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Site Management Plan

SRSNE Superfund Site
Southington, Connecticut

Prepared For:
SRSNE PRP Group

August 1996

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

PROJECT OPERATIONS PLAN

SOLVENTS RECOVERY SERVICE OF NEW ENGLAND, INC.
SUPERFUND SITE
SOUTHINGTON, CONNECTICUT

AUGUST 1996

Disclaimer

This document has been prepared pursuant to a government administrative order (U.S. EPA Region 1 CERCLA Docket No. 1-96-1036) and has not received final acceptance from the U.S. Environmental Protection Agency. The opinions, findings, and conclusions expressed are those of the authors and not those of the U.S. Environmental Protection Agency.

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Syracuse, New York 13214
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1.0 Introduction

This Site Management Plan (SMP) is part of the Project Operations Plan (POP) for the Remedial Investigation (RI) at the Solvents Recovery Service of New England, Inc. (SRSNE) Superfund Site in Southington, Connecticut (Figure 1). The SMP describes the procedures and methods for the control of access to areas being investigated during the RI, the responsibilities of site personnel, the proposed schedule for the field investigations, and other operational considerations.

2.0 Site Control

2.1 Site Access

The SRSNE Site consists of two primary areas: the "Operations Area" and the "former Cianci Property" (Figure 2). RI field activities described in the RI Work Plan will be conducted within these areas and on adjacent properties. Figure 2 presents a map of the proposed RI study area.

The participating Potentially Responsible Parties (the "PRP Group") for the SRSNE Site or its agents or representatives (e.g., *de maximis, inc.*) will be responsible for obtaining all necessary approvals for the Engineer retained to implement the RI (Blasland, Bouck & Lee, Inc. [BBL]) and its subcontractors to work at the Site and on adjacent properties. Field activities will include the installation of soil borings, bedrock corings, monitoring wells, and test pits; and the collection of soil, bedrock and ground-water samples in the vicinity of the Site. Access to the Operations Area and the former Cianci Property is provided from the north by paved and unpaved driveways off of Lazy Lane, respectively. Both the Operations Area and the former Cianci Property are enclosed by chain-link fencing, which restricts access from all other directions. In addition to these parcels, the RI field activities will be conducted on private and public lands to the east and south, including the Town of Southington Well Field, the Connecticut Light and Power (CL&P) Easement, and properties to the east and west of Queen Street (Connecticut Route 10). Access to these off-site areas will be either through gates in the fencing surrounding the former Cianci Property, or from Queen Street.

Because of the large off-site area covered during the RI field activities, there are no physical means to restrict access to the entire study area. However, legal access will be obtained for BBLs personnel and its subcontractors, as necessary. Other persons who will have access to the study area are representatives of the PRP Group, the United States Environmental Protection Agency (USEPA), and the Connecticut Department of Environmental Protection (CT DEP).

2.2 Site Security and Control

Sampling and health and safety equipment will either be transported to and from the work areas for use during specific field activities or be stored in the treatment plant building on the former Cianci Property. Drilling and test pitting equipment will be parked within the fenced area near the Non-Time-Critical Removal Action No. 1 (NTCRA 1) Ground-Water Treatment Building when not in use.

2.3 Field Office and Command Post

RI operations will be based out of the NTCRA 1 Treatment Building within the former Cianci Property. This building has adequate space for sample storage and handling, and is equipped with office space with telephone, facsimile machine, and sanitary facilities.

2.4 Traffic Control and Parking

Vehicles will be parked in a designated area near the NTCRA 1 Treatment Building. Drill rigs and other essential field vehicles will be the only vehicles allowed in the non-parking areas.

3.0 Project Organization

3.1 General

The proposed project organization and personnel assignments for the RI are shown on Figure 3. The PRP Group has retained *de maximis, inc.* to serve as its Project Coordinator for all RI activities for the SRSNE Site. The PRP Group has also retained BBL to perform the RI field work and prepare the RI Report.

3.2 Project Coordinator

Mr. Bruce Thompson of *de maximis, inc.*, is the designated Project Coordinator. His primary responsibilities include:

- Providing an interface between the USEPA, the PRP Group, and the RI Contractors;
- Oversight, review, and coordination of all required RI submittals; and
- Oversight and coordination of all RI field activities.

3.3 Remedial Investigation Contractor

BBL will perform or subcontract all work associated with the RI for the SRSNE Site. The firm's qualifications and experience, as well as resumes of key project personnel have been provided under separate cover.

3.4 Subcontractors

The following subcontractors will provide specialized services during the performance of the RI:

- **East Coast-Thomas Environmental, Inc.** (Drilling Subcontractor);
- **Galson Laboratories** (Environmental Analysis Laboratory Subcontractor);
- **COLOG, Inc.** (Acoustic Televiewing Subcontractor);
- **Conklin & Soroka, Inc.** (Survey Subcontractor);
- **Core Laboratories, Inc.** (Physical Characterization Laboratory Subcontractor);
- **Microbial Insights, Inc.** (Chemical and Biological Analysis Laboratory Subcontractor); and
- **Microseeps** (Chemical and Biological Analysis Laboratory Subcontractor).

Statements of qualifications and experience for these firms have been provided under seperate cover.

4.0 Project Schedule

The schedule for the RI, Feasibility Study (FS) and Non-Time-Critical Removal Action No. 2 (NTCRA 2) is shown on Figure 4. This schedule will be periodically updated as necessary to reflect actual deliverable approval dates, and progress in the field.

Figures

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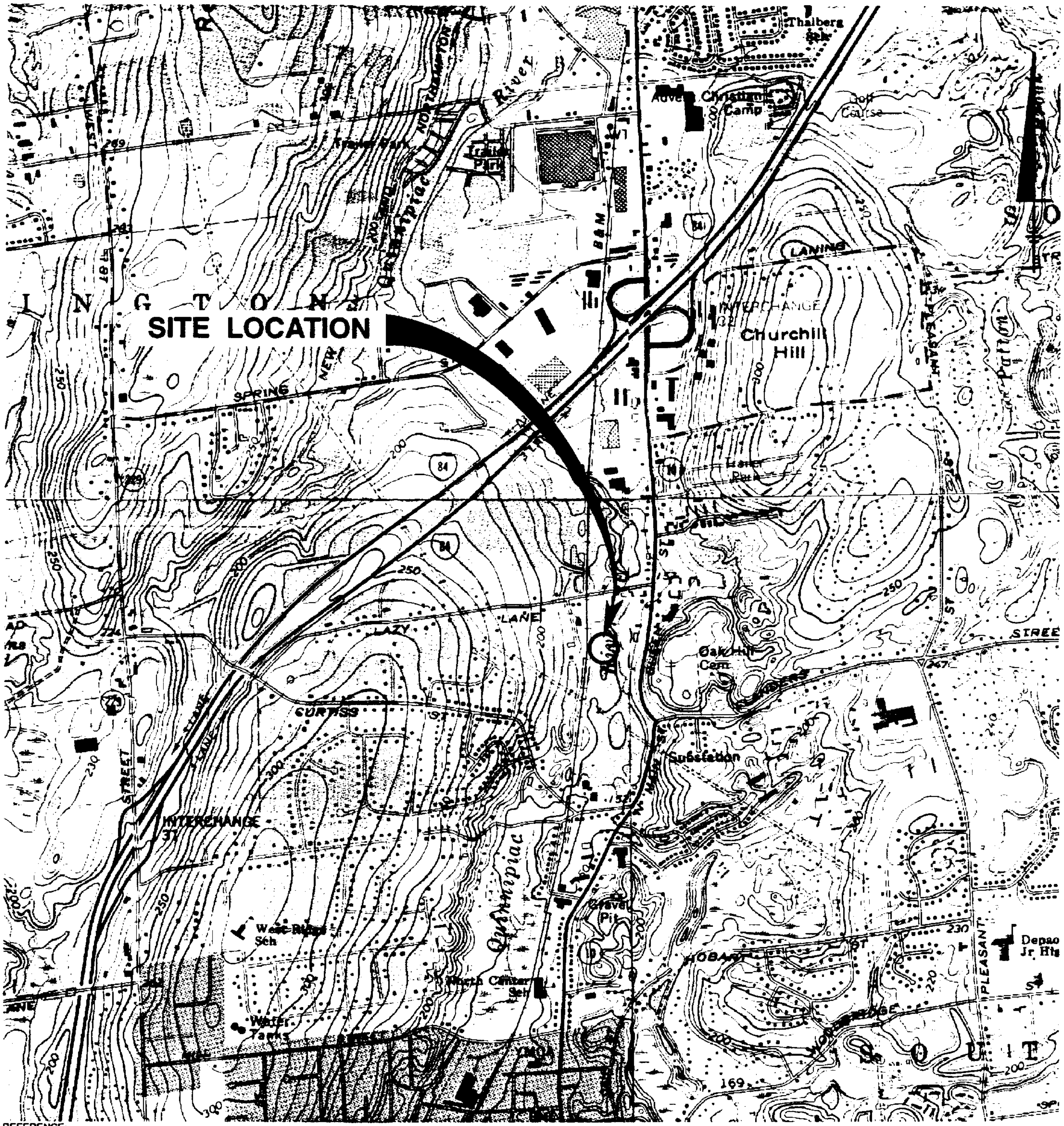

REFERENCE:
SOUTHINGTON, CONN. USGS QUAD. 1968 PR 1992, MERIIDAN, CONN. USGS QUAD. 1966 PR 1984,
NEW BRITIAN, CONN. USGS QUAD. 1966 PR 1984, & BRISTOL, CONN. USGS QUAD 1967 PR 1984

2000' 0 2000'

APPROX. SCALE: 1" = 2000'

QUADRANGLE LOCATION

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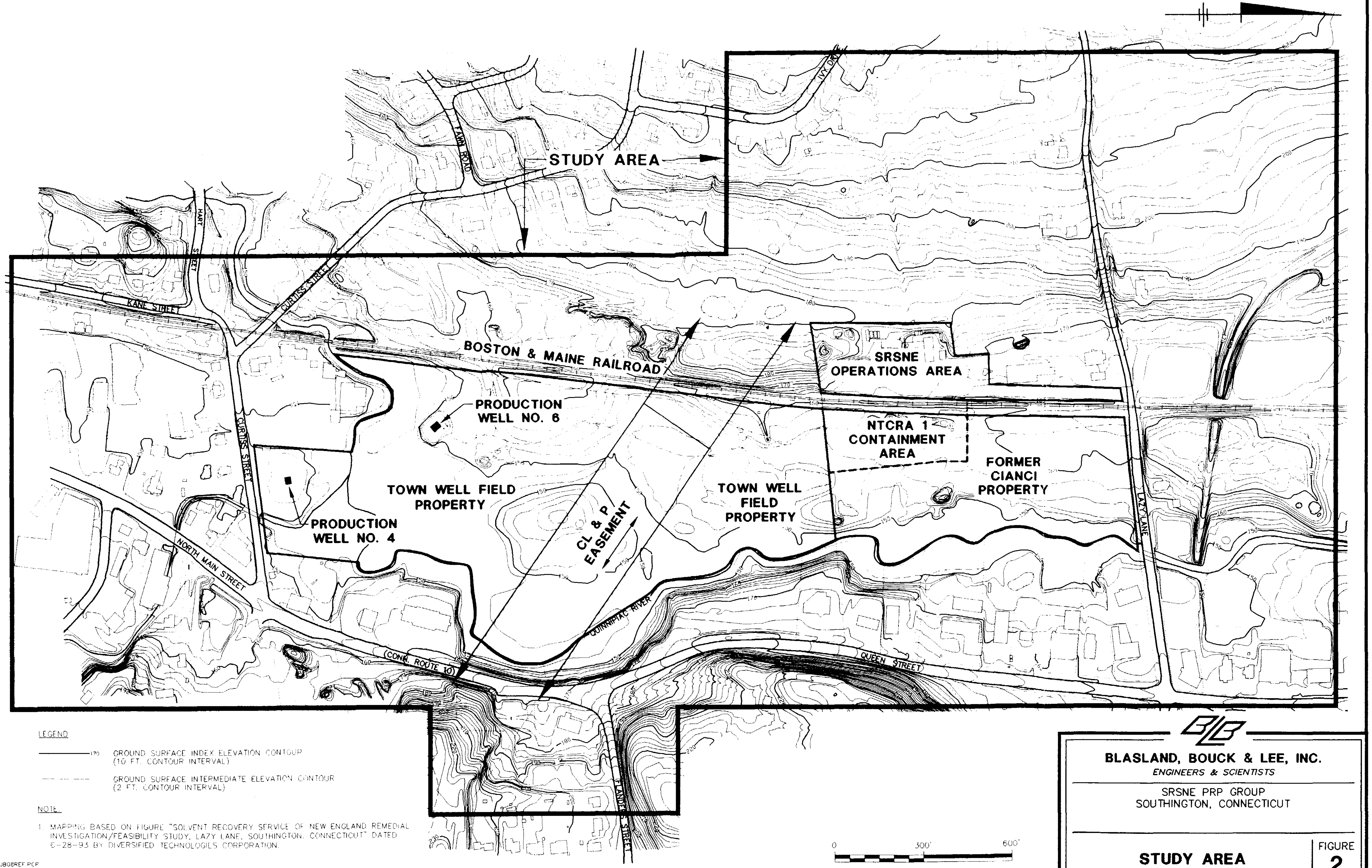
SOUTHINGTON, CONNECTICUT

SITE LOCATION MAP

FIGURE
1

6/96 SYR-D54-JVM
08330001/08330N01.cdr



LEGEND

170 GROUND SURFACE INDEX ELEVATION CONTOUR (10 FT. CONTOUR INTERVAL)

GROUND SURFACE INTERMEDIATE ELEVATION CONTOUR (2 FT. CONTOUR INTERVAL)

NOTE:

1. MAPPING BASED ON FIGURE "SOLVENT RECOVERY SERVICE OF NEW ENGLAND REMEDIAL INVESTIGATION/FEASIBILITY STUDY, LAZY LANE, SOUTHINGTON, CONNECTICUT" DATED 6-28-93 BY DIVERSIFIED TECHNOLOGIES CORPORATION.

DJB08REF.PCP
X:08325X00,08325X[illegible] OFF: REF*.(XREF X01.PIPES)
11/9/95 54-RLP, DMW,
08330002/08325SM2.DWG

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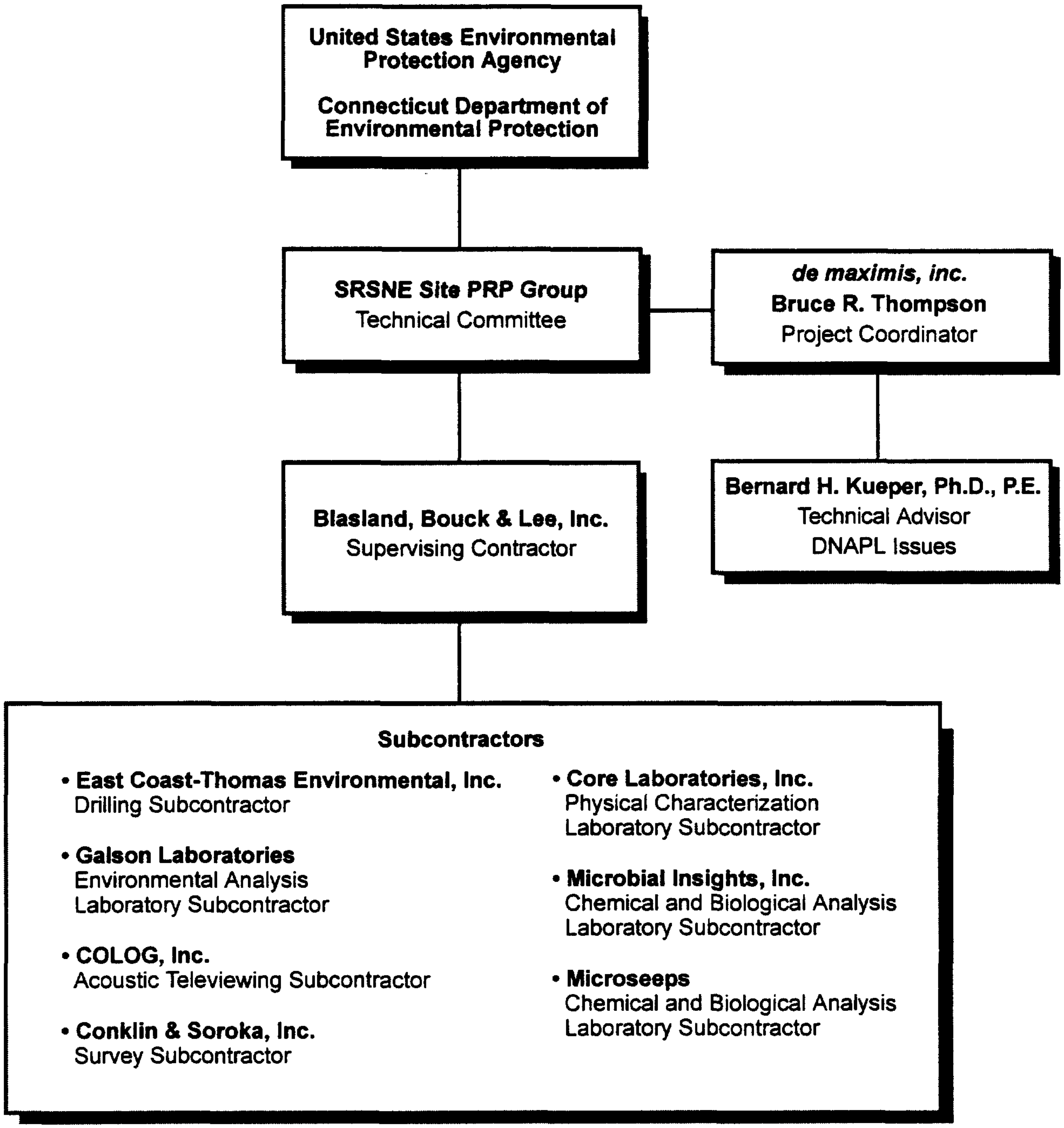
SOUTHINGTON, CONNECTICUT

STUDY AREA

FIGURE
2



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PROJECT ORGANIZATION CHART

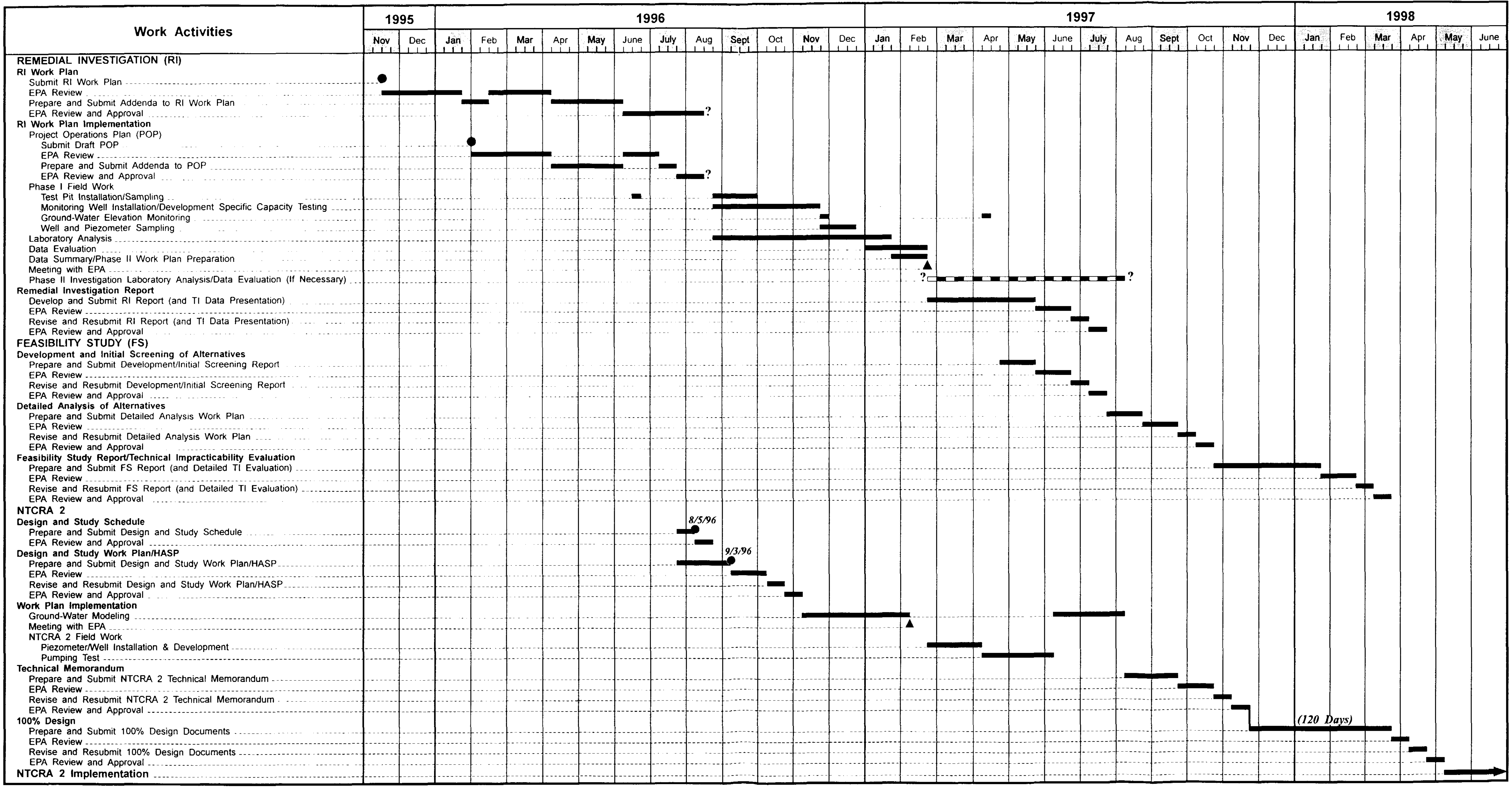
FIGURE 3

6/96 SYR-D54-JVM
08330001/08330F01.cdr

FIGURE 4

Project Schedule

SRSNE Site
Southington, Connecticut



NOTES:

1) This schedule is based on Administrative Order on Consent effective date of July 20, 1996.
2) This schedule will be revised, if necessary, based on actual review and approval times required by EPA.

07/96 SYR-D54-DJH
08330002/08330J04.CDR

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Appendices

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Appendix A:

Addenda to RI Work Plan (BBL, November 1995) and Project Operations Plan (BBL, January 1996)

BBL

Transmitted Via Facsimile/U.S. Mail

February 13, 1996

Ms. Sheila Eckman
United States Environmental Protection Agency
90 Canal Street
Boston, MA 02114

Re: SRSNE Site
RI Work Plan Addendum
Project #: 1041.08330 #2

Dear Ms. Eckman:

This letter serves as an Addendum to the Remedial Investigation (RI) Work Plan for the Solvents Recovery Service of New England (SRSNE) Site in Southington, Connecticut. The purpose for this Addendum is to present responses to comments on the RI Work Plan offered by the Halliburton NUS Corporation (HNUS), the Connecticut Department of Environmental Protection (CT DEP), and the United States Department of Environmental Conservation (USEPA). The RI Work Plan (BBL, November 1995) and this Addendum were prepared on behalf of the SRSNE Potentially Responsible Party (PRP) Group by Blasland, Bouck & Lee, Inc., with technical contribution from Professor Bernard H. Kueper of Queens University.

The comments addressed in this Addendum were presented to the SRSNE PRP Group in a productive meeting at USEPA offices in Boston, Massachusetts on January 24, 1996, and included:

- Written comments prepared on behalf of USEPA by HNUS (letter to USEPA dated December 15, 1995);
- Written comments presented by CT DEP (letter to USEPA dated January 23, 1996); and
- Verbal comments presented by USEPA during the January 24, 1996, meeting in Boston.

Responses to these three groups of comments, prepared by BBL and Dr. Kueper, are presented below.

Responses to: HNUS Corporation, Review of Remedial Investigation Work Plan (November 1995), Prepared by SRSNE PRP Group, W.A. No. 01-1L08, December 15, 1995 (Attachment 1)

Comments prepared by HNUS Corporation regarding the RI Work Plan, which were presented in a letter to USEPA dated December 15, 1995, are included as Attachment 1 to this RI Work Plan Addendum. Responses to the General and Specific Comments by HNUS are provided below.

<u>General Comments</u>

1. No response required.

2. Agreed. A Feasibility Study (FS) Work Plan will be prepared to define the scope of the forthcoming FS.

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3. Hollow-stem augers were used successfully to install the NTCRA 1 piezometers and were proposed as a preferred drilling method during the RI for the following reasons, some of which are noted in USEPA guidance on ground-water monitoring (EPA/625/6-90/016b, July 1991): 1) Relatively low cost; 2) High productivity; 3) No drilling fluids required; and 4) Flexibility for sampling, bedrock coring, or well construction through the augers. While small amounts of dissolved phase constituents may migrate along the outside of the augers prior to the completion of the borehole, the pathway (if any) along the outside of the augers will be open for only a brief period during soil boring and monitoring well construction activities. Thus, the quantity of ground-water flow along the borehole would be limited, and will be quickly dispersed by ground-water flow following the completion and sealing of the borehole (with or without a monitoring well). Based on these considerations and the successful use of hollow-stem augers during NTCRA 1, augers should remain on the list of viable drilling alternatives in the overburden.

   If an alternative overburden drilling approach is determined to be necessary based on field conditions (e.g., persistent running sands, pervasive boulders), the alternative method must ensure that split-spoon samples can be taken to allow execution of the DNAPL Contingency Plan within the Potential NAPL Zone. The DNAPL Contingency Plan was presented in the Field Sampling Plan (FSP) (BBL, January 1996) to identify pooled DNAPL and, if present, prevent it from being carried downward during drilling with hollow stem augers.

   Hollow-stem augers allow flexibility to convert to a different drilling method, if required, based on field conditions. For example, in the event that a boulder is encountered, it can be reamed through the augers using a rotary drilling technique to allow the augers to be advanced further. BBL has used this approach successfully at another site, and we anticipate that it would be effective at the SRSNE Site.

Specific Comments

1. Agreed. The ground-water elevation data measured during the RI will be used to develop cross-sectional (profile) flow nets to evaluate ground-water flow between the overburden and bedrock in the vicinity of the site and the Town Well Field. While the identification of till windows is subjective, measured hydraulic head data will provide a technical basis for interpreting zones of ground-water flow from the bedrock to the overburden or vice versa. Ground-water quality data will be plotted on the flow nets to help clarify the presence of VOCs in the Town Well Field. In brief, the RI will better define the bedrock flow field and better define contaminant distribution and velocities in bedrock and overburden.

2. HNUS correctly states that one or more "till windows" may have provided a pathway for the migration of DNAPL from overburden into bedrock in the vicinity of well TW-7B. However, the location, hydraulic significance, and basis to positively identify till windows are not well understood. Because of the textural similarity between the till and the overlying materials, it will not be possible to find and positively identify all till windows. While the number and specific locations of till windows will not be specifically investigated during the RI, the additional geologic data obtained during the RI will be evaluated with respect to the till thickness and locations of till windows.

3. Agreed.

4. Agreed

5. Agreed. The use of borehole acoustic televiewer will allow in-situ measurement of fracture orientation, fracture spacing, and estimates of fracture aperture. In addition, the fracture spacing data obtained from core samples and straddle packer permeability testing results will yield estimates of fracture aperture. While the bedrock investigation will focus primarily on fractures rather than stratigraphic bedding, the bedding orientation will be identified in bedrock core samples based on a comparison with the acoustic televiewer results. Bedding orientations can also be inferred based on published geologic reports and observations of bedrock outcrops.

6. Agreed. Three bedrock matrix samples will be obtained from corehole RC-701 for analysis of volatile organic compound (VOCs). The intent of these samples is to semiquantitatively evaluate whether VOCs have diffused into the bedrock matrix at the site. These data will also be used to support diffusion modeling, which will be performed to estimate the impact of matrix diffusion on the feasibility of bedrock ground-water restoration. The analytical VOC results from these samples will be evaluated to determine whether additional bedrock matrix sampling is appropriate.

7. HNUS correctly states that more VOCs may seasonally enter the saturated zone from the unsaturated zone due to water-table fluctuation, but this contribution is likely very small relative to the mass of VOCs already present below the water table during the seasonal low water table condition. Furthermore, if the water-table fluctuation zone were remediated, the rising and falling of the water table would re-contaminate the water-table fluctuation zone. Thus, the main focus of the vadose zone leaching evaluation during the RI will be to perform a quantitative VOC mass-balance analysis to assess whether remediating the shallow vadose zone soils above the water-table fluctuation zone would improve the feasibility of ground-water restoration at the site.

8. Agreed

9. Agreed. Free-phase NAPLs will be removed when encountered. However, depending on the total volume of NAPL in the saturated zone and the three-dimensional distribution of the NAPL, removal of small quantities of NAPL may not significantly reduce the time that hydraulic containment and treatment would need to be applied.

10. Agreed. Anomalous detections below regulatory standards within areas that are generally above regulatory standards will be used to evaluate site hydrogeology and potential release history. However, low concentrations which can be tracked systematically outward from high concentration areas (i.e., a decreasing concentration gradient) will be interpreted as the result of dispersion within the ground-water flow regime, and will not be tracked beyond the clean-up standards.

11. Agreed. Ground-water elevation data obtained during the RI will be used to develop a comprehensive understanding of the three-dimensional flow net within the RI study area. Given that ground-water flow paths may cross between the overburden and bedrock or vice versa, solute travel distances will be calculated *along three-dimensional ground-water flow paths*.

12. Agreed.

13. Agreed. Monitoring wells showing concentrations below regulatory criteria will be relied upon to identify "clean" portions of the site. The analytical method used for ground-water samples in "clean" areas (CLP-RAS, 10/92, low concentrations in water) will be commensurate with the specified action levels.

14. Bedrock characteristics will be evaluated at several locations during the installation of deep bedrock monitoring wells. Borehole acoustic televiewing will be used primarily to provide a comparison with bedrock core descriptions, which will be generally relied on to assess fracture spacing and dip angle. To limit the cost of acoustic televiewing (typically $5,000 to $8,000 for one day of data collection), deep bedrock drilling activities will be coordinated to allow acoustic televiewing at more than one borehole within one mobilization of the televiewing subcontractor, if possible. While acoustic televiewing will provide valuable information regarding in-situ fracture orientation, spacing, and estimates of aperture, straddle packer testing and core logging on the same boreholes will provide an additional measure of the fracture apertures.

15. Bentonite will be used rather than neat cement grout to seal the annulus between the monitoring well riser and borehole during installation of new monitoring wells during the RI.

16. We expect that USEPA will evaluate the definition of the zone of technical impracticability (TI zone), which the RI Work Plan describes as including the probable and potential NAPL Zones. The potential NAPL zone should be included in the TI zone if the SRSNE PRP group is to commit to cleaning up ground water outside of the TI zone. The presence of even a few pools of NAPL outside of the TI zone would keep ground water downstream of the TI zone out of regulatory compliance for several decades or longer. A larger TI zone (and potential NAPL zone) will increase the probability of cleaning up ground water outside of the TI zone.

Responses to: CT DEP, Comments Regarding Remedial Investigation Work Plan Dated November 1995 (Attachment 2)

Comments prepared by CT DEP regarding the RI Work Plan were presented in a letter to USEPA dated January 23, 1996, and are included as Attachment 2 to this RI Work Plan Addendum. Responses to the General and Specific Comments by CT DEP are provided below.

General Comments

CTDEP states that accurate definition of the NAPL zone is an issue of fundamental importance to the State. Accurate definition of the NAPL zone clearly is desirable to the SRSNE PRP Group, because the NAPL zone dimensions will strongly influence the design of the NTCRA 2 ground-water containment system and the final remedy for the site. No investigative techniques exist, however, which allow "accurate definition" of a NAPL zone. While NAPL has been positively identified at several locations at the SRSNE Site, the geometry of the NAPL zone will need to be inferred based on indirect data. The approach outlined in the RI Work Plan is to define a *potential NAPL zone* outside of the *probable NAPL zone* due to the inherent uncertainty in locating NAPL in the subsurface. This approach is much more responsible and technically defensible than simply defining a single "NAPL zone."

CTDEP correctly points out that it is not clear whether we will be using 1% of the effective solubility or 100% effective solubility when interpreting the calculated pore-water VOC concentrations in soil samples. We will be using 1% of the effective solubility to infer the upstream presence of NAPL, and 100% effective solubility to infer the presence of NAPL in the actual soil sample in question.

CTDEP states that it is unclear whether we will be using the 1% and 100% effective solubility criteria in unsaturated soil samples as well as in saturated samples. These criteria will also be applied to unsaturated samples.

CTDEP states that "... where NAPL is present in the unsaturated zone, it can and should be remediated." We agree that freely flowing NAPL will be removed from the unsaturated zone when encountered. Any residual NAPL, or sorbed and dissolved chemical constituents within the lower portion of the unsaturated zone should not be remediated, however, until the saturated zone is remediated. Otherwise, fluctuations of the water table and upward diffusion will re-contaminate the unsaturated zone. This point is particularly relevant at the SRSNE Site because the unsaturated zone is generally very thin. Conversely, at sites where the unsaturated zone is very large, it may make sense to remediate the upper portions which are above water table fluctuation zone and diffusion distances. However, in these cases, unsaturated soil remediation would be warranted only if the shallow soil poses a risk or contains sufficient concentrations of constituents to impact ground-water quality via infiltration and leaching.

CTDEP agrees with the concept of a potential NAPL zone, but would like more details as to how it was arrived at. The preliminary estimate of the potential NAPL zone, presented in the RI Work Plan, was drawn based on an evaluation of the thickness of the overburden deposits in conjunction with the likely degree of lateral spreading that the NAPL may have undergone. This evaluation was based on the available information regarding the degree of soil heterogeneity at the site. The preliminary estimates of the probable and potential NAPL zones will be re-evaluated during the RI based on receipt of additional site information. If the RI field activities reveal that numerous, laterally extensive low permeability horizons exist in the overburden, however, then the potential NAPL zone should be expanded. DNAPL tends to migrate sideways as it migrates downwards, provided that appropriate bedding structure is present. A thicker overburden deposit will provide more opportunities for lateral spreading than a thin overburden deposit.

As pointed out by BBL during the January 24, 1996, meeting in Boston, the detection of DNAPL at well MWD-601 provides an empirical demonstration of the minimum distance that the potential NAPL zone should be situated outside of the probable NAPL zone. Prior to the installation of MWD-601, the probable NAPL zone would not have included this well location, and the potential NAPL zone would have been drawn near this location. Based on the presence of DNAPL at well MWD-601, the probable NAPL zone boundary has shifted north to a location beyond well MWD-601, and the potential NAPL zone boundary has also shifted to the north. The distance of the shift indicates the degree of uncertainty in delineating the NAPL zone, and provides a measure of the appropriate "buffer zone" between the probable and potential NAPL zone boundaries. This distance should be considered a minimum, however, since it would be unreasonable to assume that DNAPL has not migrated beyond MWD-601. In other words, it is unlikely that MWD-601 encountered the very leading edge of that particular DNAPL pool. While this type of analysis may help to define the potential NAPL zone, the criteria for defining the potential NAPL zone will not be as straight forward as those used to define the probable NAPL zone. A certain degree of experience and engineering judgment will need to be employed. The criteria used to estimate the potential NAPL zone during the RI will be articulated in the RI report.

CTDEP points out that two-dimensional numerical modeling of matrix diffusion, while useful in delineating the zone of TI outside of the NAPL zones, may not be adequate for defining TI in bedrock. A three-dimensional version of the proposed model is available to the group, which would reduce the uncertainty associated with the two-dimensional model. Whether or not a pilot test needs to be run to demonstrate the time scales associated with remediating ground water in bedrock will be evaluated following the Phase 1 field work and matrix diffusion modeling.

Specific Comments

Page 42 - Probable and Potential NAPL Zone Boundaries: See earlier response to general comments.

Page 48 - Probable and Potential NAPL Zone Boundaries: See earlier response to general comments.

Page 48 - Exposure Based Risk: The RI will include an evaluation of the ground-water quality and hydraulic gradients in the vicinity of the SRSNE Site and the Maiellaro Property to evaluate whether the SRSNE plume may affect the Maiellaro well(s). If appropriate, the capture zone(s) of the Maiellaro supply well(s) can be estimated as part of the RI to account for the hydraulic influence of the well(s) on the SRSNE plume.

Page 59 - Saturated Bedrock: The sentence fragment should be deleted. As stated on Page 68, redox characteristics will be obtained for ground-water samples from wells installed in the off-site plume area to evaluate the feasibility of potential remedial alternatives, including permeable reaction walls.

Page 61: See earlier response to general comments.

Page 62: Agreed, free-phase LNAPL will be removed when encountered.

Page 63 - Free-Phase NAPL Extent: See earlier response to general comments.

Section 5.2 Task 1 - Project Planning, Page 70: No response required.

Section 5.4.1 Test Pit Installation, Page 72: The permeability testing to be carried out in the test pits on small-scale samples will be performed to provide a measure of the degree of heterogeneity within the overburden at a small scale. It is not essential that the absolute values of permeability be determined with great accuracy. Of more interest is the difference in permeability between the various samples collected (i.e., the variance). The variance of the small-scale permeability distribution should not be significantly influenced by sample disturbance. Since the primary purpose of the small-scale permeability testing is to determine the sample variance, it is recommended that the procedures outlined in the draft RIWP be retained. The CT DEP correctly states that the soil density can be used as a guide. Based on our discussions with a geotechnical testing laboratory, the soil samples can be re-packed in the laboratory to match a field bulk density value to improve the accuracy of permeability testing. We would anticipate that the re-packed bulk density values would be specified based on measured soil bulk density data from the site.

Section 5.4.2.1 Soil Sampling, Page 73: As described in the FSP (BBL, January 1996), relatively undisturbed soil samples will be obtained using internal liner sleeves within the split spoon sampler for characterization of soil porosity.

Section 5.4.3 Bedrock Drilling and Characterization: The DNAPL Contingency Plan presented in the FSP describes procedures that will be followed to evaluate whether DNAPL is present within the overburden at a given drilling location during advancement of the borehole. This is the same plan formerly used during NTCRA 1 drilling activities. If DNAPL is encountered in the overburden at the RC-701 location, the borehole will not be advanced into the bedrock. In this event the RC-701 borehole will be moved to an alternate, nearby location. If free-phase DNAPL is not interpreted as present, bedrock drilling can proceed. An additional casing, spun and seated into the top or bedrock, will be used as an added precaution against DNAPL mobilization during RC-701 bedrock coring, because of the proximity of RC-701 to the probable overburden NAPL Zone. Because the

DNAPL Contingency Plan will be used to "clear" the drilling location with respect to DNAPL, this precaution is sufficient without the use of grouting.

Section 5.4.4 Monitoring Well Installation, Page 78: The use of an additional, grouted casing is not considered necessary for the installation of bedrock monitoring wells. The majority of the proposed bedrock monitoring wells will be installed in off-site areas where the concentrations of dissolved constituents are expected to be very low, likely near the detections limit. The concern regarding ground-water migration between the overburden and bedrock formations, therefore, is not warranted. Furthermore, the exchange of ground-water between the overburden and bedrock at the base of the augers and the top of bedrock will be negligible during the limited time interval between the completion of bedrock drilling and the completion of monitoring well installation. Throughout the process of bedrock drilling, the recirculation water used to remove the bedrock cuttings will maintain a positive head at the borehole. Thus the hydraulic gradient will be away from the borehole, and will minimize "short-circuiting" of ambient ground water at the borehole. As a precaution against DNAPL mobilization, the DNAPL Contingency Plan will be followed at each drilling location within the potential NAPL zone.

Section 5.4.7 Ground-Water Elevation Monitoring, Page 82: Long-term ground-water elevation monitoring is proposed as supplemental data acquisition from which to assess the hydraulic connection between the shallow and deep bedrock. Based on the shallow bedrock hydrographs obtained as part of Private Well Monitoring performed during NTCRA 1 (BBL, October 1995), shallow bedrock wells can respond rapidly following precipitation events. By obtaining detailed hydrograph data at paired deep and shallow bedrock wells during a time interval that includes one or more precipitation events, sufficient data can be obtained to evaluate whether the deep bedrock responds similarly to the shallow bedrock. We anticipate that the transducers will be left in place until at least one precipitation event has occurred and the data have been reviewed. However, the NTCRA 2 design investigation will also include a bedrock pumping test to quantify the hydraulic coefficients of the bedrock and assess the degree of connection between the deep and shallow bedrock in support of the NTCRA 2 design.

Page 83 - Preliminary Data Evaluation: The 40 year travel distance will provide only one of several criteria (e.g., empirical ground-water concentrations at monitoring wells, hydraulic gradients, etc.) that will be used to identify the extent of the off-site VOC plume. Solute travel times will be used as a guide to help define the possible extent of the dissolved phase plume. Following the preliminary evaluation of the ground-water quality and hydrogeologic data from the site, an Interim Monitoring and Sampling Plan will be developed to periodically monitor ground-water concentrations near the edges of the interpreted off-site plume through the remainder of the RI/FS process and up to the finalization of the Record of Decision (ROD) for the site.

Page 89 - Definition of the Zone of Technical Impracticability: Agreed.

Tables 1, 2, and 3 - ARARs: The additional ARARs presented as Attachment 1 of the comment letter prepared by CT DEP will be included among the ARARs for the RI/FS and NTCRA 2.

Responses to USEPA Verbal Comments and Supplemental Documents

At the January 24, 1996, meeting in Boston, USEPA offered additional verbal comments regarding the RI Work Plan, and provided supplemental documents regarding alternative sampling and investigative methods. Responses to the additional verbal comments and the additional documents are provided below.

Bedrock Characterization Methods

At the January 24, 1996, meeting in Boston, the following bedrock characterization methods were discussed:

- borehole T.V.;
- borehole acoustic televiewer;
- borehole vertical flowmeter;
- borehole dilution testing;
- straddle packer testing; and
- straddle packer ground-water sampling.

While each of these methods is capable of providing information regarding bedrock fracture and hydraulic characteristics, the investigative techniques proposed in the RI Work Plan are well-suited to meet the objectives of bedrock characterization, which include: identify appropriate screened intervals for new bedrock monitoring wells during the RI; allow bedrock ground-water sampling and head measurements during the RI; obtain hydraulic, solute-transport, and diffusion parameters in support of TI evaluation; and assist the NTCRA 2 design for bedrock ground-water containment. As specified in the Work Plan, the specific parameters requiring characterization during the RI include:

- fracture spacing;
- fracture orientation;
- fracture aperture;
- bulk hydraulic conductivity;
- matrix porosity, bulk density, and fraction organic carbon;
- hydraulic head distribution; and
- contaminant distribution.

These parameters can be best evaluated using the investigative methods discussed in the RI Work Plan. Acoustic televiewing is likely the best method for determining fracture spacing, and orientation, and provide an estimate of fracture aperture. Fracture apertures can also be calculated based on the hydraulic conductivity of a section of a bedrock corehole and the number of fractures that intersect the same section of bedrock corehole. The hydraulic conductivity of discrete sections of bedrock will be measured by performing straddle packer testing within coreholes. The packer test results will identify the more permeable sections of bedrock, which in addition of core examination, will be used to identify appropriate bedrock intervals for installing monitoring well screens. Bulk hydraulic conductivity will be also be quantified based on specific capacity tests during the RI and by a pumping test as part of the NTCRA 2 design investigation. The matrix parameters will need to be determined by laboratory analysis of retrieved samples of bedrock core. The hydraulic head distribution is best determined from completed piezometers. The contaminant distribution is best determined based on analysis of ground-water samples from completed monitoring wells. Some information could be obtained from sampling of isolated sections of borehole between straddle packers. Most of the deep bedrock coreholes, however, will be installed in off-site areas where the existing concentrations are expected to be very low. Even where the ambient bedrock ground-water concentrations are detectible, dilution by drilling water would likely render such data ambiguous.

Thus, the proposed investigation methodologies are believed to be sufficient to provide the necessary information to meet the data needs for the RI/FS, NTCRA 2, and TI evaluation.

Delineation of Bedrock TI Zone on the Basis of Matrix Diffusion Modeling

At the January 24, 1996, meeting Mr. Peter Feldman (USEPA) inquired (via teleconference) about the role that bedrock matrix diffusion will have in the TI evaluation for bedrock ground water. Matrix diffusion will be the dominant process controlling the time required for ground-water pumping to remediate bedrock. As described in the RI Work Plan, the rate that constituents in the bedrock matrix will diffuse back out of the matrix will be dependent upon a number of factors, including: 1) matrix porosity; 2) initial concentrations in the matrix and the adjacent fractures; 3) matrix fraction of organic carbon; 4) fracture spacing; and 5) fracture aperture. The time required for contaminants to diffuse out of the matrix can best be estimated through the use of numerical modeling. Because the factors that control diffusion rates differ throughout the bedrock, particularly the constituent concentrations, certain portions of the bedrock plume will require more time to reach clean-up standards than other portions of bedrock. Thus, while ground-water restoration may be feasible in certain areas of the bedrock, ground-water restoration may not be feasible in other areas, depending on the time frame estimated to achieved restoration via ground-water flushing. A fundamental question will arise out of this. What time period will be the basis for defining the bedrock TI zone? This is not clear at present. It should be noted, however, that the placement of the TI zone containment system(s) may be dictated by other factors in addition to bedrock clean-up times. The TI zone placement in bedrock may be influenced by where the majority of mass flux leaving the bedrock aquifer enters the overburden flow system, or by where in overburden it may be most economical to intercept the ground water discharging from bedrock.

Low Flow Ground-Water Purging and Sampling

At the meeting in Boston on January 24, 1996, USEPA suggested that low flow (minimum stress) purging and sampling procedures be used to collect ground-water samples from monitoring wells during the RI. USEPA also presented a draft document describing the low flow procedure (See Attachment 3 to this Addendum). The low flow procedure entails lowering a positive displacement pump to the midpoint of the screened interval of the well, purging the well at low flow rate (approximately 0.1 to 0.2 L/min, or 0.028 to 0.055 gpm) until field parameters stabilize, and sampling the discharge from the pump during low flow pumping. The draft procedure indicates that the drawdown inside the well should be limited to 0.3 feet of drawdown or less throughout the purging and sampling process. Based on the hydraulic conductivity of the overburden and bedrock formations and well hydraulics principles, the pumping rate associated with a 0.3-foot drawdown would be between 0.12 L/min (0.032 gpm) and 0.024 L/min (0.0066 gpm) at the monitoring wells at the SRSNE site. Given these pumping rate limitations, the considerable depths (up to 200 feet) of the existing bedrock wells and proposed deep bedrock wells, and the large number of wells/piezometers to be sampled during the RI (approximately 165), low flow purging and sampling may not be practical or necessary for use at all wells during the RI. Traditional purging and sampling methods (FSP; BBL, January 1996) are recommended during the RI so that the ground-water analytical results obtained during the RI can be directly compared to historical data from previous investigations at the site, to assess changes in ground-water concentrations (e.g., plume spreading versus attenuation). However, to provide a comparison between low-flow sampling results and the ground-water quality data obtained using traditional methods, the following six wells will be sampled in accordance with both methods:

- Operations Area, Overburden: P-4B;
- Operations Area, Bedrock: P-4A;
- Former Cianci Property, Overburden: P-5B;
- Former Cianci Property, Bedrock: P-5A;
- Town Well Field, Overburden: MW-704S (Proposed); and
- Town Well Field, Bedrock: MW-704R (Proposed).

The analytical results obtained using both sampling procedures at these wells will provide a basis to assess whether low flow sampling results differ significantly from results obtained using traditional sampling methods. If the low flow sampling results are found to differ significantly, then a decision will be made whether low flow purging and sampling procedures would be appropriate for Interim Monitoring and Sampling, as discussed in the RI Work Plan.

United States Geological Survey Report (95-4121) - Azimuthal Seismic Refraction

USEPA provided this document regarding azimuthal seismic refraction, suggesting that this method may be appropriate for the SRSNE Site RI. This geophysical method is based on recording refracted waves of seismic energy originating from a point source at ground surface. The method assumes that the subsurface has a simple, layered structure, and that fractures are dipping and intersect the bedrock surface. In the case of low-angle fractures or multiple fracture sets, the results are ambiguous and a "uniqueness" problem exists. Variations in thickness of the overburden material and heterogeneity of overburden material also lead to ambiguous results. Single fractures and isolated fracture zones cannot be detected. Given the above, it is unlikely that the use of this method will yield better information for characterizing the bedrock than borehole acoustic televiewing, core sampling, packer testing, and bedrock pumping test performance.

The report also describes azimuthal direct-current square array resistivity. This method assumes that variations in azimuthal resistivity measured at ground surface are related to sets of similarly oriented, steeply dipping fractures. Fracture sets which are not steeply dipping cannot be resolved. Because of the heterogeneous nature of overburden at the SRSNE site, and the fact that there are likely bedding-plane fractures that are not steeply dipping, it is unlikely that this method will yield better results than the methods proposed in the RI Work Plan.

We trust that these responses meet your needs. Please do not hesitate to call Mr. Bruce Thompson, de maximis, inc., at (203) 693-4143 with any questions you may have regarding these responses or the forthcoming RI.

Sincerely,

BLASLAND, BOUCK & LEE, INC.

Gary R. Cameron

Gary R. Cameron
Vice President

GRC/dmd
3396359.C

cc: Mr. Mark Lewis, CT DEP
SRSNE Technical Committee
Mr. Robert Kirsch, Hale & Dorr
Mr. Bruce Thompson, de maximis, inc.
Mr. Edward R. Lynch, P.E., Blasland Bouck & Lee, Inc.
Mr. Michael J. Gefell, P.G., Blasland Bouck & Lee, Inc.

ATTACHMENT 1

Halliburton NUS
CORPORATION

55 Jonspin Road
Wilmington, MA 01887

(508) 658-7899
FAX: (508) 658-7870

0187-EPA-4594

Contract No. 68-W8-0117

December 15, 1995

Ms. Kelly McCarty, HEC-CAN6
U.S. Environmental Protection Agency
J.F. Kennedy Federal Building
Boston, Massachusetts 02203-2211

Subject: Review of Draft Remedial Investigation Work Plan
SRSNE, Inc. Site RI/FS, W.A. No. 01-1L08

Dear Ms. McCarty:

As requested, Halliburton NUS Corporation reviewed the Remedial Investigation Work Plan (dated November 1995), submitted by Blasland, Bouck, & Lee, Inc. (BB&L) on behalf of the SRSNE PRP Group. Review comments are enclosed.

Should you have any questions or comments, please call me at (508) 658-7899.

Very truly yours,

Liyang Chu

Liyang Chu
Project Manager

PMO - iy

LC:ib

Enclosure

cc: D. Kelley (EPA) w/enc.
G. Gardner/A. Ostrofsky (HNUS) w/o enc.
File 0217-1.0 w/enc.

REVIEW OF REMEDIAL INVESTIGATION WORK PLAN (NOVEMBER 1995)
PREPARED BY SRSNE PRP GROUP
W.A. No. 01-1L08
December 15, 1995

GENERAL COMMENTS

1. The RI work plan was prepared in conformance with the requirements set forth in the RI/FS Statement of Work (SOW).

2. While some of the proposed activities for completing a feasibility study is presented in this RI work plan, it is anticipated that a FS work plan would be submitted to comply with the RI/FS SOW.

3. The use of hollow stem augers for drilling at this site should be discouraged. The auger drilling method has limited ability to control the potential transfer of fluids between aquifers. Also, the presence of boulders in the overburden limits the ability of the augers to be advanced to desired depths.

SPECIFIC COMMENTS

1. Sec. 3.2.2, page 42 Last bullet - Interpretation of the current distribution of VOCs in ground water should consider: 1) the ground water flow directions while the Town Production wells were active and 2) the discharge of VOCs from the underlying bedrock aquifer into the overburden aquifer through "till windows". The town well field was actively used while SRSNE was in operation. Therefore, the current distribution of dissolved contaminants may be the result of both the current and past groundwater flow. Isolated VOCs presence in overburden ground water could also result from the discharge of contaminated ground water from the bedrock aquifer up gradient of a given monitoring well.

   These two scenarios may result in isolated VOCs presence in the Town well field and represent potential contaminant transport mechanisms that are not related to adjacent NAPL presence or sources other than SRSNE.

2. Sec 3.2.2, page 44 While well TW-7B appeared to have provided a cross-aquifer pathway for contaminant migration, it should also be noted that there may be numerous "holes" or "windows" in the till layer that may have provided conduits for NAPL migration from the overburden into the bedrock. Hydrologic data developed to data have not provided clarification. Hopefully

this data gap would be addressed under this RI since it will be an important consideration in developing groundwater containment or mitigation strategies in the future.

3. Section 3.2.2, page 48 - 49 The Human Health Risk Assessment prepared for the first Remedial Investigation followed EPA Region I risk assessment guidelines and direction by the EPA risk assessment specialist. Risk assessments do not take into account natural attenuation or biodegradation processes since these may not be quantifiable or reliable factors for risk reduction.

   The purpose of the risk assessment is to help identify potential contaminants of concern and potential exposure scenarios. Under the Feasibility Study, exposure scenarios representative of future land use can be used to develop appropriate remediation goals or to determine whether remediation is warranted.

4. Section 4.2.1, page 52 Table - general response actions such as in-situ treatment, removal/ex-situ treatment, and removal/off-site disposal are also applicable to the protection of human health RAO.

5. Section 4.3.2, page 59 It is suggested that the determination of **fracture aperture and orientation of fractures and bedding** also be included in the list of bedrock parameters to be acquired during the RI.

6. Section 4.3.2, page 59 Third paragraph - If the one proposed bedrock core sample does not have VOCs in the rock matrix, will another bedrock core sample be obtained to assess VOCs content? The nature of fractured flow may limit the ability to collect the required sample. Provisions should be made for additional sampling, if needed, to assess the matrix VOC content or confirm the lack thereof.

7. Section 4.3.2.1, page 60 The reasons put forth by the PRP Group with regards to remediating VOCs in the Operations Area/Containment Area vadose zone are reasonable. The concern for a vadose zone evaluation is that available data indicate that the unsaturated zone underlying most of the Operations Area is flushed by ground water during high ground water conditions that typically occur in the spring. This seasonal rising and falling action of the water table probably causes more VOCs to enter into the overburden and bedrock aquifers.

8. Section 4.3.2.2, page 61 Should NAPLs be encountered during the RI field activities, it is recommended that they be removed from the subsurface. We concur that additional ground water extraction may not be advisable.

However, low impact methods may be appropriate, such as bailing performed at the MWD-601 DNAPL recovery well.

9. Section 4.3.2.3, page 62 Second paragraph - There is a much greater potential for recovering and remediating LNAPL than DNAPLs. The opportunity to remove free product should not be missed. Recovery of NAPLs, whether light or dense, would probably help to decrease the total time required to maintain hydraulic containment and treatment.

10. Section 4.3.3, page 65 First paragraph - Areas that have contaminant concentrations below regulatory standards or guidelines may warrant further investigation depending on the location of the contaminants in the ground water flow field and interaction of ground water between the two aquifers underlying the SRSNE study area. The significance of contaminant detection should be assessed with respect to the site geology, hydrogeology and suspected release history.

11. Section 4.3.3.2, page 68 Calculation of solute transport distances should also consider the potential for transport in the bedrock aquifer and bedrock discharge areas (i.e. till windows or bedrock not confined by till). The potential for contaminated bedrock ground water to discharge to the overburden aquifer is believed to be plausible (based on observed potential upward vertical gradients) and warrants evaluation.

12. Section 4.3.3.3, page 69 A concentration reversal should be evaluated in the context of the interactions between the overburden and bedrock aquifers, and present an past ground water flow patterns. Also, past pumping of the Town Production wells and irregular disposal of heterogeneous contaminants at the Operations Area may have resulted contaminant presence or concentrations that differ from the "fingerprint" chemicals. Probably as data are developed during the RI, assessment of concentration reversal may be more apparent.

13. Section 5.4.2.2, page 74 Second paragraph - Since the decision of whether groundwater at a specific location is clean is dependent on chemical analyses, the detection limits of the analytical methods used (either field or fixed laboratory GC analyses) shall be commensurate with the specified action levels.

    Consideration should be given to the installation of a monitoring well that supports the determination that an area or portion of an aquifer is clean.

14. Section 5.4.3, page 74 Downhole fracture logging at more than one location and possibly at all deep bedrock holes should be considered. The fracture

aperture, fracture density, and fracture orientation are all critical data needed to support a TI waiver. Also, these bedrock characteristics may vary between locations.

15. Section 5.4.4, page 78 First paragraph - EPA Region I policy is that cement grout cannot be used for monitoring wells below the water table. The concern is that cement grout hydration will cause changes in the ground water pH, which may influence metals mobility. A bentonite grout is typically used for sealing the annulus between the borehole and the solid well riser.

16. Section 5.7, page 89 It is suggested that EPA review the definition of "zone of technical impracticability" as presented on this page, and determine whether or not to concur. The work plan proposes both the potential and probable NAPL zones as the combined zone of technical impracticability.

ATTACHMENT 2

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF WATER MANAGEMENT
PERMITTING, ENFORCEMENT & REMEDIATION DIVISION
FEDERAL REMEDIATION PROGRAM

January 23, 1996

Ms. Kelly McCarty
U.S. Environmental Protection Agency
Office of Site Restoration and Remediation
JFK Federal Building, HEC-CAN6
Boston, MA 02203-2211

Re: Comments Regarding Remedial Investigation Work Plan Dated November 1995

Dear Ms. McCarty:

Staff of the Federal Remediation Program of the Permitting, Enforcement and Remediation Division (PERD) of the Water Management Bureau of the Connecticut Department of Environmental Protection have reviewed the document entitled "Remedial Investigation Work Plan" dated November 1995. The Work Plan was prepared by Blasland, Bouck & Lee, Inc. (BB&L) on behalf of the SRSNE PRP Group.

The Department concurs with the overall approach proposed in the work plan. However, we have a number of questions and comments, which are listed below in detail.

General Comments

NAPL Zone Delineation

Accurate definition of the NAPL zone is an issue of fundamental importance to the State, since this will define the area where a waiver of ground water related Applicable or Relevant and Appropriate Requirements would be considered. We support the approach proposed to delineate the probable NAPL zone. We feel it is appropriate to use the VOC concentrations detected in a ground water sample from MWD-601 as an empirical demonstration of the effective solubility of the NAPL, and to use this as one of several criteria for delineating the probable NAPL zone. When used together with the other criteria listed, including knowledge of site history, direct observation of DNAPL, and comparison between ground water flow net data, and VOC ground water concentrations, we agree that this will result in a reasonable estimate of the probable NAPL zone.

There appears to be some confusion in the plan, however, regarding how the empirically determined effective solubility will be applied. On page 42 and page 63 the plan states that the likely presence of NAPL will be inferred at any sampling location where:

1) Ground water VOC concentrations exceed 1% of the empirically determined constituent

effective solubility based on VOC concentrations detected in MWD-601.

2) Soil VOC concentrations indicate equilibrium pore water concentrations exceeding the empirically determined constituent effective solubility.

3) Soil VOC concentrations indicate equilibrium pore water concentrations exceeding 1% of the empirically determined constituent effective solubility.

Since any samples which meet criterion 2 will also meet criterion 3, it is unclear why both of these criteria are listed. In addition, on page 61, the work plan states that the likely presence of NAPL will be inferred based on criteria 1 and 2. Criterion 3 is not mentioned on this page. Either criterion 2 or criterion 3 should be selected, and used consistently in the work plan, and in the Remedial Investigation.

It is unclear whether criteria 2 and 3 would also be applied to soil samples collected in the unsaturated zone, as well as to those collected from below the water table. We agree that it is appropriate to presume that aquifer restoration is technically impracticable in any region where NAPL is demonstrated or inferred to be present below the water table. However, where NAPL is present in the unsaturated zone, it can and should be remediated.

Delineating the potential NAPL zone is a more problematic issue for the State since ground water restoration within this zone would be presumed to be technically impracticable. The work plan states on page 44 that the potential NAPL zone was delineated, but does not specify how this was accomplished. We agree with the concept of delineating a potential NAPL zone, since it will serve as a safety factor to account for the high degree of uncertainty associated with locating NAPL. However, the work plan must provide greater detail on the methodologies used to delineate the potential NAPL zone.

Similarly, the Work Plan notes on page 89 that matrix diffusion from dissolved phase contaminants or NAPL in fractures may have resulted in significant mass loading to the bedrock matrix outside of the probable and potential NAPL zones. According to the Work Plan, restoration of the bedrock aquifer might be considered technically impracticable in these areas also. BB&L proposes to use a two dimensional finite element numerical computer model "to determine which portions of the bedrock can be restored, and" to predict "the times required for restoration". The State acknowledges that matrix diffusion may indeed make remediation of a portion of the bedrock outside the NAPL zone technically impracticable. We also agree that properly conceived and executed computer modeling will provide information useful in guiding a decision regarding technical impracticability. However, this decision will be made by EPA and the State, rather than by the PRPs or their consultants. Where only modelling, especially two dimensional modelling, indicates that restoration may not be technically practicable, the State may recommend that pilot remediation be instituted to evaluate the appropriateness of conclusions based on modelling.

Specific Comments

Section 3.2.2 Migration and Exposure Conceptual Model

Page 42- Probable and Potential NAPL Zone Boundaries

As noted above in General Comments, there appears to be some confusion regarding the criteria which will be used to delineate the probable NAPL zone. The second of the three proposed criteria is the presence of soil concentrations which would indicate pore water concentrations exceeding the constituent effective solubility in ground water. The third of three proposed criteria, however, is the presence of soil concentrations which would indicate pore water concentrations exceeding 1% of the constituent effective solubility. Since any pore water concentration which exceeds the effective solubility would also exceed 1% of that value, it is unclear why these are proposed as separate criteria. These three criteria are repeated on page 63. However, on page 61, the work plan proposes to use only the first and second criteria.

The ambiguity between the second and third criteria should be resolved by selecting one or the other and using the chosen criterion consistently throughout the work plan. Alternatively, if the respondents do intend to use both the second and the third criteria, the work plan must state clearly how the separate criteria will be applied.

Page 48- Probable and Potential NAPL Zone Boundaries

The first full paragraph on this page states that the potential NAPL zone was delineated by Dr. Kueper, to serve as a safety factor to allow for uncertainties inherent in delineating the probable NAPL zone. The work plan provides little detail on how the potential NAPL zone shown in Figures 9 and 10, was delineated. The respondents should provide additional detail which would allow the reader to decide how the preliminary boundaries of the potential NAPL zone were delineated.

Page 48- Exposure Based Risk

The first paragraph of this section states that "no current ground-water receptors exist in the areas down gradient and cross-gradient (immediately north) of the SRSNE site". It should be noted, however, that the private well on the property of Mr. Michael Maiellaro, of 106 Lazy Lane, immediately to the north of the site, is contaminated with several of the chlorinated solvents found on the SRS site. The State is currently providing Mr. Maiellaro with bottled water for drinking and cooking purposes. We are also seeking to provide Mr. Maiellaro with a permanent source of potable water by connecting his property to the public water supply. However, until Mr. Maiellaro is provided with a permanent source of potable water, the potential remains for exposure to volatile organics through inhalation or incidental ingestion during showering or bathing.

Section 4.3.2.1 Conditions Affecting Practicability of TI Zone Remediation

Page 59- Saturated Bedrock

A sentence fragment, "permeable reaction wall", is present at the end of the fourth paragraph. Is this supposed to be part of a complete sentence? The State feels that the feasibility of using permeable reaction walls at this site should be evaluated.

Section 4.3.2.3 NAPL Distribution and Quantity

Page 61

See comments above for page 42. Only criteria 1 & 2 are proposed here for use in delineating the extent of the probable NAPL zone. Criterion 3 is not included here.

Page 62

The work plan notes that the distinction between DNAPL and LNAPL may be immaterial for the purpose of evaluating technical infeasibility. We agree that it is difficult to distinguish between the two forms of NAPL at this site, and that it is appropriate to consider a technical infeasibility waiver for areas where DNAPL is known or reasonably suspected to be present in bedrock. However, a 1.5 foot thick layer of LNAPL was observed in well P-1B during the initial remedial investigation. Many proven technologies exist for dealing with LNAPL in overburden aquifers. Where LNAPL are observed, remediation should be undertaken to remove as much of it as possible.

Page 63- Free Phase NAPL Extent

See comments above for page 42. Criteria 1, 2, and 3 are proposed here for probable NAPL zone delineation. As noted above, criteria 2 and 3 appear to be ambiguous.

Section 5.2 Task 1- Project Planning, Page 70

The third paragraph of this section states that "USEPA and CTDEP will be responsible for continuing to develop and implement an effective community relations program at this site". This responsibility actual rests primarily with EPA, rather than jointly with EPA and the State. However, the State wishes to continue to work with both EPA and the PRPs to maintain the excellent community relations which have been one of the hallmarks of this project.

Section 5.4.1 Test Pit Installation, Page 72

BB&L proposes to collect soil samples from test pits for permeability testing by scraping soil from single stratigraphic layers into a sample jar. These samples will be disturbed samples and will not be representative of the in-situ permeability of the horizon sampled. Although the samples will be collected from a discrete stratigraphic layer, the effects of particle orientation within the layer, soil density, etc. will not be accounted for. To account for soil density, we suggest that BB&L use a density meter to measure the density and moisture content of the horizon where the sample is collected. It would be preferable to collect undisturbed, or less disturbed samples, or to devise field permeability tests.

Page 5.4.2.1 Soil Sampling, Page 73

In the fourth paragraph, the work plan proposes to determine soil porosity from split spoon samples collected in the pilot holes for MW703-DR and MW704-DR. Soil porosity cannot be directly determined from a split spoon sample since a split spoon sample is a disturbed sample. Its porosity may differ significantly from the in situ porosity of the sampled formation. Density can be used as a guide, and the porosity of the soil samples can be calculated from this data. We suggest that the PRPs devise a method to collect as undisturbed a sample as possible.

Section 5.4.3 Bedrock Drilling and Characterization, Page 75

The casing for shallow bedrock corehole RC-701 will be spun and seated into bedrock to isolate the corehole from the overburden formation. The work plan does not include provisions for grouting the casing into place to ensure that the casing forms an effective seal. This is particularly important at this location, since this is within the probable bedrock NAPL zone. The casing should be grouted into place and the grout should be allowed to harden before coring begins. A roller bit can then be used to remove the resulting grout plug from the casing prior to coring.

Section 5.4.4 Monitoring Well Installation, Page 78

The work plan states that bedrock wells will be installed either through augers, or through casing. While it is acceptable to use augers to drill the overburden portion of a bedrock hole, the bedrock portion of all bedrock holes should be completed through casing which is properly seated and grouted into bedrock. See the comments above for Section 5.4.3.

Section 5.4.7 Ground-Water Elevation Monitoring, Page 82

The work plan proposes to assess the degree of hydraulic interconnection between the shallow and deep bedrock aquifer by comparing "long term" hydrographs from transducer/ data logger units left in place in paired shallow and deep wells. These units would be left in place for at least one week, or until they are needed for other purposes. Unless the system will be stressed through pumping, a one week time period is not be sufficient to allow useful conclusions to be drawn regarding the similarity or dissimilarity of resulting hydrographs. The measurements should take place over a minimum time period of six months. These wells should be instrumented if any pumping test is to be performed. Information on interconnection between shallow and deep bedrock should be obtained from an appropriately designed pumping test of sufficient duration (weeks).

Section 5.5 Task 4- Data Evaluation and Interim Data Presentation

Page 83- Preliminary Data Evaluation

The work plan proposes to set the limits of the area to be investigated based on the calculated 40 year travel distance for ground water. This distance would be calculated using solute transport data for the overburden and bedrock aquifers, and hydraulic gradient and conductivity data for the off-site plume.

This would not eliminate the need to make estimates of the full extent of the plume, and to determine where it discharges. The State does not feel it is appropriate to determine the extent of the work area based soley on calculated contaminant travel times. Some empirical data will be needed to back up these calculations.

Due to the uncertainties involved in predicting travel times and other contaminant fate and transport parameters, some long term monitoring will be required at the down gradient extent of the area to be investigated. This is particularly important given the presence of Town of Southington Public Water Supply Well 1A approximately one mile south of the site. This well is in active use.

Section 5.7 Task 6- Ground-Water Technical Impracticability Determination

Page 89- Definition of the Zone of Technical Impracticability

As noted above under General Comments, the State wishes to participate in any decision regarding the extent of the zone of technical impracticability, since restoration of ground water would not be sought within this zone.

Tables 1, 2, and 3- ARARs

Several other potential ARARs might apply at this site, in addition to those listed in the tables.
A list of additional potential State ARARs is attached.

Table 1 properly cites our proposed Remediation Standard Regulations as To Be Considered. It should be noted however, that we have finalized these regulations and submitted them to the

Legislative Regulation Review Committee of the Connecticut General Assembly. The Committee unanimously approved the regulations on January 16, 1996. Upon filing the regulations with the Secretary of the State later this week, the regulations are effective. The regulations should now be noted as applicable requirements.

If you have any questions concerning this letter, please contact me at (860) 424-3768.

Sincerely,

Mark R. Lewis

Mark R. Lewis
Senior Environmental Analyst
Permitting, Enforcement & Remediation Division
Bureau of Water Management

Attachment

cc: Ed Lynch, BB&L
Gus Moody, James River Corp.
Bruce Thompson, de maximis, inc.
Robert Kirsch, Esq., Hale & Dorr
Mr. John Rudisill, Avery Dennison

Attachment 1
Solvents Recovery Service Remdial Investigation Work Plan
Additional State ARARs

Action Specific ARARS

Requirement	Status	Synopsis of Requirement	RI Work Plan Considerations
Hazardous Waste Management: Generator & Handler Requirements-General Standards, Listing & Identification (RCSA §§22a-449(c)100-101)	Applicable	These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR §§260-261 are incorporated by reference. Chromium is not exempted from listing as a hazardous waste.	This requirement would apply to any investigation derived waste or other hazarous wastes generated during the RI/FS or during implementation of a remedy. Hazardous waste determinations will be performed and the wastes will be managed in accordance with requirements of these regulations, if necessary.
Water Pollution Control (CGS §22a-430)	Applicable	This section prohibits discharge to the waters of the State without a permit.	Any discharges will meet the substantive requirements of this section, including treatment if necessary.
Connecticut Water Diversion Policy Act (CGS §§22a-365 to 378)	Applicable	These rules regulate many diversions of the waters of the State. Several broad categories are exempt, including any diversion of less than 50,000 gallons per day and any discharge permitted under CGS §22a-430.	Any non-exempt diversion will be carried out in accordance with the substantive requirements of these statutes.
Air Pollution Control-Stationary Sources (RCSA §22a-174-3)	Applicable	This regulation requires section requires permits to construct and operate stationary sources of emissions, and requires those sources to meet specified standards. Pollution abatement controls may be required. Specific standards are listed for many pollutants. Any landfill with potential emissions of any particular air pollutant including methane exceeding 5 tons per year requires a permit under subsection 3(a)1(K). Active gas collection systems with emissions controls may be required.	Any treatment system component which produces an air discharge required as part of the remedial action will be designed to meet the substantive requirements of the regulations.
Air Pollution Control-Control of Odors (RCSA §22a-174-23)	Applicable	This section prohibits emission of any substance that constitutes a nuisance because of objectionable odor.	Site remediation activities will be planned to control the release of objectionable odors from the site so that the activities comply with the substantive requirements of the regulation.

Attachment 1
Solvents Recovery Service Remdial Investigation Work Plan
Additional State ARARs

Requirement	Status	Synopsis of Requirement	RI Work Plan Considerations
State and Municipal Regulation of Wetlands and Watercourses (CGS §22a-36 through 44)	Applicable	These statutes require municipal regulation of activities in inland wetlands and watercourses.	All substantive requirements of the local inland wetlands regulations will be followed.

Location Specific ARARs

Remediation Standard Regulations (RCSA §22a-133-k-1 to k-3 and 22a-133-q-1 and 22a-209-1) May also be considered <u>Action Specific.</u>	Applicable	Provides soil, and ground water concentration standards for remedial activities in the State of Connecticut.	The numerical criteriafor soil and ground water will be used during the evaluation.

These State ARARs are in addition to the ARARs named in Tables 1,2, and 3 of the Remedial Investigation Work Plan dated November 1995. No additional Location Specific ARARs are cited.

ATTACHMENT 3

DRAFT

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW FLOW (minimum stress) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUND WATER SAMPLES FROM MONITORING WELLS

DRAFT

I. SCOPE & APPLICATION

The purpose of this standard operating procedure (SOP) is to provide information on the collection of ground water samples that are "representative" of mobil organic and inorganic loads in the vicinity of the selected open well interval, at near natural flow conditions. The minimum stress procedure emphasizes negligible water level drawdown and low pumping rates in order to collect samples with minimal alterations in water chemistry. This procedure is designed primarily to be used in wells with a casing diameter of 2 inches or more and a saturated screen, or open interval, length of ten feet or less. Samples obtained are suitable for analyses of common types of ground water contaminants (volatile and semi-volatile organic compounds, pesticides, PCBs, metals and other inorganic ions [cyanide, chloride, sulfate, etc.]). This procedure is not designed to collect samples from wells containing light or dense non-aqueous phase liquids (LNAPLs or DNAPLs) using pumps.

The procedure is flexible for various well construction and ground water yields. The goal of the procedure is to obtain a turbidity level of less than 5 NTU and to achieve a water level drawdown of less than 0.3 feet during purging and sampling. If these goals cannot be achieved, sample collection can take place provided the remaining criteria in this procedure are met.

II. EQUIPMENT

- Adjustable rate, submersible pump (e.g., centrifugal or bladder pump constructed of stainless steel or Teflon). Peristaltic pumps may be used only for inorganic sample collection.

- Disposable clear plastic bottom filling bailers may be used to check for and obtain samples of LNAPLs or DNAPLs.
- Tubing - Teflon, Teflon lined polyethylene or stainless steel tubing must be used to collect samples for organic analysis. For samples collected for inorganic analysis, Teflon or Teflon lined polyethylene, PVC, Tygon, polyethylene or stainless steel tubing may be used.
- Water level measuring device, 0.01 foot accuracy, (electronic devices are preferred for tracking water level drawdown during all pumping operations).
- Flow measurement supplies (e.g., graduated cylinder and stop watch).
- Interface probe, if needed.
- Power source (generator, nitrogen tank, etc.). If a gasoline generator is used, it must be located downwind and at a safe distance from the well so that the exhaust fumes do not contaminate the samples.
- Indicator parameter monitoring instruments - pH (EPA Methods 150.1 or 9040), turbidity (EPA Method 180.1), specific conductance (EPA Methods 120.1 or 9050) , and temperature (EPA Method 170.1). Use of a flow-through cell is recommended. Optional Indicators - eH and dissolved oxygen (EPA Method 360.1), flow-through cell is required. Standards to perform field calibration of instruments.
- Decontamination supplies.
- Logbook(s), and other forms (e.g. well purging forms).
- Sample Bottles.
- Sample preservation supplies (as required by the analytical methods).
- Sample tags or labels.
- Well construction data, location map, field data from last sampling event.
- Field Sampling Plan.
- PID or FID instrument for measuring VOCs (volatile organic compounds).

III. PRELIMINARY SITE ACTIVITIES

- Check well for damage or evidence of tampering, record pertinent observations.

- Lay out sheet of polyethylene for monitoring and sampling equipment.

- Remove well cap and immediately measure VOCs at the rim of the well with a PID or FID instrument and record the reading in the field logbook.

- If the well casing does not have a reference point (usually a V-cut or indelible mark in the well casing), make one.

- Note that if water level data will be used to construct potentiometric surface map(s) then a synoptic water level measurement round should be performed (in the shortest possible time) before any purging and sampling activities begin.

- Measure and record the depth to water (to 0.01 ft) in the well to be sampled before any purging begins. Care should be taken to minimize disturbance of any particulate attached to the sides or at the bottom of the well.

- Measure and record (as appropriate) the depth of any DNAPLs or LNAPLs with an interface probe. Care should be given to minimize disturbance of any sediment which has accumulated at the bottom of the well. If LNAPLs or DNAPLs are present, a decision needs to be made as to whether to collect samples of the free phase liquid(s) and/or the dissolved phase.

IV. PURGING AND SAMPLING PROCEDURE

Use a submersible pump to purge and sample monitoring wells which have a 2.0 inch or greater well casing diameter.

Measure and record the water level again just prior to placing the pump in the well.

Lower pump, safety cable, tubing and electrical lines slowly into the well so that the pump intake is located at the center of the saturated screen length of the well. If possible keep the pump intake at least two feet above the bottom of the well, to minimize mobilization of sediment that may be present in the bottom of the well. Collection of turbid free water samples my be difficult if there is three feet or less of standing water in the well.

When starting the pump, slowly increase the pump speed until a discharge occurs. Check water level. Adjust pump speed until there is little or no water level drawdown. The target drawdown should be less than 0.3 feet and it should stabilize. If the target of less than 0.3 feet cannot be achieved or maintained, the sampling is acceptable if remaining criteria in the procedure are met. Subsequent sampling rounds will probably have intake settings and extraction rates that are comparable to those used in the initial sampling rounds.

Monitor water level and pumping rate every three to five minutes (or as appropriate) during purging. Record pumping rate adjustments and depths to water. Pumping rates should, as needed, be reduced to the minimum capabilities of the pump (e.g., 0.1 - 0.2 l/min) to ensure stabilization of indicator parameters. Adjustments are best made in the first fifteen minutes of pumping in order to help minimize purging time. During initial pump start-up, drawdown may exceed the 0.3 feet target and then recover as pump flow adjustments are made (minimum purge volume calculations should utilize stabilized drawdown values, not the initial drawdown). If the recharge rate of the well is less than minimum capability of the pump do not allow the water level to fall to the intake level (if the static water level is above the screen, avoid lowering the water level into the screen). Shut off the pump if either of the above is about to occur and allow the water level to recover. Repeat the process until field indicator parameters stabilize and the minimum purge volume is removed. The minimum purge volume with negligible drawdown (0.3 feet or less) is two saturated screen length volumes. In situations where the drawdown is greater than 0.3 feet and has stabilized, the minimum purge volume is two times the saturated screen volume plus the stabilized drawdown volume. After the minimum purge volume is attained (and field parameters have stabilized) begin sampling. For low yield wells, commence sampling as soon as the well has recovered sufficiently to collect the appropriate volume for all anticipated samples.

During well purging, monitor field indicator parameters (turbidity, temperature, specific conductance, pH, etc.) every three to five minutes (or as appropriate). Purging is complete and sampling may begin when all field indicator parameters have stabilized (variations in values are within ten percent of each other, pH +/- 0.2 units, for three consecutive readings taken at three to five minute intervals). If the parameters have stabilized, but turbidity remains above 5 NTU goal, decrease pump flow rate, and continue measurement of parameters every three to five minutes. If pumping rate cannot be decreased any further and stabilized turbidity values remain above 5 NTU goal record this information. Measurements of field parameters should be obtained using a flow-through cell (preferred method) or taken in a clean container (a glass beaker is suitable). However, if measurements for dissolved oxygen and eH are to be obtained, they must be obtained using a flow-through cell in a manner in which the sample is not exposed to air prior to the measurement. Prior to collecting the samples for laboratory analyses, the flow-through cell must be disconnected. Note, turbidity, temperature, specific conductance and pH measurements must be recorded. If these measurements are missing, the resulting sampling data may not be acceptable. If the optional indicator parameters, dissolved oxygen and eH, are measured, they must be recorded.

VOCs samples are preferably collected first and directly into pre-preserved sample containers. Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

If the water column in the pump tubing collapses (water does not completely fill the tubing) before exiting the tubing, use one of the following procedures to collect VOC samples: (1) Collect the non-VOCs samples first, then increase the flow rate incrementally until the water column completely fills the tubing, collect the sample and record the new flow rate; (2) reduce the diameter of the existing tubing until the water column fills the tubing either by adding a connector (Teflon or stainless steel), or clamp which should reduce the flow rate by constricting the end of the tubing; (3) insert a narrow diameter Teflon tube into the pump's tubing so that the end of the tubing is in the water column and the other end of the tubing protrudes beyond the pump's tubing, collect sample from the narrow diameter tubing.

Preserve all samples immediately after they are collected.

Check the pH for all samples requiring pH adjustment to assure that the proper pH has been obtained. For VOC samples, this will require that a test sample be collected during purging to determine the amount of preservative that needs to be added to the sample containers prior to sampling.

If dissolved metal concentrations are desired, collect filtered water samples. The use of an in-line filter is preferred. An in-line 0.45 um particulate filter should be pre-rinsed with approximately 25 - 50 ml of groundwater prior to sample collection. After filtering the sample, preserve the water sample immediately. Note that filtered water samples are not an acceptable substitute for unfiltered samples when the monitoring objective is to obtain chemical concentrations representative of total mobile loads.

Label each sample as collected. Samples requiring cooling (volatile organics, cyanide, etc.) will be placed into an ice cooler for delivery to the laboratory. Metal samples after acidification to a pH less than 2 do not need to be cooled.

After collection of the samples, the pump tubing may either be dedicated to the well for resampling (by hanging the tubing inside the well), decontaminated, or properly discarded.

Before securing the well, measure and record the well depth.

Secure the well.

V. DECONTAMINATION

Decontaminate sampling equipment prior to use in the first well and following sampling of each subsequent well. Pumps will not be removed between purging and sampling operations. The pump and tubing (including support cable and electrical wires which are in contact with the well) will be decontaminated by one of the procedures listed below.

Procedure 1

- Steam clean the outside of the submersible pump.
- Pump hot water from the steam cleaner through the inside of the pump. This can be accomplished by placing the pump inside a three or four inch diameter PVC pipe with end cap. Hot water from the steam cleaner jet will be directed inside the PVC pipe and the pump exterior will be cleaned. The hot water from the steam cleaner will then be pumped from the PVC pipe through the pump and collected into another container. Note: additives or solutions should not be added to the steam cleaner.
- Pump non-phosphate detergent solution through the inside of the pump. If the solution is recycled, the solution must be changed periodically.
- Pump tap water through the inside of the pump to remove all of the detergent solution. If the solution is recycled, the solution must be changed periodically.
- Pump distilled/deionized water through the pump. The final water rinse must not be recycled.

Procedure 2

- The decontaminating solutions can be pumped from either buckets or short PVC casing sections through the pump or the pump can be disassembled and flushed with the decontaminating solutions. It is recommended that detergent and isopropyl alcohol be used sparingly in the decontamination process and water flushing steps be extended to ensure that any sediment trapped in the pump is flushed out. The outside of the pump and the electrical wires must be rinsed with the decontaminating solutions, as well. The procedure is as follows:

- Flush the equipment/pump with potable water.

- Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.

- Flush with tap or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.

- Flush with isopropyl alcohol. If equipment blank data shows that the level of contaminants is insignificant, then this step may be skipped.

- Flush with distilled/deionized water. The final water rinse must not be recycled.

VI. FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not compromised the quality of the ground water samples. All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. The following quality control samples shall be collected for each batch of samples (a batch may not exceed 20 samples). Trip blanks are required for the VOC samples at a frequency of one per sample cooler.

- Field duplicate.

- Matrix spike.

- Matrix spike duplicate.

- Equipment blank.

- Trip blank (VOCs).

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Sampling should proceed from wells with the lowest contaminant concentration to the highest concentration. Collect equipment blanks after sampling from contaminated wells and not after background wells.

When field duplicates or split samples are to be collected, they will be collected consecutively for the same parameters.

All monitoring instrumentation must be operated in accordance with EPA analytical methods and the operating instructions as supplied by the manufacturer. The instruments must be calibrated at the beginning of each day and the calibration checked at least once throughout the day (i.e. at the end of the day) to verify that the instruments remained in calibration. Temperature measuring equipment, thermometers and thermistors, should be checked for accuracy prior to field use according to the EPA Method 170.1 and the manufacturer's instructions.

VII. FIELD LOGBOOK

A field log must be kept each time ground water monitoring activities are conducted in the field. The field logbook should document the following:

- Well identification.
- Well depth, and measurement technique.
- Static water level depth, date, time and measurement technique.
- Presence and thickness of immiscible liquid layers and detection method.
- Collection method for immiscible liquid layers.
- Pumping rate, drawdown, indicator parameters values, and clock time, at the appropriate time intervals; calculated or measured total volume pumped.
- Well sampling sequence and time of sample collection.
- Types of sample bottles used and sample identification numbers.
- Preservatives used.
- Parameters requested for analysis.
- Field observations of sampling event.

- Name of sample collector(s).
- Weather conditions.
- QA/QC data for field instruments.

EXAMPLE

WELL PURGING - FIELD WATER QUALITY MEASUREMENTS FORM*

Side 1 of 2*; Sheet__ of __

Location (Site/Facility Name) ________________
Project Name / # __________ Date ________
Field Personnel ________________
Sampling Organization ________________
Submersible pump with direct line to Flow Cell used for all measurements? (Y, N)* ________

Sampling Point (common name) ________________
Facility ID (for IGWIS data entry only) ________________
Station ID (for IGWIS data entry only) ________________
Purging Device (type of pump, bailer, etc):* ________________
Pump Intake or Bailer set at (ft. below MP)

Time	DTW below MP (ft.)	Purge Rate (specify units below) ( )	Cumulative Volume Purged (specify units below) ( )	Water Column Volumes Purged	Temp. (C)	Electical Conducvity (uMhos/cm)	Specific Conductance (uMhos/cm)	pH	Eh (mv)	DO (mg/l)	Turbidity (NTU)	Comments

CALIBRATION	Date									
	Time: military									
	Comment*	1 or 2 pt	[illegible]			Buffers		Type		

Field Measurements protocol followed with no exceptions (Y, N)* Form completed by________________ Date________

Form GWS #1

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Transmitted Via Facsimile/U.S. Mail

June 7, 1996

Ms. Sheila Eckman
United States Environmental Protection Agency
90 Canal Street
Boston, MA 02114

Re: SRSNE Site
RI Work Plan
Addendum No. 2
Project #: 1028.08330 #2

Dear Ms. Eckman:

This letter serves as Addendum No. 2 to the Remedial Investigation (RI) Work Plan (November 1995) for the Solvents Recovery Service of New England (SRSNE) Site in Southington, Connecticut. The RI Work Plan and associated Project Operations Plan (POP), dated January 1996, were prepared on behalf of the SRSNE Potential Responsible Parties (PRP) Group by Blasland, Bouck & Lee, Inc. (BBL). The first RI Work Plan Addendum (February 13, 1996) was prepared by BBL to address initial comments on the RI Work Plan offered by the United States Department of Environmental Conservation (USEPA), Haliburton NUS Corporation (HNUS), and the Connecticut Department of Environmental Protection (CT DEP). This RI Work Plan Addendum No. 2 addresses the following:

- Additional USEPA comments regarding the RI Work Plan (BBL, November 1995) and the first RI Work Plan Addendum (BBL, February 13, 1996); and
- USEPA comments regarding the associated Project Operations Plan (POP) (BBL, January 1996).

The comments addressed in this Addendum were presented to the SRSNE PRP Group in a letter from USEPA dated April 4, 1996 (copy included as Attachment 1). Based on a letter from CT DEP dated March 5, 1996, we understand that CT DEP has also had an opportunity to review the POP, and had no comments requiring response from the SRSNE PRP Group.

Responses to the two groups of comments listed above comprise the remainder of this RI Work Plan Addendum No. 2.

Responses to: SRSNE Superfund Site, EPA Additional Comments on Remedial Investigation Work Plan (November 1995) and Remedial Investigation Work Plan Addendum (Feb. 13, 1996), April 4, 1996

Responses to additional USEPA comments regarding the RI Work Plan and RI Work Plan the first RI Work Plan Addendum are provided below.

1. The SRSNE PRP Group respects the USEPA's preference for the low flow purging and sampling method for ground water, but believes that representative ground-water samples can be obtained

using traditional sampling procedures, which are much less time-consuming and expensive than low flow purging and sampling. A comparison of ground-water sampling methods recently completed by BBL at a USEPA Region II Superfund Site, in a hydrogeologic setting similar to the SRSNE Site (glacial outwash), concluded that the analytical results for chlorinated volatile organic compounds (VOCs) in samples obtained using traditional ground-water purging and sampling procedures (described in the POP) were essentially identical to the results for samples obtained using low flow purging and sampling.

The additional time and cost associated with low flow purging and sampling is not warranted at all proposed RI monitoring wells (approximately 165), but we propose to perform a site-specific comparison between the analytical results obtained through traditional versus low flow purging and sampling. As discussed in the first RI Work Plan Addendum (BBL, February 13, 1996), during the upcoming Phase I field investigation at the SRSNE Site, a comparison will be made between traditional and low flow sampling results by sampling the following six wells in accordance with both methods:

- Operations Area, Overburden: P-4B;
- Operations Area, Bedrock: P-4A;
- Former Cianci Property, Overburden: P-5B;
- Former Cianci Property, Bedrock: P-5A;
- Town Well Field, Overburden: MW-704S (Proposed); and
- Town Well Field, Bedrock: MW-704R (Proposed).

The analytical results obtained using both sampling procedures at these wells will provide a sufficient basis to assess whether low flow sampling results differ significantly from results obtained using traditional sampling methods at the SRSNE Site. If the low flow sampling results are found to differ significantly from the results obtained using traditional purging and sampling methods, then a decision will be made whether low flow purging and sampling procedures would be appropriate for follow-up Interim Monitoring and Sampling, as discussed in the RI Work Plan. The inclusion of low-flow purging and sampling at the above-listed wells has been incorporated, as appropriate, into the revised FSP.

2. As discussed with USEPA during two telephone conferences in April 1996, the RI Work Plan proposed that new overburden monitoring wells would be installed with 15-foot screens (rather than 10-foot screens) to increase the probability of screening and monitoring the strata that contain detectible VOCs. USEPA indicated that the overburden zones appropriate for monitoring can be adequately identified based on field screening of split-spoon soil samples (e.g., elevated headspace PID measurements, visible staining, and/or coarse soil texture) or the results of in-situ (Hydropunch™) ground-water samples, and that overburden monitoring well screen lengths should be 10 feet except where the well straddles the water table. Based on these discussions, overburden wells straddling the water table will be installed with 15-foot well screens, and the remaining overburden wells will be installed with 10-foot screens.

As discussed with USEPA during a telephone conference on April 25, 1996, new bedrock monitoring wells will be installed with 10- to 30-foot screens, depending on the relative magnitude and distribution of bedrock hydraulic conductivity values deduced based on packer-testing results, which will be obtained at 10-foot long intervals within the deep bedrock pilot hole at each proposed bedrock monitoring well drilling location.

The criteria for overburden and bedrock monitoring well screen depths and lengths are described in detail in Appendix F (Monitoring Well Installation) of the revised Field Sampling Plan.

3. To evaluate whether the SRSNE plume may impact domestic water-supply wells, ground-water quality data and ground-water elevation (hydraulic gradient) data will be obtained from the comprehensive ground-water monitoring network including new and existing overburden and bedrock wells. The plume associated with the SRSNE Site will be delineated as described in Section 4.3.3 of the RI Work Plan (under subsection entitled "Approach to Delineate the SRSNE VOC Plume"). If the plume delineation process indicates a potential for VOCs associated with the SRSNE Site to migrate to domestic wells, the need for further investigation will be discussed with USEPA and CT DEP.

Responses to: SRSNE Superfund Site, EPA Comments on Project Operations Plan (January 1996), April 4, 1996

The responses presented below address USEPA comments regarding the POP, which includes the following documents:

- A Site Management Plan (SMP);
- A Sampling and Analysis Plan (SAP) comprised of a Quality Assurance Project Plan (QAPP) and a Field Sampling Plan (FSP); and
- A Health and Safety Plan (HSP).

In addition to the responses provided below, the revised SMP, QAPP, and FSP are included as separately bound Attachments 2, 3, and 4, respectively, to this RI Work Plan Addendum No.2.

Site Management Plan

1. The SMP (Attachment 2) has been revised to include project organization (Figure 3), a list of subcontractors, and an updated schedule (Figure 4).

Sampling and Analysis Plan

Part 1: Quality Assurance Project Plan

3.[sic] The sample preparation procedure for bedrock matrix VOC analysis is referenced in Section 1.4.1 (Data Types) of the revised text for the QAPP, and is described in detail in the revised Appendix D to the FSP.

2. The criteria for selecting monitoring well screened intervals and characterizing the nature and extent of the off-site VOC plume, which are described in the RI Work Plan, are discussed in the revised Section 1.4.2 (Data Uses) of the QAPP. Monitoring well depth and screen length criteria are discussed in detail in the Appendix F (Monitoring Well Installation) of the revised Field Sampling Plan.

3. The distinction between *in-situ* ground-water samples and ground-water samples from wells and piezometers is described in the revised Section 1.4.2 (Data Quantity) of the QAPP.

4. The analytical laboratories selected to perform sample analyses are identified in Section 2.3.4 (Analytical Laboratories) of the revised QAPP. Laboratory quality assurance documentation and standard operating procedures for non-published analytical methods are provided in Appendix A of the revised QAPP.

5. Sample temperature measurement is addressed in Section 5.3 (Laboratory Custody Procedures) of the revised QAPP. We assume that sample temperature measurement will be required only for chemical characterization samples requiring preservation at 4°C.

6. Sample temperature control for samples received on Saturdays is addressed in Section 5.3 (Laboratory Custody Procedures) of the revised QAPP.

7. The appropriate meter calibration information has been added to Section 6.2 of the revised QAPP, Tables 5 and 6, and Appendix J of the revised FSP.

8. The use of rinsate blanks for dedicated sampling devices is described in the revised Section 9.2.4 (Rinse Blanks) of the QAPP.

Part 2: Field Sampling Plan

9. See response to Comment 3 above. Similar verbiage has been added to the second bullet in Section 2.0.

10. Redox measurement, which will be performed as part of supplemental ground-water characterization to evaluate ground-water remedial alternatives, has been added to the POP in the following locations:
    - QAPP, Section 1.4.2 (Data Quality, DQO Level 1);
    - QAPP, Section 6.2, Field Instrument Calibration;
    - FSP, Section 2.0, Sampling Objectives;
    - FSP, Tables 5, 6, and 7; and
    - FSP, Appendix J.

11. Based on the results of telephone discussions with USEPA in April 1996, the criterion for containing purge water from monitoring wells/piezometers will be reduced from 100 ug/L or above to 50 ug/L or above. This modification will account for the temporal variability of ground-water concentrations, and will provide a conservative means to meet the CT DEP criterion of 100 ug/L or above for ground-water containment. This change has been made in Section 6.5.1 and in the FSP appendices, as appropriate.

12. Acoustic televiewer is not recommended at the MW-706DR location adjacent to the Quinnipiac River due to the high concentrations of VOCs (and potential presence of DNAPL) in the shallow bedrock in that area. These conditions warrant expedited completion of the deep bedrock monitoring well after drilling to the target depth and packer testing. However, pursuant to USEPA's comment, an attempt will be made to coordinate completion of a deep bedrock pilot boring at either the MW-704 or MW-707 location concurrent with the completion of the MW-702 pilot hole to facilitate acoustic televiewing at a location near the river in addition to the MW-702 location.

13. *In-situ* ground-water samples, which will be obtained during drilling operations (see Section 5.4.2.2 of the RI Work Plan), will be analyzed at Galson Laboratories, Inc. (Syracuse, New York) for VOCs by USEPA Method 601/602 with 48-hour turnaround. Table 1 of the FSP has been revised to clarify the analysis of *in-situ* ground-water samples.

    In lieu of well-headspace screening of methane using colorimetric tubes, methane concentrations in ground-water samples will be analyzed at Microseeps, Inc. (Pittsburgh, Pennsylvania) using a GC headspace equilibrium technique consistent with a USEPA protocol established by the Robert S. Kerr Laboratory in Ada, Oklahoma. The laboratory analytical procedure for methane is detailed in Appendix A to the revised QAPP. The procedures for obtaining ground-water samples for methane analysis are the same as those for obtaining samples for VOC analysis, described in the Appendix I to the FSP.

14. Table 2 of the FSP has been revised to reflect the appropriate analytical reference numbers for nitrate, ammonia, sulfate, and sulfide.

    As described in the RI Work Plan, three bedrock samples will be obtained at the RC-701 location, and will be analyzed for VOCs to provide a qualitative demonstration of VOC diffusion into the bedrock matrix. The proposed method for obtaining, handling, and preserving bedrock samples for VOC analysis is described in the revised Appendix D to the FSP. The procedure described in the revised Appendix D was developed by BBL based on discussions with Dr. Bernard Kueper of Queens University and Mr. Steve Acree of the USEPA's Robert S. Kerr Laboratory in Ada, Oklahoma. Based on these discussions, we are not aware of any published protocol for obtaining, handling, preserving and analyzing bedrock samples for VOCs within the bedrock matrix. The method described in the revised Appendix D was developed to allow the bedrock sample to be analyzed as equivalent to a soil sample by pulverizing the bedrock sample in the field and following the methanol immersion preservation procedure developed for soil samples (EPA/540/4-91/001). The purpose for using the methanol immersion procedure is to facilitate VOC extraction from the pulverized bedrock sample, which may include bedrock particles up to 0.5 cm in diameter. Dr. Kueper and Mr. Akree have indicated that the proposed method is appropriate to evaluate whether VOCs have diffused into the bedrock matrix. The method calls for measuring and reporting to the analytical laboratory the weight of the bedrock sample and methanol placed in the sample container. The analytical laboratory will analyze an aliquot of the methanol used to preserve each bedrock VOC sample, dry the bedrock sample, and calculate the mass of detected VOCs per mass of dry bedrock.

15. The analytical method for TOC in soil and bedrock has been changed to the Lloyd Kahn method, as specified in Table 4 of the revised FSP.

16. Table 5 of the FSP has been revised to include turbidity and redox precision and accuracy criteria.

17. The requested language has been added to Appendix B (Soil Boring and Sampling), Section III, Procedures.

18. The analytical laboratory will provide sample containers pre-preserved with HCl to preserve the in-situ (Hydropunch™) ground-water VOC samples, as specified in the revised Appendix C (Hydropunch Ground-Water Sampling Device) of the FSP. As the in-situ ground-water samples will be obtained only for screening purposes (Data Quality Objectives Level II), the only QA/QC samples accompanying these ground-water samples will be trip blanks provided by the analytical laboratory.

19. The Stick-Up Well Detail figure in Appendix F of the FSP has been modified in accordance with this comment.

20. The new monitoring wells will be installed with vented caps or a vent slot cut into the top of the well riser, or else will be allowed to equilibrate with the formation prior to taking water-level measurements, as specified in the revised Appendix F (Monitoring Well Installation) and Appendix K (Water Level/NAPL Thickness Measurement).

21. The requested information has been added to the revised Appendix G.

22. The requested information has been added to the revised Appendix I.

23. The requested information has been added to the revised Appendix I.

24. The requested information has been added to the revised Appendix I.

25. The requested information has been added to the revised Appendix J.

26. The requested information has been added to the revised Appendix J.

27. The suggested information has been added to the revised Appendix L.

In addition to the modifications described above, the SRSNE PRP Group proposes to obtain additional ground-water characterization data, beyond the sampling and analyses described in the RI Work Plan and POP, to enhance the evaluation of ground-water remedies involving bioremediation or reaction walls. Specifically, wells MW-502 and P-6 on the Former Cianci property will be added to the list of wells that will be sampled for the appropriate ground-water characteristics needed to evaluate these in-situ remedial technologies. Furthermore, the Group proposes to add the following analyses to the list of parameters that will be quantified to evaluate these in-situ remedial technologies: chloride; orthophosphate; ethane; ethene; TOC; and phospholipid fatty acids. These modifications have been made, where appropriate, throughout the QAPP and the FSP.

We trust that these responses meet your needs. Please do not hesitate to call Mr. Bruce Thompson, de maximis, inc., at (203) 693-4143 with any questions you may have regarding these responses or the forthcoming RI.

Sincerely,

BLASLAND, BOUCK & LEE, INC.

Gary R. Cameron

Gary R. Cameron
Vice President

MJG/mbl
3296842.P

cc: Mr. Mark Lewis, CT DEP
Mr. Liyang Chu, HNUS Corporation
Mr. A.J. Moody, James River Corporation
Mr. William Morris, United Industrial Services
Mr. Bruce Thompson, de maximis, inc.
Mr. Edward R. Lynch, P.E., Blasland Bouck & Lee, Inc.
Mr. Michael J. Gefell, P.G., Blasland Bouck & Lee, Inc.

Attachment 1:

USEPA Letter

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
JOHN F. KENNEDY FEDERAL BUILDING
BOSTON, MASSACHUSETTS 02203-0001

April 4, 1996

Bruce R. Thompson
de maximis, inc.
106 West Mountain Road
Collinsville, CT 06022

RE: SRSNE Superfund Site, Southington, CT
EPA Comments on draft Remedial Investigation Work Plan and draft Project Operations Plan

Dear Mr. Thompson:

EPA, with opportunity for review and comment by the Connecticut Department of Environmental Protection, has completed a review of the "RI Work Plan Addendum" submitted by BBL and dated February 13, 1996 and the draft "Project Operations Plan" submitted by BBL and dated January 1996. Original EPA and State of Connecticut comments on the RI Work Plan were previously distributed to the PRPs on January 24, 1996. PRP responses to these comments were included in the RI Work Plan Addendum.

Enclosed are EPA's additional comments on the draft RI Work Plan and the RI Work Plan Addendum, and comments on the Project Operations Plan. As you know, the Administrative Order on Consent for the Remedial Investigation/Feasibility Study has not yet been finalized. Therefore, this letter is not an approval or disapproval under the Administrative Order. EPA appreciates the willingness of the SRSNE PRP Group to submit deliverables ahead of schedule and looks forward to working with you to finalize these documents so that field work can begin.

Please contact me to discuss the process for revision of the Project Operations Plan.

Sincerely,

Sheila Eckman

Sheila M. Eckman
Remedial Project Manager

Enclosures

cc: Mary Jane O'Donnell, EPA
Alan Klinger, EPA
Charles Porfert, EPA
Liyang Chu, HNUS
Mark Lewis, CT DEP
A.J. Moody, James River Corporation
William Morris, United Industrial Services, In.

cc w/out enclosures:
Gretchen Muench, EPA
Paula Fitzsimmons, EPA

SRSNE Superfund Site
EPA Additional Comments on Remedial Investigation Work Plan (November 1995) and Remedial Investigation Work Plan Addendum (Feb. 13, 1996)
April 4, 1996

1. EPA would prefer that low flow groundwater purging and sampling using peristaltic pumps be used at all monitoring well locations.

2. Section 5.4.4, Monitoring Well Installation: For overburden wells straddling the water table, 15-foot screens are acceptable. Other overburden wells should be installed with 10-foot screens. A 20-foot screen length is not acceptable for a bedrock well in which packer tests have indicated that the screened interval is highly fractured.

3. The RI Work Plan references a plan to "evaluate whether the SRSNE plume may impact domestic water-supply wells" (p. 55). It is assumed that this evaluation will be completed using information collected from bedrock monitoring wells to be installed as part of the RI. If this evaluation results in a potential for migration of contaminants to domestic wells, further investigation will need to be undertaken.

SRSNE Superfund Site
EPA Comments on Project Operations Plan (January 1996)
April 4, 1996

Site Management Plan

1. This plan must be revised to include project organization (proposed Figure 3), a list of subcontractors, and an updated schedule (proposed Figure 4).

Sampling and Analysis Plan

Part 1: Quality Assurance Project Plan

3. General: Include information on the sample preparation procedure proposed for bedrock matrix VOC analysis.

2. Page 4, Section 1.4.2, Ground-Water Samples Data Uses: This section states that the one of the "primary uses of the ground-water samples will be to identify appropriate well screen intervals, ...". The plan discusses the collection of ground-water samples, but does not discuss how the ground-water samples will identify the well screen intervals. A detailed discussion of how the well screen intervals will be located needs to be included in the plan.

   Another primary use of the data is to "characterize the nature and extent of the off-site VOC plume". Before this can be determined, the criteria that will be used to define the plume's boundary in terms of contaminant concentration needs to be discussed in the plan.

3. Page 4, Section 1.4.2, Ground-Water Samples Data Quantity: The following statement states "The ground-water investigation will involve the collection of approximately 165 ground-water samples at wells and piezometers, 23 in-situ ground-water samples as listed in Table 2 of the FSP.". Explain in detail the difference between collecting ground-water samples verses collecting "in-situ ground-water samples" in terms sampling objective, sampling procedure and analysis.

4. Page 5, Section 2, Project Organization and Responsibility: Identify the laboratories that will perform the analyses. When the laboratories are selected, attach the laboratories quality assurance project plans including analytical standard operating procedures to this plan.

5. Page 13, Section 5.3: The temperature within the cooler (i.e. sample temperature) should be measured upon arrival/opening of the sample shipping container at the laboratory, to verify one of the sample preservation

conditions while they were in transit. This is typically accomplished by including a separate container of water in each shipping cooler for temperature measurement upon sample receipt, and is reported with the laboratory data packages. It is suggested that the Laboratory Custody Procedures in the POP include the sample temperature measurement.

6. Page 14, Section 5.3: Samples received by the laboratory on Saturdays should be stored at 4 degrees Centigrade upon receipt. The ice within the sample shipping container should not be relied upon to maintain the required sample temperature over the weekend.

7. Page 15, Section 6.2, Field Instrument Calibration: Add the dissolved oxygen, redox (Eh) and turbidity instrument calibration procedures to this section.

   The field instruments must be calibrated in field at the beginning and end of each day. If the measurements fall outside the calibration range, the instrument must be re-calibrated before continuing. This language needs to be included in this section, Table 6 (Field sampling Plan), and Appendix J (standard operating procedures for these instruments).

8. Page 19, Section 9.2.4: Dedicated sampling devices should also be monitored for the cleanliness of the sampling equipment. For dedicated sampling devices, rinsate blanks would only need to be collected once, during their initial use (i.e., first sampling round). The rinsate blanks would be collected at the same ratio as non-dedicated equipment.

Part 2: Field Sampling Plan

9. Page 3, Section 2.0, Sampling Objectives,,Second bullet, Soil Boring Characterization: Explain the following statement "The in-situ ground-water chemical characterization data (VOCs) will be used to identify appropriate overburden monitoring well screened intervals to characterize the off-site VOC plume." in terms of how this data will be used to determine the screen intervals in the appropriate sections of the plan.

10. Page 4, first paragraph (Section 2.0): "Redox" is listed with typical field measurements (dissolved oxygen, pH) as a parameter to be obtained during the well and piezometer sampling. However, the collection of redox potential measurements during the field activities is not mentioned elsewhere in the SAP, with the exception of Table 1. Please clarify and include the calibration and collection procedures.

11. Page 9, Section 6.5.1: As a precautionary measure, it is recommended that field screening for total VOCs be performed for purge water at all locations prior to selecting the disposal method. Reliance on the 100 ug/l contaminant concentration contour may not be appropriate since groundwater and contaminant flow are dynamic. An aliquot of purge water can be collected and field screened quickly to determine the proper purge water disposal method.

12. Table 1, Field Sampling Plan: The proposed use of an acoustic televiewer is appropriate. This table indicates that the acoustic televiewer would only be used at one well, MW-702. It is suggested that additional locations to be considered include the deep bedrock borings located along the river.

13. Table 1, Field Sampling Plan: A detailed procedure for performing in-situ "rapid analysis for VOCs" in ground water needs to be attached to the plan.

    The procedure for analyzing methane "in the well headspace using colorimetric tubes" needs to be attached to the plan.

14. Table 2, Environmental and Quality Control Analysis: Provide the proper analytical reference for the nitrate, ammonia, sulfate and sulfide analytical methods. These methods are not found in SW-846. See 40 CFR 136 for the proper reference for these methods.

    The note states that "three bedrock matrix samples for volatile organic compound analysis will be preserved by methanol immersion ... .". This type of sampling is not discussed in the plan. The plan needs to discuss the purpose of collecting the samples in this manner, provide the sampling procedure, and how these samples will be prepared and analyzed. This sampling procedure is not provided in the attached standard operating procedure for bedrock drilling and sampling. Methanol preservation of solid samples can only be used when the sample concentrations fall within the criteria for median level samples. Also, the EPA reference cited is not correct, see EPA National Publication Catalog (EPA200-B-94-001) for a list of current publications.

15. Table 4, Required Containers, Preservation Techniques: Change the Total Organic Carbon analytical reference to the Lloyd Kahn Method for the bedrock and soil samples.

16. Table 5, Field Measurements Quality Control: Add turbidity and redox precision and accuracy criteria to the table.

APPENDIX B: Soil Boring and Sampling

17. Page 2, Section III, Procedure: Describe how the samples for VOC analysis will be selected and how the quality control samples will be collected.

APPENDIX C: Hydropunch Ground-Water Sampling Device

18. Pages 3 -5, Section III, Procedures for Hydropunch Use: Include in step twelve the procedure for preserving the VOC samples with hydrochloric acid (HCl), if the samples are to be analyzed off-site.

    Describe how the quality control samples will be collected.

APPENDIX F: Monitoring Well Installation

19. The Stick-up Monitoring Well Detail figure should be modified so that cement is not placed in the annular space between the protective steel casing and the PVC well riser.. A typical well installation practice in Region I is to place the protective steel casing on a one foot layer of sand and then place the cement grout. This allow any water that is spilled during well development and sampling activities to drain out of the protective steel casing. Water trapped in the annular space between the steel casing and the PVC will freeze in the winter and may split the PVC riser. Also, the material built up around the protective casing should not have shoulders. The shoulders represent an area where frost can heave (push against) and potentially dislodge the protective casing.

    A weep or drain hole is usually drilled in the steel casing about two inches above the ground surface to aid in water drainage during sampling and well testing activities.

20. A gripper plug is indicated on the Flush Mounted Monitoring Well Detail figure, presumable to prevent debris and water from entering into the monitoring well. It is suggested that a vented plug be used so that the water level in the monitoring well can respond to head changes in the aquifer. If an unvented plug is used, the water level in the opened monitoring well should be allowed to equilibrate with the aquifer prior to taking a measurement.

APPENDIX G: Well Development

21. Please provide criteria to be used to determine when a well is sufficiently developed, including a maximum time for well development.

APPENDIX I: Ground-Water Sampling

22. Page 3, Step 11: The word "bailer" was apparently omitted from the first sentence. Please clarify which method will be used to remove the purge water from the well. It is not clear if wells are being pumped, bailed, or both.

23. Page 3, Step 12: If a well has been purged dry, please specify the minimum volume of groundwater that must recharge, prior to sampling. The procedure for filtering samples for dissolved constituents should be provided.

24. Page 5, Section III, Procedures: Step fourteen states that ground-water samples collected using a bailer will be analyzed for dissolved oxygen on site. The dissolved oxygen sample must not come in contact with the atmosphere. A bailer is not the appropriate sampling device for collecting samples to be analyzed for dissolved oxygen. Dissolved oxygen can be measured either in-situ by lowering the oxygen probe to the appropriate sampling depth or having the oxygen probe attached to a flow-through-cell and anaerobically pumping the ground-water through the cell using a peristaltic pump. Add the appropriate procedure to this step. Do the same for redox measurement which is required according to Table 1 (Summary of Phase 1 Field Investigating Activities).

    Describe how the quality control samples will be collected.

APPENDIX J: Temperature, Conductivity, pH and Dissolved Oxygen Field Measurements

25. Page 1, Section 1, Introduction: Change the following sentence "Calibration will be in accordance with manufacture's instruction, ..." to "Calibration will be in accordance with EPA analytical methods and manufacture's instruction, ..."

26. Page 2, Section III, Procedures: Add the redox sampling and calibration procedure to this section.

APPENDIX L: Equipment Decontamination

27. Table 1 Sampling Equipment Cleaning: Step three of the organic cleaning procedure states that methanol will be used as a cleaning solvent. Since methanol is a listed waste, it will require proper disposal. If you wish, you may use isopropyl alcohol in place of methanol. Also, in the case of heavily contaminated equipment from sampling oily NAPLs, you may want to clean the equipment with hexane prior to cleaning with alcohol.

Step three of the inorganic cleaning procedure states that nitric acid will be used as a cleaning solution. Region 1 recommends that this step be used only if necessary. Nitric acid may corrode the metallic sampling equipment.

Attachment 2:

Site Management Plan
(Bound Separately)

Attachment 3:

Quality Assurance Project Plan (Bound Separately)

Attachment 4:

Field Sampling Plan
(Bound Separately)

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Transmitted Via Facsimile/U.S. Mail

July 18, 1996

Ms. Sheila Eckman
United States Environmental Protection Agency
90 Canal Street
Boston, MA 02114

Re: SRSNE Site
RI Work Plan
Addendum No. 3
Project #: 1028.08330 #2

Dear Ms. Eckman:

This letter serves as Addendum No. 3 to the Remedial Investigation (RI) Work Plan (November 1995) for the Solvents Recovery Service of New England (SRSNE) Site in Southington, Connecticut. The RI Work Plan and associated Project Operations Plan (POP), dated January 1996, were prepared on behalf of the SRSNE Potential Responsible Parties (PRP) Group by Blasland, Bouck & Lee, Inc. (BBL).

The first RI Work Plan Addendum (February 13, 1996) was prepared by BBL to address initial comments on the RI Work Plan offered by the United States Department of Environmental Conservation (USEPA), Haliburton NUS Corporation (HNUS), and the Connecticut Department of Environmental Protection (CT DEP). RI Work Plan Addendum No. 2 (June 7, 1996) addressed additional USEPA comments regarding the RI Work Plan and the first RI Work Plan Addendum, and the associated Project Operations Plan (POP) (BBL, January 1996), as presented to the SRSNE PRP Group in a letter dated April 4, 1996. RI Work Plan Addendum No. 2, which was submitted to USEPA and CT DEP at a meeting in Boston on June 10, 1996, included the following revised POP documents: 1) Site Management Plan (BBL, June 1996); and Sampling and Analysis Plan (SMP), including Part 1: Quality Assurance Project Plan (QAPP; BBL, June 1996) and Part 2: Field Sampling Plan (FSP; BBL, June 1996).

This RI Work Plan Addendum No. 3 provides responses to USEPA comments presented to the SRSNE PRP Group in a letter dated July 2, 1996 regarding the revised Sampling and Analysis Plan (SAP) documents that were submitted with RI Work Plan Addendum No. 2. With the exception of one comment contained within the July 2, 1996 USEPA cover letter, the new comments were prepared by USEPA's Quality Assurance Unit and presented in a memorandum dated June 27, 1996. Copies of the July 2, 1996 letter and June 27, 1996 memorandum are included as Attachment 1.

Responses to the two groups of comments listed above comprise the remainder of this RI Work Plan Addendum No. 3.

Responses to July 2, 1996 USEPA Cover Letter: SRSNE Superfund Site, Southington, CT, EPA Additional Comments on Revised Project Operations Plan

In the July 2, 1996 cover letter, USEPA requested clarification of the NTU value that will be used to determine that turbidity has been reduced to a reasonable practical level during well development.

6723 Towpath Road • P.O. Box 66 • Syracuse, NY 13214-0066
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In accordance with well development procedure in the revised FSP (BBL, June 1996), BBL had proposed to visually assess turbidity rather than require a specific NTU criterion during well development. The well development procedure included in the FSP, which originally included only visual assessment of turbidity, was consistent with the well development procedure included in the USEPA-approved Demonstration of Compliance Plan (DCP, BBL, June 1995) and the Final Soil, Groundwater, and Additional Studies Workplan for the SRSNE Site (ENSR, March 1994). Based on the site geologic conditions and our experience developing wells at the site, BBL found that within approximately 2 hours of beginning development, development purge water cleared from an initial, "very high" level to a persistent, "low-to-moderate" turbidity level. Further development efforts resulted in no further reduction of turbidity levels, and development was considered to be complete. The stabilized turbidity at the end of development, however, was always visible and considerably above a clarity level that would require NTU measurement to discern.

While BBL believes that visual assessment of turbidity is sufficient based on our experience installing and developing wells at the SRSNE Site, as we discussed with Mr. Dick Wiley (USEPA Region I) on July 12, 1996, BBL will measure the purge-water turbidity during well development to help quantify the turbidity levels observed during development. BBL will use a portable turbidity meter to measure the turbidity periodically during the development of each new monitoring well installed during the forthcoming RI. Well development will continue until the turbidity stabilizes based on visual observation and turbidity measurements, and a minimum of 5 well volumes have been removed. No specific turbidity criterion will be used to determine that development is complete, but the turbidity measurements will provide a quantitative basis to demonstrate that the turbidity level has stabilized. As requested by Mr. Wiley, toward the end of the development process, the purge rate will be reduced to a flow appropriate for ground-water sampling, and a final turbidity measurement will be obtained. This information has been added to the revised Appendix G of the FSP - Well Development (see Attachment 2).

Responses to June 27, 1996 Memorandum: Quality Assurance Review: SRSNE Site, Sampling and Analysis Plan, Southington, CT, June 1996, prepared by Blasland, Bouck & Lee, Inc. (BBL)

The responses presented below address comments prepared by USEPA's Quality Assurance Unit regarding the revised SMP, which includes the following revised documents:

- Quality Assurance Project Plan (QAPP); and
- Field Sampling Plan (FSP).

In addition to the responses provided below, revised portions of the QAPP and FSP are included as attachments to this RI Work Plan Addendum No.3.

I. Part 1 Quality Assurance Project Plan

1. Page 4, Section 1.4.2, Ground-Water Samples

Twenty-three *in-situ* ground-water samples will be obtained at approximately 10-foot depth increments during drilling at three proposed well cluster locations (MW-703, MW-704, and MW-707) prior to well installation, using a direct-push, Hydropunch™ or equivalent sampling device. References to *in-situ* ground-water samples or *in-situ* ground-water sampling within the RI Work Plan and the POP documents indicate direct-push, Hydropunch™ samples that will be obtained during drilling at these three locations. *In-situ* ground-water samples will be sent to Galson Laboratories for analysis of VOCs by USEPA Method 601/602 with 48-hour turnaround. The *in-situ* ground-water samples will provide a tool to assess the ground-water VOC concentration profile with depth in the thick overburden prior to well installation to help select appropriate depths to install overburden monitoring wells at these three locations. Thus, the *in-situ* ground-water samples will *not* be used to delineate the overburden VOC plume, but will provide a VOC screening tool to identify appropriate well screen depths at the three specified drilling locations. *In-situ* ground-water sampling procedures are described in detail in Appendix C of the FSP (Use of the Hydropunch™ Ground-Water Sampling Device). The criteria for monitoring well screen placement are described in detail in Appendix F of the FSP (Monitoring Well Installation).

In contrast to "*in-situ* ground-water samples," "ground-water samples" will be obtained (after drilling operations) using ground-water sampling pumps and/or bailers from essentially all accessible monitoring wells, ground-water extraction wells, and piezometers in the RI Study Area. References to "ground-water samples" or "ground-water sampling" within the RI Work Plan and the POP documents, in general, indicate samples that will be obtained from the approximately 165 accessible wells and piezometers. Ground-water samples obtained from wells and piezometers will be sent to appropriate analytical laboratories for analysis of VOCs (CLP-RAS 10-92, low concentration organics in water, modified to include tetrahydrofuran), alcohols (SW-846 Method 8015), geochemical analytes (various methods), and biochemical analytes (various methods). A complete list of ground-water analytes and analytical methods is provided in Table 2 of the FSP. The analytical results from the ground-water samples obtained from wells and piezometers will be used to help delineate the three-dimensional VOC (and alcohol) plumes in overburden and bedrock and characterize the ground-water geochemistry and biochemistry to help evaluate potential ground-water remedial alternatives.

This information has been added to the revised Section 1.4.2, Ground-Water Samples, Data Uses in the QAPP (see Attachment 3).

2. Page 18, Section 7, Analytical Methods

A table of analytical data reporting limits has been added to the QAPP (see Attachment 4).

II. Part 2 Field Sampling Plan

1. Page 4, Section 2, Sampling Objectives, Well and Piezometer Sampling

The speciation of Fe (III)/Fe(II), and Mn(IV)/Mn(II) will not be explicitly analyzed for during the forthcoming RI. As recommended by Dr. Guy Sewell, of the USEPA's Robert S. Kerr Laboratory in Ada, Oklahoma in a telephone discussion with BBL on July 16, 1996, the relative speciation of Fe (III)/Fe(II), and Mn(IV)/Mn(II) will be *estimated* based on the total and dissolved concentrations of these metals in ground-water samples from the select group of wells listed in Section 2 of the FSP. It is assumed that the dissolved fraction of Fe and Mn represent predominantly the Fe(II) and Mn(II) valence states, respectively. The Fe(III) and Mn(IV) concentrations will be calculated by subtracting the dissolved Fe and Mn concentrations from the total Fe and Mn concentrations, respectively. This section of the FSP has been revised to clarify that the ground-water analytes of concern will be the total and dissolved Fe and Mn concentrations. The reporting limits for these analytes are specified in Table 1 of the QAPP (see Attachment 4).

Each ground-water sample that will be analyzed for dissolved Fe and Mn will be filtered in the field using in-line, disposable 0.45 micron filter and then preserved by acidification to pH<2. The ground-water samples that will be analyzed for total Fe and Mn will not be filtered, but will be acidified to pH<2. Based on our July 16, 1996 discussion with Dr. Sewell, minimizing contact with atmospheric oxygen is not critical to sample quality when samples are preserved by acidification. However, as an added precaution, BBL will minimize agitation of the ground-water samples obtained for analysis of total or dissolved Fe and Mn, and will minimize the headspace in the sample bottles.

2. Table 5, Field Measurement Quality Control

The precision limit for redox (ORP) measurement has been added to Table 5 of the FSP.

3. Appendix D, Bedrock Drilling and Sampling, Pages 3-4, Section III, Procedures

As written, the methanol preservation described in FSP Appendix D includes the appropriate ratio requirement between rock and methanol. USEPA's methanol immersion procedure for preserving solid matrix samples (*in* EPA/540/4-91/001) calls for the transfer of the sample into a glass jar containing a known volume of chromatigraphic-grade methanol to provide a 1:1 weight-to-volume ratio of solid sample to methanol. Assuming a rock mineral density of approximately 2.65 g/cm^3, a crushed-rock sample porosity of approximately 0.3, and a methanol density of approximately 0.7924 g/cm^3, BBL calculated that approximately 34.4 cm^3 of solid rock fragments, or 49.2 cm^3 of pulverized rock material (assuming 0.3 porosity) in the 125 mL sample jar will provide the recommended 1:1 weight-to-volume ratio of solid sample to methanol. The calculated volume of 49.2 cm^3 pulverized rock material constitutes approximately 39% of the capacity of the 125 mL sample jar. Therefore, BBL concludes that the sample jar should be packed to fill approximately 40% of the jar capacity with pulverized rock material prior to adding the methanol, as specified in FSP Appendix D. The weight of rock material and methanol placed in the sample jar will be measured in the field, and the methanol density will be used to calculate the methanol volume.

We understand that the methanol preservation method will raise the analyte detection levels, but recommend its use for the bedrock VOC samples because the VOC concentrations are likely to be several orders of magnitude above the method detection levels. In addition, the methanol preservation method will promote the extraction of VOCs from the pulverized bedrock fragments, some of which will be up to 0.5 cm in diameter, upon placement in the sample jar.

III. Bioremediation Analytical Methods

USEPA's Quality Assurance Unit offered comments regarding the biochemical analytical SOPs provided in Appendix A of the QAPP. Responses to these comments have been prepared by the two analytical laboratories that will perform these specialized analyses, including: 1) Microseeps, of Pittsburgh, Pennsylvania and 2) Microbial Insights, Inc., of Knoxville, Tennessee.

1. Analytical Method AM18, Analysis of C1-C4 Hydrocarbons in Water, MICROSEEPS

Responses to these comments were prepared by Microseeps, and are provided as Attachment 5.

2. Standard Operating Procedures Summaries for Lipid Extraction and Lipid Separation from Microbial Insights, Inc.

Responses to these comments were prepared by Microbial Insights, Inc., and are provided as Attachment 6.

Proposed Additional Site Characterization

In addition to the modifications described above, the SRSNE PRP Group proposes to obtain further ground-water characterization data to support the evaluation of ground-water remedies involving bioremediation and/or reaction walls, and characterize the ground-water quality and/or geology at two former private water-supply wells in the vicinity of the site.

To help evaluate the feasibility of in-situ remedial technologies for ground water, wells P-8A and P-8B, in the upgradient portion of the Operations Area, will be added to the list of wells that will be sampled for appropriate ground-water characteristics (total and dissolved Fe and Mn, nitrate, ammonia, sulfate, sulfide, TOC, orthophosphate, chloride, phospholipid fatty acids, methane, ethane, ethene, redox, and dissolved oxygen). Wells P-8A and P-B have consistently shown no detectible VOCs and will provide appropriate locations to characterize the background concentrations of the geochemical and biochemical parameters appropriate to evaluate in-situ remedial alternatives for ground water.

As suggested by USEPA at the meeting in Boston on June 10, 1996, an effort will be made to obtain ground-water quality and/or geologic information from the former Mickey's Garage (Maiellaro) Well, if accessible, after the downhole pumping equipment is removed from the well. The SRSNE PRP Group will provide the Mickey's Garage (Maiellaro) property with public water service in the near future. Per USEPA request, the former

Mickey's Garage Well will not be grouted following the removal of the pumping equipment, but will remain intact to allow access for additional geologic and/or hydrogeologic characterization, as appropriate. Also, during the implementation of the Wetlands Mitigation in June and July 1996, the former Cianci Well was found in the northern portion of the former Cianci Property. The former Cianci Well was shown on historical site maps (Wehran, January 1992), and historically indicated elevation concentrations of VOCs in ground-water samples obtained from the well. These conditions could influence the delineation of the VOC plume and/or technical impracticability zone at the site, and warrant a limited field evaluation. To assess the current ground-water quality at the former Cianci Well and, if accessible, the former Mickey's Garage Well, the following activities will be performed during the forthcoming RI field mobilization:

- Access the former Cianci Well and former Mickey's Garage Well and remove the pipes and pumping equipment;
- Measure the depths of the wells;
- Monitor the bottom of each well for the presence of DNAPL and remove DNAPL, if present; and
- Purge each well and obtain a ground-water sample for analysis of VOCs by CLP-RAS methods and alcohols by SW-846 Method 8015.

Also, if the downhole condition of these wells is suitable for downhole logging (no apparent obstructions, straight and plumb casing, etc.), BBL will make an effort to coordinate with the geophysical logging subcontractor (COLOG, Inc.) to log one or both of these wells using acoustic televiewer and/or borehole image processing system (BIPS) within the one day allotted for downhole data acquisition.

We trust that these responses meet your needs. Following USEPA approval of the information provided above, the POP documents will be finalized as separately-bound submittals.

Please do not hesitate to call Mr. Bruce Thompson of de maximis, inc., at (860) 693-4143 if you have any questions.

Sincerely,

BLASLAND, BOUCK & LEE, INC.

Gary R. Cameron

Gary R. Cameron
Vice President

MJG/mbl
1396359.1

cc: Mr. Mark Lewis, CT DEP
Mr. Liyang Chu, HNUS Corporation
Mr. A.J. Moody, James River Corporation
Mr. William Morris, United Industrial Services
Mr. Bruce Thompson, de maximis, inc.
Mr. Edward R. Lynch, P.E., Blasland Bouck & Lee, Inc.
Mr. Michael J. Gefell, P.G., Blasland Bouck & Lee, Inc

Attachment 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

July 2, 1996

Bruce R. Thompson
de maximis, inc.
106 West Mountain Road
Collinsville, CT 06022

RE: SRSNE Superfund Site, Southington, CT
EPA Comments on Revised Project Operations Plan

Dear Mr. Thompson:

EPA, with opportunity for review and comment by the Connecticut Department of Environmental Protection, has completed a review of the revised "Sampling and Analysis Plan" (SAP) submitted by BBL and dated June 1996. Enclosed are comments from our Quality Assurance Unit regarding the revised SAP, including the additional parameters proposed for evaluation of groundwater bioremediation.

In addition to the attached comments, please clarify what NTU value will be used to determine that turbidity has been reduced to a reasonable practical level during well development.

Please respond to the above comment and enclosed comments via letter addendum to the SAP. If you have any questions, please contact me at (617)573-5784.

Sincerely,

Sheila M. Eckman
Remedial Project Manager

Enclosure

cc: Mary Jane O'Donnell, EPA
Alan Klinger, EPA
Charles Porfert, EPA
Liyang Chu, HNUS
Mark Lewis, CT DEP
A.J. Moody, James River Corporation
William Morris, United Industrial Services, In.
Mike Gefell, BBL

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
OFFICE OF ENVIRONMENTAL MEASUREMENTS & EVALUATION
60 WESTVIEW STREET, LEXINGTON, MA 02173-3185

MEMORANDUM

DATE: June 27, 1996

SUBJ: Quality Assurance Review:
SRSNE Site
Sampling and Analysis Plan
Southington, CT
June 1996
prepared by Blasland, Bouck
& Lee, Inc. (BBL)

FROM: Charles Porfert
Nora J. Conlon, Ph.D.
Ann Jefferies
Quality Assurance Unit

TO: Sheila Eckman
HBT

The above plan was reviewed by the Quality Assurance Unit. Below are comments on the plan.

I. PART 1 QUALITY ASSURANCE PROJECT PLAN

1. Page 4, Section 1.4.2, Ground-Water Samples

This section discusses both "in-situ ground-water sampling" and "ground-water sampling". However, the section does not explain the differences between the two ground-water sampling procedures or why two procedures are needed. The section does reference sampling procedures in the Field Sampling Plan (FSP), but these are ground-water sampling procedures. These procedures describe: 1. how the sample is collected at a specific depth, 2. how the sample is brought to the surface and transferred from the sampling device to the sample container, and 3. sent to the laboratory for analysis. The section needs to explain how the "in-situ ground-water" samples are collected and analyzed, and why the samples are different than the "ground-water samples".

2. Page 18, Section 7, Analytical Methods

Add to this section a table listing the quantitation or reporting limits for each analyte by analytical method for the analytes of concern.

II. PART 2 FIELD SAMPLING PLAN (FSP)

1. Page 4, Section 2, Sampling Objectives
   Well and Piezometer Sampling

This section states that supplemental ground-water parameters, "Fe (III)/Fe(II)" and "Mn(IV)/Mn(II)" will be collected. Add to Table 2 (Environmental and Quality Control Analyses) the analytical speciation methods and the quality control samples that go along with the methods for these analytes. In addition, include the quantitation or reporting limits for each of these parameters.

The sampling procedures that will be used to collect and preserve "Fe (III)/Fe(II)" and "Mn(IV)/Mn(II)" samples need to be included in the plan. These procedures must include how the samples will be collected without coming in contact with atmospheric oxygen. Atmospheric oxygen will change the metal oxidation state thus leading to erroneous results of the above ratios.

2. Table 5, Field Measurements Quality Control

Add the precision limit for the Redox field parameter to the table.

3. Appendix D, Bedrock Drilling and Sampling
   Pages 3 - 4, Section III, Procedures

The procedure states that pulverized rock will be placed into a sample container and "packed to fill approximately 40% of the jar capacity". Jar's capacity is 125 ml. This procedure needs to include a ratio requirement between the amount of pulverized rock to the amount of methanol added to the sample container. If too much methanol is added to the sample, then contaminants in the sample may be diluted out and may not be detected.

III. BIOREMEDIATION ANALYTICAL METHODS

The following are comments on the bioremediation analytical methods that are included in Appendix A of the Quality Assurance Project Plan for the site. It is our understanding that these methods are used only for monitoring the progress of the bioremediation. Therefore, these comments are provided to address some general observations for these monitoring methods.

1. Analytical Method AM18, Analysis of C1-C4 Hydrocarbons in
   Water, MICROSEEPS.

This SOP contains most of the information necessary to evaluate the analytical method. The laboratory appears to understand the need to set quality control criteria for calibrations and blanks and to have associated actions for analyses which do not meet the criteria. Some specific comments are listed for some points which need clarification.

1. The quantitation range for this method is unclear. There are no method detection limits listed. The linear range has not been designated. Both the MDL and the quantitation range should be addressed to confirm that they meet the project needs. In addition, it should be determined if a multipoint calibration is required for this project.

2. What are the final concentration units? When all the units were factored out, ng/L = μg/L x 10^{-12} were left.

3. Quality Control Issues

   a. Many good QC steps are included such as termination of analyses when calibration criteria are not met, syringe blanks, and calibration record retention.

   b. Are water blanks analyzed to determine ambient concentrations of these analytes?

   c. Are samples taken in duplicate or triplicate to allow for reanalysis, if necessary?

   d. Are calibration standards verified by a second independent source?

   e. Are any analyses performed to provide assessments of bias, such as spiked samples, and precision, such as replicates?

2. Standard Operating Procedures Summaries for Lipid Extraction and Lipid Separation from Microbial Insights, Inc.

These Standard Operating Procedures Summaries provide a general outline of the extraction and separation procedures; however, there is insufficient information to evaluate the adequacy of these preparative methods. For example, no quality control analyses are included, with the exception of the solvent check, which would allow evaluation of the method. In addition, the lipid GC/MS analysis SOP was not included, therefore, no comments can be made about identifications and quantifications. The lipid GC/MS analysis SOP needs to be included in the site's quality assurance plan.

General areas which should be addressed for the preparative steps include:

1. Method blank analyses to demonstrate that contamination is not introduced during the method. Criteria should be set with associated corrective actions for blanks which fail the criteria.

2. Spiked sample analyses (QC check samples) to demonstrate the quantitative recovery of lipids by this method. Recovery limits should be set with associated corrective actions for outliers.

3. Additional stepwise information on the extraction and separation process.

If you have any questions concerning the review, please call me at (617)-860-4313 or 4300.

Please send me the revised plan to determine if the comments have been adequately addressed.

Attachment 2

STANDARD OPERATING PROCEDURE

Well Development

STANDARD OPERATING PROCEDURE

Well Development

I. Introduction

All newly installed wells and piezometers will be developed (i.e., cleared of fine-grained materials and sediments) to enhance the hydraulic connection between the well and formation, and ensure the screen is transmitting ground water representative of the surrounding formation waters. Development will be accomplished by surging (using as surge block, where possible) and evacuating well water by either pumping (preferred) or bailing. Acceptable pumping methods include the use of the following:

1. Electric submersible pump;
2. Surface inertial pump;
3. Centrifugal pump; and
4. Peristhaltic pump.

When developing a well using the pumping methods, the pump intake is placed in the screened section of the well and slowly lowered and raised in the screened interval. A centrifugal pump uses atmospheric pressure to lift water from the well and, therefore, can only be used where the depth to water is less than 25 feet. Alternately, a submersible pump is attached to the end of the tubing that goes into the well, pushing the water to the surface, and is effective for all wells, particularly where ground water is greater than 25 feet below land surface. The tubing is manually lifted and lowered within the screened interval to pull in fine sand and silt. To lift water from the well, the pump is turned on, forcing silty water up through the tubing. Surging is repeated as many times as necessary within the well screen interval until the ground water is relatively clear. During the development process, turbidity measurements will be obtained at a rate of at least one reading per well volume purged from the well using a portable turbidity meter.

Well development will continue until the purged water is visually free of suspended sediment, the turbidity of the purged water has been reduced to a consistent level based on visual observation and turbidity measurements, and a minimum of five well volumes have been removed from the well. Based on observations made during the development of the NTCRA 1 compliance piezometers, the well development duration will likely be approximately 2 to 6 hours per well.

At the end of development at each well, the purge rate will be reduced to a flow appropriate for ground-water sampling, and a final turbidity measurement will be obtained.

II. Materials

A. Materials for monitoring well development using a pump include:

- Health and safety equipment (as required by the Health and Safety Plan);
- Cleaning equipment;
- Photoionization detector (PID) to measure headspace vapors;
- Pump discharge tubing;
- Plastic sheeting;
- Power source;
- Field notebook;
- Graduated pails;
- Turbidity meter;
- Pump; and
- 55-gallon DOT-approved drums.

B. Materials for monitoring well development using a bailer include:

- Personal protective equipment (as required by the Health and Safety Plan);
- Cleaning equipment;
- Photoionization detector to measure headspace vapors;
- Bottom-loading bailer;
- Polypropylene or nylon rope;
- Plastic sheeting;
- Turbidity meter;
- Graduated pails; and
- 55-gallon DOT-approved drums.

III. Development Procedures

The procedure for developing a ground-water well by pumping is as follows:

1. Don appropriate personal protective equipment (as required by the Health and Safety Plan);

2. Place plastic sheeting around the well;

3. Clean non-disposable development equipment as specified in the Standard Operating Procedure for Equipment Decontamination;

4. Open the well cover while standing upwind of the well. Remove well cap and place it on the plastic sheeting. Insert the PID probe approximately 4 to 6 inches into the casing or the well headspace, and cover the probe with your gloved hand. Record the PID reading in the field log. If the well headspace reading is less than 5 PID units, proceed; if not, screen the air within the breathing zone. If the PID reading

in the breathing zone is below 5 PID units, proceed. If the PID reading is above 5 PID units, move upwind from the well and allow the volatiles to dissipate. Repeat the breathing zone test. If the reading is still above 5 PID units, put on appropriate respiratory protection, in accordance with the requirements of the Health and Safety Plan. Record all PID readings;

5. Lower the pump into the well casing below the water level and cycle it up and down to force water in and out of the screen slots and formation. After surging the well, formation water will be recovered by pumping;

6. If the well runs dry while developing with a pump, shut off the pump and allow the well to recover;

7. When development is complete, based on the criteria specified in the introduction to this procedure, secure the lid back on the well; and

8. Place plastic sheeting and tubing in plastic bags for appropriate disposal, and clean the pump.

The procedure for developing a well using the bailer method is outlined below:

1. Don appropriate personal protective equipment (as required by the Health and Safety Plan);

2. Place plastic sheeting around the well;

3. Clean non-disposable bailers as specified in the Standard Operating Procedure for Equipment Decontamination;

4. Open the well cover while standing upwind of the well. Remove the well cap and place it on the plastic sheeting. Insert PID probe approximately 4 to 6 inches into the casing or the well headspace and cover the probe with your gloved hand. Record the PID reading in the field log. If the well headspace reading is less than 5 PID units, proceed; otherwise, screen the air within the breathing zone. If the PID reading in the breathing zone reading is less than 5 PID units, proceed. If the PID reading in the breathing zone is above 5 PID units, move upwind from the well to allow the volatiles to dissipate. Repeat the breathing zone test. If the reading is still above 5 PID units, put on appropriate respiratory protection, in accordance with the requirements of the Health and Safety Plan. Record all photoionization detector readings;

5. Determine the depth of the well through examination of drilling log data, and measure a length of rope at least 10 feet greater than the total depth of the well;

6. Secure one end of the rope to the well casing, secure the other end of the rope to the bailer. Test the knots and make sure the rope will not loosen. Check bailers to be sure all parts are intact and will not be lost in the well;

7. Lower the bailer into the well until the bailer reaches the total depth of the well;

8. Surge by raising and lowering the bailer at 2-foot intervals;

9. Lower the bailer back into the well and repeat raising and lowering at an interval 2 feet above the previously surged interval;

10. Repeat Step 8 until the entire screen has been surged;

11. If significant silt remains in the purge water after surging the entire screen, and the turbidity has not stabilized, repeat Step 7 through Step 9;

12. When development is complete, based on the criteria stated in the introduction to this procedure, remove the bailer, and remove the rope from the bailer and the well;

13. Secure the lid back on the well; and

14. Place plastic sheeting and polypropylene rope in plastic bags for appropriate disposal, and clean the bailer.

IV. Disposal Methods

For wells that have been previously sampled, purge water will be containerized and treated at the NTCRA 1 treatment system if the total VOC content was greater than 50 micrograms per liter (ug/l) during the most recent sampling event. Similarly, for wells or piezometers that have not been sampled previously, purge water will be contained and treated at the NTCRA 1 treatment system if the well/piezometer is within the 50 ug/l contour line for overburden (FSP Figure 7) or bedrock (FSP Figure 8), as appropriate. Purge water from wells in public, visible areas (such as easements along roads) will be contained and treated at the NTCRA 1 treatment system. Purge water from the remaining wells/piezometers will be placed on the ground adjacent to the well/piezometer.

Attachment 3

PARCC Parameters

Precision and accuracy quality control limits for chemical constituents which are applicable to data validation to assess analytical performance are listed in the published analytical procedures. Data representativeness is addressed by the sample quantities and locations identified in the RI Work Plan and the FSP. Data comparability is intended to be achieved through the use of standard, USEPA-approved, or other published methods. Data completeness will be assessed at the conclusion of the RI.

1.4.2 Ground-Water Samples

Data Uses

Twenty-three *in-situ* ground-water samples will be obtained at approximately 10-foot depth increments during drilling at three proposed well cluster locations (MW-703, MW-704, and MW-707) prior to well installation, using a direct-push, Hydropunch™ or equivalent sampling device. References to *in-situ* ground-water samples or *in-situ* ground-water sampling within the RI Work Plan and the POP documents indicate direct-push, Hydropunch™ samples that will be obtained during drilling at these three locations. *In-situ* ground-water samples will be sent to Galson Laboratories for analysis of VOCs by USEPA Method 601/602 with 48-hour turnaround. The *in-situ* ground-water samples will provide a tool to assess the ground-water VOC concentration profile with depth in the thick overburden, prior to well installation, to help select appropriate depths to install overburden monitoring wells at these three locations. Thus, the *in-situ* ground-water samples will *not* be used to delineate the overburden VOC plume, but will provide a VOC screening tool to identify appropriate well screen depths at the three specified drilling locations. *In-situ* ground-water sampling procedures are described in detail in Appendix C of the FSP (Use of the Hydropunch™ Ground-Water Sampling Device). The criteria for monitoring well screen placement are described in detail in Appendix F of the FSP (Monitoring Well Installation).

In contrast to "*in-situ* ground-water samples," which will be obtained (during drilling) using a direct-push, Hydropunch™ or equivalent sampling device, "ground-water samples" will be obtained (after drilling operations) using ground-water sampling pumps and/or bailers from essentially all accessible monitoring wells, ground-water extraction wells, and piezometers in the RI Study Area. References to "ground-water samples" or "ground-water sampling" within the RI Work Plan and the POP documents, in general, indicate samples that will be obtained from the approximately 165 accessible wells and piezometers. Ground-water samples will be sent to appropriate analytical laboratories for analysis of VOCs (CLP-RAS 10-92, low concentration organics in water, modified to include tetrahydrofuran), alcohols (SW-846 Method 8015), geochemical analytes (various methods), and biochemical analytes (various methods). A complete list of ground-water analytes and analytical methods is provided in Table 2 of the FSP. The analytical results from the ground-water samples obtained from wells and piezometers will be used to help delineate the three-dimensional VOC (and alcohol) plumes in overburden and bedrock and characterize the ground-water geochemistry and biochemistry to help evaluate potential ground-water remedial alternatives.

The criteria that will be used to define the extent of the off-site VOC plume related to the SRSNE Site are described at length in Section 4.3.3 of the RI Work Plan (BBL, November 1995).

Data Types

Table 1 of the FSP presents the types of ground-water samples that will be collected for analysis. Table 2 of the FSP presents the specific parameters for which the ground-water samples will be analyzed. The rationale for selection of these parameters is discussed in the RI Work Plan and the FSP. Additional ground-water parameters, including methane, ethane, ethene, TOC, chloride, orthophosphate, and phospholipid fatty acids, will be obtained to provide additional characterization needed to evaluate ground-water remedies involving bioremediation and/or reaction wells.

Attachment 4

TABLE 1
SRSNE SITE
SOUTHINGTON, CONNECTICUT
QUALITY ASSURANCE PROJECT PLAN

ANALYTICAL DATA REPORTING LIMITS

Parameter	Reporting Limit[1]			
	Low Water[2]	Water	Soil[3]	Medium Soil[3]
TCL Volatile Organics (CLP-RAS and SW-846 Method 8240)				
Chloromethane	1	10	10	1200
Bromomethane	1	10	10	1200
Vinyl Chloride	1	10	10	1200
Chloroethane	1	10	10	1200
Methylene Chloride	2	10	10	1200
Acetone	5	10	10	1200
Carbon Disulfide	1	10	10	1200
1,1-Dichloroethene	1	10	10	1200
1,1-Dichloroethane	1	10	10	1200
1,2-Dichloroethene (total)	--	10	10	1200
cis-1,2-Dichloroethene	1	--	--	--
trans-1,2-Dichloroethene	1	--	--	--
Chloroform	1	10	10	1200
1,2-Dichloroethane	1	10	10	1200
2-Butanone	5	10	10	1200
Bromochloromethane	1	--	--	--
1,1,1-Trichloroethane	1	10	10	1200
Carbon Tetrachloride	1	10	10	1200
Bromodichloromethane	1	10	10	1200
1,2-Dichloropropane	1	10	10	1200
cis-1,3-Dichloropropene	1	10	10	1200
Trichloroethene	1	10	10	1200
Dibromochloromethane	1	10	10	1200

TABLE 1
SRSNE SITE
SOUTHINGTON, CONNECTICUT
QUALITY ASSURANCE PROJECT PLAN

ANALYTICAL DATA REPORTING LIMITS (cont.)

Parameter	Reporting Limit[1]			
	Low Water[2]	Water	Soil[3]	Medium Soil[3]
1,1,2-Trichloroethane	1	10	10	1200
Benzene	1	10	10	1200
trans-1,3-Dichloropropene	1	10	10	1200
Bromoform	1	10	10	1200
4-Methyl-2-pentanone	5	10	10	1200
2-Hexanone	5	10	10	1200
Tetrachloroethene	1	10	10	1200
Toluene	1	10	10	1200
1,2-Dibromoethane	1	--	--	--
1,1,2,2-Tetrachloroethane	1	10	10	1200
Chlorobenzene	1	10	10	1200
Ethylbenzene	1	10	10	1200
Styrene	1	10	10	1200
Xylenes (total)	1	10	10	1200
1,2-Dichlorobenzene	1	--	--	--
1,3-Dichlorobenzene	1	--	--	--
1,4-Dichlorobenzene	1	--	--	--
1,2-Dibromo-3-chloropropene	1	--	--	--
Tetrahydrofuran	1	--	--	--
Volatile Organics (USEPA Method 601/602)				
Chloromethane	--	0.5	--	--
Bromomethane	--	5.0	--	--
Vinyl Chloride	--	1.0	--	--
Chloroethane	--	5.0	--	--

TABLE 1
SRSNE SITE
SOUTHINGTON, CONNECTICUT
QUALITY ASSURANCE PROJECT PLAN

ANALYTICAL DATA REPORTING LIMITS (cont.)

Parameter	Reporting Limit[1]			
	Low Water[2]	Water	Soil[3]	Medium Soil[3]
Methylene Chloride	--	1.0	--	--
1,1-Dichloroethene	--	0.1	--	--
1,1-Dichloroethane	--	0.5	--	--
trans-1,2-Dichloroethene	--	0.5	--	--
Chloroform	--	0.5	--	--
1,2-Dichloroethane	--	0.1	--	--
1,1,1-Trichloroethane	--	0.1	--	--
Carbon Tetrachloride	--	0.5	--	--
Bromodichloromethane	--	0.5	--	--
1,1,2,2-Tetrachloroethane	--	0.1	--	--
1,2-Dichloropropane	--	0.5	--	--
trans-1,3-Dichloropropene	--	1.0	--	--
Trichloroethene	--	0.5	--	--
Dibromochoromethane	--	0.5	--	--
1,1,2-Trichloroethane	--	0.1	--	--
cis-1,3-Dichloropropene	--	0.5	--	--
2-Chloroethyl vinyl ether	--	0.5	--	--
Bromoform	--	1.0	--	--
Tetrachloroethene	--	0.1	--	--
Trichlorofluoromethane	--	2.0	--	--
Benzene	--	1.0	--	--
Toluene	--	1.0	--	--
Chlorobenzene	--	1.0	--	--
Ethylbenzene	--	1.0	--	--

TABLE 1
SRSNE SITE
SOUTHINGTON, CONNECTICUT
QUALITY ASSURANCE PROJECT PLAN

ANALYTICAL DATA REPORTING LIMITS (cont.)

Parameter	Reporting Limit[1]			
	Low Water[2]	Water	Soil[3]	Medium Soil[3]
1,2-Dichlorobenzene	--	1.0	--	--
1,3-Dichlorobenzene	--	1.0	--	--
1,4-Dichlorobenzene	--	1.0	--	--
Alcohols (SW-846 Method 8015)				
Methanol	--	1000	--	--
Ethanol	--	1000	--	--
n-Butanol	--	1000	--	--
n-Propanol	--	1000	--	--
Light Hydrocarbons (Microseeps, Inc. Method AM-18)				
Methane	--	15.00 ng/l	--	--
Ethane	--	5.00 ng/l	--	--
Ethene	--	5.00 ng/l	--	--
Additional Parameters				
Total Organic Carbon	--	1.0 mg/l	10 mg/kg	--
Iron (total and dissolved)	--	100 ug/l	--	--
Manganese (total and dissolved)	--	15 ug/l	--	--
Nitrate	--	0.1 mg/l	--	--
Ammonia	--	0.1 mg/l	--	--
Sulfate	--	1.0 mg/l	--	--
Sulfide	--	1.0 mg/l	--	--
Ortho-phosphate	--	0.1 mg/l	--	--
Chloride	--	1.0 mg/l	--	--
Phospholipid Fatty Acids	--	10.0 picomoles/l	--	--

TABLE 1
SRSNE SITE
SOUTHINGTON, CONNECTICUT
QUALITY ASSURANCE PROJECT PLAN

ANALYTICAL DATA REPORTING LIMITS (cont.)

CLP	Contract Laboratory Program
RAS	Routine Analytical Services
SW-846	USEPA. *Test Methods for Evaluating Solid Waste*. 3rd Edition, Update 2B (January 1995).
TCL	Target Compound List
USEPA	United States Environmental Protection Agency

Notes:

1 All reporting limits are ppb (ug/l or ug/kg, as applicable) unless otherwise specified.
2 CLP-RAS 10/92 *Low Concentration Organics in Water* (modified to include tetrahydrofuran).
3 Reporting limits for soils are based on wet weight. The sample-specific reporting limits, calculated based on dry weight, will be higher.
-- No established reporting limit, or no analyses required for specified parameter and matrix.

Attachment 5

MICROSEEPS

University of Pittsburgh Applied Research Center
220 William Pitt Way, Pittsburgh, PA 15238
(412) 826-5245
FAX (412) 826-3433

July 9, 1996

Mr. Mike Gefell
Blasland, Bouck & Lee
6723 Towpath Road
Syracuse, NY 13214

Dear Mike:

Thanks for sending us the EPA comments regarding our analytical methods for dissolved permanent gases and light hydrocarbons in groundwater. I will attempt to answer their questions as follows refering to the question numbers in their document:

1. The quantitation range is from the MQL for each analyte (see Tables 2,3,4,5 attached) to the groundwater saturation value for each analyte. Multipoint calibation is performed for AM-18 only.

2. The final concentration units are mg/liter for the permanent gases and ng/liter for the light hydrocarbons.

3.b In this case I'm not sure what a water blank should be. The important sample for the purpose of this analysis is the background groundwater sample taken upgradient of the contamination area. Ultimately, altered sample concentrations are compared to the background sample data.

3.c Yes. If only permanent gases or light hydrocarbons analyses are requested, we request duplicate samples. If both are requested we request three samples be taken.

3.d The calibration standards are gas standards, since the analysis is of the headspace gas concentration, and these standards are purchased from commercial sources and are traceable.

Geochemical and Environmental Surveying for Government and Industry

3.e I am not sure how to spike such a sample, but would gladly entertain suggestions. We recognize the need to establish precision, however we have concentrated on establishing analyte stability as a function of time as addressed in the attached Table 1 and Figure 1. We will be working on precision evaluation in the near future.

I appreciate the opportunity to respond to these comments and will look forward to any further comments that these responses may generate.

Sincerely,

Robert J. Pirkle
President

RJP/lsp

Attachment

MICROSEEPS

ANALYSES IN SUPPORT OF INTRINSIC BIOREMEDIATION

Microseeps offers analyses of species which are important in evaluating the activity and extent of intrinsic bioremediation in both aerobic and anaerobic regimes. These species include: BTEX and other VOC,s; dissolved nitrogen, oxygen, carbon dioxide, methane, ethane and ethylene; nitrate and nitrite; total and dissolved manganese; total and dissolved iron; sulfate and sulfide; total organic carbon; chemical oxygen demand and biochemical oxygen demand; and chlorides.

While the determination of many of these species is common to most environmental laboratories, in response to numerous requests from our clients, Microseeps has developed methods for the analyses of the dissolved permanent gases and light hydrocarbons. The methods are similar to those reported by Kampbell, Wilson and Vandegrift (Int. J. Env. Analytical Chem. 36, 249, 1989) and by McAullife (ChemTech 1971, pg 46). They are based on Henry's law which defines the distribution of volatile components between the aqueous phase and the gaseous phase in a closed system.

The methods (AM-15.01 and AM-18) developed by Microseeps for dissolved permanent gases and light hydrocarbons in groundwater Samples are maintained at 4°C until the analysis is performed. The samples are prepared in a fashion which creates an equilibrated headspace between the groundwater and an inert gas. This headspace is then introduced onto the GC column with appropriate detector for analysis. The gaseous concentrations are then determined from the GC response and the groundwater concentrations are then determined using Henry's Law.

The methods incorporate several quality control measures designed to prevent inadvertent contamination of the headspace with air or other species. Results of stability tests are shown on the attached Table 1 and oxygen results are plotted on Figure 1. These results were obtained from duplicate samples submitted to our laboratory over the past several weeks and suggest that within experimental limits, concentrations of these species are stable in our containers for up to 2 weeks. Method detection limits are shown on Tables 2 and 3 and the data from which they were determined are shown on Tables 4 and 5. Figure 2 is a chromatogram of the permanent gases. Figure 3 is an expanded view of the oxygen peak which in this case corresponds to 0.14 mg/l. Note that the signal to noise ratio of this peak is approximately 27 which suggests that the actual MDL for oxygen is less than the determined value of 0.11 mg/l. Further work is in progress.

220 William Pitt Way, Pittsburgh, PA 15238 • Phone (412) 826-5245, Fax (412) 826-3433

TABLE I

----- MICROSEEP, INC. -----
----- STABILITY TESTS RESULTS -----
----- CONCENTRATIONS IN (mg/l) -----

SAMPLE NAME	CARBON DIOXIDE		OXYGEN		NITROGEN		METHANE	
	A	B	A	B	A	B	A	B
1	77.70	81.10	0.14	* 0.10	0.31	1.86	24.51	21.53
2	286.40	306.50	0.14	0.14	1.37	2.50	15.99	16.77
3	154.89	144.74	0.42	0.39	9.52	8.55	10.19	8.76
4	111.98	113.30	0.57	0.52	15.57	14.32	0.82	0.84
5	101.29	93.80	0.41	0.33	7.91	6.08	12.21	10.19
6	167.95	161.48	0.39	0.36	8.64	9.22	7.69	5.99
7	122.78	127.14	0.33	0.40	6.30	8.49	11.33	13.30
8	101.03	94.43	0.32	0.31	8.12	7.63	8.69	8.00
9	44.62	45.51	0.56	0.58	16.62	15.26	1.49	1.42

A - Analyzed 4 days after sampling date.
B - Analyzed 14 days after sampling date.
* Refers to figure 1.

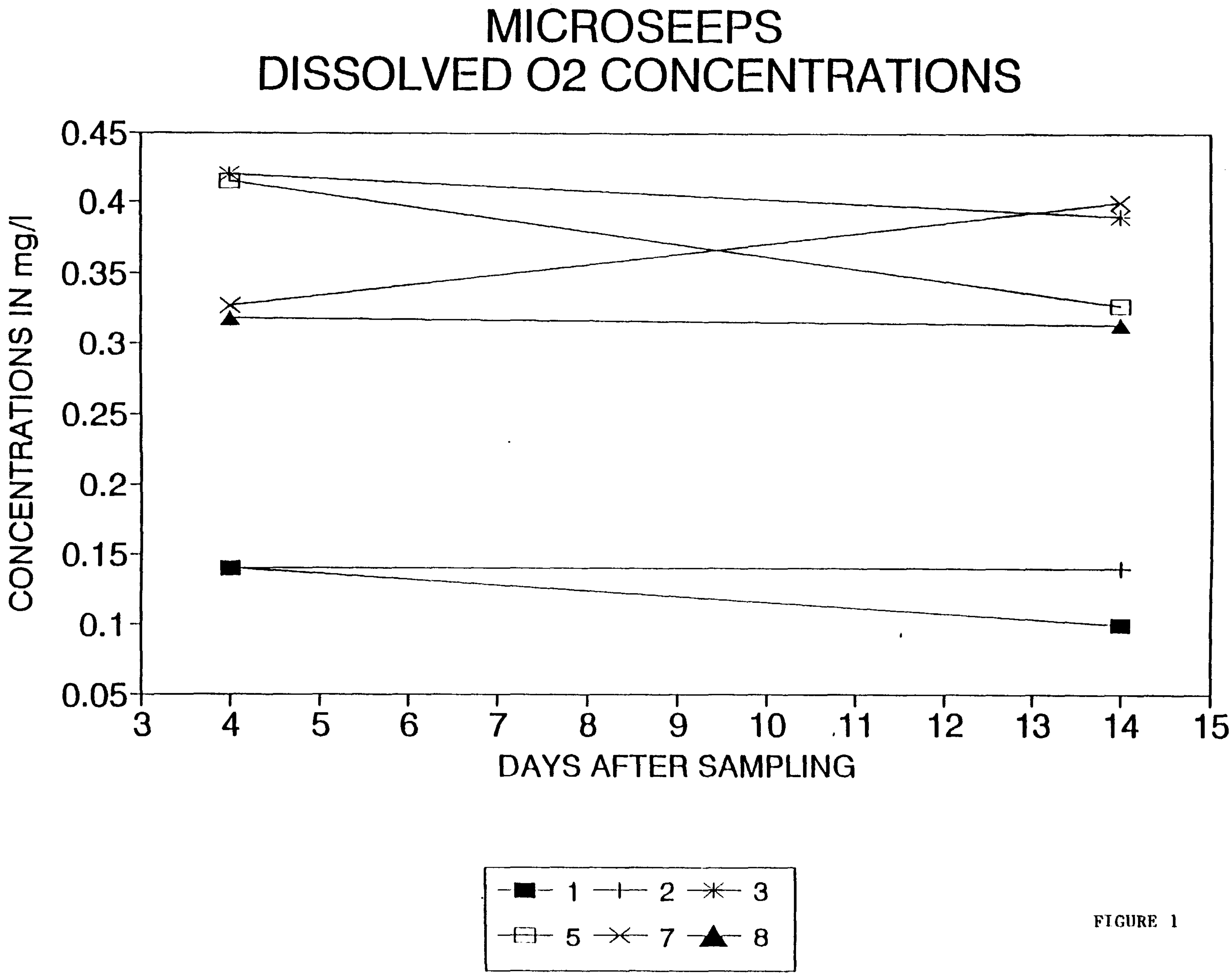
MICROSEEPS
DISSOLVED O2 CONCENTRATIONS
CONCENTRATIONS IN mg/l
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
3
4
5
6
7
8
9
10
11
12
13
14
15
DAYS AFTER SAMPLING
1
2
3
5
7
8

FIGURE 1

TABLE 2

DISSOLVED GASES IN WATER
by
ANALYTICAL METHOD AM-15.01

COMPOUND NAME	METHOD QUANTITATION LIMIT (mg / l)	* METHOD DETECTION LIMIT (mg / l)	% RSD
Carbon dioxide	0.30	0.11	1.19
Carbon monoxide	0.40	0.05	6.05
Methane	0.07	0.02	8.30
Nitrogen	0.40	0.27	3.31
Oxygen	0.15	0.11	10.02

* Method detection limit = Std. Dev. for 7 replicate analyses multiplied by 3.143
(the Student's t value for 99% confidence for 7 values).

TABLE 3

DISSOLVED LIGHT HYDROCARBONS IN WATER

by

ANALYTICAL METHOD AM-18

COMPOUND NAME	METHOD QUANTITATION LIMIT (ng / l)	* METHOD DETECTION LIMIT (ng / l)	% RSD
Methane	15.00	5.03	5.37
Ethane	5.00	0.76	3.98
Ethylene	5.00	1.26	8.22
Propane	9.00	3.17	12.63
Propylene	9.00	2.03	8.45
i-Butane	14.00	5.00	12.28
n-Butane	14.00	5.62	13.42

* Method detection limit = Std. Dev. for 7 replicate analyses multiplied by 3.143 (the Student's t value for 99% confidence for 7 values).

TABLE 4

---- MICROSEEPS, INC. ----
---- METHOD DETECTION LIMIT STUDY ----
---- CONCENTRATIONS IN (mg/l) ----

COMPOUND	KNOWN AMOUNT	REPLICATE ANALYSES OF STANDARD "237" DILUTED 100X 1	2	3	4	5	6	7	MEAN	STD DEV	% RSD	STUDENT T-FACTOR	METHOD DETECTION LIMIT	METHOD QUANTITATION LIMIT
CARBON DIOXIDE	3.25	2.93	2.84	2.89	2.84	2.86	2.86	2.93	2.88	0.034230	1.19	3.14	0.107	0.30
OXYGEN	0.34	0.29	0.31	0.31	0.40	0.32	0.36	0.35	0.34	0.033761	10.02	3.14	0.106	0.15
NITROGEN	2.66	2.49	2.55	2.51	2.76	2.53	2.62	2.60	2.58	0.085351	3.31	3.14	0.268	0.40
METHANE	0.10	0.08	0.07	0.08	0.07	0.07	0.08	0.06	0.07	0.005959	8.30	3.14	0.019	0.07
CARBON MONOXIDE	0.29	0.25	0.24	0.28	0.24	0.28	0.27	0.27	0.26	0.015898	6.05	3.14	0.050	0.40
		P6 149	P6 150	P6 151	P6 152	P6 153	P6 154	P6 155						

26-Jun-96

TABLE 5

----- MICROSEEPS -----
----- METHOD DETECTION LIMIT STUDY -----
----- C1-C4 HYDROCARBONS -----
---- CONCENTRATIONS IN (ng/l) ----

COMPOUND	KNOWN AMOUNTS	1	2	3	4	5	6	7	MEAN	STD DEV	% RSD	METHOD DETECTION LIMIT	METHOD QUATITATION LIMIT
METHANE	31.07	31.07	28.58	29.82	31.38	27.34	32.00	28.58	29.823	1.60136	5.37	5.03	15.00
ETHANE	4.87	6.34	5.85	6.34	5.85	5.85	6.34	5.85	6.057	0.24116	3.98	0.76	5.00
ETHYLENE	4.55	5.00	4.55	5.00	5.00	5.00	5.46	4.09	4.873	0.40053	8.22	1.26	5.00
PROPANE	8.11	8.92	8.11	8.11	8.92	8.92	6.49	6.49	7.994	1.00994	12.63	3.17	9.00
PROPYLENE	7.74	8.51	7.74	8.51	7.74	6.97	6.97	6.97	7.630	0.64480	8.45	2.03	9.00
i-BUTANE	12.78	12.78	11.50	15.33	10.22	14.05	12.78	14.05	12.960	1.59126	12.28	5.00	14.00
n-BUTANE	12.78	12.78	10.22	15.33	14.05	15.33	14.05	11.50	13.325	1.78842	13.42	5.62	14.00
FILE NAME		L19 217	L19 218	L19 219	L19 220	L19 221	L19 222	L19 223					

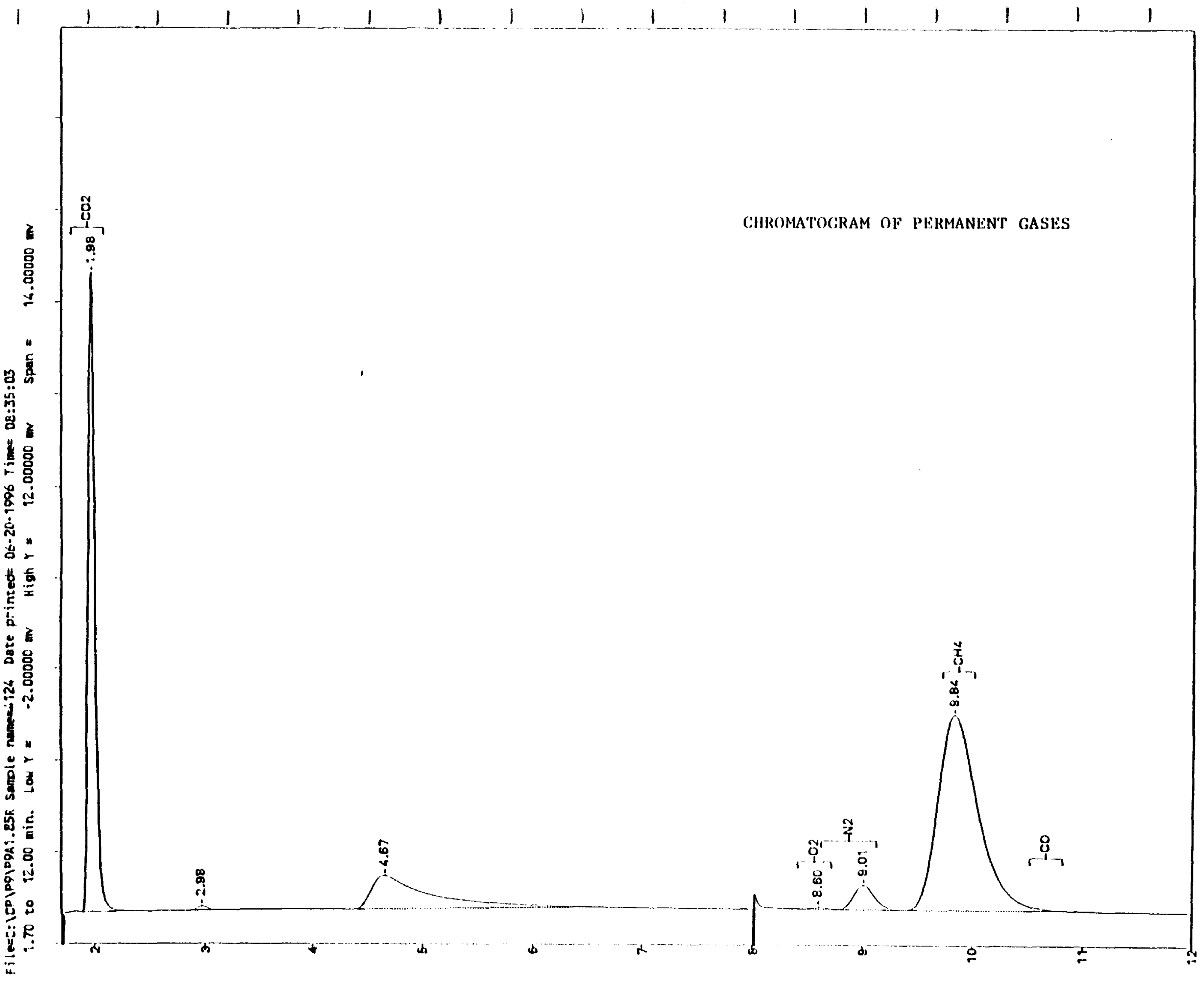
CHROMATOGRAM OF PERMANENT GASES

FIGURE 2

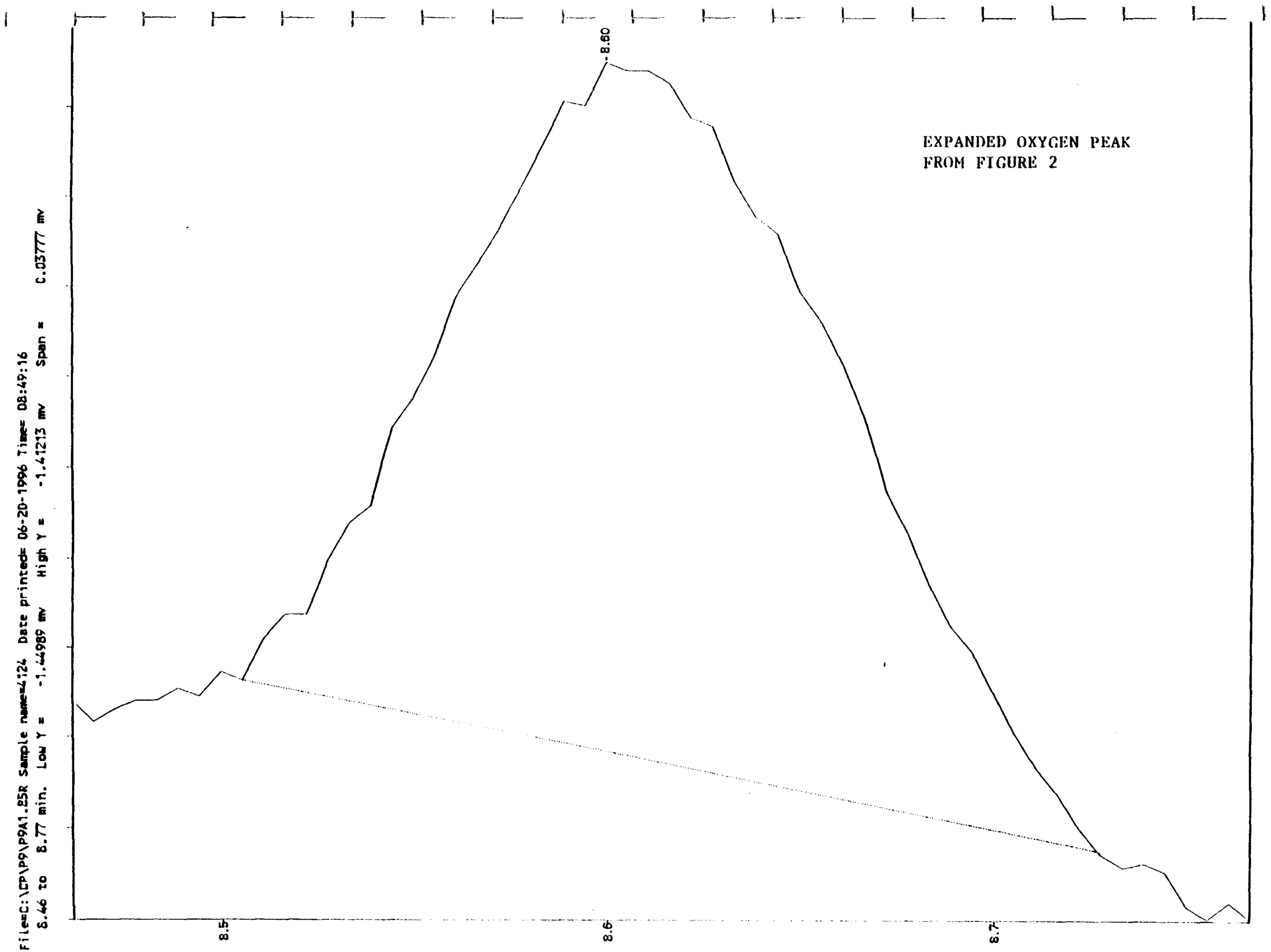
File=C:\CP\P9\P9A1.BSR Sample name=4124 Date printed= 06-20-1996 Time= 08:49:16
8.46 to 8.77 min. Low Y = -1.44989 mv High Y = -1.41213 mv Span = C.03777 mv
EXPANDED OXYGEN PEAK
FROM FIGURE 2
8.60
8.5
8.6
8.7

FIGURE 3

MICROSEEPS

ANALYTICAL METHOD AM18G

ANALYSIS OF C_1-C_4 HYDROCARBONS IN WATER

1.0 Scope and Application

1.1 Method AM18 may be used to determine the concentration of dissolved gases in water samples. Specifically, Method AM18 may be used to determine the dissolved concentration of the following light hydrocarbon gases:

1.2 This method is recommended for use by, or under the supervision of, analysts experienced in sample preparation, the operation of gas chromatographs and in the interpretation of chromatograms.

2.0 Summary of Method

2.1 Analysis of the C_1-C_4 hydrocarbons in a water sample is accomplished by transferring an aliquot of the sample plus helium into a syringe. After equilibration, the headspace gases are analyzed with a gas chromatograph. The sample (and standard calibration gas) is introduced into the column by injection. The data is transferred to a microcomputer where it is converted to digital format and processed using a chromatography data system.

3.0 Interferences

3.1 Ambient air is a potential source of "interference". Concentrations of methane in ambient air are typically 1.5 parts per million by volume (PPMV). Other light hydrocarbons may also be present at concentrations levels of concern. The analyst must take great care to ensure that air is flushed from the syringe prior to injection of the sample into the gas chromatograph.

3.2 Contamination by carryover can occur whenever high-level samples are analyzed.

3.3 The analyst should demonstrate the absence of carryover contamination. This demonstration should be performed prior to the analysis of a sample set and when carryover contamination is suspected.

3.4 Contamination from late eluting peaks can occur between injections.

3.5 The analyst should be certain that all peaks have eluted from the previous analysis prior to analyzing any sample or standard.

4.0 Apparatus and Materials

4.1 Sample vials: 40 ml VOA glass vials

4.2 Septa

4.3 Syringe: Hamilton locking gas tight

4.4 Gas Chromatograph

4.5 Data Collector

5.0 Sample Preparation and Analysis

5.1 Remove the sample (VOA) vials from the refrigerator.

5.2 Using a clean gas tight, locking syringe withdraw an aliquot of water from the sample vial.

5.3 Withdraw an aliquot of helium from a reservoir and lock the syringe.

5.4 Shake the syringe by hand.

5.5 Slowly inject the headspace gas into the gas chromatograph.

6.0 Calibration and Results

6.1 The standard calibration gas should be introduced in the same manner as the samples.

6.2 At the beginning of a project or sample set, standards of appropriate calibration ranges will be run.

6.3 The instrument response (for any one subsequent standard in section 6.1 above) must not vary by more than 20%.

6.4 Concentration of analytes in the headspace gas in PPMV are converted to the original analyte concentration.

7.0 Quality Control

7.1 If the parameters set forth in section 6.3 are not met, the analytical program will be terminated until the cause is determined and a solution is effected.

7.2 The analyst should demonstrate the absence of ambient air and other contaminates in the sample preparation system.

7.3 Before and during sample analysis, instrument blanks should be analyzed to assure the absence of interferences.

7.4 Standards analyzed during the course of analyzing samples may be used for peak identification. All chromatograms should be examined by an experienced analyst.

7.5 Throughout analysis the gas samples are injected to achieve a uniform sample size. The uniform sample size assures consistent and accurate results.

7.6 The water sample is withdrawn from the 40ml VOA vial through the septum while replacing the water with pure helium. The sample is withdrawn from the 40ml vial and the remaining sample is discarded.

7.7 Calibration records are generated and stored. All such records will be maintained in the laboratory during the course of the project and there after as determined by the client.

Attachment 6

Microbial Insights, Inc.
Comprehensive microbial community analysis

Mike Gefeu
BBL
6723 Towpath Rd,
Box 66
Syracuse, NY 13214-0066

July 3, 1996

Dear Mike

Here is a response to the questions presented by the USEPA. We can provide further information if they need. Just give me a call.

Method Blank:

A method blank will be run with each sample set to be processed using the same solvents glassware and reagents. All contamination introduced through the processing of the samples will be reflected in the method blank.

Spiked Sample Analysis:

The spiked sample analysis is not a straightforward issue. The membrane bound phospholipids will extract differently than a phospholipid spiked into the sample matrix. Also there are no commercially available phospholipids that contain fatty acids that are not found in our samples. Therefore we would be adding fatty acids that we are looking for in our samples. We can however add a standard to the method blank to determine the amount of lipids lost during the processing of the samples.

Sincerely

Drew White

201 Center Park Dr. Suite 1140
Knoxville, Tennessee 37922-2105
Tel. 615-966-7356   Fax. 615-966-7357

Gas Chromatographic Analysis of Lipids

A. Background

The purpose of this procedure is to separate, quantify, and identify lipid compounds by gas chromatography (GC). Preliminary identification of compounds will be based on comparison to retention times of standards. Mass spectrometry will be used for verification of compound structure in a collaborative arrangement with the Center for Environmental Biotechnology.

B. Safety

Reagents for this procedure include hexane, cholestane, and nonadecanoic acid. Safe handling of these materials will be followed as described in the MSDS literature located in the laboratory.

C. Sampling:

Samples will be either: fatty acid methyl esters (FAME, SOP #METH), poly-ß-hydroxyalkanoates (PHA, SOP #PHA), trimethyl-silyl (TMS)derivatives of 3ß-ol sterols (SOP #STER-1), TMS derivatives of lipopolysaccharide hydroxy fatty acids (LPS OH-FA, SOP #OHFAM), or DMDS derivatives of monounsaturated FAME (SOP #DMDS).

D. Apparatus

1. Hewlett-Packard gas chromatograph model 5890 series II with a 7673A auto injector. The instrument is controlled with an IBM-compatible PC using HP-IB Chemstation software for Windows and DOS.

2. Gasses: Carrier gas - the purest available hydrogen (99.999% pure or above), flame hydrogen - industrial grade, flame air - breathing grade, make-up nitrogen - UHP grade.
3. Nitrogen gas blow-down.
4. Volumetric pipets.
5. Injection syringes.

E. Reagents

1. Hexane of the purest grade possible, Burdick & Jackson GC^2 or equivalent. An aliquot of each new lot will be concentrated by a suitable factor (e.g. 1000) and analyzed by capillary GC for any organic contaminants.

2. 50 pmol/µL nonadecanoic acid methyl ester (C19:0, internal standard). 15.6 mg C19:0 (M.W. 312) per L hexane.

F. Procedures

1. Preparation

1.1 The GC is turned on by a switch on it's right side. The autosampler is turned on at its controller, a white box sitting next to the GC. The gases are turned on, at the following pressures: H_2 (flame) 20 psi, H_2 (carrier) 40 psi, N_2 40 psi, Air 30 psi. (**Caution:** If the GC is to remain on, do not turn off the carrier gas. Without the carrier gas, the column will deteriorate quickly.) Ignite the flame on the flame ionization detector (FID) by pressing the FID ignitor button located on the upper left corner of the GC.

1.2 Optional - if autoinjector is to be used. Slide the injector onto the post over the injection port. Make sure that the solvent levels in the wash vials in the injector are satisfactory. Turn on the computer which will be used for data acquisition.

1.3 The HP 3365 Series II Chemstation software is accessed through Windows. Clicking on the Chemstation icon brings up the Chemstation dialogue boxes. The method menu is brought up, and the method to be used, e.g. PLFA method, is loaded. (See Note 1 for temperature programs.)

2. Estimation of Sample Dilution Volume. The concentration injected should be maximized to allow accurate quantitation of minor peaks, <u>and</u> the concentration must be low enough that the linear range of the GC and it's FID detector is not exceeded. 3 methods are given, in decreasing order of accuracy.

2.1 Method #1, Estimation from Lipid Phosphate Data. If the total lipid phosphate or polar lipid phosphate has been determined for the sample, this data can be used to estimate the appropriate dilution volume. (It is assumed that the total lipid phosphate and polar lipid phosphate are equal.) Since

$$\text{moles LP} \times 2 \equiv \text{moles PLFA},$$

the largest peak in a profile is often half or more of the total, and 5 times the C19:0IS is near the maximum properly integrated peak height, therefore

$$[\text{nmoles LP} \times (2\ \text{FA/LP} \times 5)]/(50\ \text{nmole/mL}) = \text{mL solvent, or}$$

$$\text{nmoles LP} \times 0.2 = \text{mL solvent.}$$

2.2 Method #2, Estimation from Known Samples. A sample of 50 mg wet weight of of bacterial cells, or 10 mg dry weight of cells, is diluted to XXX mL for injection.

2.3 Method #3, Estimation by Injecting a Range Finder. The dried sample is dissolved in 1 mL hexane. 1 µL is shot, . The solvent is removed with the nitrogen gas blow-down, and the dried lipid is redissolved in the correct amount of internal standard solution. 100 µL of the sample is transferred to a crimp-top vial with insert, crimped tightly, and stored at -20°C until ready to shoot on the GC.

3. Injection.

3.1 The samples to be shot on the HP 5890 GC are placed into narrow-mouthed crimp-top vials. The seal around the top must be tightened three times, rotating the vial one-third of a turn each time, so that the solvent doesn't evaporate out of the vial. These vials are placed into the autosampler rack sequentially. A vial containing the GC mix an L2-24 are placed in the first and second position for each sample set, with the other vials following.

3.2 To make a single shot, click on RunControl, click on Sample Info, and enter the operator name, file name, vial position, and sample name (Make sure that the vial to be shot is in the same position as the vial position that was entered.) Click on OK. Click on RunControl, select Start Run. If this does not work, re-set the instrument and this time start the run from the start button on the GC.

3.3 To run a sequence, click on Sequence. Load the default sequence. Click Sequence, and select Edit Sample Log Table. Enter in the Vial Number, Sample Name, Method Name, Inj/vial, and Sample Info for the first vial. Click ENTER. Then click INSERT for the next vial. Continue entering the sample information until they are all in the sequence table. Click OK. Click Sequence and select Edit Sequence Parameters. Enter in the Operator Name, Subdirectory to store the data in, Sequence Comment, then click OK. Click Sequence, and Save the sequence. Click on RunControl, and select Run Sequence. The data will be stored in the subdirectory that was entered in the Sequence Parameters Table.

Note: if a ready light does not appear then, edit the entire method and make sure that both detectors are selected.

4. Separation

The compounds to be analyzed will be separated for quantification using capillary gas chromatography with flame ionization detection. A 50 meter non-polar cross-linked methyl silicone column (e.g. HP-1) will be used with a suitable temperature program (see Note 1). Generally, 1 µL is injected.

5. Quantification

Quantification will be based on a comparison to an internal standard (FAME - C19:0, LPS OH-FA - C19:0, sterols - cholestane, PHA's - malic acid). Equi-molar responses are generally assumed within the range of microbial FAME (12:0-24:0) and sterols (22C-30C); however, tables of molecular weight correction factors are available (Christie, 1989).

Results obtained from the GC will be quantified areas under each sample peak, including the internal standard. For each peak, the following calculation is done to obtain molar or weight amounts per sample.

The calculations done for each compound are:

$$C_X = (A_X/A_{ISTD}) * C_{ISTD} * D,$$

where C_X is the calculated concentration of compound X (pmoles per sample), A_X is the peak area of compound X, A_{ISTD} is the peak area of the internal standard, and C_{ISTD} is the concentration of the internal injection standard (pmole/ µL, and D is the sample dilution (µL). Data may also be expressed as pmole/gdwt by dividing C_X by grams dry weight of sample, and as mole % by dividing by total pmoles of all compounds in sample then multiplying by 100. .

Assuming an average phospholipid content of 10^{-4} moles of PLFA per 5.9×10^{12} bacterial cells (based on *E. coli*), and 10^{-4} moles PLFA per 1.2×10^{10} algal cells (based on *Chlorella*), an estimate of bacterial and algal cells may be obtained by multiplying calculated picomolar concentrations of PLFAME by the appropriate factor (2.0×10^4 cells/pmol for bacteria, 1.2×10^2 cells/pmol for algae), yielding cells per gram.

6. Identification

6.1 FAME. The use of a linear temperature program for the separation of FAME permits the use of Equivalent Chain Length (ECL) analysis for FAME identification. This technique, detailed by Christie [1989], is based on the linear relationship between the retention times of a homologous series of straight-chain saturated FAME against the number of carbons in the FAME chain. ECLs are a constant property of a specific FAME as long as the temperature program is linear. This provides the ability to utilize published ECLs in a library of FAME to help identify specific FAME.

This identification is preliminary, however, and selected samples from a sample set should be further analyzed by (1) GC/MS as detailed in Guckert *et al.* [1985], and (2) DMDS derivatization of monounsaturated double bonds [Nichols *et al.* 1986].

Fatty acid nomenclature will be of the form **'A:BwC'** where **'A'** designates the total number of carbon atoms, **'B'** the number of double bonds, and **'C'** the distance of the first unsaturation from the aliphatic end of the molecule. The suffixes 'c' for *cis* and 't' for *trans* refer to geometric isomers of double bonds. The prefixes 'i' and 'a' refer to iso and anteiso methyl-branching respectively [Kates 1986]. The prefix "Cy" refers to a cyclopropyl moiety, "NMe" to a methyl branching N carbons from the carboxylate end of the molecule, "Br" to a methyl branching of unknown position, and "NOH-" to a hydroxyl group N carbons from the carboxylate end..

6.2 PHAs. Comparison of unknown peaks to a prepared standard (usually poly-ß-hydroxybutyrate) allows preliminary identification of PHAs. However, structural identification requires GC/MS analysis as detailed by Findlay and White, [1983].

6.3 Sterols. Due to variations in chromatographic variables, identification of sterols requires the calculation of relative retention times (RRT) based on cholesterol and sitosterol [Nes 1989]. The RRT for each peak is calculated by the following formula:

$$RRT_X = 1 + [0.63 * (RT_X - RT_C)] / (RT_S - RT_C),$$

where RRT_X is the relative retention time of the unknown peak, RT_X is the retention time of the unknown peak, RT_C is the retention time of cholesterol, and RT_S is the retention time of sitosterol. By comparing the calculated RRT_X of an unknown sterol to a library of RRT's for known sterols under the given chromatographic conditions, preliminary identification of individual compounds is possible. This identification is preliminary, however, and selected samples should be further analyzed by GC/MS as detailed in Nichols et al. [1983].

6.4 LPS OH-FA. A bacterial fatty acids standard mixture containing α- and ß-hydroxy fatty acids may be obtained from Matreya (cat# 1114) and preliminary identification of hydroxy fatty acids achieved by comparison to the standard mixture. Identification should be considered tentative, however, and GC/MS analyses performed according to Parker et al. [1982].

G. Notes

1. PLFA temperature program: 100°C for 0 min., 10°/min. to 150°C for 1 min., 3°/min. to 282°C for 5 minutes. Injector temperature = 270°C, detector temperature = 290°C. Total run time = 55 minutes.

Sterol temperature program: 200°C for 0 min., 10°/min. to 280°C for 0 min., 2°/min. to 310°C for 5 minutes. Injector temperature = 290°C, detector temperature = 290°C. Total run time = 28 minutes.

PHA temperature program: 45°C for 10 min., 10°/min. to 285°C for 5 minutes. Injector temperature = 270°C, detector temperature = 290°C. Total run time = 39 minutes.

LPS OH-FA temperature program: same as FAME temperature program.

2. Rangefinders are shot to insure the internal standard is within a factor of the sample peaks. Generally, for 37 mg lyophilized bacterial isolate or 37 g dry sediment, a rangefinder is shot at 1:1000 µl hexane (no internal standard). Adjustments are made and the sample diluted in internal standard only when the proper dilution is determined.

H. References

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Parker, J.H., G.A. Smith, H.L. Fredrickson, J.R. Vestal, and D.C. White. 1982. Sensitive assay, based on hydroxy fatty acids from lipopolysaccharide lipid A, for gram negative bacteria in sediments. *Appl. Environ. Microbiol.* 44:1170-1177.

Approved by:______________________ Date __________