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ENVIRON

May 27, 1998

RECEIVED
MAY 28 1998
Bureau of Eastern
Remedial Action

Mr. Michael MacCabe
New York State Department of Environmental Conservation
50 Wolf Road
Albany, NY 12233-7010

Re: Ground Water Delineation Investigation
Former Bulova Manufacturing Facility
Valley Stream, New York
Site No. 1-30-084

Dear Mr. MacCabe:

As discussed during our meeting on May 13, 1998, ENVIRON International Corporation (ENVIRON) has prepared this proposal, on behalf of Bulova, to: (1) characterize on-site hydrogeologic conditions at the former Bulova manufacturing facility in Valley Stream, New York (the "site"); (2) delineate the elevated concentrations of volatile organic compounds (VOCs) detected near the southeastern corner of the site; and (3) evaluate ground water quality within the upper glacial aquifer at locations downgradient of the site. The following sections detail the scope of the proposed investigation.

A. Hydrogeologic Characterization

Prior environmental investigations performed by ENVIRON at the site have determined that the site is underlain by Pleistocene deposits which form the upper glacial aquifer. Although ENVIRON's investigations have been limited to the initial twenty feet of the upper glacial aquifer, regional geologic investigations indicate that the upper glacial aquifer at the site is underlain by the "20-foot" clay and the Gardiners Clay. The "20-foot" clay and the Gardiners Clay represent the major confining layers within the upper portion of the ground water reservoir beneath Nassau County. The regional geologic investigations indicate that the "20-foot" clay is approximately 5-10 feet thick in the vicinity of the site. Although an additional interval of upper Pleistocene deposits is generally located between the "20-foot" clay and the Gardiners Clay, regional geologic investigation suggest that in the vicinity of the site, the "20-foot" clay is directly underlain by an approximately 30 - 40 foot interval of the Gardiners Clay.

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Consistent with the regional geologic investigations, well construction logs for two former water wells at the site, used for air conditioning purposes, note a clay layer immediately below the bottom of each well at approximately 40 feet below ground surface (bgs). Well construction logs were previously provided to NYSDEC as an attachment to a letter from ENVIRON dated April 16, 1998.

To confirm the presence of the regional confining layer beneath the site, ENVIRON proposes to complete one soil boring near the southwestern property boundary, in the vicinity of former monitoring well MW-8. Historical ground water sampling at MW-8 has not detected VOCs in ground water and ground water flow patterns suggest that the former monitoring well was positioned upgradient and cross-gradient of potential ground water contamination source areas. Prior to installation of the soil boring, one ground water sample will be collected from immediately above the clay layer using a Geoprobe sampler for mobile laboratory analysis of VOCs to confirm that there is not significant ground water contamination at the location. During drilling at the proposed soil boring, soil samples will be collected at continuous intervals and the boring will extend to a minimum of 5 feet into the “20-foot” clay. One core sample will be collected from the clay layer and sent to a laboratory for measurement of vertical hydraulic conductivity.

To confirm the ground water flow direction within the shallow portion of the water-bearing zone, ENVIRON proposes to collect one round of water level measurements at each on-site monitoring well.

B. Ground Water Quality Evaluation

1. On-Site Ground Water Delineation

Based on the Geoprobe ground water sampling results from October 1997, ENVIRON recommends that additional on-site delineation be completed in the upper glacial aquifer shallow water-bearing zone to further delineate the horizontal extent of VOC concentrations at the southeastern corner of the site. In addition, due to the physical nature of the chemicals of concern (i.e., more dense than water in their pure form), ENVIRON recommends that the ground water quality in deeper portions of the upper glacial aquifer be evaluated to determine the vertical extent of elevated VOC concentrations detected at previous sampling point GP-3. ENVIRON proposes to perform the additional delineation by collecting ground water samples using a Geoprobe sampling device and analyzing each sample in a mobile field laboratory followed by laboratory confirmation.

To determine the horizontal extent of impacted ground water, sampling locations will be positioned west of sample location GP-1 and north of sample location GP-5. Shallow Geoprobe sample points will be selected based on ground water quality data from the October 1997 sampling event and field analysis results generated during the proposed investigation. Based on site conditions and previous experience, ENVIRON estimates that approximately 6 shallow ground water samples will be collected as part of the additional delineation. At each shallow sample point, the probe will be driven to a depth of approximately 4 feet below the water table. The estimated water table depth will be based on depth-to-water measurements at monitoring wells MW-HD4, MW-HD5, and MW-HD6.

To evaluate the vertical distribution of the chlorinated VOCs, ENVIRON proposes to collect Geoprobe ground water samples from several depth intervals at locations adjacent to monitoring well MW-HD4 and sample location GP-3. Vertical delineation samples will be collected at ten-foot depth intervals from the ground surface to the top of the "20-foot" clay (as determined during the proposed drilling at the southwestern property boundary). Following identification of the vertical extent of impacted ground water in the vicinity of MW-HD4 and GP-3, deeper ground water samples will be collected from within the on-site footprint of the impacted area delineated by the shallow ground water sample collection. Deeper sample locations will be positioned immediately adjacent to associated shallow sample locations and sampling intervals will be targeted toward zones within the impacted area identified at MW-HD4 and GP-3 and toward the zone beneath the impacted area.

To characterize background concentrations of VOCs within the upper glacial aquifer, ENVIRON proposes to collect ground water samples from one location near the northern portion of the site between existing monitoring wells MW-HD2 and MW-HD3. At the upgradient sampling location, ground water samples will be collected at 10-foot intervals from ground surface to the top of the "20-foot" clay.

2. Off-Site Characterization

Results of prior ground water sampling events and the estimated ground water flow direction at the site suggest that the limits of the VOC-impacted ground water may extend beyond the site boundary. ENVIRON recommends that ground water samples be collected from several points downgradient of the site to characterize off-site ground water quality and delineate the horizontal and vertical extent of VOC-impacted ground water, if present.

The off-site sampling activities will be completed immediately following the on-site ground water delineation investigation and will also utilize the Geoprobe sampling equipment and the mobile laboratory. Off-site sampling efforts will be directed based on results of the mobile laboratory testing and locations included in the off-site characterization will be selected to delineate the horizontal and vertical extent of site-related impacted ground water, if present. Tentative off-site sampling points, selected based on local ground water flow directions at the site and regional hydrogeology, are depicted on Figure 1.[1] Actual sampling points included in the off-site characterization will be selected following permit approval by the Town of Hempstead Highway

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[1] Based on regional geologic information (USGS 1613A, 1963) and site-specific measurements, the average ground water flow velocity has been estimated to be approximately 0.5 feet/day. The direct ground water travel time to Clear Stream and Valley Stream, based on the estimated flow velocity, would be approximately 9.5 and 14 years, respectively.

Department and in consideration of underground utilities. At each sampling location, ground water samples will be collected at 10-foot intervals from ground surface to the top of the "20-foot" clay or until significant ground water contamination is not detected by the mobile laboratory analyses.

3. Sample Analyses

Three laboratory-provided, pre-preserved 40-ml vials will be filled at each sampling interval. Two vials will be held for potential commercial laboratory analysis and one vial will be provided to a mobile laboratory for field analysis during the investigation. Vials for potential laboratory analysis will be filled first at each sampling interval.

Each ground water sample will be analyzed in a mobile field laboratory to provide rapid turnaround time and help direct the location of additional sampling points as the investigation continues. The field analysis will consist of ambient temperature headspace analysis using a Photovac 10S Plus photoionization detector gas chromatograph (PID/GC). The PID/GC will be calibrated for DCE, DCA, TCA, TCE, and PCE determinations. Although the estimated detection limits for the target compounds using the field analysis method are 10-25 μg/L, sample results at similar sites have shown excellent correlation between field and laboratory results at levels approaching 1-5 μg/L. Procedures to be utilized as part of the mobile laboratory analyses are included as Attachment 1 to this letter.

At a minimum, 20 percent of the field samples will also be laboratory analyzed for VOCs utilizing EPA Method 624 to confirm the field analysis results. Laboratory analyses will be performed on both "clean zone" samples and selected samples across the entire concentration range detected during the on-site analysis. Laboratory analysis will be performed by a NYSDOH ELAP CLP-certified laboratory and data packages will be provided following requirements for NYSDEC ASP Category B deliverables.

Who,
Accredited
[illegible]
[illegible]

Quality assurance samples, including duplicate samples and rinsate blanks from the Geoprobe sampling equipment, will be collected at a rate of approximately 5 percent. The total number of samples, including field samples and quality assurance samples, will be based on the final number of sampling locations included in the proposed investigation and the number of sampling intervals at each sample location. Trip blanks, prepared by the analytical laboratory, will accompany each sample shipment and will be analyzed for VOCs using EPA Method 624 to identify potential cross contamination during the shipping process. Samples for laboratory analysis will be delivered to the laboratory within 24 to 48 hours from the day of sample collection in order to minimize the potential for exceedances of the 14-day holding time.

C. Schedule and Report Preparation

Following receipt and review of the ground water sampling results, ENVIRON will prepare a report for submittal to the NYSDEC describing the results of the ground water investigation and proposing additional actions at the site, if appropriate. Prior to report preparation, ENVIRON will review all field measurements and laboratory deliverables to ensure the accuracy and reliability of the generated data. Following review of the laboratory deliverables, a Data Usability Summary Report will be prepared and provided as a part of the investigation results report. Guidance to be used during preparation of the Data Usability Summary Report is provided as Attachment 2. As discussed during our May 13, 1998 meeting, results of the proposed investigation will also be presented to NYSDEC during a meeting prior on or about August 1, 1998.

Quality assurance procedures will be directed by Thomas Fusillo and analytical data package review, independent of the analytical laboratory, will be performed by Mary Enard. Résumés for both are provided as Attachment 3. Project management and quality assurance review will be completed by ENVIRON's Princeton, New Jersey office.

Based on site conditions and the proposed scope of work, ENVIRON anticipates that the investigation can be completed as follows:

Task	**Date**
NYSDEC Work Plan Approval	June 1, 1998
Town of Hempstead Permit Approval/ Pre-Mobilization Coordination	June 3 - 10
Stake Off-Site Sampling Locations	June 11
Utility Mark-Out and Clearance	June 15 - 17
Hydrogeologic Characterization	June 18
On-Site Delineation	June 18 - 19
Off-Site Characterization	June 22 - 26
Commercial Laboratory Analyses	June 29 - July 17
Data Analysis and Interpretation	July 20 - 30
Meeting with NYSDEC	Approx. August 1
Prepare Draft Results Report	August 1 - 15

A site-specific health and safety plan will be provided to NYSDEC prior to implementation of the proposed field investigation. Please contact us at your earliest convenience to discuss any questions or comments.

Sincerely,

Thomas V. Fusillo
Principal

Michael Potts
Senior Associate

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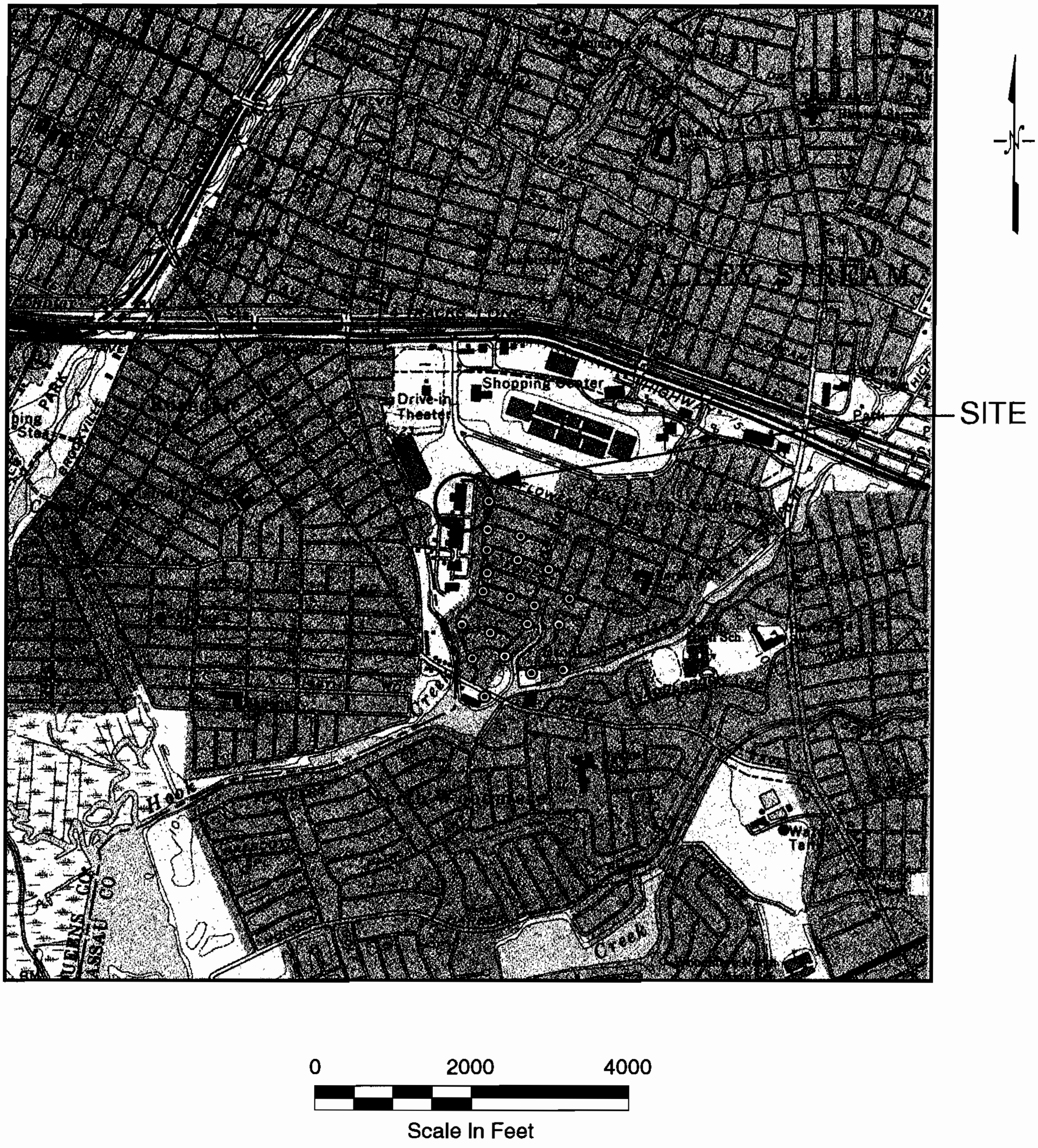
02-1961A:WP\7322_1.WPD



⊚ PROPOSED SAMPLING LOCATION

SOURCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE, LYNBROOK, NY; 1969.

ENVIRON	**PROPOSED OFF-SITE SAMPLING LOCATIONS** FORMER BULOVA MANUFACTURING FACILITY VALLEY STREAM, NEW YORK	FIGURE 1
DRAFTED BY: KPM DATE: 4/16/98		1961AJ01.PRE

ATTACHMENT 1

Mobile Laboratory Analysis Procedures

SunStar Laboratories, Inc.
Method 8010/8020 Water
Rev.01 4/01/98

EPA METHOD MODIFIED 8010/8020
VOLATILE HALOGENATED AND AROMATIC ORGANIC COMPOUNDS
HEADSPACE ANALYSIS OF WATER SAMPLES BY GAS CHROMATOGRAPHY
PHOTOIONIZATION DETECTOR/FLAME IONIZATION DETECTOR/ ELECTROLYTIC CONDUCTIVITY DETECTOR

1.0 Scope

1.1 This is a GC method applicable to the determination of a number of halogenated and aromatic organic compounds that are volatilized out of a matrix.

2.0 Summary of Method

2.1 A measured amount of water sample, approximately 20.0 milliliters, is analyzed by headspace method. This concentrated sample is analyzed on a GC by being injected onto a chromatographic column within a temperature programmed oven and detected by a combination PID/FID/DELCD. Volatile compounds are identified by comparison of retention time of the standards and quantified using the initial response factors.

3.0 Apparatus and Equipment

3.1 Gas chromatograph/GC/PID/FID/ELCD

3.1.1 SRI 8610

3.1.1.1 Column: DB-624, 60 m X 0.53 mm, 3.00um thickness chemically bonded fused silica.

3.1.1.2 GC Conditions
Oven Temp : 40^0 C Hold for (4.0 min), ramp 10^0 /min to 160^0C, hold for (2.0 min.)
Injector Temp: Ambient
Carrier Flow Rate: 10 mL/min

3.1.2 Photo ionization detector :
3.1.2.1 PID settings
Lamp Temperature: 225° C

3.1.3 Electrolytic conductivity detector:
3.1.3.1 ELCD settings
Reator temp: 850°

3.1.3 Flame ionization detector:
3.1.3.1 Fid settings
Detector temp: 225°

3.1.4 Data System: This system must allow the continuous acquisition and storage on machine readable media of all data obtained throughout the duration of the chromatographic program.

3.2 Analytical Balance
3.3 Gas tight syringes: 5 mL
3.4 Gas tight syringes: 10, 25, 50, 100, 500, 1,000 uL
3.5 1 mL Mini-Inert vials

4.0 Reagents

4.1 Reagent water: Water in which an interferent is not observed at the method detection limit (MDL) of the analytes of interest.
4.2 Methanol: pesticide or equivalent

5.0 Safety

The compounds in this method are toxic, therefore, all handling shall be conducted in a safe manner. Safety glasses and solvent-resistant gloves must be worn at all times when handling standards, samples, and solvents. A reference file of material data handling sheets are available. Primary standards of toxic compounds should be prepared in a hood.

6.0 Interference

Method interference's may be caused by contaminants in solvent, reagents, glassware, and sample processing hardware. Glassware must be scrupulously cleaned and baked in the oven for 3 hours after washing and rinsing. Matrix interference may be caused by contaminants that are co-purged from the sample.

7.0 Standards

7.1 Working Standards: A known volume of stock solutions are mixed together. The mixture is diluted to 1.0 mL with methanol.

7.1.1 The 8010/8020 standard is prepared by taking 20 uL of the 1000mg/L Accustandard custom mix and diluting it to 1.0 mL with methanol. This mix is placed in a mini-inert vial and stored in the freezer.

7.1.2 After the mixture of all components, these standards are to be considered stable for at least six months and will be replaced when (1) supply of the individual standards have been exhausted or the continuing calibration is out of control and cannot be brought back within acceptable limits using the normal maintenance procedures.

7.2 Storage

7.2.1 All the standard solutions will be stored in glass containers.

7.2.2 Solutions should be stored at 10° to -20° C.

8.0 Procedures:

8.0 Pour 20 mL of sample into a clean 40 mL VOA vial.

8.1 The samples is agitated for 3 mins.

8.3 1 mL of headspace vapor is removed for analysis with a 5 mL gastight syringe.

8.4 The vapor is injected directly onto the chromatographic column via the injection port.

9.0 Calibration procedures:

9.1 One of the calibration standards should be at a concentration near, but above the MDL and the other concentration should correspond to the expected range of concentrations found on real samples or should define the working range of the GC system. Therefore, construct a 3-point calibration table by analyzing standards at 5ug/L, 50ug/L, 100ug/L.

9.2 Using the data system to obtain the relative response factor (RRF) of each compound.
The RRF is calculated as:

$$RRF = A_s/C_s$$

Where:
A_s = area of the compound
C_s = concentration of the parameter to be measured, ug/L.

9.3 Using the RRFs from the initial calculation, calculate the percent relative standard deviation (% RSD) for all compounds:

$$\% \; RSD = (SD \; / \; X) * 100\%$$

Where:

RSD = Relative Standard Deviation.
X = Mean of 3 initial RRFs for a compound.
SD = Standard deviation of the mean RRF for a compound.

The % RSD for each individual compound should be less than 25%. This criteria must be met in order for the individual calibration to be valid.

9.4 After a 24 hr shift, a check standard should be performed by using a standard at 50 ug/L., Calculate the % difference of RRFs for each compound:

$$\% \; Difference = ((RRF_i - RRF_c) \; / \; (RRF_i)) * 100\%$$

Where:

RRF_i = Average RRF from initial calibration
RRF_c =RRF from current verification check standard.

If the value for each compound is < 20%, the continuing calibration is valid. If the difference for any compound is larger than 20%, corrective action must be taken. If no source of the problem can be determined after corrective action has been taken, a new 3 point calibration MUST be generated.

10.0 Calculations

10.1 Manual calculation:

Calculate the concentration in the sample using the RRFs determined in Section 9.2 and the following equation:

$$\text{Concentration, ug/L} = \frac{A_s * D}{RF * V}$$

Where:

A_s - area of compound to be measured.
V = Volume of sample, liter.
D - Dilution factor.
RF = Responce factor of compound to be measured.

11.0 Quality Control

11.1 When required, QC check samples may be prepared from EPA check samples per their instructions or from spiking stock prepared in the normal manner.

11.2 A reagent blank (MB) will be prepared in the same way as the samples and run in every batch (20 samples or less). All target compounds must be less than the method detection limit in the MB. If the method blank is contaminated the system will be checked for contaminants and the method blank reanalyzed. If the method blank indeed contained the contaminants, solvents used in extraction will be checked. Reanalyze the samples if the system contamination was found.

11.3 The acceptable limits for surrogate recovery are:

Surrogate compounds	Range. % recovery
1,4 Difluorobenzene	65 - 135
Chlorobenzene-d5	65 - 135
1,4 Dichlorobenzene-d4	65 - 135

If any surrogate is outside the range of recovery, the problem must be found and if the data is affected, the samples must be rerun.

11.4 Follow the batch sequence for each 24 hour shift.

Initial Calibration	Daily Analysis Sequence
STD 5 ug/mL	STD 50 ug/mL
STD 50 ug/mL	Method Blank
STD 100 ug/mL	20 Samples
Method Blank	

ATTACHMENT 2

Data Usability Summary Report Preparation Guidance

New York State Department of Environmental Conservation
Division of Environmental Remediation

Guidance for the Development of Data Usability Summary Reports

Background:

The Data Usability Summary Report (DUSR) provides a thorough evaluation of analytical data without the costly and time consuming process of third party data validation. The primary objective of a DUSR is to determine whether or not the data, as presented, meets the site/project specific criteria for data quality and data use.

Though the substitution of a DUSR for a full third party data validation may seem to be a relaxation of the Division's quality assurance requirements, this is definitely not the case. The development of the DUSR must be carried out by an experienced environmental scientist, such as the project Quality Assurance Officer, who is fully capable of conducting a full data validation. Furthermore, the DUSR is developed from a full New York State Department of Environmental Conservation Analytical Services Protocol (NYSDEC ASP) Category B or a United States Environmental Protection Agency Contract Laboratory Protocol (USEPA CLP) deliverables package.

The DUSR and the data deliverables package will be reviewed by the Division's Quality Assurance Unit. In most cases, we expect that this review will result in agreement or with only minor differences that can be easily reconciled. If data validation is found to be necessary (e.g. pending litigation) this can be carried out at a later date on the same data package used for the development of the DUSR.

Personnel Requirements:

The Environmental Scientist preparing the DUSR must hold a Bachelors Degree in a relevant natural or physical science or field of engineering and must submit a resume to the Division's Quality Assurance Unit documenting experience in environmental sampling, analysis and data review.

Preparation of a DUSR:

The DUSR is developed by reviewing and evaluating the analytical data package. During the course of this review the following questions must be asked and answered:

1. Is the data package complete as defined under the requirements for the NYSDEC ASP Category B or USEPA CLP deliverables?

2. Have all holding times been met?

3. Do all the QC data: blanks, instrument tunings, calibration standards, calibration verifications, surrogate recoveries, spike recoveries, replicate analyses, laboratory controls and sample data fall within the protocol required limits and specifications?

4. Have all of the data been generated using established and agreed upon analytical protocols?

5. Does an evaluation of the raw data confirm the results provided in the data summary sheets and quality control verification forms?

6. Have the correct data qualifiers been used ?

Once the data package has been reviewed and the above questions asked and answered the DUSR proceeds to describe the samples and the analytical parameters. Data deficiencies, analytical protocol deviations and quality control problems are identified and their effect on the data is discussed. The DUSR shall also include recommendations on resampling/reanalysis. All data qualifications must be documented following the NYSDEC ASP '95 Rev. guidelines.

Contact the Division of Environmental Remediation Quality Assurance Group at (518) 457- 9280, with any questions on the preparation of a DUSR.

Revised 09/97

ATTACHMENT 3

ENVIRON Résumés

THOMAS V. FUSILLO

EDUCATION

1977	M.S., Agricultural Engineering (Soil and Water), Rutgers University
1975	B.S., Environmental Science (Water Resources), Rutgers University

CERTIFICATIONS

Certified Ground Water Professional, No. 338.

N.J. Department of Environmental Protection Certification in Subsurface Evaluation
No. 0003212

EXPERIENCE

Mr. Fusillo is a Principal at ENVIRON Corporation. He has over 18 years of experience in environmental science and hydrology, with particular emphasis in industrial site evaluation and ground water contamination. His work here has included the following:

- Directed compliance with the Environmental Cleanup Responsibility Act (ECRA) and the Industrial Site Recovery Act (ISRA) at over 25 sites in New Jersey for clients in various industries. Sites have included chemical manufacturing, storage, and distribution facilities; chemicals and plastics research and development laboratories; a resin and specialty chemicals manufacturing facility; a major pharmaceutical firm; a cutlery manufacturer; and printing and publishing facilities. Work has included conducting preliminary assessments, site investigations, and remedial investigations; preparing and implementing remedial action work plans; and providing guidance on ECRA/ISRA compliance issues.

- Conducted and directed Phase I environmental assessments and environmental audits of numerous sites, including RCRA hazardous waste treatment, storage, and disposal facilities; chemical manufacturing and distribution facilities; printing facilities; and various manufacturing facilities, including steel mills, metal fabrication, plastics and flooring manufacturing, wire and cable manufacturing, and motor and electronics manufacturing; as well as commercial and residential properties and undeveloped land parcels.

- Designed and implemented a detailed hydrogeologic study of a southern New Jersey chemical facility to define the distribution of chlorinated solvents in ground water and the extent of surface water/ground water interactions. Installed 85 piezometers to perform detailed three-dimensional assessment of stream-aquifer interactions. Utilized soil gas surveys to assess potential sources of contamination in former wastewater lagoons. Installed monitoring well networks in two aquifers to define the lateral and vertical extent of contamination in ground water.

- Implemented a detailed RCRA ground water quality assessment at a precious metals manufacturing facility, including delineating the lateral and vertical extent of chlorinated solvent contamination in bedrock; characterizing potential source areas using soil gas sampling; and evaluating impacts of the discharge of contaminated ground water on a wetlands area.

- Designed and implemented a soil and ground water investigation at a former pharmaceutical manufacturing facility that had been demolished and was being redeveloped as an office park. Utilized soil gas surveys and surface geophysical techniques to evaluate potential contaminant source areas. Implemented three phases of site investigation to delineate soil and ground water contamination by chlorinated solvents and aromatic hydrocarbons. Developed remedial action plan to address soil and ground water contamination.

- Designed and implemented a soil and ground water investigation at a former energy research facility to evaluate the extent of chlorinated solvent contamination in bedrock and overburden aquifers. Designed soil gas investigations to identify potential source areas of chlorinated solvents. Implemented two phases of ground water investigations, including packer testing of a deep bedrock well, delineation of the lateral and vertical extent of ground water contamination, and conceptual design of a ground water remediation system.

- Directed on-site and off-site ground water investigations at a laboratory chemical manufacturing and packaging facility, where ground water contamination by chlorinated solvents is suspected to have impacted municipal well fields that are now on the National Priorities List. Developed strategies for addressing state and federal requirements for ground water investigations. Evaluated potential impacts on domestic wells and other receptors. Evaluated the effectiveness of the ground water remediation system in operation at the site.

- Designed and implemented hydrogeologic and ground water contamination investigations at numerous other industrial and commercial facilities, including soil and soil gas sampling programs, monitoring well networks, and hydrogeologic evaluation.

- Provided technical guidance on the preparation of remedial design workplans for a Superfund site in Pennsylvania.

- Directed a regulatory status review of five sanitary landfills for a major waste disposal company.

- Directed the RCRA closure of an underground hazardous waste storage tank and a hazardous waste drum storage area at a precision gear manufacturing facility, including completing a ground water assessment and corrective action plan.

- Directed underground tank investigation, removal, and remediation projects, and prepared site investigation reports for several facilities. Utilized surface geophysics, soil gas and soil sampling, and ground water monitoring to evaluate potential releases from underground tanks. Directed integrity testing of underground tanks. Evaluated remedial options to address releases from underground tanks.

- Performed environmental evaluations of several land parcels being considered for commercial development to determine the extent of any soil or ground water contamination.

- Interpreted soil and water quality data at several Superfund sites to evaluate the extent and nature of soil, ground water, and surface water contamination.

- Provided technical assistance in hydrogeology and ground water contamination in a litigation case involving insurance coverage for remediation costs at two Superfund landfills.

- Prepared Solid Waste Assessment Test (SWAT) submissions for two industrial waste disposal sites in California.

Prior to joining ENVIRON, Mr. Fusillo held the following position:

- Hydrologist and Specialist in Contaminant Geochemistry, U.S. Geological Survey, West Trenton, New Jersey.

    - Directed a multidisciplinary field and laboratory investigation of the physical, chemical, and biological processes affecting the fate and transport of chlorinated solvents in ground water, as part of the USGS Toxic Waste--Ground Water Contamination Program.
    - Directed a $1.3 million ground water contamination assessment at two RCRA-regulated industrial waste treatment facilities at a U.S. Army arsenal where ground water contamination by chlorinated solvents had affected water-supply wells.
    - Conducted a regional investigation of ground water contamination in the Potomac-Raritan-Magothy aquifer system over an area of approximately 1,000 sq. mi. in southwestern New Jersey, with emphasis on trace metals and volatile organic compounds.
    - Directed a comprehensive review of the occurrence and distribution of synthetic organic compounds in U.S. surface waters.
    - Evaluated commercially available ground water sampling devices for their effectiveness in collecting samples with representative concentration of organic compounds.
    - Analyzed the relationship between stream acidification and fish survival in Oyster Creek, New Jersey.
    - Examined the effects of suburban development on the ground and surface water resources of a rural New Jersey township.

HONORS

1987	U.S. Geological Survey Special Service Award.
1985	Listed in *Who's Who in the East.*

PROFESSIONAL MEMBERSHIPS

Member, American Geophysical Union.

Member, Association of Ground Water Scientists and Engineers.

Associate Member, Sigma Xi Scientific Research Society.

TRAINING COURSES AND WORKSHOPS ATTENDED

OSHA 40-hour Health and Safety Training, Denver, CO
OSHA 8-hour Health and Safety Refresher Course, Piscataway, NJ
Response Safety Decision-Making, U.S. Environmental Protection Agency, Philadelphia, PA
Ground Water Pollution and Hydrology, Ground Water Associates, Princeton, NJ
Ground Water Monitoring, Institute for Environmental Education, Philadelphia, PA
Ground Water Treatment Technology, National Water Well Association, Edison, NJ
Subsurface Monitoring Technology, University of Wisconsin-Extension, Philadelphia, PA
Management of Underground Storage Tanks, The Center for Professional Development, East Brunswick, NJ
Geochemistry for Ground Water Systems, U.S. Geological Survey, Denver, CO
Chemistry for Ground Water Solute Transport Models, U.S. Geological Survey, Denver, CO
Ground Water Solute Transport Workshop, U.S. Geological Survey, Denver, CO
Isotope Geochemistry, U.S. Geological Survey, Reston, VA
Seminar on Site Characterization for Subsurface Remediation, U.S. Environmental Protection Agency, Philadelphia, PA
Seminar on Characterizing and Remediating Dense Nonaqueous Phase Liquids at Hazardous Sites, U.S. Environmental Protection Agency, New York, NY

TRAINING COURSES TAUGHT

Fundamentals of Ground Water Contamination and Clean-Up, Government Institutes, Inc.
Organic Substances in Water, U.S. Geological Survey
Ground Water Sampling and Analysis, U.S. Geological Survey
Well Drilling Methods at Superfund Sites, U.S. Environmental Protection Agency

THOMAS V. FUSILLO

COMMITTEE MEMBERSHIPS

U.S. Geological Survey National Ground Water Contamination Working Group 1985-87
U.S. Geological Survey Organic Substances Task Group 1986-87
U.S. Geological Survey National Water Quality Laboratory Advisory Committee 1985-87

PUBLICATIONS AND PRESENTATIONS

Ervin, E.M., L.M. Voronin, and T.V. Fusillo. 1994. Water quality of the Potomac-Raritan-Magothy Aquifer System in the Coastal Plain, west-central New Jersey. *U.S. Geological Survey Water-Resources Investigations Report*, no. 94-4113.

Fusillo, T.V., B.P. Sargent, R.L. Walker, T.E. Imbrigiotta, and W.H. Ellis. 1991. Investigation of the discharge of ground water containing volatile organic compounds into a stream at Picatinny Arsenal, New Jersey. *Transactions, American Geophysical Union* 72(44).

Fusillo, T.V., K.M. Keoughan, and J.M. Norwood. 1991. The use of soil gas investigations for delineating chlorinated solvent contamination in soils and ground water. In *Proceedings of the Focus Conference on Eastern Regional Ground Water Issues*, Portland, Maine. National Water Well Association, Dublin, Ohio. pp. 163-175.

Sargent, B.P., T.V. Fusillo, D.A. Storck, and J.A. Smith. 1990. Assessment of contamination of ground water and surface water in the area of Building 24, Picatinny Arsenal, New Jersey, 1986-87. *U.S. Geological Survey Water-Resources Investigation Report*, no. 90-4057.

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EDUCATION

1988	M.B.A., Rutgers Graduate School of Management
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EXPERIENCE

Ms. Enard is a Consulting Environmental Chemist for ENVIRON Corporation. She has 12 years of experience in quality assurance/quality control (QA/QC) and analytical chemistry. Her work here has included the following:

- Validated laboratory report packages for completeness and contractual compliance for data submitted under the Contract Laboratory Program (CLP).

- Conducted QA/QC reviews for laboratory data packages submitted under ECRA.

- Prepared validation reports for various projects conducted under ECRA, RCRA, and CLP.

- Provided technical oversight for data quality reports submitted by third party contractors.

- Served as a technical resource for questions on environmental chemistry, including methodologies and laboratory protocols, detection limits, and data management issues.

Prior to joining ENVIRON, Ms. Enard held the following positions:

- Quality Assurance Manager, Dames & Moore, Cranford, New Jersey. Validated laboratory data packages under CLP and ECRA; conducted QA/QC audits of subcontracted laboratories; reviewed and managed data; and served as liaison between field teams, upper management, and subcontracted laboratories.

- Organics Applications Chemist, Corning/MetPath Environmental Services, Teterboro, New Jersey. Managed an organic analysis laboratory; achieved certification in organic analysis for NJDEP, NYDOH, and NIOSH; developed and implemented new tests for the organic analysis laboratory; and served as project manager for large accounts.

- Analytical Chemist, Princeton Testing Laboratory, Princeton, New Jersey. Analyzed soil, sediment, sludge, water, and air samples under USEPA, NIOSH, and independent protocols, utilizing GC, GC/MS, and physical methods of analysis.