SILRESIM SITE RI/FS
LOWELL, MASSACHUSETTS

PROJECT OPERATION PLANS

VOLUME I

Prepared for:

Silresim Site Trustees
Acton, Massachusetts

Prepared by:

Goldberg-Zoino & Associates, Inc.
Newton Upper Falls, Massachusetts

October 1985
File No. A-4054

GZA
GOLDBERG • ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS

October 30, 1985
File No. A-4054-C,PC

Silresim Site Trustees
P.O. Box 169
Acton, Massachusetts 01720

Attention: Mr. James Rogers

Re: Silresim RI/FS
Project Operation Plans
Revised

Gentlemen:

Attached please find a copy of the revised Project Operations Plans for the Silresim Site Remedial Investigation/Feasibility Study (RI/FS).

GZA has made an intensive effort to thoroughly address the numerous comments on the draft Project Operations Plans (POP) as presented in a submittal from the US EPA dated September 24, 1985, and a follow-up letter dated October 8, 1985. We feel that the present versions of the documents should encounter no major obstacles so that the subsequent phases of the project can proceed. It is noted, however, that certain aspects of the Sampling and Analysis Plan (well installations) and Subcontractor Procurement Plan are necessarily left to later stages of the project.

Certain comments provided by Mr. Phil Gschwend of the Massachusetts Institute of Technology in a letter dated September 3, 1985 were not directly addressed within the POP's. GZA offers the following responses to Mr. Gschwend's specific concerns.

- Pump type for well purging will be standard centrifugal. No attempts will be made to exclude atmospheric oxygen during well purging.
- Particle size analyses on sediments are directed at assessing hydraulic conductivity of the materials. GZA will also perform total organic content determinations on

the sediment samples, though this item is not a requirement of the CDM Work Plan.

- Sediment core samples will be vertical composites over the 0 to 2 feet depth interval specified in the CDM Work Plan. Should results from the initial sediment analyses dictate the need, more detailed delineation of contamination with depth will be completed during later stages of the project.
- The specific details of monitoring well installation and development procedures will be submitted in the Phase One Sampling Plan. Monitoring wells will be of PVC construction. Based on our extensive experience with PVC wells, we foresee no problems with use of this material. Based on the US EPA's widespread use of PVC on Region 1 National Priority List sites, it appears that they would concur.

Please advise us as to any additional comments which you or the EPA may have on these documents so that they can be finalized in an expeditious manner and field investigations can proceed.

Very truly yours,

GOLDBERG-ZOINO & ASSOCIATES, INC.

J E Ayres

John E. Ayres

JEA:crp
cc: US EPA MA/CT/VT Enforcement Section
US EPA New England Regional Laboratory
Massachusetts Department of Environmental Quality Engineering
City of Lowell
Lowell Fair Share
Ayer City Homeowners Association
Mr. Phillip Gschwend
Pollard Memorial Library, Lowell, Massachusetts

SILRESIM SITE RI/FS, LOWELL, MASSACHUSETTS

PROJECT OPERATION PLANS

INTRODUCTION

In an administrative order dated July 12, 1985, the Silresim Site Trustees agreed to assume the responsibility of performing a Remedial Investigation/Feasiblity Study (RI/FS) of the Silresim site in Lowell, Massachusetts. The Trustees have retained the firm of Goldberg-Zoino & Associates, Inc. (GZA) to conduct the RI/FS.

The objective and scope of the RI/FS are described in a work plan prepared by Camp Dresser & McKee, Inc., dated February 11, 1985. Briefly, the objectives of the RI/FS at the Silresim site are:

1. To better delineate, both on-site and off-site, the extent and nature of waste originating from the Silresim site.
2. To determine the type and extent of remedial alternatives necessary to mitigate potential threat to public health or the environment originating at the Silresim site.
3. To identify a list of potential remedial alternatives for the Silresim site and to evaluate the appropriateness and applicability of each of these remedial alternatives.
4. To recommend the most appropriate remedial action alternative or combination of alternatives to mitigate any threats from those wastes at the Silresim site.

During the Remedial Investigation, existing data will be reviewed and additional data will be collected to achieve the above objectives. The Feasibility Study will evaluate the appropriateness of various remedial alternatives and assess their cost-effectiveness.

The present document describes the various components of the Project Operation Plan for the RI. The seven site specific plans which comprise the Project Operations Plan define how various key aspects of the RI (Health and Safety, Sampling and Analysis, etc.) will be addressed by GZA. The procedures set forth in the plans will be followed during the actual performance of the RI.

BACKGROUND INFORMATION

A. SITE DESCRIPTION

The Silresim Chemical Corporation Site is located at 86 Tanner Street in the south-central portion of the City of Lowell, Massachusetts. The site is located in an area of industrial activity approximately one mile south of Lowell's central business district. The site is bordered on the east by Boston and Maine railroad tracks, by various industrial facilities on the south and north, and by Tanner Street on the west.

The closest residences to the site are located on Canada, Maple and Autumn Streets, approximately 325 feet south of the perimeter fence. Other residential areas are located to the east and northeast of the site. The site location is zoned for industrial activity. All of the local businesses and residences receive their drinking water from municipal sources distant from the site.

The site area is approximately five acres, and it is currently totally enclosed by a chain link fence with three entrance gates. The site is nearly flat with a vertical relief of approximately six feet. All structures have been removed from the site and a crushed stone/clay cap has been installed.

B. SITE HISTORY

Prior to the Silresim Chemical Corporation purchasing the properties at 86 Tanner Street they had existed as three separate parcels. The central parcel was owned by Shell Oil from 1929 to 1941. In 1941 it was purchased by Herbert Carragher, who leased the property to Mobil Oil. Silresim purchased this central parcel in 1971 and purchased the other two properties in 1974.

The following capsule summary of site history is based in part on the CDM RAMP.

- In 1971 a chemical waste reclamation facility was established by Silresim Chemical Corporation at 86 Tanner Street in the City of Lowell, Massachusetts.
- In 1973, Silresim applied for and was granted a hazardous waste collection and disposal license by the Massachusetts Division of Water Pollution Control

(DPWC). The facility was designed to recycle or ultimately dispose of chemical wastes by incineration or off-site landfill. Reclamation of certain chemicals, oils and metals was performed at the site.

- In January 1976, DWPC issued a modified permit to Silresim which contained general and specific conditions limiting the types of wastes which could be accepted at the facility. Silresim contested these permit modifications, and they were subsequently lifted under an agreement for judgment in conjunction with the imposition of a compliance schedule for site cleanup and improved operations.

- Silresim filed for bankruptcy in late 1977, leaving one million gallons of waste in drums and bulk storage at the site. The facility was abandoned in January 1978.

- In January 1978, in an effort to secure the site, a chain link fence was installed around the site's perimeter and a 24-hour guard placed at the site.

- Fred C. Hart Associates was retained by the US EPA in early 1978 to perform a preliminary study of the environmental conditions at the site.

- Coastal Services, Inc., under contract with DWPC, constructed berms and absorbent filled trenches at the site in March 1978 to reduce the spread of surface wastes.

- In late 1978, Mitre Corporation was retained by DWPC to provide services during selection of a contractor for waste removal.

- NEWCO Chemical Waste Systems, Inc., of Niagara Falls, New York was selected to remove and dispose of all drums and tanks containing waste. The work was started in December 1978. Depletion of available funds resulted in work stoppage in September 1980 before site clean-up could be completed.

- In 1981, the Massachusetts Legislature approved a bond issue for cleanup of hazardous waste. Arthur D. Little, Inc. was retained by DEQE as a hazardous waste management consultant.

- In July 1981, Arthur D. Little, Inc. prepared a request for proposals (RFP) for the removal of the remaining wastes at Silresim.

- Jet-line Services, Inc. of Stoughton, Massachusetts, was selected as the contractor for completion of site cleanup. Work began in August 1981 and site cleanup was completed by September 30, 1981.

- In October 1981, Perkins-Jordan, Inc., was hired by DWPC to conduct a hydrogeologic investigation at the Silresim site. An initial hydrogeologic report was submitted to the DWPC on February 26, 1982; an evaluation of remedial alternatives and a supplementary hydrogeologic report were submitted on April 27, 1983, and March 8, 1983, respectively.

- On December 21, 1982, the Silresim site was included on EPA's National Priority List in accordance with the National Contingency Plan. A Remedial Action Master Plan (RAMP) was prepared for EPA by its contractor Camp Dresser and McKee. The final RAMP was submitted to EPA in April 1983.

- In the Spring and Summer of 1983 EPA demolished the existing buildings at the Silresim site and installed a crushed stone cap. Subsequently, a clay cap was installed on the site.

PDP 1.1

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SILRESIM SITE RI/FS, LOWELL, MASSACHUSETTS

OFF-SITE MANAGEMENT PLAN - SECTION 3.1.1

1.00 INTRODUCTION

This document is the off-site management plan for the RI/FS work, and is intended to guide the performance of field investigations at locations off the Silresim site. The plan addresses issues of access, security, and contingency planning for all off-site areas to be included in the RI/FS. The Off-Site Management Plan will be updated regularly, as necessary, to reflect new information developed during the course of the RI/FS.

2.00 ACCESS

A minimum of thirty off-site exploration locations are in existence or proposed (Plate 1) in the work plan. These include eleven proposed test boring locations, eight existing monitoring wells, nine surface water sampling locations, and at least two surficial soil sampling locations. Access issues involved in gaining entry to these off-site locations include obtaining permission to enter the subject property, and the physical condition (topography, vegetation, etc.) of the off-site sampling location.

2.10 RIGHT OF ENTRY TO OFF-SITE LOCATIONS

The names and addresses of the owners of off-site locations included in the RI/FS will be obtained from appropriate public agencies. (It is our understanding that the U.S. EPA has already compiled much of this information. These data will be supplemented as necessary by information from the City Assessor's office and field visits to the proposed site. A preliminary list of property owners is presented as Table 1 of this plan.) The US EPA will initially notify owners of properties within which proposed explorations are located via a preliminary letter outlining general access requirements. (A sample of an access letter from EPA is included as Appendix A of this plan.) GZA will follow up this initial letter with a more explicit written request for access to the subject properties. The request will include a description of the work to be performed, including:

> the type of exploration to be conducted (test boring, surface soil sampling, etc);
>
> the location(s) on the property where the work will be performed;
>
> the type of equipment which will be brought to the property to perform the work and any equipment which may be left on site;
>
> the method of access of this equipment to the work site;
>
> the approximate date(s) the work will be carried out;
>
> an invitation to split samples and/or receive analytical results, as requested; and
>
> assurance that exploration work will not interfere with business activities on the respective properties.

A sample access request letter is provided as Appendix B of this plan. It is noted that a single letter describing anticipated work during the course of the RI is planned, with verbal follow-up, as necessary. GZA will request that the landowners give written permission to enter their property for the performance of the required work; however, access requests will assume implied permission if no reply is received.

Special requirements for access to Boston & Maine Corporation property are outlined in Appendix C.

In the case of a landowner who refuses access to his property, one of two courses of action will be pursued depending upon the specific explorations involved and data requirements, and input from the US EPA:

a) The preferred alternative would be to contact the U.S. EPA and/or the Massachusetts Department of Environmental Quality Engineering for assistance in gaining access.

b) In the event that (a) above is not possible, an alternative location will be selected subject to EPA approval based on proximity to the originally selected site and access requirements.

In the event that alternative locations must be selected, these new locations would be submitted in writing to EPA for review prior to performance of the field work.

2.20 OFF-SITE ACCESS CONDITIONS

Proposed locations for off-site explorations have been selected and presented on Figure OM-1 of this document and Plate 1 of the CDM RI/FS Work Plan, based on locations for which additional information is needed. Actual locations for the proposed monitoring wells will be selected during Part II RI activities (Initial Studies) after review of available data; locations of surface water, sediment and soil sampling stations are anticipated to correspond closely with those selected by CDM. Access for each of the previously selected exploration locations will be verified by GZA during an initial field reconnaissance. At this time, GZA will observe topography, vegetation, the presence of underground or above ground structures, and general surficial conditions at each proposed location. In addition, the presence of underground utilities will be appraised by contacting "DIG-SAFE" and the property owner. Should conditions preclude access to one or more locations, an alternative location will be selected as close as practicable to those originally proposed. Should significant changes in proposed locations be necessary, alternative exploration sites would be submitted in writing to EPA for review prior to initiation of field work.

For the monitoring wells, the access conditions outlined above will be considered in the selection of locations during preparation of the phase one and two monitoring well installation plans so additional field verification will not be necessary.

3.00 SECURITY

Three issues have been identified related to off-site security: the security of exploration equipment during the off-site investigations, the security of the off-site property itself during the exploration and testing program, and the security of sampling stations at off-site locations.

3.10 EQUIPMENT SECURITY

During working hours, drilling and sampling equipment will be in the care of GZA Drilling, Inc. or GZA personnel. At the end of each working day, equipment may be removed to fenced locations at the Silresim site. If the equipment is to be left at the off-site location, tools and other small equipment will be placed in locking containers or removed from the site. Larger equipment (drill rods, drive hammers, etc.) will be left in such a manner as not to present a threat to public safety. Keys to the drill rigs and trucks will be removed.

3.20 SECURITY OF OFF-SITE PROPERTY

In the case of off-site locations in fenced areas, arrangements will be made by GZA with the property owner to open gates or otherwise grant access to the location. Drilling and GZA personnel will be instructed as to any special property care requests of the landowner. At the end of each working day (and during the day if requested by the landowner), gates or other access points will be locked, unless otherwise directed by the landowner.

3.30 SECURITY OF OFF-SITE SAMPLING LOCATIONS

As previously noted, three types of off-site locations have been identified: test borings, with observation wells to be installed; surface water sampling locations; and surficial soil sampling locations. Unfinished boreholes will be secured at the end of each day of drilling by attaching a steel cap, wrench-tightened, over the drill casing and/or drill rods and placing the 140-pound and 300-pound hammers over the assembly. The observation wells will be equipped with locking steel casings embedded in concrete as protection from vandalism and general damage. Surface water and surficial soil sampling locations are not anticipated to require any special security precautions.

4.00 MONITORING AND CONTINGENCY PLANNING FOR FIELD EXPLORATIONS

It is currently believed that the major areas of contamination related to the Silresim site are located on or adjacent to the clay-capped area and that off-site zones will exhibit lower or nondetectable contaminant concentrations. However, it is probable that significant levels of groundwater contamination will be observed immediately to the north of the site and possible that contamination unrelated to the Silresim site may be discovered at off-site locations. Therefore, a program to monitor and abate any potential hazards associated with off-site exploration activities is a required part of the RI/FS.

4.10 NOTIFICATION OF LANDOWNER

Continual monitoring with a portable photoionization detector (PID) will be conducted in the breathing zone (1 to 6 feet above ground surface) during all subsurface explorations. In addition, periodic monitoring with the PID will be conducted at the downwind limit of the exclusion zone set up around the exploration site , as described in Section 4.20 of the Health and Safety Plan or at the downwind site boundary (fence line). "Downwind" direction will be based on readings from the portable meteorological station to be established on site. Soils brought to the surface during explorations will also be monitored with the PID on an essentially continuous basis.

4.20 ACTION LEVELS FOR MONITORING

Action levels for total organic levels measured as indicated above the the PID have been established based on the CDM Work Plan, previous NUS remedial work at the Silresim site and on GZA's past experience. These levels are based on incremental readings above an established background level for total volatile organics (TVO's). Background TVO level will be established daily, prior to the start of field activities in the general area of proposed activities. Should background TVO levels exceed 5 parts per million, EPA's on-site representative and their Regional Site Project Safety Officer, Mr. David Webster, will be notified by the GZA Site Safety Officer (SSO). A background TVO in excess of 10 ppm will trigger immediate notification to the following:

• Mr. David Webster, US EPA	223-9740
Alternate: Ms. Heather Ford US EPA	223-5906
• Mr. Richard Chalpin, MA DEQE, Northeast Region	935-2160
Alternate: Mr. John Fitzgerald, DEQE	935-2160
• Mr. James Campbell, Assistant City Manager Lowell, MA	454-8821 Ext 208
Alternate: Mr. Robert Desmarais, Board of Health, Lowell, MA	454-8821 Ext 239
• Property Owner	
• Silresim Site Trustees	
Mr. James Rogers	493-3837
Mr. Richard Cahaly	577-4106

Site work will be suspended until the source of the volatile contamination can be characterized and abated.

Assuming background ambient air readings are less than 5 ppm, incremental readings as listed below will trigger the following responses:

- 1.0 ppm sustained for 5 minutes in the breathing zone - 1) Workers in the exclusion zone will don respiratory protection. 2) Monitoring of the downwind limit of the exclusion zone will be conducted at 15-minute intervals.

- 1.0 ppm sustained for 5 minutes at the downwind limit of the exclusion zone or fence line - 1) Notify individuals from US EPA, Massachusetts DEQE, and City of Lowell as listed above and property owner. 2) Monitor downwind between exclusion zone and nearest receptor. 3) Prepare to cease exploration activities.

- 1.0 ppm sustained for 5 minutes between exclusion zone and nearest receptor of greater than 200 feet from exclusion zone - 1) Cease all exploration activities. 2) Cover exploration site and any exposed soils from exploration with polyethylene. 3) Notify parties listed above.

- 25 ppm sustained for 5 minutes in breathing zone at exploration site - Workers in exclusion zone don Level B protection as detailed in Health and Safety Plan.

Soils brought to the surface during drilling for monitoring wells or surficial soil sampling activities will be monitored with the PID, as above, and segregated if levels of TVO's exceed 10 ppm. Segregated soils will be covered with a polyethylene liner to limit generation of volatiles until completion of drilling activities. At that point, soils exceeding the 10 ppm criteria will be placed in 55-gallon drums for appropriate off-site disposal.

4.30 DISCOVERY OF CONTAMINATION OFF-SITE

It is possible that unanticipated contamination (i.e., contamination of shallow soils or groundwater not related to the Silresim site) may be encountered during subsurface explorations at off-site properties. The monitoring program, response levels, and notification requirements described in the preceding sections of this plan will, therefore, apply to all subsurface explorations. In addition, discovery of obvious evidence of waste disposal (e.g., containerized wastes, sludge layers, oil saturated soils, etc.) at off-site locales will trigger the notification requirements of Section 4.20 above, irrespective of TVO readings. The Site Safety Officer will be responsible for upgrading personnel protection levels, as necessary, in the event of such a discovery.

4.40 ACCIDENTS

Should accidents resulting in property damage or physical injuries occur during the exploration program, GZA will promptly notify EPA's or GCA's representative on the site as well as the individuals listed under Section 4.20. Relevant sections of the Health and Safety Plan will then be followed in the event of any such accident.

TABLE 1

PROPERTY OWNERS IN THE VICINITY OF THE SILRESIM SUPERFUND SITE

Name	Lot(s) Owned*	Mailing Address (If Different)
Robert P. Betty	158 Tanner; 36 Canada	160 Tanner Street, Lowell, MA 01850 or 15 Shirley Avenue Lowell, MA 01854
Robert S. Blanchard	26 Robinson	same
James Bond	125 & 147 Cambridge; 95 & 125.1 (rear) Tanner	40 Stone Street Dracut, MA 01826
Richard G. Boyle	1 Maple	Sherburne Road Tyngsboro, MA 01826
George Bresch	268 Howard	No listing
Edmund Buckley	30, 12, & 2 Canada	27 Canada Street Lowell, MA
Eleanor Burke	97.1 Lowell Connector	Address unknown
John H. Carroll	95 Cambridge	651 Trull Road No. Tewksbury, MA 01876
Robert L. D'Ambroise	137 Cambridge	46 Upham Street Lowell, MA 01850
Norberto M. Ferreira	34 Robinson	Same
George A. Gaynon	22 Robinson	No listing
Eugene F. Gessner	169 & 170 Tanner	170 Lincoln Street Lowell, MA 01851

Name	Lot(s) Owned*	Mailing Address (If Different)
Rodrique A. Houde	101 Congress	137 River Road Tewksbury, MA 01876
George R. Lima	8 Robinson Street	Same
City of Lowell	126 Cambridge; 29 Robinson; 35.1 Lowell Connector	
Maler Realty Trust	17 & 20 Hopey 148 Tanner	No listing
Massachusetts Bay Transportation Authority	115 Congress	No listing
Francis J. McCabe	30 Robinson	Same
Charles E. McNamara	15 Tanner	195 Remington Street Lowell, MA 01852
Manuel Medina	14 Robinson	Same
Menands Investment Trust	2 Tanner; 268.1 Howard	John Scannell 26 Tanner Street Lowell, MA 01854
Clarence A. Moran	48 Canada	Same
Richard J. Nowak, Jr.	280 Howard	Same
Penn Central Railroad Company/ B & M Railroad	121 Maple; 56 Canada	c/o Edward E. LeBlanc 150 Causeway Boston, MA 02114
Richard Proctor	60 Dix	216 Butman Road Lowell, MA 01852
Scannell Boiler Works	16 Tanner	John Scannell 26 Tanner Street Lowell, MA 01854
Daniel J. Sheehan	97 Tanner	8 Maplewood Drive No. Tewksbury 01876

Name	Lot(s) Owned*	Mailing Address (If Different)
William L. Stigler	1 & 9 Brook	Lowell Used Auto Parts 21 Clapp Street Dorchester, MA 02125
Daniel T. Sullivan, Jr.	131, 131.1, and 149 Tanner Street	1 Bancroft Road Andover, MA 01810
The Transit Construction Company	61 Maple	62 Sherburne Road Tyngsboro, MA 01879
Ralph & Gail Tucci	92, 94, 121, 125, 118 & 108 Tanner	No listing
Vaughn Industrial Properties	237 Howard	c/o George Cem 237 Howard Street Lowell, MA 01852
Walbert Plastics Inc.	35 Tanner	c/o Charles Garland, Jr. (same)
Wright Leasing & Realty	5 Main; 2 Russell; 66 Canada; 1, 3, & Hope	Mr. Harold Wright 194 Sherborne Road Pelham, NH 03076

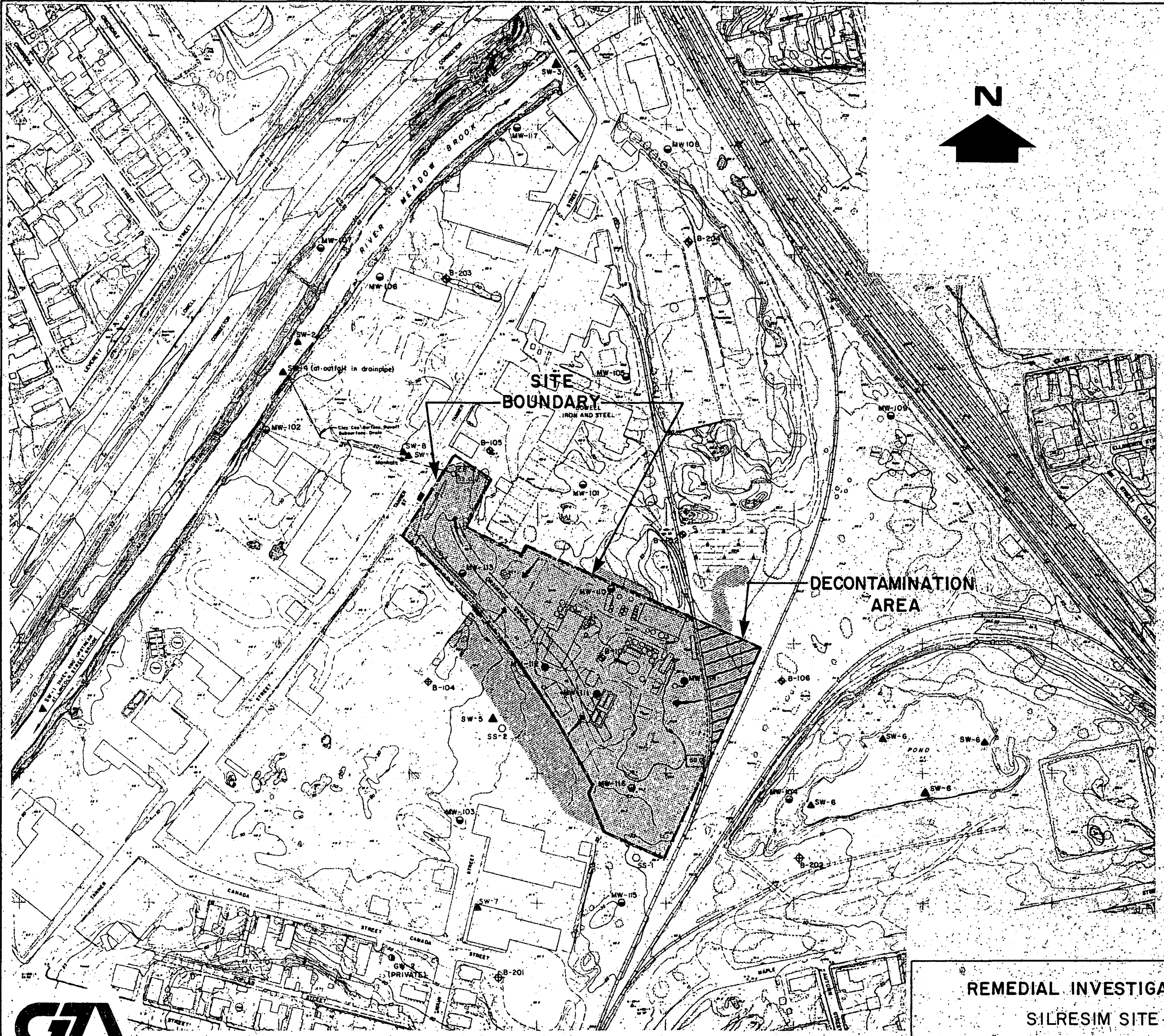
NOTES:

1) *Lot No. is same as street address in Lowell

2) Property owners, lot numbers, and mailing addresses from City of Lowell Assessor's records.

FIGURE OM-1

SITE PLAN



NOTE:

1) BASE MAP AND EXPLORATION LOCATIONS FROM PLATE I OF CDM RI/FS WORK PLAN, FEBRUARY, 1985.

LEGEND:

▒	CLAY CAPPED AREA
▨	CRUSHED STONE DECONTAMINATION AREA

REMEDIAL INVESTIGATION
SILRESIM SITE
LOWELL, MASS.

SITE PLAN

OCT., 1985

FIGURE No. OM-1

GZA

FILE No. A-4054.01

APPENDIX A

SAMPLE EPA ACCESS LETTER

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

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

SEP 16 1985

Lawrence B. Boyd, P.E.
Boston & Maine Corporation
Iron Horse Park
North Billerica, MA 01862

Re: Access to property located in Lowell, MA for Remedial Investigation/Feasibility Study (RI/FS) of Silresim Superfund Site

Dear Mr. Boyd:

The U.S. Environmental Protection Agency (EPA) has approved a work plan for a detailed investigation of the Silresim Site. This site has been listed as a priority hazardous waste site pursuant to Section 105 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9605. The site is thus eligible for cleanup response financed by the federal hazardous waste Superfund.

As a part of the remedial response to this site the Silresim Trust and its contractor GZA Corporation are conducting a Remedial Investigation and Feasibility Study (RI/FS) under order from the EPA. The purpose of the RI/FS is to determine the nature and extent of hazardous substances that exist and to evaluate cleanup plans for the site. The primary focus of the RI/FS for the Silresim Site is groundwater contamination.

As part of this investigation, it may be necessary to install groundwater monitoring wells, sample any existing wells or sample soils on your property. Your grant of access is requested in order to conduct these activities.

The purpose of these wells is to establish the extent of hazardous waste migration through groundwater. GZA Corporation personnel, under order from EPA, will supervise the well placement and the actual drilling. In order that drilling proceed in as unobstrusive a manner as possible, GZA Corporation personnel will contact you prior to sampling or drilling. If you wish to be on site during drilling you may arrange to do so with GZA Corporation. Initial sampling well installation is scheduled for fall of 1985. Copies of any analytical results of sampling and analyses performed on your property will be made available to you if requested, following appropriate quality control analysis. In addition, should you so desire, split samples can be obtained at your expense.

Entry to your property for conduct of the above described activities is authorized by the Federal Law, in particular Sections 104 and 106 of CERCLA, 42 U.S.C. Sections 9604 and 9606 and § 3007 of the Resource Conservation and Recovery Act, 42 U.S.C. § 6927. This authorization includes access to private property for purposes of sampling and testing. EPA respectfully requests your cooperation in assisting the Agency in completing the investigation on this site. If EPA does not receive any objections from you within five (5) days of receipt of this letter, it will be assumed that you have consented to entry for the above described activities.

The work plan for the RI/FS can be viewed at the Lowell Public Library and at the JFK Federal Building in Boston.

If you have any questions concerning the proposed drilling and sampling, please contact David Webster, the Regional Site Project Officer, at (617) 223-4909 or Michael Thomas, the Regional Site Attorney, at (617) 223-0400.

Thank you for your cooperation.

Sincerely,

Patricia L. Meaney for

Merrill S. Hohman, Director
Waste Management Division

cc: Phillip Nyman, Esquire
Nancy Bettinger, MA DEQE
James Campbell, Assistant City Manager
James Rodgers, Silresium Trust
John Ayers, GZA Corporation ✓
Mike Jasinski, GCA Corporation

APPENDIX B

SAMPLE GZA ACCESS LETTER

Property Owner
Abutter Street
Lowell, Massachusetts 01852

Re: Access to Property, Lowell, MA
for Remedial Investigation/
Feasibility Study RI/FS of
Silresim Susperfund Site

Dear Owner,

Goldberg-Zoino & Associates, Inc. (GZA), a local geohydrologic engineering firm under contract with the Silresim Site Trust, is conducting a Remedial Investigation/Feasibility Study (RI/FS) of the Silresim Superfund site. The study is the result of a consent order issued by the U.S. Environmental Protection Agency (EPA) who will be monitoring GZA's activities. The project will be managed by Mr. Lawrence Feldman; field work will be directed by Mr. Charles A. Lindberg. Both of these individuals can be contacted at GZA's Newton, Massachusetts, office (969-0050).

The purpose of the RI/FS is to further define and characterize groundwater and soil contamination and to evaluate potential remedial measures at the site. Data will be gathered by conducting an initial field reconnaissance, drilling test borings to obtain soil samples, and installing groundwater monitoring wells, as well as obtaining surficial soil samples in the vicinity of the site. We are writing at this time to request access to your property and to describe the drilling and sampling procedures scheduled to occur on __________.

Specifically, the work proposed on your property will entail the following:

> (Include types of explorations, plan showing proposed location, type of equipment to be used or left on-site and method of access for equipment.)

GZA will coordinate our activities on your property with you such that no interference with your normal business activities will result. You are welcome to receive replicates of samples collected from your property and/or a copy of the results of our analyses. Please indicate your desire to split samples or receive analytical results in your reply to this request.

Should you have any problems with the work on your property or require additional information, please contact Mr. Feldman or Mr. Lindberg. It is requested that you reply in writing regarding our proposed access; however, if we do not hear from you within ten days your implied permission will be assumed.

GZA appreciates your cooperation and assistance in this matter.

Very truly yours,

GOLDBERG-ZOINO & ASSOCIATES, INC.

Charles A. Lindberg

Lawrence Feldman

CAL/LF:crp

APPENDIX C

BOSTON & MAINE CORPORATION ACCESS REQUIREMENTS

BOSTON & MAINE CORPORATION
DELAWARE & HUDSON RAILWAY COMPANY
MAINE CENTRAL RAILROAD COMPANY

September 30, 1985

David Webster
Regional Site Project Officer
JFK Bldg.
Boston, MA 02203

Dear Mr. Webster:

RE: Silresim Superfund Site
Lowell, MA

Thank you for forwarding the RI/FS Work Plan and the Off-Site Management Plan for this site. I have reviewed the information relative to proposed installation of monitoring wells and sampling on Boston and Maine property.

It appears that MW-109 and MW-115 are proposed to be installed on Boston and Maine property, and that SS-1 is also located on railroad property. Further, installation of MW-109 will necessitate crossing a track by the boring rig. Please be advised that Boston and Maine Corporation, in the interest of protecting its' operations, has developed standard requirements for contractors entering railroad property to conduct work. Specifically relating to this site, the contractor will be required to meet the following requirements:

1. All borings shall be performed in accordance with railroad standards. I am forwarding a copy of our General Requirements for Test Borings on Railroad Property.
2. Contractor must execute the Standard Railroad Service Contract.
3. Contractor must provide an acceptable original Railroad Protective Liability Policy.
4. Contractor must deposit, in advance, an amount sufficient to cover anticipated railroad protective services.

Items 1 and 4 are to be coordinated with Mr. Gary A. Gordon, P.E., Assistant Chief Engineer-Design. Items 2 and 3 are to be coordinated with Mr. John J. Brennan, III, Esq., Manager-Agreements and Contracts. Their telephone numbers are, (617) 663-6972 and (617) 663-1195, respectively.

Please have GZA Corporation contact me directly at their earliest convenience in order to expedite completion of the requirements in advance of the planned construction date. Once the requirements have been met, access will be granted to perform the necessary work. Boston and Maine Corporation wishes to assist the Agency in completing the investigation of this site.

I am forwarding a plan detailing railroad property in the vicinity of Silresim for your information. Should you have any questions, please contact me at (617) 663-6967.

Very truly yours,

Michael P. Clark

Michael P. Clark
Environmental Engineer

MPC/jf

cc: G. A. Gordon
J. J. Brennan, III

BOSTON & MAINE CORPORATION
DELAWARE & HUDSON RAILWAY COMPANY
MAINE CENTRAL RAILROAD COMPANY

IRON HORSE PARK
NO. BILLERICA, MASS. 01862

GENERAL REQUIREMENTS
for
TEST BORINGS ON RAILROAD PROPERTY

All borings on the property of Guilford Transportation Industries-Rail Division (Boston and Maine Corporation, Delaware and Hudson Railway Company and Maine Central Railroad Company) are to be performed according to, but not limited to the following requirements:

1. Work on the Railroad property must be done with inspection and/or flag protection present.

2. Where access must be gained by crossing the tracks, a temporary crossing is to be used. This crossing must adhere to the following:

    a. The location and material must be approved in advance by the Chief Engineering Officer of the railroad or his authorized representative.

    b. It is to be constructed by Railroad forces at the Contractor's expense in the presence of a railroad construction inspector.

    c. It is to be removed from the track after the equipment is moved into place each day. It is <u>not</u> to remain on the track under traffic.

    d. No crossing of the track shall be made without the flagman and/or inspector present.

    e. The crossing of tracks shall be kept to a minimum.

3. Boring locations, to include positioning the boring rig, shall be made so that they do not come within 8'6" of the centerline of track.

4. All borings must be cased to insure adequate return (of mud and water) and to avoid undermining of the track.

5. All holes shall be backfilled with cement grout to fill the voids and protect against an artesian condition.

6. The location of all existing utilities (both railroad and municipal) shall be located and suitably marked by contractor, at his expense, to avoid damage to the utility and track structure.

7. Prior to entry upon the railroad property, all necessary contracts, insurance policies and financial obligations shall be provided in a form acceptable to the railroad.

8. Work within the operating right-of-way that has the potential to foul the tracks, shall be restricted to periods of non-peak passenger operations due to frequency of trains.

9. In performance of the work, full cooperation with the inspector and the flagman is essential. Work will be under train traffic, and if your work or conduct in any way jeopardizes the safety of rail traffic and personnel, then the work shall be shut down immediately.

Office of the Chief Engineer
Design and Planning
GTI Rail Division

July 10, 1984

POP 1.2

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SILRESIM SITE RI/FS, LOWELL, MASSACHUSETTS

SAMPLING AND ANALYSIS PLAN, SECTION 3.1.2

1.00 INTRODUCTION

This Sampling and Analysis Plan describes procedures to be used during the RI to ensure the collection and analysis of representative samples from the site and its environs. The sampling and analysis plan has been written to satisfy the requirements presented in the Silresim Site RI/FS Work Plan prepared by Camp Dresser & McKee, Inc. (CDM), dated February 11, 1985 in accordance with the outline provided in Guidance on Remedial Investigations under CERCLA (U.S. EPA, May 1985).

The objective of the sampling and analysis program is to provide detailed information regarding the types, concentrations, and distribution of chemicals at the Silresim site and in surrounding areas.

In addition to the sampling and analysis protocols presented in this document, additional quality assurance/quality control information is presented in the Silresim Site Quality Assurance Project Plan. The specifics of the well installation and groundwater sampling programs will be submitted as part of Deliverable 2 ("Phase I Sampling Plan") of Part II of the RI/FS (see page 5-4 of work plan).

2.00 ANALYSIS OF EXISTING DATA

Existing data regarding the extent and degree of soil and groundwater contamination at the Silresim site have not been fully reviewed by GZA to date. During Part II (Initial Studies) of the RI/FS, these data will be compiled and an appropriate assessment of the validity, sufficiency, and sensitivity of the information will be performed as described in the Work Plan. The data will also be classified in accordance with procedures outlined in the Data Management Plan.

3.00 ANALYTICAL PARAMETERS

The contaminants previously detected by other investigators at the Silresim site include volatile organic compounds, pesticides, and PCB's (see Table 1). The proposed sampling program for the RI/FS is presented in Table 3-1 of the CDM Work Plan (see Table 2). The majority of the groundwater samples will be analyzed for volatile organic compounds only; at selected existing monitoring wells, groundwater samples will also be analyzed for other contaminants detected in earlier rounds. Sediment and surface water samples, and selected groundwater samples, will be analyzed for priority pollutant compounds. In addition, groundwater from the upper level of well B-102 will be analyzed for Appendix 8 RCRA 261 pollutants.

4.00 PREPARATION FOR SAMPLING

The following sections describe preparations to be made prior to sample collection. Many of the preparations described apply to all types of samples to be collected, while other procedures and/or equipment apply only to certain types of samples (e.g. groundwater).

4.10 COORDINATION WITH ANALYTICAL LABORATORY

The analytical laboratory to be used for the RI/FS investigations, Roy F. Weston, Inc., is certified by the EPA Contract Laboratory Program. Prior to each planned sample collection round, Roy F. Weston laboratory personnel will be contacted by GZA, and the following information will be provided:

- Types of analyses required
- Sample matrix
- Number of samples
- Anticipated order-of-magnitude concentration (if known from prior analyses), and

- Date(s) samples will be collected.

At the time of scheduling, any potential conflicts at the laboratory will be discussed, and arrangements made to help ensure the analysis of samples in a timely manner.

4.20 SAMPLE CONTAINERS

Sample containers to be used during the RI will be obtained from Roy F. Weston. The types of containers to be used and the cleaning and preparation procedures for the containers will depend on the analytical parameters and sample matrix. Container type, size, method of preparation, and sample preservation will be in accordance with EPA protocol, as described in Sections 2.20 and 5.20 of the QA/QC Plan attached.

4.30 EQUIPMENT

Most of the equipment to be used for the collection of samples is maintained at GZA's Newton office, and is routinely checked for serviceability as described in the QA Project Plan. Equipment will be shipped to the site via mobile laboratory van and/or private automobile. Certain required items (e.g. ice) may be purchased locally.

Equipment available at GZA's Newton office include:

Water level measuring devices

Bailers and bailer cables

Centrifugal pumps and associated supplies

Trowels, spades, buckets

Coolers and ice

Health and Safety Equipment (e.g. Tyveks, respirators, gloves)

Field screening equipment (e.g. pH and conductivity meters)

Decontamination equipment (distilled water, decontaminating solutions, etc.)

Miscellaneous supplies (wrenches, paper towels, etc.)

Record keeping supplies (labels, pens, chain-of-custody forms, log books)

Water level measuring devices will consist of either electric water level readers or measuring tapes graduated in 0.01-foot increments and equipped with sounding devices. The water level readers will be decontaminated after each use by rinsing in methanol followed by distilled water.

Bailers to be utilized during the RI are constructed of stainless steel and equipped with Teflon ball-check valves. Prior to use, the bailers will be washed in a strong detergent (Alconox), followed by a clean water rinse. The bailers will then be rinsed with reagent-grade methanol and allowed to dry. Bailers are brought to the field sealed in clean polyethylene bags, and clean bailers are stored separately from used bailers. Bailer cables will consist of separate lengths of nylon rope, one for each well to be sampled.

4.40 ON-SITE SAMPLING AND ANALYTICAL EQUIPMENT

On-site analytical equipment to be utilized during sampling may include one or more of the following:

Portable photoionization detector (PID)

Portable pH meter

Portable conductivity meter

Portable dissolved oxygen meter

Century Systems Model OVA-128 organic vapor analyzer (OVA)

4.50 PROTECTIVE CLOTHING AND SAFETY EQUIPMENT

The types of protective clothing and other health and safety equipment required during the various sampling operations at the Silresim site are discussed in the Silresim Site Health and

Safety Plan. Sufficient health and safety equipment will be available to meet the needs of personnel involved in field sampling activities.

4.60 RECORD-KEEPING AND SAMPLE CUSTODY PROCEDURES

A variety of materials is required to record data, identify samples, and ship packages. The forms, labels, and documents required when sampling are listed in the QA/QC document. These are available at GZA's Newton office.

4.70 CLEANING, PRESERVATIVE AND PACKING MATERIALS

4.71 Cleaning Materials

Equipment used to sample in more than one location must be cleaned before it is reused. Cleaning materials are identified in the QA/QC plan. Cleaning materials which can be used without compromising sample integrity must be carried to the site or purchased locally, and include:

Distilled water
Tap water
Methanol
Detergent

4.72 Preservative Materials

Samples subject to degradation after being removed from their environment to a sample container must be properly preserved to retard this degradation. Preservation appropriate to the analyses of interest are listed in Section 5.20 of the QA/QC document. Chemical preservatives will be obtained from the Roy F. Weston laboratory and brought to the site.

4.73 Packing Materials

All samples must be packed to protect them from physical abuse and breakage during shipment. Glass containers should be packed in compartmental boxes, or blister-pack. In addition, the sampling team should have a supply of vermiculite, paint cans, tape, plastic bags, packing crates, and labels.

4.80 COORDINATION WITH REGULATORY AGENCIES

When the proposed dates of sampling rounds at the Silresim site have been determined, GZA will notify designated representatives of US EPA, EPA's Oversight Contractor (GCA), and the Massachusetts DEQE. Whenever possible, GZA will give at least two weeks advance notice of field activities. (However, it is noted that such advance notice will not be possible for sampling activities tied to precipitation events, such as surface water station SW-5 from the CDM Work Plan.) In addition, GZA shall notify EPA of the sampling date, sampling media, and numbers of samples from each media at least one week in advance of sample collection. Representatives of these agencies may then accompany GZA personnel into the field to observe sampling procedures and/or collect split or duplicate samples if desired. GZA will provide containers, labels, and chain-of-custody forms for duplicate samples to EPA or their field representatives.

4.90 DEVELOPMENT OF OPERATIONAL PLANS FOR SAMPLING

Operational sampling plans will be developed in sufficient detail to guide the Project Manager in completing the work. The first section of the plan will describe the members of the sampling team and their responsibilities and training.

The plan will give a complete description of the documentation required for field sampling. This will include a list of numbers of forms, labels, and notebooks corresponding to the type and number of samples to be taken. This discussion will be referenced to applicable parts of the QA/QC program plan.

All of the equipment and supplies to be required for field sampling, testing, and shipping will be specified. The list will be developed according to the number and types of samples to be taken. The plan will describe where the equipment can be located and will explicitly state which supplies can be purchased in the field. Responsibility for testing and checking is covered by the QA/QC program plan.

Work in the field will be guided by sampling orders. These will explicitly describe the sampling locations, media, sample types, and equipment, and will allocate tasks in sequential order. Sampling locations will be identified with plans and drawings. These plans will be prepared to use personnel in a cost effective manner, to conform with QA/QC requirements, and to fulfill needs for complete documentation.

Field activities must be conducted in accordance with the Health and Safety Program Plan. Procedures necessary to protect the health of team members and to promote safe working conditions will be specified in a Health and Safety Plan for each field sampling event.

5.00 SAMPLING PROCEDURES

The following section describes the general procedures to be used in the collection of groundwater, surface water, sediment, surficial soil, subsurface soil, and air quality samples. More detailed procedures are provided in the Standard Operating Procedures (SOP's), attached to the QA/QC Plan as Appendix QA-1. It is assumed that the sources of waste compounds (storage tanks, drums, etc.) have been removed from the site; therefore, methods of sampling these media are not discussed. Table 3 presents a summary of the sampling program for the RI, including references to SOP's, blank and duplicate sample requirements, and sample types.

5.10 GROUNDWATER SAMPLING

The existing monitoring wells and new wells to be installed during the RI will be sampled (refer to Figure 1 for locations). It is assumed that approximately 85-95 samples, plus blanks and duplicates, will be submitted to Roy F. Weston for analysis of the parameters listed in Tables 2 and 3 of this section. The actual scope of the groundwater sampling program will be developed during Parts II, III and IV of the RI/FS in accordance with the work plan.

5.11 Sequence of Sampling

The new and existing monitoring wells will be sampled in sequence proceeding from the least to most contaminated wells, as determined on the basis of available information.

Determination of the degree of contamination will be based upon results of previous analyses of samples obtained from the existing wells and on field screening of soil and water samples during the drilling of the new wells.

5.12 Sampling Protocol

Monitoring wells will be sampled in accordance with EPA protocol as outlined in EPA/530/SW-611, Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities. The following sampling procedures will be exercised at each monitoring well:

1. Identify the well and record the well number on the Sample Record Sheet.

2. Put on a new pair of disposable gloves.

3. Measure groundwater level to the nearest 0.01 foot from the top of the well casing using an electric water level indicator or acoustic sounding device. Water level indicators will be decontaminated with methanol and distilled water rinses between wells. Record water level.

4. Calculate and record the volume of standing water in the well casing. At least three well volumes will be purged by means of a stainless steel bailer or centrifugal pump; if the well recharges slowly and is pumped or bailed dry, sampling will commence when the well recharges. If bailers are used, separate pre-cleaned bailers will be used for each well. If wells are purged by pump, separate lengths of new polyethylene tubing will be used in each well. In accordance with the Work Plan, based on headspace screening the purge water from each well will either be disposed of at the well site or will be containerized for off-site disposal.

5. All groundwater samples will be collected using a bailer. Samples will be transferred from the bailer and poured into containers provided by the analytical laboratory. Samples to be analyzed for volatile organic priority pollutant compounds and by headspace screening will be collected in 40-milliliter glass vials with Teflon/silicone rubber septa secured with bakelite caps. Samples for acid extractable, base-neutral extractable, and pesticide analyses will be taken in 1-liter to 1-gallon amber glass bottles. Samples

for dioxin analyses will be collected in separate 1 liter glass bottles. Samples for metals analysis will be collected in 0.5- to 2-liter polyethylene containers. The metals samples will be preserved according to methods presented in Section 5.20 of the QA/QC Plan attached.

6. Measure specific conductance, pH, and dissolved oxygen at the wellhead using portable equipment. Record measurements on Sample Record Form.

7. Sample containers will be properly labeled with appropriate information. Samples will be logged on the Sample Record Form and on the chain-of-custody form.

8. Samples collected for metals analysis will be filtered in the field by vacuum or pressure filtration through Millipore 0.45 micron filter or equivalent. Samples will be filtered at the well site unless inclement weather precludes this procedure. In those instances, samples will be filtered within the sampling van or on-site trailer.

9. Upon completion of sampling, disposable equipment used during the sampling (i.e. gloves, paper towels, etc.) will be disposed of in a specified waste container. Wells will then be recapped and locked.

5.13 Sample Preservation, Shipment, and Chain-of-Custody

Groundwater samples collected in accordance with the previously described procedures will be packed securely in an insulated cooler containing prefrozen ice packs and shall be properly logged, labeled and shipped to Roy F. Weston for analysis.

5.20 SURFACE WATER SAMPLING

Surface water samples will be collected from the nine locations described in section 3-7 of the work plan, and indicated on Figure 1. Sampling locations include points along River Meadow Brook upstream and downstream of the Silresim site, drainage ways leading from the site to the brook, and other nearby surface water bodies. The sample to be collected from the unnamed pond to the east of the site (SW-6) will be a composite sample.

Surface water samples will be analyzed for priority pollutant compounds.

Samples will be collected in downstream order from the furthest station upstream of the site. The procedure for collecting surface water samples during the Silresim RI will be as follows:

1. Record on the Sample Record Form the general location of the station and describe appropriate characteristics including approximate flow rate, stream width and depth, streambed or pond bottom material, temperature, pH, and dissolved oxygen concentration.

2. For stream sampling, collect water samples from as near midstream as possible by directly immersing the appropriate sample containers. Where the stream is too shallow to immerse the container, use a 500 ml. stainless steel or glass container to fill the sample container. Transfer the sample from the container to all appropriate sample bottles, except the 40 ml sample bottles for volatile organic compounds. For volatile organics, the bottles are immersed directly in the stream in order to minimize loss of analyte during sample handling.

3. Secure lids and attach sample labels which have been completely filled out. Place samples in coolers for shipment to the analytical laboratory. Samples will be logged on sample record forms and chain-of-custody sheets.

4. Mark the sample location with a 5-foot long reinforcing rod driven firmly into the ground, where appropriate, and mark the location on a site map.

5.30 SEDIMENT SAMPLING

Concurrent with surface water sampling, sediment samples will also be collected at stations SW-1, SW-3, and SW-6 for priority pollutant and grain-size analyses, and at station SW-2 for priority pollutant analysis alone. Results of sediment analyses will provide information on the particle size distribution and on the concentrations of contaminants in the sediment.

The samples will be collected using a piston-type corer or similar device. Grab samples will be collected where a rocky streambed prohibits coring. Samples for priority pollutant analysis will be placed in jars provided by the laboratory, labeled, and stored in a cooler for delivery to the laboratory for analysis. Samples for grain-size analysis will be placed in 8 ounce glass jars and delivered to GZA's Newton laboratory. Containers for samples destined for laboratory analysis will be as follows: volatiles - 40 ml septum vials; extractable organics, pesticides/PCB's - 16 ounce glass jars with Teflon- or aluminum foil-lined lids; metals, cyanides - 16 ounce glass jars; dioxin - 16 ounce glass jars.

Sediment samples will be collected from a station after all other sampling and measurement activities have been completed. Samples from River Meadow Brook (Stations SW-1, SW-2, and SW-3) will be collected as follows:

1. Locate mid-channel and the leeward shore and record in log book. Leeward shore is defined as the shoreline where current velocities are lowest or the shore furthest from mid-channel.

2. Collect sediment core samples from mid-channel and two-thirds the distance from mid-channel to the leeward shore. Where rocky bottom substrate is encountered, a dredge sample will be collected instead of a core sample.

3. At each station, the cores will be mixed in a stainless steel tub and transferred to the appropriate sample containers.

4. Secure lids and attach sample labels which have been completely filled out. Place samples in a cooler packed with ice for shipment to Roy F. Weston and GZA. Samples will be logged on a sample log sheet and chain-of-custody form.

5. Decontaminate sampling equipment by washing the equipment with water and a bristle brush, followed by methanol and distilled water rinses.

The pond sediment sample (station SW-6) will be collected from four locations spaced at approximately equal intervals around the unnamed pond. The samples will be mixed in a stainless steel bucket to produce a composite pond sediment sample, which will then be placed in the appropriate sample containers and handled in the same manner as the stream sediment samples.

5.40 SURFICIAL SOIL SAMPLING

Initial screening of soils for volatile organic compounds will be conducted in accordance with the detailed procedures described on page 3-15 of the work plan. Subsequent surficial soil samples will be collected from locations SS-1 and SS-2 (indicated on Figure 1) and from approximately five additional locations to be selected on the basis of the screening. Each of the surficial soil samples will be analyzed for priority pollutant compounds.

The samples will be collected using a clean stainless steel scoop or trowel. A hole will be hand-dug to a depth of approximately 0.5 feet, and the sample will be collected from the excavated material. The samples will be placed in the appropriate sample containers provided by the analytical laboratory, and will be labeled and placed in a cooler. The sampling locations will be marked with a labeled 5-foot steel reinforcing rod driven firmly into the ground for future reference. Sample containers for laboratory analyses will be as follows: volatiles - 40 ml septum vials (2); extractable organics, pesticides/PCB's - 16 ounce glass jars with Teflon- or aluminum foil-lined lids; metals, cyanides - 16 ounce glass jars; dioxin - 16 ounce glass jars.

5.50 SUBSURFACE SOIL SAMPLING

Subsurface soil samples will be collected at 5-foot intervals or at observed changes in strata at all boring locations in accordance with ASTM D1586-67 procedures and SOP 3.1.7.2 included in Appendix QA-1 attached to the QA/QC Plan. Samples will be collected with a split spoon sampler driven by a 140-pound weight falling freely 30 inches. When the split spoon sampler is opened, the soil sample will be immediately screened using a PID. In addition, a 40 ml septum capped vial will be partially filled with soil for headspace analysis. If the initial PID screening indicates the presence of VOC's, a headspace analysis using a Foxboro (Century Systems) Model OVA-128 portable gas chromatograph (GC) with a flame ionization detector and strip chart recorder will be obtained. A second soil sample from each split spoon will be collected for subsequent laboratory analysis, if necessary.

Portions of each split spoon sample will be collected in a wide mouth jar for soil classification to log the borehole and for particle size analysis, if necessary.

5.60 AIR MONITORING

Air monitoring will be performed with both an HNU and an OVA at the vents in the clay cap to determine whether contaminants are migrating from beneath the cap to the atmosphere. Organic vapor levels will be measured both at the opening of the vents and in their immediate vicinity; the levels will be recorded in a sample log book. The HNU will be used with the span set at 9.8, which yields a 100 percent sensitivity for benzene.

The OVA will be used in total mode (bypassing the column) initially. If a reading above background occurs, the chromatographic column inject button will be pressed, and a 0.25 cc plug of air will be sent through the column. This will determine the relative concentrations of non-methane vapors. The analytical column is a 12-inch by 0.125-inch stainless steel column packed with 10 percent 1,2,3-TRIS (2-cyanoethoxy) Propane on 60/80 mesh Chromosorb PAW. The OVA is equipped with a single flame ionization detector and a portable chart recorder. Background concentrations of organic vapors will be measured on the capped area away from the vents, at the perimeter of the site, and at nearby off-site locations. If the initial screening does not detect the presence of VOC's other than methane above background levels at the vents, the monitoring program will be continued on a weekly basis. If at any time during the air monitoring program concentrations of volatile organic compounds (other than methane) above background levels are detected at any of the vents, sorbent sampling for volatile organic compounds, and other airborne contaminants as appropriate, will be performed at the vents.

The sorbent sampling of organic vapors will be performed using Gilian Model HPS 113AUT and/or SKC Model 224-43 Universal Samplers Constant Flow air sampling pumps. In the event, additional samplers are needed, a number of MDA Accuhalo Model 808 pumps are available. The flow rates will be set at 100 cc/minute using an NBS traceable soap bubble flow meter prior to sampling. Samples will be run for a maximum time of 8 hours, giving a sample volume of 48 liters. At each monitoring point, concurrent samples will be taken on Tenax-GC© and 20/40 mesh activated coconut shell charcoal. The Tenax tubes will contain 100 mg in the primary section and 50 mg in the back-up section, obtained from SKC (Eighty-Four, PA). Backup Tenax tubes will be run in tandem to adsorb any breakthrough which may occur. The charcoal tubes, available from SKC, will contain 400 mg in the primary section and 200 mg in the backup section. Tubes containing 100/50 mg will be kept on hand if the detection limit of the analysis needs to be lowered. Tandem charcoal tubes will also be used in case breakthrough occurs. If breakthrough occurs through both tubes, the sampling time will be shortened to 4 hours, and a sample volume of 24 liters.

Calibration of the pump will be done with tandem tubes from the same lot number as the analytical tubes so that pre- and post-sampling rotometer readings can be used to determine actual sample volumes.

During air sampling, a portable recording meteorological station will measure, with a permanent record, the wind speed, wind direction, and temperature. Recording charts will cycle daily or weekly depending on the duration of the air monitoring. The barometric pressure will be recorded by hand using a hand-held barometer. The relative humidity will be recorded by hand using a sling-psychrometer (Maximum, Inc., Natick, Massachusetts).

All air monitoring data will be reported with the current meteorological conditions for evaluation. Sampling locations for off-site migration will be determined using the current wind direction data. Two locations will be chosen within the downwind 90° arc from the particular emission sources (45° on each side of the downwind centerline).

During each sampling period, parallel OVA and HNU screening will be performed at hourly intervals.

5.70 ADDITIONAL SAMPLING

Procedures for additional sampling, if necessary, not specified in Sections 5.10 through 5.60 above will be developed during Part II (Initial Studies) of the RI/FS. For example, the specific protocol for the sampling of the sump located west of B-201 will be developed after a review of its construction details during preliminary site visits.

TABLES

TABLE 1

ORGANIC CHEMICALS DETECTED ON AND AROUND THE SILRESIM CHEMICAL CORPORATION SITE[1]

Volatile Organics

dichloromethane
1,1-dichloroethylene
trans-1,2-dichloroethylene
1,1-dichloroethane
chloroform
1,2-dichloroethane
1,1,1-trichloroethane
1,2-dichloropropane
trichloroethylene
benzene
1,1,2-trichloroethane
tetrachloroethylene
1,1,2,2-tetrachloroethane
toluene
chlorobenzene
ethylbenzene
trichloroflouromethane
styrene
dimethylformamide
tetrahydrofuran
dimethylsulfide

Pesticides (SDWA Primary Standards)

lindane TP-105, 106 off-site
2,4-dichlorophenoxyacetic acid (2,4-D)
2,4,5-trichlorophenoxypropionic acid (2,4,5-TP)

PCBs

Arochlor 1016
Arochlor 1248

Extractable Organics

1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
1,2,4-trichlorobenzene
hexachlorobenzene
di-n-butyl phthalate
bis(2-ethyl hexyl) phthalate
N-nitrosodiphenyl amine
naphthalene
isophorone
2 methyl naphthalene
benzyl alcohol
phenol
2-methyl phenol
2-nitrophenol

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[1] Data summarized from a report by Perkins Jordan, Inc., entitled "Hydrogeologic Investigation, Silresim Chemical Corporation Site - Lowell, Massachusetts." February 1982, updated based on GZA's preliminary review of analytical data from NUS Corporation, 1983.

TABLE 2

EXPLANATION OF GROUNDWATER, SURFACE WATER, SEDIMENT AND SOIL SAMPLING ACTIVITIES FOR LABORATORY ANALYSES

Activity	Location	Analysis	Number of Samples (not including blanks and duplicates)	RI/FS Flow Chart Activity PART
Monitoring Well Sampling of Existing Monitoring Wells	R-104,106,201,202,203 204	Volatile Organic Analysis	9	11
Monitoring Well Sampling of Existing Monitoring Wells	B-101,102,105	Priority Pollutants Appendix B, RCRA 261 Pollutants in B-102 upper level only	6	11
Monitoring Well Sampling Phase One Well Installation	Approximately 21 multi-level wells at 12 locations	Volatile Organic Analysis	Approximately 21	111
Monitoring Well Sampling Previously Existing Monitoring Wells, Phase One and Phase Two-monitoring wells	All 55 monitoring wells at 29 locations	Priority Pollutants* in a minimum of ten monitoring wells, volatile organics and previously detected contaminants in others	Approximately 55	V
Surface Water Sampling	SW-1, SW-2, SW-3 River Meadow Brook	Priority Pollutants	3	111
Surface Water Sampling	SW-4 at subsurface drain outfall in drain pipe	Priority Pollutants	1	111
Surface Water Sampling	SW-8 Tanner Street storm drain in manhole	Priority Pollutants	1	111

TABLE 2 (Continued)

EXPLANATION OF GROUNDWATER, SURFACE WATER, SEDIMENT AND SOIL SAMPLING ACTIVITIES FOR LABORATORY ANALYSES

Activity	Location	Analysis	Number of Samples (not including blanks and duplicates)	RI/FS Flow Chart Activity PART
Surface Water Sampling	SW-9 clay cap surface runoff in manhole	Priority Pollutantsd	1	111
Surface Water Sampling	SW-5 surface drainage southwest of site	Priority Pollutants	1	111
Surface Water Sampling	SW-6 Pond east of site (composite)	Priority Pollutants	1	111
Surface Water Sampling	SW-7 sump at a south of site	Priority Pollutants	1	111
Surface Water Sampling	SW-8, SW-9 manhole of clay cap subsurface drain	Priority Pollutants	2	111
Sediment Sampling	SW-1, SW-2, SW-3, SW-6	Priority Pollutants	4	111
Sediment Sampling	SW-1, SW-3, SW-6	Particle Size Analysis	6	111
Soil Sampling	SS-1, SS-2 and 5 additional (surface 0.5 feet depth)	Priority Pollutants	7	111
Soil Sampling	All monitoring wells to be installed, Sufficient tests to characterize the strata	Particle Size Analysis	Approximately 40 borings	111, V

* In addition to Priority Pollutants, Appendix B, RCRA 261 pollutants may be required for select samples.

TABLE 3

DETAILS OF RI SAMPLING PROGRAM

ACTIVITY	# OF SAMPLES	SAMPLE TYPE	PARAMETER	ANALYSIS METHOD	CONTAINER	SOP FOR COLLECTION	# OF BLANKS	# OF DUPLICATES	REMARKS
Sampling Existing Monitoring Wells	15	GW	Volatiles	EPA-624	40 ml VOA vials	3.1.2	1	2	(1)
Sampling Existing Monitoring Wells	6	GW	ABN	EPA-625	1 gal glass	3.1.2	--	1	
		GW	Pest/PCB	EPA-608	1 gal glass	3.1.2	--	1	
		GW	Metals	Various	1 liter polyethylene	3.1.2	--	1	(2)
		GW	Cyanide	EPA-335.2	1 liter polyethylene	3.1.2	--	1	
		GW	Dioxin	EPA-613	1 liter glass	3.1.2	1	1	
Surface Water Sampling	9-11	SW	Volatiles	EPA-624	40 ml. VOA vials	3.1.1A	1	1	(3)
		SW	ABN	EPA-625	1 gal glass	3.1.1A	--	1	
		SW	Pest/PCB	EPA-608	1 gal glass	3.1.1A	--	1	
		SW	Metals	Various	1 liter polyethylene	3.1.1A	--	1	(2)
		SW	Cyanides	EPA-335.2	1 liter polyethylene	3.1.1A	--	1	
		SW	Dioxin	EPA-613	1 liter glass	3.1.2	1	1	
Sediment Sampling	4	SED	Volatiles	8240	40 ml VOA vials	3.1.8A	1	1	
		SED	ABN	8270	16 oz glass	3.1.8A	--	1	
		SED	Pest/PCB's	8080	16 oz glass	3.1.8A	--	1	
		SED	Metals	Various	16 oz glass	3.1.8A	--	1	(2)
		SED	Cyanides	EPA-335.2	16 oz glass	3.1.8A	--	1	
		SED	Dioxin	CLP (84)	16 oz glass	3.1.8A	1	1	(4)
Surface Soil Sampling	2-7	Soil	Volatiles	8240	40 ml VOA vials	3.1.7.1A	1	1	(3)
		Soil	ABN	8270	16 oz glass	3.1.7.1A	--	1	
		Soil	Pest/PCB's	8080	16 oz glass	3.1.7.1A	--	1	
		Soil	Metals	Various	16 oz glass	3.1.7.1A	--	1	(2)
		Soil	Cyanides	EPA-335.2	16 oz glass	3.1.7.1A	--	1	
		Soil	Dioxin	CLP (84)	16 oz glass	3.1.7.1A	1	1	(4)

TABLE 3: DETAILS OF RI SAMPLING PROGRAM
(Continued)

ACTIVITY	# OF SAMPLES	SAMPLE TYPE	PARAMETER	ANALYSIS METHOD	CONTAINER	SOP FOR COLLECTION	# OF BLANKS	# OF DUPLICATES	REMARKS
Phase 1 Well Sampling	21	GW	Volatiles	VOC Screen	40 ml VOA vials	3.1.2	2	3	
Well Sampling (All wells)	55	GW	Volatiles	EPA-624	40 ml VOA vials	3.1.2	3	5	
Well Sampling (All wells)	10-50	GW	ABN	EPA-625	1 gal glass	3.1.2	--	1-5	(3)
		GW	Pest/PCB	EPA-608	1 gal glass	3.1.2	--	1-5	
		GW	Metals	Various	1 liter polyethylene	3.1.2	--	1-5	(2)
		GW	Cyanides	EPA 335.2	1 liter polyethylene	3.1.2	--	1-5	
		GW	Dioxin	EPA-613	1 liter glass	3.1.2	1	1-5	

REMARKS:

(1) See Section 7.10 and 7.20 of QA/QC Plan (POP 1.3) for detailed information on analytical protocols, container types, sample preservation and holding times.

(2) See Section 7.10 of QA/QC plan for specific references to analytical methods for 13 priority pollutant metals.

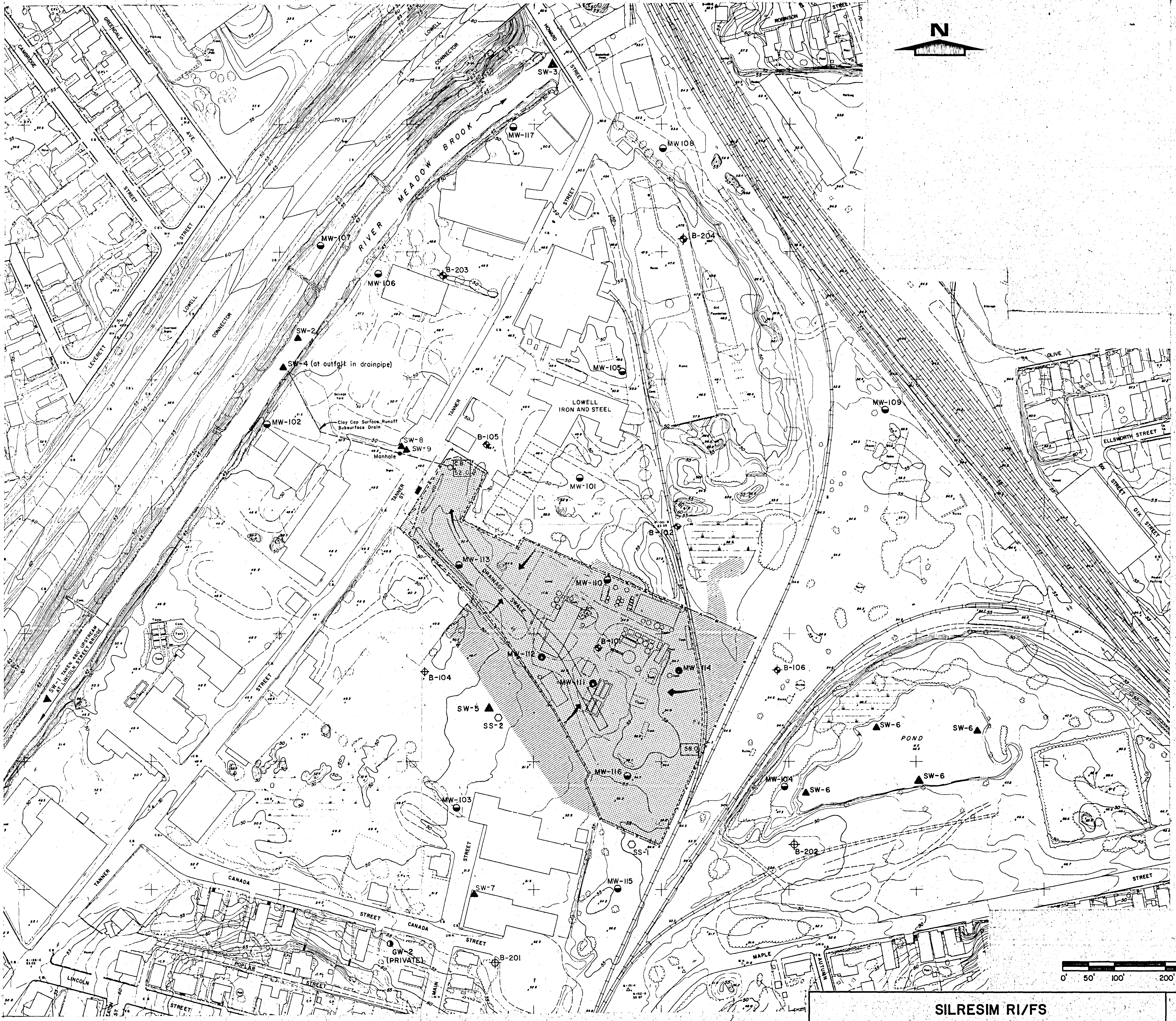
(3) Range in number of samples from CDM Work Plan estimates.

(4) Protocol to be used for dioxin analyses in soil will be as described in "Invitation for Bid WA-84-A002," US EPA Contract Laboratory Program, 1984.

(5) Abbreviations used: GW - Groundwater; SW - Surface Water; SED - Sediments; Soil - Surficial Soils; ABN - Acid/Base-Neutral extractable organics (see Tables 7 and 8 of QA/QC Plan); Pest/PCB's - Pesticide and PCB Organic Compounds (see Table 9 of QA/QC Plan).

(6) See Tables 5 and 6 of QA/QC Plan for lists of priority pollutant metals and volatile compounds, respectively.

FIGURE



NOTES:

1) BASE MAP, EXPLORATION LOCATIONS, FENCE LINES AND OTHER FEATURES FROM PLAN BY CAMP DRESSER & McKEE, INC.

2) PROPOSED MONITORING WELL LOCATIONS SUBJECT TO CHANGE PENDING COMPLETION OF INITIAL STUDIES.

LEGEND:

○ SS-1	PROPOSED SOIL SAMPLE LOCATION
▲ SW-1	PROPOSED SURFACE WATER SAMPLE
MW-102 ●	POTENTIAL SINGLE LEVEL MONITORING WELL LOCATION
⊕ B-106	MULTI-LEVEL GROUNDWATER MONITORING WELL INSTALLED BY PERKINS JORDAN, INC.
⊕ B-201	SINGLE LEVEL GROUNDWATER MONITORING WELL INSTALLED BY PERKINS JORDAN, INC.
MW-115 ◒	POTENTIAL MULTIPLE LEVEL MONITORING WELL LOCATION
▨	APPROXIMATE LIMIT OF 9" LAYER OF CRUSHED STONE
▒	AREA OF CLAY CAP
—x—	EXISTING FENCE AND PROPERTY LINE (APPROXIMATE) FOR SILRESIM SITE

FILE NO. A-4054

GZA

SILRESIM RI/FS
LOWELL, MASS.

SAMPLING LOCATION PLAN

AUGUST, 1985

FIGURE No. 1

POP 1.3

Section No. POP 1.3
Revision No. 1
Date: 10/11/85

SILRESIM SITE RI/FS, LOWELL, MASSACHUSETTS

QUALITY ASSURANCE/QUALITY CONTROL PLAN - SECTION 3.1.3

Approved by

Carl L. Eidam Quality Assurance Officer	John E. Ayres Principal-in-Charge
Lawrence Feldman RI Project Manager	

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INTRODUCTION

1.00 QUALITY ASSURANCE OBJECTIVES

A summary of Silresim site history is included in the background information section of this volume. The objectives and scope of the Silresim Remedial Investigation and Feasibility Study (RI/FS) are presented in a work plan prepared by Camp Dresser and McKee, Inc., dated February 11, 1985, included in this volume.

1.10 PROJECT OBJECTIVES

The Silresim Remedial Investigation will serve as a data collection mechanism to support the Silresim Feasibility Study and the development and evaluation of remedial alternatives applicable to identified Silresim site conditions. Project objectives are to better delineate both on-site and off-site the extent and nature of waste originating from the Silresim site; to determine the type and extent of remedial alternatives necessary to mitigate potential threat to public health or environment originating at the Silresim site.

1.20 INTENDED DATA UTILIZATION

It is intended that the data gathered during the Silresim Remedial Investigation will be utilized to evaluate the potential effects of on-site and off-site conditions at the Silresim site on human health, safety, and the environment.

Ambient background levels from areas unaffected by, i.e. upgradient of, the Silresim site will constitute the baseline against which any identified on-site or off-site contaminant levels will be evaluated.

Field screening data, such as HNu or OVA screening of soils for volatile organic compounds (VOC's), will be utilized to locate well screens or to select samples for laboratory analysis.

Analytical laboratory data will be utilized to characterize and evaluate on-site and off-site conditions in order to assess remedial alternatives.

2.00 PROJECT ORGANIZATION AND RESPONSIBILITY

2.10 GENERAL STRUCTURE

The project team for the Silresim RI/FS consists of GZA as the prime engineering contractor with overall responsibility for project completion, Roy F. Weston Inc. as the analytical laboratory, and a number of subcontractors for various tasks (geophysical investigation, data validation, surveying, etc.). For the most part, direct involvement in environmental measurements subject to QA/QC requirements will be limited to GZA and Roy F. Weston, as indicated on Figure QA-1.

2.20 PROJECT RESPONSIBILITIES

The project organization and principal lines of communication are presented in the project organization chart presented as Figure QA-1. The responsibilities of the project staff positions and support organizations are summarized below.

Principal-in-Charge, John E. Ayres, has overall responsibility for staffing and conducting the project. As part of his responsibilities he will:

1) Maintain this QA/QC Plan.

2) Indicate the types of QA records to be retained for the project.

3) Provide for QA audits.

4) Approve reports and material for release to the Silresim Trustees.

The Remedial Investigation Project Manager, Lawrence Feldman, is responsible for maintaining a clear definition of and adherence to scope, schedule and budget. As part of this responsibility, he will:

1) Serve as the communication link with the Silresim Trustees on all matters.

2) Provide overall technical direction for preparation of work plans and the conduct of tasks performed under this contract.

3) Maintain budgetary and schedule surveillance, and regularly inform the Principal-in-Charge on budgetary and scheduling status.

The Laboratory Manager, Analytical Services, Mr. Earl H. Hansen of Roy F. Weston, is responsible for interfacing between the analytical laboratory and GZA. As part of this responsibility, she will:

1) Indicate the types of QA records to be maintained for the project.

2) Provide for QA audits.

3) Approve reports and materials for release to GZA.

The Quality Assurance Officers include three individuals responsible for various aspects of QA/QC during the course of the project. These QA officers will be responsible for ongoing surveillance of project activities to help ensure conformance to this plan and will have access to all personnel and subcontractors, as necessary, to resolve quality problems.

The Project QA Officer, Mr. Carl Eidam, will have overall responsibility for QA/QC. As part of these responsibilities, he will:

1) Evaluate and approve this QA/QC Plan.

2) Schedule and conduct QA audits.

3) Provide for maintenance and retention of QA records.

4) Monitor the correction of quality problems and stop work, if necessary, when quality appears jeopardized.

5) Provide QA reports to the Principal-in-Charge and Project Manager.

The Laboratory and Field QA officers will fulfill similar duties for their respective aspects of the project. The Laboratory QA officer will report to the Laboratory Manager; the Field QA Officer will report to the Director of Field activities. Both individuals will also report to the Project QA Officer.

3.00 QUALITY ASSURANCE OBJECTIVES

The overall purpose of the quality assurance program is to ensure that samples are collected and analyzed in a way such that evaluations performed for the Remedial Investigation are scientifically reliable and supportable. The precision and accuracy of field measurements will be maintained by strict adherence to appropriate SOP's (see Appendix QA-1) and the field instrument procedures presented in Section 6.20 of this QA/QC Plan. The objectives for laboratory measurement data in terms of precision, and accuracy are presented in the following sections. In addition, results of a recent blind performance evaluation by the US EPA on Weston Analytical Laboratories are presented in Appendix QA-2.

3.10 PRECISION AND ACCURACY TARGET VALUES

The following values are those which will be strived for in this project. Actual precision and accuracy data derived for the samples analyzed in this project will be documented in the final report.

Data acceptance criteria for metals analysis shall be targeted at 100 percent, plus or minus 10 percent recovery and reproducibility.

Precision and accuracy target values for organic compounds presented on Tables 1 through 4 have been obtained under optimal conditions and represent statistical averages of multiple matrix sample analyses and will be utilized for this project. Actual precision and accuracy data derived for the samples analyzed in this project will be documented in the final report.

3.20 COMPLETENESS

The characteristic of completeness is a measure of the amount of valid data obtained compared to the amount that was specified to be obtained under normal conditions. The amount of valid data specified is established based on the measurements required to accomplish project objectives. The extent of completeness ;must be reviewed on a relative basis for sample collection activities. Completeness of data handling systems is described in Sections 10.0, 12.0 and 14.0.

3.30 REPRESENTATIVENESS

Measurements will be made so that results are as representative of the media and conditions being measured, as possible. Sampling locations will be selected to provide specific information necessary for evaluating remedial alternatives. Sampling protocols will be used to assure that samples collected are representative of the media. Sample handling protocols (e.g. storage, preservation, and transportation) protect the representativeness of the collected sample. Proper documentation will establish that protocols have been followed and sample identification and integrity assured.

3.40 COMPARABILITY

The characteristic of comparability reflects both internal consistency of measurements made at the site and expression of results in units consistent with other organizations reporting similar data. Each value reported for a given measurement should be similar to other values within the same data set and within other related data sets. Comparability of data and measuring procedures must also be addressed. This characteristic implies operating within the calibrated range of an instrument and utilizing analytical methodologies which produce comparable results.

3.50 DETECTION LIMITS

The detection limits presented for various analytical methods in Table 5 through 9 have been obtained using equipment and techniques appropriate for low concentration in "clean water" samples. Sample matrices and contaminant levels requiring dilution or sample manipulation may affect detection limit achievement. Specific detection limits are highly matrix dependent. The detection limits provided are for guidance and may not always be achievable.

4.00 SAMPLING PROCEDURES

All samples will be collected in accordance with the Sampling and Analysis Plan and the appropriate SOP as presented in Appendix QA-1 and summarized on Table 10. Where conditions warrant, the SOP may be altered with the approval of the Quality Assurance Officer prior to sampling initiation. Any special circumstances or alteration from SOP must be recorded in the field data record and referenced on the sample label and chain-of-custody form.

4.10 SAMPLE SITE SELECTION

Samples of groundwater from monitoring wells; surface water from stream, pond, and drainage ways; sediment from stream and pond; and surficial soils will be collected for analysis. A discussion of proposed sample locations is presented in the Work Plan text and in the Sampling and Analysis Plan.

4.20 SAMPLE CONTAINERS, PRESERVATION, TRANSPORT, AND STORAGE

Samples will be analyzed for constituents as presented in Tables 2 and 3 of the Sampling and Analysis Plan. The analytical parameters include the priority pollutants, volatile organics by EPA Method 624, extractable organics (base/neutrals, acids, and pesticides) by EPA Method 625, organochlorine pesticides and PCB's by EPA Method 608, 2,3,7,8 tetrachlorodibenzo-p-dioxin, and priority pollutant metals. In addition, analysis for Appendix 8, RCRA 261 pollutants may be conducted at one sample location. Each individual or class of these analytical parameters requires specific containment, preservation and handling.

After collection in appropriate containers as detailed in the following sections, samples will be placed in coolers for shipment to the laboratory on a daily basis.

Sample collection procedures for each analytical parameter are presented in the following sections. Maximum sample holding times are presented in the analytical procedures. Detailed procedures for sample container cleaning and preparation are presented in Appendix QA-3.

4.21 Hydrogen Ion (pH)

A. Apparatus and Materials:

- Clean polyethylene or glass bottles; previously cleaned with Alconox detergent and rinsed with distilled water.
- Electronic pH meter with temperature compensation adjustment. Glass electrode: Glass electrodes are available for measurement over the entire pH range with minimum sodium ion error types for high pH-high sodium samples. Reference electrode: Use a calomel, silver-silver chloride, or other constant-potential electrode.
- Two standard buffer solutions of known pH (i.e. 4 and 10).

B. Sample Collection, Preservation, and Handling:

- The electrometric measurement of pH is the only method approved by EPA. The determination will be made on-site at time of collection.

4.22 Method 624 Purgeables

A. Apparatus and Materials:

- The water sample is to be collected in two (2) 40 ml vials with Teflon-faced silicone septa and screw caps and maintained at 4°C.

B. Prepared containers will be provided by Roy F. Weston Analytical Laboratory. Standard preparation protocol is outlined below.

1. Wash 40 ml vials with screw caps (Pierce No. 13075 or equivalent) and Teflon-faced silicone septa (Pierce No. 12722 or equivalent) separately, utilizing a solution of Alconox detergent or equivalent, and hot tapwater.

2. Rinse thoroughly with deionized water.

3. Place vials, caps, and septa on precleaned aluminum foil (as described above) in an oven and bake for one (1) hour at 105°C.

4. Allow the vials to cool with the septa properly inserted and the caps screwed on loosely. Tighten down caps when cool.

5. Store vials in an area not subject to contamination by air or other sources.

C. Sample Collection, Preservation and Handling

- The following procedures apply to sampling directly with the sample vial:

  1. Collect a single undisturbed sample of water for the analysis of volatile organics. Submerge the sample vial just below the surface upside down and slowly invert. Accomplish this task creating as little disturbance as possible.

     In the case of groundwater sampling, the sample volume should be poured directly from the bailer to the sample vial.

  2. Allow the vial to fill and reach equilibrium with its surrounding reservoir for several seconds.

  3. Place the cap over the mouth of the vial so that the septum is properly oriented and screw down the cap firmly.

  4. Invert the vial to discover any entrapped air bubbles. If such is the case, the sample will be discarded and another 40 ml vial selected and filled.

5. Collect a replicate sample per instructions above.

   - Label the sample vials with the appropriate designated sample tag.

   - Place the properly labeled sample vials in an appropriate carrying container maintained at 4°C throughout the sampling and transportation period.

4.23 Method 625 Extractables (Base/Neutrals, Acids, and Pesticides

A. Apparatus and Materials:

- Sample bottle - Amber glass, 1 liter to 1 gallon volume. French or Boston Round design is recommended. The container must be washed and solvent rinsed before use to minimize interferences in accordance with the following procedure:

  1. Wash glassware with a phosphate - free detergent (e.g., Alconox). Rinse with tap water five (5) times and deionized water five (5) times.

  2. Rinse with acetone.

  3. Rinse with hexane.

  4. Kiln dry at 450°C for ten (10) hours.

  Bottle caps - Threaded to fit sample bottles. Caps must be lined with Teflon. Aluminum foil may be substituted if sample is not corrosive.

B. Sample Collection, Preservation, and Handling:

- Samples must be collected in glass containers. Conventional sampling practices should be followed, except that the bottle must not be prerinsed with sample before collection.

- The sample must be iced or refrigerated from the time of collection until extraction.

- All samples must be extracted within 7 days and completely analyzed within 30 days of collection.

4.24 Method 608 Organochlorine Pesticides and PCB's

A. Apparatus and Materials:

- Sample bottle - Amber glass, 1 liter or 1 quart volume. French or Boston Round design is recommended. The container must be washed and solvent rinsed before use to minimize interferences (see Section 4.23A).
- Bottle caps - Threaded to screw on to the sample bottles. Caps must be lined with Teflon. Foil may be substituted if sample is not corrosive.

B. Sample Collection, Preservation, and Handling:

- Samples must be collected in glass containers. Conventional sampling practices should be followed, except that the bottle must not be prerinsed with sample before collection.
- The samples must be iced or refrigerated from the time of collection until extraction.
- All samples must be extracted within 7 days and completely analyzed within 30 days of collection.

4.25 Metals

A. Apparatus and Materials:

- Polyethylene or glass bottles.
- Nitric acid (1 + 1): Mix equal volumes of conc. nitric acid, HN_3 (ACS), with deionized water.
- Deionized water.

B. Sample Collection, Preservation, and Handling:

- Wash and rinse sample container thoroughly with 1 + 1 nitric acid, then with deionized water before use.
- Acidify the sample with 1 + 1 nitric acid to a pH of 2.0 or less. Normally, 3 ml of 1 + 1 nitric acid per liter should be sufficient to preserve the samples. This will keep the metals in solution and minimize their adsorption on the container wall.
- All samples should be analyzed within 6 months of collection. An exception is mercury analysis, which must be completed within 28 days.

4.26 Cyanide

A. Apparatus and Materials

- Polyethylene or glass bottles: Minimum Required Volume 500 ml.
- Concentrated sodium hydroxide, NaOH.

B. Sample Collection, Preservation, and Handling

- Add NaOH to pH greater than 12.
- Store samples at 4°C.
- Analyze within 24 hours of collection.

4.27 Dioxin (2,3,7,8 - Tetrachlorodibenzo-p-dioxin)

A. Apparatus and Materials

- Sample bottle - 1 liter amber glass prepared as indicated in Section 4.23A.
- Bottle caps - as in Section 4.23A.

B. Sample Collection, Preservation, and Handling

- Samples must be collected in glass containers. Conventional sampling practices should be followed, except that the bottle must not be prerinsed with sample.

- The sample must be iced or refrigerated from the time of collection until analysis.

5.00 SAMPLE CUSTODY PROCEDURES

It is imperative that written procedures be followed whenever samples are collected, transferred, stored, analyzed or destroyed. The primary objectives of these procedures is to create an accurate written record which can be used to trace the possession and handling of the sample from the moment of its collection to disposal.

5.10 LOGGING OF SAMPLES

The accountability of a sample begins when the sample is taken from its natural environment. Sample labels, chain-of-custody forms and field data records must be completed at the time of sampling (see Figures QA-2, QA-3 and QA-4). The following chain-of-custody procedure must be implemented by the Site Operations Manager to assure sample integrity. Entries will be made in waterproof ink during sampling.

A. The samples are under custody of the Site Operations Manager if:

(a) they are in his (or her) possession,
(b) they are in view after being in possession,
(c) they are locked up or sealed securely to prevent tampering, or
(d) they are in a designated secure area.

B. The original of the chain-of-custody form must accompany the samples at all time after collection. A copy of the chain-of-custody form is kept by the Site Operations Manager.

C. When samples are transferred in possession, the individuals relinquishing and receiving will sign, date, and note the time on the chain-of-custody form.

D. When samples are shipped, the Site Operations Manager will note the method of shipment, courier name, and way bill number, if possible, in the "Remarks" box on the form. The Site Operations Manager will keep a copy of the way bill and attach it to his (or her) copy of the chain-of-custody form.

The chain-of-custody form will contain information to distinguish each sample from any other sample. This information will include:

1. The project for which sampling is being conducted.
2. The matrix being sampled (air, groundwater, soil, etc.).
3. The sampling date and time.
4. The specific sampling location in sufficient detail to allow resampling at the same location.
5. The method of sampling to include preservation techniques.
6. Significant observations made during the sampling process.
7. Signature of the person performing the sampling.

Each sample will be assigned a unique identification number, which will be marked on the sample container in waterproof ink. The chain-of-custody form will be forwarded to the laboratory with the samples. As a precaution against this record being lost or altered, the sampling personnel will retain a copy of the chain-of-custody form documenting all information up until the first change of sample custody. This record will be filed by the Project Manager.

Field measurements (e.g. pH, specific conductance, temperature, depth, flow) will be recorded on the field data record sheets.

5.20 SAMPLE IDENTIFICATION NUMBERS

Reporting of data to the data management system will require the assignment of a unique identification number to each sample collected (including quality control samples). A record will be maintained by the Site Operations Manager to associate the field sample with the various identification numbers used to analyze the field sample. Specific sample identification procedures are developed for each field sampling effort by the Site Operations Manager.

A master list, assigning unique identification codes to each sample location will be developed prior to initiation of field investigation.

Each sample collected will be assigned a unique identification number, which can be used to track the sample through all subsequent handling, analysis and data reduction procedures. An alpha-numeric system will be used, to facilitate handling, storage and sample traffic management.

This sample identification code will consist of:

1. A three letter project identifier - SCC (Silresim Chemical Corporation)
2. An eight digit alpha-numeric code which identifies the sample location and matrix.

The following three letter code prefix will be utilized for various sampled media:

CODE	DESCRIPTION
AMS	Air monitoring sample
GWS	Groundwater sample
SSS	Soil sample - surficial
SED	Stream/pond sediment sample
SWS	Surface water sample

The assigned sample numbers will be used on the sample label, chain-of-custody form, field data record, and for all on-site measurement and screening reports. Where more than one bottle of sample is collected, all bottles will be assigned the same sample number. Sample documentation will follow procedures outlined above for sample labeling and chain-of-custody.

6.00 PROCEDURES FOR INSTRUMENT CALIBRATION

Each instrument group must have a tailored analytical quality assurance program to promote precise and accurate analyses. A listing of major instrumentation is presented in Table 11; the corresponding quality assurance program is presented in the laboratory QAPP in Appendix QA-4. This section deals with calibration and preventive maintenance for field instruments. Field meters to be used during sampling, including the pH and specific conductance/temperature meters, will be checked against laboratory meters to insure proper calibration and precision response. The HNu photoionization organic vapor detector will be calibrated according to manufacturer's instructions. Thermometers will be checked against a precision thermometer. These activities will be performed by the Site Operations Manager. In addition, buffer solutions and standard KCl solutions will be used to field calibrate the pH and conductivity meters. The preparation date of standard solutions will be clearly marked on each of the containers to be taken into the field. A log which documents problems experienced with the instrument, corrective measures taken, battery replacement dates, when used and by whom for each instrument will be maintained by the Site Operations Manager. Appropriate new batteries will be purchased and kept with the meters to facilitate immediate replacement, when necessary in the field.

All equipment to be utilized during the field sampling will be examined to certify that it is in operating condition. This includes checking the manufacturer's operating manuals and the instructions with each instrument to ensure that all maintenance items are being observed. Field notes from previous sampling trips shall be reviewed so that any prior equipment problem notations are not overlooked and so all necessary repairs to equipment have been carried out. A spare electrode will be sent with each pH meter that is to be used for field measurements. Two thermometers will be sent to each field site where measurement of temperature is required, including those sites where a specific conductance/temperature meter is required.

6.10 pH METER CALIBRATION

The pH meter must be calibrated a minimum of twice each day using two different pH buffer solutions expected to bracket the pH range of field samples. Rinse the probe thoroughly between buffer measurements with distilled water and again after calibration is completed. Record in the field log book what buffer solutions were used. When the meter is moved, check pH reading by measuring the pH value of the buffer solution closest to the expected range of the sample. If the reading deviates from the known value by more than 0.1 standard units, recalibrate the instrument as described above. If unacceptable deviations still occur, consult the operating manual for remedial course of action.

6.20 CONDUCTIVITY METER CALIBRATION

The specific conductance/temperature meter is less likely to exhibit random fluctuations and will only require daily checks against a known KCl solution, which should be chosen to be within the expected conductivity range. Note that specific conductance is temperature-dependent and therefore the meter readings must be adjusted to reflect the temperature of the standard solution. Thoroughly rinse the probe with distilled water after immersing in KCl standard solution. In addition to daily checks of the conductivity readings, the thermistor readings must also be checked daily. This is accomplished by taking a temperature reading of the KCl standard solution with both the conductivity probe and a mercury thermometer.

6.30 ORGANIC VAPOR ANALYZER/GAS CHROMATOGRAPH CALIBRATION

The organic vapor analyzer (Foxboro - Century Model OVA-128) will be calibrated in accordance with the operator's manual for the instrument, as referenced in SOP 4.1.1. The calibration procedure in the survey mode involves introducing a methane sample of known concentration to the detector and making required electronic adjustments. Calibration in the GC mode is accomplished via preparation and analysis of standard solutions of the compounds of interests, as detailed in the operator's manual.

6.40 PID CALIBRATION

The photoionization organic vapor detector (HNu) will be calibrated daily using an analyzed gas mixture provided in a pressurized container, according to the manufacturer's instructions. Battery check with electronic zeroing of the instrument will be performed at 2-hour intervals during periods of continuous use.

6.50 THERMOMETER INSPECTION

Before use, visually inspect the thermometer to assure there is no break in the liquid column. If there is a break, visually inspect the spare thermometer. If both thermometers have a break in the liquid, neither can be used and a replacement must be obtained.

All field water quality measurements will be obtained in accordance with the appropriate Standard Operating Procedures as presented in Appendix QA-1.

7.00 SAMPLE HANDLING AND ANALYSIS

Collection, containment, preservation, handling, and analysis for all samples will be conducted in accordance with the appropriate EPA methods for the analytical parameters of interest. The methods indicated are referenced from:

> Methods for Chemical Analysis of Water and Waste, EPA-600/4-79-020.
>
> Methods for Chemical Analysis of Municipal and Industrial Wastewater, EPA-600/4-82-057, July 1982.
>
> Standard Methods for the Examination of Water and Wastewater, 15th edition, 1980.
>
> Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, U.S. EPA, SW-846, 2nd edition, July 1982.

7.10 ANALYTICAL METHODS

The following analytical methods will be utilized for this project:

Analytical Parameter	Aqueous	Soil/Sediment
EPA Volatile Organic Priority Pollutants: (Table 1)	EPA-624	8240
Acid and Base Neutral Extractables: (Tables 2 and 3)	EPA-625	8270
Organochlorine Pesticides and PCB's: (Table 4)	EPA-608	8080
Metals: (Table 5)		
Antimony	EPA-204.1	
Arsenic	EPA-206.3	
Beryllium	EPA-210.2	
Cadmium	EPA-213.1	
Chromium	EPA-218.1	
Copper	EPA-220.1	
Lead	EPA-239.1	
Mercury	EPA-245.1	
Nickel	EPA-249.1	
Selenium	EPA-270.3	
Silver	EPA-272.1	
Thallium	EPA-279.2	
Zinc	EPA-289.1	
Total Cyanide	EPA-335.2	9020
Dioxin	EPA-613	CLP*
Extraction of Soils for Metals Analysis:	--	3050

* Protocol used will be "Invitation for Bid WA-84-A002," US EPA Contract Laboratory Program, 1984.

7.20 CONTAINER TYPE, PRESERVATIVES, HOLDING TIME

A. Volatile Organic Compounds EPA Method 624.

Containers	Preservative	Hold Time
Conditioned glass vial with Teflon Septa caps.	cool to 4°C	14 days

B. 1. Acid and Base neutral Extractables - EPA Method 625
2. PCB/s and organochlorine pesticides - EPA Method 608

Containers	Preservative	Hold Time
Conditioned amber glass 1 gallon bottle with Teflon lined cap	cool to 4°C	7 days before extraction. 30 days after extraction.

C. Metals - total

Containers	Preservative	Hold Time
Conditioned 1 liter Polyethylene bottle with polyethylene cap	redistilled HNO_3 to pH<2	Mercury 28 days All others, 6 months.

D. Metals - Dissolved

Containers	Preservative	Hold Time
Conditioned 1 liter Polyethylene bottle with polyethylene cap	filter through 0.45 u membrane filter on-site then redistilled HNO_3 to pH <2	mercury 28 days all others - 6 months

E. Total Cyanide

Containers	Preservative	Hold Time
Conditioned 1 liter polyethylene bottle with polyethylene cap	cool, 4°C NaOH to pH >12 0.6 g ascorbic acid	24 hours

F. Dioxin

Containers	Preservative	Hold Time
Conditioned 1 liter amber glass bottle with Teflon lined cap	cool to 4°C	7 days before extraction 30 days after extraction

8.00 DATA REDUCTION, VALIDATION AND REPORTING

Data reduction is the process of converting measurement system outputs to an expression of the parameter which is consistent with the comparability objective. Calculations made during data reduction are specified in the US EPA analytical methods.

Organic priority pollutants in the volatile and base/neutral/acid fractions are quantified by GC/MS using the internal standard method, and all samples are fortified with appropriate surrogates. Response factors used to quantitate sample results are calculated from the daily calibration standard. The daily calibration standard is compared to a 5-point initial calibration curve for acceptability prior to sample analysis. A spectral match of positive target compounds using the laboratory generated library is used to verify compound identity.

Pesticide/PCB priority pollutants are determined by GC, with electron capture detection, using the external standard method. Sample components are identified and quantified by comparison of retention time and peak areas to the daily calibration standard.

Inorganic priority pollutants are determined by comparison to a 5-point calibration curve for the respective parameter. The calibration curve must have an acceptable correlation coefficient in order to be used for quantitation.

Validation of measurements is a systematic process of reviewing a body of data to provide assurance that the data are adequate for their intended use. The process includes the following activities:

- editing,
- screening,
- checking,
- auditing,
- verification,
- certification, and
- review.

The data reporting procedures to be employed for this project are presented in the form of flow charts on Figures QA-5 through QA-9. Additional information on data reduction, review, and reporting is provided in Section 5 of Appendix QA-4.

9.00 INTERNAL QUALITY CONTROL

Quality control procedures are established for laboratory and field activities. All field activities will follow the quality control procedures established, such as sampler blank collection, field measurement, duplicate sample collection, etc. For analytical work, the laboratory will follow procedures described in Section 4.4 of Appendix QA-4.

Field quality control activities include the use of calibration standards and blanks for pH, specific conductance, temperature, and photoionization measurements. Special samples to be submitted to the laboratory include:

- trip blanks,
- blind replicates,
- sampler blanks, and
- filtration blanks.

These samples provide a quantitative basis for validating the data reported.

Trip Blanks

Trip blanks are required for assessing volatile organic priority pollutants reported in water samples. The trip blank consists of a Volatile Organic Compound (VOC) sample container filled with reagent water which is shipped to the site with the other VOC sample containers. Two trip blanks are included with each shipment of water samples scheduled for volatile organic analysis. One of the two trip blanks will be analyzed with the other VOC samples. The other will be analyzed if VOC's are detected in a blank.

Replicates

Replicates of soil, waste, groundwater, surface water, and sediment samples amounting to a minimum of 10 percent of each type of sample for each sampling team will be submitted for analysis of all parameters specified for those samples.

The identity of the replicate samples will not be revealed to the laboratory.

True replicates of soil, sediment, and waste samples are not possible because chemicals are typically not uniformly distributed in these materials. ASTM C702, Method B "Reducing Field Samples of Aggregate to Testing Size" will be used to split soil and sediment samples. Samples for volatile organic analysis, however, must be grab samples to avoid the loss of volatile constituents, which may occur during sample handling.

The following sample locations have been selected in order to determine data precision and bias:

1.	COLLOCATED SAMPLES	LOCATION
	Ground Water M.W.S.	B-102 (lower level), B-201
	Surface Water	SW-3
	Stream & Pond Sediment	SW-3

2. SPIKED SAMPLES	LOCATION
Ground Water M.W.S.	B-105; B-204
Surface Water	SW-1
Stream & Pond Sediment	SW-1

QA/QC sample locations were chosen based on potentially sensitive sample sites as determined by review of available data and discussion with EPA personnel. Replicate samples for successive sampling rounds will be selected in a similar fashion and submitted to EPA for review.

Sampler Blanks

A minimum of one sampler blank per sampling event will be collected prior to monitoring well sampling. Contaminants present in or potentially contributed by bailers will be assessed by collecting a sample of reagent water passed through a bailer randomly selected from the set of clean bailers brought to the site.

If BarCad samplers are employed during the RI, a blank will be generated by passing reagent grade water through a randomly selected sampler.

Filtration Blanks

Groundwater samples scheduled for analysis of inorganic parameters are to be filtered. In order to assess filtration apparatus cleaning procedures and potential cross contamination, as well as any contribution to the sample from the filter itself, a filtration blank will be collected for every 10 to 15 samples filtered. The filtration blank will be prepared by passing reagent water through a freshly cleaned filtration apparatus.

Completeness

Completeness of scheduled sample collection will be controlled in the field by comparing the scheduled sample collection with samples actually collected each day. Daily checking of field data sheets and comparison of transport and chain-of-custody logs will provide further control on documentation and completeness.

10.00 PERFORMANCE/SYSTEM AUDITS

The laboratory actively participates in EPA interlaboratory performance evaluation programs for water and wastewater. This combined with internal check/audits described in Appendix QA-4 make up the data which is used by the quality assurance officer and the laboratory director in determining systems QC.

11.00 PREVENTIVE MAINTENANCE PROCEDURES

Preventive maintenance on all analytical equipment will be done in accordance with the procedures detailed in Section 4.00 of Appendix QA-4 and in strict accordance with individual instrument manufacturer's recommendations.

12.00 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION ACCURACY AND COMPLETENESS

Analytical precision is determined and monitored by analysis of laboratory replicates (usually duplicates). The agreement between replicate analysis (e.g., Relative Percent Difference) is used to ensure that the precision of analysis is within laboratory QC limits.

Analytical accuracy is determined and monitored by analysis of fortified method blanks or samples fortified with surrogate compounds (e.g., VOA, B/N/A by GC/MS). The recovery values for each analyte are evaluated to ensure that analytical accuracy is within laboratory QC limits.

Completeness is a measure of the extent to which all analytical data are judged to be valid (or validatable). No data are reported by The Weston Laboratory unless all laboratory QC criteria are addressed.

Additional information on data assessment is presented within Sections 4.4, 5.2, and 5.3 of Appendix QA-4.

13.00 CORRECTIVE ACTION

Objectives for data acceptability are described in Section 1.00 Quality Assurance Objectives. When it is found that data is incomplete or that results are unacceptable, the following procedures for corrective action shall be undertaken.

13.10 INCOMPLETE DATA

Omissions from logs, notebooks and work sheets place the entire analysis in question. Incomplete field sampling data may require resampling of the questionable location. Incomplete laboratory data usually calls for re-introduction or re-analysis of the questionable sample.

13.20 CONFLICTING DATA

As in the case of omitted data, conflicting data may require that the entire analytical performance be questioned. In some cases, however, other supportive documentation may aid in resolving problems in conflicting information. When this is not available, re-sampling or re-analysis will be required.

13.30 POOR PERFORMANCE

When results from duplicates, spikes, collocates, etc. fall outside of acceptable ranges, the available data is reviewed by the quality assurance officer. Upon examination, all or some of the following actions may be applied:

1. System audit for the analyte in question.
2. Determination of matrix interference.
3. Re-sampling of the questionable sample.
4. Reconsideration of acceptance limits with statements included with results explaining the action taken and rationale.

14.00 QUALITY ASSURANCE REPORTS TO MANAGEMENT

Monthly summary reports will be prepared to inform management of project QA status. The reports will include:

- periodic assessment of measurement data accuracy, precision and completeness;
- results of performance audits and/or systems audits;
- significant QA problems and recommended solutions; and
- status of solutions to any problems previously identified.

Additionally, any incidents requiring corrective action will be fully documented. Procedurally, the QA Officer will prepare the reports to management. These reports will be addressed to the Project Manager and the Principal-in-Charge. The summary of findings shall be factual, concise, and complete. Any required supporting information will be appended to the report.

TABLES

TABLE 1

Accuracy and Precision for Purgeable Organics

	Reagent Water		Wastewater	
Parameter	Average Percent Recovery	Standard Deviation (%)	Average Percent Recovery	Standard Deviation (%)
Benzene	99	9	98	10
Bromodichloromethane	102	12	103	10
Bromoform	104	14	105	16
Bromomethane	100	20	88	23
Carbon tetrachloride	102	16	104	15
Chlorobenzene	100	7	102	9
Chloroethane	97	22	103	31
2-Chloroethylvinyl ether	101	13	95	17
Chloroform	101	10	101	12
Chloromethane	99	19	99	24
Dibromochloromethane	103	11	104	14
1,1-Dichloroethane	101	10	104	15
1,2-Dichloroethane	100	8	102	10
1,1-Dichloroethene	102	17	99	15
trans-1,2-Dichloroethene	99	12	101	10
1,2-Dichloropropane	102	8	103	12
cis-1,3-Dichloropropene	105	15	102	19
trans-1,3-Dichloropropene	104	11	100	18
Ethyl benzene	100	8	103	10
Methylene chloride	96	16	89	28
1,1,2,2-Tetrachloroethane	102	9	104	14
Tetrachloroethene	101	9	100	11
Toluene	101	9	98	14
1,1,1-Trichloroethane	101	11	102	16
1,1,2-Trichloroethane	101	10	104	15
Trichloroethene	101	9	100	12
Trichlorofluoromethane	103	11	107	19
Vinyl chloride	100	13	98	25

Samples were spiked between 10 and 1000 µg/L.

Method EPA 624

TABLE 2

Accuracy and Precision for Base/Neutral Extractables

Parameter	Reagent Water Average Percent Recovery	Reagent Water Standard Deviation (%)	Wastewater Average Percent Recovery	Wastewater Standard Deviation (%)
Acenaphthene	77	23	83	29
Acenaphthylene	78	22	82	23
Aldrin	72	8	—	—
Anthracene	64	14	78	22
Benzo(a)anthracene	83	19	75	28
Benzo(b)fluoranthene	96	68	41	21
Benzo(k)fluoranthene	98	68	47	27
Benzo(ghi)perylene	80	45	68	40
Benzo(a)pyrene	90	22	43	21
Benzidine	87	61	63	55
Butyl benzyl phthalate	47	32	74	43
β-BHC	69	25	—	—
δ-BHC	56	18	—	—
Bis(2-chloroethoxy)methane	84	33	82	74
Bis(2-chloroethyl)ether	56	36	72	37
Bis(2-chloroisopropyl)ether	71	33	71	39
Bis (2-ethylhexyl) phthalate	129	50	82	83
4-Bromophenyl phenyl ether	80	17	75	20
2-Chloronaphthalene	73	24	79	27
4-Chlorophenyl phenyl ether	45	11	—	—
Chrysene	83	19	75	28
4,4'-DDD	80	9	—	—
4,4'-DDE	69	20	—	—
4,4'-DDT	83	15	—	—
Dibenzo(a,h)anthracene	82	39	70	40
Di-n-butyl phthalate	70	25	93	51
1,2-Dichlorobenzene	59	27	62	28
1,3-Dichlorobenzene	55	28	54	24
1,4-Dichlorobenzene	61	31	63	35
3,3'-Dichlorobenzidine	184	174	143	145
Diethylphthalate	42	28	48	28
Dimethyl phthalate	25	33	35	38
2,4-Dinitrotoluene	83	32	79	34
2,6-Dinitrotoluene	79	18	79	25
Di-n-octylphthalate	97	37	89	82
Endosulfan sulfate	79	29	—	—
Fluoranthene	89	19	80	28
Fluorene	77	18	80	20
Heptachlor	69	8	—	—
Heptachlor epoxide	82	7	—	—
Hexachlorobenzene	79	20	71	22
Hexachlorobutadiene	48	25	48	28
Hexachlorocyclopentadiene	27	25	12	12
Hexachloroethane	46	21	52	26
Indeno (1,2,3-cd) pyrene	85	37	81	43
Isophorone	75	33	77	42
Naphthalene	6	32	75	35
Nitrobenzene	72	31	82	54
N-Nitrosodi-n-propylamine	68	39	78	45
N-Nitrosodiphenylamine	84	24	88	31
PCB-1221	77	11	—	—
PCB-1254	80	13	—	—
Phenanthrene	84	14	78	22
Pyrene	86	15	80	23
1,2,4-Trichlorobenzene	64	18	69	28

Spiked between 5 to 2400 µg/L

TABLE 3

Accuracy and Precision for Acid Extractables

Parameter	Reagent Water		Wastewater	
	Average Percent Recovery	Standard Deviation (%)	Average Percent Recovery	Standard Deviation (%)
4-Chloro-3-methylphenol	79	18	75	21
2-Chlorophenol	70	23	71	25
2,4-Dichlorophenol	74	24	80	21
2,4-Dimethylphenol	64	25	58	26
2,4-Dinitrophenol	78	21	108	56
2-Methyl-4,6-dinitrophenol	83	18	90	35
4-Nitrophenol	41	20	43	16
2-Nitrophenol	75	25	75	27
Pentachlorophenol	86	20	66	36
Phenol	36	14	36	21
2,4,6-Trichlorophenol	77	20	81	20

Spiked from 10 to 1500 µg/L

TABLE 4

Single Operator Accuracy and Precision

Parameter	*Average Percent Recovery*	*Standard Deviation %*	*Spike Range (µg/L)*	*Number of Analyses*	*Matrix Types*
Aldrin	89	2.5	2.0	15	3
α-BHC	89	2.0	1.0	15	3
β-BHC	88	1.3	2.0	15	3
δ-BHC	85	3.4	2.0	15	3
γ-BHC	97	3.3	1.0	15	3
Chlordane	93	4.1	20	21	4
4-4'-DDD	92	1.9	6.0	15	3
4,4'-DDE	89	2.2	3.0	15	3
4,4'-DDT	92	3.2	8.0	15	3
Dieldrin	95	2.8	3.0	15	2
Endosulfan I	96	2.9	3.0	12	2
Endosulfan II	97	2.4	5.0	14	3
Endosulfan sulfate	99	4.1	15	15	3
Endrin	95	2.1	5.0	12	2
Endrin aldehyde	87	2.1	12	11	2
Heptachlor	88	3.3	1.0	12	2
Heptachlor epoxide	93	1.4	2.0	15	3
Toxaphene	95	3.8	200	18	3
PCB-1016	94	1.8	25	12	2
PCB-1221	96	4.2	55-110	12	2
PCB-1232	88	2.4	110	12	2
PCB-1242	92	2.0	28-56	12	2
PCB-1248	90	1.6	40	12	2
PCB-1254	92	3.3	40	18	3
PCB-1260	91	5.5	80	18	3

TABLE 5

DETECTION LIMITS

Metal	Detection Limit	
	Aqueous mg/l	Solid mg/kg
Antimony	0.060	30
Arsenic	0.010	5
Beryllium	0.005	2.5
Cadmium	0.005	2.5
Chromium	0.010	5.0
Copper	0.025	12.5
Lead	0.005	2.5
Mercury	0.0002	0.2
Nickel	0.040	20
Selenium	0.005	2.5
Silver	0.010	5
Thallium	0.010	5
Zinc	0.020	10

Elements determined by Inductively Coupled Plasma Emission or Atomic Absorption Spectroscopy.

TABLE 6

DETECTION LIMITS
EPA Method 624

VOLATILE ORGANICS	DETECTION LIMIT AQUEOUS (ug/l)	SOLID (ug/kg)
Chloromethane	10	10
Vinyl chloride	10	10
Chloroethane	10	10
Bromomethane	10	10
Acrolein	100	100
Acrylonitrile	100	100
Methylene chloride	5	5
Trichlorofluoromethane	10	10
1,1-Dichloroethylene	5	5
1,1-Dichloroethane	5	5
1,2-trans-Dichloroethylene	5	5
Chloroform	5	5
1,2-Dichloroethane	5	5
1,1,1-Trichloroethane	5	5
Carbon tetrachloride	5	5
Bromodichloromethane	5	5
1,2-Dichloropropane	5	5
1,3-trans-Dichloropropene	5	5
Trichloroethylene	5	5
Benzene	5	5
1,3-cis-Dichloropropene	5	5
1,1,2-Trichloroethane	5	5
Dibromochloromethane	5	5
Bromoform	5	5
Tetrachloroethylene	5	5
1,1,2,2-Tetrachloroethane	5	5
Toluene	5	5
Chlorobenzene	5	5
Ethylbenzene	5	5
2-Chloroethyl vinyl ether	10	10
Acetone	10	10
Carbon disulfide	5	5
2-Butanone	10	10
Vinyl acetate	10	10
4-Methyl-2-pentanone	10	10
Styrene	5	5
Total xylenes	5	5

TABLE 7

DETECTION LIMITS
EPA Method 625

BASE/NEUTRAL EXTRACTABLE ORGANICS		DETECTION LIMIT (ug/l) AQUEOUS (ug/l)	SOLID (ug/kg)
1B	N-Nitrosodimethylamine	10	330
2B	Bis (2-Chloroethyl ether)	10	330
3B	1,3-Dichlorobenzene	10	330
4B	1,4-Dichlorobenzene	10	330
5B	1,2-Dichlorobenzene	10	330
6B	Bis (2-Chloroisopropyl) ether	10	330
7B	Hexachloroethane	10	330
8B	N-Nitrosodi-N-Propylamine	10	330
9B	Nitrobenzene	10	330
10B	Isophorone	10	330
11B	Bis (2-Chloroethoxy) methane	10	330
12B	1,2,4-Trichlorobenzene	10	330
13B	Naphthalene	10	330
14B	Hexachlorobutadiene	10	330
15B	Hexachlorocyclopentadiene	10	330
16B	2-Chloronaphthalene	10	330
17B	Dimethylphthalate	10	330
18B	Acenaphthylene	10	330
19B	2,6-Dinitrotoluene	10	330
20B	Acenaphthene	10	330
21B	2,4-Dinitrotoluene	10	330
22B	Diethylphthalate	10	330
23B	Fluorene	10	330
24B	4-Chlorophenyl phenyl ether	10	330
25B	N-Nitroso diphenylamine	10	330
26B	1,2-Diphenylhydrazine	25	330
27B	4-Bromophenyl phenyl ether	10	330
28B	Hexachlorobenzene	10	330
29B	Phenanthrene	10	330
30B	Anthracene	10	330
31B	Di-N-Butylphthalate	10	330
32B	Fluoranthene	10	330
33B	Benzidine	50	1600
34B	Pyrene	10	330
35B	Butylbenzylphthalate	10	330
36B	Benzo(a)Anthracene	10	330
37B	3,3'-Dichlorobenzidene	20	660
38B	Chrysene	10	330
39B	Bis (2-Ethylhexyl) phthalate	10	330
40B	Di-N-Octylphthalate	10	330
41B	Benzo-(b)-Fluoranthene	10	330
42B	Benzo-(k)-Fluoranthene	10	330
43B	Benzo(a)pyrene	10	330
44B	Ideno (1,2,3-c,d) pyrene	10	330
45B	Dibenzo (a,h) anthracene	10	330
46B	Benzo (g,h,i) perylene	10	330

TABLE 8

DETECTION LIMITS
EPA Method 625

ACID EXTRACTABLE ORGANICS	DETECTION LIMIT AQUEOUS (ug/l)	SOLID (ug/kg)
2-Chlorophenol	10	330
2-Nitrophenol	250	1600
2,4-Dimethylphenol	10	330
2,4-Dichlorophenol	10	330
P-chloro-M-cresol	10	330
2,4,6-Trichlorophenol	10	330
2,4-Dinitrophenol	50	1600
4-Nitrophenol	50	1600
4,6-Dinitro-O-cresol	50	1600
Pentachlorophenol	50	1600

TABLE 9

DETECTION LIMITS
EPA Method 608

PESTICIDES/PCB'S	DETECTION LIMIT AQUEOUS (ug/l)	SOLID (ug/kg)
Aldrin	.05	8.0
Alpha-BHC	.05	8.0
Beta-BHC	.05	8.0
Gamma-BHC	.05	8.0
Delta-BHC	.05	8.0
Chlordane	.50	80
4,4'-DDT	.10	16
4,4'-DDE	.10	16
4,4'-DDD	.10	16
Dieldrin	.10	16
Endosulfan I	.05	80
Endosulfan II	.10	16
Endosulfan Sulfate	.10	16
Endrin	.10	16
Endrin Aldehyde	.10	16
Heptachlor	.05	8
Heptachlor Epoxide	.05	8
PCB-1242	.5	8
PCB-1254	1.0	160
PCB-1221	0.5	80
PCB-1232	0.5	80
PCB-1248	0.5	80
PCB-1260	1.0	160
PCB-1016	0.5	80
Toxaphene	1.0	160

TABLE 10

DETAILS OF RI SAMPLING PROGRAM

ACTIVITY	# OF SAMPLES	SAMPLE TYPE	PARAMETER	ANALYSIS METHOD	CONTAINER	SOP FOR COLLECTION	# OF BLANKS	# OF DUPLICATES	REMARKS
Sampling Existing Monitoring Wells	15	GW	Volatiles	EPA-624	40 ml VOA vials	3.1.2	1	2	(1)
Sampling Existing Monitoring Wells	6	GW	ABN	EPA-625	1 gal glass	3.1.2	--	1	
		GW	Pest/PCB	EPA-608	1 gal glass	3.1.2	--	1	
		GW	Metals	Various	1 liter polyethylene	3.1.2	--	1	(2)
		GW	Cyanide	EPA-335.2	1 liter polyethylene	3.1.2	--	1	
		GW	Dioxin	EPA-613	1 liter glass	3.1.2	1	1	
Surface Water Sampling	9-11	SW	Volatiles	EPA-624	40 ml. VOA vials	3.1.1A	1	1	(3)
		SW	ABN	EPA-625	1 gal glass	3.1.1A	--	1	
		SW	Pest/PCB	EPA-608	1 gal glass	3.1.1A	--	1	
		SW	Metals	Various	1 liter polyethylene	3.1.1A	--	1	(2)
		SW	Cyanides	EPA-335.2	1 liter polyethylene	3.1.1A	--	1	
		SW	Dioxin	EPA-613	1 liter glass	3.1.2	1	1	
Sediment Sampling	4	SED	Volatiles	8240	40 ml VOA vials	3.1.8A	1	1	
		SED	ABN	8270	16 oz glass	3.1.8A	--	1	
		SED	Pest/PCB's	8080	16 oz glass	3.1.8A	--	1	
		SED	Metals	Various	16 oz glass	3.1.8A	--	1	(2)
		SED	Cyanides	EPA-335.2	16 oz glass	3.1.8A	--	1	
		SED	Dioxin	CLP (84)	16 oz glass	3.1.8A	1	1	(4)
Surface Soil Sampling	2-7	Soil	Volatiles	8240	40 ml VOA vials	3.1.7.1A	1	1	(3)
		Soil	ABN	8270	16 oz glass	3.1.7.1A	--	1	
		Soil	Pest/PCB's	8080	16 oz glass	3.1.7.1A	--	1	
		Soil	Metals	Various	16 oz glass	3.1.7.1A	--	1	(2)
		Soil	Cyanides	EPA-335.2	16 oz glass	3.1.7.1A	--	1	
		Soil	Dioxin	CLP (84)	16 oz glass	3.1.7.1A	1	1	(4)

TABLE 10: DETAILS OF RI SAMPLING PROGRAM (Continued)

ACTIVITY	# OF SAMPLES	SAMPLE TYPE	PARAMETER	ANALYSIS METHOD	CONTAINER	SOP FOR COLLECTION	# OF BLANKS	# OF DUPLICATES	REMARKS
Phase 1 Well Sampling	21	GW	Volatiles	VOC Screen	40 ml VOA vials	3.1.2	2	3	
Well Sampling (All wells)	55	GW	Volatiles	EPA-624	40 ml VOA vials	3.1.2	3	5	
Well Sampling (All wells)	10-50	GW	ABN	EPA-625	1 gal glass	3.1.2	--	1-5	(3)
		GW	Pest/PCB	EPA-608	1 gal glass	3.1.2	--	1-5	
		GW	Metals	Various	1 liter polyethylene	3.1.2	--	1-5	(2)
		GW	Cyanides	EPA 335.2	1 liter polyethylene	3.1.2	--	1-5	
		GW	Dioxin	EPA-613	1 liter glass	3.1.2	1	1-5	

REMARKS:

(1) See Section 7.10 and 7.20 of QA/QC Plan (POP 1.3) for detailed information on analytical protocols, container types, sample preservation and holding times.

(2) See Section 7.10 of QA/QC plan for specific references to analytical methods for 13 priority pollutant metals.

(3) Range in number of samples from CDM Work Plan estimates.

(4) Protocol to be used for dioxin analyses in soil will be as described in "Invitation for Bid WA-84-A002," US EPA Contract Laboratory Program, 1984.

(5) Abbreviations used: GW - Groundwater; SW - Surface Water; SED - Sediments; Soil - Surficial Soils; ABN - Acid/Base-Neutral extractable organics (see Tables 7 and 8 of QA/QC Plan); Pest/PCB's - Pesticide and PCB Organic Compounds (see Table 9 of QA/QC Plan).

(6) See Tables 5 and 6 of QA/QC Plan for lists of priority pollutant metals and volatile compounds, respectively.

TABLE 11

III. EQUIPMENT LIST

ANALYTICAL INSTRUMENTATION AVAILABLE AT WESTON LABORATORY LIONVILLE, PENNSYLVANIA

Type and Model	Quantity
High Pressure Liquid Chromatograph	2
Perkin-Elmer Model LC-75, Series 211, continuously variable wave-length detector	
Ion Chromatograph	1
Dionex Model 2020i	
Atomic Absorption Apparatus	2
Perkin-Elmer Model 503 with cold vapor mercury attachment, background correction	
Perkin-Elmer Model 5000 with graphite furnace and background correction	
Technicon Automatic Analyzer	1
Gas Chromatograph/Mass Spectrophotometer	
Finnigan Model 5100, equipped with electron ionization and chemical ionization source; capillary column system; INCOS data system; positive and negative ions electron multiplier detector; all glass jet separator and direct transfer line interface for capillary column system; with stand alone computer for data reduction and reporting	2
Finnigan OWA 1020 GC/MS - electron impact quadruple mass spectrometer, equipped with packed and capillary column injectors; INCOS data system; EPA, NIH, and special EPA-priority pollutant mass spectra library	1

TABLE 11 (Continued)

Type and Model	Quantity
Total Organic-Halide Analyzer	1
Dohrmann DX-20 Analyzer System equipped with microcoulometric analyzer	
Inductively Coupled Plasma Apparatus	1
Perkin-Elmer ICP/5000 system equipped with automatic ignition system, automatic tuning, data system automatic sampler	
Chromatograph Integrators	2
Perkin-Elmer (Spectra-Physics) Model 2 calculating integrator	
Hewlett-Packard Model 3390A chromatographic integrator	
Organic and Total Carbon Analyzers	2
Ionics Model 1270 TOC and TOC analyzer equipped with automatic sampler and infrared analyzer	
Dohrmann Envirotech Analyzer Model DC-50	
Gas Chromatographs Detectors	
Flame Ionization Detectors	2
Hewlett-Packard No. 18801B	
Electron Capture Detectors	2
Hewlett-Packard No. 18803B Analog Technology Corporation Model 140A	

TABLE 11 (Continued)

Type and Model	Quantity
Hall Electrolytic Conductivity Detectors	2
Tracor Model 700A	
Photoionization Detector	1
HNV Model PI-52-02	
Flame Photometric Detector	1
Tracor Model 12003	
Nitrogen Phosphorus Detector	1
Hewlett-Packard Model 18847A/8A	
Gas Chromatographs	8
Hewlett-Packard Model 5880 with level 4 programmable keyboard, alkaline flame ionization NP detector, 2 FID detectors, and electron capture detector. Model 7672A auto-sampler for continuous sample analysis	1
Hewlett-Packard Model 5880 with level 4 programmable keyboard, flame photometric, FID, and 2 electron capture detectors. Model 7672A auto-sampler for continuous sample analysis	1
Hewlett-Packard Model 5880 with level 4 programmable keyboard, Hall Model 700A electrolytic conductivity detector, FID, and ECD	1
Hewlett-Packard Model 5840A gas chromatograph equipped with flame ionization detector; electron capture detector; automatic sampler; capillary column systems; and automatic integrator, Model 7672A auto-sampler	1
Hewlett-Packard Model 5880 with level 4 programmable keyboard, Hall Model 700A electrolytic conductivity detector, and FID. Tekmar LSC-2 Purge and Trap concentration with (Tekmar Model ALS) 10 sample auto-sampler	1

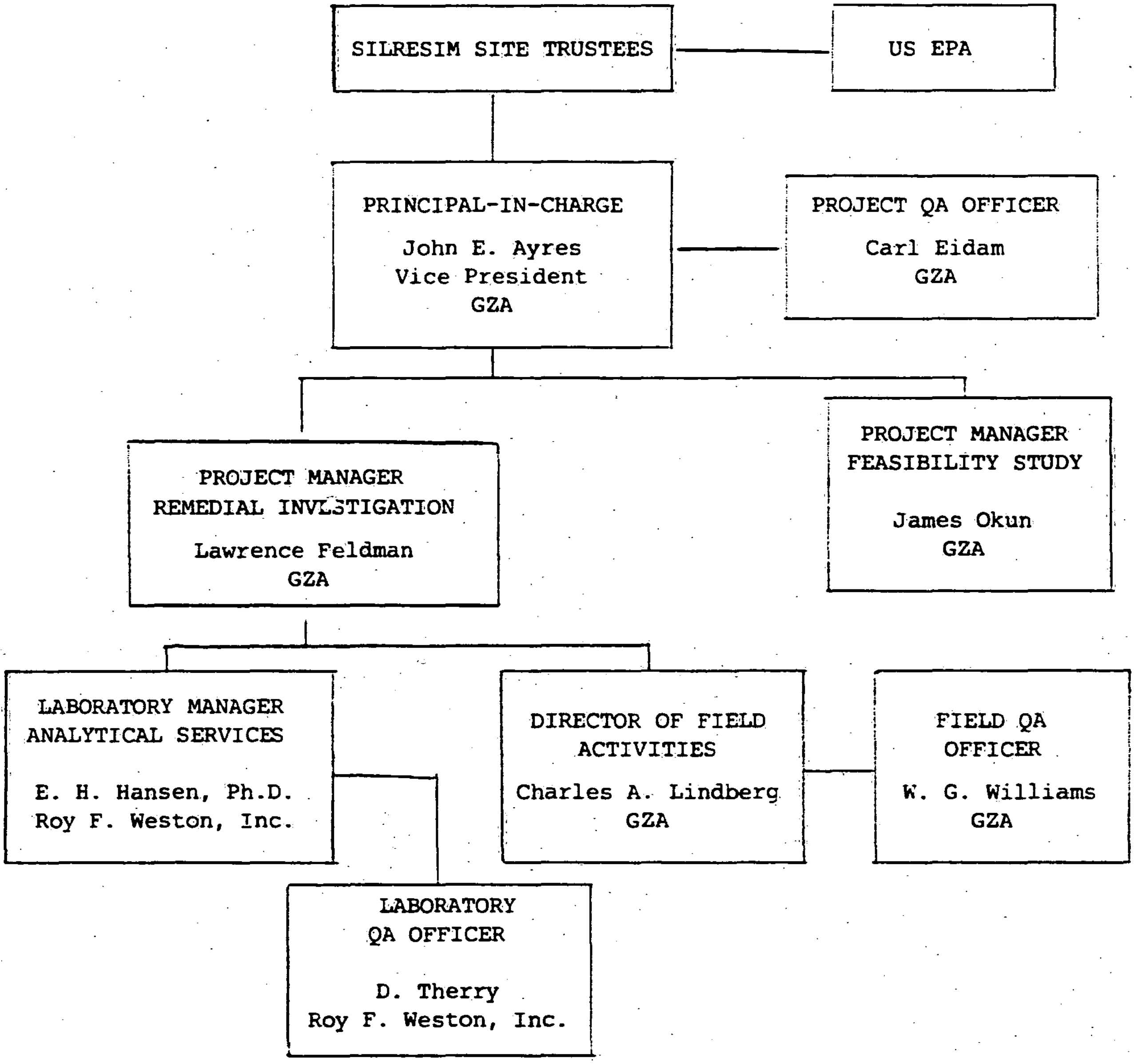
TABLE 11 (Continued)

Type and Model	Quantity
Perkin-Elmer SIGMA 2000 completely automated headspace analyzer with flame ionization and electron detectors	1
Analytical Instrument Development Portable Model 511 with flame ionization detector; dual column; and sampling, column switching, and backflush valves	1
Perkin-Elmer Model SIGMA3B isothermal and temperature programmed auto sampler for headspace analysis, packed and capillary column capability, automatic integrator	1
<u>Purge and Traps</u>	5
Chromalytics Model 1047 concentrator	1
Tekmar Model LSC-2	1
Tekmar Model ALS (Automatic Liquid Sampler)	3
<u>Spectrophotometers</u>	4
<u>pH Instruments</u>	4
<u>Specific Ion Analyzer</u>	1
Orion Model 901 pH/ion meter with Model 658 switch and various specific ion electrodes	
<u>Liquid Scintillation Counter</u>	1
Tracor Analytic Beta Trac 6895 microprocessor-based. It features automatic DPM, ESR, SCR, and is complete with printer and an internal memory.	

FIGURES

FIGURE QA-1

PROJECT ORGANIZATION AND LINE
AUTHORITY FOR THE QUALITY ASSURANCE PROGRAM



SAMPLE DESCRIPTION: ______________________________

JOB NUMBER: ______________ LOCATION: ______________

WELL I.D. ______________ ______________________

DATE: ______________ ______________________

TIME: ______________ ______________________

SAMPLING LOCATION: ______________________________

SAMPLE TYPE: ___________ PRESERVATIVE: __________

ANALYSIS REQUESTED: ______________________________

SAMPLED BY: ______________________________

SAMPLE ID NO.: ______________________________

CUSTODY FORM NUMBER: ______________________________

LAB NAME ______________________________

REMARKS

Example of Sample Label

Note: The sample container should be indelibly marked with the sample ID number to allow identification in the event of label detachment.

FIGURE QA-2

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS

CHAIN-OF-CUSTODY RECORD

FILE No. __________

PROJECT ______________________________ SHEET _____ OF __________

LOCATION ______________________________ COLLECTOR ____________________

STATION NUMBER	SEQUENCE NUMBER	DATE	TIME	SERIAL NUMBER	STATION LOCATION	SAMPLE TYPE	REMARKS
						TOTAL No. OF CONTAINERS	

RELINQUISHED BY: (Signature) 1.	DATE/TIME	RECEIVED BY: (Signature)	RELINQUISHED BY: (Signature) 2.	DATE/TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature) 3.	DATE/TIME	RECEIVED BY: (Signature)	RELINQUISHED BY: (Signature) 4.	DATE/TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature) 5.	DATE/TIME	RECEIVED BY: (Signature)	ANALYTICAL LABORATORY:		DATE/TIME

RETURN TO:

REVIEWED BY: DATE :

FIGURE QA-3

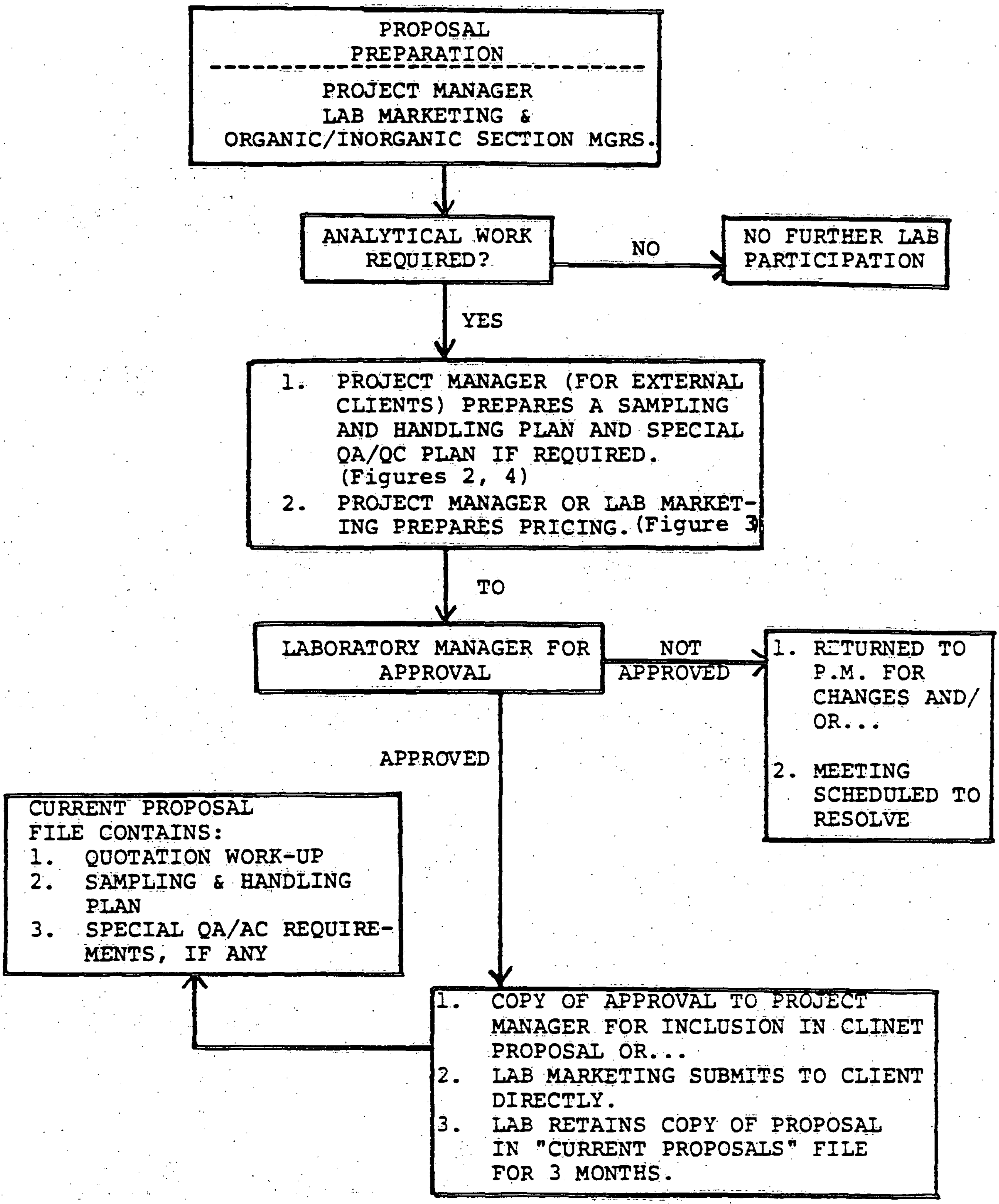
FIELD DATA RECORD

Samplers: ____________________
____
____
____

STATION	SAMPLE NUMBER	DATE OF COLLECTION	TIME (HRS)		pH	TEMPERATURE	OTHER PARAMETERS		
			SAMPLE TAKEN	SAMPLE RECEIVED					

FIGURE QA-4

WESTON ANALYTICAL LABORATORIES SAMPLE TRACKING SYSTEM
USER'S GUIDE "PROPOSAL PREPARATION"



PROPOSAL PREPARATION

PROJECT MANAGER
LAB MARKETING &
ORGANIC/INORGANIC SECTION MGRS.

ANALYTICAL WORK REQUIRED?

NO FURTHER LAB PARTICIPATION

1. PROJECT MANAGER (FOR EXTERNAL CLIENTS) PREPARES A SAMPLING AND HANDLING PLAN AND SPECIAL QA/QC PLAN IF REQUIRED. (Figures 2, 4)
2. PROJECT MANAGER OR LAB MARKETING PREPARES PRICING. (Figure 3)

LABORATORY MANAGER FOR APPROVAL

1. RETURNED TO P.M. FOR CHANGES AND/OR...
2. MEETING SCHEDULED TO RESOLVE

CURRENT PROPOSAL FILE CONTAINS:
1. QUOTATION WORK-UP
2. SAMPLING & HANDLING PLAN
3. SPECIAL QA/AC REQUIREMENTS, IF ANY

1. COPY OF APPROVAL TO PROJECT MANAGER FOR INCLUSION IN CLINET PROPOSAL OR...
2. LAB MARKETING SUBMITS TO CLIENT DIRECTLY.
3. LAB RETAINS COPY OF PROPOSAL IN "CURRENT PROPOSALS" FILE FOR 3 MONTHS.

Figure QA-5

WESTON ANALYTICAL LABORATORIES SAMPLE TRACKING SYSTEM USER'S GUIDE

"ENTRY INTO SMACS"

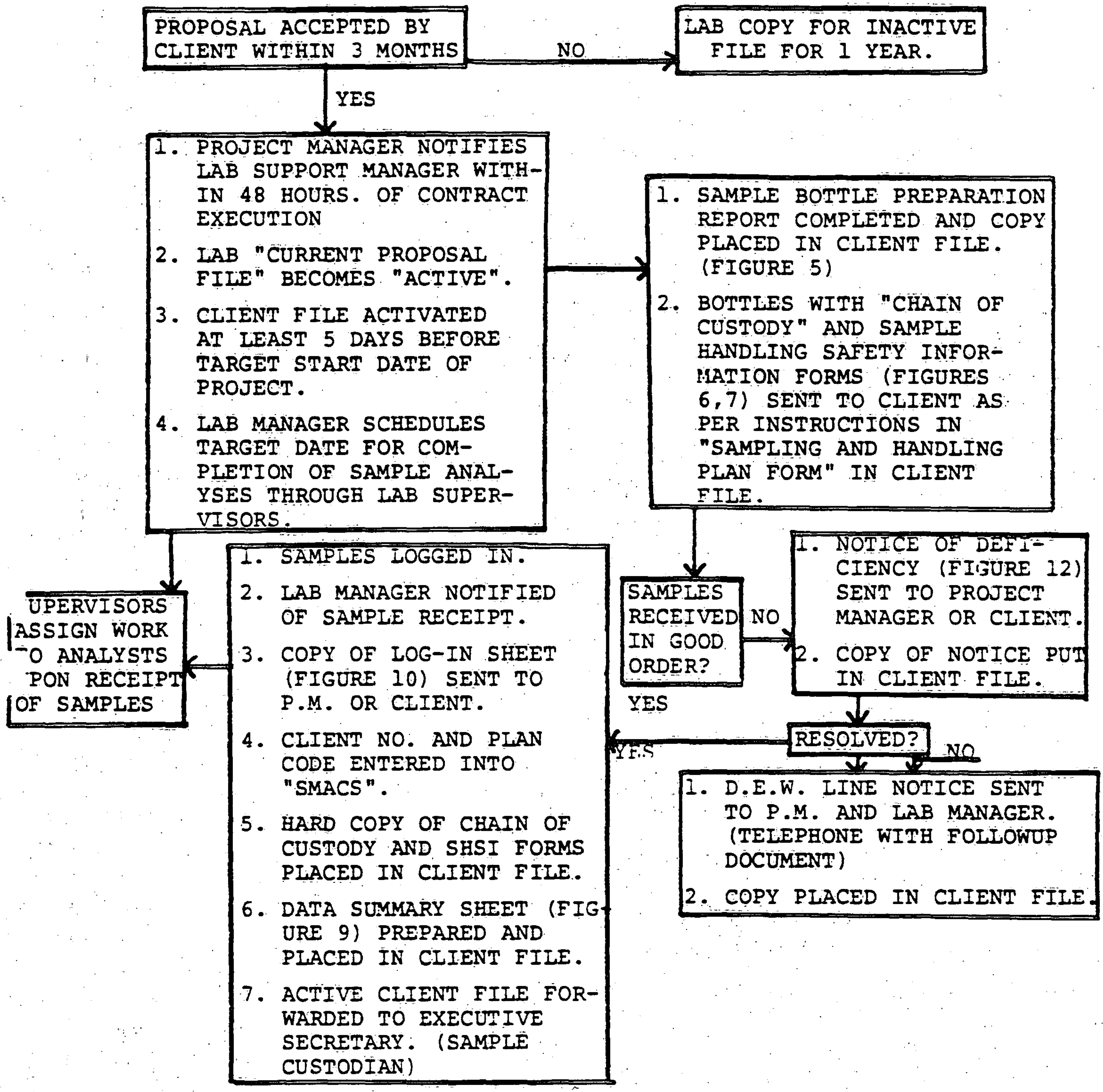
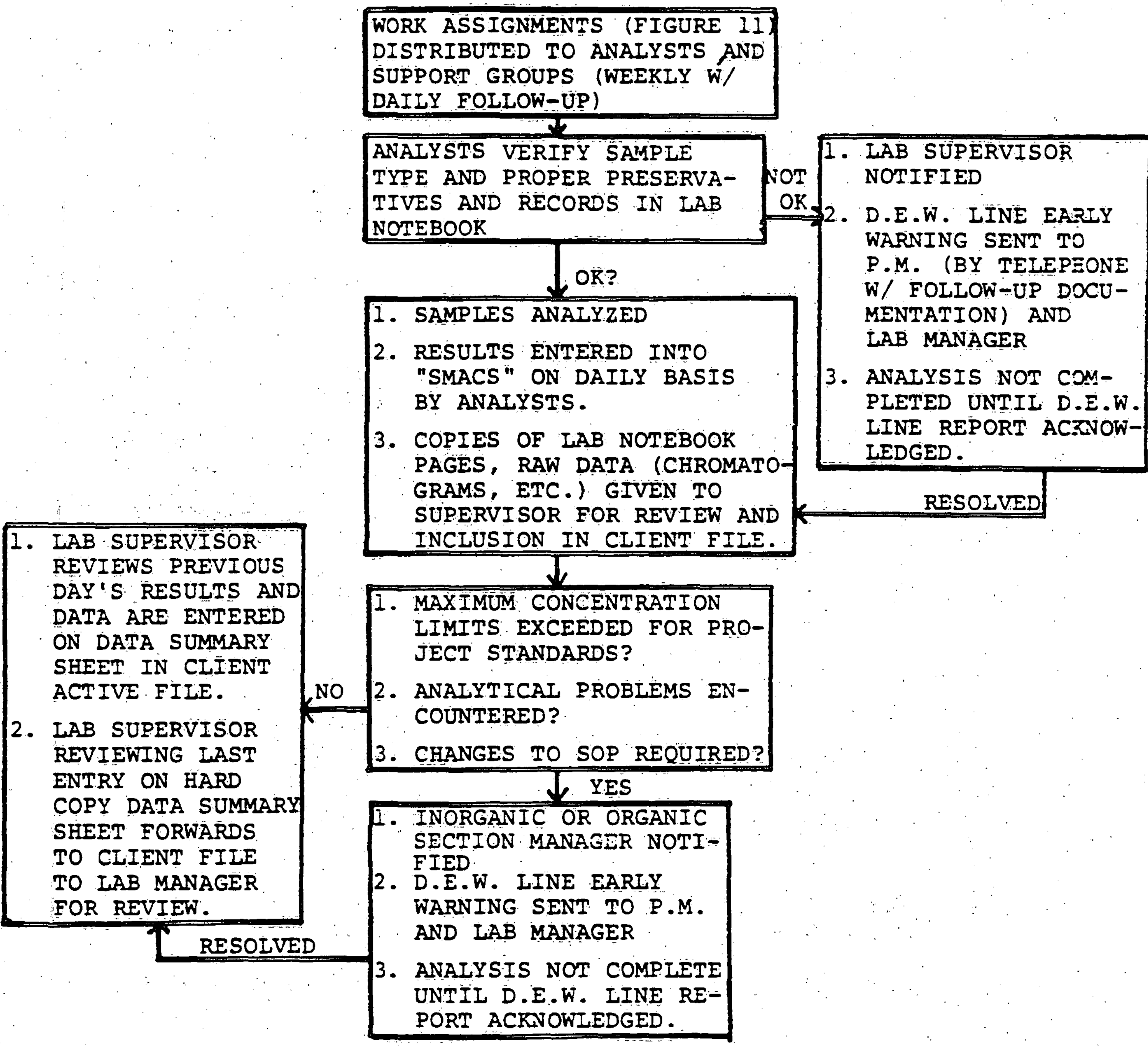


Figure QA-6

WESTON ANALYTICAL LABORATORIES SAMPLE TRACKING SYSTEM USER'S GUIDE

"RESULTS REPORTING"



WORK ASSIGNMENTS (FIGURE 11) DISTRIBUTED TO ANALYSTS AND SUPPORT GROUPS (WEEKLY W/ DAILY FOLLOW-UP)

ANALYSTS VERIFY SAMPLE TYPE AND PROPER PRESERVATIVES AND RECORDS IN LAB NOTEBOOK

1. LAB SUPERVISOR NOTIFIED
2. D.E.W. LINE EARLY WARNING SENT TO P.M. (BY TELEPHONE W/ FOLLOW-UP DOCUMENTATION) AND LAB MANAGER
3. ANALYSIS NOT COMPLETED UNTIL D.E.W. LINE REPORT ACKNOWLEDGED.

1. SAMPLES ANALYZED
2. RESULTS ENTERED INTO "SMACS" ON DAILY BASIS BY ANALYSTS.
3. COPIES OF LAB NOTEBOOK PAGES, RAW DATA (CHROMATOGRAMS, ETC.) GIVEN TO SUPERVISOR FOR REVIEW AND INCLUSION IN CLIENT FILE.

1. MAXIMUM CONCENTRATION LIMITS EXCEEDED FOR PROJECT STANDARDS?
2. ANALYTICAL PROBLEMS ENCOUNTERED?
3. CHANGES TO SOP REQUIRED?

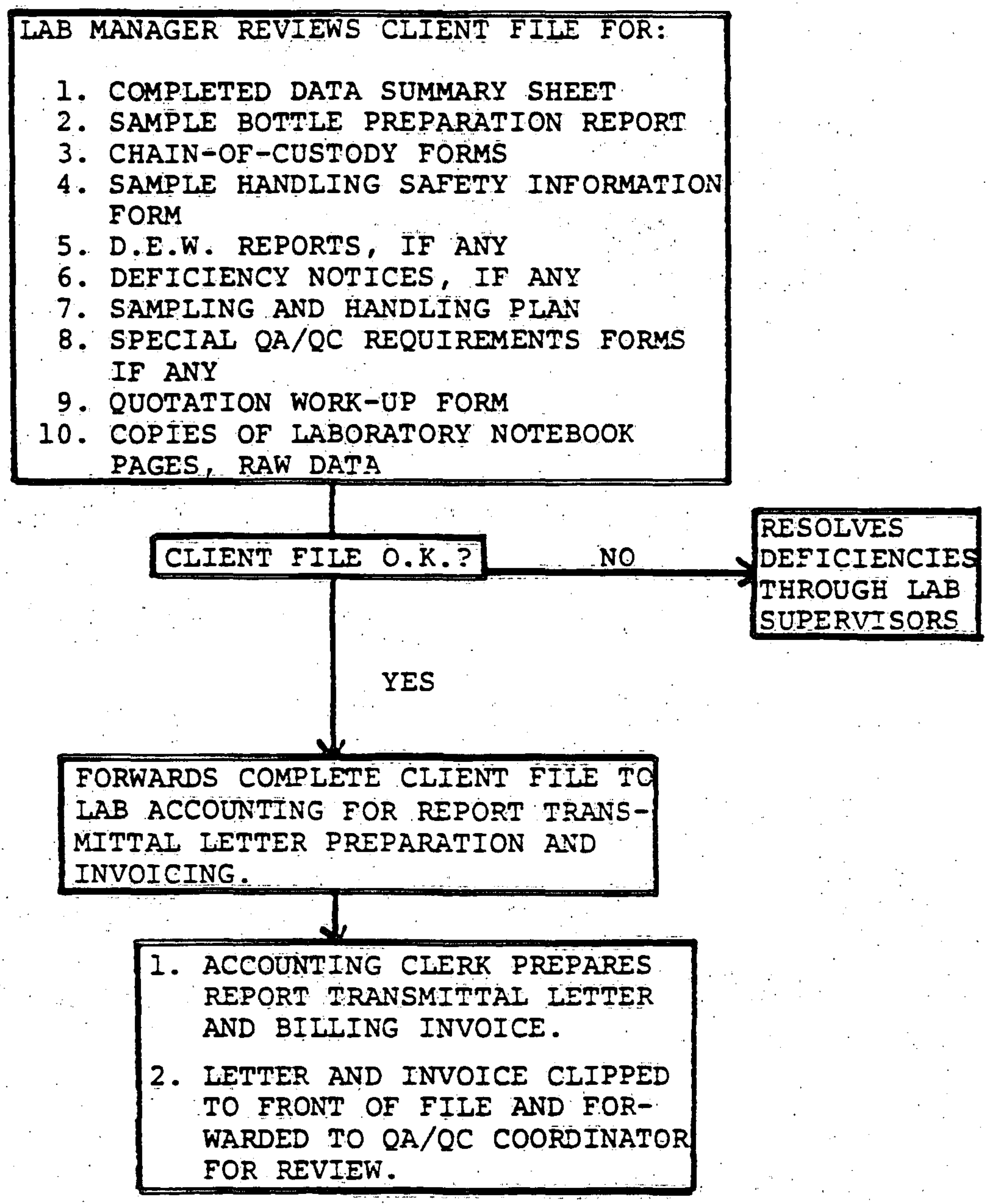
1. LAB SUPERVISOR REVIEWS PREVIOUS DAY'S RESULTS AND DATA ARE ENTERED ON DATA SUMMARY SHEET IN CLIENT ACTIVE FILE.
2. LAB SUPERVISOR REVIEWING LAST ENTRY ON HARD COPY DATA SUMMARY SHEET FORWARDS TO CLIENT FILE TO LAB MANAGER FOR REVIEW.

1. INORGANIC OR ORGANIC SECTION MANAGER NOTIFIED
2. D.E.W. LINE EARLY WARNING SENT TO P.M. AND LAB MANAGER
3. ANALYSIS NOT COMPLETE UNTIL D.E.W. LINE REPORT ACKNOWLEDGED.

Figure QA-7

WESTON ANALYTICAL LABORATORIES SAMPLE TRACKING SYSTEM USER'S GUIDE

"RESULTS REPORTING AND INVOICING"



LAB MANAGER REVIEWS CLIENT FILE FOR:

1. COMPLETED DATA SUMMARY SHEET
2. SAMPLE BOTTLE PREPARATION REPORT
3. CHAIN-OF-CUSTODY FORMS
4. SAMPLE HANDLING SAFETY INFORMATION FORM
5. D.E.W. REPORTS, IF ANY
6. DEFICIENCY NOTICES, IF ANY
7. SAMPLING AND HANDLING PLAN
8. SPECIAL QA/QC REQUIREMENTS FORMS IF ANY
9. QUOTATION WORK-UP FORM
10. COPIES OF LABORATORY NOTEBOOK PAGES, RAW DATA

CLIENT FILE O.K.?

RESOLVES DEFICIENCIES THROUGH LAB SUPERVISORS

FORWARDS COMPLETE CLIENT FILE TO LAB ACCOUNTING FOR REPORT TRANSMITTAL LETTER PREPARATION AND INVOICING.

1. ACCOUNTING CLERK PREPARES REPORT TRANSMITTAL LETTER AND BILLING INVOICE.
2. LETTER AND INVOICE CLIPPED TO FRONT OF FILE AND FORWARDED TO QA/QC COORDINATOR FOR REVIEW.

Figure QA-8

WESTON ANALYTICAL LABORATORIES SAMPLE TRACKING SYSTEM USER'S GUIDE

"FINAL APPROVAL"

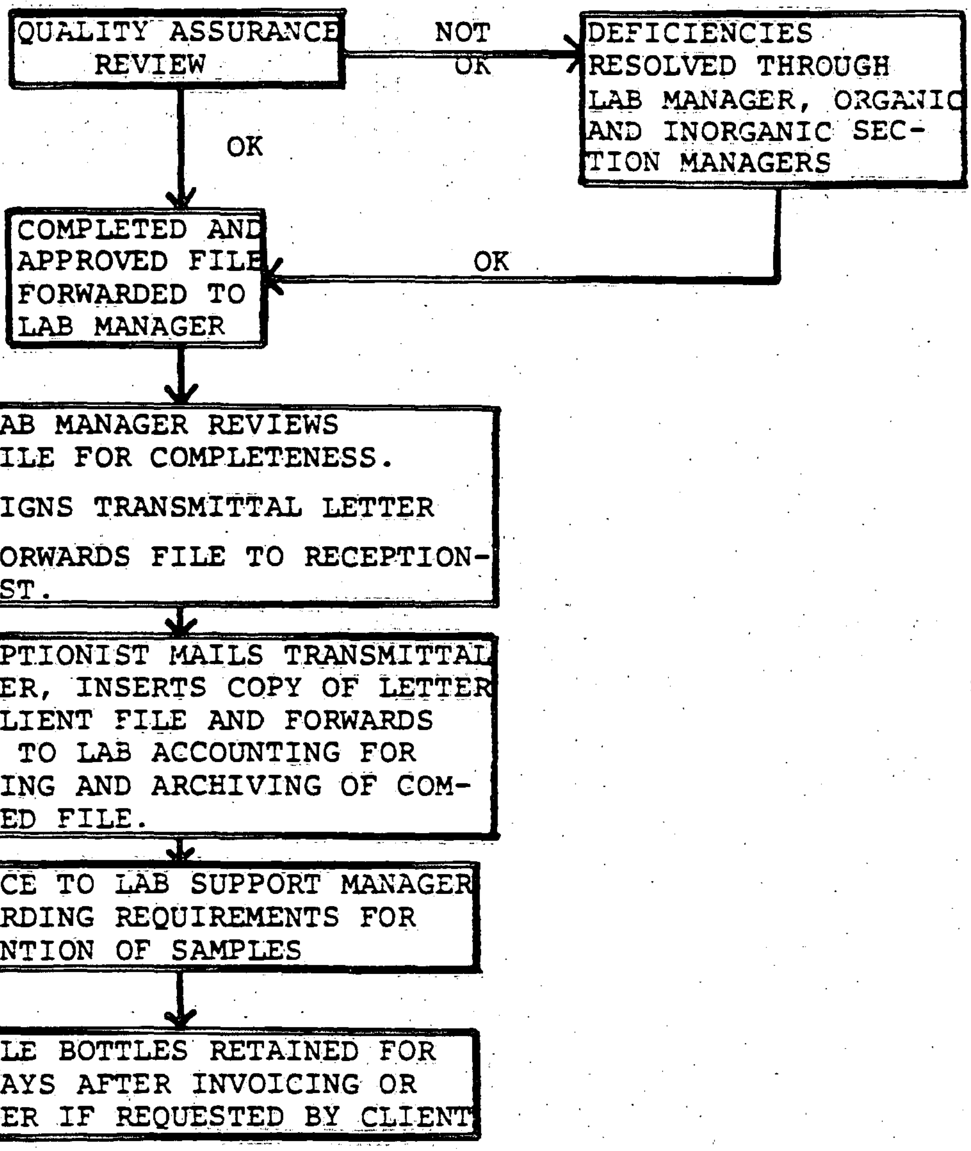


Figure QA-9

APPENDIX QA-1

STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURES
TABLE OF CONTENTS

STANDARD OPERATING PROCEDURES
TABLE OF CONTENTS (Continued)

SECTION 4.0 FIELD MONITORING AND TESTING

4.1 FIELD MONITORING

OVERBURDEN "MACHINE OPERATED HOLLOW STEM AUGERING" BORING

SOP NO. 1.1.1

1. Purpose:

To establish standard operating procedures for the advancing of shallow earth borings employing the hollow stem auger method for geotechnical explorations and hazardous waste site investigations.

2. Equipment and Materials:

The driller shall be capable of providing power-driven sectional hollow stem auger flights with a minimum inside diameter of 2-1/2 inches. In addition, the following equipment shall be present:

A. Drill rods, minimum size equivalent to the "A" rod, (1-5/8 inch O.D. and 1-1/8 inch I.D.)

B. Hollow stem auger plug

C. Drive hammer (1) 300 pound and (1) 140 pound ± 5 pounds

D. 2-inch O.D. split spoon sampler

E. Roller bit and diamond corer bit

E. Water tank and pump

3. Procedures:

The boring is advanced by rotating a single section of hollow stem auger into the soil to desired depth or the limit of the auger section. To continue advancing the bore hole, additional auger flights are added one at a time and this sequence is repeated until the required depth is reached. When an obstruction is met, the driller must attempt to penetrate the obstruction by the use of a roller bit or by coring. If attempts to penetrate obstruction are unsuccessful, boring will be abandoned.

Hollow stem auger techniques should be employed without the use of drilling water while drilling on hazardous waste sites.

If water is deemed necessary by driller, its use must be approved by the drilling inspector. When water is used to advance boring it must not be recirculated back into the boring.

The auger plug must be in place at the auger head while bore hole is being advanced to prevent soil from being transported through auger.

4. Records and Documentation:

The details of the boring shall be recorded on the GZA boring log (copy attached).

5. Special Notes:

Whenever standard operating procedures are varied, it shall be recorded. The drilling inspector should also record any detected odor from boring, and depth encountered.

Hollow stem auger borings often provide the simplest method of soil investigation and sampling. However, depths of auger investigations are limited by groundwater conditions, soil characteristics, and the equipment used.

6. Applicable Standards and References

ASTM D1452-80 Soil Investigation and Sampling by Auger Borings

GOLDBERG-ZOINO & ASSOCIATES, INC.
320 NEEDHAM ST., NEWTON UPPER FALLS, MA.

GEOTECHNICAL/GEOHYDROLOGICAL CONSULTANTS

PROJECT

REPORT OF BORING No.
SHEET OF
FILE No.
CHKD. BY

BORING Co.
FOREMAN
GZA ENGINEER

BORING LOCATION
GROUND SURFACE ELEVATION DATUM
DATE START DATE END

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 in.

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 in.

CASING SIZE:

OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (ft.)	CASING (bl/ft)	SAMPLE				SAMPLE DESCRIPTION	REMARKS	STRATUM DESCRIPTION
		No.	PEN. (in) / REC.	DEPTH (ft)	BLOWS/6"	CLASSIFICATION		

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT.	DENSITY	BLOWS/FT.	DENSITY
0-4	V. LOOSE	< 2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

REMARKS:

GZA

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.

2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING No.

GOLDBERG-ZOINO & ASSOCIATES, INC.
320 NEEDHAM ST, NEWTON UPPER FALLS, MA.
GEOTECHNICAL/GEOHYDROLOGICAL CONSULTANTS

PROJECT

REPORT OF BORING No.
SHEET ____ OF ____
FILE No.
CHKD. BY

DEPTH (ft.)	CASING (bl/ft)	SAMPLE				SAMPLE DESCRIPTION	REMARKS	STRATUM DESCRIPTION
		No.	PEN. (in)/REC.	DEPTH (ft)	BLOWS/6"	CLASSIFICATION		

REMARKS:

BORING No.

OVERBURDEN BORING: "WASH AND DRIVE BORINGS"

SOP NO. 1.1.2

1. Purpose:

To establish standard operating procedures for advancing earth borings employing the wash boring method. Wash boring is a boring system by which material loosened by a bit is borne to the surface in the annular space between the bit and casing by water forced down through the pipe bearing the bit.

2. Equipment and Materials:

The driller shall be capable of providing a power driven rotary machine, equipped with 5-foot sections of drive casing, with a minimum I.D. of 3 inches. In addition, the following equipment shall be present:

A. Drill rods; minimum size drill rod shall be equivalent to the A rod (1-5/8 inch O.D. and 1-1/8 inch I.D.).

B. Roller bit and diamond corer bit.

C. Drive hammer (1) 300 pound and (1) 140 pound ± 5 pounds.

D. 2-inch O.D. split spoon sampler.

E. Water tank and pump.

3. Procedures:

To start a borehole, a 5-foot length of casing is driven into the soil with the 300 pound hammer falling 24 inches until its top end is at the proper elevation. Hammer blows required to advance the casing each 12-inch increment should be recorded on the boring log. To cut the loose soil, the hollow rod bearing the bit is moved up and down in a chopping motion or turned while water is forced down through the drill rod and the soil in the casing is brought to the surface. Casing sections are added one at a time, and the above sequence is repeated until the required depth is reached. When an obstruction is met, the driller must attempt to penetrate the obstruction by the use of a roller bit or by coring. If attempts to penetrate obstruction are unsuccessful, boring will be abandoned. Casing of boring will be continued until the wall of the borehole stays in place uncased, then borehole can be continued simply by advancing the bit and washing, and then only with the approval of the drilling inspector. Stabilizing the borehole with drilling fluid other than water must also be approved by drilling inspector.

4. Records and Documentation:

All details of the boring shall be recorded on the GZA boring log (copy attached).

5. Special Notes:

Whenever standard operating procedures are varied, it shall be recorded. Any observed change in color, volume and/or viscosity of the returning drilling fluid is indicative of a soil change and should be recorded by the drilling inspector.

6. Applicable Standards and References

GOLDBERG-ZOINO & ASSOCIATES, INC.
320 NEEDHAM ST, NEWTON UPPER FALLS, MA.

GEOTECHNICAL/GEOHYDROLOGICAL CONSULTANTS

PROJECT

REPORT OF BORING No.
SHEET OF
FILE No.
CHKD. BY

BORING Co.
FOREMAN
GZA ENGINEER

BORING LOCATION
GROUND SURFACE ELEVATION DATUM
DATE START DATE END

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 in.

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 in.

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (ft)	CASING (bl/ft)	SAMPLE No.	SAMPLE PEN. (in) / REC.	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION CLASSIFICATION	REMARKS	STRATUM DESCRIPTION

GRANULAR SOILS BLOWS/FT.	GRANULAR SOILS DENSITY	COHESIVE SOILS BLOWS/FT.	COHESIVE SOILS DENSITY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

REMARKS:

GZA

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.

2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING No.

GOLDBERG-ZOINO & ASSOCIATES, INC.
320 NEEDHAM ST, NEWTON UPPER FALLS, MA.

GEOTECHNICAL/GEOHYDROLOGICAL CONSULTANTS

PROJECT

REPORT OF BORING No.
SHEET ______ OF ______
FILE No.
CHKD. BY

DEPTH (ft)	CASING (bl/ft)	SAMPLE				SAMPLE DESCRIPTION	REMARKS	STRATUM DESCRIPTION
		No.	PEN. (in)/REC.	DEPTH (ft)	BLOWS/6"	CLASSIFICATION		

REMARKS:

GZA

BORING No.

ROCK CORE DRILLING

SOP NO. 1.2.1

1. Purpose:

To obtain bedrock core samples for geological classification and to provide a borehole of sufficient diameter for geohydrologic testing (pressure permeability, geophysical) of the bedrock.

2. Equipment and Materials:

- Appropriate hydraulic rotary drilling rig and drilling tools
- Double-tube, core barrel with appropriate diamond bit (NX, NQ size or as required by project)
- Appropriate wooden boxes specifically constructed to hold and store rock core

3. Procedures:

A. Upon encountering refusal at the specified borehole locations, the casing shall be firmly seated on the rock and washed out before inserting the diamond bit core barrel.

B. The diamond bit core barrel shall be started in the hole and the rock shall be drilled in continuous 5-foot length intervals (runs) until the required depth is reached. The holes shall be carried into the bedrock to a depth sufficient to permit the Engineer to determine to his satisfaction the character of the rock penetrated.

Drilling methods employed shall be adjusted continuously to obtain maximum core recovery. This may include adjustments to rate of flow of drilling fluid, rotation rate, and down pressure. Variations in bit types, in terms of diamond size, matrix and configuration of water ports may also be required to maximize core recovery.

C. When the core is broken off, it shall be withdrawn, labeled, and stored in an approved core box before the drilling is continued. Cores shall be carefully handled to insure their proper identification and placing in the order in which they are removed from the hole. Care shall be taken to recover as large a percentage of unbroken core as possible.

D. The rock cores shall be placed in suitable wooden boxes so partitioned that the cores from each boring will be kept separate. The core is placed in the core box in book fashion with the top of the run at the upper left corner and the remaining core placed sequentially from left to right and from the rear (nearest the cover hinge) of the box to the front. The core should fit snugly in the box so that it will not roll or slide and suffer additional breakage.

E. A wooden block marked with the appropriate depth and run number is placed between each separate core run. In addition, wherever core is lost due to the presence of a cavity or large discontinuity (open or filled), a spacer is placed in the proper position in the core box. The spacer should be the same length as that of the lost core, and the depth range should be marked on the spacer along with the reason for the missing core; e.g., cavity, large joint, etc.

F. The core box is marked on the top and two ends with the client's name, site identification, boring number, depth range, and box number.

4. **Records and Documentation:**

A. All data, sampling information, and rock classification will be recorded on rock coring logs (attached), as specified in SOP No. 1.1. Specifically, the following items will be included:

1) Type of core drill, including size of core.

2) Length of core recovered for each length drilled.

3) Elevation at which rock was encountered.

4) Elevation at bottom of hole.

5) Description of rock.

6) Time required to drill each foot.

5. **Special Notes:**

A. Double-tube, diamond-bit core barrel and drilling tools will be cleaned via a high pressure hot water rinse upon completion of the borehole to preclude cross-contamination between successive boreholes.

B. Wash water used during the core drilling will not be recirculated to the borehole.

6. **Applicable References and Standards:**

Department of the Navy, NFEC, Soil Mechanics, Design Manual 7.1, NAVFAC DM-7.1, Alexandria, VA., May 1982.

WELL INSTALLATIONS - OVERBURDEN WELLS

SOP NUMBER 2.1

1. **Purpose:**

Overburden wells are installed to provide access to groundwater for sampling purposes, determination of groundwater elevation, and to monitor fluctuations in groundwater elevation.

2. **Equipment and Materials**

- Schedule 40 PVC pipe, 1-1/2-inch diameter, flush-joint threaded
- Schedule 40 PVC slotted wellscreen, 1-1/2-inch diameter, 0.01-inch slots, flush-joint threaded
- Bentonite clay
- Ottawa sand
- Cement grout
- Metal pipe, 3-inch or 4-inch diameter, 5-foot length, threaded one end, with cap and locking device.
- Valve gate box, 5-1/4-inch and 16-inch, with bolted cover plate

3. **Procedures**

A. Install an Ottawa sand filter below the proposed base of the well screen approximately one foot (1') thick by pouring sand down the borehole while withdrawing the casing one foot (1'). Measure and record the depth of the sand cushion.

B. Assemble and install the observation well pipe and screen. Well tip must be fitted with a threaded or slip-on plug. All pipe sections shall be connected by dry threading of the joints. No glue, solvents, or lubricating compound shall be used to make up the connections. The well pipe assembly must be carefully lowered into the borehole to ensure centering of the well in the hole. After installation, the GZA field engineer and the drilling contractor will carefully measure the depth to the well tip and record the measurement on the well log.

C. Install a sand filter around the wellscreen to at least two feet (2') above the screen. Grain size of the sand shall be appropriate for the slot size of the screen (normally 0.01 inch).

D. Withdraw the casing and install a bentonite clay seal approximately two feet (2') thick above the sand filter.

E. Insert a tremie pipe and backfill the remainder of the hole with bentonite-cement grout until it flows at the surface.

F. Square cut the well pipe stick-up at 1 foot 10 inches above grade.

G. Install a five foot (5') section of metal pipe (3 inches or 4 inches diameter) equipped with a threaded, lockable cap, three feet (3') into the borehole. Complete the installation by constructing a concrete surface pad around the steel guard pipe. The concrete pad shall be a minimum of 2 feet deep and 1.5 foot in diameter.

H. If well head completions must be flush with the ground surface, a street box or lockable valve gate box may be installed in lieu of the metal pipe. Installation consists of square-cutting the riser pipe two inches (2") below grade and cement grouting the box in place.

I. Paint the well protective pipe or box to inhibit rust formation and increase visibility. Paint the well number in one (1") block numerals of a contrasting color.

4. Records and Documentation

Well installations will be recorded on the drilling log for the hole. Installation details to be recorded include total well depth, screen depth and length, filter and seal depths and thicknesses, well head completion type, and any other details or measurements deemed necessary by the field engineer. All measurements should be made from ground surface.

5. Special Notes

a) Metal protective pipe or valve gate boxes shall be steam cleaned prior to installation to remove cutting oil or other residue. To assist in removal for sampling, the cap threads may be lubricated with a small amount of non-petroleum based material (vegetable oil or Crisco).

b) If well is to be installed above the base of the borehole, care must be taken to ensure any underlying strata are properly sealed to preclude the possibility of cross contamination. Seals can be constructed using either cement bentonite grout or bentonite pellets.

c) Grout backfill above bentonite seal may be omitted under certain stratigraphic conditions. In those cases, hole should be backfilled with native materials with occasional thin bentonite seals. Completed installation must have a vertical permeability less than that of the natural strata encountered.

Applicable Standards and References

U.S. Environmental Protection Agency, "Procedures Manual for Ground Water Monitoring at Solid Waste Disposal Facilities," SW-611, December 1980.

GROUNDWATER SAMPLER INSTALLATIONS - GAS DRIVE SAMPLERS (BARCAD)

SOP NO. 2.2

1. Purpose:

- To install several BarCads, dedicated gas-drive sampling instruments, at different depths within a single borehole.
- To install the BarCads at predetermined locations within the surface formation based on information from standard drilling logs, inspection of soil samples, review of recorded water levels, geophysical logs, chemical screening data, and permeability test data.
- To properly install and seal the BarCads in order to allow measurement of piezometric heads as well as sample collection from the discrete and well defined locations within the soil formation.

2. Equipment and Materials

- Logging/Testing Data
- Drill Rig equipped with
    - large capacity mixer or 55 gallon drum, mudgun, and positive placement pump
    - large diameter suction lines
    - 0.5 - 1.0-inch polyethylene or PVC tubing (tremie pipe)
- Clean silica sand
- Cement
- Bentonite (pellets and powder)
- BarCad sampler with properly dimensioned tube fittings
- Polypropylene filter bag with plastic pipe form (optional)
- Weighted tape
- 1/2-inch polyethylene tubing or 1/2-inch ID flush-threaded PVC pipe
- 1/4-inch or 3/16-inch OD nylon tubing
- Tamping hammer sized for drill casing

3. Procedures

A. After completion of drilling of borehole, determine locations of samplers, filters, seals, etc. based on stratigraphic and chemical screening logs obtained by sampling, classifying and testing soil during drilling.

B. Bump back casing (if necessary) to depth of bottom of lowest seal (or bottom of lowest filter if bottom seal is not used).

C. 1) In cohesive soils, where borehole will remain open after withdrawal of casing, backfill borehole to bottom of lowest seal. Withdraw casing approximately 12 to 24 inches and plumb for bottom of hole to verify that it has remained open. Add bentonite pellets <u>slowly</u>, checking periodically that they do not bridge up inside the casing. After 6-12 inches of bentonite has accumulated at bottom of hole, lower tamping hammer and thoroughly tamp the seal. (Do not allow hammer to extend below bottom of casing to prevent hammer from catching on casing lip. Add more bentonite before tamping if necessary.) Check location of top of bentonite to make sure it is below bottom of casing. Withdraw casing another 6-12 inches and repeat procedure until desired thickness of seal is attained.

2) In cohesionless soils where borehole will not remain open after withdrawal of casing, maintain head of water on casing throughout installation operations. After withdrawing casing to bottom of seal depth, plumb for bottom using weighted tape to ensure that no soil is up inside casing. (Withdraw casing maintaining a high volume flow of water into hole if necessary to prevent piping of sand up into casing. Do not attempt to place bentonite if there is any soil inside casing).

Withdraw casing 6-12 inches while maintaining maximum attainable head of water. Constantly monitor bottom of hole depth with a weighted tape to ensure that hole remains open below casing as casing is retracted. Begin adding bentonite pellets slowly after pulling casing 6-12 inches, maintaining the head of water. Monitor bentonite level, ensuring that it remains just below bottom of casing. Withdraw casing in

6-12-inch increments, then add bentonite according to the above procedure until top of seal depth is reached. Lower tamping hammer into borehole and thoroughly tamp bentonite, making sure hammer does not drop below bottom of casing. Add bentonite as necessary.

3) If borehole will not remain open below casing even with a constant head of water, bentonite must be placed in 2-3-inch lifts inside casing and casing must be extracted in 2-inch increments while resting the hammer directly on the bentonite. The bentonite plug must then be forced out of the casing by repeated blows of the tamping hammer. If this does not dislodge plug, connect the rig pump directly to the top of the casing (water-tight connection) and employ water pressure to force plug out.

D. After completing lowest seal, plumb for bottom of casing to ensure that no soil is inside casing.

E. Assemble sampler (1/2-inch OD polyethylene top fitting)

1) BarCad samplers are delivered clean and wrapped in aluminum foil. Care should be taken to ensure that they are not contaminated prior to installation. Foil should be left on samplers until just before they are installed in the borehole. To connect riser tube, peel off only the upper part of the foil wrapper, exposing only the brass fitting. Make sure that no dust, sand or other foreign matter enters the top fitting at this point.

2) Check for proper operation of check valve. Valve should seat when air is forced into sampler and should unseat when air is sucked out.

3) Connect outer riser tubing to swagelock fitting at top of sampler. Make sure tubing is clean and end is square. Insert tubing into swagelock fitting as far as it will go. Hand tighten swage nut, then turn it 1-1/4 turns with a pair of wrenches. (Scribe nut to keep track of rotation.) Check strength of

connection by holding sampler and pulling on tubing. Tubing should not dislodge.

4) Measure outer tubing and cut at desired length. Insert inner tubing into outer tube (inner tubing is typically 3/16-inch nylon) and push it to within 6 to 24 inches of top of sampler. Make sure inner tubing is kept clean during installation (e.g. leave it in plastic bag as it is being installed). Cut off inner tubing flush with outer tubing.

5) Fill riser tubing with clean water and cap off outer (and inner) riser tubes with tape or plastic caps leaving small vent hole for pressure relief. Insert entire assembly into borehole.

6) After placing sand filter around sampler, and prior to installing seal above filter, check for proper operation. Hook up riser tubing to regulator and sample in normal manner. Check to see if sampler recharges properly.

7) Clearly mark sampler riser tube with designated sampler number.

F. Assemble sampler (1/2-inch ID flush thread PVC pipe)

1) Follow instructions in items E-1 and E-2 above.

2) Place 0-ring at top of male thread of 10-foot long 1/2-inch ID flush thread PVC pipe. Thread this section securely into top of BarCad sampler.

3) Lower assembly into hole, keeping PVC pipe full of clean water, and add 10-foot PVC sections with 0-ring seals to reach desired depth. (Note: If 0-ring seals are not available, wrap a bead of Teflon tape around top of each male thread. Do not overtighten threads or joints may crack.)

4) Install 3/16-inch or 1/4-inch nylon tubing through 1/2-inch PVC pipe to top of BarCad sampler. Measure tubing length prior to inserting and check length

installed to verify depth of sampler. Record depth of sampler and lengths of tubing used. Cap outer tubing, leaving small vent hole for pressure relief.

5) Follow items E-6 and E-7 above.

G. 1) For open hole installations, withdraw casing to bottom of BarCad sampler depth (typically 2 to 3 feet above seal). Place clean uniform filter sand up to bottom of casing. Place fully assembled BarCad sampler with sufficient length of riser tubing into hole and place clean, uniform sand around it. Extract casing to proposed top of filter. Place sand up to bottom of casing. Unless formation is exceptionally stable, casing should be retracted no more than 2 to 4 feet between backfilling operations.

2) Where hole will not remain open below bottom of casing, place 6-12 inches of clean uniform sand up inside casing. Extract casing slowly, monitoring the level of sand up inside casing. Pull casing until level of sand drops just below bottom of casing. Maintain head of water on casing at all times. Repeat procedure until depth of sampler is reached. Insert fully assembled sampler into hole and place sand around base (within casing). Insert the BarCad gas drive tube through hole in tamping hammer and lower hammer down to top of BarCad. Verify depth. Remove hammer and place sand to top of sampler (sampler in casing). Lower hammer back to top of sand. Slowly extract casing ensuring that sampler does not move up with casing by measuring depth with hammer. Place more sand as necessary to fully cover sampler. Complete filter according to above procedure.

H. Prior to placing seal above sand filter, check for proper operation of sampler. At this point in the installation, the sampler can easily be retrieved by jetting out the sand should problems arise with sampler operation (improper assembly, defective tubing, etc.).

I. Place additional seals, filters, and samplers according to above procedures. Separate and maintain relative position of tubes to prevent twisting during installation.

J. Note: During installation, tops of gas drive tubes should be sealed (with sample riser tube inside) to prevent foreign material from entering tubes.

K. Depending on sampler spacing and soil deposits encountered, seals and filters may be omitted. However, a weighted tape should be employed frequently to ensure that borehole collapses (or is completely backfilled) during casing withdrawal. Water can be pumped from casing to enhance rate of borehole collapse. Completed installation should have a vertical permeability less than that of deposits encountered. Bentonite can be added periodically during casing extraction to decrease vertical permeability where tamped seals are not used.

L. Where thick seals (greater than 5 feet) are required, bentonite-cement grout placed via the tremie method can be substituted for bentonite pellets. See SOP 2.2B.

M. If protective casing (4-6 inch diameter pipe) is to be installed to complete installation, care should be exercised to prevent damaging gas drive tubes. If protective pipe is to be driven, withdrawal of last 5-10 feet of drill casing should be done after installation of protective pipe. In this way, the drill casing protects the tubing. Protective pipe can also be placed in hand dug hole and backfilled with concrete.

N. Protective casing should be designed so as to allow room to easily connect feed through sampling heads after well completion.

O. Note: The nylon inner tube expands slightly when it comes in contact with water. Hence, the riser tube should be terminated 2 feet above the sampler for every 50 feet of submerged depth. This allows for expansion and prevents the riser tube from being compressed into the check valve assembly.

4. Records and Documentation

Sampler installations will be recorded on the drilling log for the hole. Installation details to be recorded include total borehole depth, seal locations and thicknesses, filter locations and thicknesses, sampler depth, riser tubing diameter, length and material of construction (inner and outer tubing/pipe), stick-up of riser tubings above ground surface, well head completion, and any other details or measurements deemed necessary by the field engineer.

WELL INSTALLATIONS - BEDROCK WELLS

SOP NO. 2.3

1. Purpose:

Bedrock wells are installed to provide access to groundwater contained in bedrock for sampling and monitoring purposes.

2. Equipment and Materials

- Schedule 40 PVC pipe, 1-1/2-inch diameter, flush-joint threaded
- Schedule 40 PVC slotted wellscreen, 1-1/2-inch diameter, 0.01-inch slots, flush-joint threaded
- Ottawa sand
- 3-inch or 4-inch diameter metal pipe, 5-foot length, threaded one end with cap and locking device
- Valve gate box, 5-1/4-inch and 16-inch with bolted cover plate
- Bentonite clay (pellets and powder)
- Cement
- Concrete mix
- Tremie pipe

3. Procedures

A. Install a 1-foot Ottawa sand filter below the proposed base of the well screen.

B. Assemble and install the observation well pipe and screen in the required configuration for the hole. Well tip must be fitted with a threaded or slip-on bottom plug. All pipe connections shall be connected by dry-threading of the joints. <u>No glue, solvents, or lubricating compound shall be used to make up the connections.</u> The well pipe assembly must be carefully lowered into the borehole to ensure centering of the well in the hole. After installation, the GZA field engineer and the drilling contractor will carefully measure the depth to the well tip.

C. Install a sand filter around the well screen to at least 1 foot above the screen. Grain-size of the sand shall be appropriate for the slot size of the screen (normally 0.01 inch).

D. Install a bentonite clay seal (minimum 2 feet thick) above the sand filter up to the soil rock interface.

E. Insert a tremie pipe and backfill the remainder of the hole with bentonite-cement grout until it flows at the surface.

F. Square cut the well pipe stick-up 1 foot, 10 inches above grade.

G. Install a 5-foot section of metal pipe (3-inch or 4-inch diameter) equipped with a threaded, lockable cap 3 feet into the borehole. Complete the installation by constructing a concrete surface pad around the steel guard pipe. The concrete pad shall be a minimum of 2 feet deep and 1.5 feet in diameter and sloped away from steel casing.

H. If well-head completions must be flush with the ground surface, a street box or lockable valve gate box may be installed in lieu of the metal pipe. Installation consists of square cutting the well riser pipe 2 inches below grade, and cement grouting the box in place.

I. Paint the well protective pipe or box to inhibit rust formation and increase visibility. Stencil the well number in 1 inch block numerals of a contrasting color.

4. Records and Documentation

Well installations will be recorded on the drilling log for the hole. Installation details to be recorded include total well depth, screen depth and length, filter and seal depths and thicknesses, well head completion type, and any other details or measurements deemed necessary by the field engineer.

5. Special Notes

A. Metal protective pipe or valve gate boxes shall be steam cleaned prior to installation to remove cutting oil or other residue. To assist in removal for sampling, the cap threads may be lubricated with a small amount of non-petroleum based material (vegetable oil or Crisco).

B. If well is to be installed above the base of the borehole, care must be taken to ensure any underlying strata are properly sealed to preclude the possibility of cross contamination. Seals can be constructed using either cement bentonite grout or bentonite pellets.

C. Grout backfill above bentonite seal may be omitted under certain stratigraphic conditions. In those cases, hole should be backfilled with native materials with occasional thin bentonite seals. Completed installation must have a vertical permeability less than that of the natural strata encountered.

6. Applicable Standards and References

U.S. Environmental Protection Agency, "Procedures Manual for Ground Water Monitoring at Solid Waste Disposal Facilities," SW-611, December 1980.

SAMPLE COLLECTION - SURFACE WATERS

SOP NO. 3.1.1

1. Purpose:

To obtain liquid samples for analyses that are representative of environmental conditions at the location sampled.

2. Equipment and Materials

- Appropriate sample containers
- Pond sampler with disposable sampling containers
- Peristaltic pump with associated tubing
- Rags or terry cloths

3. Procedures

A. Method A - Container Sampling

This methodology will be utilized in flowing waters where minimum sample agitation is required, the sampling depth is less than 1 foot, and direct contact with the liquid being sampled will not endanger the sampling team.

1) Approach the sampling point from downstream, submerge the sample container to the required depth upstream of the sampling platform (boat, etc.) and remove it after complete filling.

2) Cap and seal the container

3) Rinse and wipe off the exterior of the container with clean paper towels.

4) Label, preserve, and store the sample in accordance with appropriate protocols.

B. Method B - Pond Sampler

This methodology will be utilized when contamination of the outside of the sample container must be avoided, the sampling depth is less than 1 foot, and direct contact with the liquid being sampled would endanger the sampling team.

1) After arrival at the sampling point, assemble the pond sampler and fit it with a disposable plastic beaker.

2) Extend and submerge the sampler to the required depth (upstream of the sampling platform, if applicable), and remove it after complete filling.

3) Carefully transfer the liquid from the sampler to the appropriate sample container by pouring the liquid down the side of the container with minimal turbulence. This procedure is critical to minimize loss of volatile materials from the sample through aeration.

4) Cap and seal the sample container.

5) Remove the disposable beaker from the sampling rod and dispose of it in a trash bag.

6) Wipe down the sampling rod with clean rags. Store the sampling rod in plastic bags for subsequent cleaning. Dispose of the rags in a trash bag.

7) Label, preserve, and store the sample in accordance with appropriate protocols.

C. Method C - Peristaltic Pump

This methodology will be utilized when the sampling depth is greater than 1 foot, but less than 25 feet, and/or direct contact with the liquid being sampled would endanger the sampling team.

1) Install clean, medical-grade silicon tubing on the pump head, allowing sufficient length on the discharge side for filling of sample containers.

2) Select and install the necessary length of clean intake tubing to provide the required sampling depth.

Intake tubing shall be heavy-wall Teflon of a diameter equal to that of the pump tubing.

3) Submerge the intake tubing to the required depth by tying it off to a graduated, weighted cable or rope.

4) Actuate the sample pump and allow 2 to 3 liters of sample to purge the system before collection.

5) Obtain sample by allowing pump discharge to gently flow down the side of the container with minimum turbulence. This procedure is critical to minimize loss of volatile materials from the sample through aeration.

6) Cap and seal the sample container.

7) Stop pump, allow system to drain, then disassemble.

8) Place tubing in plastic bag and return to Newton laboratory for decontamination.

9) Label preserve, and store the sample in accordance with appropriate protocols.

4. Records and Documentation

All data and sampling information will be recorded as specified in the Quality Assurance Project Plan.

5. Special Notes

A. Samples for oil and grease analysis should be collected using Method A, as significant amounts of material could adhere to the sample transfer container used in Method B.

B. Method A has significant shortcomings in sampling concentrated or high hazard waste streams, due to physical contact with the waste stream and contamination of the outside of the sample container.

6. Applicable references and standards

deVera, E.R.; Simmons, B.P.; Stephens, R.D.; and Storm, D.L., "Samplers and Sampling Procedures for Hazardous Waste Streams," EPA-600/2-80-018, January 1980.

U.S. Environmental Protection Agency, "Procedures for Groundwater Monitoring at Solid Waste Disposal Facilities. EPA-530/SW-611, August 1977.

Ford, J.J.; Turina, P.J.; and Seely, D.E., "Characterization of Hazardous Waste Sites - A Methods Manual, Volume II, Available Sampling Methods, EPA 600/X-83-018, March 1983.

SAMPLE COLLECTION - MONITORING WELLS

SOP NO: 3.1.2

1. Purpose:

To obtain liquid samples for analysis to determine general quality of the groundwater at the sampling location or as part of a program to define a contaminant plume.

2. Equipment and Materials

- Appropriate sample containers
- Precleaned stainless steel bailers
- Sampling cable
- 100-foot steel tape with weighted end
- Rags or terry cloth
- Cooler and ice

Additional equipment and materials such as field screening equipment, filtering equipment, etc. may be needed for particular sampling rounds.

3. Procedures

A. Measure depth to groundwater to the nearest 0.01 foot using 100-foot tape or electric water level indicator.

B. Prior to sample collection, three times the volume of standing water in the well will be removed using the following method:

1) Measure depth to groundwater to the nearest 0.01-foot from the top of the riser pipe using the 100-foot steel tape.

2) Measure total well depth to the nearest 0.1 foot from the top of the riser pipe using the 100-foot steel tape.

3) Calculate the volume of standing water in the well using the above measurements and the inside diameter of the well.

4) Using a precleaned stainless steel bailer of known volume, bail three times the volume of water calculated in (3) from the well.

5) Allow sufficient time for well to recharge before initiating sampling.

6) At locations where the well is deep, static water level is within 25 feet of top of casing, and recharge is sufficiently rapid to prevent drawdown below 25 feet, the calculated volume may be evacuated with the assistance of a portable centrifugal pump.

   a. To accommodate this process, each well to be pumped will be equipped with a dedicated 3/4-inch polyethylene tubing of sufficient length to reach from the well bottom to the pump. The tubing may be stored in the well, hung from a clip to accommodate easy retrieval, or it may be removed, labelled, and stored for the next sampling round.

   b. After attachment, the pump is started. It is then calibrated using a vessel of known volume and a watch second hand.

   c. After completion of the required volume evacuation, with the pump still running, the suction line is removed from the well and coiled and the required samples are collected with precleaned stainless steel bailers.

C. Using a precleaned stainless steel bailer, withdraw a sample from the well.

D. Transfer the sample from the bailer directly into the sample container by pouring the liquid down the side of the container with minimum turbulence. This procedure is critical to minimize loss of volatile materials from the sample through aeration.

E. Cap and seal the sample container.

F. Wipe down the bailer with clean rags to dry it and store the bailer in a plastic bag <u>separate</u> from any stock of clean bailers.

G. Label, preserve, and store the sample in accordance with appropriate protocols.

4. Records and Documentation

All data and sampling information will be recorded in accordance with SOP No. 3.2.3.

5. Special Notes

Separate precleaned bailers will be used for each well sampled to preclude cross-contamination. Either separate bailer cables will be employed or cables will be decontaminated between samples using a methanol wash followed by a distilled water rinse.

6. Applicable References and Standards

Dunlap, N.J.; McNabb, J.F.; Scalf, M.R.; and Crosby, R.L., "Sampling for Organic Chemicals and Microorganisms in the Subsurface," EPA-600/2-77-16, August 1977.

SAMPLE COLLECTION - BARCAD INSTALLATIONS

SOP NO. 3.1.3

1. Purpose

To sample from discrete, well defined locations within the subsurface saturated zone.

2. Equipment and Materials

- Nitrogen supply tank
- Tank regulator with:
  - Pressure gage
  - Regulator fitting with stainless steel knurled nut with nylon ferrules
- BarCad sampling head (compatible with gas-drive and sample riser tubes)
- Wrenches
- Teflon pipe tape
- Sample containers
- 100-foot steel tape with weighted end

3. Procedures

A. Measure depth to groundwater with capillary reader or electric water level indicator.

B. Remove plug from regulator fitting and replace it with the stainless steel knurled nut with nylon ferrules.

C. Check nitrogen tank pressure by opening tank valve.

D. Determine required supply pressure for BarCad sampler (depth of sampler divided by 2.3 times 110 percent - in psi). Check supply pressure against bursting pressure of gas drive tube. Drive pressure can be increased relative to the above calculated pressure to decrease flushing time.

E. Adjust regulator to desired supply pressure.

F. Connect BarCad sampling head to gas drive tube (hand tighten swagelock fittings) threading sample riser tube through the fitting at top of the head (again hand tighten fitting). Connect a 3-5 foot length of clean gas drive tubing from the sampling head to the regulator fitting, hand tighten fittings.

G. Check all connections, then open the regulator supply valve, allowing the nitrogen to flow down the gas drive tube to the BarCad sampler. Close supply valve after all the water has been flushed from the system through the sampler riser tube.

H. Vent the system by disconnecting the gas drive tube at the regulator.

I. Repeat the above three steps to flush the system 2 to 3 times prior to sample collection.

J. Calculate the sampling pressure. Sampling pressure should be less than flushing pressure and should be the minimum pressure required to move the column of water to the surface. Initially, the pressure should be increased slowly until water just moves out of the tubing. A rough calculation for sampling pressure is as follows:

$$\frac{[X + X\,(A1/A2)]}{2.31} \quad \text{in psi}$$

X = distance from ground surface to the water table
A_1 = internal area of the sample riser tube
A_2 = area of the annular space between the gas-drive tube and sample riser tube for

K. Clean the outside of the riser tube prior to sampling. Methanol and the discharge water obtained during flushing should be used.

L. Collect water samples for chemical analyses. Insert sample riser tube to bottom of sample vial and commence sampling by gradually increasing the pressure until the required sample volume is obtained.

M. Collect VOA samples from the beginning of the discharge stream after initially wasting 25 to 50 cc. Also, while sampling, allow the vial to overflow slightly and then withdraw the tube and cap the vial.

N. To increase system flushing and sampling efficiency, manifolds, quick-connect fittings, "three-way" valves, etc. can be connected to the regulator and used to vent and pressurize multiple samplers simultaneously.

O. For pressures exceeding 50 - 70 psi, swage fittings should be wrench-tightened for leak-free operation.

P. Label, preserve, and store samples in accordance with appropriate protocols.

4. Records and Documentation

All data and sampling information will be recorded as specified in the Quality Assurance Project Plan.

5. Special Notes

None

6. Applicable Standards and References

- Dedicated Gas-Drive Sampling Instruments
  (Case Histories)
  N.W.W.A. Short Course
  Design, Installation, and Sampling of Groundwater Monitoring Wells, presented by Matthew Barvenik, Goldberg-Zoino & Associates.

RESIDENTIAL WELL SAMPLING

SOP NO. 3.1.4

1. Purpose:

Residential/private well sampling is undertaken to determine the quality of drinking water available to residents in an area proximate to and potentially affected by a suspected contaminant source.

2. Equipment and Materials

The required materials include sample containers appropriate for the analysis to be performed and permission of the homeowner or occupant to undertake said sampling.

3. Procedures

The procedures to be followed during the residential water supply sampling are as follows:

A. Determine volume of holding/pressure tank.

B. Follow cold water system and observe for presence of any in-house treatment devices (i.e. water softener, carbon column).

C. Using empty vessel of known volume and stopwatch or secondhand, determine kitchen faucet flow rate.

D. Run kitchen faucet for a time adequate to waste two volumes of holding tank.

E. If no treatment devices exist, collect samples at kitchen faucet. If any treatment devices do exist in the system, collect sample prior to the device. Remove aerator, if any, from sample faucet prior to sample collection.

F. Samples will be labeled, preserved, and stored in accordance with the Quality Assurance Project Plan.

4. Records and Documentation

Sampling information shall be recorded in accordance with the Quality Assurance Project Plan.

5. Special Notes

None

SAMPLE COLLECTION - SURFACE SOIL

SOP NO. 3.1.7.1

1. Purpose:

Surface soil samples are collected to determine the physical characteristics of the material or levels of contamination in the unsaturated zone.

2. Equipment and Materials

- Appropriate sample containers
- D-handle shovel
- Disposable polypropylene scoops
- T-handle auger
- Split-spoon sampler with extension rods and T-handle
- Stainless steel laboratory spoons
- Clean rags or terry cloths

3. Procedures:

Method A - Scoop Sampling

This methodology will be utilized to collect soil samples from depths of less than 1 foot when exact sampling depth within the 1 foot interval is not critical.

A. Clear away all surface debris (leaves, twigs, etc.) for a 1 foot radius around the sampling location.

B. Using a precleaned D-handle shovel or soil trowel, excavate the soil to the desired sampling depth and stockpile the material on a portion of the cleared area.

C. Transfer material from the stockpile to a suitable sample container with a polypropylene scoop or steel soil trowel.

D. Cap and seal the container.

E. Label, preserve, and store the container in accordance with the Quality Assurance Project Plan.

F. Place the polypropylene scoop, if used, in a trash bag for subsequent disposal.

G. Wash the shovel or trowel with methanol, followed by distilled water, and dry with clean paper towels prior to subsequent sampling.

Method B - Spoon Sampling

This methodology will be utilized to collect soil samples from depths of less than 1 foot when exact sampling depth within the 1 foot interval is critical.

A. Clear away all surface debris (leaves, twigs, etc.) for a 1 foot radius around the sampling location.

B. Using a precleaned D-handle shovel, excavate the soil to the desired sampling depth.

C. Obtain a sample from the excavation hole sidewall at the desired sampling depth using a stainless steel laboratory spoon and transfer it directly to a suitable sample container.

D. Cap and seal the container.

E. Label, preserve, and store the sample in accordance with the Quality Assurance Project Plan.

F. Wash the shovel and spoon with methanol, followed by distilled water, and wipe it down with clean paper towels prior to subsequent sampling.

Method C - Split-Spoon Sampling: This methodology will be utilized to collect soil samples down to a depth of approximately 6 feet when soil conditions allow.

A. Clear away all surface debris (leaves, twigs, etc.) for a 1-foot radius around the sampling location.

B. Assemble a precleaned auger and auger a hole to the desired sampling depth. Carefully withdraw the auger to prevent cave-in of the borehole sidewalls.

C. Assemble a precleaned split-spoon sampler with appropriate extension rods and T-handle. Insert the sampler into the hole and force it into the soil with a twisting motion. Carefully withdraw the sampler and disassemble it.

D. Discard the upper 1 inch of the sample. Remove the remainder with a clean stainless steel laboratory spoon and transfer it directly to a suitable sample container.

E. Label, preserve, and store the sample in accordance with the Quality Assurance Project Plan.

F. Place the sampling equipment in a plastic trash bag for subsequent cleaning.

4. Records and Documentation

All data and sampling information will be recorded as specified in the Quality Assurance Project Plan.

5. Special Notes

None

6. Applicable Standards and References

Dunlap, W.J.; McNabb, J.F.; Scalf, M.R.; and Crosby, R.L., "Sampling for Organic Chemicals and Microorganisms in the Subsurface," EPA-600/2-77-16, August 1977.

U.S. Environmental Protection Agency, "Characterization of Hazardous Waste Sites - A Methods Manual, Volume II - Available Sampling Methods, EPA 600/X-83-018, March 1983.

SAMPLE COLLECTION - SUBSURFACE SOIL

SOP NO. 3.1.7.2

1. Purpose

Subsurface soil samples are collected to determine the physical characteristics or levels of contamination of overburden material at any desired depth.

2. Equipment and Materials

- Appropriate sample containers
- Split-spoon sampler with appropriate drill rods
- Drill rig with 140 pound drive weight
- Stainless steel laboratory spoons
- Clean rags or terry cloths

3. Procedures

A. After boring and cleanout of the hole to the desired sampling depth, assemble the sampler and lower it carefully to the bottom of the hole.

B. With the split spoon sampler set at the bottom of the hole (be sure sampler is at the bottom of the casing), the drill rod should be marked at three consecutive 6-inch intervals for measuring the blows per 6 inches of driving. If the sampler is above the bottom of the casing, this indicates that the bottom has been disturbed and soil has risen up the casing. Do not attempt to sample. Withdraw the sampler and clean the hole. If soil has blown up the casing, the casing should be advanced to below the disturbed soil. Clean-out alone is not sufficient. Follow the instructions in Step F of this section.

C. The sampler should be driven by a 140-pound weight falling freely 30 inches. Check to make sure that the fall is 30 inches by marking the drive head and that the hammer is falling freely. The driller should use no more than two wraps of the rope around the cathead. Be certain that the rope is fully released to permit complete free fall of the hammer. The number of blows to drive each 6-inch interval should be recorded. The sampler should be driven at least 18 inches, unless the blow count exceeds 100 blows per 6 inches or unless refusal, as defined in the specification, is met. When the blow count exceeds 100 blows per 6 inches, the driving may be stopped and the sampler removed. The number of blows and the inches penetrated should be recorded. After driving in dense soils, the drill rods may have to be turned clockwise to free the sampler for removal. Turning counterclockwise will only loosen the joints, and you may lose the sampler in the hole. Bumping up the rods should be avoided, if possible, because it tends to reduce the amount of soil recovery. However, it is sometimes necessry in very dense soils in order to free the sampler.

D. In most cases, but especially when sampling in sands and loose silts, the driller should keep the casing full of water at <u>all</u> times. This will require adding water while the rods are being withdrawn prior to sampling and when sampler is withdrawn. If this measure is not sufficient to prevent soil from running up into the casing, then commercial drilling mud should be used. Use a perforated section of drill rod above the sampler to facilitate drainage of drill fluid after sampling. When sampling soils for chemical testing, however, no water should be used so that the geochemical integrity of the sample is preserved.

E. When the sampler is brought to the ground surface, it should be opened immediately, and the length of recovery should be measured and recorded. Any loose wash at the top of the sample should not be counted as part of the recovery. If recovery is less than 6 inches, another sample should be taken immediately below this sample, except in certain instances, such as where rock is encountered and coring is necessary.

F. If recovery is insufficient, put sampler back down hole and proceed as follows: if original depth is reached, drive sampler 18 inches and record blows as new sample; if original depth is not reached, redrive sampler to recover disturbed material record only original blow count and that sample recorded or redrive.

G. Remove sample with a clean laboratory spoon and transfer it directly to a suitable sample container.

H. Label, preserve, and store the sample in accordance with the Quality Assurance Project Plan.

I. Wash the split spoon with water and rinse with reagent grade methanol followed by distilled water.

4. Records and Documentation

A. All sampling information will be recorded as specified in the Quality Assurance Project Plan.

B. Penetration resistance will be recorded on standard boring log forms, pages 1 and 2.

5. Special Notes

None

6. Applicable Standards and References

ASTM D1586-67

SAMPLE COLLECTION - LAKE, POND, AND STREAM SEDIMENTS

SOP NO. 3.1.8

1. Purpose:

Sediment samples underlying water bodies are collected to describe the physical characteristics of the sediment or to investigate contamination in the sediments.

2. Materials and Equipment

- Appropriate sample containers
- Pond sampler with disposable collection jars
- Hand corer
- Eckman or Ponar grab
- Stainless steel laboratory spoon
- Stainless steel or polypropylene tray
- Clean rags or terry cloths
- 3/4-inch nylon line

3. Procedures

Method A - Hand Corer

This methodology will be utilized in shallow (less than 3 feet) water depths when a relatively undisturbed sample is required or when samples of up to 18 inches depth are required. Teflon, brass, or stainless steel core liners may be used with this technique to prevent cross-contamination.

A. Position sampling platform downstrream of sample collection point.

B. Assemble a pre-cleaned hand corer by attaching core tube to drive head or inserting core liner into assembly.

C. Insert the corer through the water column into the sediment and force it in with a smooth pressure.

D. Twist the corer approximately 90° and slowly withdraw it in a single motion.

E. Either extrude the tube or remove the nosepiece and withdraw the sample into a stainless steel or aluminum tray.

F. Transfer the sample to a suitable sample container using a stainless steel laboratory spoon.

G. Cap and seal the sample container.

H. Flush the corer with clean water to remove any residual sediment.

I. Wash the sample tray with methanol and distilled water and wipe it down with clean paper towels.

Method B - Pond Sampler

This methodology will be utilized in shallow (less than 3 feet) water depths when disturbance of the sediment by the sampling technique will not affect sample integrity.

A. Position sampling platform (boat, etc.) downstream of sample collection point.

B. Assemble pond sampler by attaching a polypropylene collection jar to the end and extending the handle to the required length.

C. Insert the sampler through the overlying water with the collection jar facing downward.

D. When contact with the sediment is felt, rotate the sampler 180° while exerting downward pressure to obtain a sample.

E. Slowly withdraw the sampler and place the sample in a stainless steel or aluminum tray.

F. Transfer the sample to an appropriate sample container using a stainless steel laboratory spoon.

G. Cap and seal the sample container.

H. Wash the sample tray with methanol and distilled water and wipe it down with clean paper towels.

I. Remove the collection jar from the sampler and place it in a trash bag for subsequent disposal.

Method C - Grab Sampler

This methodology will be utilized in water depths exceeding 3 feet.

A. Attach a pre-cleaned Ponar or Eckman grab to an appropriate length of 3/4-inch nylon line.

B. Open grab jaws and set the release mechanism. Keep tension on nylon line to prevent premature tripping of the jaws.

C. Slowly lower the grab through the water column until contact with the sediment is felt.

D. Allow nylon line to slack approximately 1 foot, then slowly remove the slack and raise the grab to the surface.

E. Place the grab in a stainless steel or polypropylene tray, open the jaws to release the sample, and remove the grab from the tray.

F. Transfer the sample from the tray to a suitable sample container using a stainless steel laboratory spoon.

G. Cap and seal the sample.

H. Flush the grab with clean water to remove any residual sediment.

I. Wash the sample tray with methanol and distilled water and wipe it down with clean paper towels.

4. Records and Documentation

Samples will be labeled, preserved, and stored in accordance with the Quality Assurance Project Plan.

5. Special Notes

None

6. Applicable Standards and References

Ford, P.J.; Turina, P.J.; and Seely, D.E., "Characterization of Hazardous Waste Sites - A Methods Manual," Volume II - Available Sampling Methods, EPA 600/X-83-018, 1983.

AMBIENT AIR SAMPLING WITH SOLID SORBENTS

SOP NO. 3.1.10

1. Purpose

To determine the concentrations of volatile organic constituents of ambient air.

2. Equipment and Materials

- Lo-Flow Personal Sampling Pump (20-200 cc/min)
- Tygon tubing
- Sorbent tube (activated charcoal, Tenax-GC, Ambersorb XE-347, etc.)
- 2 end caps

3. Procedures

Set flow rate of pump in accordance with recommended flow rate as specified in NIOSH Manual of Analytical Methods, 3rd edition. Break off both ends of sorbent tube, place tube in the sample holder connected to the inlet of the pump. The arrow marked on the tube indicates the direction of the air flow. Sorbent tube should always be vertical during sampling to prevent channeling of air in and around the sorbent bed. Sampled air should not pass through any tubing prior to entering the sorbent tube.

When the desired volume is collected, remove the sorbent tube from the sample holder and cap both ends with the plastic caps. Capped tubes are stored in a refrigerator if not immediately analyzed. Analysis should be completed within 14 days.

4. Records and Documentation

A sampling log is maintained for each sample and contains the following information:

Date
Pump No.
Analyte
Sorbent medium
Location
Sample ID

Sample time "ON"
Rotometer "ON"
Sample time "OFF"
Rotometer "OFF"
Ambient temperature
Ambient pressure
Relative humidity

The on-site GZA representative will maintain a copy of the calibration curve for the instrument to insure flow rate stays within calibrated range.

The rotometer settings are recorded periodically and plotted on the calibration curve giving actual flow rate change during sampling. At a minimum, initial and final flow rate must be logged.

5. Special Notes:

If NIOSH method is modified due to environmental or site-specific conditions, do not exceed a sample volume of 25 liters (outdoors) or 10 liters (indoors).

6. Applicable Standards and References

TLV's Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment, ACGIH, Cincinnati, Ohio.

NIOSH/OSHA Pocket Guide to Chemical Hazards, U.S. Department of HHS.

"Occupational Exposure Sampling Strategy Manual," NIOSH Publication 77-173.

"Development and Validation of Methods for Sampling and Analysis of Workplace Toxic Substances," NIOSH Publication 80-133.

"Evaluation of Organic Solvent Vapors in the Workplace," R. C. Voborsky in Analytical Techniques in Occupational Health Chemistry, ACS Symposium Series 120.

Characterization of Hazardous Waste Sites - A Methods Manual, "Volume II - Available Sampling Methods," EPA 600/3-83-018.

FIELD MONITORING - OVA-128

SOP 4.1.1

1. Purpose:

To provide operating procedures for the Foxboro (Century Systems) Portable Organic Vapor Analyzer Model OVA-128 for field surveying of organic vapors and for field and laboratory analysis of soil and water samples with survey and GC modes.

2. Equipment and Materials

Foxboro (Century Systems) Portable Organic Vapor Analyzer Model OVA-128 with GC option and accessories.

Accessories include: battery charger, GC columns, septum adaptor, chart recorder, shoulder strap, carrying case, H_2 refilling plumbing, activated charcoal filter assembly, etc.

Syringes (0.5 ml and 10 ml, glass, gas-tight)

Sample containers (250 ml glass jars with Teflon coated caps, 40 ml EPA vials)

Water bath (optional, laboratory application)

3. Procedures

A. Preparation for use.

1) Connect the probe to the meter by first attaching the flexible Teflon tube to the swagelok fitting and hand tighten and then inserting the 5 pin connector to the switchcraft socket until it clicks into place.

2) Move the pump switch to "on" and check battery condition by moving the instrument switch to the "batt" position. The needle on the probe meter should swing into the "Battery ok" region. If it does not, the battery must be replaced with a standby battery or fully recharged (Section 27, pgs 6-7 of the instruction manual).

3) Move the instrument switch to "on" and allow five minutes for warmup.

4) Set calibrate switch to 1X position and use calibrate "adjust" knob to set meter to zero.

5) Place instrument panel in vertical position and check sample flow rate indication. Indication should be approximately 2 units.

6) Open the H_2 tank valve and observe the reading on the H_2 tank pressure indicator. (Approximately 150 psi of pressure is needed for each hour of operation). Refill self-contained tank with H_2, if necessary. (Section 2.6, pg 6 of instruction manual).

7) Open the H_2 supply valve and observe the reading on the H_2 supply pressure indicator. Indication should be approximately 11 on the gauge.

8) Depress the red igniter button until the burner lights. Ignition is confirmed from a slightly audible pop at the FID exhaust port and by deflection of the probe meter needle to a higher baseline reading. <u>DO NOT</u> depress the igniter button for more than six seconds. If the burner does not ignite, let the instrument run for several minutes and again attempt ignition. If burner will not light with repeated attempts, refer to Section 6.3 and Table 6.1 (pgs. 17-21 of instruction manual) to trouble-shoot the problem.

9) Reading on meter indicates background level of total organic vapors in the ambient air. Reading should be between 2 and 6 ppm. A reading outside this range may indicate either equipment malfunction, contamination of sample lines or a background air contamination problem. Consult trouble-shooting section of manual.

B. Calibration - Calibrate instrument in survey mode in accordance with manufacturer's instructions (Section 4, pp. 7-10 of instruction manual).

C. Operation - Air Quality Monitoring

1) The probe should be held in close proximity to the area being monitored to provide the most accurate reading. The lowest possible scale range should be selected. In environments where levels of volatile organics are unknown, initially use the 1X scale and then change to higher scales if necessary to obtain a reading.

2) Do not allow the probe intake to directly contact soil or liquid materials as this may clog the plumbing or contaminate the probe.

D. Operation - Soil Sample Screening with Survey Mode (Field and Laboratory)

1) Place the instrument in the survey mode by ensuring that the sample inject valve is in the up ("out") position and that the backflush valve is either fully up or down.

2) Sample soils immediately after exposure to the surface during test pit or drilling operations. Fill a "driller's jar" to approximately three-fourths of its 8-ounce capacity with a representative sample of soil material. Do not overfill; airspace is needed. Use specially coated lids with gaskets and close tightly by hand. (To obtain an air tight seal, Teflon tape may be used but do not use aluminum foil and avoid electrical and other tapes.)

3) These samples may be screened in the field or brought back to the office to be tested under laboratory conditions. Samples should be kept cool at 4° C or less with ice or an icepack in a cooler.

4) To obtain a sample of the headspace above the soil, employ either of the following procedures:

a) Pierce the metal lid with a nail or punch and withdraw 3.0 cc with a glass syringe. Plug the hole with aluminum foil or Teflon tape and seal with non-volatile white marking tape; or

b) Unscrew the jar cover and partially open the edge of the cap. Insert probe tip into small opening under cap.

5) If procedure 4a is employed, inject the extracted headspace into the needle of the probe with one swift movement. Record the meter response after full deflection and calibration scale (1X, 10X or 100X) on the boring log or data sheet.

6) The OVA-128 is calibrated to methane electronically according to Section 4.2 (pgs 7-8) of the owner's manual. To appraise the contribution of methane in a headspace sample to instrument response, the above procedures may be repeated with an activated charcoal filter assembly (accessory P/N 510095-1) placed as the end of the probe needle. Only methane and ethane will pass through this filter to create a response.

E. Operation - Soil and Water Sample Headspace Analysis with GC Mode (Laboratory).

1) Place the instrument in the GC mode by moving the sample inject valve to the down ("press to inject") position and moving the backflush valve into the up position.

2) Soil sample may be collected as above in Section D.2. or alternatively by filling a 40 ml septum vial approximately three-quarters of its capacity with representative soil materials. Water samples must be collected with no air bubbles or headspace in 40 ml EPA septum vials. Between the time of sampling and analysis, samples should be preserved by cooling them to 4° C. When ready to analyze, water samples should be headspaced by drawing off 15 mls of sample by a dual syringe technique (one syringe filled with charcoal acting as a filter and the other drawing off the measured amount).

3) To concentrate volatiles in the headspace, samples should be placed in a water bath heated to 40° C for at least 15 minutes. Samples collected in septum vials should be placed cap side down when immersed in the water bath.

4) Draw off a 0.2 ml aliquot of the headspace by piercing the septum with a 0.5 ml gas-tight syringe (access soil jars according to Section C.4. above), pulling the plunger past 0.2 mls and then forward to the 0.2 cc mark, and inject immediately in the septum adapter (accessory P/N 510645-1) injection port.

5) Results will be obtained in the form of a chromatogram on a strip chart recorder, such as accessory P/N 510445-2, or a reporting integrator.

6) Calibration of the instrument for use as a GC is accomplished by following the procedures in Section 7.1.4. (pgs 29-32) of the owner's manual. Standards must be prepared by trained laboratory personnel through serial dilutions of pure volatile organic compounds in methanol and/or distilled water. (Retention times may vary widely with shifts in ambient temperatures.)

F. Shut Down Procedure

1) Close the H_2 supply valve and the H_2 tank valve.

2) Move the instrument switch to off.

3) When the H_2 supply pressure indicator is reading zero, move the pump switch to off.

4) Clean the instrument and repack into its carrying case for transport.

4. Applicable Standards and References

- Operating and Service Manual for Foxboro (Century Systems) Portable Organic Vapor Analyzer Model OVA-128.
- J. C. Rock and J. A. Post, Field Analysis of Ten Parts Per Billion Trichloroethylene in Water Using a Portable, Self-contained Gas Chromatograph (May 1980), the USAF Occupational and Educational Health Laboratory, Brooks AFB, San Antonio, Texas 78235.

FIELD MONITORING - PHOTOIONIZATION DETECTOR

SOP NO. 4.1.2

1. Purpose:

To provide operating procedures for the HNu Systems Model PI 101 photoionization detector for field surveying of organic vapors.

2. Equipment and Materials

HNu Systems Model PI 101 Photoionization Detector

3. Procedures

A. Preparation for Use

1) Assemble the photoionization probe by screwing the handle to the probe body and inserting the probe extension into the probe body.

2) Connect the probe to the meter by matching the alignment keys on the 12 pin connector, pressing down, and twisting the connector lock until a distinct snap is felt.

3) Turn the function switch to the battery check position. The needle should swing into or above the green arc on the scaleplate. If it does not, the unit must be recharged before use.

4) Turn the function switch to the standby position and rotate the zero potentiometer until the meter reads zero. At this setting, the probe fan should turn on, and the UV light source should be on. A distinct hum indicates operation of the fan, while a purple glow in the probe tube indicates UV light source is operational.

5) Turn the function switch to the 0-20 ppm scale setting. The meter needle should read between 0.5-0.7 ppm.

B. Calibration

Calibrate instrument in accordance with manufacturer's specifications. (Instruction Manual for Model PI-101, Photoionization Analyzer, 1975 HNU Systems Inc. pp. 18-21.) Calibration gas will be isobutylene at a concentration of 63 parts per million.

C. Operation - Air Quality Monitoring

1) The probe should be held in close proximity to the area being monitored to provide the most accurate reading. The lowest possible scale range should also be selected. In environments where levels of volatile organics are unknown, initially use the 0-2000 ppm scale and then change to lower scales, if appropriate.

2) Do not allow the probe intake to directly contact soil or liquid materials. This will disrupt the air flow to the UV light source and may contaminate the probe.

3) After completion of monitoring, the meter should be turned off, cleaned and repacked.

D. Operation - Soil Sample Screening for Volatiles

1) Sample soils right after exposure to the surface during test pit or drilling operations. Fill a driller's jar to between 2/3's and 3/4's of its 8 oz volume with a representative sample of soil material. Do no overfill; airspace is needed. Use specially coated lids with gaskets and close tightly by hand. (Teflon tape may be used but do not use aluminum foil and avoid electrical and other tapes.)

2) These samples may be screened in the field or brought back to the office to be tested under laboratory conditions. Samples should be kept cool if laboratory screening is selected.

3) To obtain a sample of the headspace above the soil, pierce the metal lid with a nail or punch and withdraw 30 cc with a plastic syringe. Do not take the entire lid off. Seal the hole with aluminum foil or Teflon tape and non-volatile white marking tape.

4) Quickly inject the extracted headspace into the needle of the HNu probe. Record the meter response on the boring log after full response has occurred. (Note: The meter needle may deflect negatively only; record this as N or Neg, not as no reading.)

5) If a significant result is recorded (i.e. >2.0), inject a blank of ambient air into the probe to ensure that the syringe is not contaminated.

6) For repeatable results, this type of screening is best performed under laboratory conditions.

4. Special Notes

A. For general monitoring in environments where gas mixtures are present, the pot span adjustment should be set at 9.8.

B. If monitoring for a single gas is undertaken, sensitivity of the instrument to that compound may be increased by adjustment of the pot span. The HNu instruction manual provides tables of pot span settings for various compounds. This span pot setting is better determined empirically with a calibration gas of the substance to be detected.

C. Instruments are laboratory calibrated on thirty day cycles. During projects requiring repeated use of the meter for more than one day, calibration will be checked in the field daily using a factory supplied standard gas.

D. This instrument will not detect methane but may detect other potentially naturally occurring gases such as hydrogen sulfide.

E. For all activities during the Silresim RI/FS, a 10.2 eV lamp will be used in the PI-101.

5. Documentation

Readings will be recorded on the applicable log sheet for the work being performed in accordance with the Quality Assurance Project Plan.

6. Applicable Standards and References

Instruction Manual for Model PI 101 Photoionization Analyzer, HNu Systems, Inc.

FIELD MONITORING - pH METER

SOP NO. 4.1.5

1. Purpose

To provide operating procedures for the Orion digital pH/mv meter in order to measure the pH of a water sample in the field.

2. Equipment and Materials

- Pre-cleaned 8-ounce glass jars
- Three Fisher-brand pH laboratory buffer solution with pH's of 4.0, 7.0, and 10.0
- Glass rod
- Distilled water
- Squeeze bottle
- Clean paper towels
- Extech 651 and 671 Digital pH/mV/Temp meters (W/AC converters)
- Meter operation and maintenance instruction manual

3. Procedures

A. Two-buffer standardization

Select two buffers whose pH values bracket the expected sample pH with one buffer being pH 7.0. Calibrate meter according to procedures outlined in the instruction manual. (Set meter to pH 7.00 with probe reading that buffer. Record meter reading of probe in pH 4.00 and/or pH 10.00 buffer.)

B. Rinse pH electrodes with distilled water between pH measurements of buffer solutions and prior to sample measurement. Wipe off carefully with paper towel or tissue.

C. Allow all samples and buffers to reach the same temperature before attempting a measurement (unless an automatic temperature probe is used). Record temperatures of buffers and samples.

D. Samples should be measured immediately after collection. Quickly stir buffers and samples with a clean glass rod prior to pH measurement. The plastic-bodied, protected tip elecrodes can be used as a stirring rod if care if taken to avoid scratching the glass sensing bulb.

E. Place rinsed electrode in the unknown sample and allow about one minute for the reading to stabilize. Record pH measurement as digitized on meter display. Also record temperature and mv by adjusting control switch.

F. Recalibrate meter every 2 or 3 hours if pH measurements are being made continuously.

4. Special Notes

Through a series of calculations, pH readings can be double checked with the temperature and mv readings.

5. Documentation

All field readings should be recorded on the field data record in accordance with the Quality Assurance Project Plan.

Instruction Manuals, Extech Models 651 and 671, digital pH/mV/Temp meters.

Instruction Manual, Model 701A digital pH/mv meter Orion Research.

FIELD MONITORING - CONDUCTIVITY METER

SOP NO. 4.1.8

1. Purpose

To provide operating procedures for the Extech Model 440 conductivity meter in order to measure the specific conductance of a water sample in the field.

2. Equipment and Materials

- Pre-cleaned 8-ounce glass jars
- Standard solution of 1000 uS/cm at 25° c (KCI)
- Glass stirring rod
- Distilled or deionized water
- Squeeze bottle
- Clean paper towels
- Extech Model 440 Conductivity Meter (with AC converter)
- Meter operation and maintenance instruction manual

3. Procedures

A. Check the instrument according to specified procedures in the manufacturer's instruction manual.

B. Calibrate the conductivity meter, following calibration procedures outlined in the instruction manual and using standard solutions of potassium chloride at conductance of 1000 uS/cm at 25° c.

C. Calculate the cell constant according to outlined procedures.

D. Avoid calibrating on one meter range and making measurements on another.

E. Maintain calibration solution and sample at the same temperature.

F. Quickly stir sample with glass stirring rod prior to placement of cell in sample.

G. Place rinsed cell in sample solution and record digitized conductance and voltage readings. Measure specific conductance immediately after sampling.

H. Multiply recorded measurements by the cell constant to convert to actual conductance values.

4. Special Notes

5. Documentation

Record all readings on the field data record in accordance with the Quality Assurance Project Plan.

6. References

Extech Model 440 Conductivity Meter Instruction Manual

APPENDIX QA-2

WESTON ANALYTICAL LABORATORIES PERFORMANCE EVALUATION

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
ENVIRONMENTAL MONITORING SYSTEMS LABORATORY-LAS VEGAS
P.O. BOX 15027, LAS VEGAS, NEVADA 89114-5027 • 702/798-2100 (FTS 545-2100)

MAY 21 1985

Dr. Ted Them
Weston Analytical
Weston Way
Westchester, PA 19380

Dear Dr. Them:

For your information and review, the results for your participation in the EMSL-LV Second Quarter Organic Blind Performance Evaluation Study (QB2, FY-85, Case No. 3821) are enclosed. Your laboratory was coded BB. The samples were prepared by the EMSL-CIN and consisted of aqueous materials spiked with Hazardous Substance List pollutants at environmentally representative levels. Samples for all laboratories were from the same homogeneous batch. Each sample set was to be prepared and analyzed by current IFB procedures as per contract.

Acceptance windows (90 percent confidence intervals) were determined from replicate values submitted by three referee laboratories operating under the same constraints as the contract laboratories. Further details about window determinations can be obtained from the footnotes to the enclosed set of spreadsheets (Enclosure 3).

For your convenience, enclosed are the contractually required scoresheet for your laboratory (Enclosure 1), a coded summary of scores (Enclosure 2), and a set of coded analytical spreadsheets (Enclosure 3).

The major difficulty experienced by the participating laboratories in this study was non-submission, or late submission of data packages. Results for this study have also been provided, under separate cover, to the Project Officer, Deputy Project Officers, and the Quality Assurance Officer. The EMSL-LV thanks you for your participation in this study and trusts that this information will be beneficial.

Sincerely,

Larry C. Butler, Ph.D.
Manager, Performance Evaluation Program
Toxics and Hazardous Waste Operations Branch
Quality Assurance Division

3 Enclosures

Performance Evaluation Sample Data Scoring Sheet

LABORATORY: Weston Analytical DATE 05-13-85

QUARTER SAMPLE (Circle One): 1 [✓ 2] 3 4 FY 85

I. Hazardous Substance List (HSL) Results **Points Awarded**

A. Identifications (Maximum = 40 points)
[Number of compounds not identified (0) x
40/number of compounds in study (21) =
(0) points deducted] 40.0

B. Quantitation (Maximum = 40 points)
[Number of compounds not within acceptance criteria
(7) x 40/number of compounds in study (21) =
(13.3) points deducted] 26.7

C. HSL False Positive Identifications Above Contract Required Detection Limit (Maximum = 25 points)
[Number of false positives (1) x 25/number of
compounds in study (21) = (1.2) points deducted] 23.8

II. Non-HSL Results

A. Identifications (Maximum = 30 points)
[Number of non-HSL's not identified ( ) x
30/number of compounds in study ( ) =
( ) points deducted] NA

B. Non-HSL False Positive Identifications (Maximum = 15 points)
[Number of false positives (6) x 15/number of
compounds in study (21) = (4.3) points
deducted] 10.7

Maximum Score For Sections I & II = 120.0

Raw Score For Sections I & II = 101.2

Raw Percent Score for I & II = 84.3 %

III. Timeliness Criteria (-1% deducted from Raw Percent Score, above, for each day data package is delivered late). Late is defined as 31 days or more beyond the day of sample receipt. [6 percent deducted]

NET SCORE 78.3 %

CODED SUMMARY OF SCORES
SECOND QUARTER ORGANIC DOUBLE BLIND STUDY
(QB 2 FY 85, CASE NO. 3621)

CODE	POINT SCORE	% SCORE W/O LATE CHARGE ASSESSED	% SCORE W/ LATE CHARGE ASSESSED
NN	116.2	96.8	96.8
J	116.9	97.4	96.4
II	115.5	96.3	95.3
D	112.9	94.1	94.1
A	110.5	92.1	92.1
F	110.3	91.9	91.9
W	115.0	95.8	91.8
V	109.3	91.1	91.1
B	114.8	95.7	90.7
HH	108.3	90.3	90.3
N	110.0	91.7	89.7
X	107.4	89.5	89.5
JJ	107.2	89.3	89.3
C	111.2	92.7	86.7
T	103.6	86.3	86.3
EE	102.9	85.8	85.8
CC	108.6	90.5	85.5
K	100.3	83.6	83.6
I	107.2	89.3	83.3
Y	104.8	86.5	82.5
O	110.3	91.9	80.9
G	107.9	89.9	78.9
BB	101.2	84.3	78.3
U	106.4	88.7	76.7
DD	113.6	94.7	76.7
Z	116.2	96.8	75.8
FF	104.8	87.3	59.3
AA	108.6	90.5	44.5
R	114.3	95.3	40.3
KK	109.8	91.5	37.5
O [#]	109.5	91.3	37.3
L	109.1	90.9	34.9

* NO DATA SUBMITTED AS OF MAY 14, 1985
[#] RESUBMISSION OF DATA

QB 2 FY 85 Organic, Case No. 3821 (μg/L)

Compounds	A	B	C	D	E	F	G	H	H	H	I	J	K	L	M	N	O	P	CI^b 1 Value	CI^b 2 Values	CI 3 Values
VOA's																					
Chloroform	44*	71	77*	62		65	50*	56.0	52.6	59.4	60	62	76*		72	44*	62	58	51-72	53-70	[illegible]
1,2-Dichloroethane	63	77	76	67		71	56*	68.9	62.4	70.8	65	73	5U*		78	48*	77	65	58-83	61-80	[illegible]
Carbon tetrachloride	86*	130*	107	120		110	84*	104	118	122	110	84*	115		123*	99	100	114	99-121	102-118	[illegible]
Benzene	29	31	34	29		28	31	22.9*	22.0*	26.4*	39*	27	528*		36*	25	31	27	23-35	24-34	[illegible]
Bromoform	270	300J	51*	350		360	200	287*	272*	321*	290	290	494*		274	280	260	266	199-422	227-394	[illegible]
Ethylbenzene	89	90	97B	85*		100	76*	99.4*	94.5*	110*	110*	95	115*		110*	88	56*	82*	87-101	89-99	[illegible]
Acids																					
2-Chlorophenol	92	179	130	120		-*	130	174	160	176	149	121	128		149	150	180	154	65-279	91-253	[illegible]
2-Methylphenol	130	188*	98	100		-*	110	151*	137*	150*	145	125	119		130	130	150	126	38-157	52-143	[illegible]
2-Nitrophenol	57	86	68	73		-*	66	114	116	136	85	113	70		92.4	120	170	67	43-170	58-155	[illegible]
2,4-Dichlorophenol	56	97	94	85		-*	84	127	126	140	101	107	75		104	130	220*	69	51-215	71-195	[illegible]
4-Chloro-3-methylphenol	150	175	180	160		-*	130	222	230	252	198	194	126		209	240	300*	154	125-287	145-267	[illegible]
2,4,6-Trichlorophenol	6.4J*	52	36	40		-*	40	50.8*	52.5*	57.5*	45	47.6	36		49.9	54	55	26J	26-59^c	31-54^c	[illegible]
Pentachlorophenol	7.3J*	189	200	170		-*	170	326*	346*	366*	311	265	109		275	170	300	300	106-355^c	141-320^c	[illegible]
Base/Neutrals																					
1,2-Dichlorobenzene	130	155	130	80		-*	100	156	155	177	180	121	130		119	110	160	148	76-248	97-227	[illegible]
n-Nitrosodi-propylamine	70	109	66	30		-*	47	89.9	88.2	101	80	74.9	10U*		85.6	92	97	74	1-228	28-200	[illegible]
bis-(2-chloroethoxy)methane	55	53	58	24		-*	52	68.4	66.0	76.0	64	65.8	47		60.0	61	110	49	22-129	35-116	[illegible]
Acenaphthene	150	209	170	110*		-*	180	247	228	249	223	162	182		233	200	140	205	120-302	141-284	[illegible]
4-Chlorophenyl-phenylether	83	108	110	67		-*	100	145	136	144	124	116	104		107	130	150	102	60-283	88-256	[illegible]
Pesticides																					
Heptachlor	25.5*	27.2	30.6	21*		31.1	22*	40.8*	42.9*	48.0*	23*	29	18.3*		28.0	22*	29	25*	26-36	27-35	[illegible]
4,4'-DDE	57.5	66.4	0.10U*	46		105.3	38	104*	105*	106*	21*	28	42.3		76.9	80	125J*	10U*	22-122^c	36-108^c	[illegible]
Dieldrin	133.5	225	182	230		182.65	150	309	304	318	86*	203	218.1		294.0	110	321	310	125-370^c	159-335^c	[illegible]
Total out	5	2	3	3		12	5		8		5	1	7		3	3	4	3			

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[b] Confidence intervals (windows) were derived from three referee laboratories doing replicate analyses under the same constraints as the contract laboratories. These windows were derived according to the number of values submitted by the laboratories.

[c] This window was calculated using all data submitted by the laboratories; outliers were rejected using Dixon's Test. Laboratory values submitted after March 25, 1985, were not used in the calculation of the window.

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NA Not analyzed for.

* Value, or mean values, were outside the window.

\- No value submitted by the laboratory for this compound.

QB 2 FY 85 Organic, Case No. 3821 (µg/L)

Compounds	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH	II	CI[b] 1 Value	CI[b] 2 Values	CI[b] 3 Values
VOA's																						
Chloroform			69	74*	70	68	61	65.4	60	68		50*	63	68	48*	43*		69	58	51-72	53-70	[illegible]
1,2-Dichloroethane			79	86*	75	74	83	78.1	65	77		56*	71	73	57*	46*		81	69	58-83	61-80	[illegible]
Carbon tetrachloride			153*	130*	150*	140*	83*	93.6*	79*	110		89*	120	120	96*	71*		150*	130*	99-121	102-118	[illegible]
Benzene			34	38*	36*	33	28	36.8*	31	35		20*	34	30	30	23		35	31	23-35	24-34	[illegible]
Bromoform			488*	390	350	310	310	256	243	330		220	390	340	260	290		400	310	199-422	227-394	[illegible]
Ethylbenzene			102*	120*	120*	110*	69*	96.5	98	100		70*	97	98	84*	70*		120*	88	87-101	89-99	90-99
Acids																						
2-Chlorophenol			115	130	230	160	180	154	106	130		170	87	160	215	95		150	130	65-279	91-253	102-242
2-Methylphenol			115	110	91	140	69	10U*	84	100		190*	81	122	158*	88		130	94	38-157	52-141	58-137
2-Nitrophenol			86.4	64	100	95	88	91.9	89	72		100	68	100	126	180*		100	89	43-170	58-155	65-148
2,4-Dichlorophenol			93.0	77	110	110	110	75.9	98	75		110	62	108	112	76		100	100	51-215	71-195	79-186
4-Chloro-3-methylphenol			156	150	200	200	150	124*	158	140		180	100*	197	182	110*		200	160	125-287	145-267	154-259
2,4,6-Trichlorophenol			39.1	24*	47	37	34J	28.8	10U*	23*		40	20*	40	47	39		37	36	26-59[c]	31-54[c]	33-52[c]
Pentachlorophenol			205	170	340	270	200	271	340	140		240	130	408*	254	170		150	180	106-355[c]	141-320[c]	[illegible]
Base/Neutrals																						
1,3-Dichlorobenzene			119	120	150	140	160	199	103	160		200	170	125	144	120		140	140	76-248	97-227	105-218
n-Nitrosodi-propylamine			94.1	50	97	85	58	87.6	59	110		67	80	79	73	47		68	69	1-228	28-200	40-189
bis-(2-chloroethoxy) methane			77.9	53	80	77	71	53.9	52	70		64	43J*	65	53	43		62	50	22-129	35-116	41-110
Acenaphthene			140	230	260	190	220	278	249	240		180	180	207	227	150		200	190	120-307	143-284	152-276
4-Chlorophenyl-phenylether			93	110	130	100	130	120	100	120		100	83	256	124	96		110	94	60-283	88-256	99-244
Pesticides																						
Heptachlor			39.2*	47*	26	24*	35	40.6*	34.7	34		20*	36.6*	32	19.4*	16*		54*	30	26-36	27-35	[illegible]
4,4'-DDE			76.1	130*	60	1U*	79	62.2	5U*	79		31	10U*	4.8*	0.1U*	23		130*	75	22-122[c]	16-108[c]	[illegible]
Dieldrin			200	340	200	260	324	230	5U*	210		130	285	250	291	190		350	340	125-370[c]	159-335[c]	[illegible]
Total out			4	8	3	4	2	5	4	1		7	5	2	7	7		4	1			

[b] Confidence intervals (windows) were derived from three referee laboratories doing replicate analyses under the same constraints as the contract laboratories. These windows were derived according to the number of values submitted by the laboratories.

[c] This window was calculated using all data submitted by the laboratories; outliers were rejected using Dixon's Test. Laboratory values submitted after March 25, 1985, were not used in the calculation of the window.

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QB 2 FY 85 Organic, Case No. 3821 (µg/L)

Compounds	JJ	KK	LL	MM	NN	OO	PP	QQ	QQ	RR	RR	RR	SS	SS	TT	UU	VV	WW	CI^{b} 1 Value	CI^{b} 2 Values	CI^{b} 3 Values
VOA's																					
Chloroform	45*				52	55	63	66	67	58	58	53	65	63		54.5			51-72	51-70	[illegible]
1,2-Dichloroethane	56*				63	67	72	78	80	68	66	65	67	70		64.9			58-83	61-80	[illegible]
Carbon tetrachloride	84*				121	98*	86*	116	115	110	110	100	110	110		106.9			99-121	102-118	[illegible]
Benzene	20*				26	29	31.5	31	32	25	25	28	32	30		24.2			21-35	24-[illegible]	[illegible]
Bromoform	280				290	300	270	262	270	350	370	380	270	270		223.8			199-422	227-[illegible]	[illegible]
Ethylbenzene	76*				84*	93	110*	98	97	95	96	90	93	90		66.8*			87-101	89-99	[illegible]
Acids																					
2-Chlorophenol	140				150	160	130	152	158	200	230	200	91.0	NA		110			65-279	91-[illegible]	[illegible]
2-Methylphenol	130				130	142	110	131	135	80	78	81	80.0	NA		-*			38-157	52-143	[illegible]
2-Nitrophenol	92				76	96	82	99	103	110	140	130	56.0	NA		92			41-170	58-155	[illegible]
2,4-Dichlorophenol	95				84	94	100	119	132	160	170	150	66.0	NA		90			51-215	71-195	[illegible]
4-Chloro-3-methylphenol	160				160	173	200	219	224	220	230	210	131.0	NA		120*			125-287	145-267	[illegible]
2,4,6-Trichlorophenol	65				40	47	40	48	51	5J*	4J*	4J*	23.0*	NA		44			$26-59^{c}$	$31-54^{c}$	[illegible]
Pentachlorophenol	250				220	135	110	265	255	7J*	8J*	8J*	200.0	NA		160			$106-355^{c}$	141-[illegible]^{c}	[illegible]
Base/Neutrals																					
1,2-Dichlorobenzene	110				180	99	91	187	181	180	170	170	82.0	NA		190			76-248	97-227	[illegible]
n-Nitrosodi-propylamine	62				88	87	58	81	79	150	170	160	45.0	NA		150			1-228	28-200	[illegible]
bis-(2-chloroethoxy) methane	55				52	69	47	72	69	92	95	93	31.0	NA		57			22-129	35-116	41-110
Acenaphthene	190				230	211	160	262	260	210	200	200	148.0	NA		180			120-307	143-284	[illegible]
4-Chlorophenyl-phenylether	140				120	105	97	172	175	210	200	200	72.0	NA		100			60-283	88-256	[illegible]
Pesticides																					
Heptachlor	19*				32	34	24*	34	34	27.7	28.7	29.7	31	31		50*			26-36	27-35	[illegible]
4,4'-DDE	38				89	91	47	84	83	0.1U*	0.1U*	0.1U*	54	54		96			$22-122^{c}$	$36-108^{c}$	[illegible]
Dieldrin	195				280	367	240	254	243	253	261	277	0.50U*	0.50U*		-			$125-370^{c}$	159-[illegible]^{c}	[illegible]
Total out	6				1	1	3	0		3			2			5					

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APPENDIX QA-3

CONTAINER CLEANING PROCEDURES

WESTON
DESIGNERS CONSULTANTS

STANDARD PRACTICES MANUAL

OPERATING PRACTICE

Eff. Date 02/01/85 Initiated By DLST Reviewed By EH Authorized By AFT SP No 16-22-017

EPA CONTRACT LABORATORY PROGRAM
GLASSWARE CLEANING - ORGANICS

1.0 PURPOSE

Establish procedures for cleaning analytical glassware to ensure that sample integrity is not violated by contaminated glassware.

2.0 PROCEDURE

2.1 Wash glassware with a phosphate-free detergent (e.g., Alconox). Rinse with tap water five (5) times and deionized water five (5) times.

2.2 Rinse with acetone (once). If the glassware still appears dirty, consult the Section Supervisor.

2.3 Rinse with hexane (once).

2.4 Kiln dry at 450°C for ten (10) hours.

WESTON
DESIGNERS CONSULTANTS

STANDARD PRACTICES MANUAL

OPERATING PRACTICE

Eff Date 02/01/85 Initiated By DLST Reviewed By EMH Authorized By AFT SP No 16-22-016

EPA CONTRACT LABORATORY PROGRAM
GLASSWARE CLEANING - INORGANICS

1.0 PURPOSE

Establish procedures for cleaning analytical glassware to ensure that sample integrity is not affected by contaminated glassware.

2.0 PROCEDURE

2.1 General

2.1.1 Wash glassware with a low phosphate detergent (e.g., Alconox). Rinse with tap water five (5) times, and deionized water five (5) times.

2.2 Metals, Except Mercury BOD Bottles

2.2.1 Wash glassware with a low phosphate detergent (e.g., Alconox). Rinse with tap water five (5) times.

2.2.2 Rinse with 1:1 nitric acid (HNO_3), Ultrex grade or equivalent. Follow with tap water rinse, five (5) times.

2.2.3 Rinse with 1:1 hydrochloric acid (HCl), Ultrex grade or equivalent. Follow with tap water rinse, five (5) times.

2.2.4 Rinse with deionized water five (5) times.

2.3 Metals: Mercury BOD Bottles

2.3.1 Rinse bottle with tap water five (5) times.

2.3.2 Fill bottle half full with ten (10) percent weight/volume oxalic acid and place the cap on top. Holding the cap on, shake well by inverting at least five (5) times. Empty bottle (can be emptied into the next bottle to be cleaned).

2.3.3 Rinse with tap water five (5) times.

2.3.4 Fill bottle half full with 1:1 nitric acid (HNO_3), Ultrex grade or equivalent. Place the cap on top. Holding the cap on, shake well by inverting at least five (5) times. Empty bottle (can be emptied into the next bottle to be cleaned).

2.3.5 Rinse with tap water five (5) times.

2.3.6 Rinse with deionized water five (5) times.

2.4 <u>BOD (Biological Oxygen Demand)</u>

2.4.1 Empty bottles of their contents and allow to thoroughly drain upside down.

2.4.2 Line up empty, drained bottles. Fill the first bottle about 1/3 full with freshly-prepared NOCHROMIX solution (old, unused solution can be used if it is first refortified by adding approximately 1 gram of NOCHROMIX crystals per one liter of solution). Swirl the NOCHROMIX in the bottle to thoroughly coat all surfaces.

2.4.3 Empty the NOCHROMIX solution from the first bottle into the second bottle to be cleaned. Swirl the NOCHROMIX in the second bottle to thoroughly coat all surfaces.

2.4.4 Repeat step 2.4.3 to successive bottles until the solution is used up or there are no more bottles. If additional solution is needed, repeat from step 2.4.2.

2.4.5 Pour the used NOCHROMIX into a beaker containing the bottle caps. Add additional solution, if needed.

2.4.6 Allow the bottles and caps coated with NOCHROMIX residue to stand for one (1) hour.

2.4.7 Rinse bottles and caps with tap water (at least ten rinses) to remove all traces of NOCHROMIX solution. Fill bottles with tap water and check with pH paper to ensure bottles are sufficiently rinsed. If the pH paper indicates residual acid, repeat the tap water rinses and recheck the pH.

2.4.8 Rinse bottles and caps with deionized water five (5) times as set aside to drain dry upside down.

2.5 <u>COD (Chemical Oxygen Demand)</u>

2.5.1 Wash culture tubes and teflon-lined screw caps in a low phosphate detergent (e.g., Alconox). Rinse with tap water five (5) times.

2.5.2 Rinse all culture tubes and screw caps with twenty (20) percent volume/volume sulfuric acid (H_2SO_4) by filling tubes half full with acid solution. Screw on cap and shake by inverting at least five (5) times.

Alternately, put tubes and caps separately in a covered polypropylene box containing twenty (20) percent sulfuric acid to soak for at least one (1) hour. Be sure that all tubes fill with acid solution with no air bubbles.

2.5.3 Empty tubes. Rinse with water five (5) times.

2.5.4 Rinse with deionized water five (5) times. Allow to drain dry.

2.6 PHOSPHATE-PHOSPHORUS

2.6.1 Rinse glassware with hot 1:1 hydrochloric acid (HCl), Ultrex grade or equivalent.

2.6.2 Rinse with deionized water five (5) times.

2.6.3 Fill the acid-washed glassware with deionized water and treat with all the reagents to remove the last traces of phosphorus that might be absorbed on the glassware. Rinse with deionized water five (5) times.

2.6.4 This glassware will be used only for the determination of phosphorus and after use it will be rinsed with deionized water and kept covered until needed again. When immediately rinsed in this fashion, treatment with 1:1 hydrochloric acid and reagents is only required occasionally. **Commercial detergent should never be used.**

APPENDIX QA-4

LABORATORY QUALITY ASSURANCE PROJECT PLAN

WESTON
DESIGNERS CONSULTANTS
256 WELSH POOL ROAD
PICKERING CREEK INDUSTRIAL PARK
LIONVILLE, PA 19353

QUALITY ASSURANCE PROJECT PLAN

FOR

SILRESIM CHEMICAL CORPORATION LOWELL, MASSACHUSETTS

CONFIDENTIAL

BUSINESS CONFIDENTIALITY CLAIM

ROY F. WESTON submits this document and states that the information included herein is proprietory and should be handled in accordance with our Business Confidentiality Claim.

TABLE OF CONTENTS

1.0 INTRODUCTION

The purpose and goal of quality assurance/quality contol (QA/QC) is to ensure that all data generated in the laboratory conform to specific requirements for accuracy, precision, and completeness. This QA/QC plan describes the organization and procedures routinely incorporated into all analyses performed by the WESTON laboratory for the purpose of producing reliable data.

Customized, client-specific quality control procedures (to include project-specific quality assurance/quality control plans) can be added to these basic guidelines to satisfy the special needs of individual programs. Laboratory personnel are available to discuss the design, advantages, and disadvantages of other quality control options.

This plan has been prepared in accordance with "Guidelines and Specifications for Preparing Quality Assurance Program Plans", QAMS-004/80, September 20, 1984.

2.0 ORGANIZATION

2.1 Laboratory Manager

The ultimate responsibility for the generation of reliable laboratory data rests with the Laboratory Manager. The Laboratory Manager is vested with the authority to effect those policies and procedures to ensure that only data of the highest attainable quality are produced.

2.2 Section Managers

To assist the Laboratory Manager in achieving his goals, the Organic Section Manager, Inorganic Section Manager, and Data Manager as well as the laboratory QA/QC Coordinator and analytical project managers are responsible for the implementation of the established QA/QC policies and procedures. They possess the authorities commensurate with their responsibilities for the day-to-day enforcement of laboratory QA/QC procedures and monitoring of laboratory activities.

Section Managers have the responsibility for ensuring that their personnel are adequately trained to perform analyses, that equipment and instrumentation under their control are calibrated and functioning properly, that adequate preventive maintenance is provided for all instrumentation, and that system audits are performed on a periodic basis. These system audits will consist of analyses of external check samples to determine the analyst/instrument capability to identify and quantify routine analytes.

2.3 QA/QC Coordinator

The QA/QC Coordinator has the responsibility for the conduct of and evaluation of results from system audits. In addition, the preparation of SOP's and quality assurance documentation for the laboratory is the responsibility of the QA/QC Coordinator. The QA/QC Coordinator will review program plans for consistency with organizational and contractual requirements and will advise appropriate personnel of inconsistencies.

2.4 Laboratory Personnel

Any effective quality assurance and quality control program depends not only on organization and management but also on the efforts of each and every individual on the laboratory staff. The initial review for acceptability of analytical results rests with the analysts conducting the various tests. Observations made during the performance of an analytical method may indicate that the analytical system is not in control. Analysts must be constantly aware for indications of perturbations from the norm and be ready to verify that the system is in control before continuing analyses or reporting results of analyses.

3.0 SAMPLE MANAGEMENT

An organized and efficient sample management system is a necessary and critical foundation on which actual analyses of samples are based. Sample management includes client file creation, bottle preparation, sample preservation, sample receipt, sample storage, sample tracking, chain-of-custody documentation, reporting and invoicing, and sample retention and disposal.

3.1 Client File

On notification of a sampling and analysis effort, the laboratory will create a client file to maintain records associated with the project. In addition to administrative information (work order and plan numbers, client contacts, etc.), requests for sample containers, preservatives, and required analyses will be included in the file.

As the project progresses, chain-of-custody and analytical results as well as any other pertinent information will be added to and maintained in the file.

3.2 Bottle Preparation and Sample Preservation

On request by the laboratory Data Manager, sample bottles will be prepared by the laboratory and made available to the sampling team. The bottles will be prepared according to WESTON Standard Operating Procedures and will include sample preservatives appropriate to the analytes and matrices of concern. Addition of preservatives to samples shall be recorded in field notebooks and on chain-of-custody forms. WESTON adheres to the most recent recommendations from the US Environmental Protection Agency (EPA) for proper sample containers and preservation (Federal Register, Oct. 26, 1984).

If sample bottles are not prepared by the laboratory, the client assumes responsibility for bottle selection and preparation. This information will be so noted on the chain-of-custody and client report.

3.3 Sample Custody

When samples are received at the laboratory, the sample custodian will verify each and every sample against the chain-of-custody forms, note any discrepancies or losses of samples, and then sign for receipt of the samples. Samples wil remain under the control of the sample custodian until samples are transferred to the analysts for processing. Analysts will acknowledge receipt of samples by signing the chain-of-custody forms.

A sample is considered to be in custody if it:

1. Is in the physical possession of the responsible party.
2. Is in view of the responsible party.
3. Is secured by the responsible party to prevent tampering.
4. Is secured by the responsible party in a restricted area.

3.4 Sample Receipt

Samples received at the laboratory are inspected for integrity, and any field documentation is reviewed for accuracy and completeness. If chain-of-custody forms do not accompany the samples, the sample custodian will initiate these forms. When samples are received with missing or deficient chain-of-custody forms, the legal traceability of these samples cannot extend to the time of collection but must begin at the time of laboratory receipt.

Chain-of-custody and sample integrity problems are noted and recorded during sample log-in. The project manager is informed of the deficiencies and will advise the laboratory on the desired disposition of the samples. Chain-of-custody forms and deficiency notices are maintained in the client file.

Each sample that is received by the laboratory is assigned a unique sequential WESTON sample number which will identify the sample in the laboratory's internal sample tracking system. References to a sample in any communication will include the assigned sample number to specify which sample is of concern.

3.5 Sample Storage

Samples will be stored in a locked refrigerator at 4 C. The temperature of the storage refrigerators will be monitored and recorded daily by the sample custodian.

3.6 Sample Retention and Disposal

Samples will be retained in the refrigerator for 30 calendar days after the date of the invoice accompanying the analytical results. Unless a written request is received for retaining the sample beyond the 30 days, the samples will be disposed of in an appropriate manner.

4.0 ANALYTICAL SYSTEMS

4.1 Instrument Maintenance

Instruments will be maintained in accordance with manufacturers' specifications. More frequent maintenance may be dictated dependent on operational performance. Instrument logs will be maintained to document the date and type of maintenance performed.

Service contracts on major instruments with maufacturers and service agencies are used to provide routine preventive maintenance and to ensure rapid response for emergency repair service. Minimal instrument down-time is experienced through the use of these contracts.

4.2 Instrument Calibration

Before any instrument can be used as a measurement device, the instrumental response to known reference materials must be determined. The manner in which the various instruments are calibrated will be dependent on the particular instrument and the intended use of the instrument. All sample measurements will be made within the calibrated range of the instrument.

Laboratory balances will be calibrated annually by the manufacturer and will be checked before and after use on a daily basis. A record of calibrations and daily checks will be kept in the balance log.

Oven thermometers will be calibrated annually against a National Bureau of Standards certified thermometer over the range of interest. Annual calibrations and daily readings will be maintained in the oven logs.

4.3 Personnel Training

Prior to conducting analyses on an independent basis, analysts are trained by experienced personnel in the complete performance of an analytical method. For selected analytical instruments, analysts may be trained at instrument manufacturers' training courses. The analyst is then required to independently generate data on several method and/or matrix spikes to demonstrate proficiency in that analytical method. The type of data to be generated will be dependent on the analytical method to be performed. Results of this "certification" are then reviewed by the appropriate section manager for acceptability.

Since method blanks and method spikes are required routine samples in every lot, performance on a day-to-day basis can be monitored by comparison with the original and cumulative data on similar samples. Supervisors and the laboratory quality assurance coordinator (QAC) are responsible for ensuring that samples are analyzed by only competent analysts.

4.4 Standard Analytical Methods

General: Analytical methods are routinely conducted as outlined in published sources (EPA, Standard Methods, ASTM, AOAC, etc.). Modifications to these methods may be necessary in order to provide accurate analyses of particularly complex matrices. When modifications to standard analytical methods are performed, the specific alterations as well as the reason for the change will be reported with the results of analyses.

4.4.1 Gas Chromatography/Mass Spectroscopy

4.4.1.1 Calibration

Mass spectrometers are tuned on a daily basis to manufacturer's specifications with FC-43. In addition, once per shift, these instruments are tuned with decafluorotriphenylphosphine (DFTPP) or 4-bromo-fluorobenzene (BFB) for semi-volatiles or volatiles, respectively. Ion abundances will be within the windows given in EPA methods 624 and 625.

Once an instrument has been tuned, initial calibration curves for analytes (appropriate to the analyses to be performed) are generated for at least three standard solutions containing known concentrations of authentic standards of compounds of concern. The calibration curve will bracket the anticipated working range of analyses.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

4.4.1.2 Quality Control

During each operating shift, a midpoint calibration standard is analyzed to verify that the instrument responses are still within the initial calibration determinations. The calibration check compounds will be those analytes used in the EPA Contract Laboratory Program's multicomponent analysis (e.g., priority pollutants and hazardous substances list) with the exception that benzene is used in place of vinyl chloride (volatiles) and di-n-octyl phthalate is deleted from the semi-volatile list.

The response factor drift (% RSD) will be calculated and recorded. If significant (>30%) response factor drift is observed, appropriate corrective actions will be taken to restore confidence in the instrumental measurements.

All GC/MS analyses will include analyses of a method blank, a method spike, and a method spike duplicate in each lot of samples. In addition, appropriate surrogate compounds specified in EPA methods will be spiked into each sample. Recoveries from method spikes and surrogate compounds are calculated and recorded on control charts to maintain a history of analytical performance.

Duplicate samples will be analyzed for analytical lots of twenty or more.

Audit samples will be analyzed periodically to compare and verify laboratory performance against standards prepared by outside sources.

4.4.2 Gas Chromatography and High Performance Liquid Chromatography

4.4.2.1 Calibration

Gas chromatographs and high performance liquid chromatographs will be calibrated prior to each day of use. Calibration standard mixtures will be prepared from appropriate reference materials and will contain analytes appropriate for the method of analysis. Working calibration standards will be prepared daily. The working standards will include a blank and a minimum of three concentrations to cover the anticipated range of measurement. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of known versus found concentrations must be at least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be obtained, additional standards must be analyzed to define the calibration curve. A midpoint calibration check standard will be analyzed each shift to confirm the validity of the initial calibration curve. The calibration check standard must be within 20% of the initial response curve to demonstrate that the initial calibration curve is still valid.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

4.4.2.2 Quality Control

At least one method blank and two method blank spikes will be included in each laboratory lot of samples. Regardless of the matrix being processed, the method spikes and blanks will be in aqueous media. Method spikes will be at a concentration of approximately five times the detection limit.

The purpose of the method blanks is to determine if contamination is being introduced in the laboratory.

The method blank spikes will be examined to determine both precision and accuracy. Accuracy will be measured by the percent recovery of the spikes; precision will be measured by the reproducibility of both method spikes.

4.4.3 Atomic Absorption Spectrophotometry

4.4.3.1 Calibration

Atomic absorption spectrophotometers will be calibrated prior to each day of use. Calibration standards will be prepared from appropriate reference materials, and working calibration standards will be prepared daily. The working standards will include a blank and a minimum of five concentrations to cover the anticipated range of measurement. Duplicate injections will be made for each concentration. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of known versus found concentrations will be at least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be achieved, the instrument will be recalibrated prior to analysis of samples.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

4.4.3.2 Quality Control

At least one method blank and two method blank spikes will be included in each laboratory lot of samples. Regardless of the matrix being processed, the method blank spikes and blanks will be in aqueous media. Method blank spikes will be at a concentration of approximately five times the detection limit.

The method blanks will be examined to determine if contamination is being introduced in the laboratory and will be introduced at a frequency of one per analytical lot or 5% of the samples, whichever is more.

The method spikes will be examined to determine both precision and accuracy. Accuracy will be measured by the percent recovery of the spikes. The recovery must be within the range 75-125% to be considered acceptable.

Precision will be measured by the reproducibility of both method spikes. Results must agree within 20% in order to be considered acceptable.

4.4.4 Inductively Coupled Plasma Spectroscopy

4.4.4.1 Calibration

The inductively coupled plasma spectrometer will be calibrated prior to each day of use. Calibration standards will be prepared from reliable reference materials and will contain all metals for which analyses are being conducted. Working calibration standards will be prepared fresh daily. The working standards will include a blank and a minimum of five concentrations to cover the anticipated range of measurement. Triplicate readings will be made for each concentration. At least one of the calibration standards will be at or below the desired instrumental detection limit. The correlation coefficient of the plot of responses versus concentrations will be at least 0.996 in order to consider the responses linear. If a correlation coefficient of 0.996 cannot be obtained, the spectrometer will be recalibrated prior to analysis of samples.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanant record of instrument calibrations.

4.4.4.2 Quality Control

At least one method blank and two method blank spikes will be included in each laboratory lot of samples. Regardless of the matrix being processed, the method blank spikes and blanks will be in aqueous media. Method blank spikes will be at a concentration of approximately five times the detection limit.

The method blanks will be examined to determine if contamination is being introduced in the laboratory.

The method spikes will be examined to determine both precision and accuracy. Accuracy will be measured by the percent recovery of the spikes. The recovery must be within the range 75-125% to be considered acceptable.

Precision will be measured by the reproducibility of both method spikes.

Results must agree within 20% in order to be considered acceptable.

4.4.5 Total Organic Carbon

4.4.5.1 Calibration

The total organic carbon analyzer will be calibrated prior to each day of use. Calibration standards will be prepared from potassium hydrogen phthalate, and working calibration standards will be prepared fresh daily. The working standards will include a blank and a minimum of five concentrations to cover the anticipated range of measurement. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of known versus found concentrations will be at least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be achieved, the instrument will be recalibrated prior to analysis of samples. Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanant record of instrument calibrations.

4.4.5.2 Quality Control

At least one method blank and two method blank spikes will be included in each laboratory lot of samples. Method blank spikes will be at a concentration of approximately five times the detection limit.

The method blanks will be examined to determine if contamination is being introduced in the laboratory. The method blank spikes will be examined to determine both precision and accuracy. Accuracy will be measured by the percent recovery of the spikes. The recovery must be within the range 90-110% to be considered acceptable.

Precision will be measured by the reproducibility of both method spikes. Results must agree within 20% in order to be considered acceptable.

4.4.6 Ion Chromatography

4.4.6.1 Calibration

The ion chromatograph will be calibrated prior to each day of use. Calibration standards will be prepared from appropriate reference materials, and working calibration standards for the ions of interest will be prepared fresh daily. The working standards will include a blank and a minimum of five concentrations to cover the anticipated range of measurement. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of known versus found concentrations will be at least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be achieved, the instrument will be recalibrated prior to analysis of samples.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

4.4.6.2 Quality Control

At least one method blank and two method blank spikes will be included in each laboratory lot of samples. Regardless of the matrix being processed, the method blank spikes and blanks will be in aqueous media. Method blank spikes will be at a concentration of approximately five times the detection limit.

The method blanks will be examined to determine if contamination is being introduced in the laboratory.

The method blank spikes will be examined to determine both precision and accuracy.

Accuracy will be measured by the percent recovery of the spikes. The recovery must be within the range of 85-115% to be considered acceptable.

Precision will be measured by the reproducibility of both method spikes. Results must agree within 15% in order to be considered acceptable.

4.4.7 Spectrophotometric Methods

4.4.7.1 Calibration

Spectrophotometers will be calibrated prior to each day of use. Calibration standards will be prepared from reference materials appropriate to the analyses being performed, and working calibration standards will be prepared fresh daily. The working standards will include a blank and a minimum of five concentrations to cover the anticipated range of measurement. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of known versus found concentrations will be at least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be achieved, the instrument will be recalibrated prior to the analysis of samples.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

4.4.7.2 Quality Control

At least one method blank and two method blank spikes will be included in each laboratory lot of samples. Regardless of the matrix being processed, the method blank spikes and blanks will be in aqueous media. Method blank spikes will be at a concentration of approximately five times the detection limit.

The method blanks will be examined to determine if contamination is being introduced in the laboratory.

The method blank spikes will be examined to determine both precision and accuracy.

Accuracy will be measured by the percent recovery of the spikes. The recovery must be in an acceptable range (based on EPA data for the method of interest) in order to be considered acceptable.

Precision will be measured by the reproducibility of both method spikes. Results must agree within acceptable limits (based on EPA data) in order to be considered acceptable.

4.5 Methods Development

When standard (published) methods of analyses are not applicable to analyses to be performed, methods can be developed to provide the desired information. However, the lack of a historical data base does not obviate the necessity for documented quality control data to demonstrate the validity of the generated results. Reference material sources must be identified, and proof of compound identity and purity must be available. Instrumental operating parameters as well as calibration data must be documented, and specific procedures (to include sampling, if applicable) must be noted. Quality control samples (method blanks, method spikes, method spike duplicates, matrix spikes, and matrix duplicates) should be analyzed with greater frequency than with standard analytical methods to demonstrate the certainty and uncertainty of generated data. Exact requirements for demonstrating the reliability of developed methods are normally dictated by the specific program.

4.6 Reference Materials

Whenever possible, primary reference materials will be obtained from the National Bureau of Standards (NBS) or the Environmental Protection Agency (EPA). In the absence of available reference materials from these organizations, other reliable sources will be sought. These reference materials will be used for instrument calibration, quality control samples, and/or performance evaluations. Secondary reference materials may be used for these functions provided that they are traceable to an NBS standard or have been compared to an NBS standard within the laboratory.

4.7 Reagents

Laboratory reagents will be of a quality to minimize or eliminate background concentrations of the analyte to be measured. Reagents must also not contain other contaminants that will interfere with the analyte of concern.

4.8 Corrective Actions

When an analytical system is deemed to be questionable or out-of-control at any level of review, corrective actions are performed. If possible, the cause of the out-of-control situation is determined, and efforts are made to bring the system back into control. Demonstration of the restoration of a reliable analytical system will normally be accomplished by generating satisfactory calibration and/or QC sample data. The major consideration in performing corrective actions is to ensure that only reliable data are reported from the laboratory.

5.0 DATA MANAGEMENT

5.1 Data Collection

In addition to the data collected in the field and recorded on the chain-of-custody forms, data describing the processing of samples will be accumulated in the laboratory and recorded in laboratory notebooks. Laboratory notebooks will contain:

1. Date of analyses
2. Sample numbers
3. Client (optional)
4. Analyses or operation performed
5. Calibration data
6. QC samples included
7. Concentrations/dilutions required
8. Instrument readings
9. Special observations (optional)
10. Analyst's signature

5.2 Data Reduction

Data reduction is performed by the individual analysts and consists of calculating concentrations in samples from the raw data obtained from the measuring instruments. The complexity of the data reduction will be dependent on the specific analytical method and the number of discrete operations (extractions, dilutions, and concentrations) involved in obtaining a sample that can be measured.

For those methods utilizing a calibration curve, sample responses will be applied to the linear regression line to obtain an initial raw result which is then factored into equations to obtain the estimate of the concentration in the original sample. Rounding will not be performed until after the final result is obtained to minimize rounding errors, and results will not normally be expressed in more than two significant figures.

Copies of all raw data and the calculations used to generate the final results will be retained on file to allow reconstruction of the data reduction process at a later date.

5.3 Data Review

System reviews are performed at all levels. The individual analyst constantly reviews the quality of data through calibration checks, QC sample results, and performance evaluation samples. These reviews are performed prior to submission to the section managers or the analytical project manager.

The section manager and/or the analytical project manager review data for consistency and reasonableness with other generated data and determine if program requirements have been satisfied. Selected hard copy output of data (chromatograms, spectra, etc.) will be reviewed to ensure that results are interpreted correctly. Unusual or unexpected results will be reviewed, and a resolution will be made as to whether the analysis should be repeated. In addition, the analytical project manager or section manager will recalculate selected results to verify the calculation procedure.

The laboratory quality assurance coordinator independently conducts a complete review of selected projects to determine if laboratory and client quality assurance/quality control requirements have been met. Discrepancies will be reported to the appropriate section manager and/or analytical project manager for resolution.

The final routine review is performed by the laboratory manager prior to reporting the results to the client.

Non-routine audits are performed by regulatory agencies and client representatives. The level of detail and the areas of concern during these reviews are dependent on the specific program requirements.

5.4 Data Reporting

Reports will contain final results (uncorrected for blanks and recoveries), methods of analysis, levels of detection, surrogate recovery data, method blank data, and any other laboratory QC data requested by the client. In addition, special analytical problems and/or any modifications of referenced methods will be noted.

The number of significant figures reported will be consistent with the limits of uncertainty inherent in the analytical method. Consequently, most analytical results will be reported to no more than two significant figures.

Data are normally reported in units commonly used for the analyses performed. Concentrations in liquids are expressed in terms of weight per unit volume (e.g., milligrams per liter). Concentrations in solid or semi-solid matrices are expressed in terms of weight per unit weight of sample (e.g., micrograms per gram).

Reported detection limits will be the concentration in the original matrix corresponding to the low level instrument calibration standard after concentration, dilution, and/or extraction factors are accounted for.

5.5 Data Archiving

The laboratory will maintain on file all of the raw data, laboratory notebooks, and other documentation pertinent to the work on a given project. This file will be maintained for five (5) years from the date of invoice unless a written request is received for an extended retention time.

Data retrieval from archives will be handled in a similar fashion to a request for analysis. Specifically, a written work request to include a quotation must be submitted for retrieval of data. Client confidentiality will be maintained with retrieved data. Consequently, the laboratory can honor only those requests for data authorized by the original client.