfosuccinates were compatible with a wide range of water compositions and had appropriate environmental attributes. Sulfosuccinates were thus selected for evaluation; subsequent work was designed to identify the optimum composition (amount of salt and/or cosolvent required for optimum performance).

Phase Studies

Several types of sulfosuccinates are manufactured which differ in their nonpolar hydrophilic portions. Diamyl, dioctly and dihexyl sulfosuccinates have been extensively investigated by the University of Texas group and have been shown to have potential for chlorinated solvent solubilization. Selection of which sulfosuccinate to use was made on the basis of required salinity, phase relations and ease of handling. The amount of salt required to reach optimum solubility decreases as the surfactant becomes more hydrophobic, thus dioctyl sulfosuccinate requires the least salt and diamyl the most salt. Experiments with dioctyl sulfosuccinate revealed that it was difficult to handle, formed highly viscous solutions and did not produce adequate volumes of middle phase under low salt conditions. Dihexyl sulfosuccinate exhibited excellent handling properties (poured easily and mixed well), produced a low viscosity liquid and exhibited good phase behaviour. Viscosities of selected surfactant mixtures were approximately 1.79 cp at 12 °C (See Appendix 4).

To determine the composition of the system to used, salinity scans were run for both dihexyl and dioctyl sulfosuccinate, and for blends of the two. In each scan, a fixed concentration of sulfosuccinate solution was prepared at a range of concentrations of salt. These mixtures were placed in glass tubes, shaken and equilibrated. The relative volumes of aqueous phase and TCE change as solubilization increases (increasing the volume of the aqueous phase and decreasing the volume of the TCE). When surfactant partitioning approaches optimum, a separate surfactant-rich phase forms, termed the middle phase as it appears between the NAPL and water (Lake, 1989). The presence of this phase indicates a system is near-optimum; the actual optimum composition occurs where the volume of middle phase is a maximum.

Salinity scans were run for numerous surfactant/salt ratios and blends of surfactants.
The traditional way of determining the electrolyte concentration at which optimum solubilization occurs is to plot solubilization as a function of sodium chloride concentration.
Results of these scans, shown in Appendix 3, determined that dihexyl sulfosuccinate produced the highest solubilization of TCE, at approximately 1% salinity.

Although addition of sodium chloride is traditionally used to screen anionic surfactants for optimal salinity, high sodium/low calcium solutions may promote clay dispersion and hence may lead to permeability reduction (Curtin et al, 1994; Zynda, 1996). Since the target unit was clay rich, dispersion of clay was a significant concern. Thus we investigated the use of calcium chloride as an electrolyte. Experiments determined that pure calcium chloride did not produce high solubilization, or any middle phase with TCE at most temperatures (Appendix 3). Mixtures of sodium chloride and calcium chloride were then evaluated.

The effect of Sodium/Calcium ratio on clay dispersion was evaluated in vial tests. Soil from the Portsmouth site was shaken with distilled water, or with water with a range of sodium chloride/calcium chloride solutions. Results indicated high solution turbidity when distilled water was used, slightly lower when water with only sodium chloride was used and significantly lower turbidity when either calcium chloride or a mixture of sodium/calcium chloride was used (Appendix 4). Various ratios of sodium chloride/calcium chloride were then compared. Experiments found no significant difference in clay dispersion between 2:1 to 1:2 sodium chloride to calcium chloride, by weight (Appendix 4). A ratio of 1:1 was adopted as it allowed maximum variation from the designed concentration without detrimental effects.

Addition of alcohol also affects surfactant partitioning. Alcohol has traditionally been used in surfactant enhanced oil recovery both to modify partitioning and to control development of highly viscous phases which often occur in surfactant systems. Work by the University of Texas group had demonstrated that alcohols could also reduce the decrease in hydraulic conductivity that often accompanies surfactant flooding. Since sorption was a major concern at Portsmouth, alcohol was included to minimize surfactant sorption. Salinity scans with alcohol and surfactant were done in an identical fashion to the surfactant/salt scans previously described. A system with 4% surfactant, 4% isopropanol and 0.28% salt, (the salt was a 1:1 mixture, by weight, of sodium chloride and calcium chloride) was found to be optimum for TCE (Figure 3). Although optimum solubilization is achieved at this salinity, if the salinity was exceeded during a flood, potentially by the effects of ion exchange from the abundant clays in the target zone, surfactant would partition into the NAPL. To reduce the chance of this happening, a slightly lower salinity, O.2%, was used. This solution solubilized 49,464 mg/L compared to 68,706 mg/L for the optimum solution. The concentration of surfactant to be used was selected from solubilization/concentration relationships which show a large increase in solubilization beginning at 3.5% (Figure 4). A concentration of 4% was selected to ensure actual concentrations stayed above 3.5% in the subsurface.

Surfactant Sorption

The decision to use anionic surfactants was largely based on the anticipated high sorption of nonionic surfactants at Portsmouth resulting from the high clay contents. The sorption of the dihexyl sulfosuccinate was evaluated in batch tests. The results, tabulated in Appendix 4, showed the expected low sorption; sorption was below the limit of detection in 3 of four batch experiments. This confirmed the decision to use an anionic surfactant at this site.

Figure 3

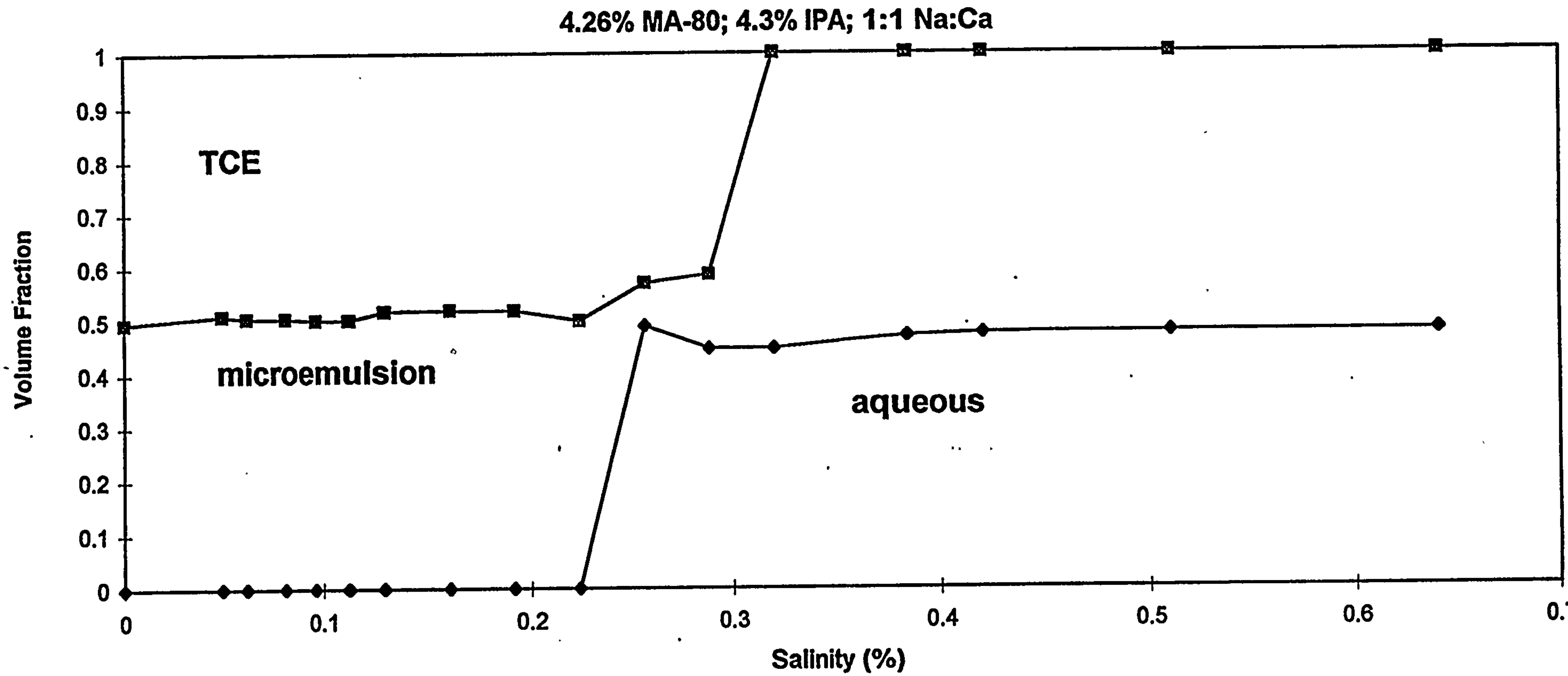
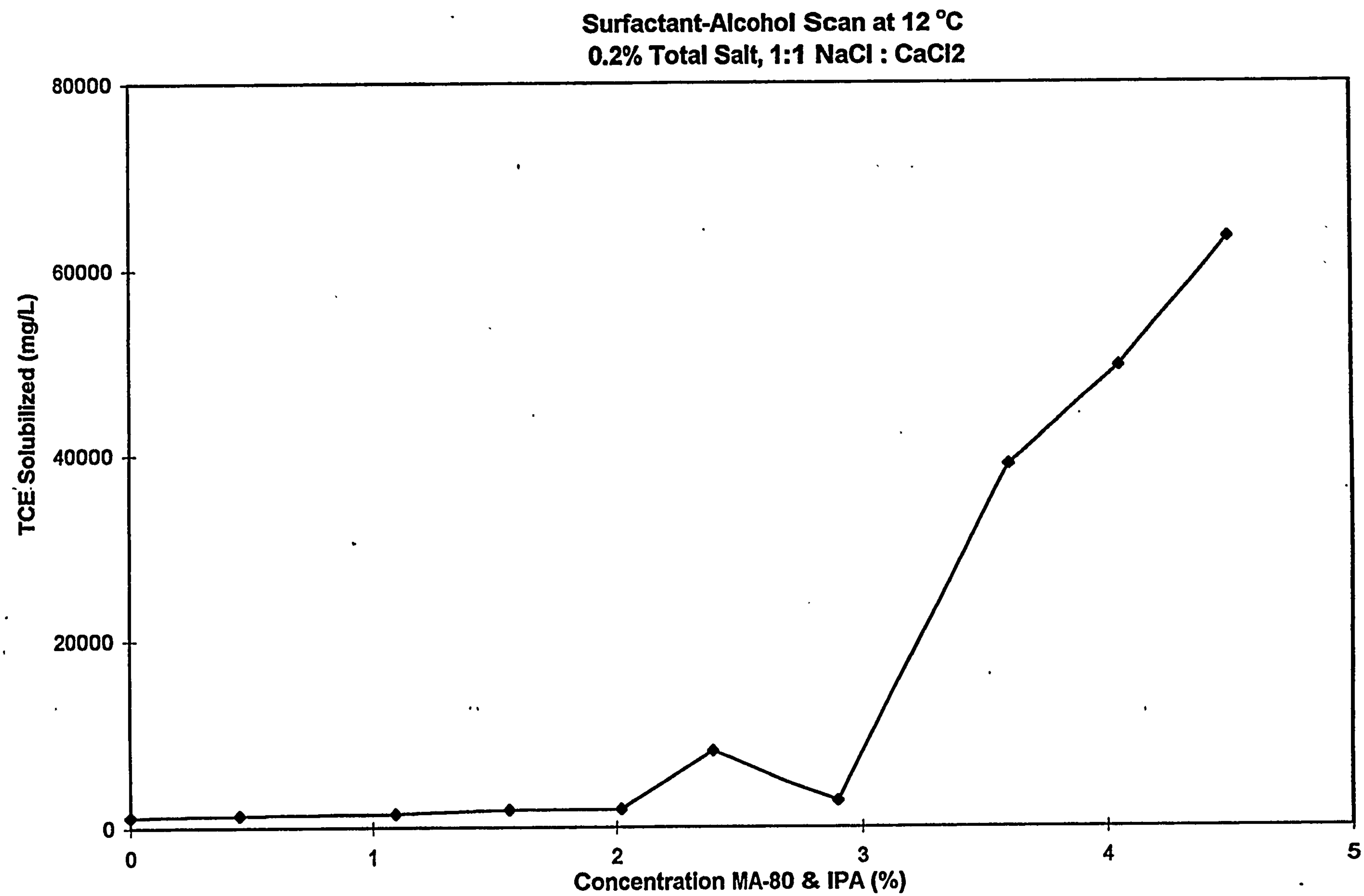

4.26% MA-80; 4.3% IPA; 1:1 Na:Ca
Volume Fraction
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
TCE
microemulsion
aqueous
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Salinity (%)

Figure 4


Surfactant-Alcohol Scan at 12 °C
0.2% Total Salt, 1:1 NaCl : CaCl2
80000
60000
40000
20000
0
TCE Solubilized (mg/L)
0
1
2
3
4
5
Concentration MA-80 & IPA (%)

Permeability Modification

The effect of the surfactant on aquifer permeability was evaluated though column experiments. Since the large cobbles from the core would not fit into the columns, and the diameter of the columns was too small to produce homogenous conditions with large clasts, cobbles were removed by sieving prior to packing the columns. The columns packed with cobble-free clay-rich sediments would pack tighter when surfactant was used and developed too high a back pressure for the glass columns. Hydraulic conductivity changed with time as the column packed-down but was always at least two orders of magnitude lower than that determined from pump tests. To provide a better approximation of site conditions a batch soil was made from the core samples by sieving to reduce the concentration of fines until conductivities on the order of 7 feet/day, were obtained. This soil was packed into 30 cm long, 2.5 cm diameter glass columns equipped with porous Teflon end plates. Water was pumped through the column under constant flow conditions with the head monitored. Surfactant solution was then pumped to determine any change in hydraulic conductivity. Results of these experiments, listed in Appendix 4, show that no measurable reduction occurred. This compares to a reduction in over one order of magnitude observed with the use of nonionic surfactants in columns with much lower clay contents (Zynda, 1996) confirming the value of using anionic surfactants and alcohol.

Characterization of DNAPL

A sample of DNAPL obtained from the site was analyzed for major components. A gas chromatography/mass spectrometer analysis determined that TCE was the only volatile that was present at levels that were quantifiable. An HPLC analysis determined a PCB concentration of 733 mg/L. The tension of the DNAPL with water was measured using a Du Nuoy ring tensiometer. A value of 16.7 dynes/cm was determined. This value is about half that of reagent grade TCE, but typical of weathered NAPL (Pankow and Cherry, 1996).

Interfacial Tension

The interfacial tension of the selected surfactant solution with TCE was measured in a pendant drop apparatus. A value of 0.288 dynes/cm was determined for the selected surfactant mixture (4% MA80, 4% IPA and 0.2% salt mixture). IFTs of other blends are given in Appendix 4. In fine grained sediments of the type found at Portsmouth, no vertical mobilization should be induced by an IFT of this value.

Environmental Acceptability

The dihexyl sulfosuccinate selected is an FDA food-grade additive used in a variety of edible products. Biodegradability of this surfactant has not been extensively studied but should be good due to its structure and its derivation from natural compounds.

Capillary Pressure

The relationship of capillary pressure to NAPL saturation is a function of pore size distribution in porous media. The relationship controls fluid flow and thus is required for understanding of a two-phase system. The relationship of capillary pressure to saturation is typically displayed as a capillary pressure/saturation curve; one objective of this work to measure a curve for sediments from the test area. A state-of-the-art capillary pressure/saturation apparatus was constructed the design of Lorentz et al, 1996. The apparatus is similar to that described in Kueper and McWhorter (1991) except that it uses a pressure transducer to provide a direct measurement of the difference between pressure on the water and NAPL phases (which is equal to the capillary pressure). Selection of the soil to be measured was a major issue. The samples from every depth of both cores received at Buffalo had very high clay and silt contents and hence presumably very low hydraulic conductivities. Measured hydraulic conductivities on a batch soil formed by homogenizing the lowest-clay portions of the cores were on the order of 10^{-4} cm/sec, nearly two orders of magnitude lower than the conductivity determined from pump tests at the site. In view of the finer nature of the remainder of the core, conductivity of other portions would be even lower. There was thus a significant difference between the hydraulic conductivity of the samples from our cores and that of the actual target zone. Some of this difference is presumably due to the presence of numerous large cobbles. Large cobbles are typically not well sampled by core tubes and are excluded from batch soils (due to the impossibility of homogenizing small samples containing large particles). To produce a capillary curve that would be more representative of the bulk sample, site soil was sieved to reduce the content of fine material. It was found to be necessary to remove nearly all fine material (by sieving through a #120 sieve and keeping the portion remaining on the sieve) to produce a hydraulic conductivity in the 10^{-3} cm/sec range. Since the shape of the curve is a function of sorting (well sorted grains have a nearly horizontal center portion of the capillary pressure/saturation curve) while poorly sorted soils have a large negative slope, the effect of sorting the grains would be to change the shape of the curve.

A number of trials were made using the sieved soil. The best curve generated from these experiments is in Appendix 4. Considerable difficulty was encountered due to the very small increments in capillary pressure for a given change in saturation, leading eventually to the use of the traditional burette method (Kueper and McWhorter, 1991) of measuring head rather than the transducer.

ANALYTICAL RESULTS of FIELD TRIAL SAMPLES

Water samples collected by Intera from the Portsmouth surfactant field trial were analyzed by SUNY for volatile organic compounds, isopropanol and for surfactant. Results of the analyses are tabulated in Appendix 5. Analyses for alcohol and volatile organics were done by direct injection gas chromatography using a mass selective detector (GC/MS). Analytical methods and QA/QC are listed in Appendix 2. Surfactant was analyzed by high performance liquid chromatography using a ultra violet detector (HPLC/UV), method details and QA/QC are given in Appendix 2.

Figure 5

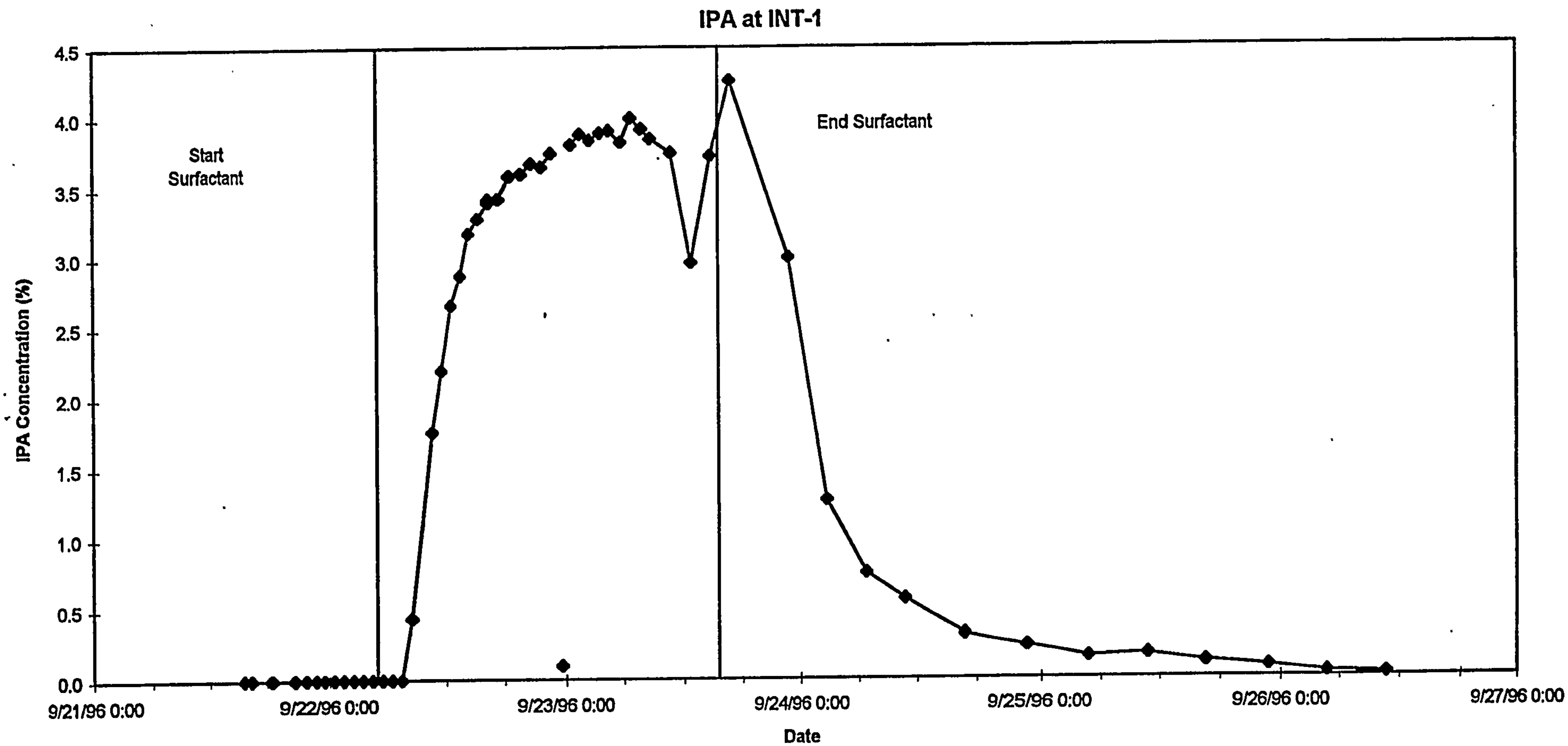

IPA at INT-1
Start
Surfactant
End Surfactant
IPA Concentration (%)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
9/21/96 0:00
9/22/96 0:00
9/23/96 0:00
9/24/96 0:00
9/25/96 0:00
9/26/96 0:00
9/27/96 0:00
Date

Figure 6

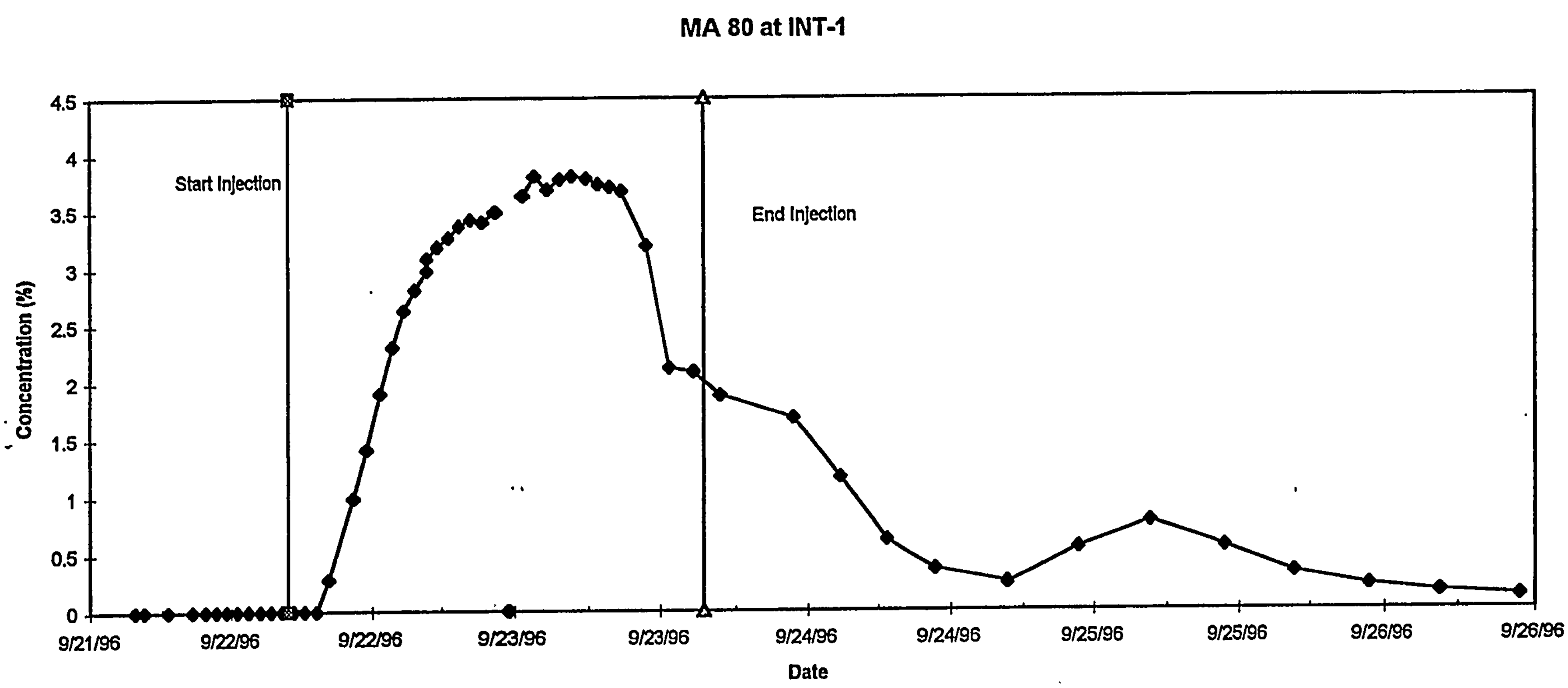
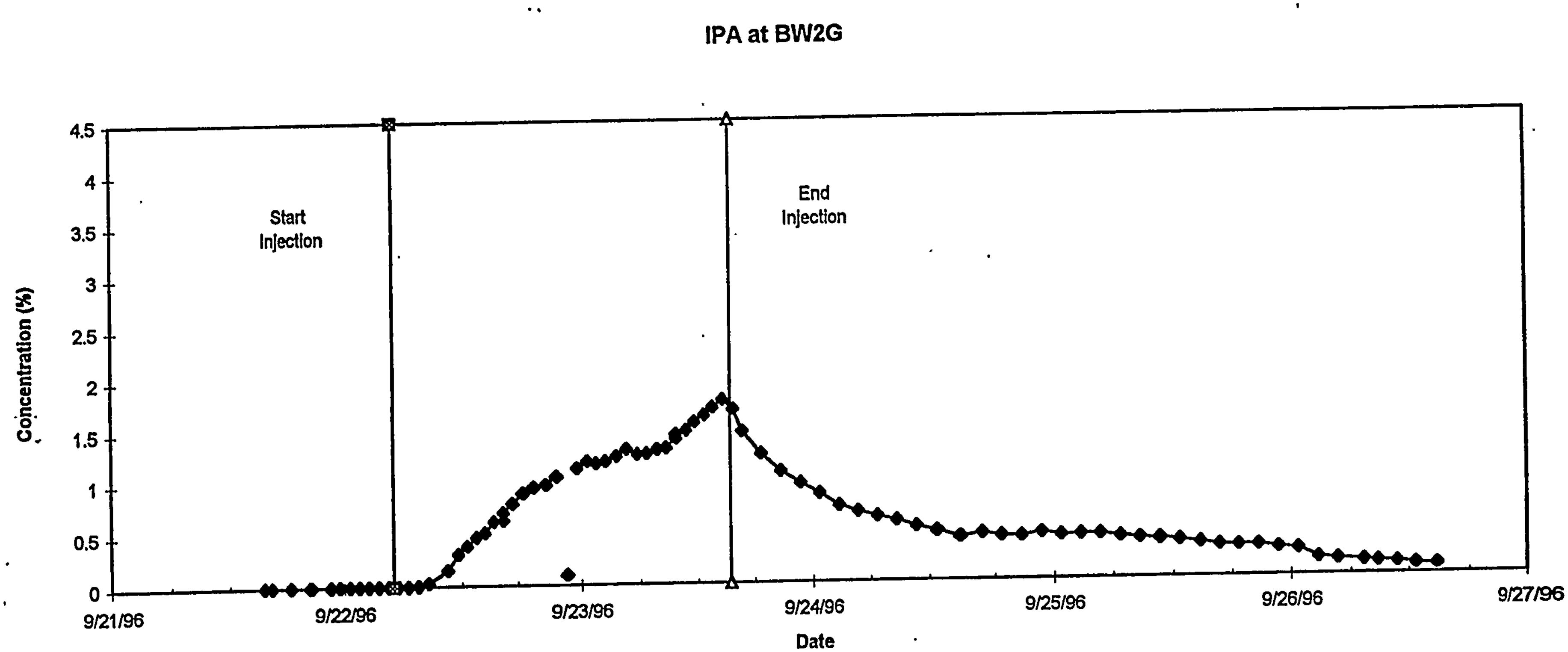

MA 80 at INT-1
Start Injection
End Injection
Concentration (%)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
9/21/96
9/22/96
9/22/96
9/23/96
9/23/96
9/24/96
9/24/96
9/25/96
9/25/96
9/26/96
9/26/96
Date

Figure 7



IPA at BW2G
Start
Injection
End
Injection
Concentration (%)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
9/21/96
9/22/96
9/23/96
9/24/96
9/25/96
9/26/96
9/27/96
Date

Figure 8

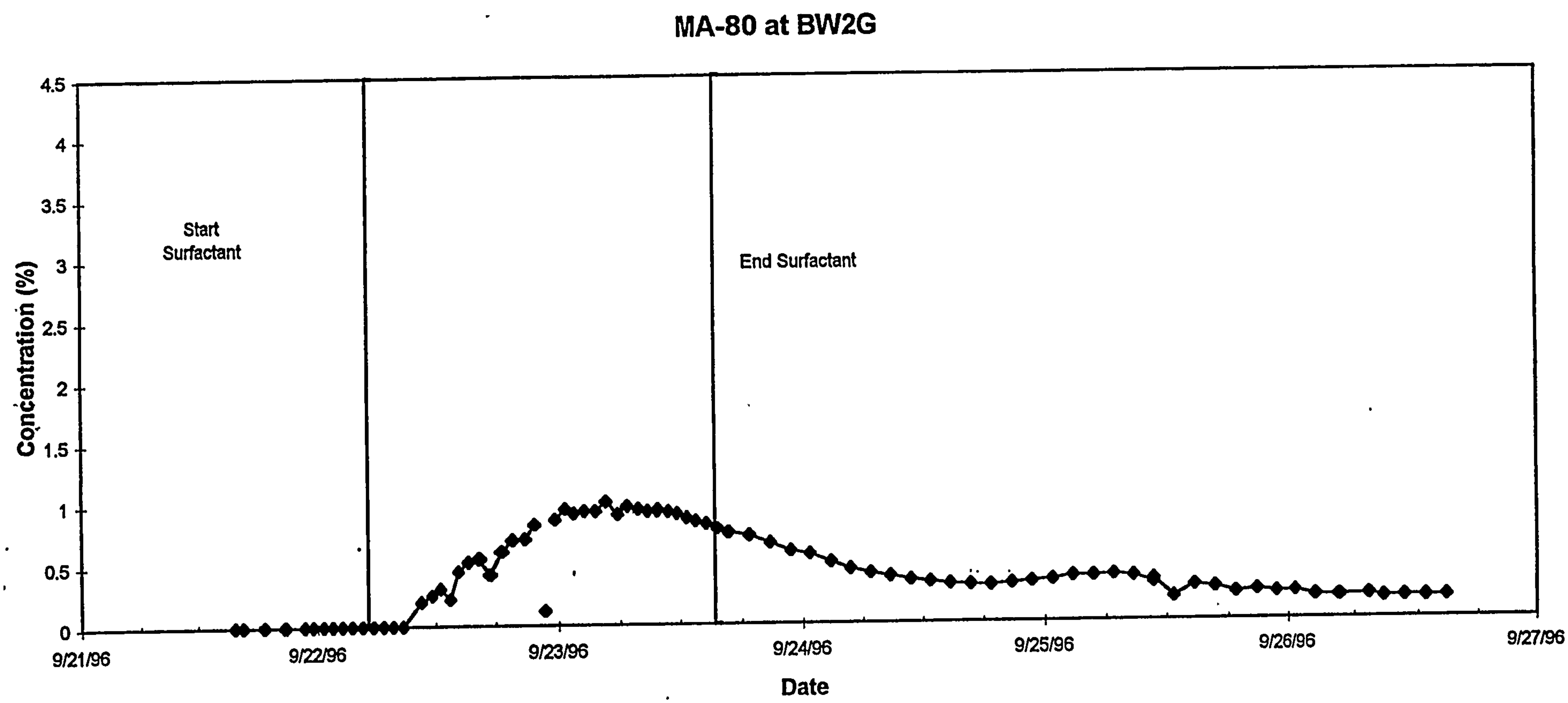
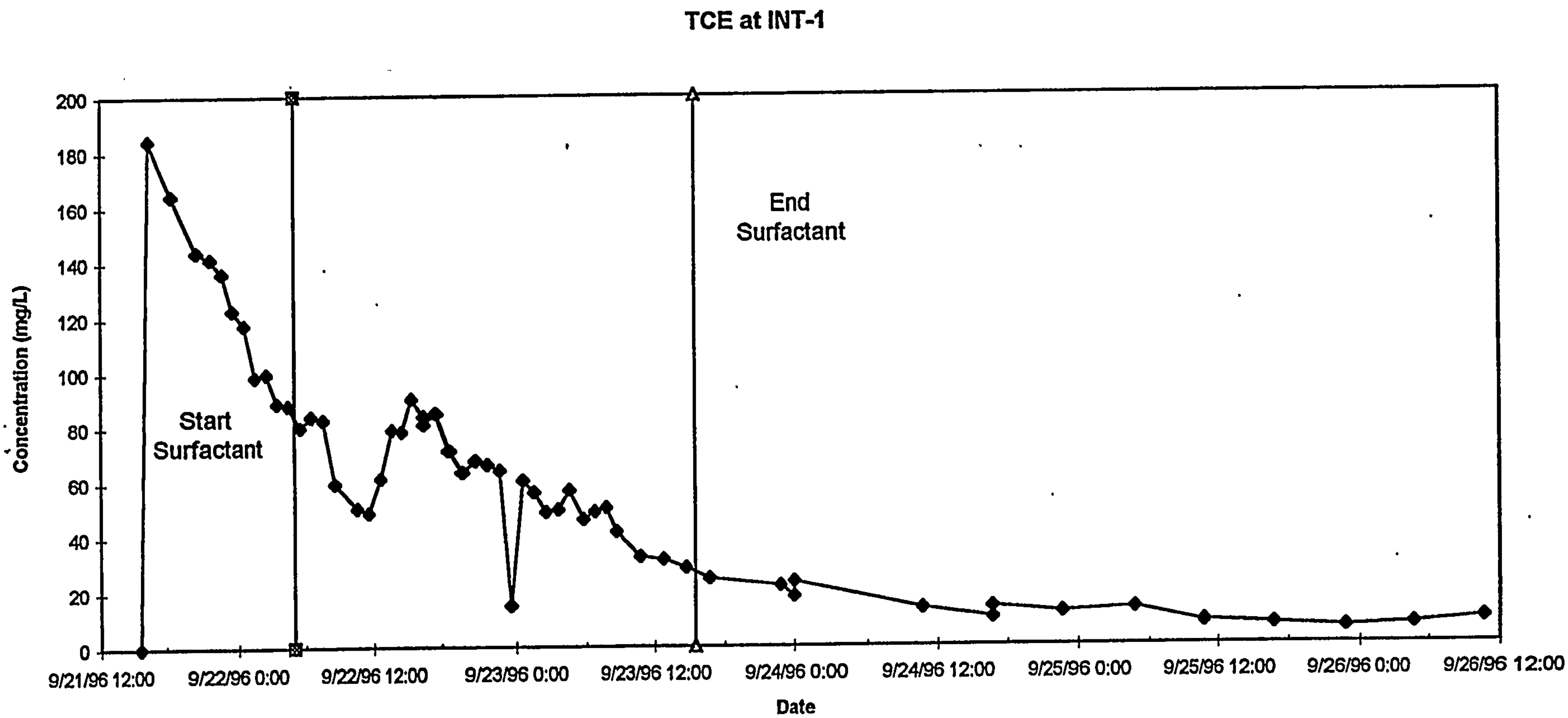
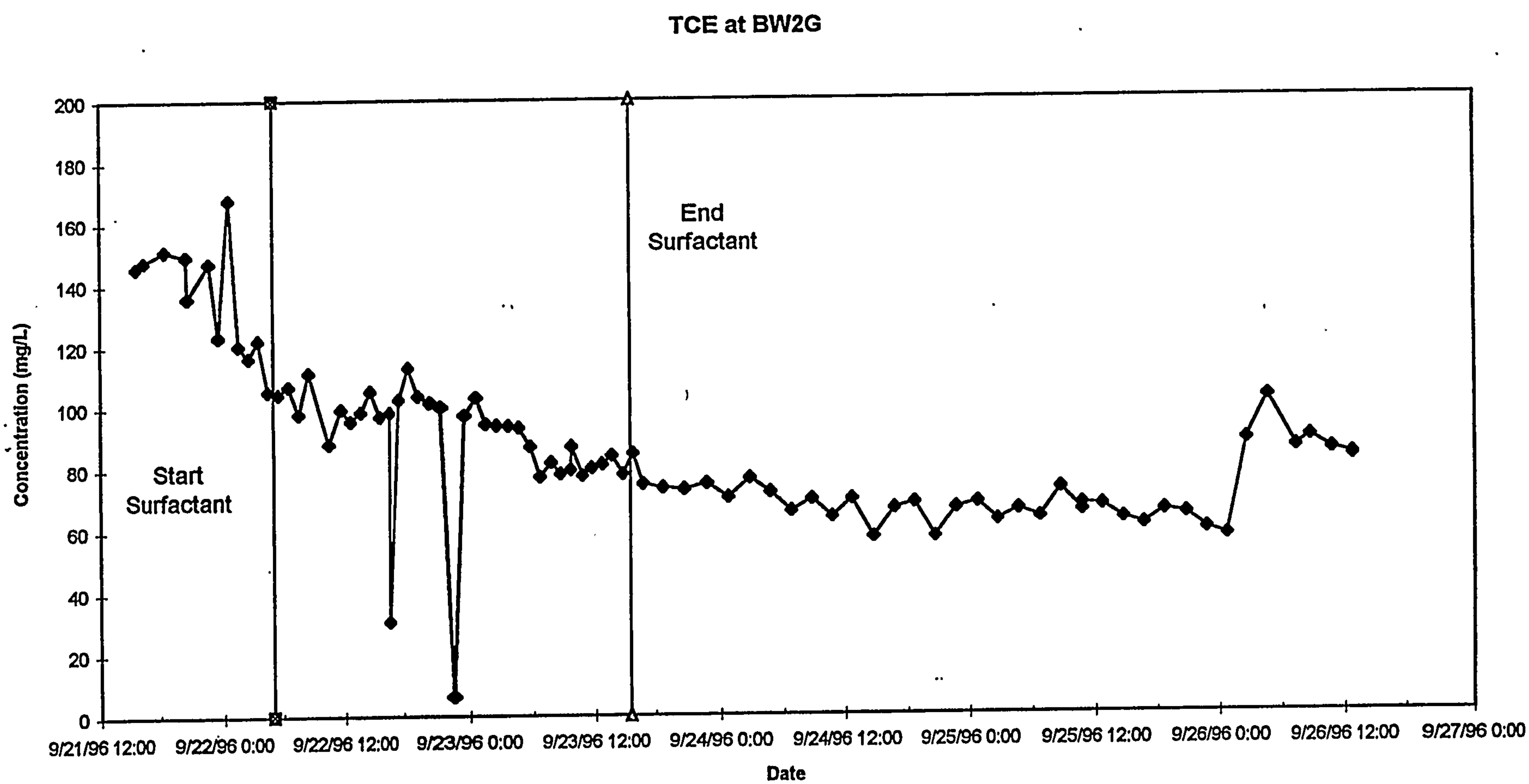

MA-80 at BW2G
Concentration (%)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Start
Surfactant
End Surfactant
9/21/96
9/22/96
9/23/96
9/24/96
9/25/96
9/26/96
9/27/96
Date

Figure 9



TCE at INT-1
Concentration (mg/L)
200
180
160
140
120
100
80
60
40
20
0
Start
Surfactant
End
Surfactant
9/21/96 12:00
9/22/96 0:00
9/22/96 12:00
9/23/96 0:00
9/23/96 12:00
9/24/96 0:00
9/24/96 12:00
9/25/96 0:00
9/25/96 12:00
9/26/96 0:00
9/26/96 12:00
Date

Figure 10


TCE at BW2G
Concentration (mg/L)
200
180
160
140
120
100
80
60
40
20
0
Start
Surfactant
End
Surfactant
9/21/96 12:00
9/22/96 0:00
9/22/96 12:00
9/23/96 0:00
9/23/96 12:00
9/24/96 0:00
9/24/96 12:00
9/25/96 0:00
9/25/96 12:00
9/26/96 0:00
9/26/96 12:00
9/27/96 0:00
Date

The analytical results are summarized on Figures 5-10. Standard curves for all analyses were linear and consistent (Appendix 2). After initial analysis, in addition to standard QA/QC, all samples that exhibited unexpected concentrations were reanalyzed. Although reanalysis produced slightly less noise (for example samples with high isopropanol concentrations were diluted 1:1 and reanalyzed as the detector was noisy at very high concentrations), no significant changes in concentration trends were found. Thus all trends shown on Figures 5-10 have been confirmed. A detailed discussion of data verification is given in Appendix 2.

DATA INTERPRETATION

Interpretation of the data is ongoing however several preliminary conclusions may be drawn:

1. Comparison of isopropanol (IPA), propanol and MA80 breakthrough. The breakthrough curves (concentration versus time) for isopropanol (which was used in the injected surfactant mixture), propanol, which was a conservative tracer in the post test tracer test (data from Intera), and MA80, the surfactant, are almost identical at INT-1 (Figures 5 and 6). This indicates that no significant sorption of the surfactant occurred and that the flow at the conclusion of the surfactant test was essentially the same as at the start, thus no degradation of the zone occurred due to surfactant injection. Curves for these three components at BW2G, the extraction well, were also similar, although the breakthrough was less steep which heightened the effect of change in injected concentration in IPA and MA80 during the surfactant flood (Figures 7 and 8). The lower slope on the breakthrough at BW2G is presumably due to the multiple paths from the injection well to the extraction well compared to the single path to the monitor well (INT-1).

The concentration of both IPA and MA80 at INT-1 reached the concentration of the injected solution indicating that no dilution occurred. The concentration of MA80 at BW2G reached approximately 1% while the IPA initially plateaued at 1.2%. MA80 then decreased as IPA increased reflecting parallel changes in concentrations of the injected solution. The lower concentration at the extraction wells relative to INT-1 reflect dilution at the extraction well. The ratio of concentration of the IPA and MA80 at BW2G to their concentrations in the injected solutions are very similar to the ratio observed for propanol in the final tracer test suggesting dilution was unchanged. This also indicates that flow paths were not significantly changed during the test.

An interesting aspect of the concentration versus time curves is the abrupt change of concentration at the wells immediately after changing concentration at the injection well. Isopropanol concentrations at BW2G declined in the first sample collected after IPA injection was stopped and in the second sample at INT-1 after injection was stopped. MA80 concentration at INT-1 declined the first sample after each change in concentration of the injected solutions. MA80 concentrations at BW2G also declined immediately after concentration changes in the injection well, although the changes were more gradual reflecting the lower slope on the breakthrough curve. The abrupt changes indicate that a significant volume of solution was flowing rapidly from the injection well to the monitor well and the extraction well. This was not observed in the breakthrough curves since inflections in the concentration were not observed until 4 samples (4 hours) after the start of surfactant injection at either INT-1 or BW2G. This was the case for the propanol for the post-test tracer as well.

TCE versus time curves are shown in Figures 9 and 10. The concentration of TCE at INT-1 began at over 180 mg/L and declined rapidly. An increase from about 50 to 100 mg/L on 9/22 in the early afternoon corresponds to breakthrough of surfactant. The very low increase in concentration, and the subsequent rapid decline to less the 50 mg/L while surfactant was still arriving, indicate a very small amount of TCE was encountered by the solution reaching INT-1. The tailing of concentration in the monitor well then followed the typical exponential tailing expected from water pumping.

TCE at BW2G initially was about 150 mg/L and tailed rapidly. A plateau in the tail at about 100 mg/L began at the time of surfactant breakthrough and remained until surfactant concentration began to decline. As with INT-1 samples, the very low TCE concentrations indicate very little TCE was encountered. The much higher tail at BW2G, over 60 mg/L compared to about 10 at INT-1 is presumably due to arrival of water along slower flow paths to the extraction well. Since pre-test TCE concentrations at BW2G-1 were about 20 mg/L, the tail presumably represents an elevated level reflecting surfactant arrival through slower flow paths.

The initial TCE concentrations at both INT-1 and BW2G were much higher than observed during the first tracer test. Since the increase occurred prior to surfactant injection it is not due to surfactants. The tracer test was run more than a month before the surfactant flood, apparently ground water with higher concentrations of TCE flowed into the test area during the period between the tracer test and the surfactant test. We do not have data on concentrations of other wells in the area over time, nor of the flow in the area during the time between the initial tracer and the surfactant flood from which to verify this hypothesis. The pattern of decline of the TCE is however, except for the effect of the surfactants, consistent with dissolved phase contamination.

The tracer tests conducted by Intera aid interpretation of the data. The initial tracer suggested about 0.2-0.4% saturation in the Lower Gravel, the post test tracer suggested about 0.13% remained. While a reduction of 50% in the amount of NAPL present with a 1.5 day flood is remarkable, the reason the remaining NAPL was not removed is also important. The solubilization ability of the surfactant is such that it should have been able to solubilize all the NAPL present in one pore volume. The lack of removal may have been due to three factors:

1. Kinetics: If DNAPL were present as a pool, even a small pool such as in the very large pores between cobbles in the gravel layer, then pool dissolution could have been kinetically limited. Surfactant concentrations exceeded the 3.5% concentration at which solubilization is first effective for only 12 hours at INT-1. This may have been too brief a time for trapped pool dissolution.

2. Heterogeneities. The bulk hydraulic conductivity of the gravel unit is due to large pores produced by large cobbles in the gravel. The unit is composed of a fine grained matrix with cobbles, producing a very heterogeneous unit. The unit will be heterogeneous in hydraulic conductivity, in DNAPL distribution and in flow direction. DNAPL that penetrated to the gravel would follow the high

conductivity zones, but may be readily trapped in the spaces between cobbles. This would produce a number of small, isolated pools.

Flow is channelized through the large pores, with comparatively minor flow through the matrix. While a high permeability channel connection must be present between the injection and extraction wells to produce the observed hydraulic conductivity, it is unlikely all channels are oriented along the line from injection to extraction wells. Surfactant flow in channels that are at an angle to the primary flow direction may be much less than in the main channel. It is almost inevitable that the heterogeneities inherent in a gravel zone of this type produce slower cleaning in some areas than others. Since the variation between gravel-rich zones and gravel poor zones is at least two orders of magnitude, and probably four, a range of cleaning times should also be expected. This problem is somewhat ameliorated by the fact that DNAPL tends to concentrate in the high K zones and generally cannot enter the low K zones. However horizontal heterogeneity can hydraulically isolate a high K zone and thus produce slower cleaning even in a high permeability zone.

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APPENDIX 1

Grain Size Analysis

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Grain Size Analysis of Core B1

B1-C1	Sample Wt =	9.712	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g	Weight (g)	Percent
#10 (Granule)	50.193	50.245	0.052	0.5
#18 (v. coarse san	48.077	48.107	0.03	0.3
#35 (coarse sand)	41.074	41.334	0.26	2.7
#60 (medium sand	35.024	35.86	0.836	8.6
#120 (fine sand)	34.254	35.721	1.467	15.1
#230 (v. fine sand)	32.905	35.936	3.031	31.2
fines (silt + clay)	20.889	24.786	3.897	40.1
			9.573	98.6

B1-C2	Sample Wt =	9.908	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g	Weight (g)	Percent
#10 (Granule)	50.169	50.169	0	0.0
#18 (v. coarse san	48.068	48.088	0.02	0.2
#35 (coarse sand)	41.061	41.282	0.221	2.2
#60 (medium sand	35.008	35.897	0.889	9.0
#120 (fine sand)	34.249	36.367	2.118	21.4
#230 (v. fine sand)	32.903	36.178	3.275	33.1
fines (silt + clay)	20.905	24.264	3.359	33.9
			9.882	99.7

B1-C3	Sample Wt =	8.043	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g	Weight (g)	Percent
#10 (Granule)	50.196	50.204	0.008	0.1
#18 (v. coarse san	48.077	48.123	0.046	0.6
#35 (coarse sand)	41.069	41.218	0.149	1.9
#60 (medium sand	35.02	35.494	0.474	5.9
#120 (fine sand)	34.259	35.446	1.187	14.8
#230 (v. fine sand)	32.907	35.559	2.652	33.0
fines (silt + clay)	20.857	24.321	3.464	43.1
			7.98	99.2

B1-C4	Sample Wt =	8.848	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g	Weight (g)	Percent
#10 (Granule)	50.202	50.202	0	0.0
#18 (v. coarse san	48.09	48.117	0.027	0.3
#35 (coarse sand)	41.097	41.528	0.431	4.9
#60 (medium sand	35.039	35.85	0.811	9.2
#120 (fine sand)	34.259	34.961	0.702	7.9
#230 (v. fine sand)	32.91	35.686	2.776	31.4
fines (silt + clay)	20.838	24.791	3.953	44.7
			8.7	98.3

Grain Size Analysis of Core B3

B3-C5	Sample Wt =	8.508	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.193	50.202	0.009	0.1
#18 (v. coarse sand)	48.073	48.118	0.045	0.5
#35 (coarse sand)	41.068	41.333	0.265	3.1
#60 (medium sand)	35.037	36.175	1.138	13.4
#120 (fine sand)	34.262	35.487	1.225	14.4
#230 (v. fine sand)	32.925	35.063	2.138	25.1
fines (silt + clay)	20.869	24.391	3.522	41.4
			8.342	98.0

B3-C6	Sample Wt =	9.147	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.194	50.194	0	0.0
#18 (v. coarse sand)	48.076	48.076	0	0.0
#35 (coarse sand)	41.068	41.173	0.105	1.1
#60 (medium sand)	35.037	35.983	0.946	10.3
#120 (fine sand)	34.261	36.009	1.748	19.1
#230 (v. fine sand)	32.903	34.913	2.01	22.0
fines (silt + clay)	20.838	25.019	4.181	45.7
			8.99	98.3

B3-C7	Sample Wt =	8.42	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.212	50.216	0.004	0.0
#18 (v. coarse sand)	48.089	48.119	0.03	0.4
#35 (coarse sand)	41.086	41.158	0.072	0.9
#60 (medium sand)	35.057	35.777	0.72	8.6
#120 (fine sand)	34.274	37.479	3.205	38.1
#230 (v. fine sand)	32.927	35.316	2.389	28.4
fines (silt + clay)	20.82	22.575	1.755	20.8
			8.175	97.1

B3-C8	Sample Wt =	10.995	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.195	50.201	0.006	0.1
#18 (v. coarse sand)	48.084	48.113	0.029	0.3
#35 (coarse sand)	41.082	41.274	0.192	1.7
#60 (medium sand)	35.048	36.798	1.75	15.9
#120 (fine sand)	34.27	37.172	2.902	26.4
#230 (v. fine sand)	32.928	35.878	2.95	26.8
fines (silt + clay)	20.867	23.929	3.062	27.8
			10.891	99.1

Grain Size Analysis of Core B1

B1-C14	Sample Wt =	7.477	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g	Weight (g)	Percent
#10 (Granule)	50.193	50.209	0.016	0.2
#18 (v. coarse san	48.071	48.123	0.052	0.7
#35 (coarse sand)	41.062	41.179	0.117	1.6
#60 (medium sand	35.013	35.563	0.55	7.4
#120 (fine sand)	34.26	35.435	1.175	15.7
#230 (v. fine sand)	32.905	35.37	2.465	33.0
fines (silt + clay)	20.844	23.841	2.997	40.1
			7.372	98.6

B1-C15	Sample Wt =	8.887	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g	Weight (g)	Percent
#10 (Granule)	50.207	50.207	0	0.0
#18 (v. coarse san	48.079	48.116	0.037	0.4
#35 (coarse sand)	41.066	41.189	0.123	1.4
#60 (medium sand	35.034	35.564	0.53	6.0
#120 (fine sand)	34.258	35.506	1.248	14.0
#230 (v. fine sand)	32.917	35.708	2.791	31.4
fines (silt + clay)	20.884	24.858	3.974	44.7
			8.703	97.9

B1-C16	Sample Wt =	6.92	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g	Weight (g)	Percent
#10 (Granule)	50.189	50.197	0.008	0.1
#18 (v. coarse san	48.074	48.095	0.021	0.3
#35 (coarse sand)	41.065	41.178	0.113	1.6
#60 (medium sand	35.027	35.599	0.572	8.3
#120 (fine sand)	34.254	35.59	1.336	19.3
#230 (v. fine sand)	32.892	34.96	2.068	29.9
fines (silt + clay)	20.876	23.583	2.707	39.1
			6.825	98.6

B1-C18	Sample Wt =	8.869	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g	Weight (g)	Percent
#10 (Granule)	50.184	51.641	1.457	16.4
#18 (v. coarse san	48.08	48.126	0.046	0.5
#35 (coarse sand)	41.069	41.267	0.198	2.2
#60 (medium sand	35.021	36.126	1.105	12.5
#120 (fine sand)	34.26	35.627	1.367	15.4
#230 (v. fine sand)	32.91	35.079	2.169	24.5
fines (silt + clay)	20.871	23.37	2.499	28.2
			8.841	99.8

Grain Size Analysis of Core B1

B1-C19	Sample Wt =	7.332	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g	Weight (g)	Percent
#10 (Granule)	50.187	50.582	0.395	5.4
#18 (v. coarse san	48.082	48.098	0.016	0.2
#35 (coarse sand)	41.068	41.25	0.182	2.5
#60 (medium sand	35.024	35.717	0.693	9.5
#120 (fine sand)	34.258	35.299	1.041	14.2
#230 (v. fine sand)	32.89	35.15	2.26	30.8
fines (silt + clay)	20.861	23.529	2.668	36.4
			7.255	98.9

B1-C20	Sample Wt =	10.124	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g	Weight (g)	Percent
#10 (Granule)	50.164	52.542	2.378	23.5
#18 (v. coarse san	48.067	48.141	0.074	0.7
#35 (coarse sand)	41.055	41.221	0.166	1.6
#60 (medium sand	37.234	38.152	0.918	9.1
#120 (fine sand)	34.246	35.718	1.472	14.5
#230 (v. fine sand)	32.896	35.033	2.137	21.1
fines (silt + clay)	20.907	23.82	2.913	28.8
			10.058	99.3

B1-C21	Sample Wt =	8.616	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g	Weight (g)	Percent
#10 (Granule)	50.184	50.259	0.075	0.9
#18 (v. coarse san	48.075	48.079	0.004	0.0
#35 (coarse sand)	41.068	41.269	0.201	2.4
#60 (medium sand	35.012	36.223	1.211	14.2
#120 (fine sand)	34.256	35.927	1.671	19.6
#230 (v. fine sand)	32.908	35.315	2.407	28.3
fines (silt + clay)	20.873	23.638	2.765	32.5
			8.334	97.9

Grain Size Analysis of Core B3

B3-C1	Sample Wt =	12.848	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.166	50.172	0.006	0.0
#18 (v. coarse sand)	48.069	48.117	0.048	0.4
#35 (coarse sand)	41.056	41.209	0.153	1.2
#60 (medium sand)	37.233	38.917	1.684	13.1
#120 (fine sand)	34.25	38.022	3.772	29.4
#230 (v. fine sand)	32.904	36.757	3.853	30.0
fines (silt + clay)	20.936	24.138	3.202	24.9
			12.718	99.0

B3-C2	Sample Wt =	7.556	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.195	50.206	0.011	0.1
#18 (v. coarse sand)	48.075	48.107	0.032	0.4
#35 (coarse sand)	41.065	41.145	0.08	1.1
#60 (medium sand)	35.082	35.409	0.327	4.3
#120 (fine sand)	34.249	35.121	0.872	11.5
#230 (v. fine sand)	32.903	36.1	3.197	42.3
fines (silt + clay)	20.858	23.672	2.814	37.2
			7.333	97.0

B3-C3	Sample Wt =	8.742	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.179	50.182	0.003	0.0
#18 (v. coarse sand)	48.075	48.131	0.056	0.6
#35 (coarse sand)	41.065	41.241	0.176	2.0
#60 (medium sand)	35.014	35.432	0.418	4.8
#120 (fine sand)	34.259	35.426	1.167	13.3
#230 (v. fine sand)	32.904	36.137	3.233	37.0
fines (silt + clay)	20.869	24.351	3.482	39.8
			8.535	97.6

B3-C4	Sample Wt =	7.86	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.203	50.203	0	0.0
#18 (v. coarse sand)	48.091	48.132	0.041	0.5
#35 (coarse sand)	41.098	41.394	0.296	3.8
#60 (medium sand)	35.073	35.882	0.809	10.3
#120 (fine sand)	34.314	36.74	2.426	30.9
#230 (v. fine sand)	33.019	35.343	2.324	29.6
fines (silt + clay)	20.87	22.728	1.858	23.6
			7.754	98.7

Grain Size Analysis of Core B3

B3-C5	Sample Wt =	8.508	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.193	50.202	0.009	0.1
#18 (v. coarse sand)	48.073	48.118	0.045	0.5
#35 (coarse sand)	41.068	41.333	0.265	3.1
#60 (medium sand)	35.037	36.175	1.138	13.4
#120 (fine sand)	34.262	35.487	1.225	14.4
#230 (v. fine sand)	32.925	35.063	2.138	25.1
fines (silt + clay)	20.869	24.391	3.522	41.4
			8.342	98.0

B3-C6	Sample Wt =	9.147	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.194	50.194	0	0.0
#18 (v. coarse sand)	48.076	48.076	0	0.0
#35 (coarse sand)	41.068	41.173	0.105	1.1
#60 (medium sand)	35.037	35.983	0.946	10.3
#120 (fine sand)	34.261	36.009	1.748	19.1
#230 (v. fine sand)	32.903	34.913	2.01	22.0
fines (silt + clay)	20.838	25.019	4.181	45.7
			8.99	98.3

B3-C7	Sample Wt =	8.42	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.212	50.216	0.004	0.0
#18 (v. coarse sand)	48.089	48.119	0.03	0.4
#35 (coarse sand)	41.086	41.158	0.072	0.9
#60 (medium sand)	35.057	35.777	0.72	8.6
#120 (fine sand)	34.274	37.479	3.205	38.1
#230 (v. fine sand)	32.927	35.316	2.389	28.4
fines (silt + clay)	20.82	22.575	1.755	20.8
			8.175	97.1

B3-C8	Sample Wt =	10.995	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.195	50.201	0.006	0.1
#18 (v. coarse sand)	48.084	48.113	0.029	0.3
#35 (coarse sand)	41.082	41.274	0.192	1.7
#60 (medium sand)	35.048	36.798	1.75	15.9
#120 (fine sand)	34.27	37.172	2.902	26.4
#230 (v. fine sand)	32.928	35.878	2.95	26.8
fines (silt + clay)	20.867	23.929	3.062	27.8
			10.891	99.1

Grain Size Analysis of Core B3

B3-C9	Sample Wt =	8.084	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.199	50.222	0.023	0.3
#18 (v. coarse sand)	48.087	48.187	0.1	1.2
#35 (coarse sand)	41.07	41.234	0.164	2.0
#60 (medium sand)	35.033	35.575	0.542	6.7
#120 (fine sand)	34.26	36.082	1.822	22.5
#230 (v. fine sand)	32.904	35.484	2.58	31.9
fines (silt + clay)	20.871	23.74	2.869	35.5
			8.1	100.2

B3-C10	Sample Wt =	8.974	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.166	50.17	0.004	0.0
#18 (v. coarse sand)	48.071	48.102	0.031	0.3
#35 (coarse sand)	41.057	41.168	0.111	1.2
#60 (medium sand)	37.233	37.688	0.455	5.1
#120 (fine sand)	34.25	36.09	1.84	20.5
#230 (v. fine sand)	32.895	36.182	3.287	36.6
fines (silt + clay)	20.906	24.092	3.186	35.5
			8.914	99.3

B3-C11	Sample Wt =	9.355	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.2	50.24	0.04	0.4
#18 (v. coarse sand)	48.082	48.115	0.033	0.4
#35 (coarse sand)	41.067	41.318	0.251	2.7
#60 (medium sand)	35.026	36.302	1.276	13.6
#120 (fine sand)	34.27	36.035	1.765	18.9
#230 (v. fine sand)	32.907	35.347	2.44	26.1
fines (silt + clay)	20.889	24.213	3.324	35.5
			9.129	97.6

B3-C12	Sample Wt =	8.086	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.183	50.227	0.044	0.5
#18 (v. coarse sand)	48.075	48.194	0.119	1.5
#35 (coarse sand)	41.067	41.482	0.415	5.1
#60 (medium sand)	35.02	35.856	0.836	10.3
#120 (fine sand)	34.258	35.214	0.956	11.8
#230 (v. fine sand)	32.901	35.247	2.346	29.0
fines (silt + clay)	20.865	24.081	3.216	39.8
			7.932	98.1

Grain Size Analysis of Core B3

B3-C13	Sample Wt =	7.638	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.2	50.236	0.036	0.5
#18 (v. coarse sand)	48.085	48.192	0.107	1.4
#35 (coarse sand)	41.081	41.338	0.257	3.4
#60 (medium sand)	35.03	36.133	1.103	14.4
#120 (fine sand)	34.261	35.697	1.436	18.8
#230 (v. fine sand)	32.912	34.722	1.81	23.7
fines (silt + clay)	20.822	23.616	2.794	36.6
			7.543	98.8

B3-C14	Sample Wt =	7.287	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.183	50.194	0.011	0.2
#18 (v. coarse sand)	48.086	48.086	0	0
#35 (coarse sand)	41.063	41.219	0.156	2.1
#60 (medium sand)	35.023	35.912	0.889	12.2
#120 (fine sand)	34.256	35.527	1.271	17.4
#230 (v. fine sand)	32.904	35.036	2.132	29.3
fines (silt + clay)	20.871	23.592	2.721	37.3
			7.18	98.5

B3-C15	Sample Wt =	8.33	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.191	51.235	1.044	12.5
#18 (v. coarse sand)	48.073	48.102	0.029	0.3
#35 (coarse sand)	41.068	41.133	0.065	0.8
#60 (medium sand)	35.049	35.323	0.274	3.3
#120 (fine sand)	34.263	35.219	0.956	11.5
#230 (v. fine sand)	32.904	35.209	2.305	27.7
fines (silt + clay)	20.873	24.358	3.485	41.8
			8.158	97.9

B3-C16	Sample Wt =	7.875	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.176	50.214	0.038	0.5
#18 (v. coarse sand)	48.07	48.173	0.103	1.3
#35 (coarse sand)	41.056	41.371	0.315	4.0
#60 (medium sand)	37.239	38.355	1.116	14.2
#120 (fine sand)	34.254	35.748	1.494	19.0
#230 (v. fine sand)	32.896	35.041	2.145	27.2
fines (silt + clay)	20.91	23.482	2.572	32.7
			7.783	98.8

Grain Size Analysis of Core B3

B3-C17	Sample Wt =	8.353	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.168	50.453	0.285	3.4
#18 (v. coarse sand)	48.067	48.27	0.203	2.4
#35 (coarse sand)	41.088	41.576	0.488	5.8
#60 (medium sand)	37.236	38.316	1.08	12.9
#120 (fine sand)	34.247	35.375	1.128	13.5
#230 (v. fine sand)	32.901	35.126	2.225	26.6
fines (silt + clay)	20.887	23.725	2.838	34.0
			8.247	98.7

B3-C19A	Sample Wt =	7.259	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.182	50.351	0.169	2.3
#18 (v. coarse sand)	48.074	48.112	0.038	0.5
#35 (coarse sand)	41.061	41.279	0.218	3.0
#60 (medium sand)	37.239	38.48	1.241	17.1
#120 (fine sand)	34.253	35.804	1.551	21.4
#230 (v. fine sand)	32.907	34.847	1.94	26.7
fines (silt + clay)	20.914	22.912	1.998	27.5
			7.155	98.6

B3-C19-B	Sample Wt =	9.773	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.173	50.228	0.055	0.6
#18 (v. coarse sand)	48.073	48.246	0.173	1.8
#35 (coarse sand)	41.063	41.829	0.766	7.8
#60 (medium sand)	37.232	39.392	2.16	22.1
#120 (fine sand)	34.252	36.359	2.107	21.6
#230 (v. fine sand)	32.903	35.095	2.192	22.4
fines (silt + clay)	20.936	23.115	2.179	22.3
			9.632	98.6

B3-C20	Sample Wt =	8.574	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.169	50.196	0.027	0.3
#18 (v. coarse sand)	48.068	48.085	0.017	0.2
#35 (coarse sand)	41.059	41.137	0.078	0.9
#60 (medium sand)	37.238	38.988	1.75	20.4
#120 (fine sand)	34.25	36.218	1.968	23.0
#230 (v. fine sand)	32.898	34.865	1.967	22.9
fines (silt + clay)	20.902	23.622	2.72	31.7
			8.527	99.5

Grain Size Analysis of Core B3

B3-C21	Sample Wt =	9.93	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.173	50.239	0.066	0.7
#18 (v. coarse sand)	48.08	48.506	0.426	4.3
#35 (coarse sand)	41.069	43.023	1.954	19.7
#60 (medium sand)	35.04	37.096	2.056	20.7
#120 (fine sand)	34.254	35.815	1.561	15.7
#230 (v. fine sand)	32.896	34.627	1.731	17.4
fines (silt + clay)	20.89	22.882	1.992	20.1
			9.786	98.5

B3-C22	Sample Wt =	7.903	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.17	50.171	0.001	0.0
#18 (v. coarse sand)	48.073	48.098	0.025	0.3
#35 (coarse sand)	41.061	41.154	0.093	1.2
#60 (medium sand)	35.019	35.335	0.316	4.0
#120 (fine sand)	34.252	35.294	1.042	13.2
#230 (v. fine sand)	32.899	35.217	2.318	29.3
fines (silt + clay)	20.889	24.916	4.027	51.0
			7.822	99.0

B3-C23	Sample Wt =	9.277	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.176	50.187	0.011	0.1
#18 (v. coarse sand)	48.078	48.262	0.184	2.0
#35 (coarse sand)	41.065	41.732	0.667	7.2
#60 (medium sand)	35.037	36.845	1.808	19.5
#120 (fine sand)	34.253	35.837	1.584	17.1
#230 (v. fine sand)	32.907	35.204	2.297	24.8
fines (silt + clay)	20.886	23.491	2.605	28.1
			9.156	98.7

B3-C24	Sample Wt =	11.32	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.174	51.694	1.52	13.4
#18 (v. coarse sand)	48.078	48.814	0.736	6.5
#35 (coarse sand)	41.069	42.553	1.484	13.1
#60 (medium sand)	35.05	36.867	1.817	16.1
#120 (fine sand)	34.255	35.657	1.402	12.4
#230 (v. fine sand)	32.908	34.954	2.046	18.1
fines (silt + clay)	20.89	23.061	2.171	19.2
			11.176	98.7

Grain Size Analysis of Core B3

B3-C25	Sample Wt =	10.858	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.163	51.078	0.915	8.4
#18 (v. coarse sand)	48.07	48.289	0.219	2.0
#35 (coarse sand)	41.055	41.666	0.611	5.6
#60 (medium sand)	37.233	38.583	1.35	12.4
#120 (fine sand)	34.248	35.692	1.444	13.3
#230 (v. fine sand)	32.898	35.706	2.808	25.9
fines (silt + clay)	20.931	24.453	3.522	32.4
			10.869	100.1

B3-C26	Sample Wt =	9.108	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.172	50.443	0.271	3.0
#18 (v. coarse sand)	48.077	48.806	0.729	8.0
#35 (coarse sand)	41.06	42.074	1.014	11.1
#60 (medium sand)	35.018	36.388	1.37	15.0
#120 (fine sand)	34.253	35.477	1.224	13.4
#230 (v. fine sand)	32.898	35.105	2.207	24.2
fines (silt + clay)	20.896	23.3	2.404	26.4
			9.219	101.2

B3-C27	Sample Wt =	8.943	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.177	50.79	0.613	6.9
#18 (v. coarse sand)	48.075	48.956	0.881	9.9
#35 (coarse sand)	41.07	42.605	1.535	17.2
#60 (medium sand)	35.045	36.408	1.363	15.2
#120 (fine sand)	34.258	35.29	1.032	11.5
#230 (v. fine sand)	32.913	34.554	1.641	18.3
fines (silt + clay)	20.904	22.667	1.763	19.7
			8.828	98.7

B3-C28	Sample Wt =	8.564	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.173	50.173	0	0.0
#18 (v. coarse sand)	48.07	48.096	0.026	0.3
#35 (coarse sand)	41.061	41.126	0.065	0.8
#60 (medium sand)	35.012	35.503	0.491	5.7
#120 (fine sand)	34.25	35.574	1.324	15.5
#230 (v. fine sand)	32.896	35.892	2.996	35.0
fines (silt + clay)	20.897	24.317	3.42	39.9
			8.322	97.2

Grain Size Analysis of Core B3

B3-C33	Sample Wt =	7.873	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.185	50.185	0	0.0
#18 (v. coarse sand)	48.072	48.104	0.032	0.4
#35 (coarse sand)	41.059	41.146	0.087	1.1
#60 (medium sand)	37.237	37.583	0.346	4.4
#120 (fine sand)	34.249	35.182	0.933	11.9
#230 (v. fine sand)	32.896	36.213	3.317	42.1
fines (silt + clay)	20.91	24.096	3.186	40.5
			7.901	100.4

B3-C34	Sample Wt =	8.716	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.179	52.426	2.247	25.8
#18 (v. coarse sand)	48.081	48.146	0.065	0.7
#35 (coarse sand)	41.067	41.199	0.132	1.5
#60 (medium sand)	37.235	38.294	1.059	12.2
#120 (fine sand)	34.251	35.955	1.704	19.6
#230 (v. fine sand)	32.91	34.627	1.717	19.7
fines (silt + clay)	20.912	22.643	1.731	19.9
			8.655	99.3

B3-C35	Sample Wt =	10.05	g	
	Sieve Wt.	Sieve+	Sample	Weight
Sieve Number	(grams)	Sample (g)	Weight (g)	Percent
#10 (Granule)	50.171	50.196	0.025	0.2
#18 (v. coarse sand)	48.067	48.122	0.055	0.5
#35 (coarse sand)	41.06	41.279	0.219	2.2
#60 (medium sand)	35.016	36.087	1.071	10.7
#120 (fine sand)	34.255	35.751	1.496	14.9
#230 (v. fine sand)	32.899	36.286	3.387	33.7
fines (silt + clay)	20.918	24.654	3.736	37.2
			9.989	99.4

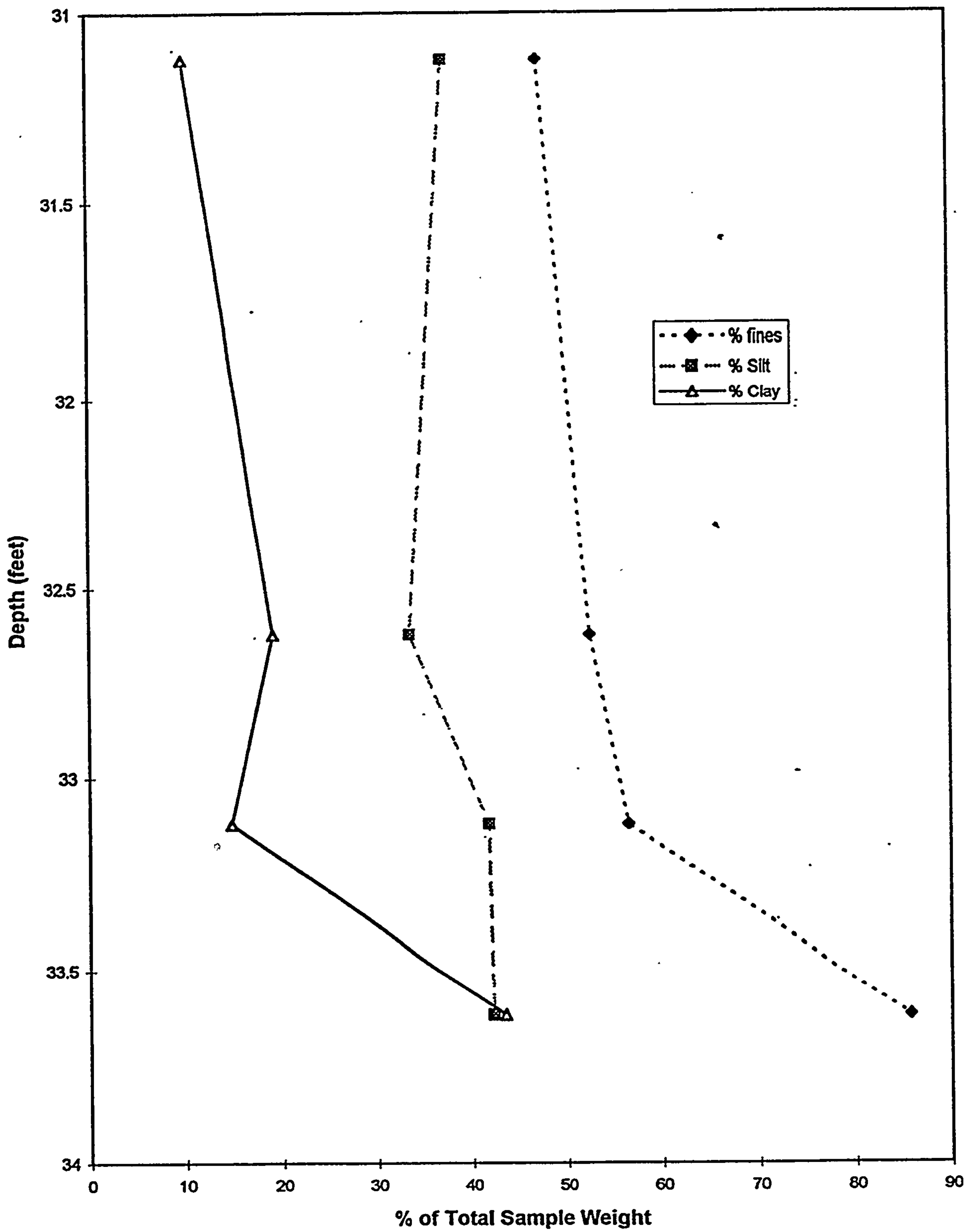
Grain Size Analysis of DOE Core B3											
Sample Depth (ft)			% SAND						% FINES		
Core B3	Top	Bottom	Granule >2.0 mm	V.Coarse < 2.0 mm	Coarse < 1.0 mm	Medium < 0.5 mm	Fine < 0.25 mm	V. Fine < 0.125 mm	Silt + Clay < 0.0625 mm	Hydrometer* Silt	Hydrometer* Clay
C1	24.0	24.25	0.0	0.4	1.2	13.1	29.4	30.0	24.9		
C2	24.25	24.5	0.1	0.4	1.1	4.3	11.5	42.3	37.2		
C3	24.5	24.75	0.0	0.6	2.0	4.8	13.3	37.0	39.8		
C4	24.75	25.0	0.0	0.5	3.8	10.3	30.9	29.6	23.6		
C5	25.0	25.25	0.1	0.5	3.1	13.4	14.4	25.1	41.4		
C6	25.25	25.5	0.0	0.0	1.1	10.3	19.1	22.0	45.7		
C7	25.5	25.75	0.0	0.4	0.9	8.6	38.1	28.4	20.8		
C8	25.75	26.0	0.1	0.3	1.7	15.9	26.4	26.8	27.8		
C9	26.0	26.25	0.3	1.2	2.0	6.7	22.5	31.9	35.5		
C10	26.25	26.5	0.0	0.3	1.2	5.1	20.5	36.6	35.5		
C11	26.5	26.75	0.4	0.4	2.7	13.6	18.9	26.1	35.5		
C30	26.75	27.0	3.4	1.2	4.6	16.1	16.4	24.6	32.5		
C31	27.25	27.5	0.1	0.2	1.0	5.1	17.2	37.6	38.2		
C32	27.5	27.75	0.4	1.4	1.5	6.5	16.3	28.2	44.5		
C33	27.75	28.0	0.0	0.4	1.1	4.4	11.9	42.1	40.5		
C34	28.0	28.25	25.8	0.7	1.5	12.2	19.6	19.7	19.9		
C35	28.25	28.5	0.2	0.5	2.2	10.7	14.9	33.7	37.2		
C22	28.5	28.75	0.0	0.3	1.2	4.0	13.2	29.3	51.0		
C23	28.75	29.0	0.1	2.0	7.2	19.5	17.1	24.8	28.1		
C24	29.0	29.25	13.4	6.5	13.1	16.1	12.4	18.1	19.2		
C25	29.25	29.5	8.4	2.0	5.6	12.4	13.3	25.9	32.4		
C26	29.5	29.75	3.0	8.0	11.1	15.0	13.4	24.2	26.4		
C27	29.75	30.0	6.9	9.9	17.2	15.2	11.5	18.3	19.7		
C28	30.0	30.25	0.0	0.3	0.8	5.7	15.5	35.0	39.9		
C29	30.25	30.5	7.7	2.6	10.1	16.6	14.0	21.1	26.8		
C12	30.5	30.75	0.5	1.5	5.1	10.3	11.8	29.0	39.8		
C13	30.75	31.0	0.5	1.4	3.4	14.4	18.8	23.7	36.6	39.65	16.50
C14	31.0	31.25	0.2	0.0	2.1	12.2	17.4	29.3	37.3		
C15	31.25	31.5	12.5	0.3	0.8	3.3	11.5	27.7	41.8		
C16	31.5	31.75	0.5	1.3	4.0	14.2	19.0	27.2	32.7	36.09	15.55
C17	31.75	32.0	3.4	2.4	5.8	12.9	13.5	26.6	34.0		
none	32.0	32.5	no	recovery							
C18	32.5	32.75	too	small	to	meas.					
C19a	32.75	33.0	2.3	0.5	3.0	17.1	21.4	26.7	27.5	34.73	35.11
C19b	32.75	33.0	0.6	1.8	7.8	22.1	21.6	22.4	22.3		
C20	33.0	33.25	0.3	0.2	0.9	20.4	23.0	22.9	31.7	32.94	28.07
C21	33.25	33.50	0.7	4.3	19.7	20.7	15.7	17.4	20.1	32.08	23.90

* Separate samples were taken to run hydrometer analyses.

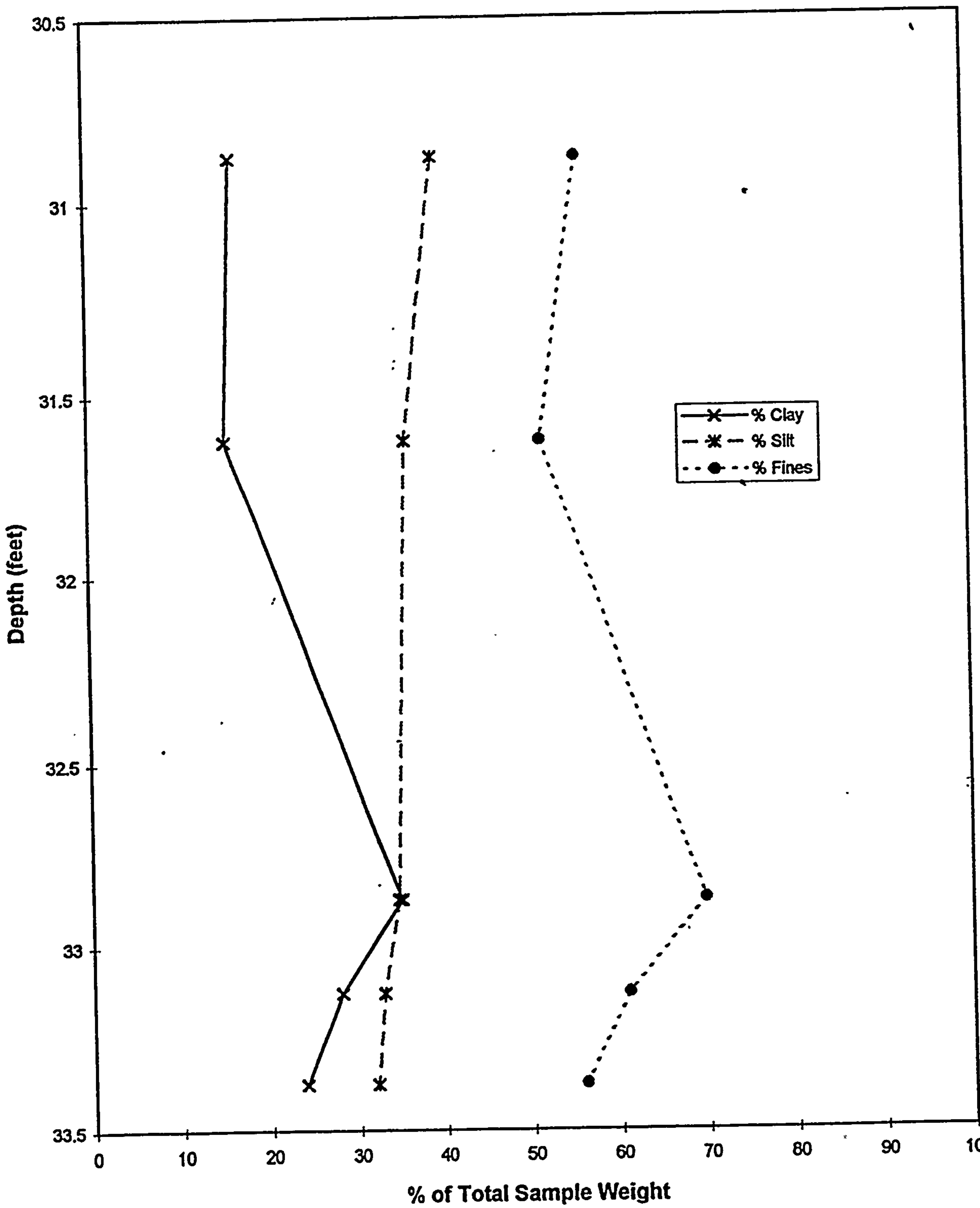
Grain Size Analysis of DOE Core B1											
Sample Depth (ft)			% SAND						% FINES		
Core B1	Top	Bottom	Granule >2.0 mm	V.Coarse <2.0 mm	Coarse <1.0 mm	Medium <0.5 mm	Fine <0.25 mm	V. Fine <0.125 mm	Silt + Clay <0.0625 mm	Hydrometer* Silt	Clay
C1	24.0	24.25	0.5	0.3	2.7	8.6	15.1	31.2	40.1		
C2	24.25	24.5	0.0	0.2	2.2	9.0	21.4	33.1	33.9		
C3	24.5	24.75	0.1	0.6	1.9	5.9	14.8	33.0	43.1		
C4	24.75	25.0	0.0	0.3	4.9	9.2	7.9	31.4	44.7		
C5	25.0	25.25	0.0	0.2	0.9	4.9	17.8	37.6	37.4		
C6	25.25	25.5	6.2	1.5	4.8	8.8	13.3	28.3	35.3		
C7	25.5	25.75	0.2	0.6	2.1	7.6	9.8	26.5	50.4		
C8	25.75	26.0	0.2	0.8	2.0	10.6	20.0	24.0	41.1		
C14	26.0	26.25	0.2	0.7	1.6	7.4	15.7	33.0	40.1		
C15	26.25	26.5	0.0	0.4	1.4	6.0	14.0	31.4	44.7		
C16	26.5	26.75	0.1	0.3	1.6	8.3	19.3	29.9	39.1		
none	26.75	28.5	no	recovery							
C18	28.5	29.0	16.4	0.5	2.2	12.5	15.4	24.5	28.2		
C19	29.0	29.5	5.4	0.2	2.5	9.5	14.2	30.8	36.4		
C20	29.5	30.0	23.5	0.7	1.6	9.1	14.5	21.1	28.8		
C21	30.0	30.25	0.9	0.0	2.4	14.2	19.6	28.3	32.5		
C24	30.25	30.5	17.2	1.6	3.2	9.8	13.0	23.3	30.2		
C25	30.5	30.75	3.3	2.1	6.3	14.4	13.7	25.8	30.2		
C26	30.75	31.0	31.6	1.3	1.3	6.3	13.9	22.0	24.0		
C27	31.0	31.25	27.3	0.5	0.8	4.3	12.9	25.1	28.4	37.23	10.02
C28	31.25	31.5	0.3	4.4	10.3	19.6	12.4	23.9	27.7		
none	31.5	32.5	no	recovery							
C30	32.5	32.75	53.0	0.3	0.9	4.7	8.2	17.2	15.5	33.48	19.15
C31	32.75	33.0	0.0	0.6	2.3	11.2	19.6	32.4	32.4		
C32	33.0	33.25	0.1	1.0	3.9	14.0	16.2	30.0	33.1	41.83	14.76
C33	33.25	33.5	12.0	0.8	2.6	10.3	13.9	25.6	34.4		
C34a	33.5	33.75	0.1	0.3	0.8	18.0	30.5	20.6	27.2	42.25	43.50
C34b	33.5	33.75	0.3	1.0	3.2	16.0	23.4	24.8	31.3		

*Separate samples were taken to run hydrometer analyses.

Percentage of Fines in Core B1



Percentage of Fines in Core B3



APPENDIX 2

QA/QC Report and Methods

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APPENDIX 2

Analyses of Portsmouth Field Test Samples:

Quality Assurance/Quality Control Report

Surfactant Analyses

Surfactant (Cytec MA80) was analyzed using an SSI model 222D UV (ultraviolet) detector on an SSI model 500HPLC (high performance liquid chromatograph) equipped with an Alltech Exsil column (250 mm, 5 micron silica, Alltech cat. no. 10658). The UV detector was set at a wavelength of 224 nm. The rise time was set at 0.1. The scale was adjusted as required to keep all samples on scale. The mobile phase was water and methanol, both a 1:1 ratio and pure water were used with equal linearity in response. Pump rate was set to 0.5 ml/min.

Standards were prepared from Cytec MA80 in distilled water, the standards contained isopropanol and salt at the same ratio as used in the field. Concentration is reported as per cent of MA80 by weight. The surfactant standards yielded a readily recognizable double peak (Figure 1) which also readily identifiable in the samples (Figure 2).

Blanks run include distilled water, isopropanol and salt water (NaCl and $CaCl_2$) all of which yielded no peaks. TCE was also run, it yielded a peak that was later than the surfactant (see Figure 2) thus it did not interfere.

Instrument calibration was verified daily with a five point calibration curve, plus distilled water. The calibration curve was rerun at the conclusion of each day. Linearity of response for these standards was 0.988 or better in every case (Table 1 shows calibration data).

Drift was monitored by analysis of a mid-range standard approximately every 10 samples. In no case was drift significant during the course of a given day (the drift standards are shown in Table 1).

Duplicate samples were analyzed approximately every 10 samples, duplicates yielded calculated concentrations that differed by less than 0.02% MA80 in every case but one (duplicates are listed in Table 2). In one case, in which the sample had 3.8% MA80, the difference in calculated MA80 concentration was 0.17% MA80.

The limit of detection of the instrument, based on standard analyses, is less than 0.0038%. However, analyses of samples yielded a small interference, based on appearance of the interfering peak in samples taken prior to the start of surfactant injection, that limited quantification to concentrations above 0.1 %. The ratio of methanol to water was varied from 1:1 to 100% water in an attempt to improve separation from the interfering peak. Although the change affected retention time, no separation between peaks occurred and linearity of response was unchanged. A 1:1 ratio was selected for all subsequent analyses. After all INT-1 and BW2G samples had been analyzed the column began to plug and peak shape degraded. The column was washed with pure isopropanol at the manufacturer's suggestion and performance was restored. Reanalysis of various samples yielded data fully compatible with earlier data.

Integration of chromatograms was done using SRI's PeakSimple II data reduction program. Integration parameters were adjusted until all chromatograms yielded proper baseline position and peak start and end positions at the same integrator settings. This could only be determined after analyses were completed, thus some of the earlier data reports contained data integrated with the autointegrator settings.

After recording peak areas, every chromatogram was recalled from memory and reintegrated. The values were individually compared with tabulated values to verify integration and recording. Areas were converted to concentrations using Excel. The formulas used in Excel were verified by random hand calculation, all results were found to be identical to those calculated by the spreadsheet.

No instrumental problems were encountered in the course of the analyses, other than the temporary plugging of the column, which occurred after all analyses reported were completed (additional analyses will not be done until a new column arrives):

After the data were initially reduced and plotted, the curves were analyzed for any apparent anomalies. The following points were noted:
-surfactant was apparently detected at low concentration prior to the beginning of surfactant injection.
-there was considerable noise, in the form of abrupt changes in surfactant concentration during the interval of high surfactant concentration at INT-1.
-the concentration of surfactant declined at both INT-1 and BW2G prior the to stopping of surfactant injection.

To address these apparent anomalies all samples were reintegrated and, if the apparent anomalies persisted, the samples in the anomalous interval, as well as samples before and after the interval, were reanalyzed. As previously mentioned, after integration of initial samples determined that the autointegrator occasionally produced incorrect placement of baselines, all samples were reintegrated using the same integrator parameters. This eliminated most of the apparent "noise" mentioned in the previous paragraph. The apparent detection of surfactant at low concentration persisted, as did the apparent early drop in surfactant concentration. Several samples from the earliest sampling of INT-1, before surfactant injection began, were reanalyzed. Apparent surfactant peaks were again detected. As previously discussed, a considerable effort was made to eliminate this apparent interference by changing solvent ratios. We were not successful, and have thus ordered a new column to provide better separation. To address this problem, we used the level observed in these samples as the limit of detection.

Samples spanning the range of high concentrations, and the sudden decrease later, were reanalyzed. The results were identical, showing the same decrease previously reported. Analysis of samples from the injection well disclosed that the surfactant concentration had actually decreased earlier than reported. These samples were also reanalyzed to confirm our results, and again were duplicated. The reported results are from the original analyses as long holding times for the samples before reanalysis makes the later results less reliable.

Analyses of TCE and IPA

Analyses of TCE (Trichloroethylene) and IPA (Isopropanol) were done on a Hewlett Packard model 5890 series II plus GC equipped with a model 5972 mass selective detector (HP GC/MS), using an Alltech 1/8 inch x 4 ft stainless steel column packed with Porapack P. Elution was done with He as the carrier gas at 15 PSI. Initial temperature was 100 degrees for three minutes then ramped at 25 degrees C/min. to 200 degrees. Injection was direct injection of 1 microliter samples by an HP autosampler. Complete separation of IPA and TCE was achieved. As discussed later, no other interfering compounds were seen. The instrument was run in scan mode to ensure recognition of all contaminants present while quantification was done by integration using extracted ion chromatograms (mass 130 for TCE and mass 45 for IPA). Analyses of standards of IPA, TCE, tetrachloroethylene (PCE), trichloroethane (TCA) and carbon tetrachloride (CTET) determined that there was no interference from these compounds, which were suspected possibly to be present. The retention times of these compounds are shown in Table 3. Tuning was done daily using the standard spectrum autotune program which is part of the HP software package. A representative tune report is attached as Figure 3.

Table 3. Retention Times of Target Compounds

Compound	Peak Retention Time	Start of Peak	End of Peak
IPA	2.86 minutes	2.7 minutes	3.6 minutes
TCA	4.70	4.59	4.85
CTET	4.93	4.82	5.04
TCE	5.11	4.97	5.39
PCE	6.23	6.11	6.39

Table 4. Masses and Times for Target Compound Integration

Compound	MASS	Other Compounds with same mass	Time of elution of other compound with same mass
IPA	45	none	none
TCA	97	TCE	TCE at 5.11 min. TCA at 4.70 minutes
CTET	117	none	none
TCE	130	none	none
PCE	166	none	none

Standards were prepared from reagent grade TCE in methanol and IPA in distilled water. Five point calibration curves were run at the start of every run and at the conclusion of every run (except when the run was terminated by mechanical failure as noted below). The response of the instrument is linear from 1 mg/L to about 30,000 mg/L as demonstrated through repeated analyses in our laboratory. Linearity of response for the standards for these analyses exceeded 0.99 for TCE (Table 4). Isopropanol also exhibited linear response in the range of 0-3%, above 3% the detector became slightly non linear. Initially a curve fit program was used to allow all samples to be analyzed, the curve fit was also better than 0.99 (Table 4). Later all samples with IPA concentrations above 2% were diluted 1:1 with water and reanalyzed. Linear fit below 2% was better than 0.99 (Table 4). Blanks included distilled water, methanol, TCA in methanol, CTET in methanol and PCE in methanol.

Drift was monitored by analysis every 10 samples of a mid-range standard. After integration, peak areas were corrected for drift using a program which fits a fourth order polynomial to the instrument response, as determined by all drift standards, and correcting each sample to the calculated instrument response at the time each sample was collected..

Duplicate analyses were scheduled every 10 samples. The results of the duplicates from the second set of analyses are shown in Table 5. Duplicates from earlier runs are not shown due to a mechanical failure of the instrument which terminated the first run prior to duplicate analyses. During the run the autosampler turret failed after initial analyses were completed, but before duplicates were run. The duplicate samples were not rerun until 36 hours after they were initially analyzed and all TCE concentrations were much lower in the reanalyze due to volatilization. The duplicates listed are from the final run which did not encounter delays between initial and final analyses. Although duplicate data is not available for the first data set, the multiple analyses of the drift correction standard provide excellent documentation of instrument performance.

Chromatograms were integrated using the HP integrator provided in the GC/MS software. Integration parameters (start and end of each peak, baseline) were visually verified for each analysis. Data can be written from the integrator program to an excel file, reducing manual data entry. After drift correction sample concentrations were calculated and plotted. The same procedure described for the HPLC data was followed: each plot was examined for internal consistency and apparent anomalous values.

TCE showed a surprisingly high initial concentration in INT-1 samples and a steep decline. All initial samples were reanalyzed with the duplicates showing an identical trend, confirming the initial analyses. Only the initial data is reported as again longer holding times for the samples prior to reanalysis (several weeks) resulted in slightly lower concentrations (but parallel trends) during reanalysis.

IPA showed some noise in the very high concentration samples, and two discontinuities in the data near the end of the run. Since the detector becomes nonlinear at very high concentrations (above 3%) all samples that yielded high values were diluted and rerun. Results of the reanalyses show less noise than the initial data.. The decline in concentration of IPA at INT-1 was later than that of MA80, which was not what was expected. All samples from the peak of the concentration to the base of the decline were rerun, with identical results. These analyses confirmed both the time of IPA decline and the peak in IPA concentration prior to the decline. Finally, the discontinuity in the tail occurred at the time a filament blew in the instrument. Since it is possible that filament performance degraded just before failure, and no standards were run after the samples (because the filament blew), the samples before and after the filament failure were reanalyzed. The results provided a smoother curve without discontinuities, but, since they were on the tail of the curve, did not affect our interpretation.

We also analyzed for TCA, PCE and CTET in all samples. Analyses were done on the same runs as the initial analyses. Run conditions provided for nearly complete separation of TCA and PCE from the other peaks (Table 3). Where minor overlap of peaks occurred, use of specific masses eliminated inteferences (Table 4). Analysis of every sample disclosed non-detect for these compounds. Instrument performance parameters for these compounds are not included as a consequence.

Conditions : FIGURE 1

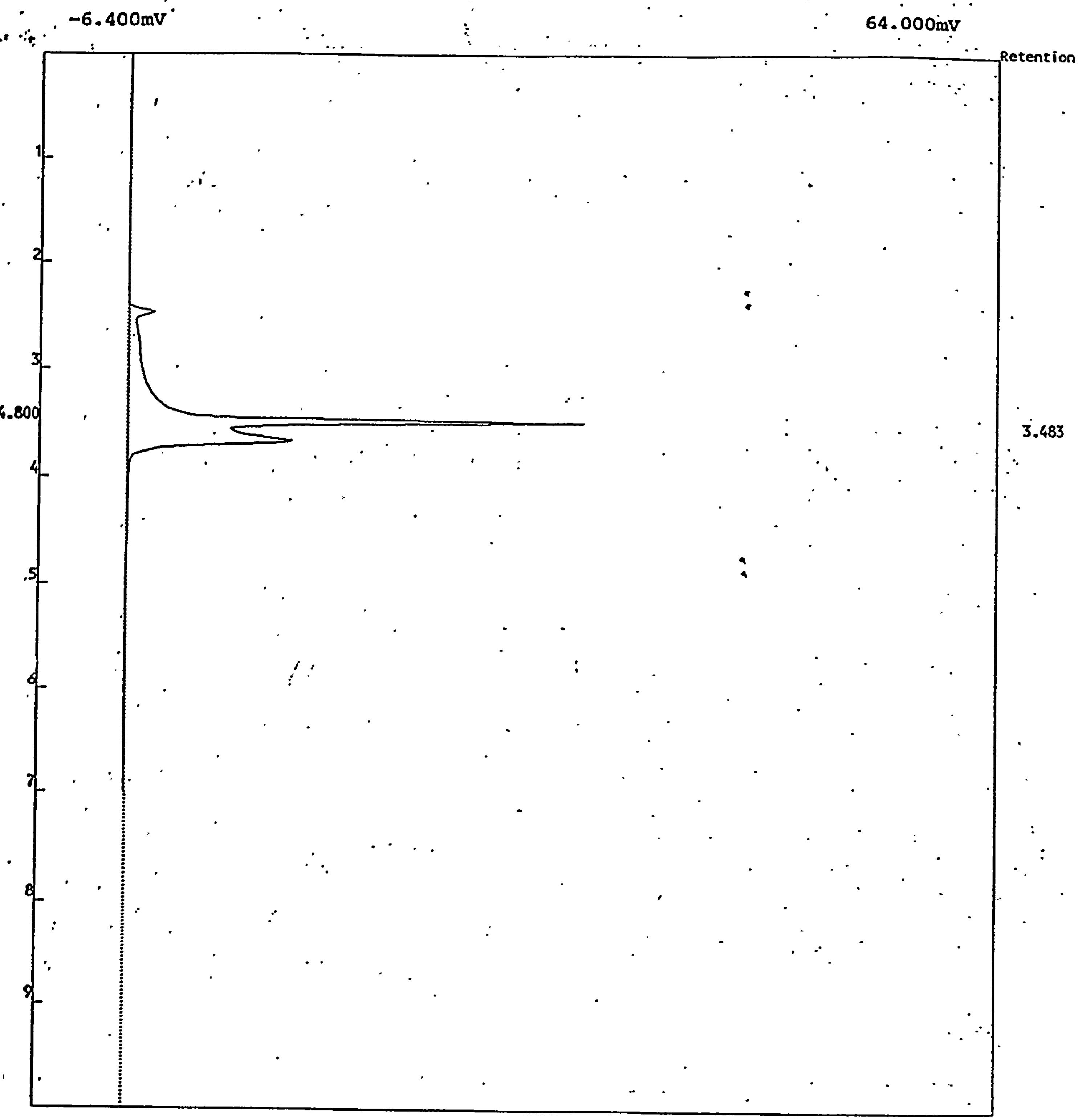


Figure 1

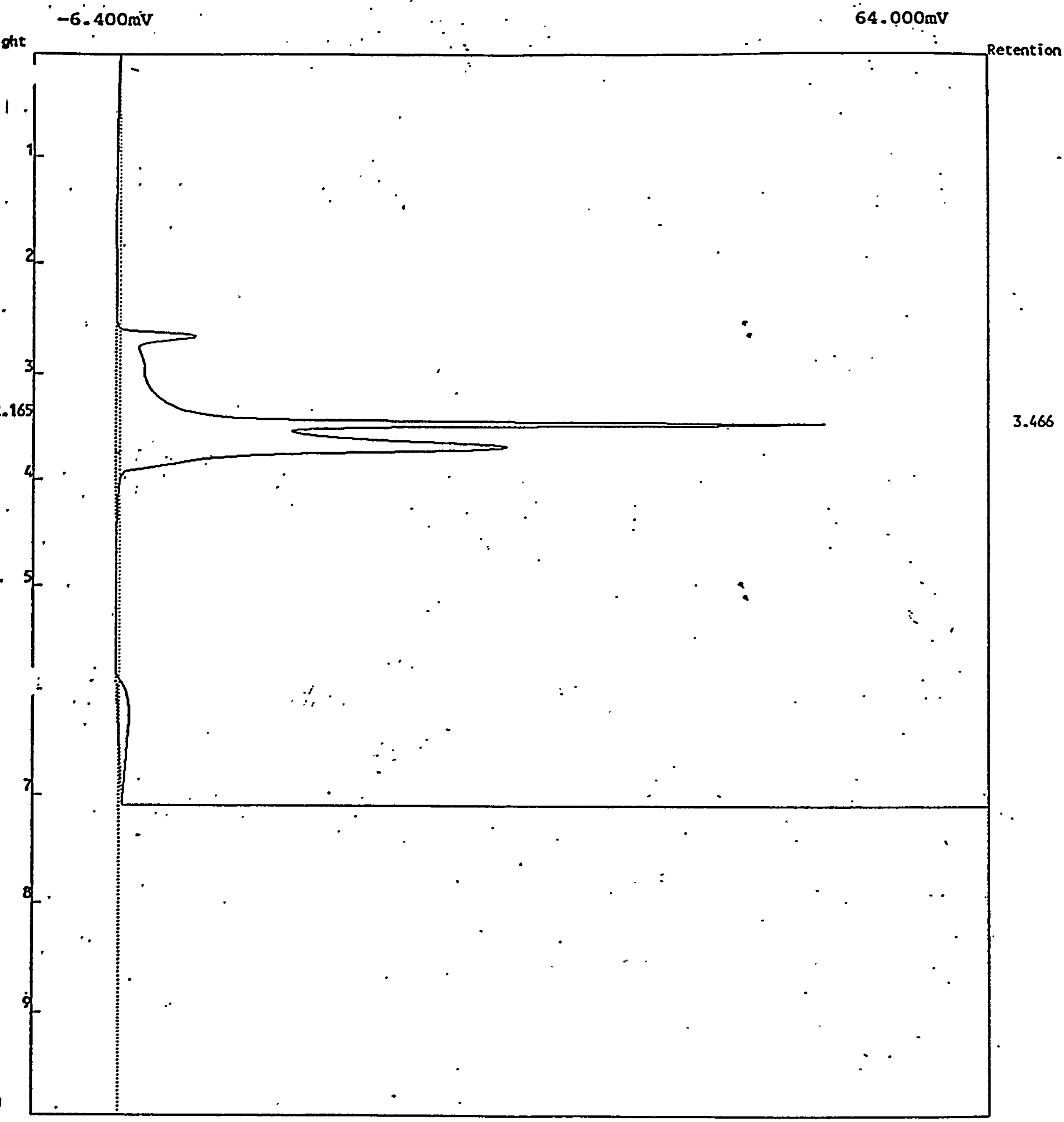
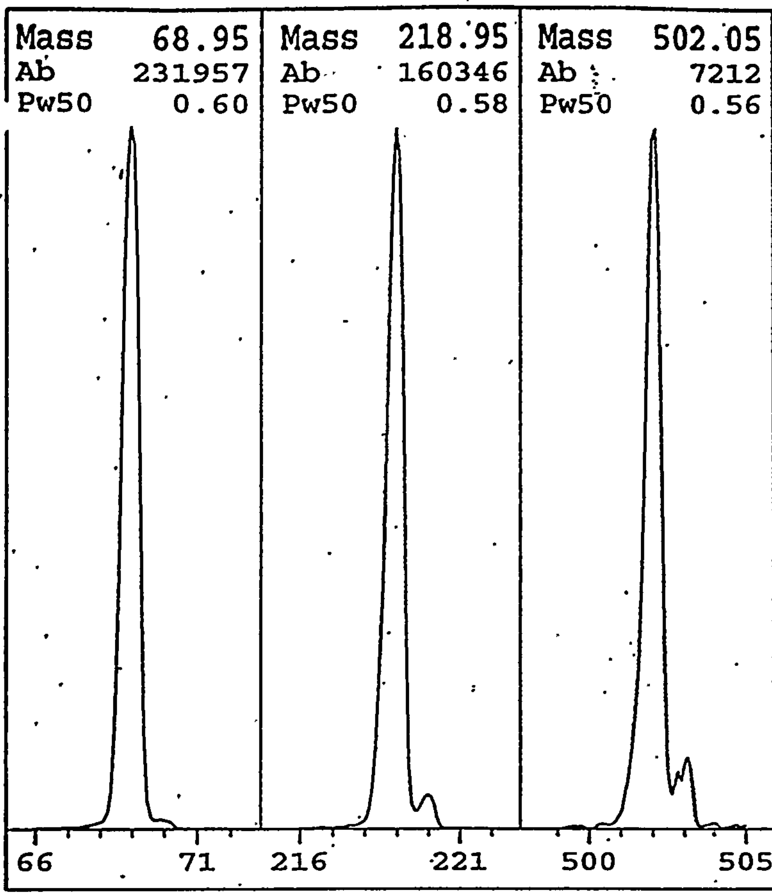


Figure 2

HP5972 Standard Spectra AutoTune

Instrument: 5972 - Instrument1

Wed Sep 25 07:39:20 1996 C:\HPCHEM\1\5972\ATUNE.U

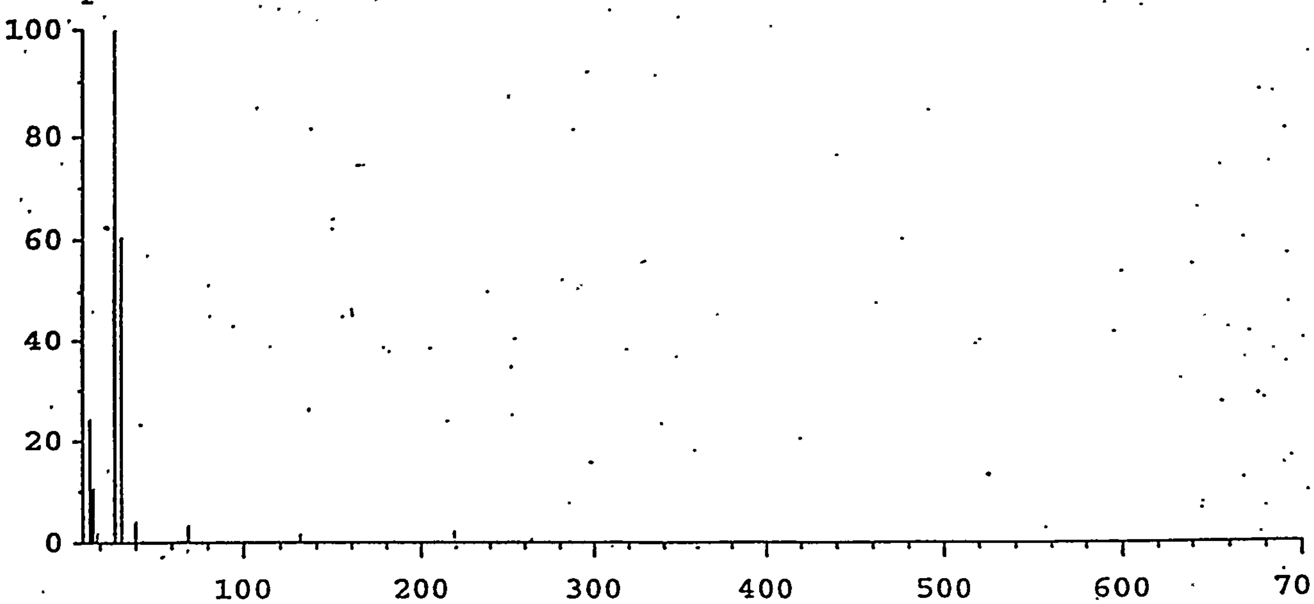


EMVolts	2988	AmuGain	436
Xray	42.8	AmuOffs	85
Emission	50.0	Wid219	-0.026
MS Temp	167	TTI	OFF
Vacuum	138	DC Pol	NEG
Samples	8	Repeller	25.03
Averages	3	IonFocus	90.0
StepSize	0.10	EntLens	42.16
MassGain	-47	EntOffs	7.28
MassOffs	8	Filament	1

PFTBA OPEN

Scan: 10.00 - 700.00 Samples: 8 Thresh: 100 Step: 0.10

177 peaks Base: 28.05 Abundance: 6535680



Mass	Abund	Rel Abund	Iso Mass	Iso Abund	Iso Ratio
68.90	223872	100.00	69.90	3034	1.36
218.90	166464	74.36	219.90	7986	4.80
502.00	7483	3.34	503.00	694	9.27

Figure 3

Table 1

9/25/96		
sample	adjusted area (scale)	R^2
0.049% MA-80/IPA	12.7	0.993
0.049% MA-80/IPA	13.2	
0.49% MA-80/IPA	116.5	
0.049% MA-80/IPA	16.2	
4.9% MA-80/IPA	890.84	
2.4% MA-80/IPA	501.99	
0.49% MA-80/IPA	117.805	
0.049% MA-80/IPA	12.0185	
0.0049% MA-80/IPA	2.19	
9/26/96		
4.9% MA-80/IPA	1075.4	R^2
2.4% MA-80/IPA	417.55	0.988
0.49% MA-80/IPA	108.07	
0.049% MA-80/IPA	12.15	
0.0049% MA-80/IPA	2.03	
0.049% MA-80/IPA	13.1745	
2.4% MA-80/IPA	595.62	
2.4% MA-80/IPA	586.96	
2.4% MA-80/IPA	559.58	
2.4% MA-80/IPA	585.82	
4.9% MA-80/IPA	1110.94	
2.4% MA-80/IPA	543.42	
0.49% MA-80/IPA	112.35	
0.049% MA-80/IPA	11.5235	
0.0049% MA-80/IPA	1.9778	
9/27/96		
4.9% MA-80/IPA	1022.08	R^2
2.4% MA-80/IPA	476.2	0.999
0.49% MA-80/IPA	113.52	
0.049% MA-80/IPA	11.519	
0.0049% MA-80/IPA	2.409	
4.9% MA-80/IPA	1099.28	
2.4% MA-80/IPA	553.74	
0.49% MA-80/IPA	112.94	
0.049% MA-80/IPA	12.2685	
0.0049% MA-80/IPA	3.3627	
9/30/96		
4.9% MA-80/IPA	1059.38	R^2
2.4% MA-80/IPA	475.72	1
0.49% MA-80/IPA	110.67	
.049% MA-80/IPA	12.575	
.0049% MA-80/IPA	2.1568	
0.49% MA-80/IPA	112.375	
0.49% MA-80/IPA	120.905	
4.9% MA-80/IPA	1011.66	
4.9% MA-80/IPA	1047.64	
2.4% MA-80/IPA		
0.49% MA-80/IPA	112.09	
0.049% MA-80/IPA	14.23	
0.0049% MA-80/IPA	2.92	
10/10/96		
4.9% MA-80/IPA	1118.54	R^2
2.4% MA-80/IPA	561.88	0.999
0.32% MA-80/IPA	73.185	
0.052% MA-80/IPA	14.285	
4.9% MA-80/IPA	952.72	
0.32% MA-80/IPA	76.535	
4.9% MA-80/IPA	1079.22	
2.4% MA-80/IPA	558.38	
0.32% MA-80/IPA	74.76	
0.052% MA-80/IPA	14.201	
0.0038% MA-80/IPA	1.3577	

Table 2

Duplicate analyses from INT-1 and BW2G HPLC runs.					
sample	area	area difference %	caculated MA 80 %	difference between duplicates (%MA 80)	
BW2G-37	1907	-0.10487677	0.526	-0.00055	
BW2G-37 dup	1909				
BW2G-46	315.42	1.036712954	0.867	0.008988	
BW2G-46 dup	312.15				
INT 1-16	1303.64	2.120217238	0.28	0.005937	
INT 1-16 dup	1276				
INT 1-35	503.5	-3.36047666	2.31	-0.07763	
INT 1-35 dup	520.42				
BW2G-120	142.68	4.415475189	0.342	0.015101	
BW2G-120 dup	136.38				
BW2G-123	163.33	0.269393253	0.369	0.000994	
BW2G-123 dup	162.89				
INT 1-48	386.96	-4.7136655	3.81	-0.17959	
INT 1-48 dup	405.2				
INT 1-103	22.66	7.811120918	0.21	0.016403	
INT 1-103 dup	20.89				

Table 5

IPA Standard Data		
PORTS 1&2 IPA		PORTS 3 IPA
% IPA STD	Drift Corr. Area	Drift Corr Area
4.42	1618817579	1670442958
2.21	912863227.2	1075277873
1.05	483837611.6	573083100.1
0.45	220889690.2	228907614.8
0.19	104507773.7	104856130.1
	R^2	R^2
linear	0.987	
curve fit	0.999	0.9976
equation	y=4E=08x	y=8E-19x^2 = 1E-09x

TCE Standard Data				
PORTS 1. & 2 TCE			PORTS 3 TCE	
mg/L TCE	Drift Corr Area		mg/L TCE	Drift Corr Area
68263	750271579.9		36885	652760955.1
36885	473621130.5		22943	352457070
22943	314885683.1		145	4002615.166
16770	249581707.4		187	608913.8129
5425	90766219.16			
linear	R^2			R^2
curve fit	0.996			0.993
equation	y=11571x			y=17046x

Ports 3 Duplicates		
Sample	TCE mg/L	IPA (%)
bw2g -155	82.6	0.10
bw2g -155 dup	80.7	0.09
66g7	0	3.12
66g7 dup	0	3.02
1-105	8.54	0.02
1-105 dup	6.49	0.02

APPENDIX 3

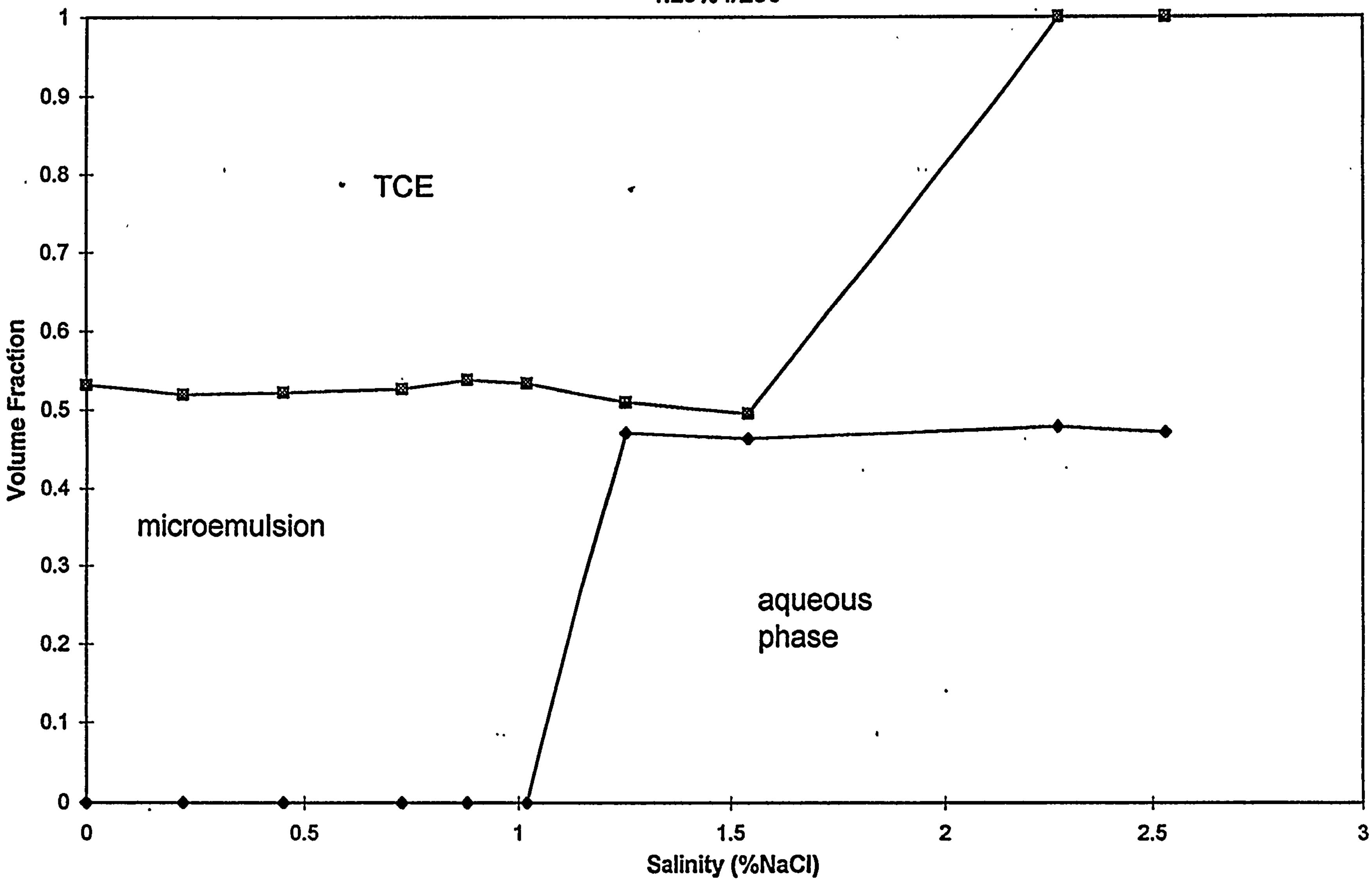
Phase Results

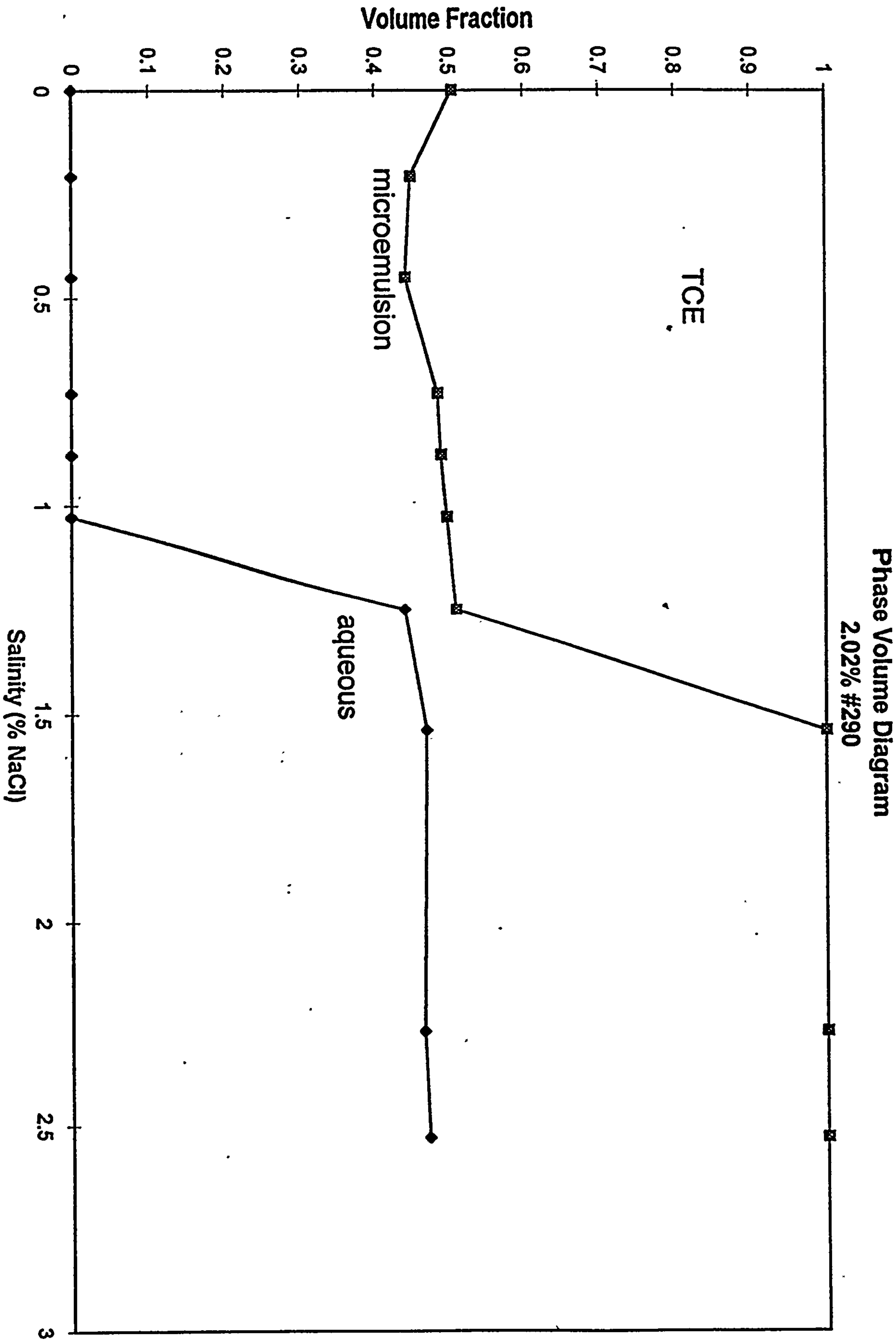
Table of Contents

Phase Volume Data for a System of 4.21%, MA 80 2.13% AT 100, 4.13% Isopropanol

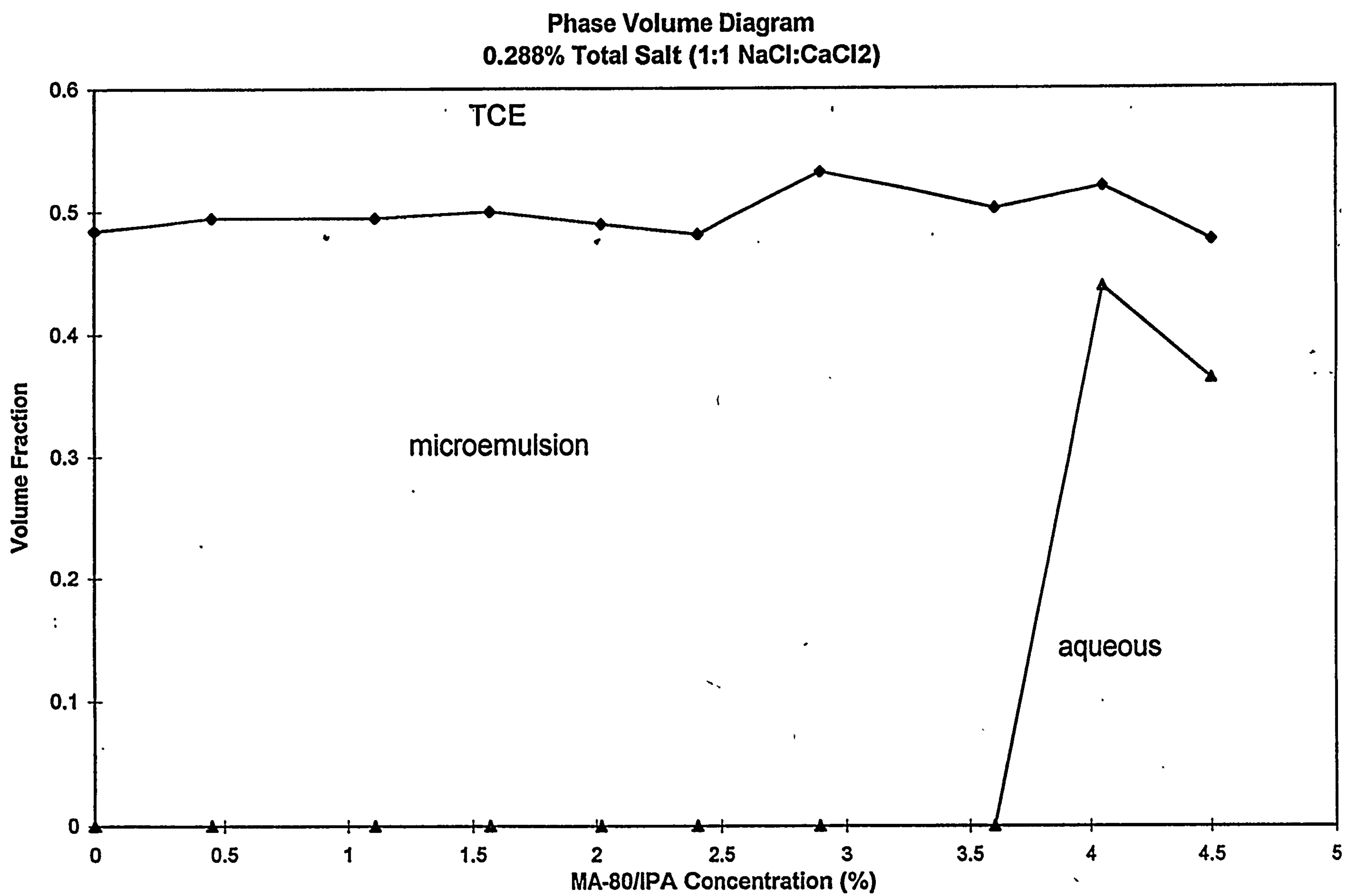
Salinity	Temp (C)	total volume (cm)	TCE volume (cm)	MP volume	comments
0	21	19.5	9.5		
	18.1	19.6	9.5		
	16.7	19.6	9.5		
	14.7	19.6	9.6		
0.015	21	20.1	9.8		
	18.1	20	9.8		
	16.7	19.7	9.4		
	14.7	19.7	9.5		
0.031	21	20.6	9.6		
	18.1	19.5	9.5		
	16.7	19.5	9.5		
	14.7	19.5	9.5		
0.046	21	20.2	9.7		
	18.1	20.1	9.5		
	16.7	20	9.5		
	14.7	20.1	9.6		opaque
0.062	21	20	9.3		opaque
	18.1	20	9.4		
	16.7	20	9.5		
	14.7	20	9.5		opaque
0.077	21	19.6	9.2		opaque
	18.1	19.6	9.2		
	16.7	19.6	9.2		
	14.7	19.7	9.3		opaque
0.093	21	19.7	9.4		opaque
	18.1	19.8	9.5		opaque
	16.7	19.8	9.7		opaque
	14.7	19.8	10		
0.108	21	19.6	9.3		opaque
	18.1	19.6	9.6	present	
	16.7	19.5	10	present	
	14.7	19.5	11.3	present 2.5 cm	
0.124	21	19.4	9.6		opaque
	18.1	19.3	10.8	present	
	16.7	19.2	11	present 1.8 cm	
	14.7	19.2	11	present 2.3 cm	

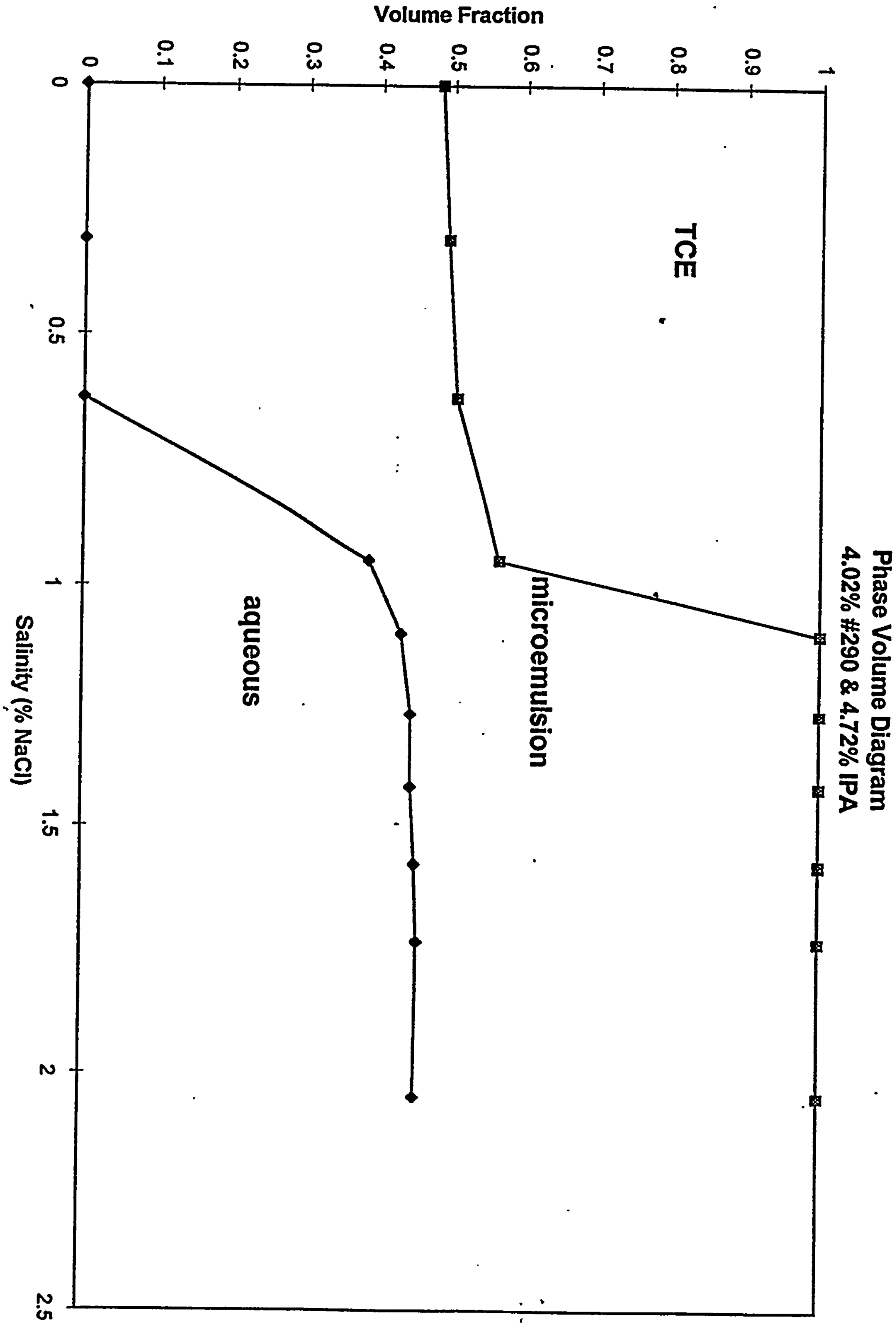
Phase Volume Diagram
1.29% #290



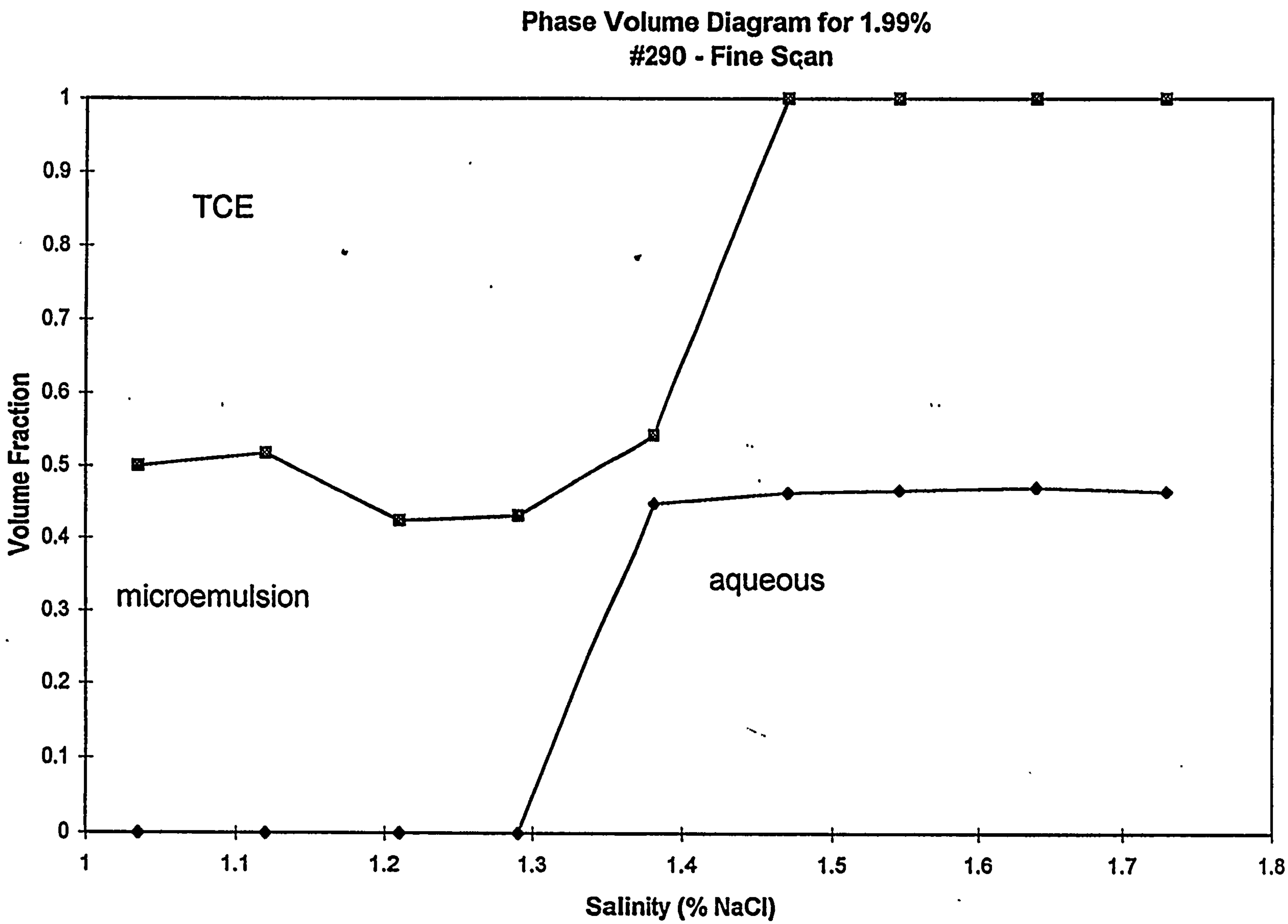


Phase Volume Diagram
2.02% #290
Volume Fraction
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
TCE
microemulsion
aqueous
0
0.5
1
1.5
2
2.5
3
Salinity (% NaCl)


Phase Volume Diagram
0.288% Total Salt (1:1 NaCl:CaCl2)
Volume Fraction
0.6
0.5
0.4
0.3
0.2
0.1
0
TCE
microemulsion
aqueous
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
MA-80/IPA Concentration (%)

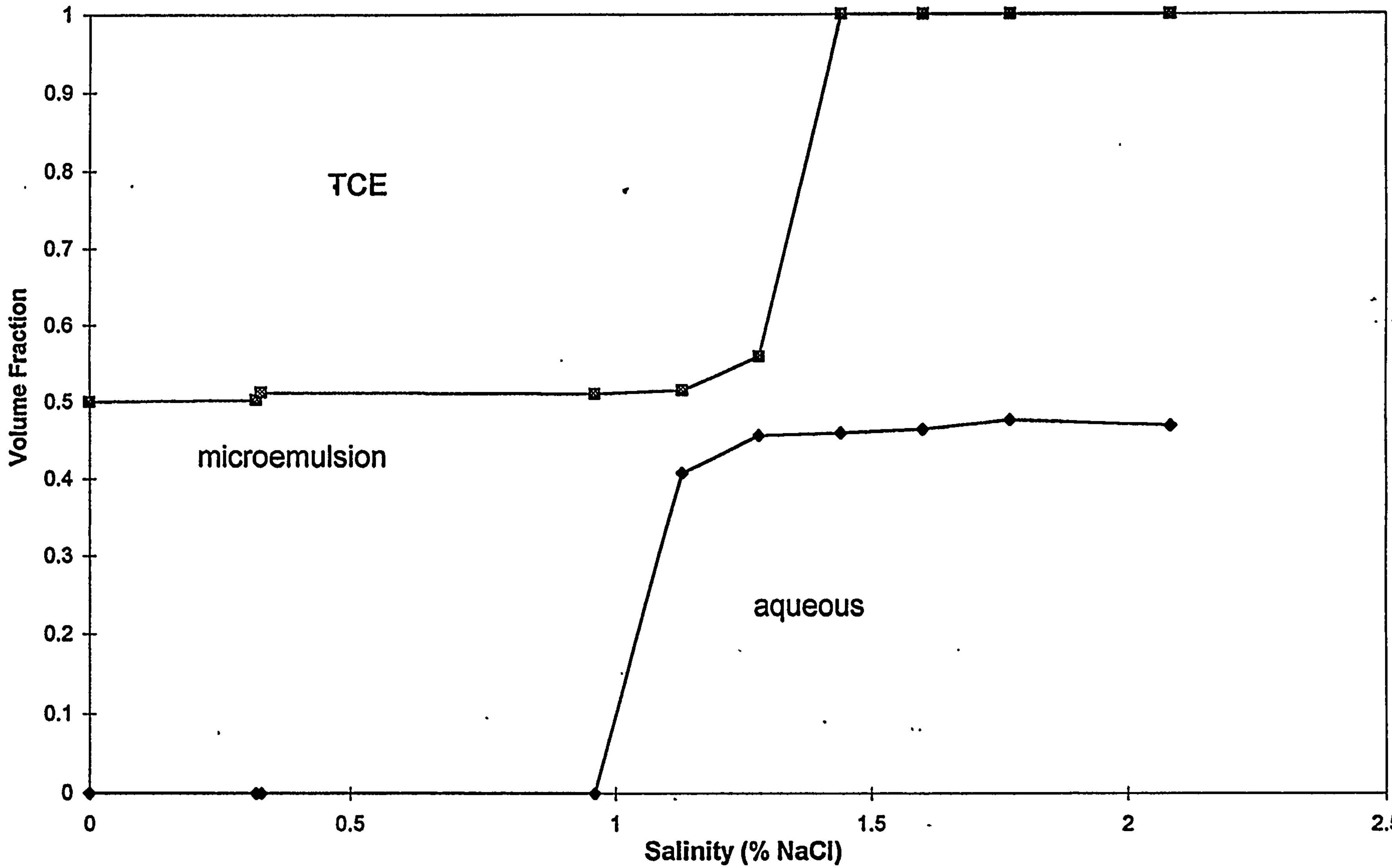


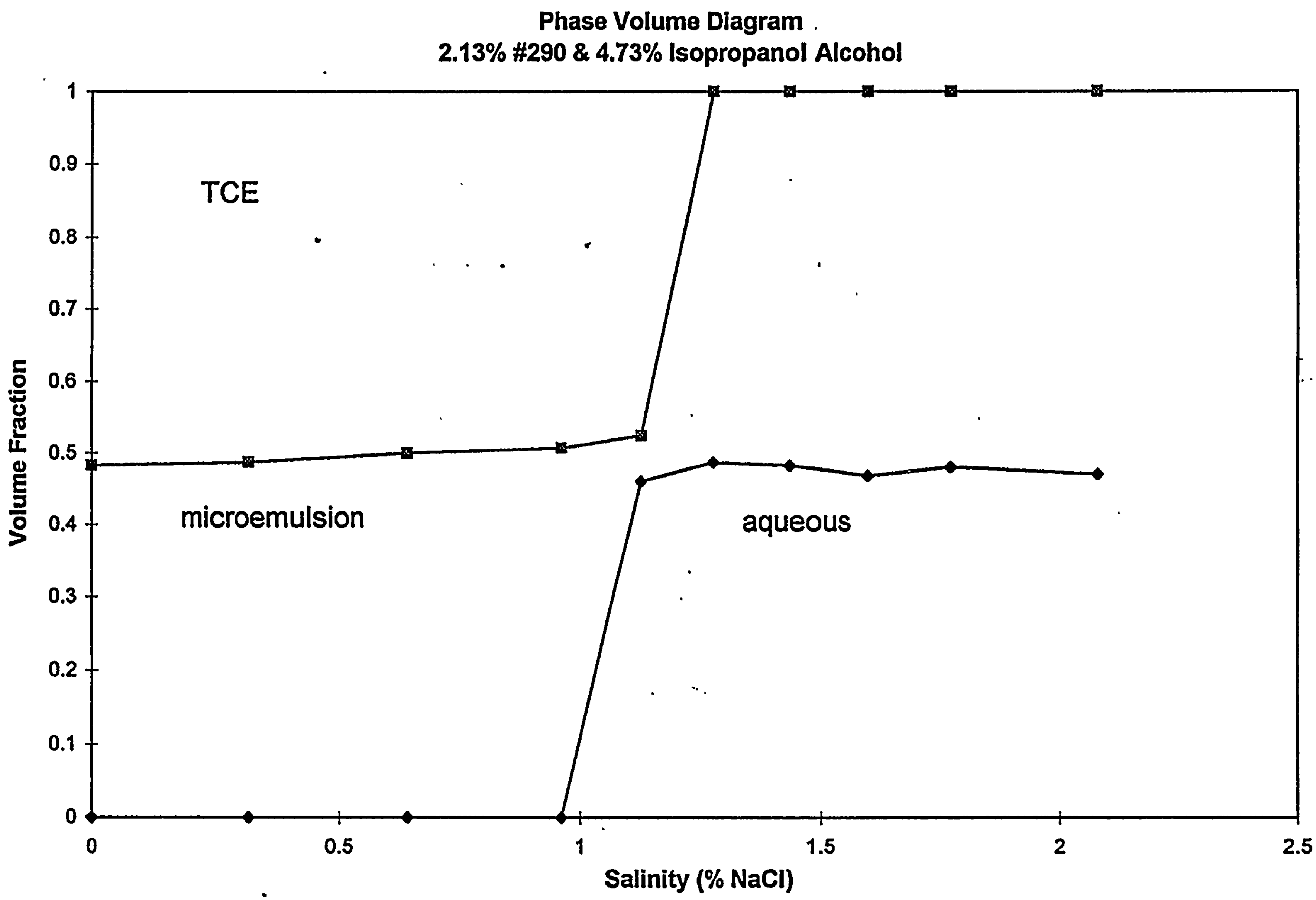
Phase Volume Diagram
4.02% #290 & 4.72% IPA
Volume Fraction
Salinity (% NaCl)
TCE
microemulsion
aqueous
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
0.5
1
1.5
2
2.5



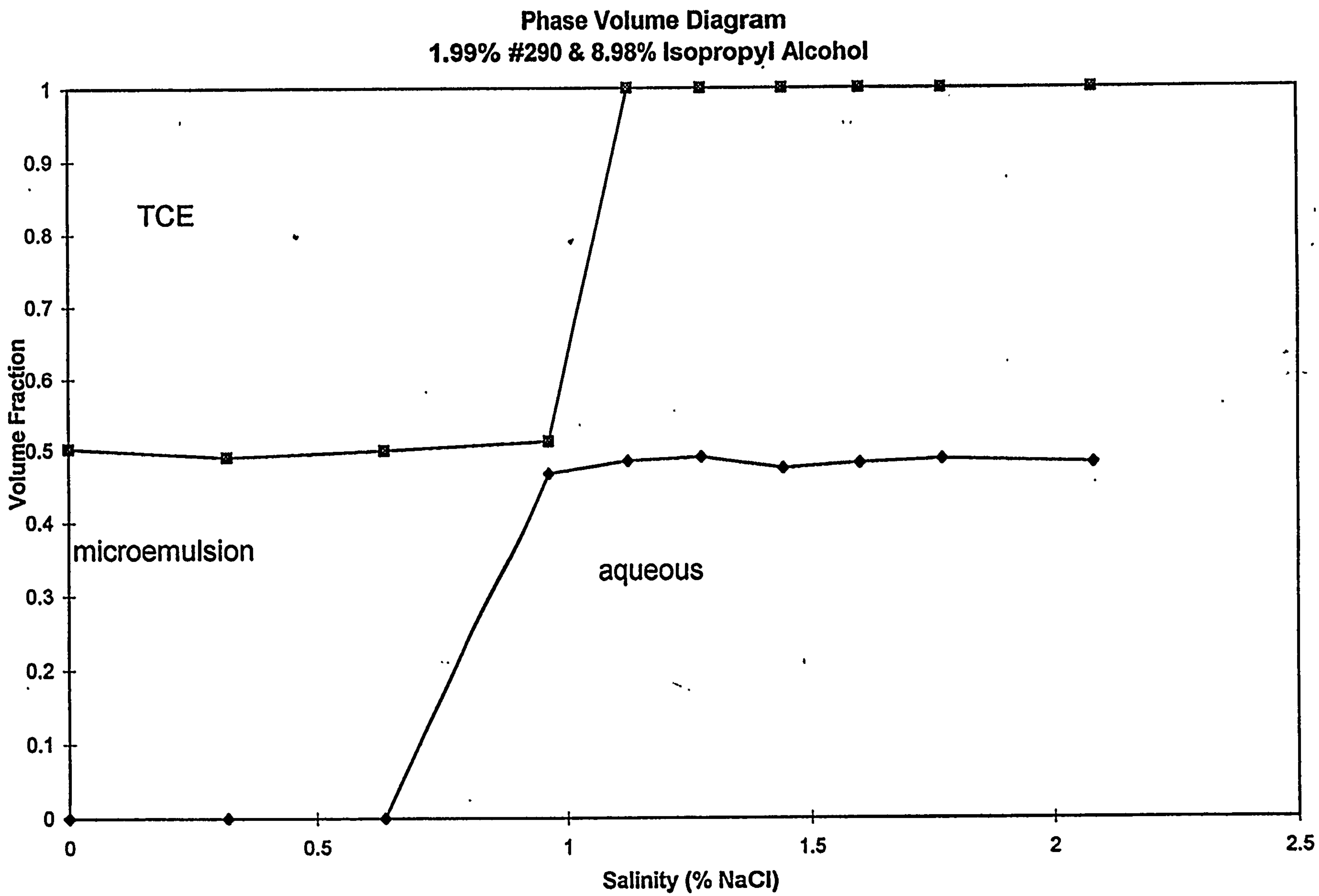
Phase Volume Diagram for 1.99%
#290 - Fine Scan
Volume Fraction
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
TCE
microemulsion
aqueous
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
Salinity (% NaCl)

Phase Volume Diagram
2.8% #290 & 2.3% Isopropanol Alcohol

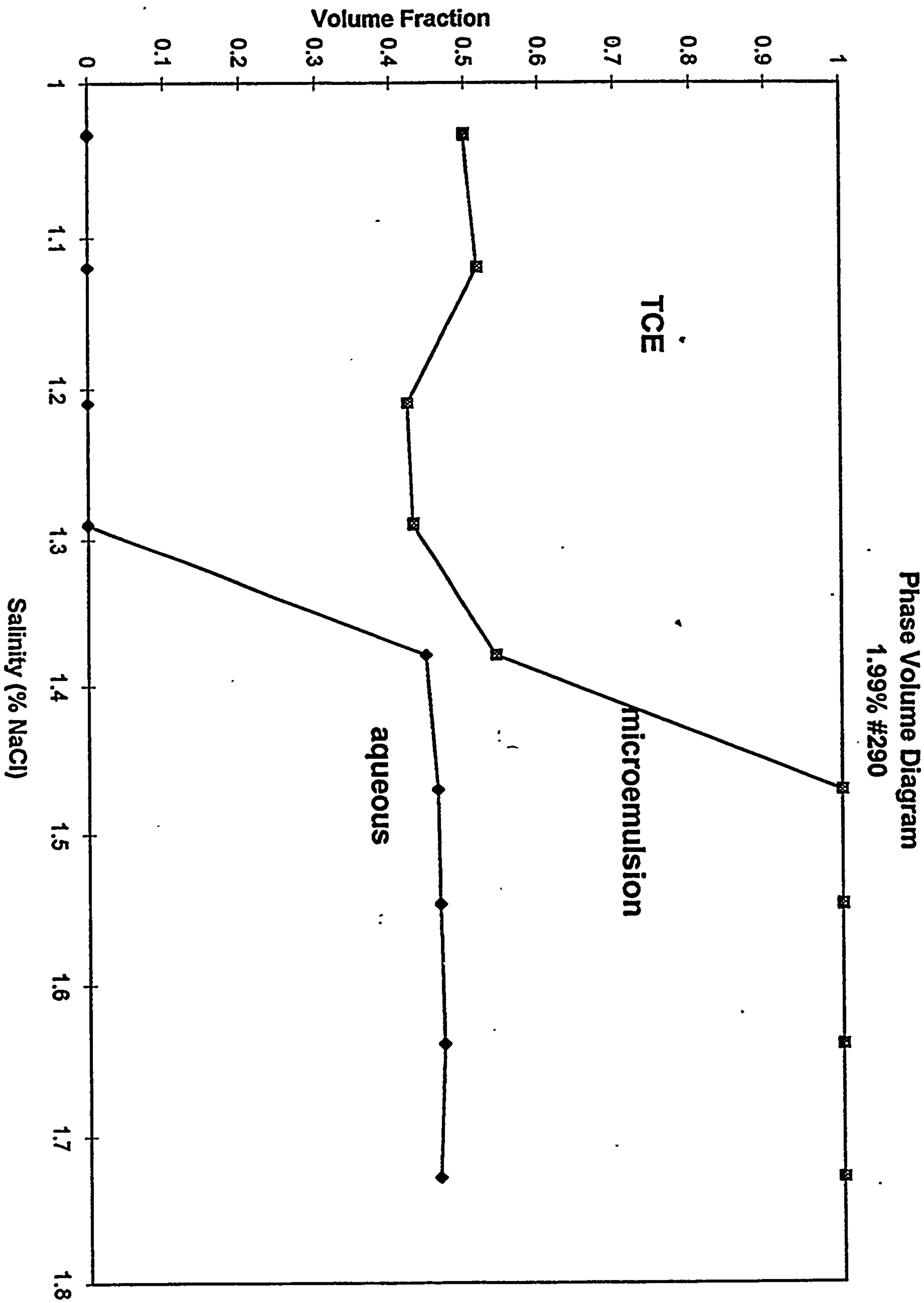


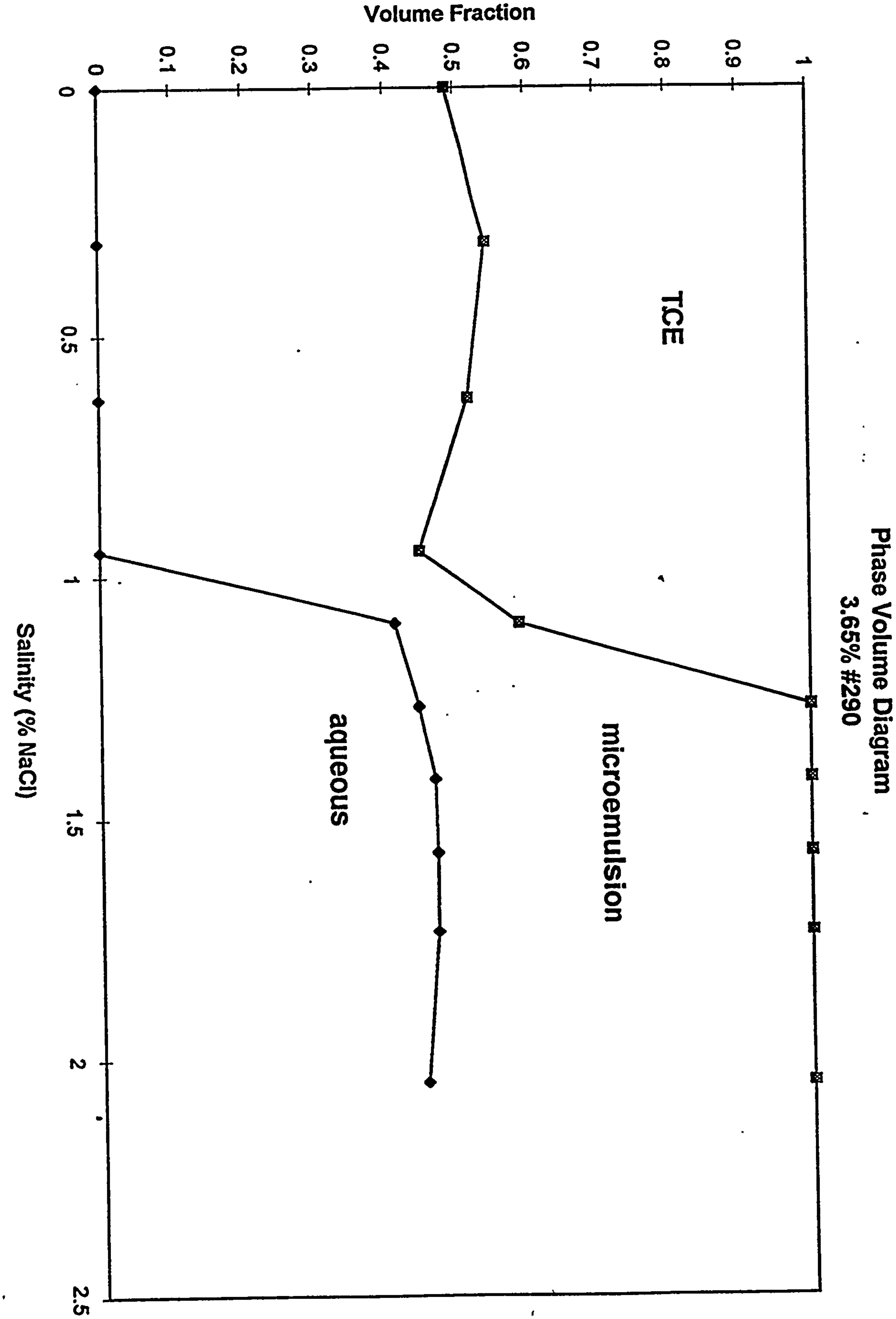


Phase Volume Diagram
2.13% #290 & 4.73% Isopropanol Alcohol
Volume Fraction
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
TCE
microemulsion
aqueous
0
0.5
1
1.5
2
2.5
Salinity (% NaCl)



Phase Volume Diagram
1.99% #290 & 8.98% Isopropyl Alcohol
Volume Fraction
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
TCE
microemulsion
aqueous
0
0.5
1
1.5
2
2.5
Salinity (% NaCl)


Phase Volume Diagram
1.99% #290
Volume Fraction
Salinity (% NaCl)
TCE
microemulsion
aqueous
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8


Phase Volume Diagram
3.65% #290
Volume Fraction
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
TCE
microemulsion
aqueous
0
0.5
1
1.5
2
2.5
Salinity (% NaCl)

Solubilization of TCE with a Mixture of 4.02% #290 and 4.72% Isopropanol at Various NaCl Concentrations

sample (salinity %)	concentration (mg/L)
0% NaCl	9334
0.236% NaCl	15361
0.39% NaCl	23006
0.631% NaCl	37646
0.867% NaCl	94147
0.946% NaCl	839713

Solubilization of TCE for 4.2% #290 Only at Various NaCl Concentrations

sample (salinity %)	concentration (mg/L)
0% NaCl	2585
0.236% NaCl	3811
0.36% NaCl	4615
0.631% NaCl	9600
0.867% NaCl	18616
0.946% NaCl	1331
1.1% NaCl	2388
1.26% NaCl	9030
1.42% NaCl	6879
1.57% NaCl	6932

Solubilization of TCE with 4.03% #290 and 4.18% Isopropanol at Various NaCl Concentrations at 15 degrees Celsius

sample (salinity %)	concentration (mg/L)
0.16% NaCl	32854
0.32% NaCl	54291
0.48% NaCl	69819
0.64% NaCl	120829
0.72% NaCl	352007
0.80% NaCl	979800
0.88% NaCl	774532
0.96% NaCl	2011

Solubilization of TCE with a Mixture of 4.3% MA 80 and 1.86% AT 100 at Various NaCl Concentrations

sample (salinity %)	concentration (mg/L)
0% NaCl	61668
0.047% NaCl	67838
0.063% NaCl	71210
0.078% NaCl	83917
0.094% NaCl	90943
0.1% NaCl	98694

Solubilization of TCE for 1:1 Mixtures of MA 80 and Isopropanol at Various Concentrations at a Salinity of 0.28% NaCl

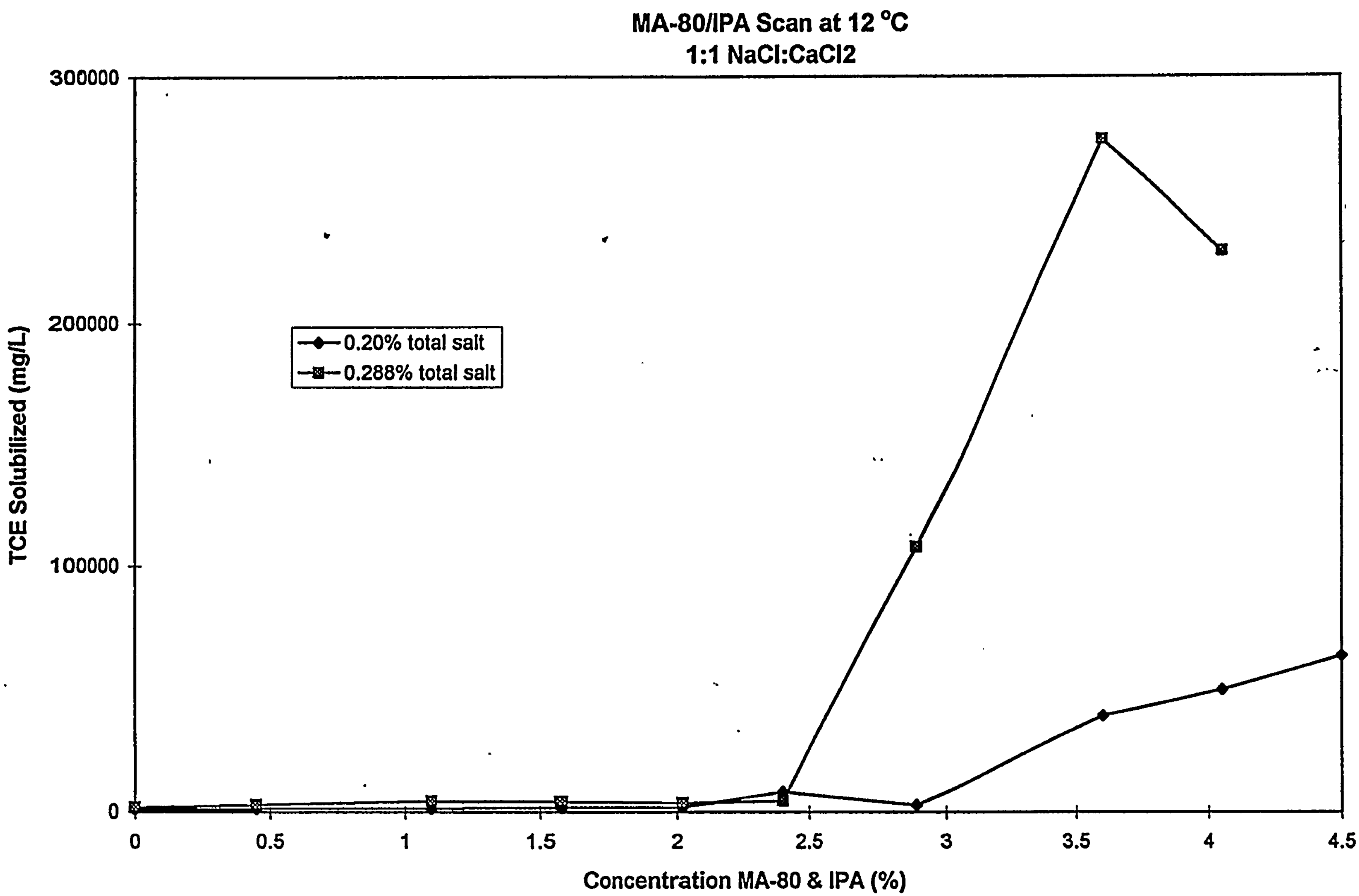
sample	concentration (mg/L)
0% MA-80 & IPA	1165
0.45% MA-80 & IPA	1318
1.1% MA-80 & IPA	1478
1.57% MA-80 & IPA	1876
2.02% MA-80 & IPA	1954
2.4% MA-80 & IPA	8142
2.9% MA-80 & IPA	2822
3.6% MA-80 & IPA	38906
4.05% MA-80 & IPA	49464
4.5% MA-80 & IPA	63393

Solubilization of TCE for 1:1 Mixtures of MA 80 and Isopropanol at Various Concentrations at a Salinity of 0.20% NaCl

sample	concentration (mg/L)
0% MA-80 & IPA	1165
0.45% MA-80 & IPA	1318
1.1% MA-80 & IPA	1478
1.57% MA-80 & IPA	1876
2.02% MA-80 & IPA	1954
2.4% MA-80 & IPA	8142
2.9% MA-80 & IPA	2822
3.6% MA-80 & IPA	38906
4.05% MA-80 & IPA	49464
4.5% MA-80 & IPA	63393

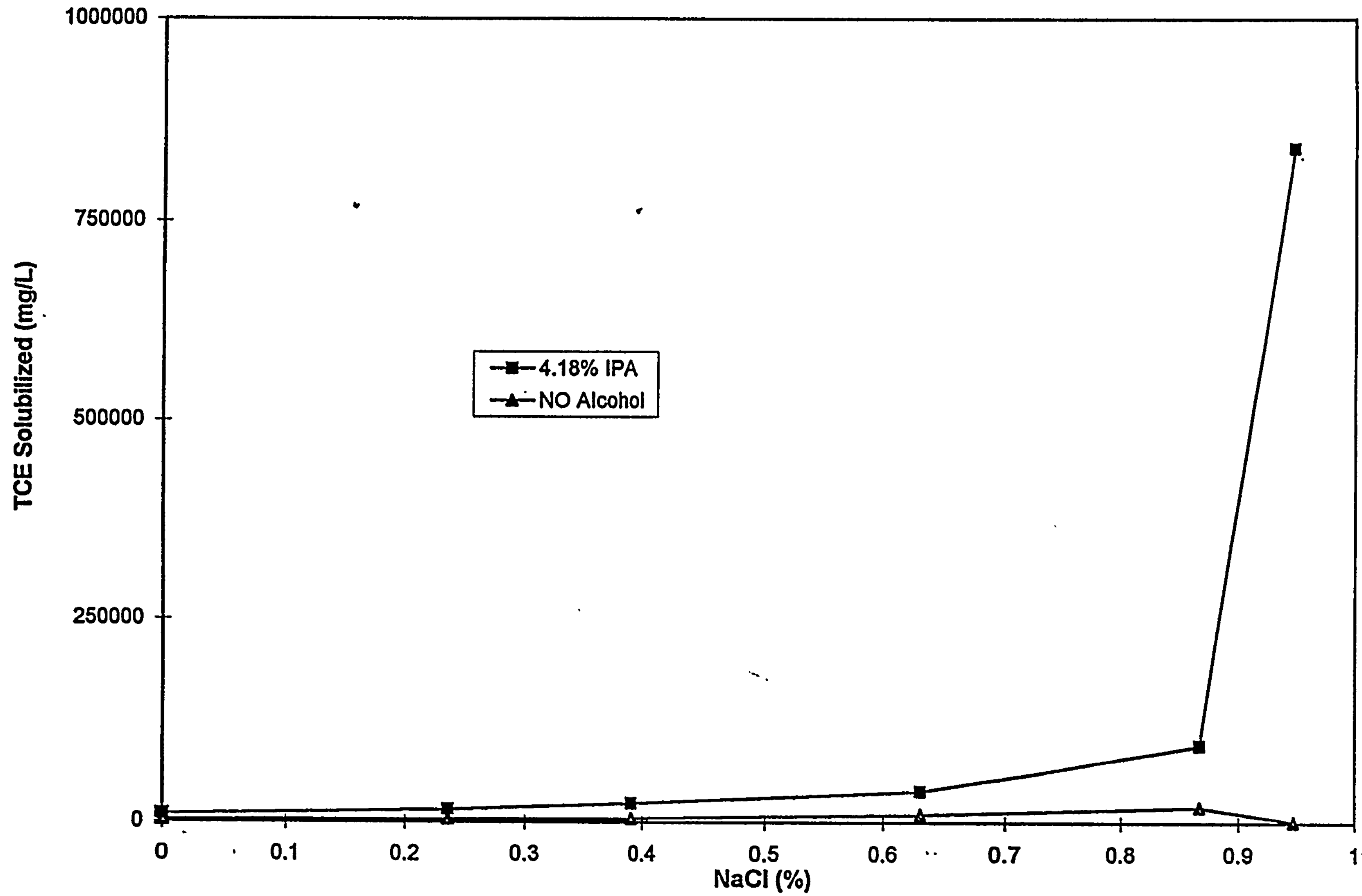
Solubilization of TCE for a Mixture of 4.3% MA 80 and 4.3% Isopropanol with a range of salinities that are all a 1:1 mixture of NaCl : CaCl2 at 12 degrees Celsius

sample (salinity %)	concentration (mg/L)
0.258	220294
0.295	235325
0.332	602



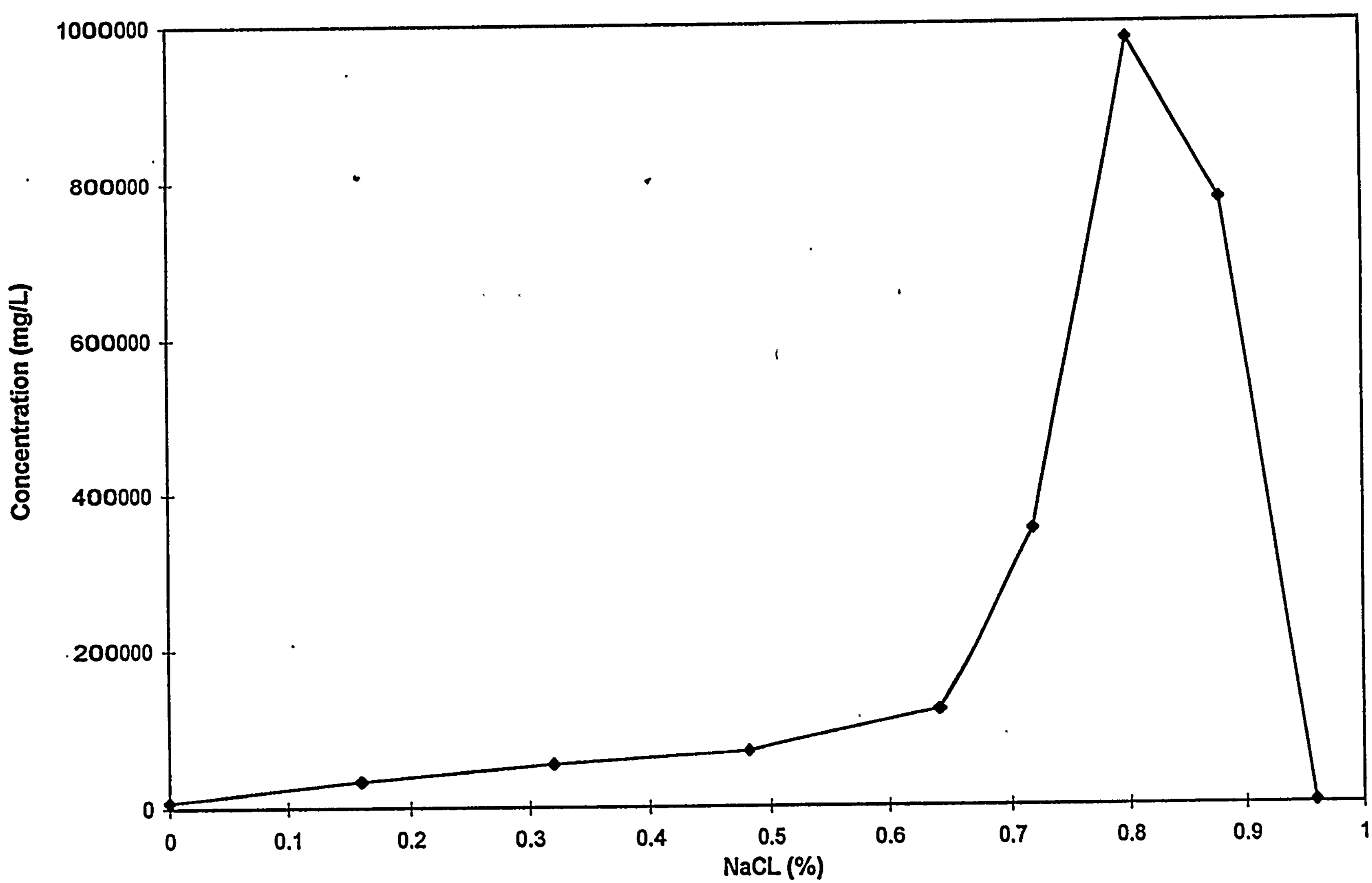
MA-80/IPA Scan at 12 °C
1:1 NaCl:CaCl2
TCE Solubilized (mg/L)
300000
200000
100000
0
0.20% total salt
0.288% total salt
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Concentration MA-80 & IPA (%)

4.2% #290



TCE Solubilized (mg/L)
1000000
750000
500000
250000
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
NaCl (%)
4.18% IPA
NO Alcohol

TCE Solubilization
using 4.03% #290 & 4.18% Isopropoanol



APPENDIX 4

Additional Data

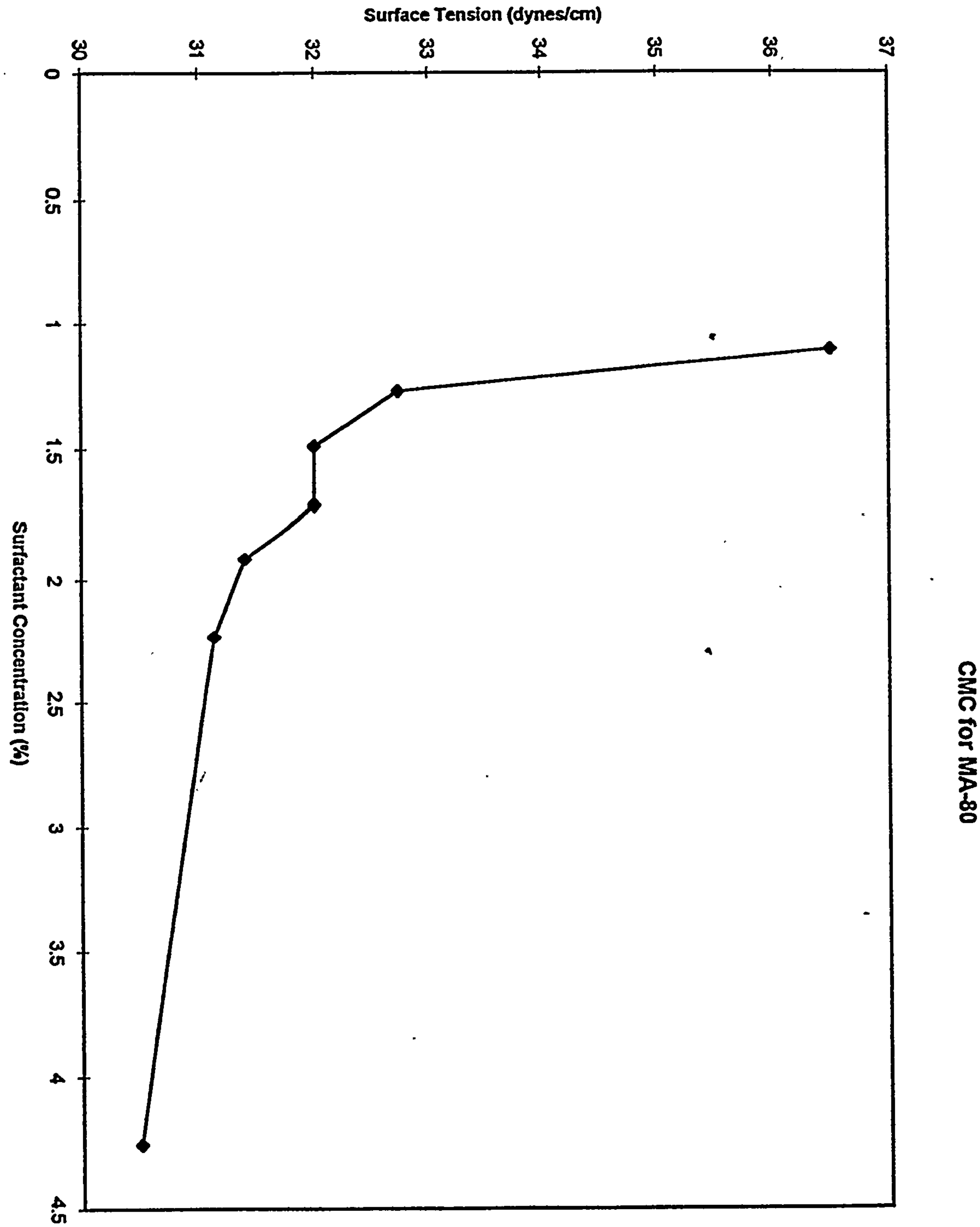
Table of Contents

Clay Dispersion as a function of Solution Type

Solution	Turbididty (after 5 minutes)
distilled H2O	High
CaCl2 only	Low
NaCl only	Moderate

Clay Dispersion as a function of NaCl/CaCl2 Ratio

Solution	Turbididty (after 5 minutes)
distilled H2O	High
2:1	low
1:1	low
1:2	low



CMC for MA-80
Surface Tension (dynes/cm)
30
31
32
33
34
35
36
37
Surfactant Concentration (%)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5

Viscosity Measurements for MA-80						
% MA-80	% #109	% IPA	ppm NaCl	ppm CaCl2	Viscosity (centipoise) 12 °C	21 °C
4.26	1.6	4.3	----------	----------	2.01	
4.24	2.19		----------	----------	1.53	
2.13	0.80	2.15	----------	----------	1.54	
1.065	0.40	1.075	----------	----------	1.36	
4.26	1.6	4.3	4000	----------	2.09	
4.26	1.6	4.3	----------	2000	3.02	
5.58	2.28	5.65	----------	2000	5.06	1.85
5.58	2.28	5.65	2000	----------		1.79
6.1	--------	4.02	----------	----------	1.97	
7.6	--------	5.0	----------	----------	2.32	1.66
distilled water (from Handbook of Chemistry and Physics)					1.235	0.9779

Interfacial Tension Measurements of TCE in Surfactant Using Pendant Drop Method

Each sample contains equal concentrations of MA 80 and Isopropanol
1st sample also contained 0.28 % total salt (1:1 NaCl:CaCl2) which was diluted along with the MA 80 and IPA

sample (% MA 80 & IPA)	ift (dynes/cm)
4.2	0.2800
3.6	0.1800
2.9	0.3430
2.4	0.4370
2.02	0.9110
1.1	0.9470
0.45	5.3460

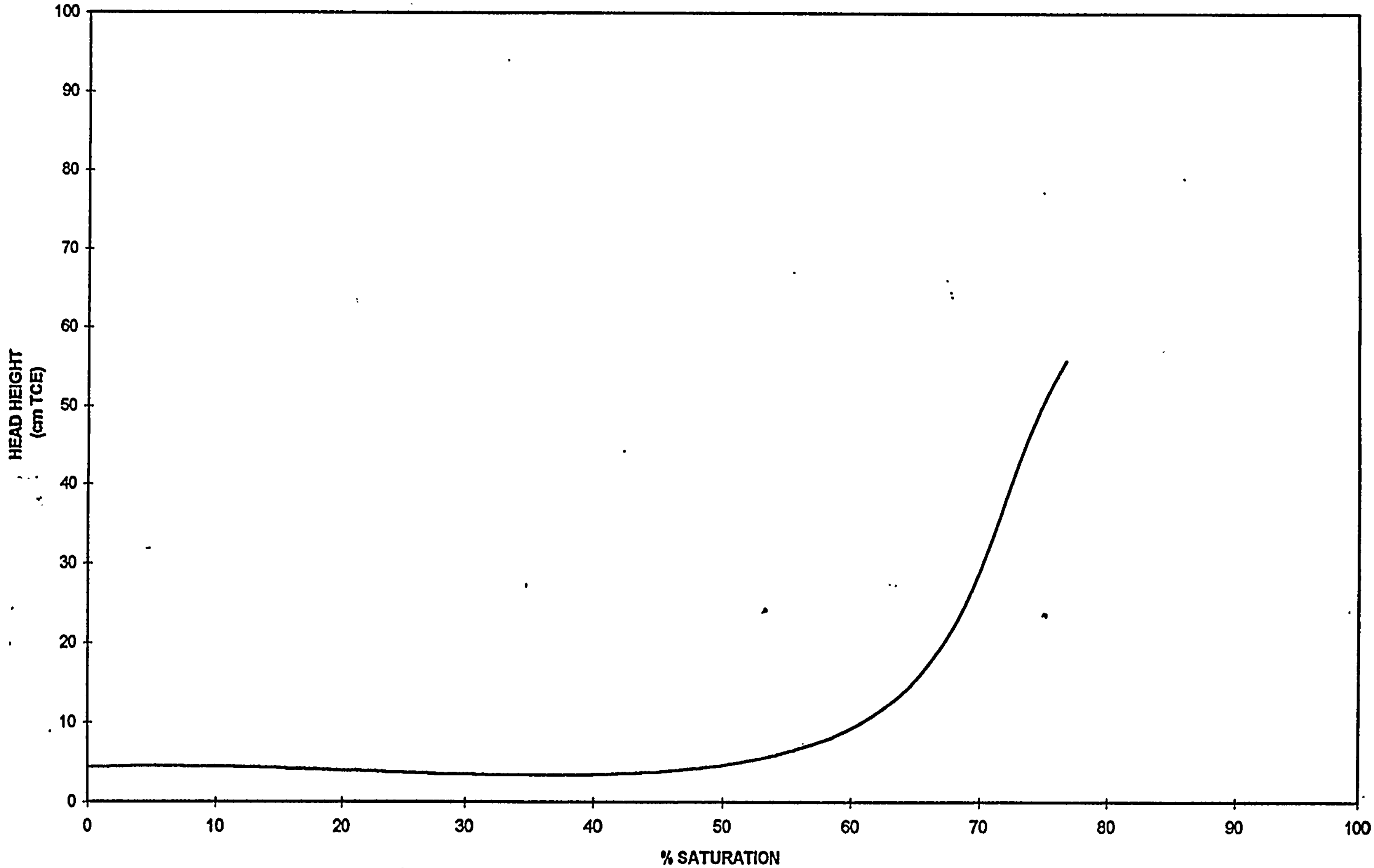
each sample contains equal concentrations of Ma 80 and Isopropanol
All samples contain 0.28% total salt (1:1 NaCl:CaCl2)

sample (% MA 80 & IPA)	ift (dynes/cm)
4.2	0.1451
3.6	0.0892
2.9	0.1858
2.4	0.2211
2.02	0.4595
1.1	0.4794
0.45	2.2651

Capillary Pressure Saturation Data

% SATUATION	CM HEAD
0	4.4
58.4083	8.0
76.818	55.9

CAPILLARY PRESSURE SATURATION CURVE



PERMEABILITY VS TIME: 4%MA80, 4% IPA, 0.2% SALT (1:1 sodium:calcium chloride)							
start time	Q (ml/min)	K (cm/sec)					
0	0.537	2.34E-03	water through column				
3	0.52175	2.27E-03					
7	0.536333	2.33E-03					
13	0.54175	2.36E-03					
21	0.544667	2.37E-03					
30	0.634	2.76E-03	surfactant added to column				
36	0.658	2.86E-03					
47	0.629	2.74E-03					
55	0.611111	2.66E-03					
64	0.536267	2.33E-03					
79	0.589143	2.56E-03					
86	0.5815	2.53E-03					
96	0.5843	2.54E-03	dye seen in effluent, surfactant break through				
106	0.5959	2.59E-03					
116	0.5967	2.60E-03					
126	0.596579	2.60E-03					
145	0.5922	2.58E-03					

Calculated Kd Values from Batch Sorption Experiments
nd= measured Kd value too low to quantify

System	Kd
#290	nd
#290	nd
#290 & Isopropanol	nd
#290 & Isopropanol	0.127

Portsmouth Clay X-Ray Data

Grain size analyses using the hydrometer method determined that the clay content exceeded 15% in all samples tested. Since sorption depends on the type of clay content present (Lagowski, 1996), with expandable clays such as smectites exhibiting high sorption, two clay slides were prepared for X-ray diffraction analysis. The slides were prepared by mixing fines from the Portsmouth cores with water. The sand and silt was allowed to settle out until primarily clays remained in suspension. Small amounts of this solution were repeatedly put onto the two clay slides and each time allowed to dry overnight until a thick enough clay film was formed for the analyses. Each of the two clay slides were analyzed twice, once right after air drying the solution on the slides ("as is" sample labels) and again after letting the samples sit in a dessicator for 2 days with ethylene glycol ("glycolated" sample labels).

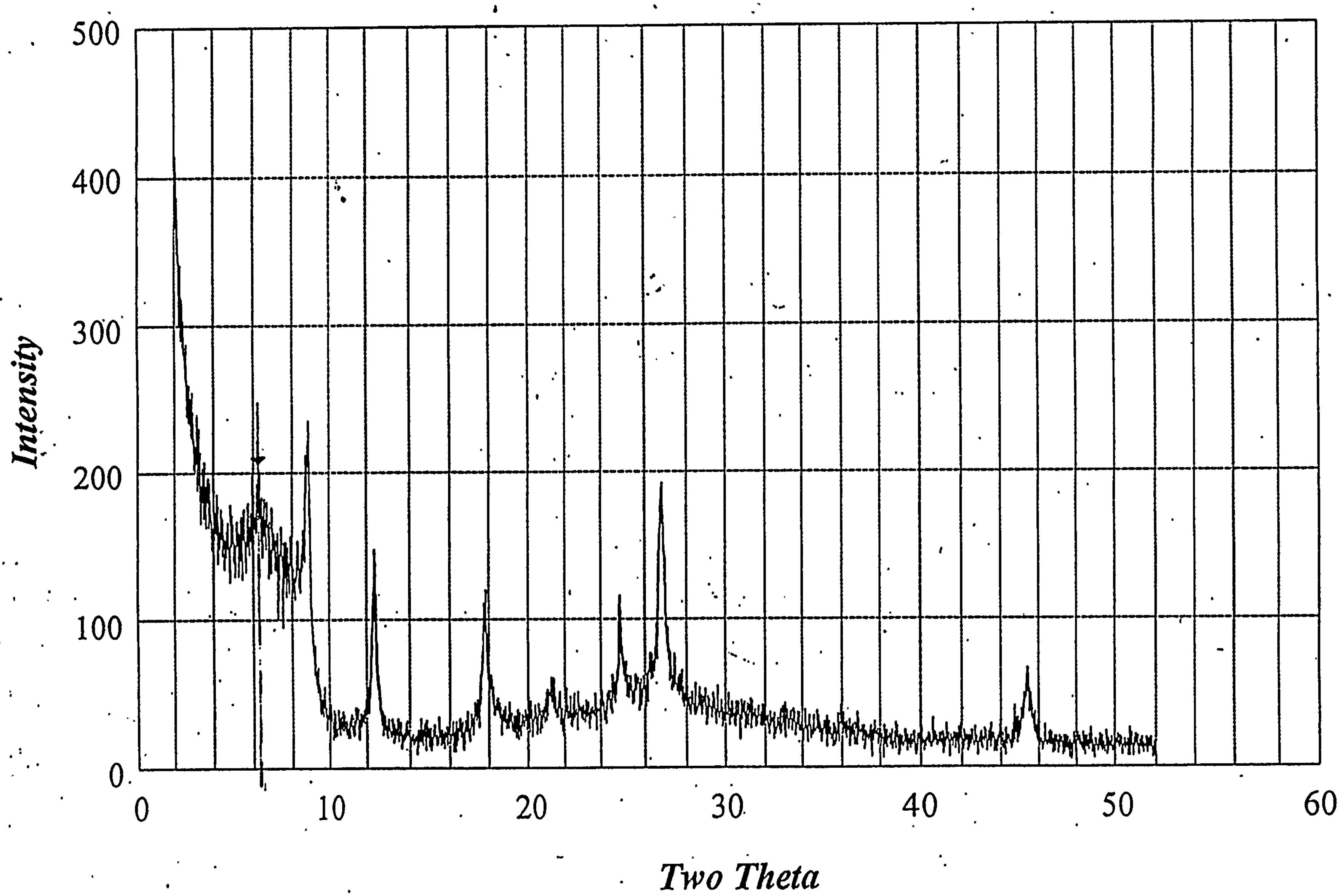
As discussed by Moore and Reynolds (1989), smectite can be identified by looking for a shift in the 001 reflection from approximately 6 degrees 2θ (15 angstroms d-spacing) for an air dried sample to approximately 5.2 degrees 2θ (16.9 angstroms d-spacing) for a glycolated sample. The following four charts show the output from the x-ray diffraction of each slide before and after glycolation. Sample I (as is) shows a peak at approximately 6.2 two theta which shifts in sample I (glycolated) to approximately 5.2 two theta after glycolation. The set for sample II show very similar results. Although the peaks are difficult to see in the charts of the glycolated samples, the fact that the initial peak has disappeared from it's original place indicates that the peak has shifted after glycolation. The shift in peaks indicates there are expandable clays present in the Portsmouth core materials.

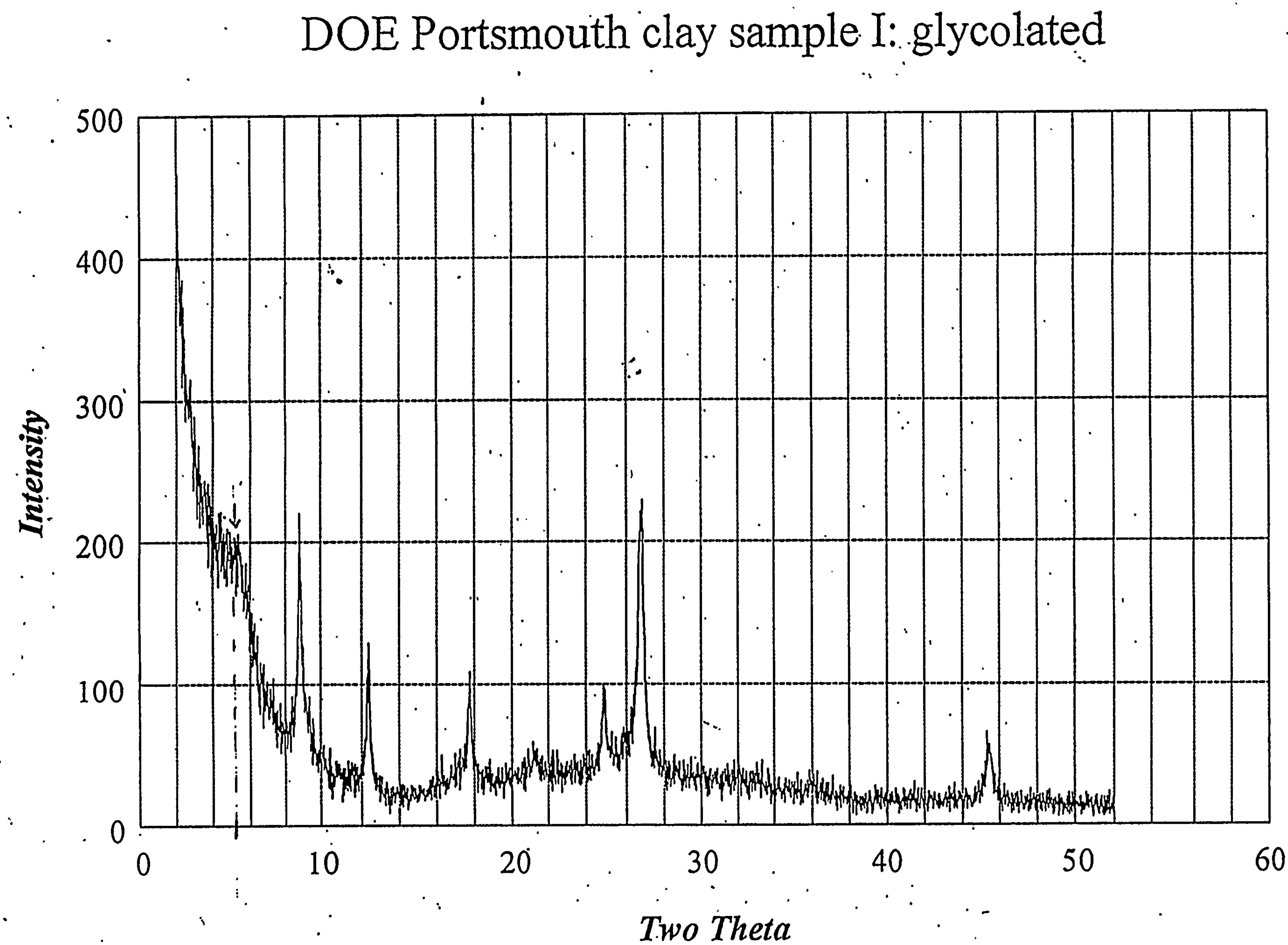
References:

Lagowski, A. (1996). "Surfactant Adsorption on Porous Media as a Function of Surfactant Type and Soil Type," Masters Thesis, State University of New York at Buffalo, Buffalo.

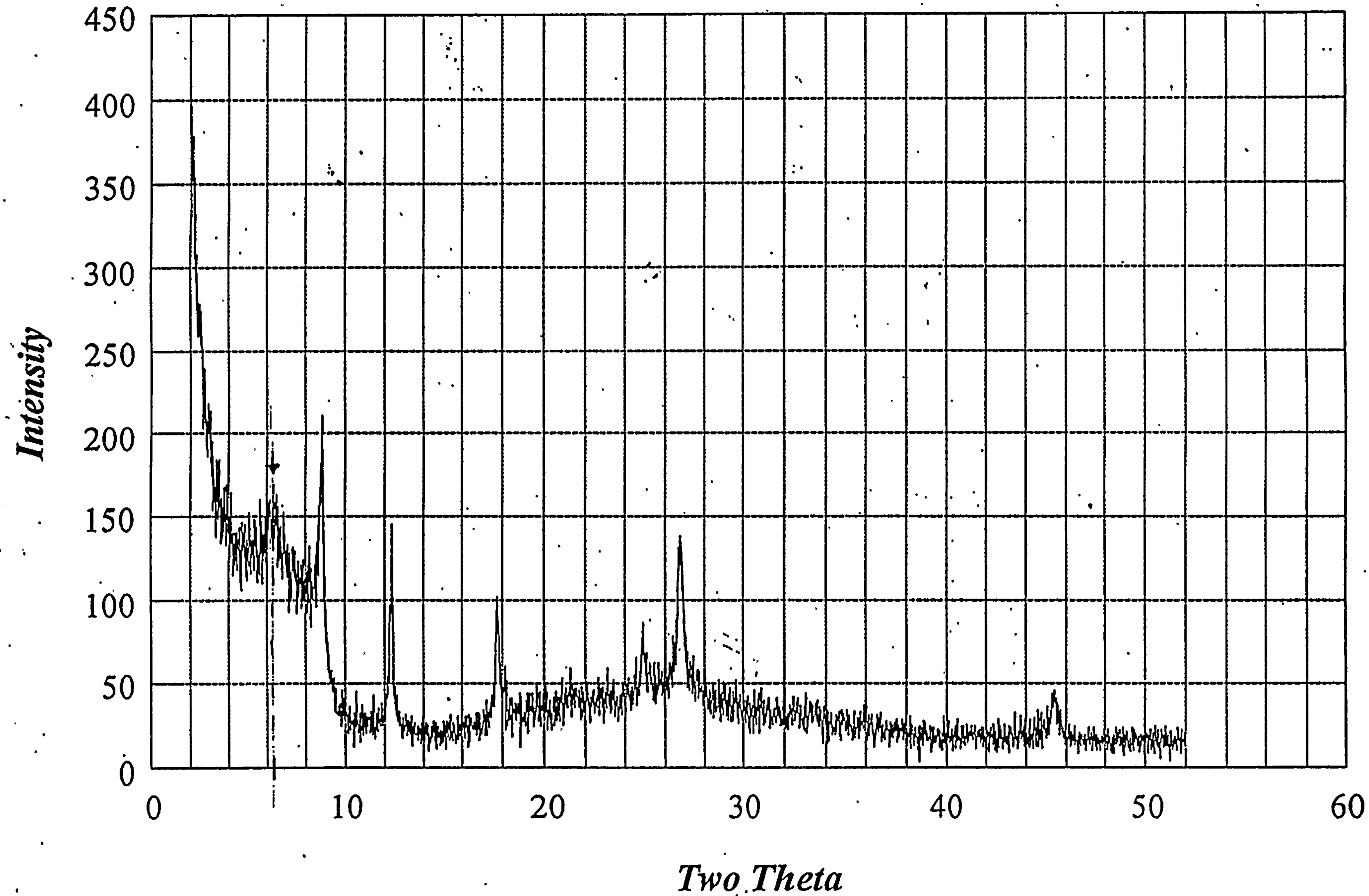
Moore, D. M., and Reynolds, R. C. (1989). *X-Ray Diffraction and the Identification and Analysis of Clay Minerals*, Oxford University Press, New York.

Portsmouth clay sample I (as is)

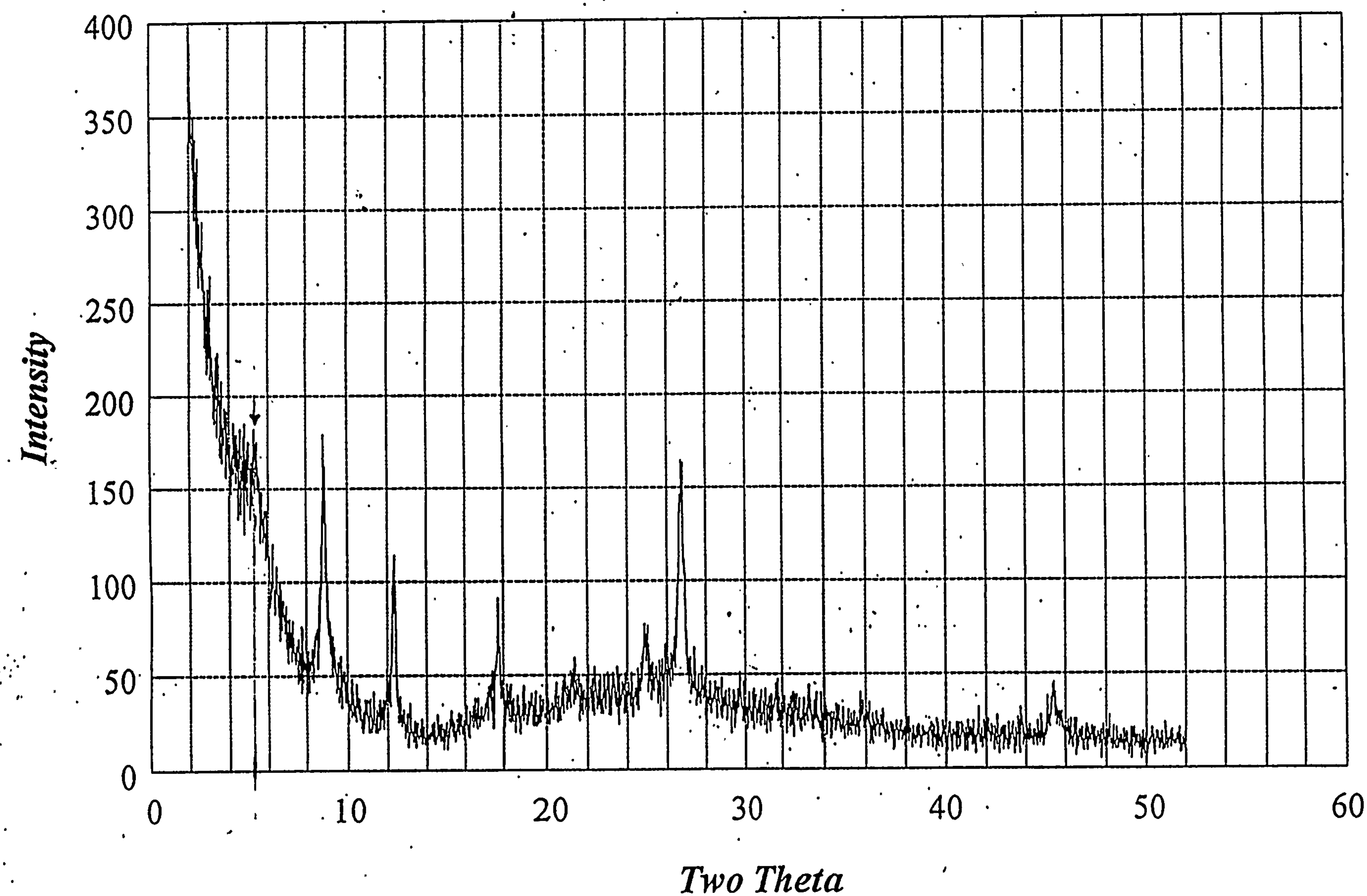



DOE Portsmouth clay sample I: glycolated
Intensity
500
400
300
200
100
0
0
10
20
30
40
50
60
Two Theta

Portsmouth clay II (as is)



DOE Portsmouth clay sample II; glycolated



APPENDIX 5

Field Trial Sample Analyses

Table of Contents

Isopropanol Concentrations at INT-1

sample	Date	IPA (%)
INT 1-1	9/21/96 15:45	0
INT 1-2	9/21/96 16:30	0
INT 1-3	9/21/96 18:30	0
INT 1-4	9/21/96 20:36	0
INT 1-5	9/21/96 21:43	0
INT 1-6	9/21/96 22:41	0
INT 1-7	9/21/96 23:33	0
INT 1-8	9/22/96 0:32	0
INT 1-9	9/22/96 1:31	0
INT 1-10	9/22/96 2:33	0
INT 1-11	9/22/96 3:30	0
INT 1-12	9/22/96 4:30	0
INT 1-13	9/22/96 5:30	0
INT 1-14	9/22/96 6:29	0
INT 1-15	9/22/96 7:29	0
INT 1-16	9/22/96 8:30	0.44
INT 1-17	9/22/96 10:30	1.76
INT 1-18	9/22/96 11:30	2.20
INT 1-34	9/22/96 12:37	2.67
INT 1-35	9/22/96 13:40	2.88
INT 1-36	9/22/96 14:35	3.18
INT 1-37	9/22/96 15:33	3.28
INT 1-38	9/22/96 16:36	3.40
INT 1-39	9/22/96 16:37	3.42
INT 1-40	9/22/96 17:33	3.42
INT 1-41	9/22/96 18:35	3.59
INT 1-42	9/22/96 19:35	3.60
INT 1-43	9/22/96 20:37	3.68
INT 1-44	9/22/96 21:35	3.65
INT 1-45	9/22/96 22:35	3.75
INT 1-46	9/22/96 23:35	0.10
INT 1-47	9/23/96 0:36	3.81
INT 1-48	9/23/96 1:31	3.88
INT 1-49	9/23/96 2:31	3.84
INT 1-50	9/23/96 3:35	3.89
INT 1-51	9/23/96 4:33	3.90
INT 1-68	9/23/96 5:47	3.83
INT 1-69	9/23/96 6:46	3.99
INT 1-70	9/23/96 7:47	3.92
INT 1-71	9/23/96 8:42	3.85
INT 1-72	9/23/96 10:45	3.75
INT 1-73	9/23/96 12:46	2.96
INT 1-74	9/23/96 14:45	3.72
INT 1-84	9/23/96 16:45	4.26
INT 1-85	9/23/96 22:47	3.00
INT 1-86	9/24/96 0:00	1.27
INT 1-87	9/24/96 0:00	0.75

Isopropanol Concentrations at INT-1

INT 1-96	9/24/96 16:43	0.32
INT 1-97	9/24/96 16:43	0.31
INT 1-98	9/24/96 22:45	0.23
INT 1-99	9/25/96 4:45	0.15
INT 1-100	9/25/96 10:47	0.17
INT 1-101	9/25/96 10:47	0.16
INT 1-102	9/25/96 16:45	0.11
INT 1-103	9/25/96 22:45	0.08
INT 1-104	9/26/96 4:45	0.03
INT 1-105	9/26/96 10:45	0.02

MA 80 Concentrations at INT-1

sample	Date	MA-80 (%)
INT 1-1	9/21/96 15:45	0
INT 1-2	9/21/96 16:30	0
INT 1-3	9/21/96 18:30	0
INT 1-4	9/21/96 20:36	0
INT 1-5	9/21/96 21:43	0
INT 1-6	9/21/96 22:41	0
INT 1-7	9/21/96 23:33	0
INT 1-8	9/22/96 0:32	0
INT 1-9	9/22/96 1:31	0
INT 1-10	9/22/96 2:33	0
INT 1-11	9/22/96 3:30	0
INT 1-12	9/22/96 4:30	0
INT 1-13	9/22/96 5:30	0
INT 1-14	9/22/96 6:29	0
INT 1-15	9/22/96 7:29	0
INT 1-16	9/22/96 8:30	0.281
INT 1-17	9/22/96 10:30	0.989
INT 1-18	9/22/96 11:30	1.412
INT 1-34	9/22/96 12:37	1.906
INT 1-35	9/22/96 13:40	2.311
INT 1-36	9/22/96 14:35	2.634
INT 1-37	9/22/96 15:33	2.819
INT 1-38	9/22/96 16:36	2.984
INT 1-39	9/22/96 16:37	3.088
INT 1-40	9/22/96 17:33	3.187
INT 1-41	9/22/96 18:35	3.265
INT 1-42	9/22/96 19:35	3.374
INT 1-43	9/22/96 20:37	3.429
INT 1-44	9/22/96 21:35	3.408
INT 1-45	9/22/96 22:35	3.495
INT 1-46	9/22/96 23:35	0.000
INT 1-47	9/23/96 0:36	3.640
INT 1-48	9/23/96 1:31	3.813
INT 1-49	9/23/96 2:31	3.699
INT 1-50	9/23/96 3:35	3.785
INT 1-51	9/23/96 4:33	3.814
INT 1-68	9/23/96 5:47	3.793
INT 1-69	9/23/96 6:46	3.740
INT 1-70	9/23/96 7:47	3.718
INT 1-71	9/23/96 8:42	3.684
INT 1-72	9/23/96 10:45	3.197
INT 1-73	9/23/96 12:46	2.124
INT 1-74	9/23/96 14:45	2.092
INT 1-84	9/23/96 16:45	1.887
INT 1-85	9/23/96 22:47	1.687
INT 1-86	9/24/96 0:00	1.169

MA 80 Concentrations at INT-1

INT 1-87	9/24/96 0:00	0.620
INT 1-88	9/24/96 10:44	0.366
INT 1-96	9/24/96 16:43	0.251
INT 1-97	9/24/96 16:43	0.242
INT 1-98	9/24/96 22:45	0.549
INT 1-99	9/25/96 4:45	0.775
INT 1-100	9/25/96 10:47	0.552
INT 1-101	9/25/96 10:47	0.555
INT 1-102	9/25/96 16:45	0.327
INT 1-103	9/25/96 22:45	0.213
INT 1-104	9/26/96 4:45	0.156
INT 1-105	9/26/96 10:45	0.117

Isopropanol Concentration at BW2G

sample	Date	% IPA
BW2G-1	9/21/96 15:40	0
BW2G-2	9/21/96 16:27	0
BW2G-3	9/21/96 18:33	0
BW2G-4	9/21/96 20:35	0
BW2G-5	9/21/96 20:41	0
BW2G-6	9/21/96 22:40	0
BW2G-7	9/21/96 23:32	0
BW2G-8	9/22/96 0:35	0
BW2G-9	9/22/96 1:30	0
BW2G-10	9/22/96 2:30	0
BW2G-11	9/22/96 3:29	0
BW2G-12	9/22/96 4:29	0
BW2G-13	9/22/96 5:29	0
BW2G-14	9/22/96 6:30	0
BW2G-15	9/22/96 7:30	0
BW2G-16	9/22/96 8:30	0.031
BW2G-17	9/22/96 10:28	0.157
BW2G-24	9/22/96 11:36	0.312
BW2G-34	9/22/96 12:33	0.388
BW2G-35	9/22/96 13:36	0.472
BW2G-36	9/22/96 14:31	0.516
BW2G-37	9/22/96 15:34	0.627
BW2G-38	9/22/96 16:33	0.637
BW2G-39	9/22/96 16:33	0.714
BW2G-40	9/22/96 17:32	0.799
BW2G-41	9/22/96 18:33	0.894
BW2G-42	9/22/96 19:31	0.948
BW2G-43	9/22/96 20:38	0.977
BW2G-44	9/22/96 21:35	1.051
BW2G-45	9/22/96 22:36	0.096
BW2G-46	9/22/96 23:35	1.129
BW2G-47	9/23/96 0:36	1.197
BW2G-48	9/23/96 1:30	1.177
BW2G-49	9/23/96 2:30	1.198
BW2G-50	9/23/96 3:36	1.246
BW2G-51	9/23/96 4:37	1.308
BW2G-52	9/23/96 5:46	1.262
BW2G-69	9/23/96 6:42	1.267
BW2G-70	9/23/96 7:46	1.305
BW2G-71	9/23/96 8:42	1.322
BW2G-72	9/23/96 9:40	1.410
BW2G-73	9/23/96 9:43	1.450
BW2G-74	9/23/96 10:47	1.488
BW2G-75	9/23/96 11:41	1.566
BW2G-76	9/23/96 12:43	1.632
BW2G-77	9/23/96 13:38	1.711
BW2G-89	9/23/96 14:43	1.779
BW2G-90	9/23/96 15:45	1.689

Isopropanol Concentration at BW2G

BW2G-91	9/23/96 16:45	1.473
BW2G-92	9/23/96 18:42	1.252
BW2G-93	9/23/96 20:44	1.077
BW2G-94	9/23/96 22:46	0.959
BW2G-95	9/24/96 0:43	0.858
BW2G-96	9/24/96 2:47	0.740
BW2G-97	9/24/96 4:43	0.679
BW2G-98	9/24/96 6:45	0.630
BW2G-99	9/24/96 8:43	0.588
BW2G-100	9/24/96 10:44	0.527
BW2G-101	9/24/96 12:43	0.478
BW2G-115	9/24/96 14:44	0.420
BW2G-116	9/24/96 16:46	0.454
BW2G-117	9/24/96 18:43	0.427
BW2G-118	9/24/96 20:44	0.420
BW2G-119	9/24/96 22:45	0.454
BW2G-120	9/25/96 0:45	0.427
BW2G-121	9/25/96 2:45	0.549
BW2G-122	9/25/96 4:45	0.549
BW2G-123	9/25/96 6:45	0.517
BW2G-124	9/25/96 8:43	0.496
BW2G-125	9/25/96 10:42	0.473
BW2G-126	9/25/96 10:43	0.490
BW2G-127	9/25/96 12:42	0.461
BW2G-141	9/25/96 14:45	0.429
BW2G-143	9/25/96 16:44	0.394
BW2G-144	9/25/96 18:42	0.385
BW2G-145	9/25/96 20:45	0.386
BW2G-146	9/25/96 22:45	0.350
BW2G-147	9/26/96 0:45	0.328
BW2G-148	9/26/96 2:45	0.138
BW2G-149	9/26/96 4:45	0.145
BW2G-151	9/26/96 7:20	0.122
BW2G-152	9/26/96 8:45	0.121
BW2G-153	9/26/96 10:45	0.114
BW2G-154	9/26/96 12:45	0.092
BW2G-155	9/26/96 12:45	0.099
BW2G-169	9/26/96 14:49	0.094

MA 80 Concentrations at BW2G

sample	Date	MA-80 conc. (%)
BW2G-1	9/21/96 15:40	0
BW2G-2	9/21/96 16:27	0
BW2G-3	9/21/96 18:33	0
BW2G-4	9/21/96 20:35	0
BW2G-5	9/21/96 20:41	0
BW2G-6	9/21/96 22:40	0
BW2G-7	9/21/96 23:32	0
BW2G-8	9/22/96 0:35	0
BW2G-9	9/22/96 1:30	0
BW2G-10	9/22/96 2:30	0
BW2G-11	9/22/96 3:29	0
BW2G-12	9/22/96 4:29	0
BW2G-13	9/22/96 5:29	0
BW2G-14	9/22/96 6:30	0
BW2G-15	9/22/96 7:30	0
BW2G-16	9/22/96 8:30	0
BW2G-17	9/22/96 10:28	0.198
BW2G-24	9/22/96 11:36	0.254
BW2G-34	9/22/96 12:33	0.309
BW2G-35	9/22/96 13:36	0.224
BW2G-36	9/22/96 14:31	0.449
BW2G-37	9/22/96 15:34	0.526
BW2G-38	9/22/96 16:33	0.557
BW2G-39	9/22/96 16:33	0.549
BW2G-40	9/22/96 17:32	0.424
BW2G-41	9/22/96 18:33	0.611
BW2G-42	9/22/96 19:31	0.704
BW2G-43	9/22/96 20:38	0.713
BW2G-44	9/22/96 21:35	0.828
BW2G-45	9/22/96 22:36	0.121
BW2G-46	9/22/96 23:35	0.867
BW2G-47	9/23/96 0:36	0.952
BW2G-48	9/23/96 1:30	0.918
BW2G-49	9/23/96 2:30	0.936
BW2G-50	9/23/96 3:36	0.933
BW2G-51	9/23/96 4:37	1.009
BW2G-52	9/23/96 5:46	0.909
BW2G-69	9/23/96 6:42	0.971
BW2G-70	9/23/96 7:46	0.948
BW2G-71	9/23/96 8:42	0.928
BW2G-72	9/23/96 9:40	0.931
BW2G-73	9/23/96 9:43	0.944
BW2G-74	9/23/96 10:47	0.924
BW2G-75	9/23/96 11:41	0.907
BW2G-76	9/23/96 12:43	0.874
BW2G-77	9/23/96 13:38	0.844
BW2G-89	9/23/96 14:43	0.824
BW2G-90	9/23/96 15:45	0.785
BW2G-91	9/23/96 16:45	0.752

MA 80 Concentrations at BW2G

BW2G-92	9/23/96 18:42	0.724
BW2G-93	9/23/96 20:44	0.664
BW2G-94	9/23/96 22:46	0.596
BW2G-95	9/24/96 0:43	0.568
BW2G-96	9/24/96 2:47	0.503
BW2G-97	9/24/96 4:43	0.445
BW2G-98	9/24/96 6:45	0.410
BW2G-99	9/24/96 8:43	0.383
BW2G-100	9/24/96 10:44	0.351
BW2G-101	9/24/96 12:43	0.335
BW2G-115	9/24/96 14:44	0.316
BW2G-116	9/24/96 16:46	0.306
BW2G-117	9/24/96 18:43	0.302
BW2G-118	9/24/96 20:44	0.314
BW2G-119	9/24/96 22:45	0.330
BW2G-120	9/25/96 0:45	0.344
BW2G-121	9/25/96 2:45	0.369
BW2G-122	9/25/96 4:45	0.370
BW2G-123	9/25/96 6:45	0.377
BW2G-124	9/25/96 8:43	0.365
BW2G-125	9/25/96 10:42	0.314
BW2G-126	9/25/96 10:43	0.339
BW2G-127	9/25/96 12:42	0.193
BW2G-141	9/25/96 14:45	0.286
BW2G-143	9/25/96 16:44	0.268
BW2G-144	9/25/96 18:42	0.224
BW2G-145	9/25/96 20:45	0.240
BW2G-146	9/25/96 22:45	0.224
BW2G-147	9/26/96 0:45	0.226
BW2G-148	9/26/96 2:45	0.192
BW2G-149	9/26/96 4:45	0.188
BW2G-151	9/26/96 7:20	0.197
BW2G-152	9/26/96 8:45	0.173
BW2G-153	9/26/96 10:45	0.178
BW2G-154	9/26/96 12:45	0.176
BW2G-155	9/26/96 12:45	0.173
BW2G-169	9/26/96 14:49	0.179

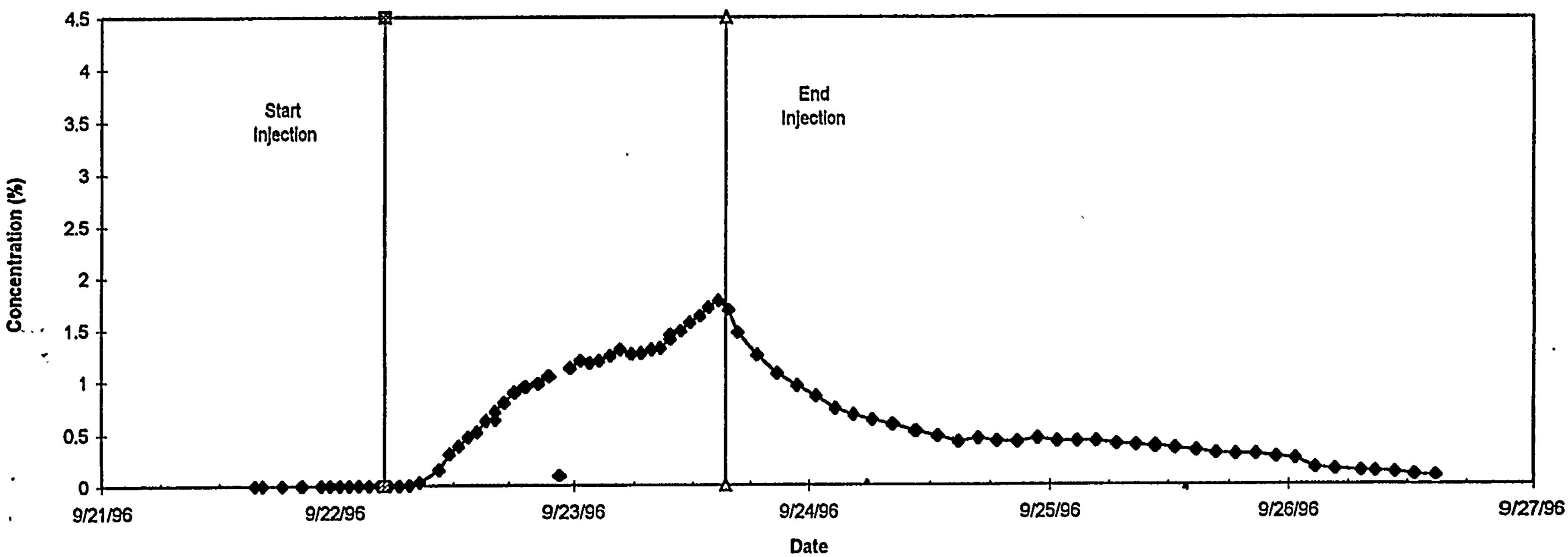
Isopropanol Concentrations at 66G

sample	Date	IPA (%)
66G-1	9/21/96 17:00	0
66G-2	9/21/96 17:40	0
66G-3	9/21/96 18:30	0
66G-4	9/21/96 20:40	0
66G-5	9/22/96 0:37	0
66G-6	9/22/96 4:31	0
66G-7	9/22/96 8:30	3.12
66G-8	9/22/96 12:35	3.20
66G-9	9/22/96 20:38	3.08
66G-10	9/23/96 2:33	3.18
66G-11	9/23/96 6:41	3.30
66G-12	9/23/96 9:45	4.00
66G-13	9/23/96 9:46	4.01
66G-14	9/23/96 14:47	4.45

MA 80 Concentrations at 66G

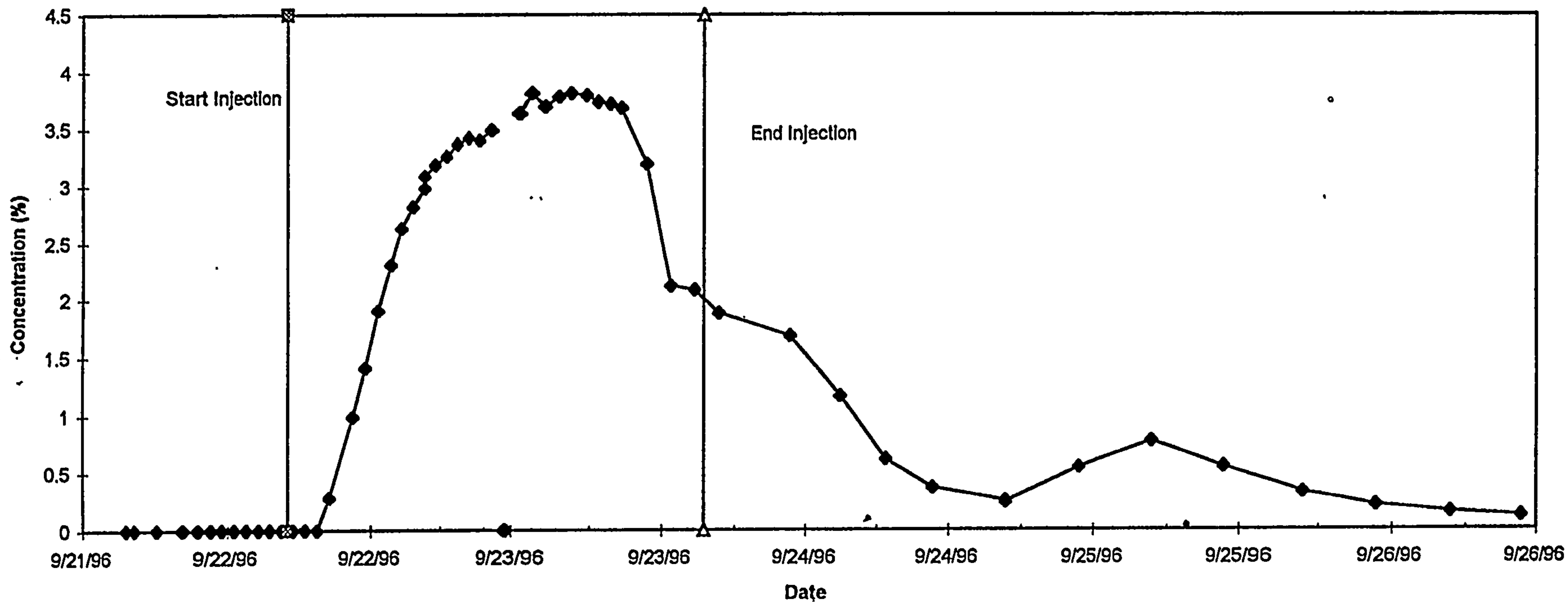
sample	Date	MA-80 (%)
66G-1	9/21/96 17:00	0
66G-2	9/21/96 17:40	0
66G-3	9/21/96 18:30	0
66G-4	9/21/96 20:40	0
66G-5	9/22/96 0:37	0
66G-6	9/22/96 4:31	0
66G-7	9/22/96 8:30	3.57
66G-8	9/22/96 12:35	3.74
66G-9	9/22/96 20:38	3.56
66G-10	9/23/96 2:33	3.66
66G-11	9/23/96 6:41	3.49
66G-12	9/23/96 9:45	1.74
66G-13	9/23/96 9:46	1.75
66G-14	9/23/96 14:47	1.68

IPA at BW2G



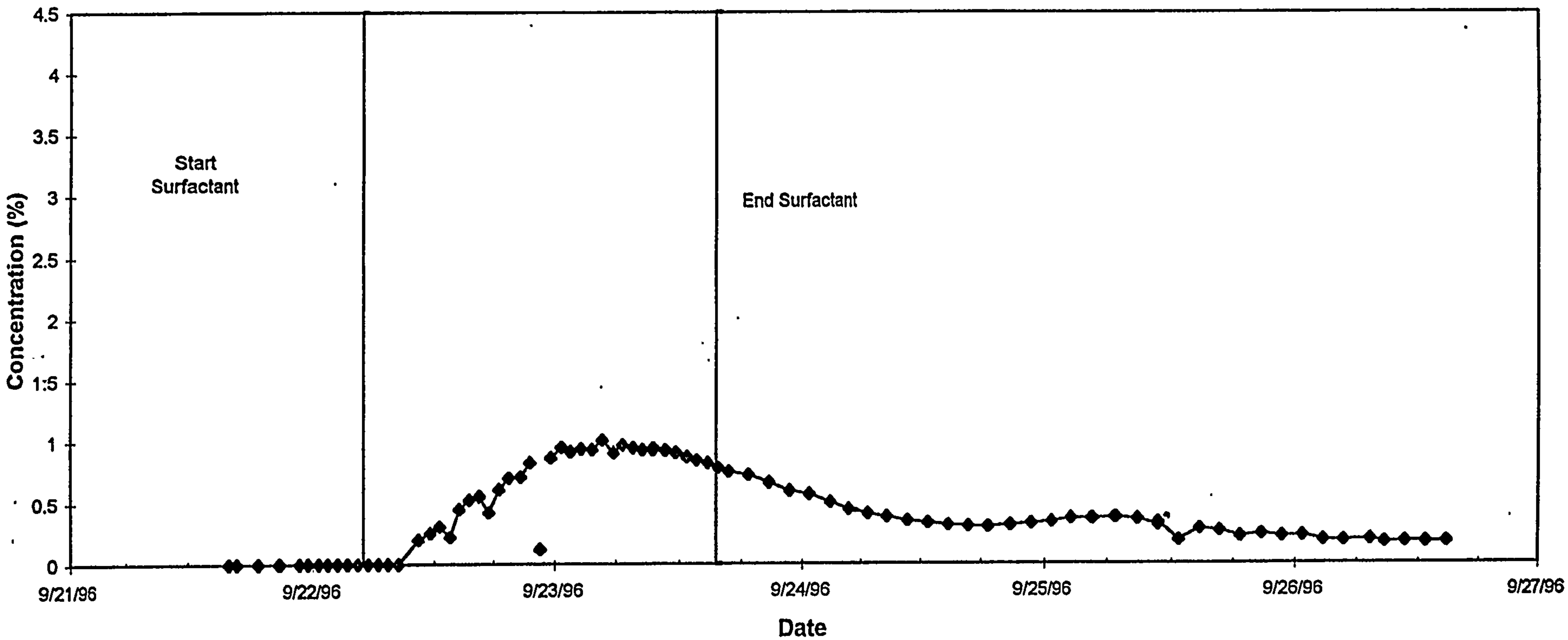
A5-11

MA 80 at INT-1

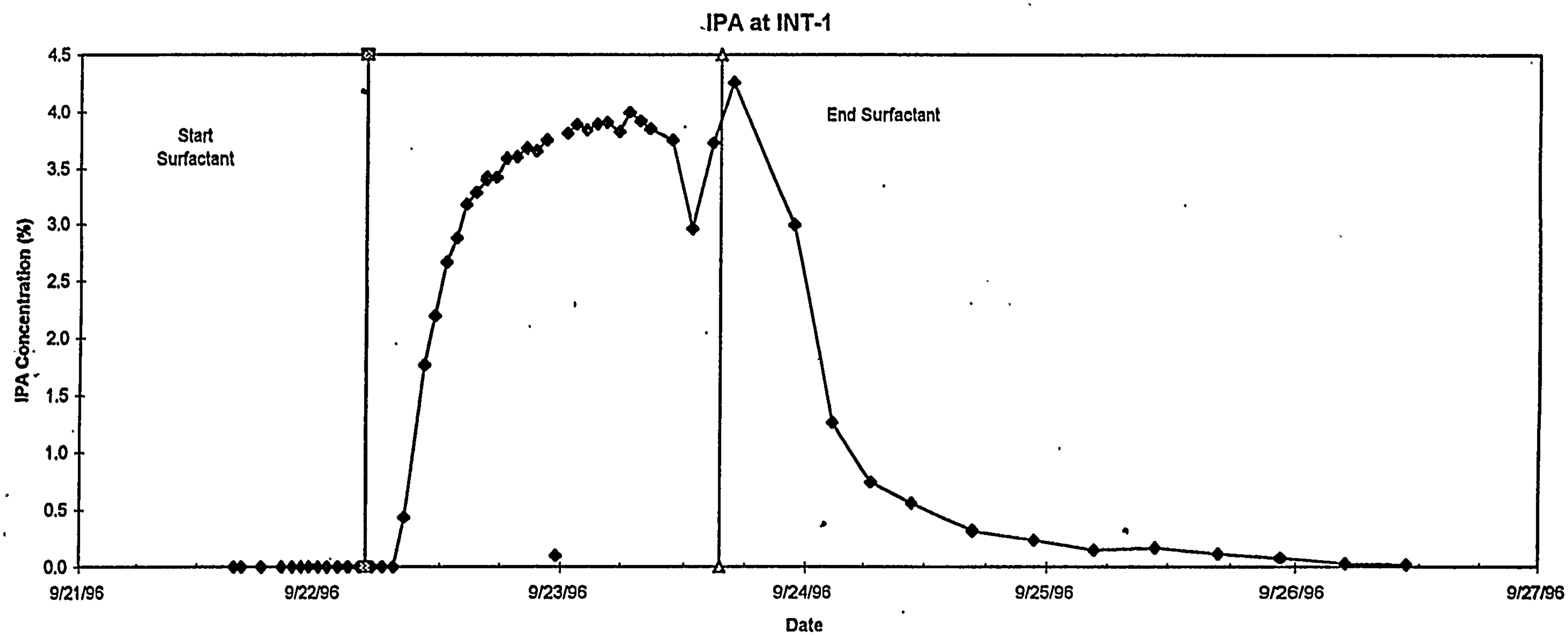


A5-12

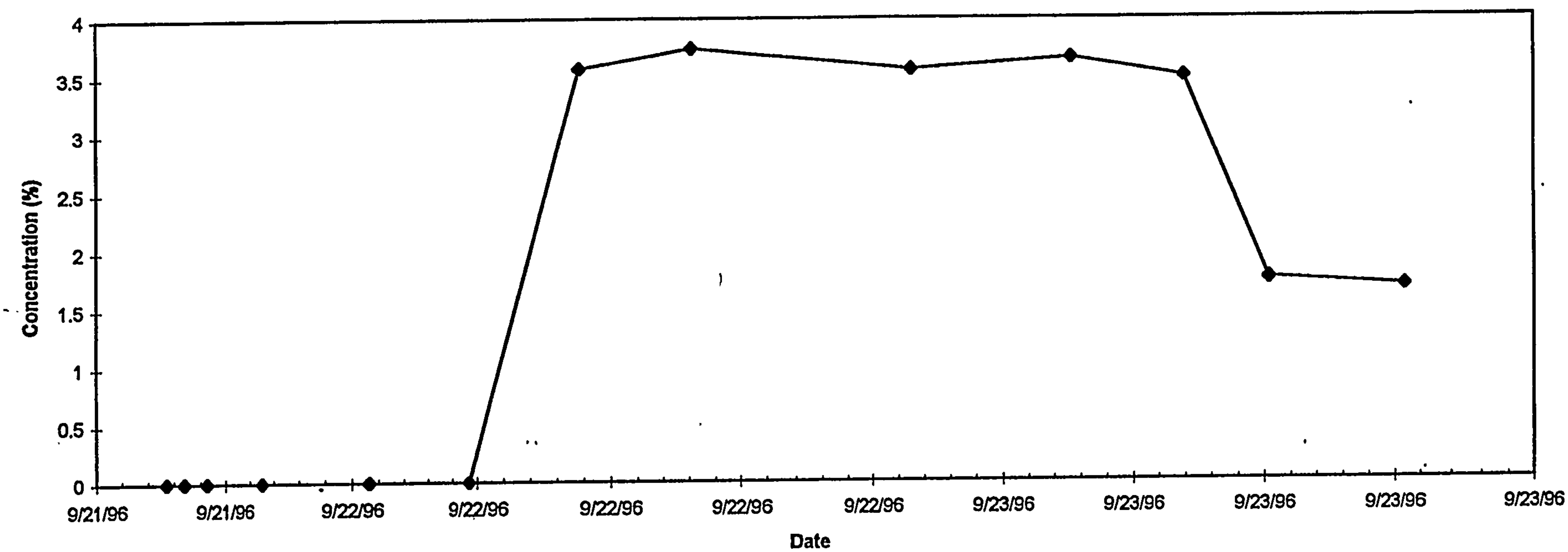
MA-80 at BW2G



A5-13

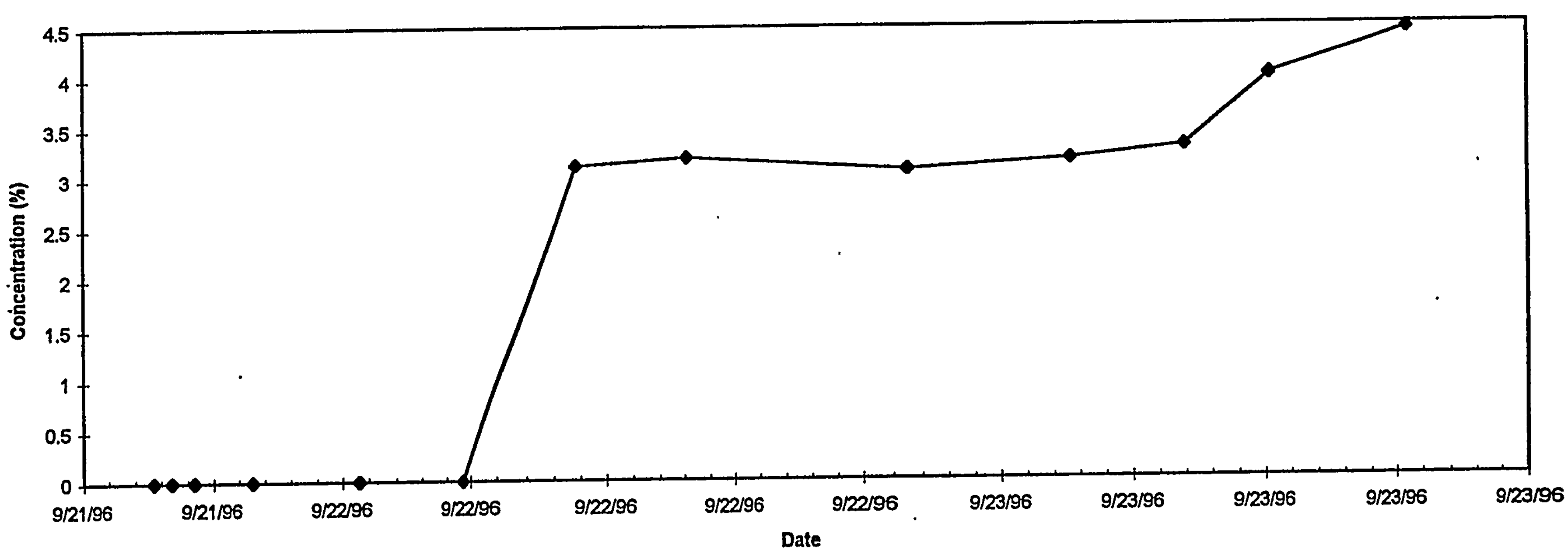

IPA at INT-1
Start
Surfactant
End Surfactant
IPA Concentration (%)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
9/21/96
9/22/96
9/23/96
9/24/96
9/25/96
9/26/96
9/27/96
Date

MA 80 at 66G



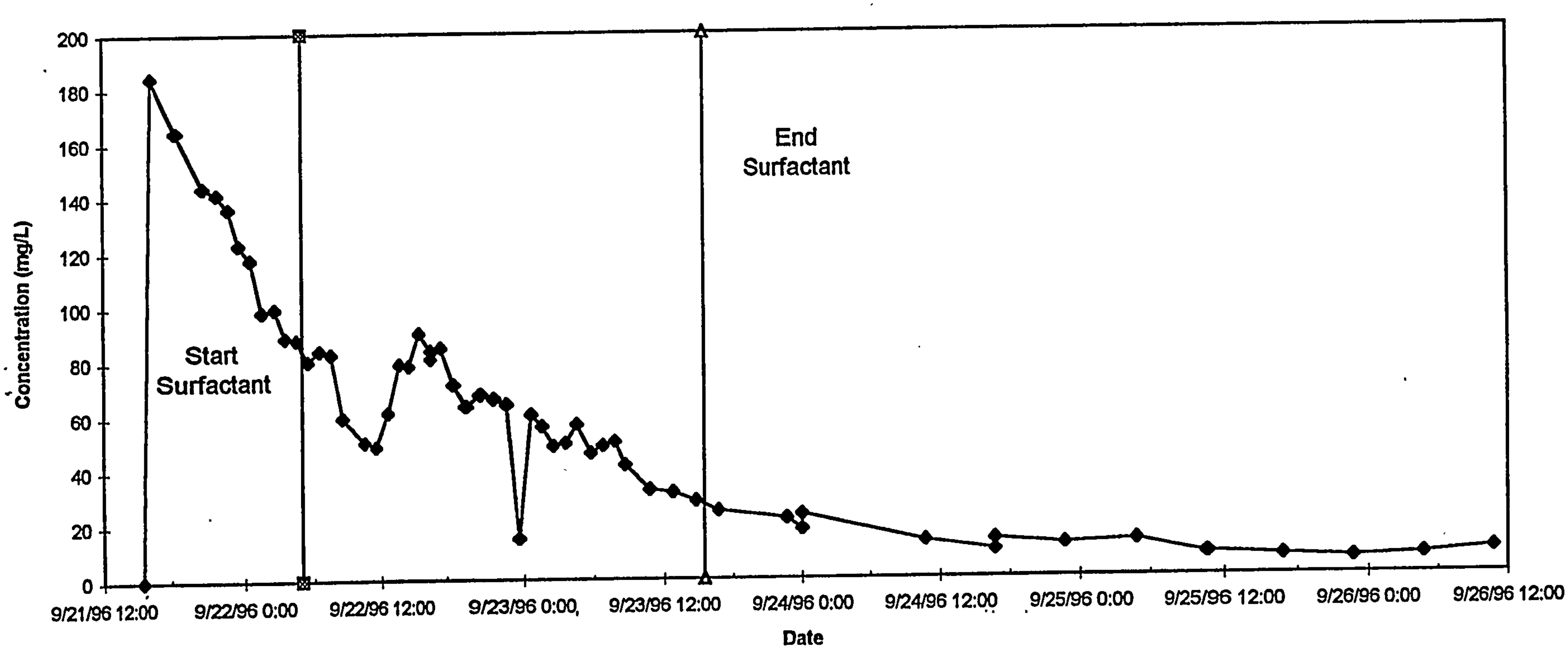
A5-15

Isopropanol at 66G

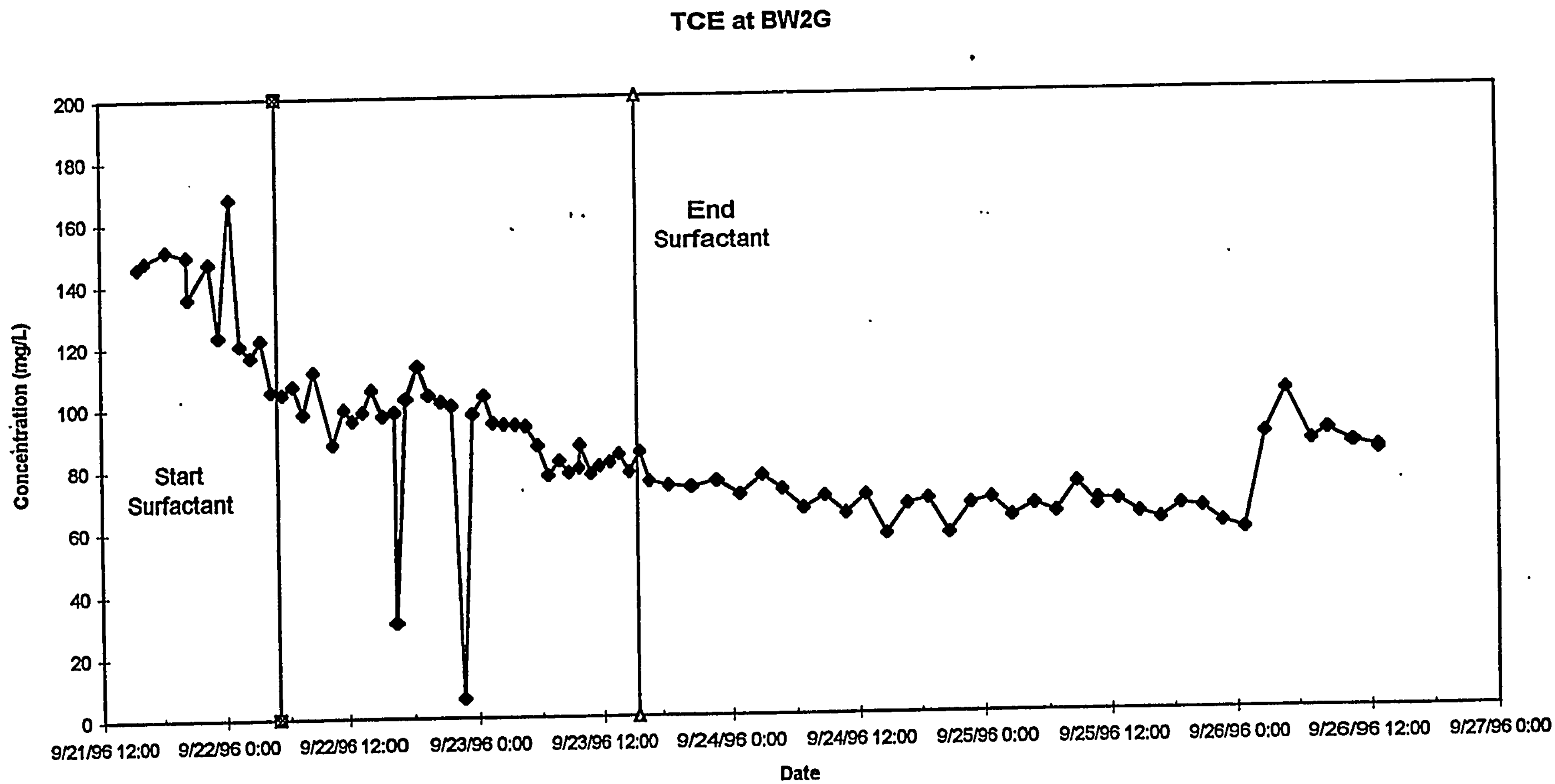


A5-16

TCE at INT-1



A5-17


TCE at BW2G
Concentration (mg/L)
200
180
160
140
120
100
80
60
40
20
0
Start Surfactant
End Surfactant
9/21/96 12:00
9/22/96 0:00
9/22/96 12:00
9/23/96 0:00
9/23/96 12:00
9/24/96 0:00
9/24/96 12:00
9/25/96 0:00
9/25/96 12:00
9/26/96 0:00
9/26/96 12:00
9/27/96 0:00
Date

A5-18

APPENDIX O

Equipment Inventory

Item	Type	Quantity	Units
bolt cutters	steel, 18"	1	unit
boots	rubber, PPE-type, galosh-style, large	3	pairs
buckets	plastic, 3 & 5 gallon	7	units
cover-alls	Tyvek/Saranex, PPE-type, large	26	units
electric power strip	plastic, 6-outlet	3	units
electric cord	extension-type, heavy-duty, 50'	4	units
fence posts	steel, 4'	20	units
gloves	viton, PPE-type, large	4	pairs
hose	rubber, 1"	200	feet
hose	rubber, 3/4"	25	feet
hoses	teflon/stainless steel overbraid, 3/4"x6'	4	units
lights, flood	quartz halogen, 115 volt, on short base	2	units
meters	brass, water flow, turbine-type, 3/4"	3	units
packer	rubber/plastic, 2"x2', with 3/4" port	1	unit
packer	rubber/aluminum, 6"x1.5', with 1.25" port	1	unit
pipe	galvanized, 3/4"	100	feet
pipe	galvanized, 1-1/4"	100	feet
plumbing fittings	galvanized, assorted sizes, in 1.5'x2'x1.5' box	~40	units
pool, decon	plastic, 20-gallon	2	units
pressure regulator	pneumatic, 3/4"	3	units
pump, drum	plastic, manually operated	1	unit
pump power converter	Grundfos Rediflo-2, 115 volts	1	unit
pump, submersible	Grundfos Rediflo-2, stainless steel	1	unit
pump, submersible	Clean Environment stainless pneumatic	1	unit
pump, submersible	Solinst stainless steel, double-valve	4	units
pump, jet	Grundfos JP-7, stainless steel, 3/4 hp.	2	units

Item	Type	Quantity	Units
pump, jet	Water-Ace, carbon steel, 1 hp.	1	unit
reagents	sodium chloride salt	15	kgs
reagents	potassium bromide tracer	2	kgs
reagents	calcium chloride salt	40	kgs
rotameter	Blue & White, F-45500LHKN-3	1	unit
sprayers	plastic, decon-type, 3-gallon capacity	2	units
tarpaulin	nylon, 20'x30'	1	unit
tents	nylon over aluminum frame, 12'x12'x6'h	3	units
tubing	nylon, 1/2"	40	feet
tubing	nylon, 3/4"	40	feet
valves, ball	brass, 3/4"	20	units
well points	stainless steel, 3/4"	3	units
well points	stainless steel, 1-1/4"	4	units