LAWRENCE
21 CANAL ST
3-2691

SCANNED

OXFORD MILL
SITE INVESTIGATION PLAN

for

SITE CLOSURE
of the
Oxford Paper Mill Site
Lawrence, Massachusetts
Release Tracking No. 3-2691

FINAL

APRIL 2001

Prepared for:
Office of Planning and Development
City of Lawrence
225 Essex Street
Lawrence, Massachusetts 01840

Prepared by:
Stone & Webster, Inc.
100 Technology Drive
Stoughton, Massachusetts 02072

Stone & Webster A Shaw Group Company
Founded 1889

April 30, 2000

EPA Regional Administrator
Attn: Ms. Kim Tisa
US EPA Region 1
One Congress St, Suite1100 (HIO)
Boston, MA 02114-2023

RE: Quality Assurance Project Plan
Oxford Paper Mill (OPM), Lawrence, MA

Dear Ms. ~~Tisa:~~ Kim

Enclosed is the Quality Assurance Project Plan for the closure of the Oxford Mill site. Included in this document, are the Sampling and Analysis Plan, the Health and Safety Plan, the Quality Assurance Project Plan, and the MADEP Release and Abatement Measure Plan. The sub-basement work covered in this document should begin around May 7, 2001 and be completed in October 2001.

Sincerely,

Ronald Richards, LSP

Attachment

CC: J. D'Angelo, A. Roche, MHD (w/o attach)
R. Luongo, City of Lawrence (w/ attach)
L. Tyrala, Stone & Webster (w/o attach)

Stone & Webster, Inc.
100 Technology Center Drive
Stoughton, Massachusetts 02072-4705
Phone: 617.589.5111
Fax: 617.589.2156

CONTROL COPY NO. 01

OXFORD MILL
SAMPLING AND ANALYSIS PLAN

FOR SITE CLOSURE

of the

Oxford Paper Mill Site
Lawrence, Massachusetts
Release Tracking No. 3-2691

Final

April 2001

Prepared for:
Office of Planning and Development
City of Lawrence
225 Essex Street
Lawrence, Massachusetts 01840

Prepared by:
Stone & Webster, Inc
100 Technology Center Drive
Stoughton, Massachusetts 02072

Table of Contents

List of Tables

List of Figures

List of Appendixes

1.0 INTRODUCTION

The former Oxford Paper Mill (OPM) Site (Release Tracking Number 3-2691) is located on approximately 3 acres of land in Lawrence, Massachusetts, immediately northwest of the intersection of Canal Street and the Spicket River (refer to the Locus Plan attached as Figure 1). A small portion of the Site is also located north of Canal Street on the eastern bank of the Spicket River. The Site is transected by a raceway, which discharges to the Spicket River.

A Notice of Responsibility (NOR) was issued by the Department of Environmental Protection (DEP) to the City of Lawrence on May 15, 1989; the NOR indicated that contaminant conditions at the former OPM render the Site a "Location To Be Investigated" (LTBI). According to an October 23, 1989 letter from DEP to the City of Lawrence, the Emergency Response Branch concluded that no further emergency response actions at the Site were necessary at the time and the case was referred to the Site Management Branch. The Site was first listed as an LTBI on DEP's "List of Confirmed Disposal Sites and Locations to be Investigated" on January 15, 1990.

On November 23, 1999 the Site was Tier Classified under the MADEP Massachusetts Contingency Plan (MCP) by Mr. Kevin Scully, LSP of Stone & Webster. The numerical ranking for the Site was 558, and a Tier 1A Permit Application Submittal was sent to DEP on November 29, 1999 for administrative and technical review. A Site visit was conducted by MADEP on February 3, 2000. During this meeting and in discussions with Mr. Kevin Scully and Ms. Ann Roche of Massachusetts Highway Department (MHD), Mr. Larry Mach of MADEP indicated that the Site would be classified Tier 1B. On March 3, 2000, MADEP classified the Site as a Tier 1B.

The Massachusetts Highway Department (MHD) is currently in the process of constructing a bridge whose footprint will occupy a substantial portion of the property. As part of their activities, MHD will remediate a substantial portion of the site. The City of Lawrence is proposing to close out the MCP activities at the site by completing additional assessment to define the nature and extent of contamination and subsequently perform remediation, as required to complete site closure.

The purpose of this Sampling and Analysis Plan (SAP) is to describe in detail the sampling and data gathering methods to support site closure.

The SAP outlines the sampling objectives, frequency and locations to determine the extent of contamination and to support the determination of risk at the completion of site closure. Sampling will be performed within the site property including the soil underlying the basements and the surficial soils. Where applicable, the information obtained will be utilized to close portions of the site to allow construction to proceed in a timely manner. The SAP describes the sampling rationale, equipment and procedures for sample retrieval, handling and analysis.

A Quality Assurance Project Plan (QAPP) has also been developed to support this sampling effort. The QAPP provides the planning mechanism and procedures to evaluate the sample collection and analysis, and to provide a defensible assessment to provide acceptable results for regulatory review. Relevant sections of the QAPP are referenced in the SAP.

2.0 PROJECT DESCRIPTION

2.1 Site Description

The former Oxford Paper Mill (OPM) Site (Release Tracking Number 3-2691) is located on approximately 3 acres of land in Lawrence, Massachusetts, immediately northwest of the intersection of Canal Street and the Spicket River (refer to the Locus Plan attached as Figure 1). A small portion of the Site is also located north of Canal Street on the eastern bank of the Spicket River. The Site is transected by a raceway, which discharges to the Spicket River. Nine buildings (Building Nos. 1, 2, 3, 4, 5, 6, 13, 1A, and 28) currently occupy the Site; these buildings are south of the raceway. Buildings north of the raceway were demolished in the early 1980s. The Site is surrounded by either a wooden stockade or chain-linked fence. Oxford Paper ceased operations at the Site in the mid-1970s. The City of Lawrence took ownership of the property in 1983.

2.2 Site History and Background

2.2.1 Description of Release/Threat of Release

On April 10, 1989, the Emergency Response Branch of DEP investigated a release of an unknown quantity of petroleum product into the Spicket River. The oil appeared to be released through a sanitary sewer manhole near the former OPM property and the Spicket River. Clean Harbors, Inc. removed oil from this manhole and the impacted area of the Spicket River.

A Notice of Responsibility (NOR) was issued to the City of Lawrence on May 15, 1989; the NOR indicated that contaminant conditions at the former OPM render the Site a "Location To Be Investigated" (LTBI). According to an October 23, 1989 letter from DEP to the City of Lawrence, the Emergency Response Branch concluded that no further emergency response actions at the Site were necessary at the time and the case was referred to the Site Management Branch. The Site was first listed as an LTBI on DEP's "List of Confirmed Disposal Sites and Locations to be Investigated" on January 15, 1990. As a Transition Site under the Massachusetts Contingency Plan (MCP), the August 2, 1996 deadline for submittal of a Licensed Site Professional (LSP) Evaluation Opinion, as specified in the MCP (310 CMR 40.0610(3)(b)), applied to the Site. Neither one of the submittals listed in 310 CMR 40.0610(5)(a) through (c) (i.e., an LSP Evaluation Opinion, statement pursuant to 310 CMR 40.0610(4)(b), or Response Action Outcome Statement) nor a Tier Classification Submittal was submitted to DEP by this deadline. As such, the Site was categorically classified as a Tier IB disposal Site on August 2, 1996.

On November 23, 1999 the Site was Tier Classified by Mr. Kevin Scully, LSP of Stone & Webster. The numerical ranking for the Site was 558, and a Tier 1A Permit Application Submittal was sent to DEP on November 29, 1999 for administrative and technical review. A Site visit was conducted by MADEP on February 3, 2000. During this meeting and subsequence discussions with Mr. Kevin Scully and Ms. Ann Roche of MHD, Mr. Larry Mach of MADEP indicated that the Site would be classified Tier 1B. On March 3, 2000, MADEP classified the Site as a Tier 1B.

2.2.2 Site Conditions

Currently, there is no evidence of soil contamination beneath Site buildings. Upon completion of building demolition (Nos. 1-6, 13 and 28) predetermined soil sampling locations will be sampled and analyzed. Once all soil laboratory data has been received and undergone QA/QC protocols, basement slabs will be either removed and undergone soil remediation or leveled to grade.

2.2.3 Previous Studies

The following sections presents information regarding the contaminant conditions at the Site which was gathered as part of environmental investigations prior to and after the Site entered the MCP process. Also, provided is information on the status of; (1) existing transformers, (2) drums, storage tanks, or containers of oil and/or hazardous material which remain at the Site, (3) locations of the Site known to be contaminated with asbestos, and (4) potentially contaminated PCB materials (See Appendix C for a summary of analytical results to date). Investigation locations referred to are shown on Figure 3.

Prior to the 1989 emergency response incident described above, environmental investigations of the Site were conducted by Briggs Associates, Inc., Camp, Dresser & McKee, Earth Tech (HMM) and Eckenfelder, Inc. The scope and results of each of these studies are presented below.

Briggs Associates, Inc., 1984

In December 1984, Briggs Associates, Inc. (Briggs) completed an Environmental Site Investigation of the former OPM property in accordance with Massachusetts General Laws (M.G.L.) Chapter 21E. The study consisted of a Site reconnaissance, a review of information at the Lawrence Fire Department regarding storage tanks on the property, excavation of five shallow (to a maximum depth of 7 feet below ground surface) test pits (TP-1B thorough TP-5B), and collection and analysis of soil samples for volatile organic compounds (VOCs), RCRA-8 metals, and oil and grease. Briggs concluded that, "RCRA metals, oil and grease, and volatile organics concentration were all within limits not to represent a problem," and "all factors indicate that the area is environmentally acceptable."

Camp, Dresser & McKee, 1985

In 1985, Camp, Dresser & McKee (CDM) conducted an evaluation of conditions surrounding a transformer at the southeastern corner of Building No. 6. Soil samples collected at various locations and depths around the transformer indicated the presence of PCBs at levels up to 6,000 parts per million (ppm), which exceeds the MCP limit of 2 ppm.

As part of CDM's study, two samples were collected from an oil-stained area on the surface of the western most portion of the south-exterior wall of the former OPM Building No. 22; this wall borders the north raceway (Figure 2). The former Building No. 22 is located north of the raceway, above Building No. 3. The two samples were submitted for PCB analysis. Analytical results indicated the presence of PCBs at levels of 4,300 mg/m^2 and 4,800 mg/m^2.

Since the Site was first listed as an LTBI in 1990, further environmental investigations of the Site have been conducted by HMM Associates, Inc. of Concord, Massachusetts; Eckenfelder, Inc. of Mahwah, New Jersey; and EARTH TECH (formerly HMM Associates, Inc.). The work conducted as part of these studies is summarized below.

Eckenfelder, Inc. 1984 through 1992

Eckenfelder, Inc. conducted investigations of the GenCorp, Inc. Site between 1984 and 1992 in order to assess and monitor the mobility of contaminants from the GenCorp property. These studies were conducted in phases (i.e., Phase I-A, Phase I-B, Phase II, Phase III-A, Phase III-B, Phase IV-A, Phase IV-B, and Phase IV-C). Eckenfelder's Phase IV investigations, which were completed between September 1990 and December 1992, included sampling and analysis of soil and groundwater on the former OPM Site. The scope and results of their work on the former OPM Site are presented below.

Eckenfelder's Phase IV groundwater investigation program included: installation of monitoring wells on both the GenCorp, Inc. and former OPM property; collection of two rounds of groundwater samples from existing and newly installed wells; collection of a third round of groundwater samples from a limited number of wells; and collection of surface and subsurface soil samples. The following paragraphs summarize soil and groundwater analytical results for the Oxford Paper property.

Soil

With the exception of 0.12 ppm of methylene chloride in surface soil sample G-19, no VOCs were detected in soil. Low levels of SVOCs (i.e., benzo(a)anthracene, benzo(b)fluoranthene, bis-(2-ethylhexyl) phthalate, di-n-butyl phthalate, chrysene, fluoranthene, and pyrene) were detected in soil at various depths. PHCs were detected in three subsurface soil samples (B-16XD, B-22, and B-18) at concentrations ranging from 13 to 1720 ppm. PCBs (Aroclor 1254) were detected in two surface soil samples, G-19 and G-22 at 0.165 ppm and 0.34 ppm, respectively. Mercury was detected in surface soil at one location (B-19) at a concentration of 43 ppm. Lead and zinc were detected in surface soil sample G-18 at 230 ppm and 200 ppm, respectively. Phenols were also detected in soil sample G-18 at 59.5 ppm.

Groundwater

VOCs (i.e., benzene, chloroform, ethylbenzene, toluene, 2-chloro-ethyl vinyl ether, MIBK, MEK, acetone, THF) were detected at low concentrations in groundwater during Eckenfelder's Phase IV investigation.

Analytical results indicated the presence of low levels of PCBs (Aroclor 1242) in three wells (B-18D, B-20D, and B-22D) on the former OPM Site at concentrations close to the detection limit (concentrations ranged from 0.5 to 2.9 ppb). No PCBs were detected in deep bedrock wells or in wells along the downgradient perimeter of the former OPM Site.

Elevated levels of several metals (arsenic, chromium, mercury, and lead) were detected in groundwater. Arsenic was detected in wells B-16D and B-22D at 212 ppb and 370 ppb, respectively. Analytical results indicated the presence of mercury in monitoring well B-19 at 440 ppb and lead in monitoring well B-16D at 16 ppb.

Phenanthrene was detected in groundwater collected from monitoring well B-22S at a concentration of 70 ppb. Pesticides (beta BHC) were detected in B-22D at a concentration of 0.09 ppb.

Based on the results of this study, Eckenfelder, Inc. concluded that the shallow VOC plume emanating from the GenCorp, Inc. property had decreased in size and no longer extends on to the former OPM property.

HMM Associates, Inc., 1992

In February 1992, HMM Associates, Inc. (HMM) completed a Preliminary Site Assessment of the former OPM Site. The study included a Site reconnaissance, a review of Site history, and a summary of available analytical data. Potential migration pathways and routes of exposure were also identified as part of this study. No environmental sampling or laboratory testing was conducted during this investigation. HMM concluded that, "due to the evidence of a release of several hazardous materials in soil, groundwater, sediment, and building structures at the Oxford Paper Site, the completion of additional assessment is recommended." HMM also prepared a draft Release Abatement Plan (RAM) to address PCBs in soil near Building No. 6.

EARTH TECH, 1994

In October 1994, EARTH TECH conducted additional investigations in the area of the transformer at the southeastern corner of Building No. 6. Soil samples were collected at depths up to 6.5 feet below ground surface. The samples were analyzed in the laboratory for PCBs via U.S. EPA Method 8080. Selected samples were also analyzed for pH, flashpoint, cyanide (reactive), sulfide (reactive), and TCLP (metals, VOCs, SVOCs, pesticides, and herbicides). Analytical results indicated the presence of PCBs in soil at levels up to 23,000 ppm. Data analysis was not Aroclor specific. A TCLP lead concentration of 12 mg/l was detected in soil sample SS-6 at 2.5 feet below ground surface.

Eckenfelder, Inc., 1994

In October 1994, Eckenfelder, Inc. collected groundwater samples from 20 monitoring wells located on and around the Oxford Site in order to assess and monitor the mobility of contaminants on the GenCorp property. The samples were analyzed for VOCs, PCBs, arsenic, chromium, mercury, and zinc. Low to non-detectable levels of VOCs were present in groundwater. PCBs were not detected in any of the groundwater samples. Concentrations of arsenic, chromium, mercury, and zinc were consistent with previous sampling results.

Eckenfelder, Inc., 1995

In May 1995, Eckenfelder, Inc. collected surface water samples from locations within the Spicket River, North Canal, and raceway. The samples were analyzed for VOCs via U.S. EPA Method 8240 and tetrahydrofuran (THF). With the exception of 1.1 ug/l of 1,2-dichloroethene (1,2-DCE) in the Spicket River at General Street (SW-1) and 2.7 ug/l of carbon disulfide in the raceway (SW-11), no VOCs were detected in the surface water samples collected.

Transformers

Based on available information, one of the previous three transformers remains on Site. The existing transformer (referred to as transformer No. 6) is located at the southeastern corner of Building No. 6. The transformers formerly located between Building Nos. 1, 2, and 4 (referred to as transformer No. 2) and in Building No. 3 (referred to as transformer No. 3) were disposed of in the raceway. According to Mr. Edward Fitzpatrick of GenCorp, GenCorp assisted the Lawrence Fire Department in removing these two transformers from the raceway between 1981 and 1982.

Although soil near existing transformer No. 6 has been sampled and analyzed, no soil sampling has been conducted to assess contaminant conditions in the vicinity of transformers No. 2 or No. 3 that were previously removed. Therefore, as part of the Release Abatement Plan (RAM), samples will be collected from these areas to assess the soil conditions and determine whether additional PCB-contaminated material should be removed. Sampling will occur in the area of former transformer No. 2, which is now accessible. Samples will be collected and submitted for PCB analysis (U.S. EPA Method 8082) prior to demolition activities in this area. Soil sampling in the previous location of transformer No. 3, within in Building 3 is currently not accessible for soil sampling. Demolition will be required in this area before samples can be collected and submitted for analysis. There has been no update in the status of sampling for PCBs in the vicinity of the transformers. Transformer 6 should be removed in May of 2001 and sampling should occur soon after that.

Storage Tanks, Drums, and Containers

Information on the status of storage tanks, drums and containers is provided in various letters and reports regarding the former OPM Site and is summarized below.

According to a review of City of Lawrence Fire Department records by Briggs Associates, Inc. personnel during their 1984 study, no aboveground storage tanks were present at the Site. However, the records indicated that one 20,000-gallon and three-30,000-gallon underground storage tanks (USTs) were present at the Site. The license for these tanks was issued on July 6, 1953. Fire Department records also indicated that gasoline was stored in two 300-gallon USTs. One tank was installed in 1921 and the other one was installed in 1928; both were removed on July 23, 1968.

A March 19, 1992 letter from Mr. Robert J. Devaney, Jr., Director of Environmental Engineering at GenCorp to the City of Lawrence Community Development Department summarizes the results of CDM's December 1985 report titled "Final Technical Memo Report #3 - Oxford Paper Site." The letter indicates that the presence of three 30,000-gallon tanks at the Site was confirmed in April 1989.

The May 15, 1989 NOR letter from DEP to the City of Lawrence indicates that based on DEP's review of a July 25, 1967 plan of the Site, seven fuel oil storage tanks were located on the property (three 30,000-gallon, one 20,000-gallon, one 10,000-gallon, and two 1,000-gallon tanks). The letter indicates that these tanks were abandoned in 1976. According to the letter, two of the tanks (one 20,000-gallon and one 1,000-gallon) were located on April 19, 1989 and were scheduled to be removed; no leakage was observed from the 20,000-gallon tank.

A Commonwealth of Massachusetts, Department of Public Safety, Division of Fire Prevention, Permit for Removal and Transportation to Approved Tank Yard was obtained for the 20,000-gallon tank on April 18, 1989. The tank was removed on April 19, 1989 and transported off-Site to John C. Tombarello & Sons of Lawrence, Massachusetts. The permit indicates that the tank was accepted at this location on June 9, 1989.

The 1,000-gallon tank was excavated on April 20, 1989. This 1,000-gallon tank was removed from the location of a supposed 10,000-gallon fuel oil tank shown on a historical map of the Site. According to a Commonwealth of Massachusetts, Department of Public Safety, Division of Fire Prevention, Permit for Removal and Transportation to Approved Tank Yard, the tank was transported off-Site to John C. Tombarello & Sons of Lawrence, Massachusetts. The permit indicates that the tank was accepted at this location on June 9, 1989.

An April 23, 1991 letter from Eckenfelder, Inc. to Mr. Robert J. Devaney, Jr., Director of Environmental Engineering at GenCorp indicates that GenCorp responded to the 1988 oil release to the Spicket River by assisting with UST location, identification, and removal on the former OPM property. The letter also indicates that subsequent excavations conducted by the City of Lawrence confirmed the presence of several large diameter USTs which contained petroleum residuals of unknown composition.

According to information gathered, as part of HMM's Preliminary Site Assessment in 1992, five underground storage tanks were identified on the Site to the north of the raceway. Two of these tanks (one 500-gallon and one 1,000-gallon) were removed by Clean Harbors in 1988. Records maintained by the City of Lawrence Fire Department indicate that one 1,000-gallon tank was removed in 1989. The remaining USTs are each 30,000-gallons. The contents of the tanks were sampled by Clean Harbors in 1988; analytical results indicated that petroleum was stored in the tanks. Clean Harbors reportedly removed the contents of two of the USTs. According to records at the City of Lawrence Fire Department, the contents of the third tank had solidified.

Observations made by HMM during the Site reconnaissance indicated the presence of five 30-gallon cardboard containers of a dry, purple substance in Building No. 3. Several of the containers had leaked onto the floor surrounding them. Several 55-gallon drums of unknown contents were observed by HMM throughout the basement level of Building No. 3; based on their weight, the drums appeared to be essentially empty. Several drums of unknown contents were also observed in the basement of Building No. 2; these drums also appeared to be essentially empty. Three approximately 500-gallon above ground storage tanks were observed in the basement of Building No. 6; they appeared to be essentially empty. The use and contents of these tanks is unknown.

The three 30,000-gallon fuel oil UST's were removed in November of 2000. Analytical data showed no exceedances at reportable levels. Based on the above information, it appears that there are no remaining underground storage tanks at the former OPM Site.

As indicated above, sampling performed by CDM in 1985 within an oil-stained area on the surface of the south exterior wall of former OPM Building No. 22 indicated the presence of PCBs at levels of 4,300 mg/m^2 and 4,800 mg/m^2. PCBs may also be present in soil behind the wall.

Locations Known to be Contaminated with Asbestos

Visual observations made by GZA and others near transformer No. 6 indicate the likely presence of asbestos and/or asbestos containing materials on the surface soil within this area.

Potentially Contaminated PCB Materials

As indicated above, sampling performed by CDM in 1985 within an oil-stained area on the surface of the south exterior wall of former OPM Building No. 22 indicated the presence of PCBs at levels of 4,300 mg/m^2 and 4,800 mg/m^2. PCBs may also be present in soil behind the wall.

2.3 Project Objectives

The primary goal of this SAP is to obtain field information to define the extent and nature of contamination at the site so as to provide a basis for a risk characterization and determination of the need to conduct remediation to complete site closure. Specific objectives to meet these goals are:

- Determine the nature and extent of hazardous substances known or suspected to be present in soil.
- Assess the potential risk of harm to human health and the environment.
- Provide a basis to determine the type of response action to be considered.

- Groundwater will not be addressed at this time. In the instance, groundwater becomes an issue, the QAPP and SAP will be amended, or a new QAPP will be issued.

The sampling events described in the SAP should take about two months to complete. However, as a result of demolition associated with the construction schedule, the field investigations will take place in accordance with the project schedule.

2.4 Project Organization

Project personnel from Stone & Webster will execute this project in coordination with Massachusetts Highway Department Personnel and their construction contractor, (North American site developers, Inc). The primary individuals responsible assigned to these roles are provided in Table 1 at the end of this section. A brief experience summary of the primary personnel is provided in Appendix A.

Program Manager

The Program Manager will ensure the overall organizational, quality assurance, and quality control protocols established by Stone & Webster are met and followed in a timely fashion. This individual will ensure that all project goals and objectives are met with high standards and in a timely manner.

Project Manager

The Project Manager will be responsible for evaluating the appropriateness and adequacy of the technical services provided, tracking schedules and ensuring that the technical approaches and levels of effort are commensurate with those required to address each task. This individual will ensure that all project technical objectives, including analytical data methods, are obtained in a consistent manner applicable laws and regulations. The Project Manager will review the ongoing Quality Control during the performance of the work, the technical integrity of conclusions and recommendations, and the clarity and usefulness of all project work products. The Project Manager reports directly to the Program Manager.

Field Manager

The field manager has the direct responsibility for implementing the SAP, including all phases of work plan development, field activities, data management, and report preparation. This individual will be responsible for ensuring proper technical performance of drilling operations and field sampling activities, adherence to required sample custody and other related QA/QC field procedures, coordination of field personnel activities, management of investigation-derived wastes, checks of all field documentation, and preparation of Field Change Orders (FCOs), if required. The Field Manager reports directly to the Project Manager.

Field Personnel

In addition to the Field Manager, other field personnel participating in the implementation of field activities will be required. These individuals will be responsible for collection of soil samples, site health and safety monitoring, preparation of field notebooks, and overseeing soil boring.

Health and Safety Officer

Field personnel as required by the Health and Safety Plan (HASP) prepared for these activities will perform health and safety monitoring to ensure the protection of field personnel from potential hazards. This individual will perform safety and health briefings in the field for all personnel and will track all safety and health related activities. This individual will have the authority to stop fieldwork if health or safety issues can not be immediately resolved in accordance with the HASP.

Table 1
Project Personnel

Position	Company	Name	Telephone	Fax
Program Manager	S&W	Lester Tyrala	617-589-8028	617-589-2160
Project Manager	S&W	Ron Richards	617-589-5499	617-589-2160
Field Manager	S&W	Jim McComiskey	617-589-5810	617-589-2160
Health and Safety Officer	S&W	Mat Scheller	617-589-5216	617-589-2160

The field personal may change due to availability at the time of sampling.

2.5 Subcontract Services

To support field activities described in this SAP, services such as sample analysis, soil borings, waste removal, and data validation will be subcontracted. The preliminary subcontractors selected for this project are listed in Table 2. The subcontractors, where noted, are preliminary since the project schedule is over a long period of time that may result in conflict with subcontractor schedules and capacity at the time of sampling. Equivalent services may be obtained in these instances.

Table 2
SUBCONTRACT SERVICES

Company	Location	Responsibility
Severn Trent Laboratories	Westford, Ma	Sample Analysis
New Hampshire Boring	Londonderry, NH	Soil Borings
Kestral	Freeport, Me	Data Validation

3.0 SAMPLING RATIONALE

The environmental investigation will be completed within three acres of land in Lawrence, Massachusetts, immediately northwest of the intersection of Canal Street and the Spicket River (refer to the Locus Plan attached as Figure 1). A small portion of the Site is also located north of Canal Street on the eastern bank of the Spicket River. The Site is transected by a raceway, which discharges to the Spicket River.

The sampling provided herein is intended to define the extent and characteristics of contamination on the south side of the raceway. The sampling is designed to meet the requirements of the MCP and Toxic Substances Control Act (TSCA) regulations. Table 3 is provided to outline the target analytes.

After the buildings are removed, the basement floor (concrete pad) will be penetrated at predetermined sample locations and direct push samples will be collected in accordance with Stone & Webster Geoprobe Soil Sampling Survey Standard Operating Procedure (SOP 5) in Appendix E. Proposed sample locations are shown on Figure 4.

- Building No. 1 – samples will be collected from five locations;
- Building No. 2 – samples will be collected from four locations;
- Building No. 3 – samples will be collected from 44 locations;
- Building No. 4 – samples will be collected from two locations;
- Building No. 5 – samples will be collected from one location;
- Building No. 6 – samples will be collected from six locations;
- Building No. 13 – samples will be collected from four locations;
- Building No. 28 – samples will be collected from six locations

The above mentioned sampling points are deemed to be sufficient to characterize the soil conditions beneath each building and are based upon the TSCA PCB requirements. These samples will be analyzed for PCBs, Pesticides, VOC's, RCRA 8 + Be & Zn, and PAHs. The actual number of sample locations and analytical parameters may vary based on the conditions found in the basements. The conditions include the number of floor drains observed, the competency of the basement floor, and the results of waste stream analysis of materials found in each basement. Table 4 identifies the number of samples and type of analysis. Sample locations are general for MCP compliance.

In addition, to address TSCA PCB requirements, a 25-foot grid is proposed for building basements. Using this grid, an estimate 44 sample shall be collected from Building #3 basement. The above locations, in addition to being used for the MCP sampling would be sampled for the TSCA PCB requirements. At a minimum, an additional 10% of the number of grid samples described above will be utilized to delineate any potential hotspots.

The dimensions of Building #3 are approximately 150 feet by 350 feet. Since the soil under the concrete basement floor is geologically similar, pathways of PCB contamination could be seepage of the oil through the thick concrete floor or seepage through any cracks and holes that may exist. Since the permeability of concrete with respect to PCB oils is relatively high, it would be anticipated that any PCB materials that seeped through the floor would spread out somewhat in a widely dispersed pattern over a period of time (as opposed to a point source). Any holes or cracks would be potential point or line sources. Based upon this analysis and the geostatistical analysis done by GenCorp (Phase II Demolition Main Buildings Project, Supplemental Sampling and Analysis Program," Camp, Dresser & McKee (March 1996)), it is proposed to implement a sampling program that focuses on both seepage and "point sources". To this end, it is proposed to sample areas where a visible hole or crack existed, focusing on sampling at visible staining and locations where known breaks had been present in the floor. At least 10% of the samples will be selected based on this focus. To detect any seepage through the concrete, the sampling program will focus on a grid 25 feet on center to detect any seepage that may have occurred through the concrete. This grid is sufficient to detect any seepage that would have occurred through the floor since the seepage would be diffuse and spread out due to the long time periods involved.

3.1 Building No. 3 Sub-Basement Characterization

Building No.3 is the largest single building on the Oxford Paper Mill Site. A mobile laboratory will be on-site to expedite soil characterization of the Building No.3 sub-basement. Samples will be analyzed by the mobile laboratory for: PCBs by modified EPA Method 8082; Lead by XRF; and PAHs by EPA Method 8015 (See SOP 10). Samples will be collected from 0 to 0.5 (ft.) below the basement floor (bbf), 0.5 to 2 (ft.) bbf, and 2-4 (ft.) bbf. A discrete sample will be taken from the first six inches of soil, followed by samples taken from the subsequent 2-foot intervals. Sampling within each 2-foot depth interval will be biased toward visually stained soil. All samples will be submitted to the onsite laboratory. Initially, the 0-0.5 (ft.) bbf interval from each sampling location will be analyzed at the on-site laboratory and at the off-site laboratory. If contaminants of concern (COC) are not present above S-3/GW-3 levels of the MCP (Table 3) in the 0 to 0.5 (ft.) sample at a given location, then samples collected below that depth interval will not be analyzed unless visual staining is present. If one or more COC is above its respective MCP S-3/GW-3 standard, then both the 0.5 to 2 ft. and 2-4 ft bbf intervals will be analyzed. If the 4-6 ft bbf sample has one or more COC above its respective MCP S-3/GW-3 standard (except for background PAHs), then the next six-foot depth interval (6-12 ft bbf) will be sampled and analyzed by the field laboratory. At the twelve foot level, if contamination still exists above the S-3/GW-3 level (but below the TSCA action level), if the soil is well characterized and contamination levels are decreasing, then based upon the LSP's judgement, no additional actions may be necessary. If COCs are not present at concentrations of concern then sample intervals collected below the depth interval would not be analyzed, unless observations indicate otherwise. This process will be repeated until all COCs in a sample are less than their respective MCP S-3/GW-3 standard.

All samples collected will be field screened for VOCs using a Photo Ionization Detector (PID). After the initial 0-0.5(ft) bbf sampling, samples with PID readings greater than 10 parts per million (ppm) will be analyzed for COCs by the onsite laboratory and will be submitted to the off-site laboratory for VOC analysis by EPA Method 8260.

Samples will be sent to the offsite laboratory at a frequency of 100% for the 0-0.5 (ft) bbf samples. The first interval of samples will provide the comparability criteria, which will determine the percent of samples that will be sent to the off-site laboratory. If, in the first sample interval, the concentrations of PCBs in the soil are consistently below 1 ppm, the City will evaluate the economic feasibility for the continued use of the mobile lab. Samples from the following intervals will be analyzed on-site and the pre-determined percent will be sent off-site. The depth, at which contamination ceases to exist in a sampling location, that sample will be sent to the offsite lab for confirmatory analysis. Soil samples will be submitted to an off-site laboratory (in accordance with SOP 8 included in Appendix E) for analysis within a 48-hour turnaround time. Confirmatory samples will be analyzed for PCBs by EPA extraction Method 3500/3550B and modified EPA Method 8082, Pesticides using EPA Method 8081, RCRA 8 + Zn & Be using EPA Method 6010B/7471A, selected VOC's using EPA Method 8260B, and PAHs by EPA Method 8270 (See SOP 10). Quality Assurance/Quality Control (QA/QC) samples will be collected as follows for the parameters in Table 6:

1. Sample Duplicates will be collected at a frequency of 10%
2. Rinsate Blanks will be collected at a frequency of 5% or daily, whichever is the higher frequency
3. Matrix spike/matrix spike duplicates (MS/MSD) will be collected at a frequency of 5%.
4. One trip blank will be included in each cooler containing VOC and VPH samples

The feasibility of using the mobile lab will be determined based on preliminary data from the basement concrete sampling, initial soil sampling, and cost effectiveness. Based upon initial sampling results, if low levels of site contaminates are detected in the soils beneath the basement, the mobile laboratory may be eliminated. All samples will then be sent to the fixed laboratory for analysis. The mobile laboratory will be utilized on a cost-effective basis.

3.2 Remaining Buildings – Sub-basements Characterization

Characterization of the sub-basements beneath the remaining buildings will be identical to the Building No. 3 process with the possible exception that samples characterized by the rapid analysis methods may be done at a fixed base laboratory rather than in an onsite mobile lab. This decision will be based on the cost effectiveness of bringing an onsite mobile lab for the number of sampling points that can be accessed at the time of each characterization mobilization. Table 4 outlines the type of sample to be collected at each location and the analysis required for each sample. The table includes background and QC samples.

4.0 ONSITE OPERATIONS, MONITORING AND SAMPLING

Activities related to this SAP will involve the sampling of soils and air (for the purposes of site health and safety monitoring. This section outlines overall site operations such as monitoring for health and safety, utility clearance, access, waste handling, and building specific plans.

4.1 Site Monitoring

A Health and Safety Plan (HASP) has been prepared for the protection of field personnel performing work as described in this SAP. The HASP is attached as Appendix G and out lines the monitoring to be performed for the protection of field personnel. Monitoring for airborne parameters for the protection of the health of site workers will include monitoring for organic vapors and explosivity in the ambient air and breathing zone. Measurements will be made each day at the start of site activities and at fixed time intervals during the day. Action levels and monitoring methods are outlined in the HASP.

4.2 Utility Clearance

One to two weeks prior to conducting intrusive field investigations, Stone & Webster will notify Dig Safe and obtain utility clearance as applicable (Note: only good for problem areas). Stone & Webster will provide proposed sampling locations and they will designate the locations of all subsurface utilities with spray paint or other markings.

4.3 Quality Control Sampling

In addition to regular field samples, quality control (QC) samples will be collected. Field QC sample types include trip blanks, temperature blanks, equipment rinsate blanks, and duplicates. The QAPP prepared for this effort describes the guidelines for determining type and number of QC samples to be collected. The following is a brief description of the types of QC samples that will be collected as part of this effort:

MS/MSD samples are collected at a frequency of 5% to assess the precision and accuracy of the sample collection and testing process. A sample is split into three aliquots, two of which are spiked in the same manner with representative compounds. All three aliquots are analyzed. The percentage of spiked compound concentrations recovered provides a measure of accuracy as well as potential matrix effects, while the percent difference between the spike and spike duplicate percent recoveries provides an indicator of precision.

Field duplicates provide a measure of the precision associated with sampling and testing, as well as sample homogeneity.

The Laboratory Control Sample (LCS), also known as a blank spike, is a laboratory quality control check on the accuracy of the sample preparation and testing process.

Several types of blank samples are employed. A method blank is a laboratory control to assess possible introduction of laboratory contamination. Trip blanks are used exclusively for volatile organic compound analysis. They consist of sample containers containing a blank matrix. They are shipped with the field sample containers, kept in the field for the duration of a sampling event (typically one or two days), then returned with the collected field samples to the laboratory for testing. The trip blank sample container is not opened in the field. It assesses the potential migration of volatiles into the capped sample container. One trip blank must accompany every cooler containing volatile samples. Rinseate blanks are collected daily. They are analyte-free water rinses of sampling equipment. Their purpose is to assess decontamination efficiency.

5.0 SAMPLING EQUIPMENT AND PROCEDURES

5.1 Field Equipment Calibration

Each instrument and measuring device that is used for conducting field tests will be maintained to ensure accuracy. The instruments and equipment will be calibrated twice daily (prior to its first use in the morning and prior to first use after lunch break) or on a scheduled, periodic basis according to manufacturer instructions. The testing and screening equipment will be calibrated as specified by the manufacturer and in accordance with Standard Operating Procedure (SOP) 1 and 2 (Appendix E). If calibration results are not as expected, adjustments will be made to the instrument as required by the SOP.

The types of field monitoring equipment that will require calibration includes the following:

- Oxygen/LEL – Explosivity Monitor
- Organic Vapors - Photoionization Detector (PID);
- Carcinogenic PAHs RaPID Assay; and
- PCB RaPID Assay.

Lower Explosive limit (LEL) and PID will be used continuously during site assessment activities to screen ambient levels. In addition the PID will be used for field screening. PAHs and PCBs will be utilized for up to 10 samples in which elevated levels of PAH and PCB are believed to be present. This field screening analysis will be suitable to use as a stand-alone test. The specific SOP for the applicable field analysis method governs calibration of field instruments, which will be performed at the intervals specified in the SOP (SOP 1 and 2, Onsite Air Monitoring, and Onsite Analytical Screening respectively). Field instruments will be calibrated at intervals specified by the manufacturer. Calibration procedures and frequency will be recorded in the field logbook. Calibration information will include the following:

- date/time;
- project number;
- project name;

- name and signature of person performing the calibration;
- equipment type and model number;
- manufacturer and lot number of standards; and
- calibration result.

5.2 Field Documentation

The following is a summary of the requirements for recording the conditions during fieldwork. Emphasis is placed on sample designation and documentation procedures that will be followed during sample collection to ensure that samples collected can be easily tracked. In addition, SOP 3 (Field Notebook Content and Control) includes field notebook documentation procedures.

5.3 Sample Designation

Every sample location will have a unique identifier. Matrix/media identifiers will begin with one of seven two-letter codes:

- **SB** indicates that the samples were collected from a soil boring location;
- **SS** indicates that the samples were collected from a soil sample location;

The individual samples will be identified by 'OM' to indicate Oxford Mill, the building area number, the two-letter code, and the predetermined numerical counter. For soil samples, a number string in parentheses follows, indicating the depth of the sample. For example, the sample number for a soil boring sample collected from study area 5 from 0 to 1 foot would be OM05SB01(0-1).

The format for sample identifiers is:

Study Area[1]	***AA***	***00***[2]	***(00-00)***[3]
1-6	Letter Code SB – Soil Boring SS – Soil Sample	Two Digit Counter	Depth from which sample was collected, if applicable.

Notes:

[1] Samples retrieved for reference will be marked with an "RS" for Reference Sample.

[2] The next available counter will designate duplicate samples for the media in which the sample was taken in order to be blind to the laboratory.

[3] Additional notation will be added to the end of a sample identifier to indicate QA/QC notation (MS/MSD, RB etc.).

5.4 Sample Information Documentation

Each sample bottle will be identified with a separate identification label as indicated in SOP 8. Labels may be pre-printed and/or augmented by notations made in indelible/waterproof ink. Entry errors will be crossed out with a single line, dated, and initialed. Each securely fixed label will include:

- project identification;
- sample identification;
- samplers name;
- preservatives added;
- type(s) of analysis(es) to be performed; and
- date and time of collection.

5.5 Preparation of Field Logbooks

All information relating to collection of field samples, including personnel names, sampling method, location, conditions, date and time, sample numbers, equipment calibration, and observations shall be recorded in a bound field notebook. Field boring logs and well diagrams, when required for a particular task, are also considered part of the field documentation. The field logbooks used will be bound with lined, consecutively numbered pages. Each field team will maintain separate field books, as necessary. The following information shall be recorded inside the front cover of the logbook:

- Person and organization to whom the book is assigned (with signature), and phone number(s);
- Start date;
- Project name [Oxford Mill Site Closure];
- Job Number;
- Field Operations Manager's name; and
- Sequential book number (if applicable).

The assigned person will make all entries to a logbook. Any transfer of the logbook to a different person will require a signature and date from both the original assignee and the new person. Field notes will include identification of field control samples such as duplicates, split samples, MS/MSDs, equipment rinsate blanks, etc. Monitoring instrument readings and calibration information will also be noted in the logbook. Other specifics regarding logbook entries, corrections, and opinions are discussed in SOP 3 (Field Notebook Content and Control). The same requirements will be imposed on all field subcontractors.

5.6 Photographs

Photographs may be taken of sampled areas in support of the information written into the logbook. The date, time, weather conditions (if applicable), subject, purpose of taking photograph, person taking the photograph, photograph identification number and identifying number from roll will be recorded in the field logbook. This recorded information will be transferred to the back of the photograph after the photographs have been developed. Digital photography may be used if the resolution is sufficient for the project needs.

5.7 Sample Location Survey

Sample locations will be surveyed using either traditional surveying equipment or a global positioning system. Traditional surveying methods will be utilized to accurately determine the ground surface elevations. The surveyed sampling locations will be incorporated into the existing "OPM" site database and will be used to generate sample location figure.

6.0 DECONTAMINATION PROCEDURES

6.1 Equipment

The goal of decontamination is to eliminate cross-contamination resulting from the use and reuse of sampling equipment. Detailed equipment decontamination procedures are outlined in SOP 6 (Equipment Decontamination). Equipment requiring decontamination during the project may include the following:

- Large Equipment: Large equipment such as drill rigs and augers may become contaminated during field activities. Gross contamination of equipment will be removed in the exclusion zone before bringing the equipment into the pre-determined concrete-lined decontamination area. Equipment will be washed with alconox or TSP and water solution, followed by a pressurized clean water rinse.

- Tools and Sampling Equipment: Contaminated tools and equipment including, sampling buckets, split spoons and bailers, will be decontaminated in suitable containers, such as plastic tubs using soap & water.

Downhole and sampling equipment will be decontaminated onsite before first use, between sampling intervals, and just prior to demobilization to prevent cross-contamination.

Material and equipment, which are exposed to PCB contamination, will be decontaminated in accordance with §761.79. Decontamination fluids will be transferred to the On-site treatment system. Solid and liquid residues which could not be treated on-site will be packaged and shipped off-site for disposal. Personnel conducting equipment decontamination will wear appropriate personal protective equipment (PPE) as required in the HASP prepared for this project. The Standard Operating Procedure for Equipment Decontamination (SOP 6) is located in Appendix E and the PCB Decontamination Regulations §761.79 are attached to the SOP.

6.2 Personnel

Personnel decontamination is described in the HASP. Decontamination procedures include personal hygiene and properly removing and cleaning PPE. Detailed personal protective equipment guidelines are outlined in SOP 9.

6.3 Investigation-Derived Waste

Field personnel will characterize IDW as outlined in SOP 7 (Cuttings and Fluids Management). IDW will be managed onsite to the extent reasonably feasible to minimize the volume of waste requiring shipment and offsite management. IDW includes decontamination fluids, soil cuttings, and PPE. IDW associated with activities outlined in this SAP include, but are not limited to:

- Soil: Soil IDW generated during the field investigation will be inspected for visual and olfactory evidence of contamination. Soils that exhibit VOC concentrations below site-specific "action levels" will be returned to the point of collection. For any soil contaminated with PCBs at a concentration of 1.0 ppm or above, the applicable action level specified will be used for disposal offsite in accordance with applicable regulations. Soil that exceeds the action levels will be containerized in 55-gallon drums, or other appropriate container, for subsequent management. Drums will be labeled with permanent ink in a contrasting color. The label will include the following:

☐ Date the IDW was generated;
☐ Facility name [Oxford Paper Mills];
☐ Facility contact and phone number;
☐ Sample location identification(s); and
☐ Highest headspace screening result and/or visual and olfactory observations.

- Liquid: Liquid IDW generated during the field investigation will include decontamination liquids. Water that exhibits VOC concentrations below site-specific "action levels" will be returned to the point of collection. If liquids exceed the action levels, they will be containerized in 55-gallon drums for subsequent management. Drums will be labeled with permanent ink in a contrasting color. The label will include the following:

☐ Date the IDW was generated;
☐ Facility name [Oxford Paper Mills];
☐ Facility contact and phone number;
☐ Well identification(s); and
☐ Visual and olfactory observations.

- Solid Waste: Solid waste includes PPE and other consumables used during field investigations. Solid waste will be removed as normal waste/trash.

Management of IDW will be conducted according to state and federal regulations. Offsite disposal characterization requirements for soil and liquid will be determined based on sample analyses. Specifically, laboratory results from the soils/liquids collected from sample locations contained in a waste drum will be used to determine the appropriate disposal option.

7.0 SAMPLE HANDLING, ANALYSIS AND CUSTODY REQUIREMENTS

When handling samples in the field and in the laboratory, care should be taken to ensure the integrity of the samples is maintained at all times. Samples must be collected, transported, and received under strict chain of custody protocols consistent with procedures established by the EPA for litigation-related materials. Sample containers will be provided by the laboratory and will be prepared in accordance with EPA and laboratory protocols. Required sample containers, preservation methods and holding times are detailed in the QAPP. A list containing the number of sample jars and required preservatives and the laboratory analysis and methods are summarized in Tables 5 and 6 respectively. The following subsections describe the steps to be taken in the field when collecting samples and preparing them for shipment to the analytical laboratory.

7.1 Field Preservation

Depending on the analyses proposed for the samples collected, chemical field preservation may be required. The preservative will be noted both on the sample labels and on the respective chain-of-custody for the sample. Sample preservation requirements for all sampling and test methods are expected to be employed on this project. The sample preservation requirements are detailed in the QAPP and summarized in Tables 5 & 6. Note that the preservative may be present in laboratory provided glassware. In which case, chemical field preservation would not be required.

As a minimum, all samples being analyzed for chemical analyses will be placed on ice immediately following collection. The temperature and trip blanks as required will be placed in the coolers at the same time as the ice (i.e. at the start of the sampling event) to ensure they receive adequate cooling. This will ensure they are representative of the temperature of the samples prior to transferring custody of the samples to the analytical laboratory. Enough ice should be placed in the coolers in order to completely cover all samples and maintain the temperature of the cooler and its contents are less than or equal to 4°C.

7.2 Packaging and Shipping

The packaging and shipping of samples will be controlled to prevent damage or deterioration, in accordance with SOP 8 (Labeling, Packing, and Shipping Environmental Samples).

A properly completed chain-of-custody (COC) form shall accompany all sample shipments. The chain-of-custody description section requires the following:

- the sample identification number;
- types and quantities of containers and preservation techniques;
- date and time of collection;
- sample media;
- name and signature of the sampler(s) and the person shipping the samples;
- the date and time that the samples were delivered for sampling; and
- the names of those individuals responsible for receiving the samples at the laboratory (to be filled out at the laboratory).

QC samples and trip blanks are shipped with the other field samples. There must be at least one trip blank in each shipping container that has volatile samples. Temperature blanks are required for each cooler that is temperature dependent (e.g., 4° C).

When sending samples for the RCRA-8 analysis, the COC should indicate the zinc and beryllium should be included.

Environmental samples will be transported to the laboratory via the most rapid means. In some cases, the subcontracted analytical laboratory may pick up the samples at the site. All shipments of samples will be in compliance with applicable United States Department of Transportation (DOT) regulations.

7.3 Cooler Receipt

The condition of shipping coolers and enclosed sample containers, including the results of all checks for temperature and pH preservation, will be documented upon receipt at the analytical laboratory. This documentation will be accomplished using the cooler receipt form to be completed by the laboratory. A copy of the completed cooler receipt form will also be transmitted with the final analytical results from the laboratory.

7.4 Laboratory Sample Handling and Custody Procedures

Laboratory custody procedures, along with the holding times and sample preservative requirements for samples, will be described in the laboratory's QA Program documents contained in the QAPP. These documents will identify the laboratory custody procedures for sample receipt and log-in, sample storage, tracking during sample preparation and analysis, and laboratory storage of data. Table 5 contains the number and type of bottles required, and preservation methods. Table 6 contains the laboratory preparation and analysis methods.

Table 3
Target Analytes

Compound	MCP S-3/GW-3	S-1/GW-3	UCL
	(expected cleanup level most areas) mg/kg (ppm)	mg/kg (ppm)	ug/g (ppm)
Acenaphthene	4000	1000	10000
Acenaphthylene	1000	100	10000
Anthracene	5000	1000	10000
Benzo(a)anthracene	4	0.7	100
Benzo(a)pyrene	0.7	0.7	100
Benzo(b)fluoranthene	4	0.7	100
Benzo(k)fluoranthene	40	7	400
Benzo(ghi)perylene	2500	1000	10000
Chrysene	40	7	400
Dibenzo(a,h)anthracene	0.8	0.7	100
Fluoranthene	1000	1000	10000
Fluorene	4000	1000	10000
Indeno(1,2,3-cd)pyrene	4	0.7	100
Naphthalene	1000	100	10000
Phenanthrene	100	100	10000
Pyrene	5000	700	10000
RCRA 8 + Zn & Be			
Polychlorinated Biphenyls	1*	1*	100
* “walk away level” for TSCA			

TABLE 5
SAMPLE CONTAINERS AND PRESERVATION METHODS

Analysis	**No. & Type of Bottles***	**Preservation**
RCRA-8 + Zn & Be (solid)	1 - 8 oz. Glass jar	Not required
Selected VOCs (solid)	Encore sampler	4°C, sodium thiosulfate within 48hrs
PAH's	1 - 8 oz. Clear wide mouth glass jar	4°C
PCBs (solid)	1 - 8 oz. Clear wide mouth glass jar	4°C
Moisture Content	Clear glass jar	Not required

*Note: Laboratory may require additional sample volume (e.g. ms/msd sample require triple the volume)
**: Rinsate blanks shall be collected for PAHs ((2) 1L amber bottle), PCB ((2) 1L amber bottle), and metals ((1) 500ml bottle). A field blank of clean sand will be collected in a encore for volatiles.

TABLE 6

LABORATORY ANALYSES AND METHODS

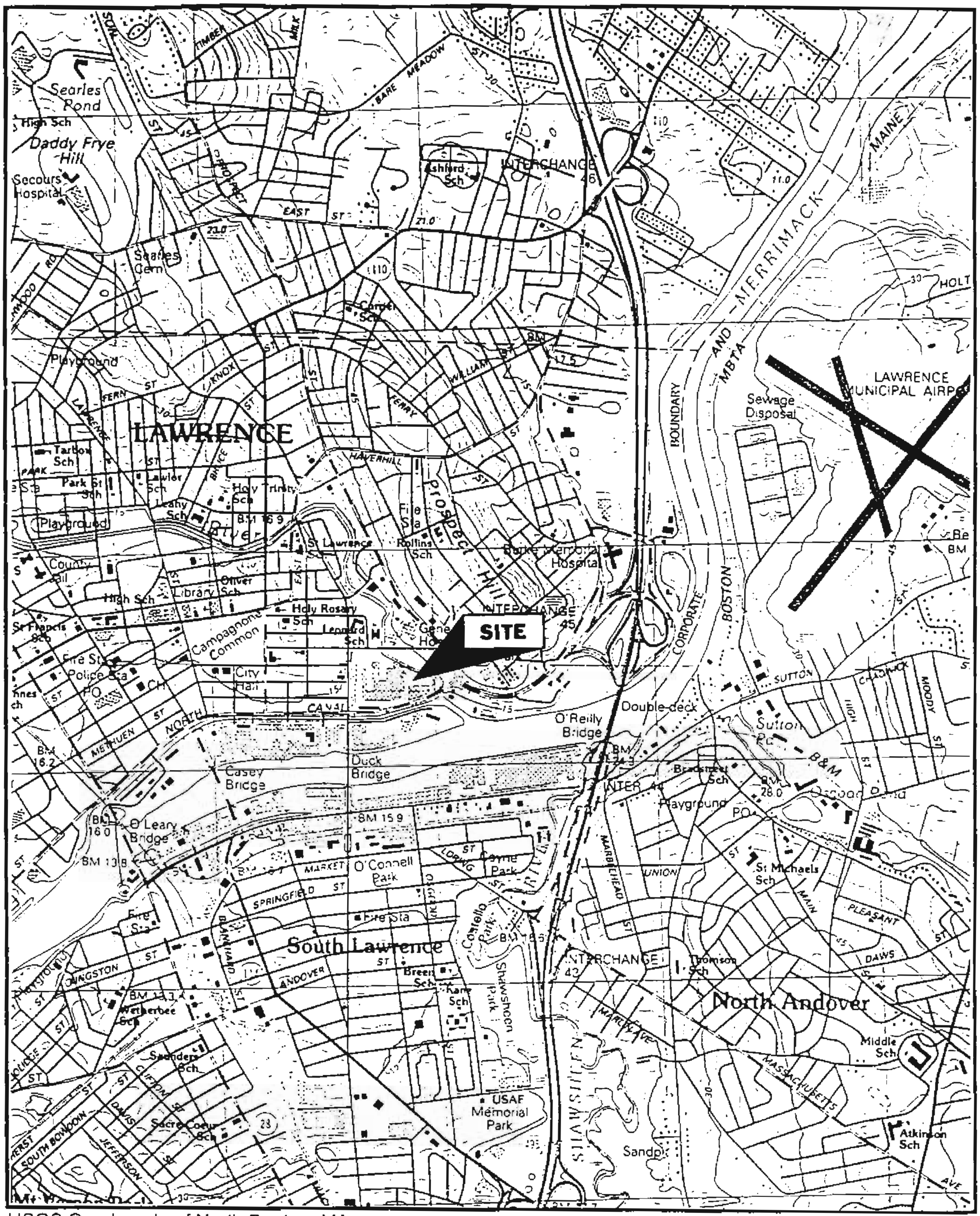
Sample Media	Parameter(s)	Preparation Method(s)	Analysis Method(s)
Soil	Selected VOCs	5035	8260B
	PAH'S	3550C	8100
	PCBs	3550B	8082
	RCRA-8 + Zn & Be	3050B	6010B/7471A

Notes:

1. "SW" refers to *Test Methods for Evaluating Solid Wastes, Physical and Chemical Methods, SW-846,* U.S. Environmental Protection Agency, 1986, as amended.
2. For sample preparation of soil for organic analysis Method 3550B, Ultrasonic Extraction shall be used except for tightly packed soils and clays for which Method 3540C/3541, Soxlet Extraction and/or Automated Soxlet Extraction, shall be used.

SAP

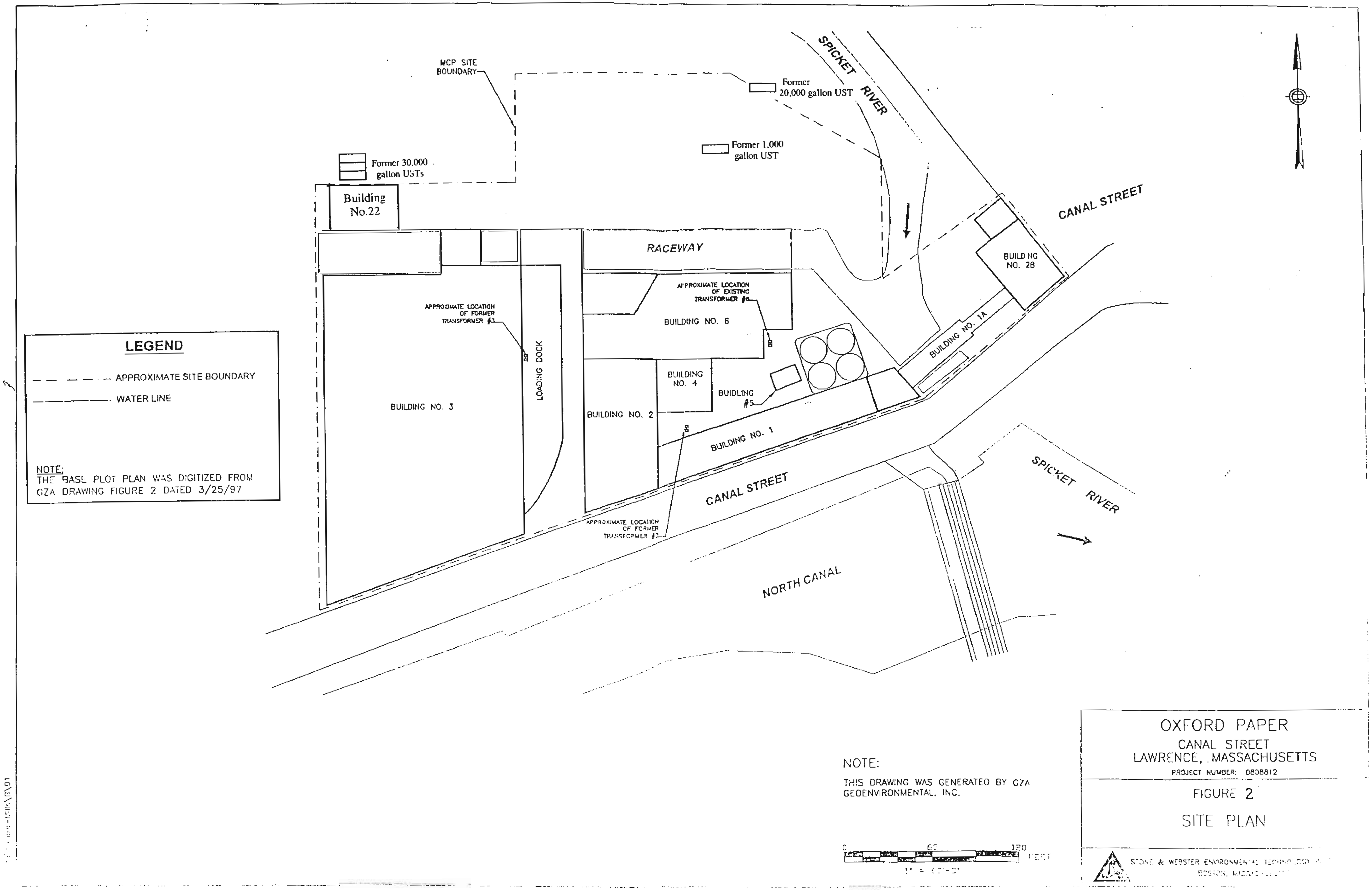
Figures



USGS Quadrangle of North Boston, MA
7.5 x 15 minute Quadrangle

SCALE 1:25,000

FIGURE 1 - LOCUS MAP



LEGEND

— — — — APPROXIMATE SITE BOUNDARY

———— WATER LINE

NOTE:
THE BASE PLOT PLAN WAS DIGITIZED FROM GZA DRAWING FIGURE 2 DATED 3/25/97

NOTE:
THIS DRAWING WAS GENERATED BY GZA GEOENVIRONMENTAL, INC.

OXFORD PAPER
CANAL STREET
LAWRENCE, MASSACHUSETTS
PROJECT NUMBER: 0808812

FIGURE 2

SITE PLAN

STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY
BOSTON, MASSACHUSETTS

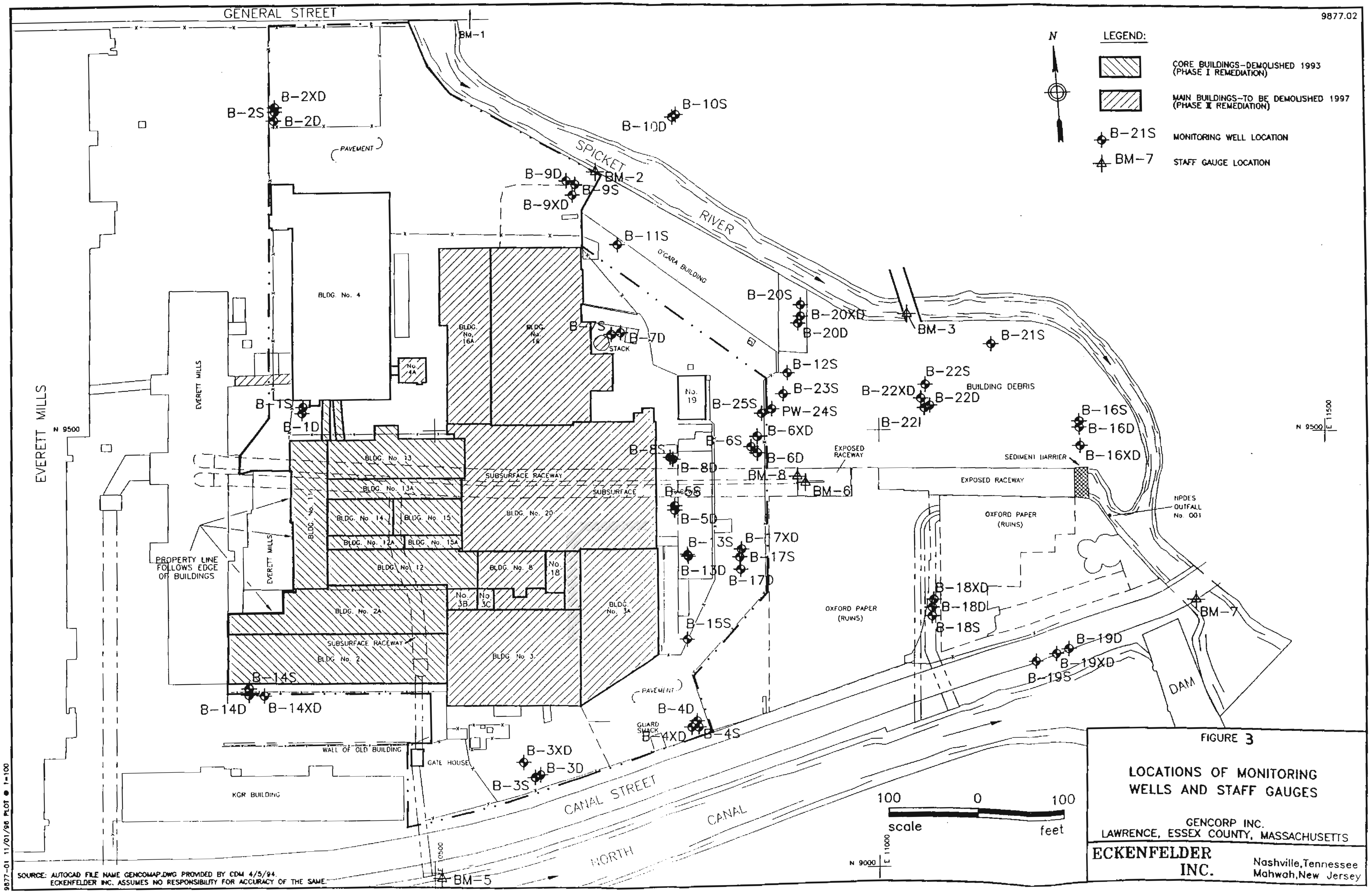


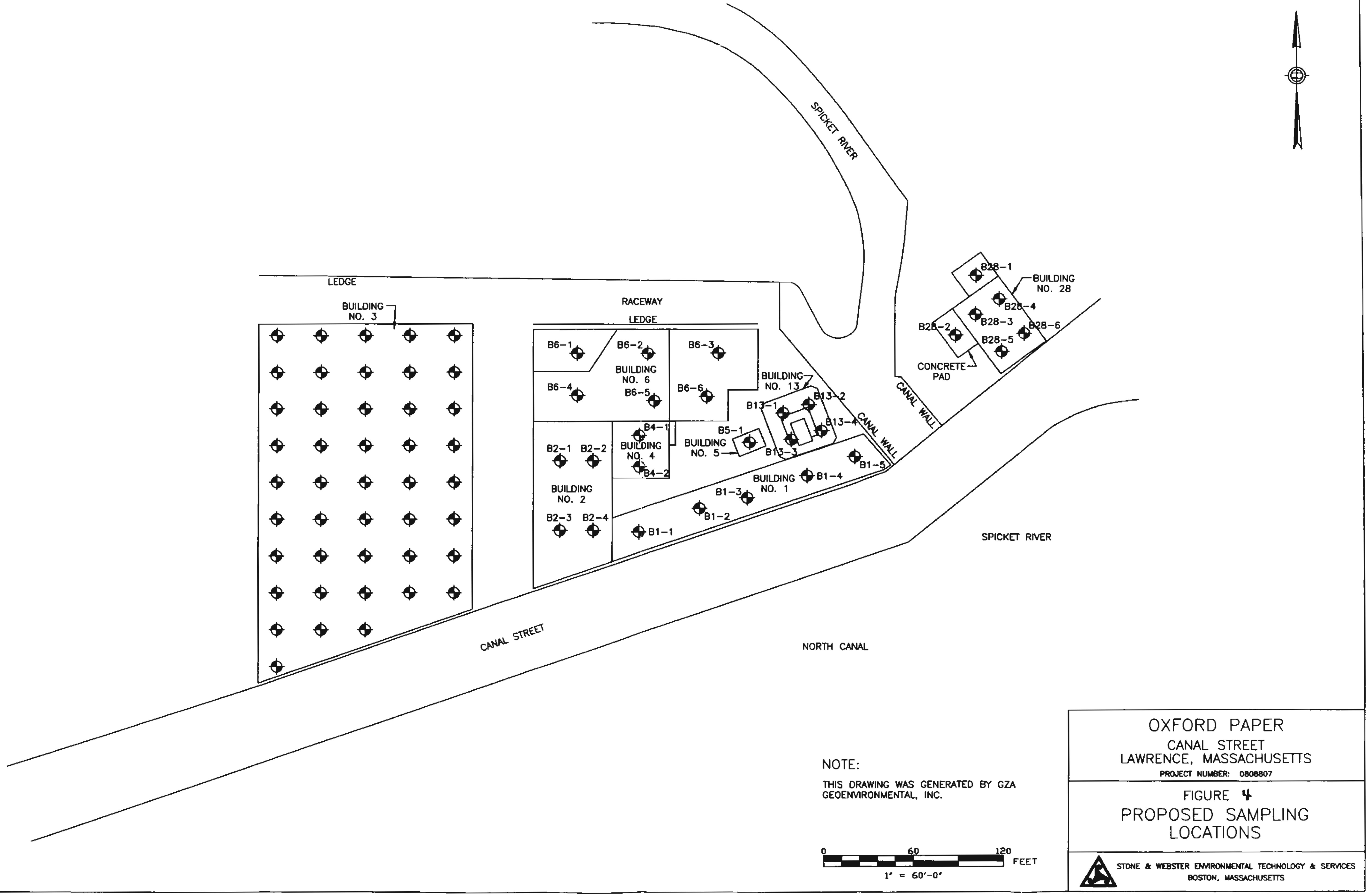
FIGURE 3

LOCATIONS OF MONITORING WELLS AND STAFF GAUGES

GENCORP INC.
LAWRENCE, ESSEX COUNTY, MASSACHUSETTS

ECKENFELDER INC.
Nashville, Tennessee
Mahwah, New Jersey

SOURCE: AUTOCAD FILE NAME GENCOMAP.DWG PROVIDED BY CDM 4/5/94.
ECKENFELDER INC. ASSUMES NO RESPONSIBILITY FOR ACCURACY OF THE SAME.



NOTE:

THIS DRAWING WAS GENERATED BY GZA GEOENVIRONMENTAL, INC.

OXFORD PAPER
CANAL STREET
LAWRENCE, MASSACHUSETTS
PROJECT NUMBER: 0808807

FIGURE 4
PROPOSED SAMPLING LOCATIONS

STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY & SERVICES
BOSTON, MASSACHUSETTS

C:\Data\Oxford-Mills\esk\B\02\base.dwg
14-February-2001

APPENDIX A

Project Personnel Experience Summaries

Ron Richards, PE, LSP, LEP

Project Manager
Stone & Webster Engineering

Mr. Richards has more than 25 years of environmental project management and remediation experience. He has managed investigation programs focused on projects in New England. His experience in site investigations range from simple sites with well-defined groundwater flow to filled sites where contaminate migration pathways were the filled streambeds. Through his experience and depth of understanding contaminant behavior, he will provide a direct focus to the program.

Mr. Richards is a registered Professional Engineer and Licensed Site Professional (License # 4488).

LESTER M. TYRALA

Program Manager
Stone & Webster Engineering

Mr. Tyrala has over twenty years in the environmental field, specializing the geotechnical and management aspects of consulting. He is well-versed in project management and planning; proposal preparation, preparation and administration of contracts, planning of budgets, supervision of staff, and recommendations to client. Mr. Tyrala has significant experience in all aspects of geophysical land and marine investigations, geological site assessments, and an extensive knowledge of the wide range of drilling technologies from water well to oil field, responsible for monitoring well installations, managed large drilling projects.

Licenses, Registrations, and Certifications

Delaware State Board of Registration of Professional Geologists, No. 337, 1983
OSHA HAZWOPER 40 hour training plus annual 8 hour reviews
OSHA Supervisor 8 Hour

James McComiskey

Lead Field
Stone & Webster Engineering

Mr. McComiskey has over 6 years of experience in the environmental area. His current responsibilities include support of projects involving multidisciplinary environmental assessments, and hazardous waste activities.

Prior to joining Stone & Webster in July 1997, Mr. McComiskey was a Project Manager at Environmental Science Services, Inc. (ESS). He was responsible for the management of air measurement projects, including the management of budgets, and conducting and overseeing of field activities.

Prior to joining ESS, Mr. McComiskey was an Environmental Engineer with York Services Corporation. He was responsible for the management of field activities and development of equipment maintenance SOP's.

Education

B.S. , Engineering Technology Environmental - Norwich University Military College of Vermont - 1993

Brian J. Tucker

Current Corporate Title

Task Scientist

Experience Summary

Dr. Tucker has more than 15 years of progressively responsible professional experience in the fields of hazardous and radioactive materials analysis, management of sampling and analysis activities for RI/FS projects, chemical quality assurance/quality control, nuclear power plant sampling system design, pollution prevention/waste minimization, analytical equipment design and construction, laboratory evaluation and design, remedial planning, and air monitoring for hazardous organics. He has been a Project Manager for multi-million dollar engineering and remediation projects and is currently a Task Scientist for Stone & Webster's Environmental Technology & Services group, where he develops and ensures implementation of Quality Assurance Project Plans, prepares and reviews Project Sampling and Analysis Plans, assesses laboratory practices and performance, and validates project data.

APPENDIX B

Field Personnel Sign-off Sheet

CONTROL COPY NO. 01

FIELD PERSONNEL SIGN-OFF SHEET

The undersigned field personnel have read the SAP and QAPP, including all associated appendices, prior to performing field work at the OPM site, and understand it's contents.

Name/Company	Date

APPENDIX C

Analytical Data to Date

Soils

	MCP Limits	G-17	B-18	G-18	B-19	G-19	B-20	B-21	G-21	B-22	G-22
Location in relation to the proposed sampling sites	(ppm)	North	Within	Within	South	South	North	North	North	North	North
PCB's (ppm)											
1242 (Total)	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1254 (Total)	2	ND	ND	ND	ND	0.165	ND	ND	ND	ND	0.34
Extractable compounds & Pesticides (ppm)											
Acenaphthene	20	ND	ND	4	ND	ND	ND	ND	ND	20	100
Anthracene	1000	ND	ND	7	ND	ND	ND	ND	ND	29	300
Benzo (a) anthracene	1	1	ND	19	ND	1	ND	ND	2	67	1100
Benzo (a) pyrene	0.7	1	ND	13	ND	1	ND	ND	1	ND	1000
Benzo (b) fluoranthene	1	2	ND	35	ND	2	ND	ND	2	ND	1900
3, 4 Benzo-fluoranthene		ND	ND	12.7	ND	ND	ND	ND		ND	ND
Benzo- (ghi)- perylene	2500	ND	ND	9	ND	1	ND	ND	1	24	530
Benzo (k) fluoranthene	1000	2	ND	ND	ND	ND	ND	ND	2	73	
bis (2-Ethylhexyl) phthalate	300	ND	ND	11	ND	1	ND	ND	1	50	530
Chyrysene	10	1	ND	13	ND	1	ND	ND	1	33	1
Di-n-butyl phthalate	500	ND	ND	ND	ND	ND	ND	ND	ND	47	
Fluoranthene	1000	3	ND	26	ND	2	ND	ND	2	100	2
Indeno (1,2,3, -cd) pyrene	1	ND	ND	11	ND	1	ND	ND	1	21	1
Naphthalene	1000	ND	ND	2	ND	1	ND	ND	ND	12	
Phenanthrene	100	2	ND	16	ND	2	ND	ND	2	100	1
Phenols	500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	2000	2	ND	32	59.5	2	ND	ND	2	80	2
Beta BHC	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals (ppm)											
Antimony	40	3.9	ND	ND	ND	ND	ND	ND	2.2	ND	4.3
Arsenic	30	4.58	ND	4.45	ND	5	1.45	ND	11	ND	5.5
Beryllium	0.8	0.53	ND	ND	ND	ND	ND	ND	0.96	ND	1.18
Cadium	80	0.44	ND	3.3	ND	1.4	ND	ND	ND	ND	ND
Chromium	2500	42.9	ND	21.2	ND	ND	3.8	ND	25.9	ND	ND
Copper	10000	32	ND	145	ND	40.8	16.6	ND	51	ND	97
Lead	600	260	ND	290	ND	78	32.5	ND	120	ND	15
Mercury	60	ND	ND	0.24	ND	43	ND	ND	0.68	ND	0.32
Nickel	700	48	ND	51	ND	ND	ND	ND	27	ND	15
Selenium	2500	ND	ND	ND	ND	ND	ND	ND	1.3	ND	ND
Zinc	2500	82	ND	525	ND	ND	24	ND	76	ND	59

CONTROL COPY NO. 01

Groundwater																	
Wells	**B-12S**	**B-16D**	**B-16S**	**B-16XD**	**B-18D**	**B-18S**	**B-19D**	**B-19S**	**B-19XD**	**B-20D**	**B-20S**	**B-20XD**	**B-21S**	**B-22D**	**B-22I**	**B-22S**	**MCP Limits (ppb)**
Location in relation to proposed sampling site	North	North	North	North	Within	Within	Within	South	South	North	North	North	North	North	North	North	
Volatile Organic Compounds (ppb)																	
Benzene	ND	ND	ND	ND	2.3	2.9	ND	ND	ND	2.7	ND	ND	ND	ND	ND	ND	2000
2- Chloro-ethyl vinyl ether	ND	ND	ND	1.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3	ND	ND	50000
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	1.3	ND	ND	ND	2.9	ND	ND	ND	400
Ethyl benzene	ND	ND	ND	ND	ND	ND		ND	ND	1.7	ND	ND	ND	ND	ND	ND	
Toluene	ND	ND	9	ND	ND	ND	2	ND	2	15	2	ND	ND	ND	ND	ND	6000
Methyl iso- butyl ketone (MIBK)	ND	ND	ND	ND	ND	ND	8.8	6.3	ND	ND	40.1	ND	ND	64	ND	ND	50000
Methyl Ethyl ketone (MEK)	ND	ND	ND	ND	ND	ND	7	ND	ND	ND	ND	ND	ND	44	ND	ND	50000
Acetone	ND	ND	ND	ND	ND	ND	22	9	6	24	ND	ND	ND	53	ND	ND	50000
Tetra- hydro- furan	ND	ND	ND	ND	ND	ND	7.8	ND	ND	ND	ND	ND	ND	40.6	ND	ND	50000
PCB's (ppb)																	
1242 (Total)	5.4	46.2	1	ND	0.5	ND	ND	ND	ND	0.6	29.9	ND	4.3	2.9	54.3	6.3	0.3
Extractable compounds & Pesticides (ppb)																	
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	70	50
Beta BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.09	ND	ND	1000
Metals (ppb)																	
Arsenic	ND	212	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	370	ND	ND	400
Chromiun	ND	84	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2000
Lead	ND	16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	30
Mercury	ND	ND	ND	ND	ND	ND	440	ND	ND	ND	ND	ND	ND	ND	ND	ND	1

APPENDIX D

Target Compound List / Target Analyte List

Target Analyte List (TAL) / Target Compound List (TCL)

RCRA 8 + Be & Zn
Arsenic
Barium
Beryllium
Cadmium
Chromium
Lead
Mercury
Selenium
Silver
Zinc

Volatile Organic Compounds (VOC) TCL
Acetone
Benzene
Carbon disulfide
Chloroform
1,2-Dichloroethane
Ethylbenzene
Vinyl chloride

Method 8100 PAHs
Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(j)fluoranthene
Benzo(k)fluoranthene
Benzo(g,h,i)perylene
Chrysene
Dibenz(a,h)acridine

Method 8100 PAHs
Dibenz(a,j)acridine
Dibenzo(a,h)anthracene
7H-Dibenzo(c,g)carbazole
Dibenzo(a,e)pyrene
Dibenzo(a,h)pyrene
Dibenzo(a,i)pyrene
Fluoranthene
Fluorene
Indeno(1,2,3-cd)pyrene
3-Methylcholanthrene
Naphthalene
Phenanthrene
Pyrene

Pesticides TCL
Beta-BHC

Polychlorinated Biphenyls (PCBs) TCL
Arochlor-1016
Arochlor-1221
Arochlor-1232
Arochlor-1242
Arochlor-1248
Arochlor-1254
Arochlor-1260

CONTROL COPY NO. 01

APPENDIX E

Standard Operating Procedures

SOP 1

Onsite Air Monitoring

STONE & WEBSTER ENGINEERING CORPORATION
ENVIRONMENTAL/INFRASTRUCTURE DIVISION
STANDARD OPERATING PROCEDURE

TITLE: Oxford Mill **Onsite Air Monitoring**	**NO.:**	SOP 1
	PAGE	1 of 5
	DATE:	March 2001

APPROVED:

Environmental/Infrastructure Division

1.0 PURPOSE

This Standard Operating Procedure (SOP) includes various **Air Monitoring** screening test method procedures. This Procedure provides the methods for identifying and quantifying hazardous substances, so that the appropriate level of protection can be determined. These methods may be employed to measure concentrations of Volatile Organic Compounds (VOCs), inorganic constituents, and/or particulates. The purpose of this procedure is to ensure Air Monitoring is conducted using well-developed techniques and methods consistently for the Oxford Mill sampling program.

2.0 SCOPE

This procedure details the materials, equipment, and methods common to employing various Air Monitoring methods. Always consult state-specific or program-specific requirements as well as manufacturer's instructions for equipment use to ensure compatibility of this SOP with project requirements. **Any changes to this SOP shall be discussed with the Project Manager prior to implementation and shall be documented in project log books.**

3.0 REFERENCES

Stone & Webster SOP SW-E/I-xx Lower Explosive Limit (LEL) Meter

Foxboro: Century OVA 128 Organic Vapor Analyzer Instruction, October, 1989

HNu Systems, Inc.: Model PI 101 Quick Start Manual

MINIRAE PGM-75 Instruction Manual

NUS Corporation: HNu PI 101 Standard Operating Procedure

NUS Corporation: OVA 128 Standard Operating Procedure

Weston: General Operating and Calibration Procedures for the HNu PID/OVA

4.0 DEFINITIONS

Electrode - A solid electric conductor through which current enters or leaves a medium.

Ion - An atom, group of atoms, or molecule having a net electric charge acquired by gaining or losing electrons from an initially neutral configuration.

Ionization Potential - The amount of energy, measured in electron volts (eV), required to ionize a specific atom or molecule.

Ultraviolet Light - Electromagnetic radiation with wavelengths just shorter than that of visible light.

5.0 RESPONSIBILITIES

5.1 OFFICE HEALTH AND SAFETY SUPERVISOR (OHSS)

The OHSS shall ensure that the user has been appropriately trained and certified in the usage of the aforementioned instruments. She/He shall also ensure that the instruments are properly maintained and calibrated prior to their release for field service.

5.2 INSTRUMENT USER

The user shall be personally secure that she/he has been adequately trained, and understands the operation and limitations of the instruments. The user should also be sure that the instruments have been calibrated and are working properly.

6.0 PROCEDURE

6.1 PHOTOIONIZATION DETECTORS (PIDs)

Photoionization systems detect the concentration of many organic gases as well as a few inorganic gases. The basis for detection is the ionization of gaseous species. The incoming gas molecules are subjected to ultraviolet (UV) radiation, which is energetic enough to ionize many gaseous compounds. The molecule is transformed into charged-ion pairs, creating a current between two electrodes. Each molecule has a characteristic ionization potential, which is the energy required to remove an electron from the molecule, yielding a positively-charged ion and the free electron. The instrument measures the current, which is proportional to the concentration of ionizable species.

6.1.1 HNU PI-101 Organic Vapor Meter

Three probes, each containing a different UV light source, are available for use with the HNu. Probe energies are 9.5, 10.2, and 11.7 electron volts (eV). All three detect many aromatic and large-molecule hydrocarbons. The 10.2 and 11.7eV probes, in addition, detect some smaller organic molecules and some halogenated hydrocarbons. The 10.2eV probe is the most useful for environmental response work, since it is more durable than the 11.7eV probe and detects more compounds than the 9.5eV probe. A combination of two or three of the probes can be used to provide additional data on the relative concentrations of different classes of hydrocarbons.

The primary HNu calibration gas is benzene (or isobutylene, since its ionization potential is equivalent). The span potentiometer knob is adjusted for benzene calibration. A knob setting of zero increases the sensitivity to benzene approximately ten-fold. The instrument's response can be adjusted to give more accurate readings for specific gases and eliminate the necessity for calibration charts. Calibration shall be performed daily.

The HNu PI-101 is a non-destructive analyzer; calibrations using toxic or hazardous gases must be done in a hood.

6.1.2 MiniRAE PGM-75

The MiniRAE PGM-75 Profession PID uses an interchangeable 10.6 eV electrodeless ultraviolet discharge lamp, powered by two rechargeable 6 V, 500 mAh sealed lead-acid, field replaceable batteries. This unit offers two different operating modes.

Industrial Hygiene Mode

In this mode of operation, the unit measures the air sample once each second and compares it with a preset peak alarm limit. These same measurements are also averaged over one minute intervals. The result value is used to compute Time Weighted Average (TWA) and Short Term Level (STEL) values which are themselves compared to preset alarm limits. In addition, the STEL values are captured and recorded every 15 minutes for up to 12 hours. A time stamp indicates when the unit was last turned on and off.

Site Survey / Leak Detection Mode

In this mode of operation, the unit measures the air sample once each second and compares it with a preset low alarm limit. A variable frequency alarm signal is generated in proportion to the magnitude of the measurement. When datalog is enabled, the average value or the peak value over a sampling period, which can be programmed to be 1 second to 9999 seconds (166 hours) is stored. The datalogging can be initiated manually (event driven) or the unit can perform continuous sampling (automatic). Up to 50 sets of sample readings with 24 hour time stamps can be recorded in this mode.

For both modes, MiniRAE utilizes a two-point calibration process using "zero gas" and standard reference gas. First, a "zero gas" which contains no detectable organic vapors (<1 ppm total hydrocarbons) is used to set the zero point (C0). Then a standard reference gas which contains a known concentration of a specific gas is used to set the second point of reference (C1). The calibration procedures are detailed in the MiniRAE Professional PID Operation and Maintenance Manual. To reduce the risk of ignition of hazardous atmospheres, recharge the MiniRAE battery only in areas known to be non-hazardous. Likewise, remove and replace the battery only in areas known to be non-hazardous. The programming function should not be performed in a potentially hazardous environment that requires continuous protection. The real time monitoring of gas concentration will be interrupted during the task.

6.1.3 Instrument Limitations

There are some limitations the operator should be aware of when using PIDs. They are as follows:

1. The PID is a non-specific, total vapor detector. It cannot be used to identify unknown substances; it can only quantify them.
2. The PID does not respond to certain low molecular weight hydrocarbons such as methane and ethane, and does not detect a compound if the probe has a lower energy than the compound's ionization potential.
3. Certain toxic gases and vapors, such as carbon tetrachloride and hydrogen cyanide, have high ionization potentials and cannot be detected with a PID.
4. Certain models of PIDs are not intrinsically safe.
5. Electrical power lines, radio transmissions, and power transformers may cause interference and measurement errors.
6. Winds and high humidity affect readings.
7. This instrument should not be used for head space analysis where liquids can inadvertently be drawn into the probe.

6.2 MIE PDM-3 AEROSOL MONITOR

The MIE PDM-3 Aerosol Monitor (MINIRAM) measures airborne concentration of aerosols, dusts, fumes, smoke, fogs, and particulates (both solid and liquid). It has a preferential response to particles sizing between 0.1 and 10 um. The system displays a 10 second average concentration in units of mg/m^3 (updated every 10 seconds). It also computes TWA and shift average (SA) on request.

MINIRAM uses a Gallium-Aluminum Arsenide light source to generate narrow band emission centered at 880 nm. It detects scattered electromagnetic radiation in the near infrared region. It also measures combined scattering from the population of particles present within the sensing chamber.

The interior walls of the MINIRAM sampling chamber reflect a small amount of source light into the detector. This background level is referred to as the "zero value". When the instrument is "zeroed", this background is automatically subtracted from the digital output. (Zeroing the instrument will not affect the analog output.) The zero value varies from instrument to instrument as well as with different sensing chambers. It will increase somewhat as the sensing chambers inner walls and windows become contaminated with dust. A zero level reading of about 3 mg/m^3 is indicative of excessive chamber contamination. The MINIRAM will store the average of 4 consecutive 10-second zero level measurements as the new Zero Reference Value.

SOP 2

Onsite Analytical Screening

STONE & WEBSTER ENGINEERING CORPORATION
ENVIRONMENTAL/INFRASTRUCTURE DIVISION
STANDARD OPERATING PROCEDURE

TITLE: Oxford Mill **Onsite Analytical Screening**	**NO.:**	SOP 2
	PAGE	1 of 7
	DATE:	March 2001

APPROVED:

Environmental/Infrastructure Division

SOP 2 - ONSITE ANALYTICAL SCREENING

PURPOSE

The purpose of onsite analytical screening is to provide field data regarding the presence or absence of volatile organic compound (VOC) vapors. Onsite screening at Oxford Mill sites will be monitored for VOCs in the breathing zone

Field screening for VOC compounds can be useful for such environmental characterization purposes as: discovery of site VOC contamination; selection of which field samples will be submitted to a laboratory for analyses; selection of surface soil sampling locations; selection of boring locations; placement of groundwater monitoring wells; soil cutting (from drilling operations) screening for disposal characterization purposes; and purge water (from well purging/sampling tasks) screening for disposal characterization purposes.

Related Standard Operating Procedures

SOP 1: Onsite Air Monitoring
SOP 4: Surface and Shallow Subsurface Soil Sampling
SOP 5: Geoprobe Soil Sampling Survey

SCOPE

This SOP details the materials, equipment, and methods common to the screening of media samples for the presence of VOCs. This SOP serves as general guidance on the proper methods for conducting Onsite analytical screening. Always consult state-specific, program-specific, or project specific requirements to ensure compatibility of this SOP. Changes to this SOP should be documented within the site-specific Sampling and Analysis Plan and/or Health and Safety Plan. Field changes to this SOP shall be discussed with the Project Manager prior to implementation and shall be documented in project field logbooks.

DEFINITIONS

eV - Electron Volts

FID - Flame Ionization Detector

GC - Gas Chromatograph

HASP - Health and Safety Plan

IDW - Investigation Derived Waste

PID - Photo Ionization Detector

SAP - Sample Acquisition Plan

VOC - Volatile organic compound

REFERENCES

Massachusetts Department of Environmental Protection, Interim Remediation Waste Management Policy for Petroleum Contaminated Soils, #WCS-94-400

PERSONNEL RESPOSIBILITIES

Program Manager - Sets technical capability requirement criteria for personnel and ensures that personnel assigned to project tasks are properly qualified to perform onsite analytical screening.

Project Manager - Translates client's requirements into technical direction of project. Reviews and approves technical progress, ensures that the Task Manager has been properly briefed and is prepared for onsite analytical screening task.

Task Manager - The Task Manager is the individual designated by the Project Manager to supervise investigative activities by Stone & Webster and related subcontracting personnel at a given site for the designated tasks. The Task Manager is responsible for ensuring that the field personnel have been briefed on conducting onsite analytical screening in accordance with the project requirements, this SOP, and related SOPs. The Task Manager assures that all necessary equipment including safety equipment is available and functioning properly before project operations begin. The Task Manager assures that all necessary personnel are mobilized on time and maintains daily log of activities each workday. The Task Manager coordinates and consults with the Project Manager on decisions relative to unexpected encounters during field investigations and deviations from this SOP.

Site Personnel - All employees who engage in site sampling activities are required to read and sign the site-specific Health and Safety Plan (HASP) and to follow the procedures in this SOP, unless superseded by project-specific requirements. All onsite analytical screening activities, including deviations to this SOP, will be recorded in field logbooks during on-site activities.

Site Health & Safety Officer - All field activities must be carried out in accordance with a site-specific HASP. The Site Health and Safety Officer (who may also serve as a onsite analytical screener) is responsible for ensuring that all site workers (Stone & Webster and subcontractors) have read, signed and are familiar with the requirements of the HASP and that the requirements of the HASP are met during site activities.

GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

The following is a list of equipment & material that is commonly used on all field VOC screening projects. Refer to method-specific equipment requirements to ensure completeness.

- Health And Safety Plan (HASP). To be read and signed by all site personnel prior to site activities.
- Personal Protective Equipment (PPE)
- Field logbook(s)
- Volatile organic compound vapor meter (PID of FID)
- Field data forms-See SOP 8

- Decontamination supplies - See SOP 6
- Indelible markers
- Soil sampling equipment (spit spoon, spatula, shovel, etc.)
- Disposable bailers, if screening groundwater collected from borings
- Glass bottles (500 ml preferred, 250 ml minimum size) or 1 quart Zip-Lock® type polyethylene bags
- Stainless steel laboratory spoons
- Metal dial-type thermometer, -10°C to 50°C
- Trash containers
- Paper towels
- Aluminum foil
- Plastic sheets (to lay equipment on)
- Plastic garbage bags
- Storage containers (e.g. DOT approved 55 gallon drums) for storage and disposal of contaminants and contaminated soils

GENERAL ONSITE ANALYTICAL SCREENING PROCEDURES

The following are recommended procedures for conducting analytical screening of contaminated soils utilizing a portable Photoionization Detector (PID), or Flame Ionization Detector (FID) meter or gas chromatograph:

1. Calibrate field screening equipment in accordance with manufacturer's instructions. PID and FID field instruments shall be operated and calibrated to yield "total organic vapors" in ppm (v/v) as benzene unless a specific compound of concern is being screened for. In this instance, the instrument can be calibrated for representative response to the target compound.
2. Obtain a soil sample from the sampling device (split spoon, spatula, shovel, etc.) immediately after removal from the ground. Groundwater samples can be collected from the inside of auger flights using a disposable bailer. In order to reduce loss of the volatile compounds, care should be taken to minimize handling of the sample and exposure to the air during transfer to the jar/poly bags.

- Half-fill a clean glass jar/poly bag with the sample to be analyzed. Collect one duplicate sample for every ten headspace samples collected. Quickly cover each open top with one or two sheets of clean aluminum foil and subsequently apply screw caps to tightly seal the jars. Sixteen ounce (approximately 500 ml) soil or "mason" type jars or 1 quart Zip-Lock® type polyethylene bags are preferred; jars less than 8 oz. (approximately 250 ml) total capacity may not be used.

3. Allow sealed jar/poly bag to sit for at least 10 minutes but no longer than four hours. Vigorously shake jar/ knead the poly bags for 15 seconds at the beginning of the headspace development period. Where ambient temperatures are below 32°F (0°C), sample bottles should be placed within a heated vehicle or building for the prescribed period to allow the volatilization process to occur.
4. Remove screw/lid and expose foil seal. Puncture foil seal with instrument sampling probe into the jar. Keep probe tip sufficiently above the media surface to avoid uptake of water droplets or soil particulate into the sample probe. If using the poly-bag technique, insert the probe through the bag opening while squeezing the bag tight around the probe.
5. As an alternative collection method, syringe withdrawal of a headspace sample with subsequent injection into instrument probe or septum-fitted inlet.
6. Following probe insertion through foil seal and/or sample injection to probe, record the highest meter response as the jar headspace concentration in the field logbook and on the form included as Attachment 3B. The maximum (non-GC) instrument response should occur between 2 and 5 seconds. Instrumentation with digital (LED/LCD) displays may not be able to discern maximum headspace response unless equipped with a "maximum hold" feature or strip-chart recorder.

7. The headspace screening data from jar samples/poly bags should be recorded and compared; generally, duplicate sample values should be consistent to plus or minus 20 percent.
8. For onsite analytical analysis, instrument calibration shall be checked/adjusted no less than once every 10 analyses, or daily, whichever occurs sooner.

Unused portions of samples which register a VOC response below the project specified "Level of Concern" should be returned to the point of collection. Samples, which exceed the project "Level of Concern" should be treated as Investigation Derived Waste and disposed of in the manner specified in the Sampling and Analysis Plan.

The following discusses specific information regarding:

- The use of PID instruments to screen for headspace

Headspace Screening Using a Photoionization Detector

A Photoionization Detector (PID) operates on the principle that VOCs, when subjected to a sufficient energy level of photoionizing energy will eject photons which can be detected by special instrumentation. Each compound requires a specific level of energy that must be reached before this effect (and therefore the compound) can be detected. Refer to Attachment 3A - Photoionization Activation Energy Levels for Common Volatile Contaminants for the activation energy requirements of the common chemical of concern. When using a PID meter at sites with unknown volatile chemicals of concern, PID instruments must be operated with a minimum 10.6 eV (+/-) lamp source (11.7 eV is recommended if available). For sites with known chemicals of concern Attachment 3A can be used to determine the minimum lamp energy required in your screening instrument.

Please note that certain compounds such as methane cannot be detected by the commercially available field instruments (11.7 eV is currently the maximum). PIDs are also more sensitive to low temperatures and the presence of moisture than FIDs. If wet field conditions or screening of water samples is anticipated, the use of a Flame Ionization Detector should be considered.

Operation, maintenance, and calibration of the Photoionization Detector shall be performed in accordance with the manufacturer's specifications.

Other Screening Techniques

Other screening techniques may be used to field screen samples. These methods include but are not limited to PetroFlag™ hydrocarbon test kits for soil and other Dexsil Corporation test kits. PetroFlag™ product information is included as Attachment 3C.

QUALITY ASSURANCE

Data collection procedure Steps 8 and 9 listed above are included to provide quality assurance of field data.

DISPOSAL OF ONSITE ANALYTICAL SCREENING WASTES

Unless proscribed in the SAP, site soils and/or groundwater that exhibit VOC concentrations below site specific "action levels" can be returned to the point of collection. Refer to the Sampling and Analysis Plan for specific instructions regarding the handling and disposition of all other investigation derived materials.

ATTACHMENT 3A

Photoionization Activation Energy Levels for Common Volatile Contaminants

Analyte	**IP (eV)**
Acetone	9.69
Acrolein	10.10
Allyl alcohol	9.67
Benzene	9.245
Bromochloromethane (I.S.)	10.77
Bromoform	10.51
Bromomethane	10.53
n-Butanol	10.04
2-Butanone (MEK)	9.53
Carbon disulfide	10.08
Carbon tetrachloride	11.47
Chlorobenzene	9.07
Chlorodibromomethane	10.59
Chloroethane	10.98
Chloroform	11.42
Chloromethane	11.28
1,2-Dibromoethane	10.19
Dibromomethane	10.49
1,2-Dichlorobenzene	9.07
1,3-Dichlorobenzene	9.12
1,4-Dichlorobenzene	8.94
Dichlorodifluoromethane	12.31
1,2-Dichloroethane	11.12
trans-1,2-Dechloroethene	9.66
1,2-Dichloropropane	10.87
Diethyl ether	9.53
Ethanol	10.48
Ethyl acetate	10.11
Ethyl benzene	8.76
Ethylene oxide	10.565
2-Hexanone	9.34
Iodomethane	9.54
Isopropylbenzene	8.69
Methane	12.98
Methanol	10.85
Methylene chloride (DCM)	11.35
4-Methyl-2-pentanone (MIBK)	9.30
Naphthalene	8.12
Nitrobenzene	9.92
b-Propiolactone	9.70
Pyridine	9.32
Styrene	8.47
Tetrachloroethene	9.32
Toluene	8.82
Trichloroethene	9.45
Trichlorofluoromethane	11.77
Vinyl acetate	9.19
Vinyl chloride	9.995
o-Xylene	8.56
m-Xylene	8.56
p-Xylene	8.445

ATTACHMENT 3B

Jar/Poly Bag Headspace Screening Results Log

Site:

Location:

Job No:

Sample ID	Date	Headspace Reading	Comments

CONTROL COPY NO. 01

SOP 3

Field Notebook and Control

CONTROL COPY NO. 01

STONE & WEBSTER ENGINEERING CORPORATION
ENVIRONMENTAL / INFRASTRUCTURE DIVISION
STANDARD PROJECT PROCEDURE

TITLE: Oxford Mill **Field Notebook Content and Control**	**NO.:**	SOP 3
	PAGE	1 of 6
	DATE:	March 2001

APPROVED:

____
Environmental/Infrastructure Division

1.0 PURPOSE

The objective of this standard operating procedure (SOP) is to set criteria for content entry and form of field logbooks for the sampling program at the Oxford Mill in Lawrence.

2.0 SCOPE

Nielsen Environmental Field School, Field Notebook Guidelines, 1997.

3.0 REFERENCES

None.

4.0 GENERAL

4.1 Definitions

Biota - The flora and fauna of a region.

Decontamination - To remove contaminants from field sampling equipment that might bias analytical results.

4.2 Responsibilities

Site Personnel - All employees who make entries in field logbooks during on-site activities are required to read this procedure prior to engaging in this activity.

4.3 Scope

This procedure serves as general guidance for Stone & Webster personnel on the proper methods of using and maintaining field logbooks at the Oxford Mill field sites.

4.4 Equipment and Materials

Site logbook
Site-specific plans
Hard-covered, waterproof field notebook(s)
Indelible black ink pen (sharpie)

Ruler or similar scale (in some circumstances)

4.5 Records

The site logbook is initiated at the start of the first on-site activity (e.g., initial reconnaissance survey). Entries are made for every day that on-site activities take place. One current site logbook is maintained per site.

All field activities should be recorded in a field logbook.

Information recorded in field logbooks include observations, data, calculations, time, weather, description of the data collection activity, methods, instruments, and results. Additionally, the logbook may contain descriptions of wastes, biota, geologic material, and site features including sketches, maps, or drawings as appropriate.

5.0 PROCEDURES

5.1 Preparation

In addition to this SOP, site personnel responsible for maintaining logbooks must be familiar with other pertinent SOPs. These should be consulted as necessary to obtain specific information about equipment and supplies, health and safety, sample collection, packaging, decontamination, and documentation.

The field notebook is assigned to an individual responsible for its care and maintenance.

Field logbooks shall be bound with lined, consecutively numbered pages. All pages must be numbered prior to initial use of the logbook. The following information shall be recorded inside the front cover of the logbook:

- Person and organization to whom the book is assigned, and phone number(s)
- Start date
- Project Name
- Building Number
- Stone & Webster Job Number
- Site Manager's Name
- Sequential Book Number (if applicable)

The first five pages of the logbook shall be reserved for a table of contents. Mark the first page with the heading and enter the following:

TABLE OF CONTENTS

Date/Description	Page
(Start Date/Reserved for TOC)	1-5

The remaining pages of the Table of Contents will be designated as such with "TOC" written on the top center of each page.

5.2 Operation

The following is a list of requirements that must be followed when using a logbook:

- Record work, observations, quantities of materials, calculations, drawings, and related information directly in the logbook. If data-collection forms are specified by an activity-specific plan, this information need not be duplicated in the logbook. However, any forms used to record site information must be referenced in the logbook.

Information should be factual and unbraised.

- Do not start a new page until the previous one is full or has been marked with a single diagonal line so that additional entries cannot be made. Use both sides of each page.

Write in black, indelible ink (sharpie). Do not write in pencil unless working in wet conditions.

- Do not erase or blot out any entry at any time. Before an entry has been signed and dated, changes may be made but care must be taken not to obliterate what was written originally. Indicate any deletion by a single line through the material to be deleted. A change should be initiated and coded using one of the common data error codes shown in Table 1. All error codes should be circled.

- Do not remove any pages from the book.

Do not use loose notebook paper and copy into logbook later.

- Record as much information as possible.

All entries should be neat and legible.

Specific requirements for field logbook entries include:

- Initial and date each page.

- Sign and date the final page of entries for each day.

- Initial and date all changes.

- Multiple authors must sign out the logbook by inserting the following:

Above notes authored by:

______________________ (Sign name)
______________________ (Print name)
______________________ (Date)

- A new author must sign and print his/her name before additional entries are made.

- Draw a diagonal line through the remainder of the final page at the end of the day.

Record the following information on a daily basis:

- Date and time
- Name of individual making entry
- Description of activity being conducted including station (i.e., boring, sampling location number, building number soil description) if appropriate

- Any other information as required.

Unusual site conditions

- Weather conditions (i.e., temperature, cloud cover, precipitation, wind direction, and speed) and other pertinent data

- People on site

- Level of personnel protection to be used

- Arrival/departure of site visitors
- Arrival/departure of equipment
- Sample pickup (chain-of-custody form numbers, carrier, time)
- Sampling activities/sample logsheet numbers
- Start or completion of borehole/trench/monitoring well installation or sampling activ

- Health and Safety issues

Instrumentation calibration details

Entries into the field logbook shall be preceded with the time of the observation. The time should be recorded frequently and at the point of events or measurements that are critical to the activity being logged. All measurements made and samples collected must be recorded unless they are documented by automatic methods (e.g., data logger) or on a separate form required by an operating procedure. In these cases, the logbook must reference the automatic data record or form.

While sampling, record observations such as color and odor. Indicate the locations from which samples are being taken, sample identification numbers, the order of filing bottles, sample volumes, and parameters to be analyzed.

A sketch of station location may be warranted. All maps or sketches made in the logbook should have descriptions of the features shown and a direction indicator. It is preferred that maps and sketches be oriented so that north is towards the top of the page.

Other events and observations that should be recorded include (but are not limited to):

- Changes in weather that impact field activities.

- Subcontractor activities should be recorded.

- Deviations from procedures outlined in any governing documents. Also record the reason for any noted deviation.

- Problems, downtime, or delays.

- Upgrade or downgrade of personnel protection equipment.

- Sample results from onsite lab.

5.4 Post-Operation

To guard against loss of data due to damage or disappearance of logbooks, copies of completed pages shall be periodically and securely stored by the project. Documents which are separated from the logbook shall be copied and submitted regularly and as promptly as possible to the project. This includes all automatic data recording media (print-outs, logs, disks or tapes) and activity-specific data collection forms required by other SOPs.

At the conclusion of each activity or phase of site work, the individual responsible for the logbook will ensure that all entries have been appropriately signed and dated, and that corrections were made properly (single lines drawn through incorrect information, then initialed, coded, and dated). The completed logbook shall be submitted to the project records file.

6.0 RESTRICTIONS/LIMITATIONS

Field logbooks constitute the official record of on-site technical work, investigations, and data collection activities. Their use, control, and ownership is restricted to activities pertaining to specific field operations carried out by Stone & Webster personnel and their subcontractors. They are documents that may be used in court to indicate and defend dates, personnel, procedures, and techniques employed during site activities. Entries made in these notebooks should be factual, clear, precise, and as non-subjective as possible. Field logbooks, and entries within, are not to be utilized for personal use.

TABLE 1 B COMMON DATA ERROR CODES

RE	Recording Error
CE	Calculation Error
TE	Transcriptions Error
SE	Spelling Error
CL	Changed for Clarity
DC	Original Sample Description Changed After Further Evaluation
WO	Write Over
NI	Not Initialed and Dated at Time of Entry
OB	Not Recorded at the Time of Initial Observation

All Error Codes should be circled

CONTROL COPY NO. 01

SOP 4

Surface and Shallow Subsurface Soil Sampling

STONE & WEBSTER ENGINEERING CORPORATION
ENVIRONMENTAL / INFRASTRUCTURE DIVISION
STANDARD OPERATING PROCEDURE

TITLE: Oxford Mill **Surface and Shallow Subsurface Soil Sampling**	**NO.:**	SOP 4
	PAGE:	Page 1 of 8
	DATE:	March 2001

APPROVED:

Environmental / Infrastructure Division

1.0 PURPOSE

This SOP describes the procedures for collecting representative environmental and/or geotechnical samples from the surface or shallow subsurface soils. The following sections describe various methods and equipment used to collect disturbed soil samples. A disturbed soil sample is a representative sample of a selected geologic unit which has undergone structural alteration as a result of the sampling operation. These types of samples can be used for soil classification, soil index testing, and analytical testing purposes

2.0 SCOPE

This procedure serves as general guidance on the proper methods of collecting both discrete and composite surface and shallow subsurface soil samples. This procedure can be used in most soil types but is limited to sampling depths of one foot or less below ground surface. Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sampling team member. The use of a flat, pointed mason trowel to cut a block of the desired soil can be helpful when undisturbed profiles are required. A stainless steel scoop or lab spoon will suffice in most other applications. Consult the Oxford Paper Mill Sampling and Analysis Plan for soil sampling locations and techniques. Always consult state-specific or program-specific requirements as well as manufacturer's instructions for equipment use to ensure compatibility of this SOP with project requirements. **Field changes to this SOP shall be discussed with the Project Manager prior to implementation and shall be documented in project field logbooks (SOP 3).**

3.0 REFERENCES

1. S&W ENV 23 - Investigation Derived Waste Disposal.
2. S&W ENV 6 - Equipment Decontamination
3. S&W ENV 8- Packaging and Shipping of Environmental Samples

U.S. Environmental Protection Agency, Compendium of ERT Soil Sampling and Surface Geophysics Procedures, EPA/540/P-91/006, January 1991.

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.

4.0 DEFINITIONS

None.

5.0 RESPONSIBILITIES

5.1 DIVISION CHIEF

Sets technical capability requirement criteria for personnel and ensures that personnel assigned to project tasks are properly qualified for the needed work.

5.2 PROJECT MANAGER

Translates client's requirements into technical direction of project. Reviews and approves technical progress, ensures that the Site Manager has been properly briefed and is prepared for soil sampling task.

5.3 SITE MANAGER

The Site Manager is the individual designated by the project manager to supervise investigative activities by Stone & Webster and related subcontracting personnel at a given site for the designated tasks. The Site Manager is responsible for ensuring that the field personnel have been briefed in conducting the method of soil sampling chosen in accordance with the project requirements, this SOP and related SOPs. The Site Manager assures that all necessary equipment including safety equipment is available and functioning properly before project operations begin. The Site Manager assures that all necessary personnel are mobilized on time and maintains a daily log of activities each work day.

The Site Manager coordinates and consults with Project Manager on decisions relative to unexpected occurrences during soil sampling and deviation from this SOP.

5.4 SITE PERSONNEL

All employees who are engaging in soil sampling activities are required to read and sign the site-specific Health and Safety Plan (HASP) and to follow the procedures in this SOP, unless superseded by project-specific requirements. All soil sampling activities, including deviations to this SOP, will be recorded in field logbooks during on-site activities.

5.5 SITE HEALTH & SAFETY OFFICER

All field activities must be carried out in accordance with a site-specific Health and Safety Plan (HASP). The Site Health and Safety Officer (who may also serve as a soil sampler) is responsible for ensuring that all site workers (Stone & Webster and subcontractors) have read, signed and are familiar with the requirements of the HASP and that the requirements of the HASP are met during site activities.

6.0 PROCEDURE

6.1 General Equipment & Material Requirements for Surface Soil Sampling

The following is a list of equipment & material which is commonly used on all surface soil sampling projects. Refer also to related SOP equipment & material requirements to ensure completeness.

- Field Sampling Plan (FSP)
- Health And Safety Plan (HASP). **To be read and signed by all site personnel prior to site activities.**
- Personal Protective Equipment
- Field logbook(s)
- Volatile organic compound vapor meter
- Decontamination supplies - **See SOP 6- Equipment Decontamination and FSP**
- Indelible markers
- Tape measure
- Stainless steel or plastic trowel or shovel
- Geoprobe
- Surveyors stakes
- Hammer
- Flagging Tape
- Spray paint
- Stainless steel mixing bowls
- Sample bottles and labels
- Chain-of-Custody forms - Packaging and Shipping of Environmental Samples
- Chain-of-Custody tape
- Sample Coolers
- Sample packing material
- Ice or pre-cooled “cold” packs - for sample preservation
- Shipping forms (not needed if hand delivered to lab or courier pickup arranged)
- Shipping tape (transparent)
- Duct tape
- Paper towels

The use of devices plated with chrome or other materials will be avoided, since samples will be analyzed for metals analysis.

6.2 General Surface Soil Sampling Procedures

6.2.1 Pre-Sampling Activities

1. The OPM Sampling and Analysis Plan should be consulted to determine the sampling methods to be employed and the sampling and monitoring equipment necessary for field activities.

2. In accordance with the Health and Safety Plan, a general site survey should be performed prior to site entry.

3. All sampling equipment should be decontaminated prior to each sampling episode. Decontamination procedures are detailed in Standard Operating Procedure 6.

6.3 Surface Soil Sampling

Appropriate field procedures are as follows:

1. Carefully remove the top layer of soil to the desired sample depth with a decontaminated tool.

2. Screen the area to be sampled using a Volatile Organic Compound (VOC) vapor analyzing meter and record readings in the field log. The VOC screen is used as a field safety procedure. The VOC readings should be compared to action levels presented in the project Health and Safety Plan. The VOC screen can also be used or selecting potentially contaminated soil samples.

3. Using a decontaminated tool, remove and discard a thin layer of soil from the area that came in contact with the tool.

4. Obtain a discrete soil sample using a stainless steel sampling tool. Place the sample into a sterile wide-mouth glass soil sample jar with screw on cap.

5. Secure all caps tightly. Although chemical preservation of solids is generally not required, the samples shall be refrigerated (normally in iced coolers to approach approximately 4°C). Refer to **SOP 8- Labeling, Packaging, and Shipping of Environmental Samples** for procedure-specific requirements.

6. Label the sample bottle with the appropriate sample tag. Complete all chain-of-custody documents. Refer to **SOP 8- Labeling, Packaging, and Shipping of Environmental Samples** for procedure-specific requirements.

7. Record sampling events in the field logbook (SOP 3) and on a sample log, dictated by the Sampling and Analysis Plan.

8. Decontaminate equipment after use and between sample locations. Also, decontaminate sample containers and/or isolate them (such as sealing in Ziploc bags). Refer to **SOP 6- Equipment Decontamination** for procedure-specific requirements.

6.4 Shallow Subsurface Soil Sampling

A bucket auger or hand corer, can be advanced to obtain soil samples up to approximately 5 feet below the surface when soil conditions allow. The method is less effective with coarse, granular soils or soils containing cobbles or boulders. Appropriate field procedures are as follows:

1. To make a hand auger borehole, attach the auger bit to a drill rod extension, and attach a "T" handle to the drill rod.

2. Clear the area to be sampled of any surface debris (twigs, rocks, or litter). It may be necessary to remove the first three to six inches of surface soil for an area approximately six inches in radius around the auger location.

3. Begin auguring by pressing down on the handle while manually rotating it. Periodically remove soil cuttings that accumulate on the ground around the auger stem with a decontaminated tool. This will prevent loose material from falling back down into the borehole when removing the auger or adding drill rods. If necessary, the cuttings from each foot of advancement should be screened for volatile compounds (VOCs) with a photoionization meter (PID) or for other parameters, as appropriate.

4. Compare PID readings to action levels presented in the project Health and Safety Plan. The operator of the PID must be experienced in its use and aware of such factors as temperature, humidity, and methane on the readings provided by the PID.

5. After reaching the desired depth, carefully remove the auger/corer from the hole.

6. Place the soil sample into a stainless steel mixing bowl. Obtain a discrete soil sample using a stainless steel lab spoon or its equivalent and place in appropriate sample jars. **See Section 6.4 for discussion of discrete vs. composite sample collection.**

7. Secure all caps tightly. Although chemical preservation of solids is generally not required, the samples shall be refrigerated (normally in iced coolers to approach approximately 4°C). Refer to **SOP 8- Packaging and Shipping of Environmental Samples** for procedure-specific requirements.

8. Label the sample bottle with the appropriate sample tag. Complete all chain-of-custody documents. Refer to **SOP 8- Packaging and Shipping of Environmental Samples** for procedure-specific requirements.

9. Record in the field logbook (SOP 3) and on a sample log, if dictated by the Sampling and Analysis Plan.

10. Decontaminate equipment after use and between sample locations. Also, decontaminate sample containers and/or isolate them (such as sealing in Ziploc bags). Refer to **SOP 6- Equipment Decontamination** for procedure-specific requirements.

6.5 Preparation of Composite Samples

Soil samples will be discrete and composite fragments (refer to your Field Sampling Plan for designated sampling intervals). The discrete sample represents the sample taken from 6 inches below ground surface within the vertical soil column. Composite samples represent a mixture of soil from more than one discrete vertical location, within the same soil column. If a composite sample is to be obtained, it can be mixed in a shallow high-density polyethylene pan, lined with aluminum foil, or in a stainless steel pan. Stainless steel sieves may be used to remove larger rock and must be used for all VOC analyses. Compositing procedures are not appropriate for samples obtained for analysis for VOCs because the agitation of the sample results in a loss of volatiles from the sample.

Procedure outlined in Attachment A shall be followed for soil compositing.

6.6 Glossary of Terms

Composite Sample - represents a mixture of soil from more than one discrete location.

Discrete Sample - A discrete sample represents a single sample location within a vertical soil column and at a single horizontal area point. Discrete sampling must be used when collecting soil samples for VOC analyses.

Trowel - Resembles a small shovel. To be constructed of steel for sampling purposes. The blade of a trowel is generally flat and 5 to 6 inches in length. A scoop (blade has curved edges versus flat) may be substituted if necessary. Both can be purchased with volume calibrations.

Hand Corer - A hollow metal tube with a detachable, hardened metal cutting nose and a plastic "core catcher" fitting. This tube can be attached to a short spiral-bladed hollow metal rod (auger) attached to a "T" handle for hand-advancement. Clockwise rotation of the T handle with simultaneously applied downward pressure initiates the cutting process. Most of the soil is discharged upwards through the auger as it moves downwards. When the desired sampling interval is reached, rotation is stopped and the auger is withdrawn from the hole with the soil of interest inside it. If soil is extremely uncohesive (e.g. dry sand), a hand corer should be considered for use.

Hollow-Stem Bucket Auger - a short spiral-bladed hollow metal rod (auger) attached to a "T" handle for hand-advancement. Clockwise rotation of the T handle with simultaneously applied downward pressure initiates the cutting process. Most of the soil is discharged upwards through the auger as it moves downwards. When the desired sampling interval is reached, rotation is stopped and the auger is withdrawn from the hole with the soil of interest inside it. If soil is extremely uncohesive (e.g. dry sand), a hand corer should be considered for use.

7.0 ATTACHMENTS

Attachment A - Soil Compositing Procedure

ATTACHMENT A

SOIL COMPOSITING PROCEDURE

The following procedure will be used for compositing grab samples from the soil piles.

1. Empty the soil container(s) into stainless steel mixing bowls.

2. Inspect the material for large stones and other objects which are not representative of the sample matrix and remove them from the bowl.

3. Homogenize the remaining sample material by breaking up any large clumps and thoroughly mixing with stainless steel spatula.

4. Fill the sample container(s) using a spatula.

SOP 5

Geoprobe Soil Sampling Survey

STONE & WEBSTER ENGINEERING CORPORATION
ENVIRONMENTAL / INFRASTRUCTURE DIVISION
STANDARD PROJECT PROCEDURE

TITLE: **Geoprobe Soil Sampling Survey**	**NO.:**	SOP 5
	PAGE	1 of 4
	DATE:	March 2001

APPROVED:

____
Environmental/Infrastructure

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to collect surface and subsurface soil samples with a Geoprobe at Oxford Mill in order to determine the extent of soil contamination in a shorter time period compared with conventional boring methods.

2.0 REFERENCES

"Geoprobe GH-40, Soil Probing Hammer," Technical Bulletin 94-040A, Operating Instructions, April 1994.

"Geoprobe AT-660, Series Large Bore Soil Sampler," Technical Bulletin 93-660, Standard Operating Procedure, September 21, 1993.

3.0 APPENDICES

None.

4.0 GENERAL

4.1 Definitions

Geoprobe - A hydraulic device used to advance a hollow stem probe into soil for the purpose of collecting a soil sample.

Probe-Drive Sampler - A soil sampling device designed for use with the Geoprobe.

4.2 Responsibilities

Site Manager - The Site Manager is responsible for ensuring that the field personnel have been trained in conducting the Geoprobe survey in accordance with the project requirements and this and related SOPs.

Field Team Leader - The Field Team Leader is responsible for ensuring that the Field Team conducts the Geoprobe survey in accordance with the project requirements.

4.3 Applicability

The Geoprobe unit utilizes the Probe-Drive sampler to retrieve approximately 100 gram (or larger) soil samples at the working depth of the Geoprobe. Unlike split-spoon samplers, the Probe-Drive sampler remains completely sealed by a piston tip at the end of the sample tube while it is pushed or driven to the desired sampling depth. A piston stop-pin at the opposite end of the sampler is removed by means of extension rods inserted down the inside diameter of the probe rods after the sampler has been driven to depth. This enables the piston to retract into the sample tube while the sample is taken.

The Geoprobe soil sampling system is not intended for collecting large sample volumes. The Standard Sampler will obtain approximately 100 grams of soil.

The Geoprobe is limited to sampling up to depths of approximately 40 feet in unconsolidated, sandy soils and to shallower depths in compacted gravelly soils and tills.

4.4 Equipment and Materials

Required Equipment - The usual Geoprobe rods and driving accessories with the following tools are required to sample soil using the Probe-Drive system:

Assembled Sampler
Extension Rods
Extension Rod Couplers
Extension Rod Handle
Extruder Rack*
Extruder Piston*

* Kansas Stainless and Large Bore Samplers feature removable hardened cutting shoes that thread onto the sample tube. Large Bore Sampler also utilizes an acetate liner inside of the sample tube for easy removal of soil sample.

4.5 Records

Information which should be documented includes, but not limited to, date and time of sampling, names of persons present, weather conditions, unusual conditions, and other information defined in this and other applicable SOPs.

5.0 PROCEDURES

5.1 Set-up and Sampling

1. After decontaminating probe rods and sampler parts according to the Decontamination SOP, assemble the soil sampler. All parts must fit tightly. The stop-pin is reverse threaded and should be tightened with a wrench so that it exerts pressure against the piston rod. Damage could occur during probing if pin is not tight.

2. Attach assembled sampler onto leading Geoprobe probe rod. Place the drive cap on top of the probe rod. A 12-inch probe rod is recommended to start the Standard 24-inch and Large Bore Samplers. Replace the 12-inch rod with a 36-inch rod as soon as the sampler is driven below the surface.

3. Drive the sampler with the attached probe rods to the top of the interval to be sampled using manual probe rod driver or hydraulically-powered Geoprobe unit. The drive cap must be installed prior to driving the probe.

   IMPORTANT: Some soil conditions may warrant using a retractable or solid drive point to preprobe the hole to the desired sampling depth. Do not drive the sampler into bedrock or other impenetrable layers.

4. If using the Geoprobe driver, move the driver unit back from the top of the probe rods to allow room to work, to allow for removal of stop-pin.

5. Remove the drive cap and lower extension rods into the inside diameter of the probe rods using couplers to join rods together.

6. Attach the extension rod handle to the top extension rod. Rotate the extension rod handle clockwise until the leading extension rod is screwed into the piston stop-pin downhole.

7. Continue to rotate the handle clockwise until the reverse-threaded stop-pin has disengaged from the drive head.

8. Remove the extension rods and attached stop-pin from the probe rods.

9. If the top of probe rod is already in the lowest driving position, attach another probe rod before driving for sampling. Replace the drive cap onto the top probe rod.

10. Mark the top probe rod with a marker or tape at the appropriate distance above the ground surface (i.e., 10 inches for Standard Sampler, 12 inches for Kansas Sampler, and 24 inches for Large Bore Sampler).

11. Drive the probe rods and sampler the designated distance. Be careful not to overdrive the sampler which could compact the soil sample in the tube making it difficult to extrude.

12. Retract probe rods from the hole and recover the sampler. Inspect the sampler to confirm that a sample was recovered.

5.2 Extrusion for Standard and Kansas Samplers

A. By Machine:

   1. Disassemble the sampler. Remove all parts. Screen sampler with a photoionization detector (PID), if required.

   2. Position the extruder rack on the foot of the Geoprobe derrick.
   3. Insert the sample tube into the extruder rack with the cutting end up.

4. Position the extruder piston and push the sample out of the tube using the "probe" function on the Geoprobe.

5. Catch the sample as it is extruded beneath the extruder in the sample container or mixing bowl. Volatile organic compound samples will be collected directly into the sample container.

CAUTION: Use care when performing this task. Apply down pressure gradually. Use of excessive force could result in injury to the operator or damage to tools.

B. By Hand: (Good for use with sandy soils)

1. Disassemble the sampler. Remove all parts.

2. Screen sampler with a PID, if required.

3. Deposit sample into container by lightly tapping the side of the sample tube with a hammer.

5.3 Plugging Geoprobe Holes

It will not be required to plug the boring holes.

5.4 Equipment Decontamination

Improperly cleaned and prepared sampling equipment can lead to misinterpretation of environmental data due to interference caused by cross-contamination.

Sampling equipment is decontaminated after each sample is taken.

The geoprobe is steam-cleaned prior to coming on-site and prior to leaving the site. The equipment is generally inspected by the Field Team Leader or other field personnel.

SOP 6

Equipment Decontamination

CONTROL COPY NO. 01

STONE & WEBSTER ENGINEERING CORPORATION
ENVIRONMENTAL / INFRASTRUCTURE DIVISION
STANDARD PROJECT PROCEDURE

TITLE: Oxford Mill **Equipment Decontamination**	**NO.:**	SOP 6
	PAGE	1 of 4
	DATE:	March 2001

APPROVED:

____
Environmental/Infrastructure Division

1.0 PURPOSE

To describe procedures for removing contamination from personnel and sampling equipment before and after sampling events. Decontamination is necessary to prevent spread of contaminants, to prevent cross-contamination of samples, and to protect the health and safety of site personnel.

2.0 SCOPE

None.

3.0 REFERENCES

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA, DHHS (NIOSH) 85-115, October 1985.

Field Standard Operating Procedures (FSOP) 7, "Decontamination of Response Personnel", USEPA, January 1995.

"Hazardous Waste Site Workers Basis Health & Safety Course", The New England Consortium, 1990.

29 CFR Part 1910, "Hazardous Waste Operations and Emergency Response", March 1989.

Massachusetts Department of Environmental Protection, Standard Reference for Monitoring Wells, DEP Publication #WSC-310-91, January 1991.

U.S. Environmental Protection Agency, Compendium of ERT Soil Sampling and Surface Geophysics Procedures, EPA/540/P-91/006, January 1991.

U.S. Environmental Protection Agency, "Decontamination of PCBs", USEPA 761.79 (Attachment A)

4.0 DEFINITIONS

None.

5.0 RESPONSIBILITIES

Personnel requirements for decontamination activities will vary depending upon the size and scope of the sampling effort. Designated field personnel are responsible for implementing all aspects of this SOP. In addition, all field activities must be carried out in accordance with a site-specific Health and Safety Plan (HASP). Ensuring the fulfillment of the requirements of the HASP is the responsibility of the site Health and Safety Officer who may also perform sampling and decontamination activities.

6.0 PROCEDURE

6.1 APPLICABILITY

This procedure serves as general guidance on the proper methods of decontaminating personnel and sampling equipment.

6.2 EQUIPMENT AND MATERIALS

Basic equipment necessary for decontamination field equipment include: appropriate personnel protective clothing; non-phosphate detergent; selected solvents (e.g., nitric acid, acetone, hexane, or methanol); deionized water and tap water; brushes; spray bottles for solvents and water; wash basins; plastic sheets; emergency eyewash bottle; trash containers; and paper towels.

Additional equipment necessary for decontaminating personnel vary depending upon the level of personnel protection clothing and equipment used onsite. These additional items are identified in relevant sections of this Standard Operating Procedure.

6.3 DECONTAMINATION EQUIPMENT SELECTION

- In selecting decontamination equipment, consider whether the equipment itself can be decontaminated for reuse or can it be easily disposed.
- Table 1 lists recommended equipment for decontamination of personnel, PPE, and equipment.
- Table 2 lists recommended equipment for decontamination of large equipment and vehicles.

6.4 DECONTAMINATION FACILITY DESIGN

At Oxford Mill, decontamination facilities should be located in the Contamination Reduction Zone (CRZ), i.e., the area between the Exclusion Zone (the contaminated area) and the Support Zone (the clean area) as described in the Site Safety Plan.

6.5 PERSONNEL DECONTAMINATION

Four levels of personnel protection, as discussed in the PPE procedure, are available for use at any given site. The following is a description of the decontamination process for Level D and modified Level D.

- If required, an area will be designed for the removal of gloves and boot covers. Paper towels will be available for removal of this equipment.
- A trash barrel at the site will be provided for all disposable noncontaminated PPE. This material will be disposed of in a normal trash receptacle at the plant before leaving the site.
- Laundering of personal clothing should be completed as soon as possible once off-site.
- Soap and water will be used to wash hands before eating, drinking or smoking, and before using the bathroom facilities.

6.6 EQUIPMENT DECONTAMINATION

6.6.1 General

- Adequate supplies of all materials must be kept on hand. This includes all rinsing liquids and other required materials.

6.6.2 Standard Procedures

- Remove any solid particles from the equipment or material by brushing and then rinsing with available tap water. This initial step is performed to remove gross contamination.
- Wash equipment with a non–phosphate detergent solution.
- Rinse with distilled/deionized water.
- Use methanol if the sample will be analyzed for organics.
- Follow decontamination procedures for removal of PCB contamination in EPA 761.79.
- Rinse again with distilled/deionized water.
- Dispose of all rinse and decontamination fluids in an appropriate manner specified in the site-specific Sampling and Analysis Plan.

Sampling equipment that requires the use of plastic tubing should be disassembled and the tubing replaced with clean tubing, before commencement of sampling and between sampling locations.

6.6.3 Sanitizing Procedures

- Reusable clothing and other personal articles must be decontaminated and sanitized before reuse.
- If practical, reusable protective clothing should be machine washed after a thorough decontamination. Otherwise, clean the clothing by hand.

6.7 QUALITY ASSURANCE

- The effectiveness of any decontamination method used at a site should be assessed at the beginning of a project periodically throughout the life of a project.
- The Site Health & Safety Officer shall monitor project procedures to determine their effectiveness.
- If a decontamination method is not considered effective, the decontamination program must be revised.
- Visual observation, wipe sampling, cleaning solution analysis, and permeation testing are the typical methods used to determine the effectiveness of decontamination.

6.8 DISPOSAL METHODS

- All equipment used for decontamination must be decontaminated and/or disposed of properly.

CONTROL COPY NO. 01

Attachment A

PCB Decontamination Regulations

the non-TSCA waste management document which serves as the basis for a TSCA PCB Coordinated Approval. Changes in the ownership of a commercial storage facility which holds a TSCA PCB Coordinated Approval shall be handled pursuant to §761.65(j).

(b) Any person who owns or operates a facility that he or she intends to use to landfill PCB wastes; incinerate PCB wastes; dispose of PCB wastes using an alternative disposal method that is equivalent to disposal in an incinerator approved under §761.70 or a high efficiency boiler operating in compliance with §761.71; or stores PCB wastes may apply for a TSCA PCB Coordinated Approval. The EPA Regional Administrator may approve the request if the EPA Regional Administrator determines that the activity will not pose an unreasonable risk of injury to health or the environment and the person:

(1)(i) Has a waste management permit or other decision or enforcement document which exercises control over PCB wastes, issued by EPA or an authorized State Director for a State program that has been approved by EPA and is no less stringent in protection of health or the environment than the applicable TSCA requirements found in this part; or

(ii) Has a PCB waste management permit or other decision or enforcement document issued by a State Director pursuant to a State PCB waste management program no less stringent in protection of health or the environment than the applicable TSCA requirements found in this part; or

(iii) Is subject to a waste management permit or other decision or enforcement document which is applicable to the disposal of PCBs and which was issued through the promulgation of a regulation published in Title 40 of the Code of Federal Regulations.

(2) Complies with the terms and conditions of the permit or other decision or enforcement document described in paragraph (b)(1) of this section.

(3) Unless otherwise waived or modified in writing by the EPA Regional Administrator, complies with §761.75(b); §761.70(a)(1) through (a)(9), (b)(1) and (b)(2), and (c); or the PCB storage requirements at §§761.65(a), (c), and (d)(2), as appropriate.

(4) Complies with the reporting and recordkeeping requirements in subparts J and K of this part.

(c) A person conducting research and development (R&D) into PCB disposal methods (regardless of PCB concentration), or conducting PCB remediation activities may apply for a TSCA PCB Coordinated Approval. The EPA Regional Administrator may approve the request if the EPA Regional Administrator determines that the activity will not pose an unreasonable risk of injury to health or the environment and the person:

(1)(i) Has a permit or other decision and enforcement document issued or otherwise agreed to by EPA, or permit or other decision and enforcement document issued by an authorized State Director for a State program that has been approved by EPA, which exercises control over the management of PCB wastes, and that person is in compliance with all terms and conditions of that document; or

(ii) Has a permit, which exercises control over the management of PCB wastes, issued by a State Director pursuant to a State PCB disposal program no less stringent than the requirements in this part.

(2) Complies with the terms and conditions of that permit or other decision and enforcement document.

(3) Complies with the reporting and recordkeeping requirements in subparts J and K of this part.

[63 FR 35456, June 29, 1998]

§761.79 Decontamination standards and procedures.

(a) *Applicability.* This section establishes decontamination standards and procedures for removing PCBs, which are regulated for disposal, from water, organic liquids, non-porous surfaces (including scrap metal from disassembled electrical equipment), concrete, and non-porous surfaces covered with a porous surface, such as paint or coating on metal.

(1) Decontamination in accordance with this section does not require a disposal approval under subpart D of this part.

(2) Materials from which PCBs have been removed by decontamination in accordance with this section may be distributed in commerce in accordance with §761.20(c)(5).

(3) Materials from which PCBs have been removed by decontamination in accordance with this section may be used or reused in accordance with §761.30(u).

(4) Materials from which PCBs have been removed by decontamination in accordance with this section, not including decontamination waste and residuals under paragraph (g) of this section, are unregulated for disposal under subpart D of this part.

(5) Any person decontaminating porous surfaces other than concrete under paragraph (b)(4) of this section and non-porous surfaces covered with a porous surface, such as paint or coating on metal, under paragraph (b)(3) or (c)(6) of this section must obtain an alternative decontamination approval in accordance with paragraph (h) of this section.

(6) Any person engaging in decontamination under this section is responsible for determining and complying with all other applicable Federal, State, and local laws and regulations.

(b) *Decontamination standards*. Chopping (including wire chopping), distilling, filtering, oil/water separation, spraying, soaking, wiping, stripping of insulation, scraping, scarification or the use of abrasives or solvents may be used to remove or separate PCBs, to the following standards, from liquids, concrete, or non-porous surfaces.

(1) The decontamination standard for water containing PCBs is:

(i) Less than 200 µg/L (i.e., <200 ppb PCBs) for non-contact use in a closed system where there are no releases;

(ii) For water discharged to a treatment works (as defined in §503.9(aa) of this chapter) or to navigable waters, <3 µg/L (approximately <3 ppb) or a PCB discharge limit included in a permit issued under section 307(b) or 402 of the Clean Water Act; or

(iii) Less than or equal to 0.5 µg/L (i.e., approximately ≤0.5 ppb PCBs) for unrestricted use.

(2) The decontamination standard for organic liquids and non-aqueous inorganic liquids containing PCBs is <2 milligrams per kilogram (i.e., <2 ppm PCBs).

(3) The decontamination standard for non-porous surfaces in contact with liquid and non-liquid PCBs is:

(i) For unrestricted use:

(A) For non-porous surfaces previously in contact with liquid PCBs at any concentration, where no free-flowing liquids are currently present, ≤10 micrograms PCBs per 100 square centimeters (≤10 µg/100 cm^2) as measured by a standard wipe test (§761.123) at locations selected in accordance with subpart P of this part.

(B) For non-porous surfaces in contact with non-liquid PCBs (including non-porous surfaces covered with a porous surface, such as paint or coating on metal), cleaning to Visual Standard No. 2, Near-White Blast Cleaned Surface Finish, of the National Association of Corrosion Engineers (NACE). A person shall verify compliance with standard No. 2 by visually inspecting all cleaned areas.

(ii) For disposal in a smelter operating in accordance with §761.72(b):

(A) For non-porous surfaces previously in contact with liquid PCBs at any concentration, where no free-flowing liquids are currently present, <100 µg/100 cm^2 as measured by a standard wipe test (§761.123) at locations selected in accordance with subpart P of this part.

(B) For non-porous surfaces in contact with non-liquid PCBs (including non-porous surfaces covered with a porous surface, such as paint or coating on metal), cleaning to Visual Standard No. 3, Commercial Blast Cleaned Surface Finish, of the National Association of Corrosion Engineers (NACE). A person shall verify compliance with standard No. 3 by visually inspecting all cleaned areas.

(4) The decontamination standard for concrete is ≤10 µg/100 cm^2 as measured by a standard wipe test (§761.123) if the decontamination procedure is commenced within 72 hours of the initial spill of PCBs to the concrete or portion thereof being decontaminated.

(c) *Self-implementing decontamination procedures*. The following self-implementing decontamination procedures are available as an alternative to the measurement-based decontamination methods specified in paragraph (b) of this section. Any person performing self-implementing decontamination must comply with one of the following procedures.

(1) Any person decontaminating a PCB Container must do so by flushing the internal surfaces of the container three times with a solvent containing <50 ppm PCBs. Each rinse shall use a volume of the flushing solvent equal to approximately 10 percent of the PCB Container capacity.

(2) Any person decontaminating movable equipment contaminated by PCBs, tools, and sampling equipment may do so by:

(i) Swabbing surfaces that have contacted PCBs with a solvent;

(ii) A double wash/rinse as defined in subpart S of this part; or

(iii) Another applicable decontamination procedure in this section.

(3) Any person decontaminating a non-porous surface in contact with free-flowing mineral oil dielectric fluid (MODEF) at levels ≤10,000 ppm PCBs must do so as follows:

(i) Drain the free-flowing MODEF and allow the residual surfaces to drain for an additional 15 hours.

(ii) Dispose of drained MODEF according to paragraph (g) of this section.

(iii) Soak the surfaces to be decontaminated in a sufficient amount of clean (containing <2 ppm PCBs) performance-based organic decontamination fluid (PODF) such that there is a minimum of 800 ml of PODF for each 100 cm^2 of contaminated or potentially contaminated surface for at least 15 hours at ≥20 °C.

(iv) Approved PODFs include:

(A) Kerosene.

(B) Diesel fuel.

(C) Terpene hydrocarbons.

(D) Mixtures of terpene hydrocarbons and terpene alcohols.

(v) Drain the PODF from the surfaces.

(vi) Dispose of the drained PODF in accordance with paragraph (g) of this section.

(4) Any person decontaminating a non-porous surface in contact with free-flowing MODEF containing >10,000 ppm PCB in MODEF or askarel PCB (up to 70 percent PCB in a mixture of trichlorobenzenes and tetrachlorobenzenes) must do so as follows:

(i) Drain the free-flowing MODEF or askarel and allow the residual surfaces to drain for an additional 15 hours.

(ii) Dispose of drained MODEF or askarel according to paragraph (g) of this section.

(iii) Soak the surfaces to be decontaminated in a sufficient amount of clean PODF (containing <2 ppm PCBs) such that there is a minimum of 800 ml of PODF for each 100 cm^2 of contaminated or potentially contaminated surface for at least 15 hours at ≥20 °C.

(iv) Approved PODFs include:

(A) Kerosene.

(B) Diesel fuel.

(C) Terpene hydrocarbons.

(D) Mixtures of terpene hydrocarbons and terpene alcohols.

(v) Drain the PODF from the surfaces.

(vi) Dispose of the drained PODF in accordance with paragraph (g) of this section.

(vii) Resoak the surfaces to be decontaminated, pursuant to paragraph (c)(3)(iii) of this section, in a sufficient amount of clean PODF (containing <2 ppm PCBs) such that there is a minimum of 800 ml of PODF for each 100 cm^2 of surface for at least 15 hours at ≥20 °C.

(viii) Drain the PODF from the surfaces.

(ix) Dispose of the drained PODF in accordance with paragraph (g) of this section.

(5) Any person decontaminating piping and air lines in an air compressor system must do so as follows:

(i) Before decontamination proceeds, disconnect or bypass the air compressors and air dryers from the piping and air lines and decontaminate the air compressors and air dryers separately in accordance with paragraphs (b), (c)(1) through (c)(4), or (c)(6) of this section. Dispose of filter media and desiccant in the air dyers based on their existing PCB concentration.

(ii) Test the connecting line and appurtenances of the system to assure that there is no leakage. Test by introducing air into the closed system at from 90 to 100 pounds per square inch (psi). Only if there is a pressure drop of <5 psi in 30 minutes may decontamination take place.

(iii) When there is no leakage, fill the piping and air lines with clean (containing <2 ppm PCBs) solvent. Solvents include PODF, aqueous potassium hydroxide at a pH between 9 and 12, or water containing 5 percent sodium hydroxide by weight.

(iv) Circulate the solvent to achieve turbulent flow through the piping and air lines in the air compressor system until the total volume of solvent circulated equals 10 times the total volume of the particular article being decontaminated, then drain the solvent. Calculate the total volume of solvent circulated by multiplying the pump rate by the time of pumping. Turbulent flow means a Reynolds number range from 20,000 to 43,000. Refill the system with clean solvent and repeat the circulation and drain process.

(6) Any person using thermal processes to decontaminate metal surfaces in contact with PCBs, as required by §761.62(a)(6), must use one of the following options:

(i) Surfaces in contact with liquid and non-liquid PCBs at concentrations <500 ppm may be decontaminated in a scrap metal recovery oven or smelter for purposes of disposal in accordance with §761.72.

(ii) Surfaces in contact with liquid or non-liquid PCBs at concentrations ≥500 ppm may be smelted in a smelter operating in accordance with §761.72(b), but must first be decontaminated in accordance with §761.72(a) or to a surface concentration of <100 µg/100 cm^2.

(d) *Decontamination solvents.* (1) Unless otherwise provided in paragraphs (c)(3) through (c)(5) of this section, the solubility of PCBs in any solvent used for purposes of decontamination under this section must be 5 percent or more by weight.

(2) The solvent may be reused for decontamination so long as its PCB concentration is <50 ppm.

(3) Solvent shall be disposed of under paragraph (g) of this section.

(4) Other than as allowed in paragraphs (c)(3) and (c)(4) of this section, solvents may be tested and validated for performance-based decontamination of non-porous surfaces contaminated with MODEF or other PCB liquids, in accordance with the self-implementing procedures found in subpart T of this part. Specific conditions for the performance-based testing from this validation are determined in the validation study.

(e) *Limitation of exposure and control of releases.* (1) Any person conducting decontamination activities under this section shall take necessary measures to protect against direct release of PCBs to the environment from the decontamination area.

(2) Persons participating in decontamination activities shall wear or use protective clothing or equipment to protect against dermal contact or inhalation of PCBs or materials containing PCBs.

(f) *Sampling and recordkeeping.* (1) Confirmatory sampling is required under paragraph (b) of this section. For liquids described in paragraphs (b)(1) and (b)(2) of this section, sample in accordance with §§ 761.269 and 761.272. For non-porous surfaces and concrete described in paragraphs (b)(3) and (b)(4) of this section, sample in accordance with subpart P of this part. A written record of such sampling must be established and maintained for 3 years from the date of any decontamination under this section. The record must show sampling locations and analytical results and must be retained at the site of the decontamination or a copy of the record must be made available to EPA in a timely manner, if requested. In addition, recordkeeping is required in accordance with §761.180(a) for all wastes generated by a decontamination process and regulated for disposal under this subpart.

(2) Confirmatory sampling is not required for self-implementing decontamination procedures under paragraph (c) of this section. Any person using these procedures must retain a written record documenting compliance with the procedures for 3 years after completion of the decontamination procedures (e.g., video recordings, photographs).

(g) *Decontamination waste and residues.* Decontamination waste and residues shall be disposed of at their existing PCB concentration unless otherwise specified.

(1) Distillation bottoms or residues and filter media are regulated for disposal as PCB remediation waste.

(2) PCBs physically separated from regulated waste during decontamination (such as by chopping, shredding, scraping, abrading or oil/water separation, as opposed to solvent rinsing and soaking), other than wastes described in paragraph (g)(1) of this section, are regulated for disposal at their original concentration.

(3) Hydrocarbon solvent used or reused for decontamination under this section that contains <50 ppm PCB must be burned and marketed in accordance with the requirements for used oil in §761.20(e), disposed of in accordance with §761.60(a) or (e), or decontaminated pursuant to this section.

(4) Chlorinated solvent at any PCB concentration used for decontamination under this section shall be disposed of in an incinerator operating in compliance with §761.70, or decontaminated pursuant to this section.

(5) Solvents ≥50 ppm other than those described in paragraphs (g)(3) and (g)(4) of this section shall be disposed of in accordance with §761.60(a) or decontaminated pursuant to this section.

(6) Non-liquid cleaning materials and personal protective equipment waste at any concentration, including non-porous surfaces and other non-liquid materials such as rags, gloves, booties, other disposable personal protective equipment, and similar materials resulting from decontamination shall be disposed of in accordance with §761.61(a)(5)(v).

(h) *Alternative decontamination or sampling approval.* (1) Any person wishing to decontaminate material described in paragraph (a) of this section in a manner other than prescribed in paragraph (b) of this section must apply in writing to the EPA Regional Administrator in the Region where the activity would take place, for decontamination activity occurring in a single EPA Region; or the Director of the National Program Chemicals Division, for decontamination activity occurring in more than one EPA Region. Each application must describe the material to be decontaminated and the proposed decontamination method, and must demonstrate that the proposed method is capable of decontaminating the material to the applicable level set out in paragraphs (b)(1) through (b)(4) of this section.

(2) Any person wishing to decontaminate material described in paragraph (a) of this section using a self-implementing procedure other than prescribed in paragraph (c) of this section must apply in writing to the EPA Regional Administrator in the Region where the activity would take place, for decontamination activity occurring in a single EPA Region; or the Director of the National Program Chemicals Division, for decontamination activity occurring in more than one EPA Region. Each application must describe the material to be decontaminated and the proposed self-implementing decontamination method and must include a proposed validation study to confirm performance of the method.

(3) Any person wishing to sample decontaminated material in a manner other than prescribed in paragraph (f) of this section must apply in writing to the EPA Regional Administrator in the Region where the activity would take place, for decontamination activity occurring in a single EPA Region; or the Director of the National Program Chemicals Division, for decontamination activity occurring in more than one EPA Region. Each application must contain a description of the material to be decontaminated, the nature and PCB concentration of the contaminating material (if known), the decontamination method, the proposed sampling procedure, and a justification for how the proposed sampling is equivalent to or more comprehensive than the sampling procedure required under paragraph (f) of this section.

(4) EPA may request additional information that it believes necessary to evaluate the application.

(5) EPA will issue a written decision on each application for risk-based decontamination or sampling. No person may conduct decontamination or sampling under this paragraph prior to obtaining written approval from EPA. EPA will approve an application if it finds that the proposed decontamination or sampling method will not pose

STONE & WEBSTER ENGINEERING CORPORATION
ENVIRONMENTAL / INFRASTRUCTURE DIVISION
STANDARD PROJECT PROCEDURE

TITLE: Oxford Mill **Cuttings and Fluids Management**	**NO.:**	SOP 7
	PAGE	1 of 4
	DATE:	March 2001

APPROVED:

Environmental/Infrastructure Division

1.0 PURPOSE

This standard operating procedure (SOP) presents the management options for handling investigation-derived waste (IDW).

2.0 REFERENCES

U.S. Environmental Protection Agency, Region IV, Engineering Support Branch Standard Operating Procedure and Quality Assurance Manual, 1986.

U.S. Environmental Protection Agency, A Compendium Superfund Field Operations Methods, EPA/540/P-87/001.1, 1987.

U.S. Environmental Protection Agency, Guide to Management Investigation-Derived Wastes, 9345.3-03FS, January 1992.

3.0 APPENDICES

None.

4.0 GENERAL

4.1 DEFINITIONS

Hazardous Waste - Waste that is a RCRA regulated listed waste, or waste that exhibits ignitability, corrosivity, reactivity, or toxicity.

4.2 RESPONSIBILITIES

The Site Manger is responsible for ensuring that all investigation derived waste (IDW) procedures are conducted in accordance with this SOP. The Site Manager is also responsible for ensuring that handling IDW is in accordance with site-specific requirements.

4.3 APPLICABILITY

Field investigation activities result in the generation waste materials that may be characterized as a hazardous waste. The IDW may include drilling muds, cuttings, soil, other materials from collection samples, contaminated personal protective equipment (PPE), and solutions (aqueous or otherwise) used to decontaminate non-disposable protective clothing and equipment. The management of IDW must comply with (or waive) regulatory requirements that are applicable or relevant and appropriate requirements (ARARs), such as the Land Disposal Restriction Regulations and treatability study exemptions.

4.4 REQUIRED EQUIPMENT

IDW Containment Devices

5.0 PROCEDURES

During the routine course site investigation, where materials are known (via field instrumentation or visual observation) or suspected (historic information) to be contaminated, sampling activity (i.e., soil boring) will produce waste intrinsic to the site. The disposition this material must be carried out in a manner such as not to contribute further environmental degradation or pose a threat to public health or safety.

The three general options for managing IDW are (1) collection and on-site disposal; (2) collection and off-site disposal; and (3) collection and interim management. The option selected should take into account the following factors:

- type and quantity IDW (soil, sludge, liquid, debris)
- IDW minimization, and consistency with the IDW remedy and the site remedy

5.1 ON-SITE DISPOSAL

For this project, significant on-site disposal is not anticipated.

5.2 OFF-SITE DISPOSAL

5.2.1 Soil

Soil will be field characterized. This characterization may be used to determine disposal options.

When the final site remedy requires off-site treatment/disposal, the IDW may be stored (e.g. drummed, covered in a waste pile). The management option selected should take into account relevant site-specific factors including weather, storage space, and public concerns/perceptions.

Before sending offsite to a TSDF, analysis is required. Manifests will also be required. Confirm that the TSDF and transporter are permitted for the respective wastes.

Potential treatment options include Bioremediation, Low Temperature Thermal Stripping, High Temperature Thermal Stripping, Beneficial Reuse - Asphalt Incorporation, Construction Reuse, Chemical Extraction, Solidification/Stabilization, Isolation/Containment and others.

5.2.2 Aqueous Liquids

Aqueous liquids (i.e. stormwater, decontamination fluids) will be field characterized. This characterization may be used to determine disposal options.

When the final site remedy requires off-site treatment/disposal, the IDW may be stored (e.g., mobile tank or drums) or returned to its source until final disposal. The management option selected should take into account other relevant site-specific factors including weather, storage space, and public concerns/perceptions).

Before sending offsite to a TSDF, analysis is required. Also manifests may be required. Confirm that the TSDF and transporter are permitted for the respective wastes.

Potential treatment options include: Physical Separation, Air Stripping, Steam Stripping, Carbon Adsorption, Resin Adsorption, Precipitation, Flocculation, Sedimentation, Dissolved Air Flotation, Detoxification/Oxidation, Biological Degradation, Chemical Oxidation, Ultraviolet/Ozone Oxidation, Incineration, Neutralization, Concentration, Reverse Osmosis, Ultrafiltration Ion Exchange, Electrodialysis, and others.

5.2.3 Disposable PPE

Field judgement on level of contamination will be made and an appropriate disposal method will be selected. If offsite disposal at a regulated facility is required, analysis of soil and water in contact with PPE may be used to determine disposal options.

5.3 INTERIM MEASURES

A. Storing IDW on-site until the final action may be practical in the following situations:

1. Returning wastes (especially sludges and soils) to their on-site source area would require reexcavation for disposal in the final remediation alternative.

2. Interim storage in containers may be necessary to provide adequate protection to human health and the environment.

3. Off-site disposal options may trigger land disposal regulations under RCRA. Storing IDW until the final disposal of all wastes from the site will eliminate the need to address this issue more than once.

B. Segregate and containerize all waste for future treatment and/or disposal.

1. Containment options for soils include drums or covered waste pile in AOC.

2. Containment options for aqueous liquids include mobile tank or drums.

3. Containment options for PPE include drums or roll-off boxes.

6.0 <u>RESTRICTED/LIMITATIONS</u>

Site managers should determine the most appropriate disposal option for aqueous liquids on a **site-specific** basis. Parameters to consider, especially in making the protectiveness decision, include the volume IDW and the presence contaminants in the soil at the site. Special disposal/handling may be needed for drilling fluids because they may contain significant components.

SOP 8

Labeling, Packaging and Shipping Environmental Samples

STONE & WEBSTER ENGINEERING CORPORATION
ENVIRONMENTAL / INFRASTRUCTURE DIVISION
STANDARD OPERATING PROCEDURE

TITLE: Oxford Mill **Labeling, Packaging, and Shipping Environmental Samples**	**NO.:**	SOP 8
	PAGE:	Page 1 of 12
	DATE:	March 2001

APPROVED:

Environmental / Infrastructure Division

1.0 PURPOSE

This Standard Operating Procedure (SOP) - **Labeling, Packaging, and Shipping Environmental Samples** is to be employed at the Oxford Mills sites when samples are to be collected for laboratory analysis.

The purpose of this SOP is to provide detailed guidance on how to label, package and ship samples of various matrices for analysis by a fixed-based laboratory. It also provides guidance on how the samples should be labeled and how the Chain-Of-Custody (COC) form which accompanies the samples should be filled out.

2.0 SCOPE

This SOP details the materials, equipment, and methods common to all sample labeling, chain-of-custody, packaging, and shipping activities for groundwater, surface water, soil, and sediment samples. **Field changes to this SOP or the Sample Acquisition Plan (SAP) shall be discussed with the Project Manager or Project Chemist prior to implementation and shall be documented in project field log books.**

Section 4 - Personnel Responsibilities - outlines the areas of responsibility for each of the Stone & Webster project team members.

Section 5 - Equipment - outlines those materials and equipment which are commonly employed during any sample packaging and shipping activities.

Section 6 - Labeling - outlines those items which should be listed on any sample label.

Section 7 - Chain-of-Custody - describes the requirements that ensure an audible paper trail follows every sample container.

Section 8 - Sample Packaging - outlines those activities which shall be employed to package and, if necessary, store any kind of sample.

Section 9, Sample Shipping - describes the techniques for shipping samples to ensure that sample integrity is preserved.

3.0 REFERENCES

Stone & Webster Quality Control Plan, Volume III - Operational Management Plan, Appendix IIIB - Corporate Chemical Quality Management Plan, Stone & Webster, 1995.

4.0 DEFINTIONS

None.

5.0 RESPONSIBILITIES

5.1 DIVISION CHIEF

Sets technical capability requirement criteria for personnel and ensures that personnel assigned to project tasks are properly qualified for the needed work.

5.2 PROJECT MANAGER

Translates client's requirements into technical direction of project. Reviews and approves technical progress, ensures that the Site Manager has been properly briefed and is prepared for packaging and shipping task.

5.3 SITE MANAGER

Ensures that field personnel have been briefed in chain-of-custody, sample packaging and shipping in accordance with the project requirements, this SOP and related SOPs. Assures that all necessary equipment including safety equipment is available and functioning properly before project operations begin. Assures that all necessary personnel are mobilized on time. Maintains daily log of activities during each day of fieldwork.

The Site Manager or Project Chemist is also responsible for determining that samples are properly packaged and shipped, and for determining that chain-of-custody procedures are implemented from the time the samples are collected to their release to the shippers.

Should field conditions necessitate changes in the number and/or type of samples collected, or changes in sample shipment dates, the Site Manager must notify the Project Manager and the Project Chemist of the changes prior to completion of field activities.

The Site Manager coordinates and consults with the Project Manager on decisions relative to unexpected occurrences or deviations from this SOP during the packaging and shipping phase.

The Site Manager shall notify the Project Chemist of the number and type of samples and approximate collection, shipment, and delivery dates for all samples prior to leaving for the field.

5.4 SITE PERSONNEL

All employees who are engaging in sample packaging and shipping activities are required to read and sign the site-specific Health and Safety Plan (HASP) and to follow the procedures in this SOP, unless superseded by project-specific requirements. All sample packaging and shipping activities, including deviations to this SOP, will be recorded in field logbooks during on-site activities.

Field sampling personnel are expected to carry out the sample packaging and shipping activities. They are responsible for the care and custody of the samples collected until they are properly disposed or dispatched. The Site Manager or Project Chemist should be contacted if any problems arise during this phase of the sample collection process.

Personnel assigned to a project team with the task of collecting and shipping samples will be trained in specific techniques of sample collection and shipment.

5.5 PROJECT CHEMIST

The Project Chemist is responsible for coordinating sample shipment with the laboratories to minimize holding times and assure proper handling of all samples.

The Project Chemist shares responsibility with the Site Manager for determining that samples are properly packaged and shipped, and that chain-of-custody procedures are implemented from the time the samples are collected to their release to the shippers.

5.6 SITE HEALTH & SAFETY OFFICER

All field activities must be carried out in accordance with a site-specific Health and Safety Plan (HASP). Ensuring the fulfillment of the requirements of the HASP is the responsibility of the Site Health and Safety Officer (who may also serve as a sample packer and shipper).

6.0 PROCEDURE

6.1 EQUIPMENT

The following is a list of equipment & material commonly used for labeling, packaging and shipping samples.

- Teflon® and Nylon strapping tape
- COC forms
- COC seals
- Vermiculite, Styrofoam, and/or bubble wrap
- Resealable plastic bags
- Permanent felt tip marker
- Pen (black permanent ink)
- Ice
- Shipping coolers
- Labels
- Metal cans (if high hazard samples are anticipated)
- Absorbent pads
- Transparent shipping tape
- Trash bags
- Duct tape (seals off openings in coolers)
- Knife or scissors to cut tape

6.2 SAMPLE LABELING

Prior to sample removal from the sampling location and packaging and shipment to an offsite laboratory, all sample containers will be assigned a permanent sample label. All notations on the label will be marked using indelible ink. Use the prepared sample labels (whenever possible) to document all information necessary for effective sample tracking. In the case of soil samples, the boring number and the depth at which the sample was taken should also be included on the label. The information on the label will include the following:

- Date and time of sample collection (use military 24-hour format for the time)
- Company name
- Sample description
- Sampler's name and initials

- Sample ID number
- Job number
- Preservation method used for sample

The sample label can be modified to satisfy client/project specific requirements. An example of a completed sample label is provided in Attachment A.

A set of labels will be prepared and numbered to correspond with unique samples to be collected. Assign a sample number using the SWETS Identification System using 10-digit codes, as follows:

Digits 1&2 - Site Locator (letter code), e.g.,

28 – Building No. 28
03 – Building No. 3

Digits 3,4,5,6,7, & 8 - Sample Location, e.g.,

UT04SP - UST 4 Soil Boring (split spoon) Sample
UT04GW - UST 4 Groundwater Sample
UT04SW - UST 4 Surfacewater Sample
UT04SD - UST 4 Sediment Sample

Digits 9,10,11, & 12 (Optional - to be used when sampling subsurface depth intervals) Sample depth, e.g.,

UT04SP(12-14) - UST 4 soil boring (Split Spoon) sample collected from depth interval 12 to 14 feet below ground surface)

Digits 13 & 14 Modifiers (to be used if not prohibited by Field Sampling Plan)

Unique letters used to designate sample type (e.g., regular samples, trip blanks, duplicate samples, etc.). A record will be maintained to identify codes associated with QA/QC sample locations; e.g.,

XX - Regular Sample
TB - Trip Blank
DS - Duplicate Sample
MS - Matrix Spike
MSD - Matrix Spike Duplicate

6.3 CHAIN-OF-CUSTODY

Stone & Webster has established a program of sample custody that shall be followed during sample handling activities from the field to the laboratory. This program is designed to ensure that each sample is accounted for at all times.

The objective of the sample custody identification and control system is to ensure, to the extent practicable, that the following conditions are met:

- Samples scheduled for collection are uniquely identified
- The correct samples are analyzed and are traceable to their records
- Important sample characteristics are preserved
- Samples are protected from loss or damage
- Any alteration of samples (e.g., filtration, preservation) is documented
- Client confidentiality is maintained
- Sample COC shall be maintained through sample collection, shipment, storage, and analysis as a legal record and audible trail of sample possession.
- Possession will be traceable by means of a COC record similar to the one shown in Attachment B. The COC bears the signatures of the persons in possession of the samples. **The COC shall remain with the samples at all times until receipt by the laboratory.**

COC records (see Attachment B) shall be completed by the appropriate sampling and laboratory personnel for each sample. The following COC protocol shall be employed by sampling crews and recorded on the COC for each sample:

- SWETS Sample ID number (as described in the Labeling Section of this report) and sample bottle identification number, where applicable. Use a separate column (or line depending on the configuration of the particular COC being used) for each parameter to be tested for a given sample number.
- Bottle type and size
- Analytical test parameters or test parameter method (in Analysis/Remarks Section); e.g., EPA Method 8270. Also indicate lab QC sample, if applicable; e.g., MS/MSD
- Specific instructions to the lab; e.g., unique turnaround times, specific analytes or other special instructions for analysis
- Number of containers corresponding to each sample ID number and parameter,
- Preservatives used (if any),
- Specific sample collection method (grab or composite)

- Type of matrix
- Date and time of each sample collection
- Name(s) of the sampler(s) and signature of the person shipping the samples
- Date and time that the samples were sealed for delivery
- Names of those responsible for receiving the samples at the laboratory (to be filled out at the laboratory)

The COC record shall be completed in quadruplicate using black waterproof ink. If any changes or corrections are made, they should be made by drawing a single line through the entry, initialing and dating the change, and entering the correct information. Two copies shall accompany the samples to the laboratory, another is kept by the sample crew chief and transferred to the Project Chemist, and the last copy shall be maintained in the project file. Additional copies shall be provided as needed for the project. An example of a completed COC is provided in Attachment B.

After shipment, the laboratory sample receiver signs and dates the COC, completing the sample transfer process.

6.4 SAMPLE PACKAGING

Sample containers are generally packed in insulated coolers for shipment. Appropriate packing materials are bubble wrap and vermiculite. Bottles are packed tight so that they cannot move during shipment. The following steps shall be followed:

- To eliminate the chance of breakage during shipment, approximately one inch of inert cushioning material shall be placed in the bottom of the cooler.

- Place each sample container tightly inside its own plastic bag and seal, as a precaution against cross-contamination due to leakage or breakage.

- Place containers upright in the cooler in such a way that they will not touch during transport.

- After samples have been packed, ice shall be placed in double Ziplock bags and added to the cooler. Use enough ice to ensure that the temperature of the cooler contents are ≤ 4°C. Also make sure the entire cooler is packed tightly so no containers shift during shipping, thus avoiding breakage.

- Include all paperwork in a separate Ziplock bag taped to the inside lid of the cooler.

Chain-of-Custody documents will accompany all shipped samples

For courier pickup - COC forms will be completed by the sampler and courier and placed in the cooler - See Section 9.1 for details.

For sample shipment - COC forms will be completed by the sampler and placed in the cooler - See Section 9.2 for details.

1. Duct-tape cooler lid seal and drains. Tape the cooler shut with strapping tape.
2. Affix numbered, signed, and dated custody seals to ensure that samples have not been disturbed during transport. Cover custody seals with clear tape.
3. If not already there, the lab address will be written on the top of the cooler with indelible ink.

6.5 SAMPLE SHIPPING

After collection, all samples shall be transported to the contract laboratory in such a manner as to preserve their integrity. To maintain the required level of sample custody, overnight carrier shipping manifests are normally employed. Field samples which require shipment shall be sent to the laboratory by an overnight courier service within 24 hours of their collection. No sample shall remain on site for more than 24 hours after collection unless previous arrangements have been made with the laboratory, i.e., weekend sampling.

Courier Pickup of Environmental Samples

If the laboratory is located within a reasonable distance from the site, arrangements may be made to have the laboratory pick up the samples. Most laboratories have their own courier service and will pick up samples if the site is within 200 miles of their facility. **Coordinate with the receiving laboratory prior to sample collection events to ensure that the desired pick-up will occur on time.**

When the samples are transferred to a laboratory courier, the sampler shall:

- Sign, date, and enter the time in the "Relinquished by" entry location of the COC form.
- Make sure that the courier receiving the sample signs the "Received by" entry of the COC form.

Shipping Environmental Samples

Environmental samples requiring shipment to a laboratory shall be sent next-day delivery by Federal Express or an equivalent overnight carrier. **The receiving laboratory shall be given advance notice by the Stone & Webster Site Manager no later than 48 hours before sample shipment.**

If Friday sampling is unavoidable and Saturday delivery is not possible, samples shall be properly stored (custody and sample preservation must be maintained) over the weekend. If prompt shipping and laboratory receipt of samples cannot be guaranteed, the samplers will be responsible for proper storage of samples until adequate transportation arrangements can be made or sample collection schedules will be modified by the Site Manager. If holding times would be exceeded by storing samples over the weekend (e.g., if there are 24 hour turnaround requirements), alternative arrangements must be made by the Site Manager for sample collection and shipment or pickup.

Note: Overnight carriers usually will not accept responsibility for signing COC forms. Therefore, the Sampler shall sign, date, enter the time in the "Relinquished by" entry location of the COC form, place inside a zip-lock bag inside the sample container, and seal the container as specified in Section 8 - Sample Packaging.

6.6 GLOSSARY OF TERMS

COC - Chain-Of-Custody form

Matrix - The physical description of the medium being sampled e.g. soil (solid), aqueous (liquid)

SOP - Standard Operating Procedure

QA - Quality Assurance

QC - Quality Control

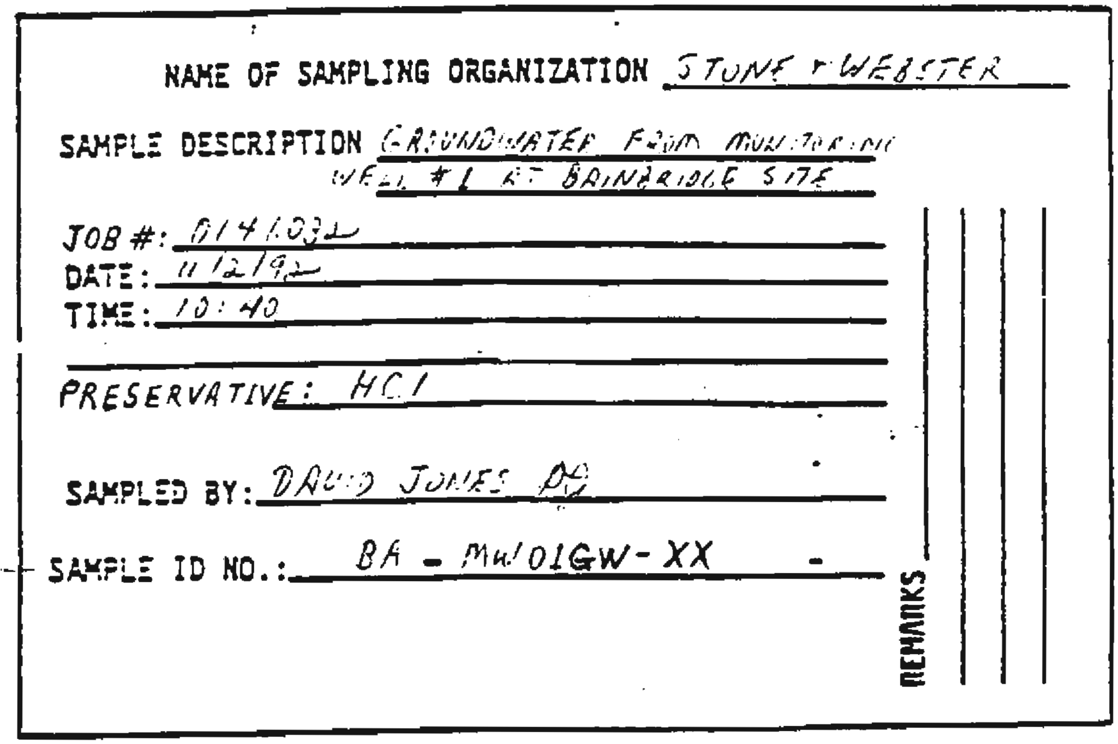
7.0 ATTACHMENTS

Attachment A - Sample Label

Attachment B - Chain-of-Custody Record

ATTACHMENT A

SAMPLE LABEL



NAME OF SAMPLING ORGANIZATION STONE & WEBSTER

SAMPLE DESCRIPTION GROUNDWATER FROM MONITORING WELL #1 AT BAINBRIDGE SITE

JOB #: 0141032

DATE: 11/2/92

TIME: 10:40

PRESERVATIVE: HCl

SAMPLED BY: DAVID JONES

SAMPLE ID NO.: BA - MW01GW-XX

REMARKS

ATTACHMENT B

Attachment B

Environmental Laboratories

55 South Park Drive
Colchester, VT 05446

TEL: (802) 655-1203
FAX: (802) 655-1248

PAGE 2 OF 2

COMPANY INFORMATION

Name: Stone & Webster
Address: 245 Summer St
Boston, MA
02210
Telephone: 617-589-1080
Facsimile: 617 589-2722
Contact Name: Tim Taylor

COMPANY'S PROJECT INFORMATION

Project Name: ANG-BURL
Project Number:
Sampler Name(s): Kevin Scully
Paul Graden

SHIPPING INFORMATION

Carrier:
Airbill Number:
Date Shipped:
Hand Delivered: ☐ yes ☐ no

INCHCAPE LABORATORY INFORMATION

Quote #:
Client Code:

SAMPLE IDENTIFICATION (NOTE 1)	COLLECTION DATE	COLLECTION TIME	GRAB	COMPOSITE	MATRIX	ANALYSIS/REMARKS (NOTE 2,3)	1 L / Amb GL / Cool	40 mL / GL / HCL	1 L / Amb GL / Cool	500 mL / NM PL / Cool	500 mL / NM PL / Cool	
EQ 1	8/21/96	13:20	✓		A	8270	1	—	—	—	—	
MCW 101	8/22/96	0900	✓		A	8260	—	2 KS	—	—	—	
MCW 101	8/22	0910	✓		A	8270	—	—	1	—	—	
MCW 101	8/22	0920	✓		A	Total Metals - 6010* As, Pb, Cr only	—	—	—	1	—	
MCW 101 (B)	8/22	0925	✓		A	Dissolved Metals - 6010* As, Pb, Cr only	—	—	—	—	1	

Relinquished by: (signature)	DATE	TIME	Received by: (signature)
Kevin Scully	8/22/96	10:15	James P. Poman
Relinquished by: (signature)	DATE	TIME	Received by: (signature)
Relinquished by: (signature)	DATE	TIME	Received for Laboratory by: (signature)
	8/22/96	1130	

NOTES TO SAMPLER(S): (1) Limit Sample Identification to 6 characters, if possible; (2) Indicate designated Lab Q.C. sample and type (e.g.: MS/MSD/REP) and provide sufficient sample; (3) Field duplicates are separate sample; (4) e.g.: 40 ml/glass/H_2SO_4

Notes to Lab: (B) Filter Sample & Run dissolved metals - Do Immediately

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

SOP 9

Personal Protection Equipment

STONE & WEBSTER ENGINEERING CORPORATION
ENVIRONMENTAL/INFRASTRUCTURE DIVISION
STANDARD OPERATING PROCEDURE

TITLE: Oxford Mill **Personal Protective Equiment**	**NO.:**	SOP 9
	PAGE	1 of 2
	DATE:	March 2001

APPROVED:

Environmental/Infrastructure Division

1 PERSONAL PROTECTIVE EQUIPMENT

Site activities at Oxford Mill may include the use of a variety of personal protective equipment ensembles. The selection of these ensembles for various activities is the responsibility of the SSHO and is based on the hazards analyses described in previous sections of this SSHP. Field personnel shall use PPE as directed by the SSHO.

The site walkover, soil boring and subsurface soil sampling will all be initiated in Level D protection. An Exclusion Zone will be established around the drilling and sampling locations. Based on air monitoring results and action levels established the possibility of splash hazards and other field observations, the SSHO at his/her discretion may require modifications to the initial level of protection. Modifications may require an upgrade to Modified Level D.

Disposable personal protective equipment used during Level D and modified Level D will be used for a maximum of one shift. The PPE will then be either properly decontaminated/cleaned or disposed of as appropriate. If PPE becomes grossly contaminated prior to this time frame, disposable PPE will be discarded sooner and each time when leaving the Exclusion Zone.

All disposable contaminated personal protective equipment and contaminated disposable sampling equipment will be placed in approved 55-gallon drums for disposal.

For the activities covered by this SSHP it is not anticipated that Level C protection will be required. If air monitoring results indicate that Level C protection is required, the project manager and Program Health and Safety Manager will be notified and work shall stop and the hazards associated with the specific operation will be re-evaluated.

The following paragraphs describe the specific components of what shall be considered Level D and modified Level D as required in this SSHP.

LEVEL D PROTECTION

This level of protection will include use of:

- Steel-toed work boots
- Work gloves (as required)
- Long pants
- Hard hat
- Additional appropriate outdoor dress as required by weather conditions

MODIFIED LEVEL D PROTECTION

Modified D protection shall include all of the items for Level D as well as:

- Disposable outer boots
- Chemically resistant nitrile gloves with latex undergloves
- Tyvek or Saranex-coated coveralls (taped to protective gloves and boots at wrists and ankles)
- Full face shield (if splash hazards exists)
- Safety glasses (with side shields)
- Hearing protection

SOP 10

Severn Trent Fixed Laboatory

STL WESTFIELD

STANDARD OPERATING PROCEDURE

Analytical Procedures for the Analysis of PCB Aroclors

Method SW846 8082

SOP ID: GCS00200.MA

Date Effective: 04/01/99
Date Revised: 04/19/01

Approved Signatures and Dates

QUALITY ASSURANCE COORDINATOR

LABORATORY DIRECTOR

This documentation has been prepared by Severn Trent Laboratories (STL) solely for STL's own use and the use of STL's customers in evaluating its qualifications and capabilities in connection with a particular project. The user of this document agrees by its acceptance to return it to Severn Trent Laboratories upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use it for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.
THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF SEVERN TRENT LABORATORIES IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY SEVERN TRENT LABORATORIES IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES. IF PUBLICATION OF THIS WORK SHOULD OCCUR THE FOLLOWING NOTICE SHALL APPLY:

1.0 TITLE

Analytical Procedures for the Analysis of PCB Aroclors by Method SW846 8082

2.0 AREA OF APPLICABILITY

Organic Sample Preparation Laboratory
Organic Instrument Laboratory

3.0 SCOPE AND APPLICATION

This procedure is used to determine the concentrations of pcb's as arochlors in extracts from solid and liquid matrices. The seven target arochlors are listed in table 1. This method is applicable to water, soil, sediment, and sludge. Sample extracts maybe subject to various clean-up procedures to remove interferences from non-target matrices. The procedure used will depend on the nature of the interference. Compound identification is based on pattern recognition of arochlors and relies on analyst expertise. Arochlor concentration is confirmed automatically with dual column injections. The practical quantitation limit for this method is 0.3-25.0 ug/L for waters and 100-5000 ug/kg for soils.

4.0 SUMMARY OF METHOD

Either 1liter of water or 10 grams of soil is extracted by using the appropriate matrix-specific extraction technique. Liquids samples are extracted at neutral pH with methylene chloride using a Corning accelerated one-step continuous liquid-liquid extractor (method 3520) or separatory funnel procedure (3510). Soils are extracted with hexane-acetone (1:1) using soxhlet (method 3540) or ultrasonic procedure (3550). The extraction solvent is concentrated, and exchanged to hexane. The final volume of the extract is brought to 5 mL for waters and 10mL for soils. Depending on the appearance of the extract, e.g. if it is highly colored, the extract may be subject to clean-up with sulfuric acid or florisil to remove interferences. 2uL of the extract is injected into a Hewlett Packard gas chromatograph fitted with two 0.32id capillary columns connected with a deactivated glass "Y-splitter" preceded by a 5-meter fused silica guard column. Each column is connected to a separate electron capture detector. Sample extracts are analyzed simultaneously on each column. The connection to the Y-splitter can be problematic and a leak free seal difficult to obtain. Alternatively, both columns can be fitted with a 2-hole ferrule conversion fitting.

TABLE 1
EPA 8082 TARGET COMPOUNDS

NUMBER	ANALYTE	CAS NUMBER
1	Aroclor 1016	12674-11-2
2	Aroclor 1221	11104-28-2
3	Aroclor 1232	11141-16-5
4	Aroclor 1242	53469-21-9
5	Aroclor 1248	12672-29-6
6	Aroclor 1254	11097-69-1
7	Aroclor 1260	11096-82-5

5.0 REFERENCE

EPA SW-846 Manual and Method 8082, Rev. 0, 1996.
Operation Manuals for the HP 5890 Series II GC, Enviroquant user quide.
Operation Manuals for the HP autosampler 7673A, Hewlett Packard.

6.0 SAMPLE HANDLING & PRESERVATION

6.1 Water samples are collected in 1 liter amber bottles. Soil samples are collected in 250 mL wide mouth jars. Both are preserved at 4°C.

6.2 Samples are shipped to the laboratory on ice.

6.3 Samples are stored in either a secured (locked) water or soil refrigerator at 4°C.

6.4 **Holding time**: Waters are required to be started within seven days of sample collection and soils are required to be started within fourteen days of sample collection.

6.5 All sample extracts must be analyzed within forty days of extraction.

7.0 INTERFERENCES

Interference's in this method can result from contaminated solvents, reagents, glassware, or other sample processing hardware, as well as contaminated GC gases, parts, columns, and detectors. Interference's can also result from compounds co-extracted from the sample matrix to which the detector will respond. In this case a variety of extract clean-up procedures are available to eliminate the problem. Phthalate esters are particularly problematic to this method. These compounds are present in many plastics and can be leached out especially when coming into contact with extraction solvents. Avoiding contact with any plastic materials during sample extraction can minimize this problem. Exhaustive clean up of solvents reagents and glassware may be required to eliminate background levels of phthalates. Method blanks are treated identically to samples and are processed with every batch to ensure no contamination is present. Glassware must be scrupulously cleaned with detergent and hot water, rinsed with tap water and organic free reagent water, followed by drying in an oven at 400°C or by rinsing with methanol or acetone to dry and methylene chloride to remove impurities.

8.0 APPARATUS

8.1 Hewlett Packard 5890 Series II Gas Chromatograph equipped with dual electron capture detectors and model 7673 autosampler. Complete with septa, inlet liner, carrier and make-up gas helium, argon/methane.
8.2 Hewlett Packard Chemstation/Enviroquant PC based data system.
8.3 Column #1: Restek Rtx-CLPesticides 30meter x 0.32mm ID; 0.5um df
8.4 Column #2: Restek Rtx-CLPesticides2 30meter x 0.32mm ID; 0.25um df
8.5 Guard column: Restek Siltek 5meter x 0.32mm ID
8.6 Siltek press tight deactivated "Y-splitter"
8.7 2-liter separatory funnel
8.8 Corning accelerated one-step continuous liquid/liquid extractor with Teflon membrane
8.9 Soxhelet glassware
8.10 Hotplates
8.11 Tekmar model TM500 ultrasonic disrupter
8.12 Low pressure liquid nitrogen tank
8.13 Condensers with water supply
8.14 Zymark Turbo-vap II, nitrogen blowdown device and associated glassware.
8.15 Syringes, volumetric flasks, graduated cylinder, autosampler vials, instrument supplies, pipets and other accessories
8.16 Analytical balance capable of weighing 0.1mg.

9.0 REAGENTS

9.1 Reagent grade (ACS) chemicals shall be used in all tests.
The date received must be recorded on all reagent labels. Consult the Safety manual for proper handling and storage of reagents. Whenever the lab receives new lots of reagents they must be screened to show they are free of contaminants. Analyze an equivalent portion of the reagent as would be used for a sample to demonstrate it is free of contaminants.
The following is a list of reagents that may be used in analysis:
9.2 Organic free reagent water.
9.3 Pesticide grade acetone, methanol, methylene chloride, hexane, toluene,

diethyl ether.

9.4 Florisil cartridges (supelco cat# 5-7053)
9.5 Sulfuric acid
9.6 Sodium sulfate
9.7 Dimethyldichlorosiloxane

10.0 STANDARDS:

10.1 Primary standards are purchased as certified solutions or as pure material.
Table 2 lists the commercial sources available that provide the necessary quantitation and calibration materials for this method.

10.2 Intermediate stock standards. Standards used for calibration are generally in the ppb range. Intermediate solutions are required to accurately achieve these low concentration levels. Table 3 lists the dilutions of the stock standard materials that may be used to accomplish this.

10.3 Working standards are prepared from the intermediate stocks and are recorded in the GC working standards logbook with description of contents, date of preparation, initial and final volumes, concentration, dilution solvents, lot numbers, and expiration dates. Each working standard is assigned a unique lot number based on page number and volume of the logbook. This number must also be recorded onto the instrumental software data file to enable traceability from the final quantitation report. Unless super-ceded by the method, expiration dates are 6 months from date of preparation for semi-volatile standards and 1month for volatile standards. Standards purchased as certified solutions often have expiration dates of their own. If this date expires sooner than the 6 months than that is the expiration date. Standards with expired dates must discarded. It is sometimes possible to get extended expiration dates by calling the manufacturer with the lot number. A certificate must be obtained before the standard can be used.

10.4 Standards integrity is verified by purchasing second source standards of a different lot number.

10.5 Calibration standards are prepared at a minimum of five levels for the aroclors 1016 and 1260. Table 4 is a summary of the steps required to formulate these five levels. All other aroclor calibrations are based on single points.

10.6 Spiking solutions used to monitor the extraction performance are prepared in acetone. A 1.0mg/L solution of tetrachloro-m-xylene and decachlorobiphenyl is used for the surrogate spike. From this solution, an aliquot of 1.0mL for soils and 0.5mL for water is spiked into all samples, blanks, and matrix spikes, giving a final extract concentration of 100ug/L. A 10.0mg/L solution of aroclor 1016 and 1260 is used for matrix spiking.

From this solution, an aliquot of 1.0mL for soils and 0.5mL for water is spiked into matrix spikes and Lab control spikes to give an extract concentration of 1000ug/L.

TABLE 2
Commercial Blends Required for Production of Method Standard Solutions

#	ITEM	VENDOR	CAT #	CONC.	SOLVENT	USE
1	Equity aroclor mix 1016/1260 tcmx/dcb	Supelco	86-1181	500 mg/L 1016/1260 50 mg/L tcmx/dcb	Acetone/methanol (40:60)	QC check
2	Aroclor1016	Accu-standard	C-216S-H-10X	1000mg/L	hexane	Quantitation
3	Aroclor1260	Accu-standard	C-260S-H-10X	1000mg/L	hexane	Quantitation
4	Tcmx/dcb	Accu-standard	CLP-032-R	200 mg/L	Acetone	Quantitation
5	Aroclor1221	Accu-standard	C-221S-H-10X	1000 mg/L	hexane	Quantitation
6	Aroclor1232	Accu-standard	C-232S-H-10X	1000 mg/L	hexane	Quantitation
7	Aroclor1242	Accu-standard	C-242S-H-10X	1000 mg/L	hexane	Quantitation
8	Aroclor1248	Accu-standard	C-248S-H-10x	1000 mg/L	hexane	Quantitation
9	Aroclor1254	Accu-standard	C-254S-H-10X	1000 mg/L	hexane	Quantitation

TABLE 3

Formulation of Intermediate Concentration Stock Solutions.

NUMBER FROM TABLE 2	ITEM	Volume (µL)	Final Vol. (mL)	SOLVENT	FINAL CONCENTRATION (mg/L)
1	Aroclor1016/1260 TCMX/DCB	200	10	Acetone	10.0 1.0
2	Aroclor1016	100	10	hexane	10.0
3	Aroclor1260	100	10	hexane	10.0
4	Tcmx/dcb	50	10	hexane	1.0
5	Aroclor1221	100	10	hexane	10.0
6	Aroclor1232	100	10	hexane	10.0
7	Aroclor1242	100	10	hexane	10.0
8	Aroclor1248	100	10	hexane	10.0
9	Aroclor1254	100	10	hexane	10.0

TABLE 4

Standard Formulation for EPA Method 8082.

- Refers to Intermediate Dilutions From Table 3.

Volume #1 (µL)	Final Vol. (mL)	SOLVENT	FINAL CONCENTRATION (µg/L)
10	1.0	Hexane	100
20	1.0	Hexane	200
50	1.0	Hexane	500
100	1.0	Hexane	1000
200	1.0	Hexane	2000
Volume #5-9 (µL)	**(mL)**	**SOLVENT**	**FINAL CONCENTRATION (µg/L)**
100	1.0	Hexane	1000

11.0 PROCEDURES

11.1 Work lists:

Work/hold time lists are used to keep track of sample backlog and hold time expirations. Each list shows sample id's, client names, due date, date sampled, and hold days remaining. Several computers in the lab have access to this program. After clicking on the "hold time" icon a menu pops up. For extractions, choose holding time information and enter section 035. For analysis, choose holding time information grouped by method and enter section 031 for extractable GC/FID, 032 for purgeable GC/FID, 033 for GC/MS, and 034 for GC/ECD work lists.

11.2 Refrigerators:

Samples are found in one of the refrigerators in sample receiving, wet-chem, or organics, depending on the analysis. Each refrigerator has a thermometer inside and temperatures need to be recorded daily on the sheet attached to the door. If any out of range readings are observed notify a supervisor immediately. Rotation of samples in and out of the fridge is necessary to keep samples organized for easy location. Typically samples are held for sixty days after which they are disposed of.

11.3 Extraction Logbooks:

In the appropriate log book, fill in all relevant information for the extraction batch including, initials, date, sample ph prior to adjustment, sample ID's, volume used, reagent and standard lot numbers, date concentrated, final volume, and any comments or observations noted. In addition, the left-hand margin is used to keep track of batch QC. At the beginning of a batch, samples are numbered 1-20. When 20 is reached another full set of QC is extracted. Method blanks are extracted every day and one every additional 20 samples extracted in a day. When a logbook is created, a unique volume number is assigned and each page is paginated. Logbook pages should never be removed. If a mistake is made, void the page by drawing a single line through it and initial and date the bottom.

11.4 Glassware:

All glassware used must be scrupulously cleaned before use in trace analysis. Wash glassware in warm soapy water followed by rinsing with de-ionized water. Bake all glassware at 450C for a minimum of one hour in the glassware oven located in the organic instrument room. Be sure to remove any tape or plastic from glassware such as separatory funnel stopcocks as this may cause a smoke hazard in the lab. After loading the oven racks, lower the cover, and set the timer to 4-5 hours. This should allow for the oven to reach temperature in 3 hours and remain there for another 1-2. Be sure to check the temperature gauge as it is heating to be sure 450C is reached. If the temperature is not reaching 450C replacement of one or more filaments may be necessary. After the oven cycle is complete, allow cooling for a minimum of 2-3 hours, slowly opening the cover a few inches to vent. Glassware is ready to use.

11.5 Sample preparation

For a more detailed explanation of the specific extraction procedures mentioned, consult the related sop.

11.6 Water:

One liter of water sample is measured into either a separatory funnel or continuous liquid-liquid extractor. Before extraction samples are brought to room temperature and the pH is recorded in the extraction logbook. If the pH is outside the neutral range it is noted on the report. No adjustment is made to the pH. 0.5 mLs of surrogate solution is added to each blank, sample, and spike. 0.5 mLs of matrix spiking solution is added to each lab control spike and matrix spike. After extraction samples are concentrated to approx. 1ml then solvent exchanged with 20mls of hexane. The final volume of hexane extract is brought to 5.0mls. Samples are now ready for analysis and/or clean-up. EPA Method SW 3510C or 3520C.

11.7 Soil:

Ten grams of soil sample is measured to .01grams and recorded into the extraction logbook. Enough sodium sulfate is added until a free flowing mixture is obtained without clumping. 1.0 mls of surrogate solution is added to each blank, sample, and spike. 1.0 mls of matrix spiking solution is added to each lab control spike and matrix spike. The samples are then extracted with hexane-acetone (1:1) using either soxhlet extractors or ultrasonication. The extraction solvent is then concentrated to 10mls in hexane. Solvent exchange is not necessary because all the acetone is driven off during concentration. Samples are now ready for analysis and/or clean-up. EPA Method SW-846 3540C or 3550B.

11.8 Extract clean-up

Extracts may be subject to various clean-up procedures to eliminate interfering compounds. The analyst may choose to clean-up an extract initially based on appearance or after analysis shows an interfering matrix in the chromatogram.

The following procedures are used for pcb extract clean-up

11.8.1 Sulfuric acid may be used to remove many common interferences. This procedure is usually the most effective removal of interferences in pcb extracts. Add 1ml or less of sulfuric acid to a 2ml vial. Using a pipet slowly add approximately 1ml of extract, if excessive heat or bubbling occurs add the extract more slowly. Let layers settle out and pipet cleaned extract off the top. If an emulsion forms and layers don't separate, use less acid and more extract.

11.8.2 Elemental sulfur obscures much of the chromatographic regions of interest. It is removed by shaking 1ml of the extract with 1-2 drops of mercury in a glass vial with teflon lined screw cap. Shake mixture for 1-2 mins., let settle, transfer 1 ml to autosampler vial. The presence of sulfur is indicated by the appearance of black mercuric sulfide precipitate. Extended mixing times or multiple additions of mercury may be required.

11.8.3 Polar interferences are removed by passing the extract through florisil cartridges. With the valve in the closed position, place a 1-gram florisil cartridge onto a vacuum manifold and set vacuum to 10in of mercury. Condition the cartridge by adding 4ml of hexane to each cartridge. Slowly open the valve to allow hexane to pass through the sorbent bed to the lower frits. Allow a few drops to pass through to remove air bubbles. Close valve and allow hexane to soak the sorbent bed for five minutes. Do not turn off vacuum.

Slowly open valve to allow the hexane to pass through cartridge. Close the valve when there is still 1mm of solvent above the sorbent bed. Do not allow the cartridge to go dry. Transfer 1ml of extract to the cartridge. Open the valve to allow the extract to pass through at 2ml/min. Close the valve after the entire extract passes through but before the cartridge becomes dry. Add 9ml of acetone/hexane (10/90 v/v) to the cartridge, open valve, and slowly collect the eluate into a clean vial. Reconcentrate to 1ml in the turbovap.

11.9 GC conditions

This procedure uses a dual column dual injection technique that enables a primary and confirmatory analysis to be run simultaneously. The following table is a summary of instrument operating conditions. Helium is used as a carrier gas and argon-methane (P5) is used as the ECD make-up gas. Samples must be run under conditions identical to the calibration.

	HP 5890 Series II
Column Head Pressure (psi)	10 (Initial Conditions)
Column Flow (mL/min)	1 (Constant Flow - EPC)
Make-up Flow (mL/min)	60
Anode Purge Gas Flow	Fully open
Septum Purge Flow (mL/min)	2
Split Vent Flow (mL/min)	50
Initial T (degrees C)	100 for 1 min
Rate (1) (degree C/min)	8
Final T (degrees C)	280 for 10min
Injector T (degrees C)	250
Detector T (degrees C)	320

12.0 PREVENTIVE MAINTENANCE

The analytical system requires periodic maintenance. The frequency of maintenance will depend on the type of samples being analyzed. The more complex the matrix, the more contaminants are deposited in the injection port, analytical column and detector. Normal maintenance would require replacing the injection liner and removing 6 inches from the beginning of the analytical column. Active sites from sample matrix may accumulate in these areas causing low recovery. More extensive maintenance would be to bake ECD at 400°C at an extended period of time. Any abnormalities should be brought to the attention of the organic supervisor. If contamination is suspected in the instrument, blanks should be analyzed for confirmation. If contamination is present, notify organic supervisor for appropriate corrective actions.

13.0 INSTRUMENT CALIBRATION

13.1 Because of the sensitivity of the electron capture detector, the injection port and column should always be cleaned prior to performing the initial calibration. The initial calibration is developed using a equal mixture of aroclors 1016 and 1260 along with surrogates tcmx and dcb at 1/10 the concentration of the aroclors. A minimum of five concentration levels that bracket the linear range of the detector are required. Unless otherwise required by a specific project, the analysis of all other pcb aroclors employ a single point calibration. A single calibration standard of each of the aroclors 1221, 1232, 1242, 1248, and 1254 near the mid-point of the expected calibration range is included with the initial calibration as well as the continuing calibration sequence to assist in pattern recognition.

13.2 A 2ul injection of each calibration level is made and the resulting peak areas divided by the mass injected gives a calibration factor. A minimum of three peaks from each aroclor is used for quantitation. Peaks selected must be at least 25% of the height of the largest peak in the given aroclor pattern. The mean and the standard deviation of the calibration factors for each selected peak in the five levels is calculated. If the percent relative standard deviation or the standard deviation divided by the average of the calibration factors is $\leq$ 20% than the response of the instrument is considered linear and the mean response factor can be used to quantitate samples. Alternatively a linear regression curve fit can be used provided the correlation coefficient is $\leq$ 0.99.

14.0 CALCULATIONS

Sample analysis:

14.1 Absolute retention times are used for tentative compound identification. Retention time windows are ±0.1 minutes by default. Alternatively the retention time window can be established by using ± 3sd of three standards run within a 72 hour period. Generally with electronic pressure control of the inlet, retention times will be very consistent and vary less than 0.02 minutes. Tentative identification based on retention time must be confirmed on a second GC column of dissimilar stationary phase. A tentative peak is considered confirmed when it falls within the retention time window of each column and the % difference of the results are <40%.

14.2 The calibration curve must be verified initially with a standard from a separate source (ICV) and every 12 hour shift or once every 20 samples by the measurement of a calibration standard or CCV. The % difference between the initial calibration mean response factors and the continuing calibration response factors must be <15% or a new calibration curve must be prepared for any compounds that fail. Additionally a closing calibration verification must be analyzed at the end of the analysis sequence and all samples up to the last passing ccv must be reanalyzed.

14.3 Samples extracts are injected at 2ul aliquots and the resulting peak areas are used to calculate analyte concentration. External calibration is used to calculate concentration. The area of a confirmed peak is divided by the average response factor or alternatively applied to a linear regression formula. This number is µg/L in the concentrated extract, which is the number from the instrumental quant report. This number is multiplied by the volume of the extract in liters (e.g. 10ml=0.01L). This is the microgram equivalent in the extract which is then divided by the initial volume of sample extracted. For waters this number is expressed in liters (usually 1). For soils this is expressed as kilograms of dry sample (usually 0.01). Dry sample weight is obtained by multiplying the kilogram weight by the determined % solids expressed as 1 being equal to 100%.

14.4 The working range of this method is limited to the range of the calibration curve. All extracts with analyte concentrations exceeding the upper limit must be diluted so the result falls within the range of the calibration curve.

15.0 QC ACCEPTANCE CRITERIA AND CORRECTIVE ACTIONS

15.1 Laboratory Control Sample (LCS) - This is a spiked blank matrix sample prepared with each extraction batch and analyzed prior to any samples to verify the extraction procedures and to act as a check for system performance when the MS/MSD results are outside the QC acceptance criteria. If the acceptance criteria are not met then a second injection of the LCS should be made. If the second injection of the LCS is still out, then the issue must be brought to the attention of the QC officer as soon as possible. In most instances, recalibration and reanalysis or re-extraction of samples will be necessary.

15.2 Matrix Spike/Matrix Spike Duplicate - After running the MS/MSD the analyst must compare the % recovery of the spiked compounds to limits established by the laboratory. If any of the %R's are outside these limits then the analyst should consider reanalyzing the spike as a first step. If the spike is still outside limits then evaluate the LCS. If the LCS is in control then the problem is considered to be the matrix and no further reanalysis is required. The analyst must document this on a QA memo and submit the memo for approval by the QA Officer. The sample used for spiking should be reported as estimated due to matrix interference.

15.3 Method Blank - After analysis of the method blank the analyst should verify that all analytes are < the detection limit (DL). If any values are detected above the DL then a second injection of the MB should be made to check the system prior to sample analyses. The system should be cleaned prior to proceeding with analysis. If the second analysis still shows contamination the samples may be subject to re-extraction. Any sample in a batch with a result that is also present in the blank must be marked as such on the final report. If the sample result exceeds >10 times the result of the blank then no action is required.

15.4 Surrogate Standards - If surrogate % recoveries are out of control then the system should be checked for problems and the samples rerun. If the surrogates are still out of control then the samples may be subject to re-extraction unless obvious matrix interference is noted. All surrogate failures must be reported to the QA department. The data results may be qualified if the QA Officer deems the recoveries are low enough to impact the validity of the data.

15.5 Continuing Calibration - Include a continuing calibration standard after each group of 10 samples. The acceptance criteria for the continuing calibration is a mid-point standard with the %R $\leq$ 15%. If the continuing calibration fails to pass these criteria then the analyst must recalibrate and any samples analyzed after the continuing calibration must be reanalyzed.

15.6 Surrogate Spike Acceptance Criteria

Compound	Water % Recovery	Soil % Recovery
Tetrachloro-m-xylene	20-140	20-140
Decachlorobiphenyl	20-140	20-140

15.7 Matrix Spike Recovery and Relative Percent Difference Limits

Compound	Water % Rec.	RPD	Soil % Rec.	RPD
1016	50-114	50	50-114	50
1260	8-127	50	8-127	50

16.0 REPORTING

16.1 The analyst initially reviews data and the department supervisor performs a secondary review. Any QC discrepancies are noted and a determination of corrective action is made.

17.0 SAFETY

17.1 Proper precautions should be taken when formulating new standards, or handling suspected high concentration samples. Care should be taken when handling the electron capture detector. It should never be open as it contains radiochemical sources.

17.2 Procedures shall be carried out in a manner that protects the health and safety of all STL employees.

17.3 Eye protection that satisfies ANSI Z87.1, a laboratory coat, and appropriate gloves must be worn while samples, standards, solvents, and reagents are being handled. Disposable gloves that have been contaminated will be removed and discarded; other gloves will be cleaned immediately. Appropriate gloves for the inorganic department and sample receiving shall be made of 100% powder-free, non latex and composed of Nitrile.

17.4 The health and safety hazards of many of the chemicals used in this procedure have not been fully defined. Additional health and safety information can be obtained from the Material Safety Data Sheets (MSDS) maintained in the laboratory.

17.5 Exposure to chemicals must be maintained as low as reasonably achievable, therefore, unless they are known to be non-hazardous, all samples must be opened, transferred, and prepared in a fume hood, or under other means of mechanical ventilation. Solvent and waste containers will be kept closed unless transfers are being made.

17.6 The preparation of standards and reagents should be conducted in a fume hood with the sash closed as far as the operation will permit.

17.7 All work must be stopped in the event of a known or potential compromise to the health and safety of a STL employee. The situation must be reported **immediately** to a laboratory supervisor.

18.0 METHOD PERFORMANCE

18.1 The group supervisor has the responsibility to ensure that this procedure is performed by an associate who has been properly trained in its use and has the required experience.

19.0 POLLUTION PREVENTION

19.1 This method does not contain any specific modifications that serve to prevent or minimize pollution.

20.0 WASTE MANAGEMENT

20.1 Waste generated in this procedure must be segregated and disposed according to the facility hazardous waste procedures. The Environmental Health and Safety Officer should be contacted if additional information is required.

STL WESTFIELD

STANDARD OPERATING PROCEDURE

Analytical Procedures for the Analysis of Organochlorine Pesticides

Method SW846 8081A

SOP ID: GCS00100.MA

Date Effective: 04/01/99
Date Revised: 04/27/01

Approved Signatures and Dates

QUALITY ASSURANCE COORDINATOR

LABORATORY DIRECTOR

This documentation has been prepared by Severn Trent Laboratories (STL) solely for STL's own use and the use of STL's customers in evaluating its qualifications and capabilities in connection with a particular project. The user of this document agrees by its acceptance to return it to Severn Trent Laboratories upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use it for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.
THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF SEVERN TRENT LABORATORIES IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY SEVERN TRENT LABORATORIES IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES. IF PUBLICATION OF THIS WORK SHOULD OCCUR THE FOLLOWING NOTICE SHALL APPLY:

© **COPYRIGHT 1999 SEVERN TRENT LABORATORIES, INC. ALL RIGHTS RESERVED.**

1.0 TITLE

Analytical Procedure For Organochlorine Pesticides by Gas Chromatography, EPA SW-846, Method 8081A

2.0 AREA OF APPLICABILITY

Organic Sample Preparation Laboratory
Organic Instrument Laboratory

3.0 SCOPE AND APPLICATION

This procedure is used to determine the concentrations of various organochlorine pesticides in extracts from solid and liquid matrices using capillary column chromatography with electron capture detectors (ECD). The target compounds are listed in table 1. This method is applicable to water, soil, sediment, and sludge.
This procedure is no longer suitable for PCB analysis, which was combined, in previous methods. These are analyzed by method 8082, which include specific clean-up and quantitation procedures designed for PCB analysis.

The two multi-component mixtures listed as target analytes in table 1 are chlordane and toxaphene. These mixtures are identified by pattern recognition and require a higher level of expertise in identification and quantitation.

Sample extracts maybe subject to various clean-up procedures to remove interferences from non-target matrices. Compound identification is confirmed automatically with dual column injections. The practical quantitation limit for this method is 0.1-2.0 ug/L for waters and 10-200 ug/kg for soils.

4.0 SUMMARY OF METHOD

Either 1liter of water or 10 grams of soil is extracted by using the appropriate matrix-specific extraction technique. Liquids samples are extracted at neutral pH with methylene chloride using a Corning accelerated one-step continuous liquid-liquid extractor (method 3520) or separatory funnel procedure (3510). Soils are extracted with hexane-acetone (1:1) using soxhlet (method 3540) or ultrasonic procedure (3550). The extraction solvent is concentrated, and exchanged to hexane. The final volume of the extract is brought to 10mL. Depending on the appearance of the extract, e.g. if it is highly colored, the extract may be subject to clean-up with florisil or mercury to remove interferences. 2uL of the extract is injected into a Hewlett Packard gas chromatograph fitted with two 0.32id capillary columns connected with a deactivated glass "Y-spliter" preceded by a 5-meter fused silica guard column. Each column is connected to a separate electron capture detector. Sample extracts are analyzed simultaneously on each column. The connection to the Y-splitter can be problematic and a leak free seal difficult to obtain. Alternatively, both columns can be fitted with a 2-hole ferrule conversion fitting. Compound identification occurs when a peak falls within a defined retention time window on both columns.

TABLE 1
EPA 8081A TARGET COMPOUNDS

NUMBER	ANALYTE	CAS NUMBER
1	Aldrin	309-00-2
2	alpha-BHC	319-84-6
3	beta-BHC	319-85-7
4	gamma-BHC (Lindane)	319-86-8
5	delta-BHC	58-89-9
6	Chlordane	57-74-9
7	4,4'-DDD	72-54-8
8	4,4'-DDE	72-55-9
9	4,4'-DDT	50-29-3
10	Dieldrin	60-57-1
11	Endosulfan I	959-98-8
12	Endosulfan II	33212-65-9
13	Endosulfan Sulfate	1031-07-8
14	Endrin	72-20-8
15	Endrin Aldehyde	7421-93-4
16	Heptachlor	76-44-8
17	Heptachlor Epoxide	1024-57-3
18	Methoxychlor	72-43-5
19	Toxaphene	8001-35-2

5.0 REFERENCE

EPA SW-846 Manual and Method 8081A, Rev. I, 12/1996.
Operation Manuals for the HP 5890 Series II GC, Enviroquant user quide.
Operation Manuals for the HP autosampler 7673A, Hewlett Packard.

6.0 SAMPLE HANDLING & PRESERVATION

6.1 Water samples are collected in 1 liter amber bottles. Soil samples are collected in 250 mL wide mouth jars. Both are preserved at 4°C.

6.2 Samples are shipped to the laboratory on ice.

6.3 Samples are stored in either a secured (locked) water or soil refrigerator at 4°C.

6.4 **Holding time**: Waters are required to be started within seven days of sample collection and soils and concentrated wastes are required to be started within fourteen days of sample collection.

6.5 All sample extracts must be analyzed within forty days of extraction.

7.0 INTERFERENCES

Interference's in this method can result from contaminated solvents, reagents, glassware, or other sample processing hardware, as well as contaminated GC gases, parts, columns, and detectors. Interference's can also result from compounds co-extracted from the sample matrix to which the detector will respond. In this case a variety of extract clean-up procedures are available to eliminate the problem. Phthalate esters are particularly problematic to this method. These compounds are present in many plastics and can be leached out especially when coming into contact with extraction solvents. Avoiding contact with any plastic materials during sample extraction can minimize this problem. Exhaustive clean up of solvents reagents and glassware may be required to eliminate background levels of phthalates. Method blanks are treated identically to samples and are processed with every batch to ensure no contamination is present. Glassware must be scrupulously cleaned with detergent and hot water, rinsed with tap water and organic free reagent water, followed by drying in an oven at 400°C or by rinsing with methanol or acetone to dry and methylene chloride to remove impurities.

8.0 APPARATUS

8.1 Hewlett Packard 5890 Series II Gas Chromatograph equipped with dual electron capture detectors and model 7673 autosampler. Complete with septa, inlet liner, carrier and make-up gas helium, argon/methane.

8.2 Hewlett Packard Chemstation/Enviroquant PC based data system.

8.3 Column #1: Restek Rtx-CLPesticides 30meter x 0.32mm ID; 0.5um df

8.4 Column #2: Restek Rtx-CLPesticides2 30meter x 0.32mm ID; 0.25um df

8.5 Guard column: Restek Siltek 5meter x 0.32mm ID
8.6 Siltek press tight deactivated "Y-splitter"
8.7 2-liter separatory funnel
8.8 Corning accelerated one-step continuous liquid/liquid extractor with Teflon membrane
8.9 Soxhelet glassware
8.10 Hotplates
8.11 Tekmar model TM500 ultrasonic disrupter
8.12 Low pressure liquid nitrogen tank
8.13 Condensers with water supply
8.14 Zymark Turbo-vap II, nitrogen blowdown device and associated glassware.
8.15 Syringes, volumetric flasks, graduated cylinder, autosampler vials, instrument supplies, pipets and other accessories
8.16 Analytical balance capable of weighing 0.1mg.

9.0 REAGENTS

9.1 Reagent grade (ACS) chemicals shall be used in all tests.
The date received must be recorded on all reagent labels. Consult the Safety manual for proper handling and storage of reagents. Whenever the lab receives new lots of reagents they must be screened to show they are free of contaminants. Analyze an equivalent portion of the reagent as would be used for a sample to demonstrate it is free of contaminants.
The following is a list of reagents that may be used in analysis:
9.2 Organic free reagent water.
9.3 Pesticide grade acetone, methanol, methylene chloride, hexane, toluene, diethyl ether.
9.4 Florisil cartridges (supelco cat# 5-7053)
9.5 Sodium sulfate
9.6 Dimethyldichlorosiloxane

10.0 STANDARDS:

10.1 Primary standards are purchased as certified solutions or as pure material.
<u>Table 2</u> lists the commercial sources available that provide the necessary quantitation and calibration materials for this method.
10.2 Intermediate stock standards. Standards used for calibration are generally in the ppb range. Intermediate solutions are required to accurately achieve these low concentration levels. <u>Table 3</u> lists the dilutions of the stock standard materials that may be used to accomplish this.
10.3 Working standards are prepared from the intermediate stocks and are recorded in the GC working standards logbook with description of contents, date of preparation, initial and final volumes, concentration, dilution

solvents, lot numbers, and expiration dates. Each working standard is assigned a unique lot number based on page number and volume of the logbook. This number must also be recorded onto the instrumental software data file to enable traceability from the final quantitation report. Unless super-ceded by the method, expiration dates are 6 months from date of preparation for semi-volatile standards and 1month for volatile standards. Standards purchased as certified solutions often have expiration dates of their own. If this date expires sooner than the 6 months than that is the expiration date. Standards with expired dates must discarded. It is sometimes possible to get extended expiration dates by calling the manufacturer with the lot number. A certificate must be obtained before the standard can be used.

10.4 Standards integrity is verified by purchasing second source standards of a different lot number.

10.5 Calibration standards are prepared at a minimum of five levels for each pesticide. Table 4 is a summary of the steps required to formulate these five levels. Two multi-component pesticides, chlordane and toxaphene are quantitated by single point calibration only.

10.6 Spiking solutions used to monitor the extraction performance are prepared in acetone. A 1.0mg/L solution of tetrachloro-m-xylene and decachlorobiphenyl is used for the surrogate spike. From this solution, an aliquot of 1.0mL is spiked into all samples, blanks, and matrix spikes, giving a final extract concentration of 100ug/L. A 1.0mg/L solution of each single component pesticide is used for matrix spiking. From this solution, an aliquot of 1.0mL is spiked into matrix spikes and lab control spikes to give an extract concentration of 100ug/L.

TABLE 2

Commercial Blends Required for Production of Method Standard Solutions

#	ITEM	VENDOR	CAT #	CONC.	SOLVENT	USE
1	Single Component Blend	Supelco	4-8913	2000 mg/L	Tol/Hex (50:50)	Quantitation
2	Single Component Blend 2nd Source	Supelco	4S-8913	2000 mg/L	Tol/Hex (50:50)	QC Check

3	Toxaphene	Ultra Scientific	PP-271	100 mg/L	Hexane	Quantitation
4	Chlordane	Ultra-Scientific	PP-151	100 mg/L	Hexane	Quantitation
5	DDT/Endrin mix	Supelco	4-8282	500 mg/L	Methanol	QC Check
6	TCMX/DCB mix	Accu-standard	CLP-032-R	200 mg/L	Acetone	Quantitation

TABLE 3

Formulation of Intermediate Concentration Stock Solutions.

NUMBER FROM TABLE 2	ITEM	Volume (µL)	Final Vol. (mL)	SOLVENT	FINAL CONCENTRATION (mg/L)
1 6	Pesticide mix TCMX/DCB	50 500	100	hexane	1.0 1.0
2 6	Pesticide mix 2nd Source TCMX/DCB	50 500	100	Hexane (acetone for spiking)	1.0
3	Toxaphene	100	10	hexane	1.0
4	Chlordane	100	10	hexane	1.0
5	DDT/Endrin mix	20	100	hexane	0.1
6	TCMX/DCB mix	50	10	acetone	1.0

TABLE 4

Standard Formulation for EPA Method 8081A.

- Refers to Intermediate Dilutions From Table 3.

Volume #1,6 or #2,6 (µL)	Final Vol. (mL)	SOLVENT	FINAL CONCENTRATION (µg/L)
10	1.0	Hexane	10
20	1.0	Hexane	20
50	1.0	Hexane	50
100	1.0	Hexane	100
200	1.0	Hexane	200

11.0 PROCEDURES

11.1 Work lists:

Work/hold time lists are used to keep track of sample backlog and hold time expirations. Each list shows sample id's, client names, due date, date sampled, and hold days remaining. Several computers in the lab have access to this program. After clicking on the "hold time" icon a menu pops up. For extractions, choose holding time information and enter section 035. For analysis, choose holding time information grouped by method and enter section 031 for extractable GC/FID, 032 for purgeable GC/FID, 033 for GC/MS, and 034 for GC/ECD work lists.

11.2 Refrigerators:

Samples are found in one of the refrigerators in sample receiving, wet-chem, or organics, depending on the analysis. Each refrigerator has a thermometer inside and temperatures need to be recorded daily on the sheet attached to the door. If any out of range readings are observed notify a supervisor immediately. Rotation of samples in and out of the fridge is necessary to keep samples organized for easy location. Typically samples are held for sixty days after which they are disposed of.

11.3 Extraction Logbooks:

In the appropriate log book, fill in all relevant information for the extraction batch including, initials, date, sample ph prior to adjustment, sample ID's, volume used, reagent and standard lot numbers, date concentrated, final volume, and any comments or observations noted. In addition, the left-hand margin is used to keep track of batch QC. At the beginning of a batch, samples are numbered 1-20. When 20 is reached another full set of QC is extracted. Method blanks are extracted every day and one every additional 20 samples extracted in a day. When a logbook is created, a unique volume number is assigned and each page is paginated. Logbook pages should never be removed. If a mistake is made, void the page by drawing a single line through it and initial and date the bottom.

11.4 Glassware:

All glassware used must be scrupulously cleaned before use in trace analysis. Wash glassware in warm soapy water followed by rinsing with de-ionized water. Bake all glassware at 450C for a minimum of one hour in the glassware oven located in the organic instrument room. Be sure to remove any tape or plastic from glassware such as separatory funnel stopcocks as this may cause a smoke hazard in the lab. After loading the oven racks, lower the cover, and set the timer to 4-5 hours. This should allow for the oven to reach temperature in 3 hours and remain there for another 1-2. Be sure to check the temperature gauge as it is heating to be sure 450C is reached. If the temperature is not reaching 450C replacement of one or more filaments may be necessary. After the oven cycle is complete, allow cooling for a minimum of 2-3 hours, slowly opening the cover a few inches to vent. Glassware is ready to use.

11.5 Sample preparation

For a more detailed explanation of the specific extraction procedures mentioned, consult the related sop.

11.6 Water:

One liter of water sample is measured into either a separatory funnel or continuous liquid-liquid extractor. Before extraction samples are brought to room temperature and the pH is recorded in the extraction logbook. If the pH is outside the neutral range it is noted on the report. No adjustment is made to the pH. 1.0 mLs of surrogate solution is added to each blank, sample, and spike. 1.0 mLs of matrix spiking solution is added to each lab control spike and matrix spike. After extraction samples are concentrated to approx. 1-5ml then solvent exchanged with 20mls of hexane. The final volume of hexane extract is brought to 10.0mls. Samples are now ready for analysis and/or clean-up. EPA Method SW 3510C or 3520C.

11.7 Soil:

Ten grams of soil sample is measured to 0.01grams and recorded into the extraction logbook. Enough sodium sulfate is added until a free flowing mixture is obtained without clumping. 1.0 mls of surrogate solution is added to each blank, sample, and spike. 1.0 mls of matrix spiking solution is added to each lab control spike and matrix spike. The samples are then extracted with hexane-acetone (1:1) using either soxhlet extractors or ultrasonication. The extraction solvent is then concentrated to 10mls in hexane. Solvent exchange is not necessary because all the acetone is driven off during concentration. Samples are now ready for analysis and/or clean-up. EPA Method SW-846 3540C or 3550B.

11.8 Extract clean-up

Extracts may be subject to various clean-up procedures to eliminate interfering compounds. The analyst may choose to clean-up an extract initially based on appearance or after analysis shows an interfering matrix in the chromatogram.

The following procedures are used for pcb extract clean-up

11.8.2 Elemental sulfur obscures much of the chromatographic regions of interest. It is removed by shaking 1ml of the extract with 1-2 drops of mercury in a glass vial with teflon lined screw cap. Shake mixture for 1-2 mins., let settle, transfer 1 ml to autosampler vial. The presence of sulfur is indicated by the appearance of black mercuric sulfide precipitate. Extended mixing times or multiple additions of mercury may be required.

11.8.3 Polar interferences are removed by passing the extract through florisil cartridges. With the valve in the closed position, place a 1-gram florisil cartridge onto a vacuum manifold and set vacuum to 10in of mercury. Condition the cartridge by adding 4ml of hexane to each cartridge. Slowly open the valve to allow hexane to pass through the sorbent bed to the lower frits. Allow a few drops to pass through to remove air bubbles. Close valve and allow hexane to soak the sorbent bed for five minutes. Do not turn off vacuum. Slowly open valve to allow the hexane to pass through cartridge. Close the valve when there is still 1mm of solvent above the sorbent bed. Do not allow the cartridge to go dry. Transfer 1ml of extract to the cartridge. Open the valve to allow the extract to pass through at 2ml/min. Close the valve after the entire extract passes through but before the cartridge becomes dry. Add 9ml of acetone/hexane (10/90 v/v) to the cartridge, open valve, and slowly collect the eluate into a clean vial. Reconcentrate to 1ml in the turbovap.

11.9 GC conditions

This procedure uses a dual column dual injection technique that enables a primary and confirmatory analysis to be run simultaneously. The following table is a summary of instrument operating conditions. Helium is used as a carrier gas and argon-methane (P5) is used as the ECD make-up gas.

Samples must be run under conditions identical to the calibration.

	HP 5890 Series II
Column Head Pressure (psi)	10 (Initial Conditions)
Column Flow (mL/min)	1 (Constant Flow - EPC)
Make-up Flow (mL/min)	60
Anode Purge Gas Flow	Fully open
Septum Purge Flow (mL/min)	2
Split Vent Flow (mL/min)	50
Initial T (degrees C)	100 for 1 min
Rate (1) (degree C/min)	8
Final T (degrees C)	280 for 10min
Injector T (degrees C)	250
Detector T (degrees C)	320

12.0 PREVENTIVE MAINTENANCE

The analytical system requires periodic maintenance. The frequency of maintenance will depend on the type of samples being analyzed. The more complex the matrix, the more contaminants are deposited in the injection port, analytical column and detector. Normal maintenance would require replacing the injection liner and removing 6 inches from the beginning of the analytical column. Active sites from sample matrix may accumulate in these areas causing low recovery. More extensive maintenance would be to bake ECD at 400°C at an extended period of time. Any abnormalities should be brought to the attention of the organic supervisor. If contamination is suspected in the instrument, blanks should be analyzed for confirmation. If contamination is present, notify organic supervisor for appropriate corrective actions.

13.0 INSTRUMENT CALIBRATION

13.1 Because of the sensitivity of the electron capture detector, the injection port and column should always be cleaned prior to performing the initial calibration. After the instrument sits idle for an extended period, injection of a high concentration pesticide standard approx 20 times more concentrated than the mid level standard may help to reduce active sites. To ensure the injection port is not active a solution containing DDT and endrin only is injected in to the GC. The presence of DDD, DDE, endrin aldehyde, or endrin ketone indicates breakdown. Using the formula below the sum of the breakdown products must be less than 15% before analysis can begin.

DDT %breakdown = DDD + DDE / DDD + DDE + DDT

Endrin % breakdown = End ald + End ket / End ald + End ket + End

The initial calibration consists of five concentration levels that bracket the linear range of the detector. Unless otherwise required by a specific project, the analysis of multi-component analytes employs a single point calibration. A single calibration standard of chlordane and toxaphene near the mid-point of the expected calibration range is included with the initial calibration of the single component analytes for pattern recognition

13.2 A 2ul injection of each calibration level is made and the resulting peak areas divided by the mass injected gives a calibration factor. The mean and the standard deviation of the calibration factors for each analyte in the five levels is calculated. If the percent relative standard deviation or the standard deviation divided by the average of the calibration factors is ≤ 20% than the response of the instrument is considered linear and the mean response factor can be used to quantitate samples. Alternatively a linear regression curve fit can be used provided the correlation coefficient is ≤ 0.99.

14.0 CALCULATIONS

Sample analysis:

14.1 Absolute retention times are used for tentative compound identification. Retention time windows are ±0.1 minutes by default. Alternatively the retention time window can be established by using ± 3sd of three standards run within a 72 hour period. Generally with electronic pressure control of the inlet, retention times will be very consistent and vary less than 0.02 minutes. Tentative identification based on retention time must be confirmed on a second GC column of dissimilar stationary phase. A tentative peak is considered confirmed when it falls within the retention time window of each column and the % difference of the results are <40%.

14.2 The calibration curve must be verified initially with a standard from a separate source (ICV) and every 12 hour shift or once every 20 samples by the measurement of a calibration standard or CCV. The % difference between the initial calibration mean response factors and the continuing calibration response factors must be <15% or a new calibration curve must be prepared for any compounds that fail. Additionally a closing calibration verification must be analyzed at the end of the analysis sequence and all samples up to the last passing ccv must be reanalyzed.

14.3 Samples extracts are injected at 2ul aliquots and the resulting peak areas are used to calculate analyte concentration. External calibration is used to calculate concentration. The area of a confirmed peak is divided by the average response factor or alternatively applied to a linear regression formula. This number is µg/L in the concentrated extract, which is the number from the instrumental quant report. This number is multiplied by the volume of the extract in liters (e.g. 10ml=0.01L). This is the microgram equivalent in the extract, which is then divided by the initial volume of sample extracted. For waters this number is expressed in liters (usually 1). For soils this is expressed as kilograms of dry sample (usually 0.01*%solids). Dry sample weight is obtained by multiplying the kilogram weight by the determined % solids expressed as 1 being equal to 100%.

14.4 The working range of this method is limited to the range of the calibration curve. All extracts with analyte concentrations exceeding the upper limit must be diluted so the result falls within the range of the calibration curve.

14.5 Identification of Toxaphene and Chlordane is based on pattern recognition. 3-5 major characteristic peaks (>25% of the largest peak) are selected for quantitation. The sum of the peak area is used to calculate concentration based on a response factor generated from the same peaks present in the calibration standards of chlordane or toxaphene.

15.0 QC ACCEPTANCE CRITERIA AND CORRECTIVE ACTIONS

15.1 Laboratory Control Sample (LCS) - This is a spiked blank matrix sample prepared with each extraction batch and analyzed prior to any samples to verify the extraction procedures and to act as a check for system performance when the MS/MSD results are outside the QC acceptance criteria. If the acceptance criteria are not met then a second injection of the LCS should be made. If the second injection of the LCS is still out, then the issue must be brought to the attention of the QC officer as soon as possible. In most instances, recalibration and reanalysis or re-extraction of samples will be necessary.

15.2 Matrix Spike/Matrix Spike Duplicate - After running the MS/MSD the analyst must compare the % recovery of the spiked compounds to limits established by the laboratory. If any of the %R's are outside these limits then the analyst should consider reanalyzing the spike as a first step. If the spike is still outside limits then evaluate the LCS. If the LCS is in control then the problem is considered to be the matrix and no further reanalysis is required. The analyst must document this on a QA memo and submit the memo for approval by the QA Officer. The sample used for spiking should be reported as estimated due to matrix interference.

15.3 Method Blank - After analysis of the method blank the analyst should verify that all analytes are < the detection limit (DL). If any values are detected above the DL then a second injection of the MB should be made to check the system prior to sample analyses. The system should be cleaned prior to proceeding with analysis. If the second analysis still shows contamination the samples may be subject to re-extraction. Any sample in a batch with a result that is also present in the blank must be marked as such on the final report. If the sample result exceeds >10 times the result of the blank then no action is required.

15.4 Surrogate Standards - If surrogate % recoveries are out of control then the system should be checked for problems and the samples rerun. If the surrogates are still out of control then the samples may be subject to re-extraction unless obvious matrix interference is noted. All surrogate failures must be reported to the QA department. The data results may be qualified if the QA Officer deems the recoveries are low enough to impact the validity of the data.

15.5 Continuing Calibration - Include a continuing calibration standard after each group of 10 samples. The acceptance criteria for the continuing calibration is a mid-point standard with the %R $\leq$ 15%. If the continuing calibration fails to pass these criteria then the analyst must recalibrate and any samples analyzed after the continuing calibration must be reanalyzed.

15.6 Surrogate Spike Acceptance Criteria

Compound	Water % Recovery	Soil % Recovery
Tetrachloro-m-xylene	20-140	20-140
Decachlorobiphenyl	20-140	20-140

15.7 Matrix Spike Recovery and Relative Percent Difference Limits

Compound	Water % Rec.	RPD	Soil % Rec.	RPD
gamma-BHC	32-127	50	32-127	50
Heptachlor	34-111	50	34-111	50
Aldrin	42-122	50	42-122	50
Dieldrin	36-146	50	36-146	50
Endrin	30-147	50	30-147	50
4,4-DDT '	25-160	50	25-160	50

16.0 REPORTING

16.1 The analyst initially reviews data and the department supervisor performs a secondary review. Any QC discrepancies are noted and a determination of corrective action is made.

17.0 SAFETY

17.1 Proper precautions should be taken when formulating new standards, or handling suspected high concentration samples. Care should be taken when handling the electron capture detector. It should never be open as it contains radiochemical sources.

17.2 Procedures shall be carried out in a manner that protects the health and safety of all STL employees.

17.3 Eye protection that satisfies ANSI Z87.1, a laboratory coat, and appropriate gloves must be worn while samples, standards, solvents, and reagents are being handled. Disposable gloves that have been contaminated will be removed and discarded; other gloves will be cleaned immediately. Appropriate gloves for the inorganic department and sample receiving shall be made of 100% powder-free, non latex and composed of Nitrile.

17.4 The health and safety hazards of many of the chemicals used in this procedure have not been fully defined. Additional health and safety information can be obtained from the Material Safety Data Sheets (MSDS) maintained in the laboratory.

17.5 Exposure to chemicals must be maintained as low as reasonably achievable, therefore, unless they are known to be non-hazardous, all samples must be opened, transferred, and prepared in a fume hood, or under other means of mechanical ventilation. Solvent and waste containers will be kept closed unless transfers are being made.

17.6 The preparation of standards and reagents should be conducted in a fume hood with the sash closed as far as the operation will permit.

17.7 All work must be stopped in the event of a known or potential compromise to the health and safety of a STL employee. The situation must be reported **immediately** to a laboratory supervisor.

18.0 METHOD PERFORMANCE

18.1 The group supervisor has the responsibility to ensure that this procedure is performed by an associate who has been properly trained in its use and has the required experience.

19.0 POLLUTION PREVENTION

19.1 This method does not contain any specific modifications that serve to prevent or minimize pollution.

20.0 WASTE MANAGEMENT

20.1 Waste generated in this procedure must be segregated and disposed according to the facility hazardous waste procedures. The Environmental Health and Safety Officer should be contacted if additional information is required.

CONTROL COPY NO. 01

STL WESTFIELD

STANDARD OPERATING PROCEDURE

STANDARD OPERATING PROCEDURE
For
Metals Analysis by Inductively Coupled Plasma Spectroscopy Using EPA Method 6010A from SW-846

SOP Number - 05-040

Date Written: 06/05/95
Revision Date: 7/14/00
Effective Date: 7/14/00

Approved Signatures and Dates

QUALITY ASSURANCE COORDINATOR

LABORATORY DIRECTOR

1.0 TITLE

Inductively Coupled Plasma Atomic Emission Spectrometric Analysis of Metals

2.0 LOCATION

Samples are prepared in the Metal's Preparation Lab, and analyzed in the Metals Analysis Lab.

3.0 SCOPE

3.1 This method is suitable for the analysis of samples of liquid and solid matrices for the determination of trace elements. Analysis is based on acid digestion with subsequent analysis following ICP methodologies. The acid digestion procedures for this SOP can be found in STL Westfield SOP #05-003 and #05-008.

4.0 SUMMARY

Aqueous samples and soil/sediment samples are digested in Nitric and Hydrochloric acid. After digestion the samples are adjusted to 100 mL final volume. Samples are subsequently analyzed by ICP techniques. In ICP analysis samples are nebulized and the aerosol that is produced is transported to the plasma torch where excitation occurs. Characteristic atomic line emission spectra are produced by the inductively coupled plasma. Photo currents from the photo multiplier tubes are processed and controlled by a computer system. A background correction technique is required to compensate for variable background contribution. Uses of standards and a data terminal allows the user to quantitate the concentrations of metal analytes in the digested solution and thus to further calculate the aqueous or solid sample concentration.

5.0 REFERENCE

5.1 "Method 6010A Inductively Coupled Plasma-Atomic Emission Spectroscopy" SW-846 Test Methods for Evaluating Solid Waste July 1992 Revision.

5.2 QA Manual for STL Westfield.

6.0 SAMPLE HANDLING & PRESERVATION

6.1 Water samples are collected in plastic or glass 1000 mL sample containers. Soils are collected in 250 mL wide mouth jars. Water samples are preserved with Nitric acid to a pH of < 2.0.

6.2 Samples are shipped to the laboratory on ice.

6.3 Samples are stored in either a secured water or soil refrigerator at 4^0C.

6.4 Holding time for digestion and analysis is 6 months from date of collection for all metals except mercury which is 28 days.

7.0 APPARATUS

7.1 Leeman ICP, Model PS 1000

7.2 Argon gas supply, welding grade or better.

8.0 REAGENTS

8.1 All acids used shall be Trace Metal grade or equivalent.

8.2 Hydrochloric Acid

8.3 Nitric Acid

8.4 Deionized distilled water equivalent to ASTM II reagent water, specification D1193, (Milli-Q Water).

8.5 Rinse water: 2% Nitric and 5% HCL Acid Solution with Milli- Q water.

8.6 Stock Standard Solutions

Calibration standards should be prepared as documented in this SOP and the Metals preparation SOP #05-003 and 05-008. The traceability of the standards must be documented from source to use at the instrument. Adherence to these SOPs and the system outlined in Appendix V are critical for the standard traceability.

Store calibration standards and other check solutions in the appropriate acid solution in Nalgene plastic bottles at room temperature. Standards with concentrations ≤ 5ppm should be prepared daily whereas standards with concentrations >5 ppm can be stored and used up to 6 months before discarding.

8.6.1 Stock standard solutions; Fisher Scientific, SPEX Plasma grade (1000 mg/L and 10,000 mg/L).

8.7 Calibration Standard Solutions

8.7.1 Calibration blank: Solution containing a concentration of 1% Nitric Acid and 5% hydrochloric acid.

8.7.2 Calibration Standard Solutions

Standard Solution	Calibration	Standard Solution	Stock Standard Solution	Final Volume Solution

Conc. (Final mg/L)	Analyte	Concentration (mg/L)	Volume (mL)	(mL)**
50.0	*	1000	5.0	100
5.00	*	50	10.0	100
2.50	*	50	5.0	100
1.0	*	50	2.0	100

* Analytes: Al, B, Ba, Be, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Sn, V, Zn, Si

** 1mL HNO_3,5mL HCl per 100mL Milli-Q water.

NOTE: Use Trace Metals Standards Preparation Log Book for recording all pertinent data concerning standard preparation (Appendix IV). Standards must be traceable from the instrument back to the Prep. book. Follow the guidelines established in Appendix V.

8.7.3 Minerals Calibration Standard Solutions

Standard Solution Conc. (Final mg/L)	Calibration Analyte	Standard Solution Concentration (mg/L)	Stock Standard Solution Volume (mL)	Final Volume Solution (mL)**
1000	CA, K, Mg	10,000	10.0	100
100	CA, K, Mg	1000	10.0	100
50	CA, K, Mg	1000	5.0	100
25	CA, K, Mg	1000	5.0	200

** 1mL HNO_3,5mL HCl per 100mL Milli-Q water.

NOTE: Use Trace Metals Standards Preparation Log Book for recording all pertinent data concerning standard preparation (Appendix IV). Standards must be traceable from the instrument back to the Prep. book. Follow the guidelines established in Appendix V.

8.7.4 Sodium (Na) Calibration Standard Solutions

Standard Solution Conc. (Final mg/L)	Calibration Analyte	Standard Solution Concentration (mg/L)	Stock Standard Solution Volume (mL)	Final Volume Solution (mL)**

500	Na	10,000	5.0	100
50	Na	500	10.0	100
25	Na	500	5.0	100
12.5	Na	500	5.0	200

** 1mL HNO_3,5mL HCl per 100mL Milli-Q water.

NOTE: Use Trace Metals Standards Preparation Log Book for recording all pertinent data concerning standard preparation (Appendix IV). Standards must be traceable from the instrument back to the Prep. book. Follow the guidelines established in Appendix V.

8.8 Interference Check Samples (ICS)

8.8.1 ICS Solution A

Concentration(mg/L)	ICS Solution Analyte	Stock Standard Solution Concentration (mg/L)	Volume: Standard Solution (mL)	Stock Solution Final (mL)
500	Al	10,000	25	500
500	CA	10,000	25	500
500	Mg	10,000	25	500
200	Fe	10,000	10	500

* 1mL HNO3,5mL HCl per 100mL Milli-Q water.

8.8.2 ICS Solution AB

Concentration (mg/L)	Analyte	Stock Standard Solution Concentration (mg/L)	Volume: Standard Solution (mL)	Volume Stock Solution (Final)(mL)
500	Al,CA,Mg	10,000	25.0	500
200	Fe	10,000	10.0	500
1.00	Ag	50.0	10.0	500
1.00	Cd,N,Pb,Zn	50.0	10.0	500
0.50	Ba,Be,Co,Cr, Cu,Mn,V	50.0	10.0	500

+ 1mL HNO_3, 5mL HCl per 100mL Milli-Q water.

8.9 MS/MSD Spiking Solution-see Metals Preparation SOP #05-003.

8.10 Laboratory Control Sample (LCS) Spiking Solution- see Metals Preparation SOP #05-003.

9.0 INTERFERENCES

9.1 Spectral Interferences

9.1.1 Overlap of a spectral line from another element.

9.1.2 Unresolved overlap of molecular band spectra.

9.1.3 Background contribution from continuous or recombination phenomena

9.1.4 Background contribution from stray light from the line emission of high concentration elements.

9.2 Physical interferences

9.2.1 Matrix interference can be assessed by the ICP Serial Dilution Analysis performed on a sample from each group of samples of similar concentration and matrix type. Agreement within 10% of the original determination after correction for dilution indicates an absence of matrix interference. (See section 12.6.7.1).

10.0 SAFETY

10.1 Proper precautions should be taken when formulating new standards, or handling suspected high concentration samples.

10.2 MSDS sheets are loCAted in the Laboratory Office.

11.0 PREVENTATIVE MAINTENANCE

11.1 The instrument should be maintained according to the manufacturer instructions. See Appendix V.

12.0 PROCEDURES

The Metal's Analysts receives a DW list from the previous day's log-in of samples that require metals analyses. The Metals Prep Analysts print a daily list "METPREP" which lists all samples requiring preparation for metals analysis and which preparation is required. Once the samples have been prepared the Metals Prep Analysts enter the preparation date into the laboratory LIMS system to notify the analytical lab that the samples are ready for analysis.

12.1 Water Sample Preparation -see Metals SOP # 05-003 for exact procedure.

Summary:Shake sample and transfer 100 mL of a well mixed sample to a 250mL beaker, add 2 mL of (1:1) HNO_3 and 10 mL of 1:1 HCl to the sample. Cover with a ribbed watch glass or similar cover and heat on hot plate for 2 hours at 95^0C or until the volume is reduced to about 20 mL making certain the sample does not boil. Cover the lip of the beaker with a watch glass to reduce additional evaporation and gently reflux the sample for 30 minutes. (Slight boiling may occur, but vigorous boiling must be avoided to prevent loss of the HCL-H_2O azotrope.)

Allow the beaker to cool. Quantitatively transfer the sample solution to a 50 mL volumetric flask, make to volume with reagent grade water, stopper and mix.

The sample is now ready for analysis.

12.2 Soil/Sediment Sample Preparation-see metals SOP #05-008 for exact procedures.

12.3 Leeman PS1000 Instrument Set up, Calibration and Sample Analysis

12.3.1 Turn on ICP (green button to the right of Torch chamber), computer screen and printer.

12.3.2 Turn on Argon gas supply, water supply and exhaust vent. (All interlock lights on the right side of the spray chamber should be off and no interlock message should be flashing on the computer screen).

12.3.3 Fill rinse reservoir with 1% HNO3/5% HCl acid solution and lower tip into reservoir.

12.3.4 Press yellow menu key

12.3.5 Press hot key "I" (hot keys refer to a highlighted letter on any particular page, and will activate the command in which the letter is highlighted).

12.3.6 Press hot key "0".

12.3.7 Press hot key "S". This will automatiCAlly ignite the plasma (If plasma does not initially ignite it will automatiCAlly attempt a restart. If this fails make sure all interlock lights are off and press hot key "S" again.

NOTE: If, on plasma ignition, the tube starts to glow, orange press the red button to the right of the torch chamber. This will extinguish the plasma and shut down the spectrophotometer.

12.3.8 Lift lever on sample pump (below torch chamber and to the right) to start sample introduction.

If the liquid in the waste tube is not flowing smoothly release the pump lever and turn the thumb wheel about a quarter turn clockwise and then move the lever back into position.

12.3.9 Allow ICP to warm up for 60 minutes before running standards and samples.

12.3.10The instrument must be peaked each time it is started up. Mn1 is the normal peaking element. Press "menu" hot key "P" then hot key "O". This will allow you to turn on the Mn1 line if it is off. The line must be on for the instrument to peak. Press "insert" and "enter" until the Mn line is highlighted. Then press "Y" and enter.

12.3.11 Press "Menu", "I" and "O".

12.3.12Make sure auto sampler is on, if not press "Alt" and "A" simultaneously.

12.3.13 Place vial containing 10 ppm Mn in rack 24, position 6 (remove vial CAp). Make sure peaking cup position shown on operations screen is 6. Press "B". This will peak Mn on the X,Y,X axis, see page 12 of the "PS Series Tutorial" for samples of good peaking curves.

12.3.14 Press "T" if Mn peaks look good or else "B" to repeak Mn.

12.3.15 Open protocol for desired elements. Press "Menu", "P", "G". Type in desired protocol and folder (a list of folders CAn be viewed by pressing "menu", "D", "O").

12.3.16 To turn on desired elements in the protocol press "menu", "P","O", then press "Insert" and enter "Y" for the desired elements.

12.3.17 Press "Menu", "C", "S" to determine what standards are used to generate the curve (they will be listed under S1 and S2).

12.3.18 Position S1 in rack #24 will contain the calibration blank (initial calibrator blank) and position S2 should contain the high standard for the particular protocol selected. S1-S4 contain the blank and three standards.

12.3.19 Press "Menu", "C", "K" to determine what check standards are used to verify the curve for any particular protocol. C1 will contain the Mid-point standard C3 to appropriate P.E.

12.3.20 To enter sample ID's press "menu","A","R","A". This will bring up autosampler rack entry. Use the table below for the usual loading sequence of standards, PEs and samples.

12.3.21 If any dilutions or concentrations of the samples are required enter the dilution of concentration factor in the "extended ID" column on the rack entry page next to the corresponding sample. The instrument will not calculate the results but will bring the information out when the sample information is printed.

12.3.22 While on rack "A" page press green "print screen" button to print the page being displaced. Using the "page down" button more to the next screens being used and print each page (These pages are used to set up the samples in the rack). Reprint all the pages being used again; these will remain attached to the instrument readout pages.

12.3.23 After all samples are entered onto the rack entry page press the blue "sample" button. Enter the cup position to be analyzed in rack A by pressing "1", "A", "Enter". The first cup number to be run "Enter" then the ending cup number to be run "Enter" (i.e. - 1 thru 30). To clear any cups in the station 2 cups (if not needed) press "2", the letter(s) under "rack" column, "enter", "0", "Enter".

12.3.24 When desired protocol and folders are open (12.3.15) the sample rack is loaded are in place and the appropriate standards, blanks, and P.E. is in rack #24. Press yellow "Macro" key. Type in AUTO T&B and press enter. This macro will generate a calibration for curve for all element lines that have been turned on, verify each curve with a P.E. and analyze all sample cups entered on the autosampler page.

12.3.25 When sample run is complete (screen will read.Idle) and all criteria for QC is met. A new protocol may be opened for additional analyses (12.3.15 - 12.3.27).

12.3.26 To shut down ICP press "Menu", "I", "O","E"". This will extinguish the plasma.

12.3.27 Raise sampling tip from the rinse water and press "R","O". (This will drain the tubing and spray chamber) When tubing is clear of water press "R", "F" and release lever on pump.

12.3.28 Drain coolant line, shut off Argon gas supply (do not turn anything on the regulator) press "C","O". When coolant level on regulator shows empty press "C" "F".

12.3.29 Turn off water supply and exhaust fan.

12.3.30 Turn off ICP (red button), printer and computer screen only (leave the computer itself on)

12.4 Calibration Curves

12.4.1 Start up ICP

12.4.2 When using the "AUTOT&B" macro the generator of a Calibration curve is included in this macro, when not using the "AUTOT&B" macro follow 12.4.3 - 12.4.9 to generate the Calibration curves.

12.4.3 If a new Calibration curve is desired press "menu" , "C", "S" and put vials containing the appropriate standards positions 1-4 in rack 24 (place rack on left side of each tray) starting with the Calibration blank.

12.4.4 When all standards are in place, and elements turned on press "macro" key and enter "calcurve". This macro will generate curves for all active elements in the protocol.

12.4.5 When computer reads Idle, press "Menu","C","L". This will bring up the page with the new and old line Calibration.

12.4.6 Evaluate the correlation coefficient for the linear regression of the Calibration standards. The r-value hould be ≥ 0.995 or corrective action is required. When the r-value is within criteria press "A" to accept the new curve.

12.4.7 Repeat above procedure for additional curves, using the "page up" and "page down" keys to move from element to element.

12.4.8 To run samples on new curve see 12.3.17-12.3.27.

12.5. Data Reduction

12.5.1 Liquids are reported directly off the instrument printout in mg/L.

12.5.2 A separate determination of percent solids must be performed (Section IX)

12.5.3 The concentration determined in the digestate are to be reported on the basis of the dry weight of the sample.

Install Equation Editor and double-click here to view equation.

(dry weight)

Where:

C = Concentration (mg/L)
V = Final volume in liters after sample preparation
W = weight in kg of wet sample
S = % Solids/100

12.6 Quality Control and Corrective Actions

12.6.1 Initial Calibration

Calibrate the instrument following the procedures in section 12.4. using a blank and three standards. Generate a calibration curve using a first order (linear) regression equation and evaluate the correlation coefficient (r). The r-value must be ≥ 0.995 of the curve is invalid and corrective action is required prior to proceeding. If an apparent error was made in the measurement of one or more of the standards then those standards may be reanalyzed and a new curve generated. If no apparent measurement error is found then recalibration is required and in some instances this may include the preparation of new calibration standard solutions. In all cases the linearity check of r ≥0.995 must be satisfied prior to proceeding with analysis.

12.6.2 Immediately after calibration the accuracy of the initial calibration should be verified and documented for every analyte by analyzing a high-level Initial calibration Verification Solution (ICV). The initial ICV results immediately following the initial calibration must be within ± 5% of true value or the analysis must be terminated, the problem corrected and the calibration reverified.

12.6.3 Continuing Calibration Verification

Analyze a CCV standard after every ten (10) sample analyses and at the end of the analytical run. The CCV should be mid-point in the curve and should be an independent source from the calibration standards. The CCV must be within ± 10% of calibration. If outside these limits, check the solution and recalibrate and rerun the previous samples back to the last passing CCV.

12.6.4 Initial Calibration Blank (ICB) and Continuing Calibration Blank (CCB) Analyses

A calibration blank must be analyzed at each wavelength used for analysis immediately after every CCV. The blank must be analyzed at the beginning of the run, immediately after the CCV and after the last analytical sample. **NOTE**: A CCB must be run after the last CCV that was run after the last analytical sample of the run.

12.6.5 Digestion Blank (DB) Analysis

At least one Digestion blank (or Method blank), consisting of deionized distilled water processed through each sample preparation and analysis procedure, must be prepared and analyzed with every batch of 20 samples or less. If the concentration of the DB exceeds the MDL it indicates laboratory or reagent contamination and redigestion of the batch is required unless:

1) The concentration of the sample analyte is greater than 20 times the DB concentration; then the result can be reported without qualifiCAtion.

2) The QA Officer or the Lab Director is consulted and chooses to report the result with a "B" qualifier for detected in the blank. However, in most instances, reanalysis will be required.

12.6.6 ICP Interference Check Sample (ICS) Analysis

The Interference Check Samples consists of two solutions: Solution A and Solution AB. Solution A consist of the interferents, and solution AB consists of the analytes mixed with the interferents. An ICS analysis consist of analyzing both solutions consecutively (starting with Solution A) for all wavelengths used for each analyte reported by ICP.

Results for the ICP analyses of Solution AB during the analytical runs must fall within the control limit of ± 20% of the true value for the analytes included in the Interference Check samples. If not, terminate the analysis, correct the problem, recalibrate the instrument, and reanalyze the analytical samples analyzed since the last acceptable ICS.

TABLE 2
INTERFERANT AND ANALYTE ELEMENTAL CONCENTRATIONS USED FOR ICP INTERFERENCE CHECK SAMPLE

Analytes	(mg/L)	Interferents	(mg/L)
Ag	1.0	Al	500
Ba	0.5	CA	500
Be	0.5	Fe	200
Cd	1.0	Mg	500
Co	0.5		
Cr	0.5		
Cu	0.5		
Mn	0.5		
Ni	1.0		
Pb	1.0		
V	0.5		
Zn	1.0		

12.6.7 Matrix Spike Sample Analysis

The spike is added before the digestion (i.e. prior to the addition of other reagents). At least one set of MS/MSD samples must be performed on each group of 20 samples or less of a similar matrix type (i.e. water, soil).

If the spike recovery is not within the limits of 80-120%, the data of all samples received associated with that spiked sample must be flagged with the letter "n" on FORMS I-IN an V-IN. An exception to this rule is granted in situations where the sample concentration exceeded the spike concentration by a factor of four or more. In such an event, the data shall be reported without a flag even if the percent recovery does not meet the 80-120% recovery criteria. Individual component percent recoveries (%R) are calculated as Follows:

$$\text{Concentration (mg/Kg)} = \frac{(C)\ (V)}{(W)\ (S)}$$

(dry weight)

Where:

SSR = Spiked Sample Result

SR = Sample Result

SA = Spike Added

12.6.7.1 Post Digest Spike (PDS)

The PDS and the Serial Dilution analyses (section 12.6.7.2) are utilized to determine the presence of matrix interference and to determine the need for running the analysis by the Method of Standard Additions (MSA). (See QC Manual for description of MSA).

Run both the PDS and the Serial Dilution per batch of analyses. Evaluate the Serial Dilution if the analyte concentration is >10 times the MDL, otherwise evaluate the PDS as follows.

Post Digestion Spike (PDS) addition is accomplished by adding analyte standard to a portion of a prepared sample, or it's dilution at sufficient concentration to yield a result at a minimum level of 20 times and a maximum of 100 times the MDL and should be recovered to within 75-125% of the known value. If recovery of the analyte(s) is not within the specified limits, a matrix effect should be suspected, and if sample analytes are 2-5 times the MDL then dilute and run the PDS again as well as the samples in the batch. If still outside the 75-125% limits then the samples must be analyzed by the method of standard additions or flagged as having matrix interference (see QC Manual for description of MSA). If the MSA technique is employed or if a second PDS is required the analyst must submit a QC memo to the QA Manager.

12.6.7.2 Serial Dilution Test

If the analyte concentration is sufficiently high (minimally a factor of 10 above the instrument detection limit in the original solution but <90% of the linear limit), an analysis of a 1+4 dilution should agree (after correction for the fivefold dilution) within ± 10% of the original determination. If not, a chemical or physical interference effect should be suspected and if the sample analytes are still 2-5 times the MDL then conduct a second serial dilution and reanalyze. If still outside the ± 10 limits then the samples must be analyzed by the method of standard additions or flagged as having matrix interference (see QC Manual for description of MSA). If the MSA technique is employed or if a second Serial Dilution is required the analyst must submit a QC memo to the QA Officer.

12.6.8 Matrix Spike Duplicate Analysis

One MS/MSD set must be analyzed from each group of 20 samples or less of a similar matrix type (i.e., water, soil). The relative percent difference (RPD) for each component are CAlculated as follows:

$$RPD = \frac{ABS\ (MS-MSD)}{(MS + MSD)/2}$$

(dry weight)

Where:

RPD = Relative Percent Difference
ABS = Absolute Value
MS = MS Value (original)

MSD = MSD Value (duplicate)

Calculate the RPD and compare to the ≤ 20% limit. If outside the limits the QA Officer should be consulted. Minor deviations may be reported on a QC memo and major deviations require re-preparation and reanalysis.

12.6.9 Laboratory Control Sample (LCS)

Aqueous LCS sample must be analyzed for each analyte using the same sample preparations, analytical methods and QA\QC procedures employed for the samples. The LCS is a spiked blank sample using the same MS/MSD spiking solution as the MS/MSD samples. If the percent recovery for the aqueous LCS falls outside the control limits of 85-115%

the analyses must be terminated, the problem corrected, and the previous samples associated with the LCS redigested and reanalyzed.

12.6.10 Linear Dynamic Range Analysis

For all ICP analysis, a Linear Dynamic Range, (LDR), verification check standard must be analyzed and reported annually for each element. The LDR should be determined by analyzing succeeding higher standard concentrations of the analyte until the observed analyte concentration is no more than ±5% of the stated concentration of the standard. Determined LDR's must be documented and kept on file. The LDR is checked each day (if samples contain analytes in the upper half of the calibration curve) by analyzing a high concentration standard to verify the dynamic range. The LDR which may be used for the analysis of samples should be judged by the analyst from the resulting data. Determined sample analyte concentrations that are greater than 90% of the determined upper LDR limit must be diluted and reanalyzed. The LDR's should be verified annually or whenever, in the judgement of the analyst, a change in analytical performance caused by either a change in instrument hardware or operating conditions would indiCAte they be redetermined.

12.6.11 Low-Level Check Standard

On a daily basis verify the calibration and the Reporting Limit (RL) by analyzing a low level standard that is at the RL for each individual element. Calculate the percent recovery of the element and compare it to the 85-115% R limits. If these criteria are not met then corrective action is required. Initially the Low-Level Check Standard may be reanalyzed. If recovery limits are still not met then reCAlibration and/or reformulation of the solutions and reCAlibration may be required. The 85-115% R criteria must be met prior to proceeding with the analysis.

12.6.12 Quality Control Standard (QCS)

13.0 REPORTING

Data is initially reviewed by the analyst. A secondary review is performed on the data by the Group Leader. The Group Leader verifies all QC limits are met. The identification of reported compounds are verified, along with checking the data for reasonability. If for any reason there is a question of the data, it is then brought to the attention of the Group Leader or QA Coordinator. After data is signed off twice, it is then entered into the laboratory reporting system. The concentration values are reported to two significant figures. See section 12.5 "Data Reduction" for example calculations for reporting of data.

APPENDIX

MDL study I

Copy of Sequence Log II
Copy of Prep Benchsheet III
Copy of Trace Metals Standards Preparation Log Book IV
Standard Traceability Memo dated 8/5/96

STL WESTFIELD

STANDARD OPERATING PROCEDURE

Analysis of Volatile Organic Compounds by EPA 524

SOP Number: MSS002.00MA

Date Written: 12/23/96
Date Revised: 10/19/00
Effective Date: 10/19/00

Approved Signatures and Dates

QA MANAGER

LABORATORY DIRECTOR

1.0 TITLE

Analysis of Volatile Organic Compounds by Method 524.2

2.0 LOCATION

Volatile Organic Instrument Laboratory

3.0 SCOPE

3.1 This method is utilized for the detection and measurement of purgeable organics and is applicable to drinking water and groundwater. This method is suitable for working concentration range from 0.5 to 60 µg/L. Appropriate dilutions should be made to maintain the highest positive detection in the upper half of the calibration curve's linear range.

4.0 SUMMARY

The sample is analyzed for Volatile Organic Compounds by purging helium gas through the sample and concentrating the volatile compounds onto the appropriate trapping material. The resulting concentrated sample is then desorbed from the trap and analyzed using GC/MS instrumentation.

This method can be used for Trihalomethane (TTHM) analyses. If used for just TTHM analysis then only the four (4) TTHM compounds are evaluated in the QC and client samples.

5.0 REFERENCE

"Methods for the Determination of Organic Compounds in Drinking Water" EPA 600/4-90/020, Supplement I, July 1990.

EPA Method 524.2 Measurement of Purgable Organic compounds in Water by Capillary Column GC/MS. Env. Mon. Systems Lab. (EMSL-ORD) U.S. EPA Cinn. OH 45268. Revision 4.0, August 1992.

Operation Manuals for the HP 5890 Series II GC, 5970B MSD, 5971 MSD, DOS Chemstation Data System, Hewlett Packard.

Operation Manuals for the OI MPM-16 auto sampler and 4560 purge and trap concentrator, OI Corporation.

Severn Trent Laboratories Analytical QA Manual

6.0 SAMPLE HANDLING & PRESERVATION

6.1 Water samples are collected in 40 mL glass VOA vials with Teflon septum caps. These containers are designed to have zero headspace when filled with water. The vials for water samples are inspected by the Sample Custodian upon receipt and should not contain any bubbles (see Sample Receipt SOP #04036).

6.2 VOA vials for water samples are preserved with 1:1 HCl to pH<2. If the source of the water is a chlorinated supply then vials must be preserved with ascorbic acid first, filled with water and then acidified in the field to a pH <2 with 1:1 HCL.

6.3 Samples are shipped to laboratory on ice or with blue ice at 4°C or less.

6.4 Water samples are stored in the volatile lab refrigerator at 4°C.

6.5 Holding time: 14 days from sample date for preserved water. Unpreserved water samples must be analyzed within 24 hours.

7.0 APPARATUS

7.1 Hewlett Packard 5890 Series II Gas Chromatograph.

7.2 Hewlett Packard 5970 B Mass Spectrometer or Model 5971 Mass Spectrometer.

7.3 Hewlett Packard DOS Chemstation data acquisition Software.

7.4 Supelco Vocol 115 meter 0.53 mm ID analytical column.

7.5 OI 4560 purge and trap concentrator.

7.6 OI MPM 16 autosampler.

7.7 5 mL or 25 mL glass purge tubes.

7.8 5 mL Hamilton gas tight syringe.

7.9 Various - Hamilton syringes.

7.10 Miscellaneous Class A volumetric glassware for the preparation of reagents/standards.

8.0 REAGENTS

8.1 Reagent grade chemicals shall be used in all tests.

8.2 Volatile organic free reagent water is made from Laboratory DI water (Type II) that is purged with helium to remove any volatiles.

8.3 Methanol, CH3OH (MeOH) - Purge and trap grade or equivalent. Demonstrated to be free of analytes. Store apart from other solvents.

8.4 1:1 Hydrochloric acid (HCl) - Add a measured volume of concentrated HCl to a volume of organic free distilled water.

8.5 Primary Stock Standard Solutions - Are purchased as certified solutions using the following commercial sources. Multiple vendors are listed to facilitate replacement in out-of-stock conditions. The preferred standard formulation approach is to utilize a liquid, gases, & MTBE concentrate (2000mg/L). A set of standards from two separate vendors is required to comply with this SOP.

Initial and Continuing Calibration Standards

Sources for Primary Standards
524 Method

Standard	Manufacturers							
	Absolute		AccuStandard		Supeleco		Ultra Scientific	
Cal Stds	Cat#	Conc. µg/mL	Cat#	Conc. µg/mL	Cat#	Conc. µg/mL	Cat#	Conc. µg/mL
Liquids	32001	2000	M-502A-R-10X	2000	5-0211	2000	DWM-589N-1	2000
Gases	30058	2000	M-502B-10X	2000	4-8799-U	2000	DWM-544-1	2000
MTBE	34140	20000	S-078-10X	2000	4-8483	2000	NV-250	100
A&B 60comp	-	-	M-502-10X	2000	-	-	DWM-588-1	2000
Fluorobenzene	34004	2000	M-524-IS-2	2000	4-8943	2000	STS-160	2000
BFB	19267	2000	CLP-004-80X	2000	4-8083	2000	STS-110N	2000
1,2-Dichlorobenzene-d_4	30070	2000	M-624-SS-11-10X	2000	4-8952-U	2000	STS-210	2000
IS/SS 3comps	30005	2000	M-524-FS	2000	4-7358-U	2000	STM-320N	2000

Primary stock standards are stored in the Volatile freezer at -10°C to -20°C and are used or replaced every 3 months or sooner if problems with the gas compounds are observed.

8.6 Secondary Stock Standard, at 200 mg/L. Two mLs of standard are prepared using primary stock solutions. Listed below are the volumes, measured using glass syringes, of MeOH and primary standards used. This standard is prepared in MeOH and stored in an autosampler 2.0 mL vial.

Volatile Gases Standard Initial & Continuing Calibration conc. 200 mg/L			
Standard	**Std. Volume µL**	**MeOH Volume µL**	**Final Volume µL**
Volatile Liquid Standard	200	1800	2000
Volatile Gases Standard	200	1800	2000
MTBE	200	1800	2000

8.7 Working Standards - Prepared daily for initial and continuing calibrations or calibration checks using the following formulations. Standards are prepared by adding the working stock standards to clean volumetric flasks containing 100 mL of organic free water. Then, 25.0 mL of standards are transferred to spargers on the purge and trap auto-sampler.

Working Stock	1 µg/L	15 µg/L	30 µg/L	45 µg/L	60 µg/L
Secondary Stock (200mg/L)	0.5	7.5	15	22.5	30

8.8 Surrogate & Internal standard solution - surrogates are 1,2-Dibchlorbenzene d_4 (1,2-DCB d_4) and Bromoflurobenzene (BFB) prepared at 50 µg/mL. Fluorobenzene is the internal standard prepared at 40 µg/mL. A solution is prepared by adding 50 µL IS/SS primary standards to 1950µL MeOH. A sample is spiked with 15 µL of surrogate/ internal standard resulting in a sample concentration of 30 µg/L.

Surrogate standards & Internal standards solution are stored in the Volatile freezer at -10°C to -20°C and are used or replaced every 3 months or sooner if problems are encountered.

8.9 4-Bromofluorobenzene, used to tune the GC/MS, is a separate solution at 25 µg/mL.

8.10 Preparation information for all standards, including purchased primary standards, is documented in the Volatiles Standards Logbook. This information includes: names of standard, date of preparation, initials of analyst, primary stock standard name, source lot #, concentration, date opened, amount added, final volume and concentration of standard.

8.11 Preparation of a standard called an Initial Calibration Verification (ICV) standard is required each time a new initial calibration is generated. **This standard must be purchased from a second source, must contain all the target analytes and must be prepared separately from the calibration standards.**

These Primary Stock standards are stored in the Volatile freezer at -10°C to -20°C and are used or replaced every 3 months or sooner if problems with the gas compounds are seen.

This ICV standard is required to include all the analytes contained in the STL 524.2 target list (Appendix I). If additional 524.2 compounds are requested then additional calibration and ICV standards are required.

8.12 LAB FORTIFIED BLANK (LFB)/LFBD

The LFB/LFBD utilizes the same compound list as reported for samples.

To prepare the LFB/LFBD, 15 µL of the LFB spiking solution is added to 100 mL of a water sample to achieve a 30 µg/L spike level.

9.0 INTERFERENCES

9.1 Major contamination sources are volatile contaminants that are present in the laboratory environment such as methylene chloride, acetone and other solvents. Also, the Instrumentation Lab is equipped with it's own HVAC system and is maintained at a positive pressure compared with the surrounding rooms to minimize solvent contamination. Reagent blanks are analyzed with each run to determine contamination from laboratory sources. Blank subtraction can not be used.

9.2 Impurities in the purging gas or the sorbent trap can be a source of contamination. Only chromatography grade gasses are used. All carrier gas lines are made of copper or stainless steel tubing to prevent the permeation of methylene chloride of plastic tubing.

9.3 To prevent other sources of contamination, only PTFE sealants or devices that could come into contact with the standards or samples shall be used.

9.4 Interfering contamination can occur from carryover from preceding samples that contain a high concentration of a target analyte. Suspected high concentration samples should be analyzed at a dilution. If carry-over occurs, one or more calibration blanks should be analyzed between samples.

9.5 Samples may also be contaminated through the PTFE seals on the vials. Trip blanks (when received) are analyzed with each set of samples to determine if the samples have been contaminated through absorption.

10.0 SAFETY

10.1 Proper precautions should be taken when formulating new standards, or handling suspected high concentration samples.

10.2 MSDS sheets are located in the Laboratory Office and should be referenced for all potential hazards when working with these chemicals.

10.3 High temperatures are present in the heated zones of the GC/MS system including transfer lines, valves and detector/injector zones. Care should be taken when working around these areas and if direct contact is required then these zones should be cooled prior to initiating the work.

10.4 Electrical shock may be a hazard when working on instruments with high voltage power sources. All instruments should be powered off and disconnected from electrical power prior to initiating work.

11.0 PREVENTIVE MAINTENANCE

11.1 The Mass Spectrometer should be monitored daily via the vacuum on the ionization controller gauge. A normal reading is between $5.0 \times 10^{-6} \rightarrow 1.0 \times 10^{-6}$. Also, the vacuum gauge for the jet separator should read between 0.4 Torr → 0.75 Torr. Any abnormalities should be brought to the attention of the organic supervisor. If contamination is suspected in the instrument, blanks should be analyzed for confirmation. If contamination is present, notify organic supervisor for appropriate corrective actions.

12.0 PROCEDURES

12.1 The volatile analyst receives DW lists which contain the previous day's samples logged into the LIMS and require VOA analyses. The operator will check and monitor the sample date to insure that all VOA analyses are performed within the required holding times.

12.2 The volatile analyst must be thoroughly trained in the correct operating procedures of the GC/MS instruments and their computer operating systems. The actual procedures to operate the HP 5970 B GC/MS with OI 4560 Purge and Trap system and or the HP 5971 GC/MS with OI 4560 Purge and Trap and PC-DOS Chemstation system can be found in their appropriate operating manuals.

12.3 Method 524.2 is run at 25 mL purge volume for analysis.

12.4 TUNING

Tuning of the GC/MS is performed prior to running initial calibration curves or continuing calibration check samples. A 25 ng BFB standard is direct injected, and is required to pass acceptable criteria (Table 1) before initial or continuing calibration samples or calibration check samples are analyzed.

Table 1

Tuning Acceptable Criteria

M/Z	**Ion Abundance Criteria**
50	15-40% of mass 95
75	30-80% of mass 95
95	Base peak, 100% relative abundance
96	5-9% of mass 95
173	Less than 2% of mass 174
174	Greater then 50% of mass 95
175	5-9% of mass 174
176	95-101% of mass 174
177	5-9% of mass 176

12.5 INITIAL CALIBRATION

12.5.1 The initial GC/MS calibration is based on a five point curve ranging between 1 µg/L to 60 µg/L. The concentrations of the standards are 1 µg/L, 15 µg/L, 30 µg/L, 45 µg/L, and 60 µg/L. Each compound has a response factor (RF) calculated for each concentration point of the curve using the following equation.

$$RF = (Ax \times Cis) / (Ais \times Cx)$$

Ax = Area of the characteristic ion for the compound being measured.
Ais = Area of characteristic ion for the specific internal standard.
Cis = Concentration of the specific internal standard.
Cx = Concentration of the compound being measured.

A mean RF is calculated using the initial calibration points and a percent relative standard deviation (%RSD) is calculated. The % RSD for all compounds must be <20%.

If the RSD criteria of 20% can not be achieved then a linear calibration curve (or higher order) may be generated to fit the line. A correction coefficient of $r=0.995$ ($r^2 = 0.990$) is required.

12.6 CONTINUING CALIBRATION CHECK

A continuing calibration standard at a concentration of 10 µg/L is required before analyzing samples. A passing BFB is necessary before the continuing calibration is run. This will open an 8 hr. time period for analysis providing the continuing calibration is acceptable. Acceptable criteria for the continuing calibration is <30 %D for all compounds.

The internal standards retention time must be within 30 seconds, and the area must be -50% to +50% of the previous continuing calibration.

If the GC/MS systems fail any criteria within the initial or continuing calibrations, an evaluation of the instrument is necessary. The instrument problem needs to be resolved, and re-calibration is necessary. If the failure continues, the problems need to be brought to the attention of the organic supervisor.

12.7 METHOD BLANK

Prepare one method blank per 8-hr period or one method blank per 20 samples, whichever is more frequent, by adding 25 mL of Organic-free reagent water to a 25 mL syringe. Add 8 µL of the internal standard and surrogate solutions and inject into the sparger assembly on the autosampler.

To demonstrate the system is free of contamination, the method blank must not contain any analyte above ½ the detection limit.

12.8 LABORATORY FORTIFIED BLANK (LFB)

Prepare one LFB (and one LFBD) per batch of 20 samples or less. 10uL of the LFB/LFBD spiking solution (see Section 8.13) is added to 25 mL of organic-free reagent water, add 8 µL of the internal standard and surrogate solutions and inject into the sparger assembly on the autosampler. Prepare LFBD by following same procedure.

It is preferable to run and evaluate the LFB and ICV prior to loading any samples on the instrument. If problems occur with the ICV or LFB it is likely that recalibration and reanalysis of samples will be necessary.

12.9 SAMPLE ANALYSES

12.9.1 All samples are warmed to ambient temperature. The 40 mL vial containing the water sample is opened, and poured into the barrel of a clean 25 mL syringe.

12.9.2 The syringe is spiked with 8 µL of 50 µg/mL & 40µg/mL of the internal standard and surrogates standard solutions. The syringe is then connected to the sparger fitting on the auto sampler of the purge and trap, and injected into the sparger. The water sample is now ready to be purged for analysis.

12.9.3 Hewlett-Packard 5970 and 5971 GC/MS Systems are currently the systems set up for

VOA analysis. Both the 5970 and 5971 have OI 4560 with a MPM-16. The samples are purged onto the trap for 11.0 minutes. They are desorbed from the trap at 4 minutes and the trap is baked for 20 minutes. An OI 4560 3 part trap is used. A column with a 0.53 inside diameter is installed in the GC 5890. The oven initial temperature is 35°C held for 6 minutes. It is then ramped at 4°C/min until it reaches final temperature of 155°C (check when not running).

12.10 QUANTITATION

Quantitation is based on the internal standard method. One internal standard is spiked in the standards and samples at 12.8 µg/L. It is Fluorobenzene. The sample concentration of each compound is calculated using this internal standard.

Water Samples

$$\text{Concentration } \mu g/L = Ax \times Is / Ais \times RF$$

Ax = Area of Characteristic ion for compound being measured.
Is = Amount of internal standard injected (ng).
RF = Response factor for compound being measured.
Ais = Area of characteristic ion for the internal standard.

12.11 QUALITY CONTROL

12.11.1 The quality control of the methods consists of the following:

METHOD 524.2 QC ANALYSES

QC Analysis	Frequency	Acceptance Criteria	Corrective Action
Initial Calibration	3-5 points At start-up and when cont. cal fails	% RSD <20%	use linear curve if %RSD is out or recalibrate
Initial Calibration Verification (ICV)	Second source std. run each time an initial calibration is run	Lab Limits of ±20%	Rerun ICV std. or correct problem and recalibrate
Method Blank (MB)	1X per 12 hr period or per loading event	All analytes <½ Det. Limit	Clean system, Reanalyze or report with flag
BFB Tune	1X per 12 hr period	Table 4 in Method 524.2	Check Instrument Operating Parameters, Rerun tune
Continuing Calibration	10 μg/L std. 1X per 12 hr. period	%D <30% all analytes	Correct Problem rerun Cont. Cal. If still out recalibrate & rerun samples.
Surrogates	All samples and QC analyses - 2 compounds	80-120%	Check analysis -then rerun sample
Internal Standards	All samples and QC Analyses - 1 compounds	EICP -50% to +50% Vs last cont. cal std.	Check analysis then rerun sample
Laboratory Fortified Blank (LFB/LFBD)	Run one set per batch of 20 samples or less	Limits of 70-130% RPD = 20%	Check for errors, rerun LFB or rerun entire batch of samples
Control Charts	Updated weekly	See above limits for: LFB/LFBD and Surrogates	Out of control events must be reported on a QC Memo
MDL	Run yearly	Requires QA Officer; Lab Director Approval	Rerun if not approved

12.11.2 QUALITY CONTROL CHARTS

On an on-going basis, the analyst must plot the QC analytical results for the surrogate standards, LFB/LFBD % recoveries as well as RPD. Examples of these charts are attached in Appendix I.

12.11.3 METHOD DETECTION LIMIT (MDL) STUDIES

On a yearly basis, the analyst must run one MDL study for each of the water and soil preparation methods following EPA 40 CFR Part 136 Appendix B and calculate new MDL's. This MDL study is conducted by running 7 replicate analyses of a standard prepared at 2-5 times the expected detection limit. The average and standard deviation (s) of the 7 readings are calculated and the MDL is calculated as 3.143 times s. Examples are contained in Appendix II.

12.12 CORRECTIVE ACTIONS

An analyst must take corrective actions when a quality control parameter is not met during routine analyses. These corrective actions are outlined below.

12.12.1 Initial calibration - After running the 5-point initial calibration an analyst must first evaluate the % Relative Standard Deviation (RSD) of the response factors (calculated and evaluated as in section 12.4).

If any of the analytes do not meet the <20% criteria then the system must be checked for leaks or reactive sites prior to proceeding.

For any analyte not passing initial calibration limits the first choice for the calibration plot would be a first order regression equation. If the analyst chooses this type of calibration for this analyte the correlation coefficient (r-value) must be $r \geq 0.995$ ($r^2 \geq 0.990$) or a QC memo must be written and presented to the QA officer. Likewise if a second order or higher regression equation must be used then consultation with the group leader or QA Officer is required. In both of these instances, the QC memo and consultation must be completed prior to proceeding with use of the initial calibration.

12.12.2 Continuing Calibration - The acceptance criteria for the continuing calibration is a passing BFB and a 10 µg/L standard (see section 12.6). If the continuing calibration fails to pass these criteria then the analyst must recalibrate according to section 12.5 and any samples analyzed after the continuing calibration must be reanalyzed.

12.12.3 Initial Calibration Verification Standard (ICV) - This is a second source standard analyzed prior to any samples to verify the calibration If the 80-120%R criteria are not met then check for errors such as a bad purge or outdated solutions, rerun the ICV and if still not passing then the issue must be brought to the attention of the Organic Supervisor as soon as possible. In most instances, recalibration and reanalysis of samples will be necessary.

12.12.4 Laboratory Fortified Blank - A LFB and LFBD standard is run per batch of 20 samples or less to act as a system performance check when the results are outside the QC acceptance criteria. The LFB is spiked with the same solution and same compounds as the standards and it is considered to be a matrix-free analysis to determine if the system is in control. Compare the % recovery of the LFB compounds to the 70-130% limits. If any of the LFB compounds are out of control, check the solutions, check calculations, run a second LFB and evaluate it. If the second LFB is outside limit then the system may be out of control and the Organic Supervisor should be consulted. In most cases the batch of samples must be reanalyzed prior to proceeding.

%RPD= ABS[A-B]/((A+B)/2)*100

Where: ABS=Absolute value
A=Original value
B=Duplicate value

12.12.5Method Blank - A Method Blank (MB) should be analyzed each time the volatile instrument is loaded with samples and at a minimum once per 8-hr. period. After analysis of the method blank (per section 12.7) the analyst should verify that all analytes are <½ the detection limit (DL). If any values are detected above ½ the DL then the system should be cleaned prior to proceeding with analysis. If the blank was run as part of an automated analytical run and shows contamination then the following guidelines may be followed upon review by the QA officer or department supervisor.

If a compound is detected in the blank at a level of 0.25µg/L or greater and also found in an associated sample at a level less than 5x's this level at the instrument (10x for Acetone, Methylene Chloride, Benzene, Hexachlorobutadine, Chlorobenzene). The sample must be reanalyzed. The MADEP will reject B flagged data.

12.12.5.1 If the blank levels are >½ DL and no analytes are detected in the samples then data can be reported without qualification. And the system contamination must be corrected prior to further analysis.

12.12.5.2 If the blank levels are above the DL but the concentration in the sample is greater than 5X the blank level (>10X for Methylene chloride, Acetone, Toluene and 2-Butanone) then results can be reported without qualification.

12.12.5.3 If the blank levels are above the DL and the sample concentration is <5X the blank level (<10X for $MeCl_2$, Acetone, Toluene and 2-Butanone) then samples should either be reanalyzed or data must be reported with a qualifier.

12.12.6 Surrogate Standards - If surrogate % recoveries are out of control then the system should be checked for problems and the samples rerun. If the surrogates are still out of control then the data is reported and is qualified if the QA Officer deems the recoveries are low enough to impact the validity of the data. *Note: Samples for submission to MADEP for drinking water analysis require all surrogates to be in control (80-120)..*

12.12.7 Internal Standard Response - The analyst must compare the area/response of each of the Internal Standards to the most recent mid level standard (or continuing calibration standard) and the EICP must meet -50% to +50% criteria or the sample requires reanalysis. If still outside the limits then a QA memo is written and the QA Officer is notified for making a decision to either report or qualify data.

13.0 REPORTING

13.1 Primary review of the data is performed by the analyst. Out of control events are documented on a QC memo and the data pack is passed on to the supervisor for secondary review. The supervisor verifies all QC limits are met. The identification of reported compounds are verified, along with checking the data for reasonability. If for any reason there is a question regarding the data, it is then brought to the attention of the Organic Manager. After data is signed off twice, it is then entered into the laboratory reporting system (LaBS). The concentration values are reported to four significant figures on the sample worksheet. A dilution factor, (DF), needs to be reported in the sample header. If there is no dilution of the sample the DF is 1.

CONTROL COPY NO. 01

SOP 11

Severn Trent Mobile Laboatory

CONTROL COPY NO. 01

Committed To Your Success

SEVERN TRENT LABORATORIES.
ON-SITE TECHNOLOGIES (OST) DIVISION

STANDARD OPERATING PROCEDURE

Field Screening Analysis of Low-Level PCB's in Soil and Sediment

SOP Number: OSS00905.MA

Date Written: 08/94
Revision Date: 03/25/97
Revision Date: 06/24/98
Revision Date: 07/09/98
Revision Date: 07/09/98
Revision Date: 03/10/00

a part of
Severn Trent Services Inc.

CONTROL COPY NO. 01

Committed To Your Success

SOP OSS00905.MA
Page 1 of 12
Written: 08/94
Revision: 03/25/97, Revision: 06/24/98
Revision: 07/09/98, Revision: 03/22/99
Revision: 03/10/00

This documentation has been prepared by Severn Trent Laboratories (STL) solely for STL's own use and use of STL's customers in evaluating its qualifications and capabilities in connection with a particular project. The user of this document agrees by its acceptance to return it to Severn Trent Laboratories upon request and not to reproduce, copy, lend, or other wise disclose its contents, directly or indirectly, and not to use it for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF SEVERN TRENT LABORATORIES IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY SEVERN TRENT LABORATORIES IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES. IF PUBLICATION OF THIS WORK SHOULD OCCUR THE FOLLOWING NOTICE SHALL APPLY:

1.0 APPROVALS

The signatures of the following individuals indicates that this SOP is complete and meets the requirements specified in corporate document #QAS00200.NET.

Laboratory Director ______

Quality Assurance Manager ______

Technical Director ______

2.0 SCOPE AND APPLICATION

2.1 This method is used to measure the PCB arochlors in soil and/or sediment samples and is based upon a modified EPA 8082 Method.

2.2 It is the policy of STL and of the On-Site Technologies Division to ensure that we administer contracts and orders for goods and services in a manner that is fully compliant with governmental laws and regulations, as well as the STL Policy Statement on Business Ethics and Conduct.

2.3 The document control number for this SOP is OSS00905.MA.

3.0 Terms and Definitions

3.1 There are many definitions used within the laboratory, which may be generic to all laboratory analyses, or more specific for certain methods. For the most recent terms and definitions used within the laboratory, reference the SOP of Terms and Definitions.

4.0 SUMMARY OF METHOD

4.1 This SOP defines the analysis of soil and sediment samples for PCB arochlors by a modified EPA SW-846 Method 8082 on-site in a mobile laboratory and utilizes a gas chromatograph and an electron capture detector (ECD). The analysis is performed on-site, immediately upon sample collection, as sample preparation time allows. Results are reported in units of mg/kg, wet weight or dry weight (dw).

The target PCB's include the following arochlors. This list may be altered for specific projects:

Analyte	MDL (mg/kg,dw)*	Minimum Report Level ** (mg/kg, dw)
Arochlor 1016	0.019	0.1
Arochlor 1221	0.014	0.1
Arochlor 1232	0.016	0.1
Arochlor 1242	0.010	0.1
Arochlor 1248	0.010	0.1
Arochlor 1254	0.018	0.1
Arochlor 1260	0.092	0.1

* MDL (Method Detection Limit) calculated according to 40 CFR Part 136 Appendix B procedures.

** Actual quantitation limits may vary due to sample matrix and moisture content of the specific samples. Quantitation limits may be changed to reflect project- specific requirements.

5.0 INTERFERENCES

5.1 Petroleum hydrocarbon mixtures will often give chromatographic patterns which resemble those of PCB's. Sample clean-up may be used to remove these interferences. (See SOP Number OSS01703.MA, Sulfuric Acid Cleanup)

5.2 Interferences may also be caused by contaminants in solvents and reagents and on glassware and syringes. These materials must be shown to be free from contamination by the use of extracted method blanks.

6.0 SAFETY

6.1 It is strongly recommended that analysts shall treat all samples as if they are hazardous and take all appropriate safety precautions. Analysts shall wear:

lab coats
safety glasses with side shields and

impervious gloves (Nitrile, eg. Sol-Vex)

7.0 SAMPLE PRESERVATION

7.1 All samples for PCB analysis must be refrigerated at 4°C from the time of receipt until analysis.

7.2 All samples for PCB analysis must be extracted within 7 days and analyzed within 40 days.

8.0 APPARATUS AND MATERIALS

8.1 Hewlett Packard Model 5890II Gas Chromatograph with electron capture detector and Hewlett Packard Model 7673 autosampler, Hewlett Packard Company, Palo Alto, CA.

8.2 HP Chemstation or Enviroquant Software running on a Pentium-based Personal Computer with a Hewlett Packard Laserjet Printer, or equivalent.

8.3 Balance: Mettler College 150 Analytical Balance.

8.4 4mL vials: 3.7mL vials with Teflon septum caps, Macro Scientific, or equivalent.

8.5 2mL vials: 2mL autosampler vials with crimp caps, Chasma Scientific Company, or equivalent.

8.6 Methanol: Purge and Trap grade, Fisher, or equivalent.

8.7 Hexane: Optima grade, Fisher, or equivalent.

8.8 Syringes: 10uL, 50uL Hamilton.

8.9 Micropipets: 50uL and 100uL wiretrol micropipets, Drummond.

8.10 Analytical column: DB-5ms megabore, J&W Scientific, or equivalent.

8.11 PCB Standards: Individual PCB's, 1ug/uL in iso-octane, Supelco.

8.12 Analyte-free water: Free of contaminants.

8.13 Surrogate Standard: TCMX and Decachlorobiphenyl, at 1μg/μL, Absolute Standards.

8.14 Performance Evaluation (PE) Standard: approximately 10 mg/kg of arochlor of interest, ERA

8.15 Vibrating Engraving Tool: Dremil Brand.

9.0 REAGENTS AND STANDARD PREPARATION

9.1 Standard Solutions

9.1.1 Stock Standard Solutions

Surrogate Standard

Surrogate Standard Solution Concentration	Analyte	Stock Standard Concentration	Volume of Stock Standard	Volume of Hexane
10ng/μL	TCMX + DCB	1μg/μL	40μL	3960μL

PCB 1016 & PCB 1260

Spiking Solution Concentration	Analyte	Standard Solution Concentration (1000 ng/μL)	Volume of Stock Standard Solution	Volume of Hexane
50ng/μL	PCB 1016 +PCB 1260	1μg/μL + 1μg/μL	50μL + 50μL	900μL
100ng/μL	PCB 1016 +PCB 1260	1μg/μL + 1μg/μL	100μL + 100μL	800μL

Individual PCB Spiking Solutions

Spiking Solution Concentration	Analyte*	Standard Solution Concentration	Volume of Stock Standard Solution	Volume of Hexane
50ng/μL	PCB 1254	1μg/μL	50μL	950μL

* Analyte applies to either PCB 1221, PCB 1232, PCB 1242, PCB 1248, or PCB 1254. Samples are spiked with a PCB representative of a specific project.

9.2 Calibration Standard Solutions

Calibration Stock Standards:

Calibration Stock Std. Solution Concentration	Analyte*	Stock Standard Solution Concentration	Volume of Stock Standard Solution	Volume of Hexane
20ng/μL	PCB + TCMX+DCB	100ng/μL + 100ng/μL	200μL + 200μL	600μL
10ng/μL	PCB + TCMX+DCB	100ng/μL + 100ng/μL	100μL + 100μL	800μL

* Analyte applies to either PCB 1016 & PCB 1260, or PCB 1221, PCB 1232, PCB 1242, PCB 1248, or PCB 1254.

Calibration Standards

Calibration Standard Solution Concentration	Analyte*	Stock Standard Solution Concentration	Volume of Stock Standard Solution	Volume of Hexane
5ng/µL	PCB + TCMX+DCB	100ng/µL + 100ng/µL	50µL + 50µL	900µL
2ng/µL	PCB + TCMX+DCB	20ng/µL	100µL	900µL
1ng/µL	PCB + TCMX+DCB	20ng/µL	50µL	950µL
0.5ng/µL	PCB + TCMX+DCB	10ng/µL	50µL	950µL
0.1ng/µL	PCB + TCMX+DCB	1ng/µL	100µL	900µL

* Analyte applies to either PCB 1016 & PCB 1260, or PCB 1221, PCB 1232, PCB 1242, PCB 1248, or PCB 1254.

9.2.1 Calibration Standard Solutions should be stored in 1.8mL vials at -10 to -20°C. Calibration Standard Solutions are made fresh at a minimum of every two months.

9.2.2 The preparation of Calibration Standard Solutions and Spiking Solutions is documented in the Standard Prep Book

10.0 CALIBRATION & SET-UP

10.1 Initial Calibration consists of a 3-5 point calibration curve injected from the lowest concentration to highest concentration.

10.2 Instrument warm-up consists of:

Overnight conditioning of the column at 220°C and the ECD at 300°C, if required.

10.2.1 Instrumental conditions are:

Column gas
Helium 7 mL/min

Carrier gas
P-5 argon/methane
44mL/min

Oven
initial temperature - 210°C for 6min
ramp at 3°C/min
final temperature - 250°C for 11min

Injection port
temperature - 250°C

Detector temperature
electron capture - 300°C

Run time
30min

10.3 Sample run sequence:

1. Hexane Blank
2. Mid Level Continuing Calibration Standard
3. Method Blank
4. PE Sample
5-14. Sample(s)
15. Continuing Calibration Standard
16. Method Blank
17-28. Sample(s)
29. MS
30. MSD
31. Continuting Calibration Standard
32. Method Blank

11.0 QUALITY CONTROL

11.1 Initial calibration. A 3-5 point calibration curve, dependent upon project requirements at the start of project. Correlation coefficient (r) of 0.990, or greater required. If this criteria is not met, remake all standards and reanalyze. If still out, perform any required instrument maintenance and repeat.

11.2 Continuing Calibration Check Standard. A mid point standard of a single arochlor. Analyze at the beginning of each day, and after every 10 samples and at the end of the day. %R must be 80-120%. If criteria is not met, re-make and/or reanalyze the standard. If still out of criteria, review instrument maintenance and performance, locate and correct any problems with instrument or standards and recalibrate.

11.3 Method Blanks are analyzed at the start of each day, and after each calibration check standard. It is recommended they also be analyzed after samples with high levels of PCB's to ensure a contaminant free system. The blank should be less than ½ the Minimum Reporting Level for all PCB's. If criteria is not met, remake blank and reanalyze. If still out, perform any required instrument maintenance and re-do analytical sequence.

11.4 PE Sample is analyzed 1 time per day. This is a standard derived from a source other than the initial calibration and usually a soil standard. %R must be 75-125% of the true value. If criteria is not met, re-extract and reanalyze. If still out, perform any required maintenance and recalibrate.

11.5 MS and MSD are analyzed per batch (of 20 samples or less). %R to be 75-125%. RPD to be ≤20%. If the RPD exceeds 20% a LCS/LCSD must be analyzed with a RPD ≤20% or corrective action must be taken. If criteria is not met, re-extract and reanalyze. If LCS does not meet criteria, note on report and notify project manager.

11.6 Surrogate Standards. TCMX and Decachlorobiphenyl standards are added to each sample. %R criteria per method to be 60-140% for at least one of the compounds. If criteria is not met, reanalyze. If still out, note on report and alert project manager.

11.7 Lab Control Sample (LCS) and LCS Duplicate (LCSD) may be analyzed in addition to the MS/MSD to verify that complex matrices are causing poor MS/MSD recoveries. %R 75-125% RPD ≤20%. If MS/MSD meets, criteria, report results. If criteria is not met, reanalyze. If still out, note on report and alert project manager.

11.8 Optional Confirmatory Analysis (field vs base laboratory results) is recommended at a frequency of once per batch (of 20 samples or less). If criteria is not met, re-extract and reanalyze.

12.0 SAMPLE PREPARATION AND PROCEDURE

12.1 Method Blank:

12.1.1 Weigh 1g of Ottawa sand (Fisher Scientific) into a 4mL vial. Spike the soil with 50uL of the Surrogate Standard Solution (10ng/μL). Add 200uL of analyte-free water, 800uL of methanol, and 1000uL of hexane.

12.1.2 Lab Control Sample (LCS)/LCS Duplicate (LCSD): Weigh 1g of Ottawa sand (Fisher Scientific) sample into a 4mL vial. Spike the soil with 50uL of the Spiking Solution (100ng/μL). Spike the soil with 50μL of the Surrogate Standard Solution (10ng/μL). Add 200uL of analyte-free water, 800uL of methanol, and 1000uL of hexane.

12.1.3 MS/MSD: Weigh 1g of well mixed, homogenized soil sample into a 4mL vial. Spike the soil with 50uL of the Spiking Solution (100ng/μL). Spike the soil with 50μL of the Surrogate Standard Solution (10ng/μL). Add 200uL of analyte-free water, 800uL of methanol, and 1000uL of hexane.

12.1.4 Sample: Weigh 1g of well mixed, homogenized soil sample into a 4mL vial. Spike the soil with 50μL of the Surrogate Standard Solution (10ng/μL). Add 200uL of analyte-free water, 800uL of methanol, and 1000uL of hexane.

12.1.5 Performance Evaluation (PE) Sample: Weigh 1g of PE Sample (Certified Soil Standard purchased from ERA). Spike the soil with 50μL of the Surrogate Standard Solution (10ng/μL). Add 200uL of analyte-free water, 800uL of methanol, and 1000uL of hexane.

12.2 Vibrate the vial with the vibrating engraver for 2 minutes. Allow the hexane layer to separate.

12.3 Withdraw a minimum of 300uL of the hexane layer with a pasteur pipet and transfer to 2mL autosampler vial for loading onto GC autosampler. If an emulsion is present after the sample is vibrated, break the emulsion by passing a small piece of silanized glass wool through the emulsion to free the hexane layer.

12.4 Samples that appear to have hydrocarbon, or sulfur interference should be cleaned up using concentrated sulfuric acid. Refer to SOP OSS01703.MA.

13.0 CALCULATIONS

13.1 The specific arochlor is identified by matching the sample chromatographic pattern to a Calibration Standard chromatographic pattern.

13.2 Qualitatively determine the PCB from the chromatographic pattern as it compares to the Calibration Standard Solution.

13.3 The concentration of any PCB is calculated:

13.3.1 Calculate the concentration:

$$\text{Result (mg/kg)} = A \times \frac{FV}{W} \times \frac{V_1}{D_1} \times \frac{1\mu g}{1000ng} \times \frac{1mg}{1000\mu g} \times \frac{1000g}{1kg}$$

where:

A = result taken from the data acquisition and reduction software as a sum of select peak areas for the PCB as determined in 13.2 (ng/μL).
FV = Final Volume of hexane (μL), usually 1000μL
W = Weight of sample in (g)(in units of wet or dry weight)
V_1 = volume of diluted sample (uL)
D_1 = volume of sample taken for dilution (uL)

NOTES: 1) The same peaks are to be utilized in both the calibration standards and sample for quantitative analyses.

2) The ng/μL result (A) is provided directly from the Hewlett Packard operating software (Chemstation) and is based upon the area detected in the environmental sample for the selected peaks as compared to the calibration standard. The calibration curve is based upon a 3-5 point calibration, must have a correlation coefficient (r) of 0.990 or better and must be verified by a second source Performance Evaluation standard.

14.0 ACCEPTANCE OF DATA

14.1 Method Blank < ½ Minimum Report Level for each PCB

14.2 Surrogate Standard Recovery: R% = 60-140%

14.3 Accuracy control limits for MS/MSD and LCS/LCSD: R% = 75-125%

14.4 Precision control limits for MS/MSD and LCS/LCSD: RPD ≤20%

14.5 Accuracy control limits for PE: R % = 75-125%

15.0 REPORTING OF RESULTS

15.1 Sample identity, collection date/time, analysis date, dilution and comments are documented in the Mobile Laboratory PCB Log-in Sheet.

15.2 Results are entered into the Sample Summary/Field Data Report. Sample Summary/Field Data Report form serves as a preliminary results report.

15.3 Final results are submitted after project completion and after all results have gone through QC review. This review is to be completed by the STL OST Director and/or his/her designee and consists of a review of the analytical sequence, calculations and reporting of results to ensure all QC requirements were adhered to. Any discrepancies will be noted on the final report.

16.0 SUPPLEMENTAL DOCUMENTS

16.1 STL Corporate Quality Management Plan, September 1999.

17.0 REFERENCES

17.1 Spittler, T.M. "Field Measurement of PCB's in Soil and Sediment Using a Portable Gas Chromatograph", Sampling & Monitoring.

17.2 Method 8082, "Test Methods for Evaluating Solid Waste", Physical/Chemical Methods, SW846, 3rd Edition (and revisions).

17.3 Quality Assurance Manual for Severn Trent Laboratories.

18.0 SUBSTANTIVE REVISIONS

18.1 Original issue - 08/94

18.2 Revision #1 - 03/25/97

18.3 Revision #2 - 06/24/98

18.4 Revision #3 - 07/09/98

18.5 Revision #4 - 03/22/99

18.6 Revision #5 - 03/10/00

CONTROL COPY NO. 01

Operating Procedure for Metals Analysis using Spectrace 9000 XRF

In general, follow the procedures for Fe Response Check and Analytical Background Check recommended by the manufacturer and use the quantitation procedure outlined in the U.S. EPA SOP #1713. The procedures are outlined below.

1. Turn on the instrument and allow to warm-up for approximately 10 minutes.

2. Conduct the Fe Response check daily by placing the Fe sample over the center of the probe window and following the directions detailed in the manufacturers manual. Check that the Fe intensity is greater than 0.96 and the Co and Mn intensity are less than 0.003. Record these readings on the XRF bench sheet (copy attached). If these values are outside the limits follow the instructions (copy attached) for checking of the instrument and reanalyzing. Proceed to step 3 when readings are within limits.

3. Conduct Analytical Background Check daily by placing the Teflon sample on the probe window and measuring for 200 seconds on each of the three sources. Note the Std. Dev. values on the bench sheet and check that the readings are within 3 standard deviations of zero. If values are outside these limits follow the instructions for the Acquire Background procedure in the manual.

4. No site-specific calibration is necessary with this XRF however verification of the calibration is required using Certified Standards (CS and also designated as PE) with known concentrations. A two-level standard reference material for As, Cd, Cr and Pb must be analyzed seven times at the beginning of each 10-day working period. % R is to be 80-120% of the true value for As, Cd and Pb and 70-130% for Cr. Conduct the analysis using the appropriate counting times on each source. The counting time must be the same for samples and CS's. Measure the CS's and calculate Percent Recovery (%R) values using the true values. Compare the %R against the established control limits of 42%-128%. If out of control results are encountered repeat steps 2 and 3 and/or consult the manual for calibration check procedures. Acceptable CS results must be achieved before proceeding with sample analysis.

5. Sample analyses are conducted by homogenizing the sample (soil) in the container using a spatula and removing roots, leaves, rocks and other particles that are large in size (i.e. >0.25"). Soils are dried (via the percent solids analyses) and then the homogenized soil is placed in an XRF cup to ¾ full or greater and covered with mylar film and secured with a plastic sealing ring. The mylar film should not have any creases or wrinkles that may interfere with the X-rays. The cup is then inverted and compacted lightly by tapping on clean level surface (e.g. counter-top). The sample ID should be written with a permanent marker (Sharpie or equivalent) on the side of the plastic cup.

   The cups are then placed into the XRF probe and the counting sequence commenced. The sample ID, date and time of analysis and counting times are recorded in the bench sheet. When analysis is complete the values for the target analytes are recorded on the bench sheet. Ten samples can be analyzed before additional QC is required.

6. After analysis of 10 samples, a duplicate sample analysis (including preparation of XRF cup) is conducted. The relative percent difference (RPD) is calculated between the original and duplicate and compared to the established control limit of ≤40%. If out of control RPD values are encountered, then reanalysis of the original and duplicate is required and the laboratory supervisor should be notified.

7. A calibration check is also conducted daily and after every 10 analyses to verify that instrument drift has not caused the calibration to change. One of the Certified Standards is analyzed and %R values are compared to the 70-130% control limits for As, Cd and Pb and 65-135% for Cr. If values are outside control limits then steps 2, 3, and 4 should be repeated before continuing sample analysis.

8. A final calibration check must be conducted at the end of the day to bracket all analyses with calibration checks. The Certified Standard is run again and the %R is evaluated against control limits.

9. The analyst must sign the bench sheet and have all data reviewed by the laboratory supervisor prior to reporting.

CONTROL COPY NO. 01

SEVERN TRENT LABORATORIES

STANDARD OPERATING PROCEDURE

Field Analysis for

Polyaromatic Hydrocarbons (PAHs)

by Gas Chromotography, EPA SW-846 Method 8015

SOP Number: 06-026

Date Written: 04/09/97

Approved Signatures and Dates

____

QUALITY ASSURANCE COORDINATOR

____

LABORATORY DIRECTOR

1.0 TITLE

Polyaromatic Hydrocarbons (PAHs) by GC/FID

2.0 LOCATION

Mobile or Field Laboratory

3.0 SCOPE

This method is applicable to water, soil, oil and sludge. This method is suitable for a concentration range from 0.2 mg/L to 5000 mg/L for water, and 0.2 mg/kg to 5000 mg/kg for soil. Appropriate dilutions should be made to maintain the concentration in the upper half of the calibration curves linear range. This method is based on EPA SW-846 method 8015.

4.0 SUMMARY

One liter of a liquid sample is extracted with methylene chloride by either a liquid/liquid continuous extractor or separatory funnel (method 3510 and 3520). If the sample is a solid (method 3550), 30 grams will be sonicated with methylene chloride for 1.5 minutes, then decanted and repeated three times. The extracts are concentrated to one mL, and analyzed by GC/FID. The GC/FID is calibrated for 17 PAHs using a 3 or 5-point curve. Check standards are run every 10 samples (acceptable passing criteria is ± 15%).

5.0 REFERENCE

Method 8015 , Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, (and revisions)

Operation Manuals for the HP 5890 GC/FID, 5972 autosampler Chemstation Data System, Hewlett Packard.

6.0 SAMPLE HANDLING & PRESERVATION

6.1 Water samples are collected in amber 1 liter containers with Teflon lined caps.

6.2 Soil samples are collected in 250 mL wide mouth jars with Teflon lined caps.

6.3 Extraction holding time:
Liquid - 7 days
Solids - 14 days

7.0 APPARATUS

7.1 Hewlett Packard 5890 Gas Chromatograph.

7.2 Hewlett Packard DOS Chemstation data acquisition Software.

7.3 J&W DB -5MS, 30m x 0.32mm and 0.50μm film thickness.

7.4 Hewlett Packard Flame Ionization Detector.

7.5 Hewlett Packard 7673 GC/SFE autoinjector.

7.6 Zymark Turbo Vap II.

8.0 REAGENTS

8.1 Reagent grade chemicals shall be used in all tests.

8.2 Organic free reagent water.

8.3 Methylene Chloride - Fisher Optima meeting ACS specifications

8.4 ortho-Terphenyl - Surrogate

8.5 Absolute PAH Mix- Calibration Standards

Primary stock standards are stored in the freezer at -10 to -20°C.

8.6 Surrogate Secondary Stock Standard for OTP is formulated at a concentration of 20 μg/mL.

the final reported value. Therefore, all glassware is put in ChemSolv (see SOP for cleaning glassware), then rinsed with Methylene chloride immediately before use.

9.2 Interfering contamination can occur from carryover from preceding samples that are highly contaminated. Suspected high concentration samples should be analyzed by dilution. If carry-over occurs, one or more Methylene chloride blanks should be analyzed between samples.

10.0 SAFETY

10.1 Proper precautions should be taken when formulating new standards, or handling suspected high concentration samples.

10.2 MSDS sheets are located in the Laboratory Office.

11.0 PREVENTIVE MAINTENANCE

If contamination is suspected, the instrument blank should be analyzed for confirmation. If contamination is present the following corrective actions should be taken:

- Change the septum and injection port liner
- Cut off a few inches from the front of the column
- Bake columns and detectors as outlined by manufacturers

12.0 PROCEDURES

12.1 The analyst will receive samples in the field that require PAH analyses. The field analyst will log the samples on a field sample receipt log or Chain of Custody Form (COC).

12.2 EXTRACTION

12.2.1 Water - Separatory Funnel

One liter of sample is transferred into a separatory funnel. The sample is spiked with one ml of 20 μg/mL OTP surrogate standard. 60 mL of Methylene Chloride is added to the separatory funnel. The separatory funnel is capped and inverted. The pressure is released by opening the stopcock. The funnel is shaken for three minutes, reliving the pressure periodically. After the three minutes shakeout, the funnel is placed in a ring holder allowing the Methylene chloride to separate out from the water. After the phases separate, the Methylene chloride is eluted through sodium sulfate into a Turbo Vap tube. Extract is then concentrated to 0.5 mL. It is then quantitatively transferred to an autosampler vial and brought to one mL final volume.

12.2.2 Solid

30 grams of sample is weighed into a 250 mL beaker. Sodium sulfate (baked) is added to remove moisture. The sodium sulfate is mixed with sample until it becomes a dry, granular mixture. 60 mLs of Methylene chloride is added to the beaker and sonicated for 1.5 minutes. The sonication procedure is done twice more for a total of three sonication steps on each sample. The sample is spiked with 1 mL surrogate std (20 μg/mL) before adding the sodium sulfate. The Methylene chloride is decanted after each sonication step into a Turbo Vap tube for concentration. Follow concentration procedure in above water extraction.

12.2.3 Oil

Product or Solvent samples are diluted 1:1000 and analyzed. This concentration should not cause contamination. Then the appropriate dilution can be calculated from the initial analysis, and analyzed.

12.3 INSTRUMENT CALIBRATION

12.3.1 The GC analyst must be thoroughly trained in the correct operating procedures of the GC/FID instrument and the computer operating system. The actual procedures to operate the HP 5890 GC with a 7673 autosampler and PC-DOS Chemstation system can be found in their appropriate operating manuals.

12.3.2 The initial GC calibration is based on a five point curve (or three point if specified in project plan. Quanitation is performed by the external standard technique. The linearity of the calibration curve is checked by linear regression. A valid calibration curve must have a correlation coefficient (r) of at least 0.995.

12.3.3 A daily continuing calibration standard is required before analyzing samples. A passing continuing standard is necessary before samples are analyzed. A continuing standard is required every ten samples. Acceptable criteria for the continuing standard is ± 15% of the true value. Usually a 1000 μg/mL is used for the continuing calibration standard. A 20 μg/mL OTP surrogate standard is analyzed daily along with the continuing calibration standard.

If the GC system fails any criteria within the initial or continuing calibrations, an evaluation of the instrument is necessary. The instrument problem needs to be resolved, and re-calibration is necessary.

12.4 SAMPLE ANALYSIS

12.4.1 Each extract is already in autosampler vials, each can be placed directly onto the autosampler. If an extract appears dark, a dilution should be performed for initial analysis.
A Hewlett-Packard 5890II is currently the GC/FID system set up for PAH analysis. The oven initial temperature is 45° and is held for 1 minute. It is then ramped at 10°C/min. until it reaches final temperature of 280°C. It is held at 280°C for 17 minutes. The injection port temperature is 325°C, and the detector (FID) is at 380°C

12.5 The sample is quantitated by integrating the total area of the sample. The area is compared against the calibration curve and a concentration value is calculated.

WATER CALCULATION

Sample Conc. mg/L = (A x R) x (V) x DF/ B

A = Area count of sample
R = Response Factor (mg/L) area count
V = Extract volume (mL)
B = Sample volume (mL)
DF = dilution factor

SOIL CALCULATION (dry weight)

Sample Conc. mg/kg = (A x R) x (V) x DF/(C) x (% solid;decimal notation)

same as above
C = Weight of sample (kg)

12.6 QUALITY CONTROL

The quality control of the method consists of the following :

EPA METHOD 8100A
QC Criteria & Corrective Actions

QC Analysis	Frequency	QC Criteria	Corrective Actions
Initial Calibration	5 pt. curve run initially, upon instrument changes & when cont. cal is out.	Use linear regression curve, r value must be ≥ 0.995.	check for injection problems,reanalyze std. or recalibrate
Calibration Verification 2nd source Std. used in the lab control sample (LCS).	Run one per extraction batch of 20 samples or less.	50-150%R (until Lab establishes limits)	Correct problem, reinject LCS. If still out, recalibrate.
Method Blank (MB)	extracted per batch of 20 samples or less.	< 1/2 Detection limit	Clean system, reanalyze MB or report samples with a "B" flag.
Method Spike (MS)/MS Duplicate	Run one per batch of 20 samples or less.	50-150%R	Reinject, if still out then evaluate LCS,
Continuing Calibration	At beginning (if not an initial cal) every 10 sample analyses and at end of analytical batch.	± 15% from the true value.	Correct problem, rerun Cont. Cal.If still out of control, recalibrate & rerun.

Matrix Spike/ Matrix Spike Duplicate	Per Batch of 20 samples or less	± 50% R	Check analysis, Check LCS, evaluate Method Spikes.
Surrogate Stds	All samples and QC analyses - OrthoTerphenyl (OTP).	50-150% R (until Lab establishes limits)	Check analysis-then rerun sample.Reinject sample
Control Charts	Updated Weekly	See above limits for LCS, MS/MSD and Surrogates	Out of control events must be reported on a QC Memo if not resolved by corrective actions.
MDL Study	Run yearly	0.2 mg/L 10 mg/kg	Rerun MDL in not acceptable.

12.6.2 QUALITY CONTROL CHARTS

On an ongoing basis, the analyst must plot the QC analytical results for the surrogate standards, MS/MSD's and the LCS % recoveries as well as RPD's. Examples of these charts are attached in Appendix I.

12.6.3 METHOD DETECTION LIMIT (MDL) STUDIES

On a yearly basis, the analyst must run an MDL study following EPA 40 CFR Part 136 Appendix B and calculate new MDL's. This MDL study is conducted by running 7 replicate analyses of a standard prepared at 2-3 times the expected detection limit. The average and standard deviation (s) of the 7 measurements are calculated and the MDL is calculated as 3.143 times (s). Examples are contained in Appendix II.

12.7 CORRECTIVE ACTIONS

Analyst must take corrective actions when a quality control parameter is not met during routine analyses. These corrective actions are outlined below. If corrective action still produces data that is outside the QC limits, then a QA Deviation Form is written and presented to the On-site Project Manager to initiate a course of action. In most cases this form will simply be submitted with the 24-hr. data package.

12.7.1 Initial Calibration- After running the five point initial calibration an Analyst must first evaluate the r values from the linear regression equation (calculated and evaluated as in section 12.4).

If any of the compounds do not meet the r-value criteria then the system must be checked for leaks or reactive sites prior to proceeding. Obvious problems with individual standard injection can be corrected by reanalyzing the standard and replacing it in the calibration curve. Recalibration is required for r- values not meeting criteria or the data should be qualified on the QA Deviation Form.

12.7.2 Continuing Calibration- The acceptance criteria for the continuing calibration is a 2000 μg/L standard with the % R $\leq$ 15%. If the continuing calibration fails to pass these criteria then the Analyst must recalibrate according to section 12.3 and any samples analyzed after the continuing calibration must be reanalyzed.

12.7.3 Laboratory Control Sample (LCS)- This is a second source standard analyzed prior to any samples to verify the calibration and to act as a check for the system performance when the MS/MSD results are outside the QC acceptance criteria. If the 50-150% criteria are not met then a second LCS should be injected. If the second LCS is still failing , the issue must be presented on a QA Deviation Form.

12.7.4 Matrix Spike/ Matrix spike Duplicate- After running the MS/MSD the Analyst must compare the % recovery of the spiked compounds to limits established by the Laboratory. If any of the % R's are outside these limits then the Analyst should consider reanalyzing the spike as a first step. If the spike is still outside QC limits then evaluate the LCS and Method Spikes. If the Method Spikes and LCS are in control the problem is considered to be matrix and no further reanalysis is required. The Analyst must document this on a QA Deviation Form. The sample used for spiking should be reported as estimated due to matrix interference.

12.7.5 Method Blank- After analysis of the method blank (per section 12.5) the analyst should verify that all analytes are < 1/2 the detection limit, (DL). if any values are detected above 1/2 the DL then a second injection of the method blank should be analyzed to check the system prior to sample analyses. The system should be cleaned prior to proceeding with analysis. If the second blank still shows contamination or the blank was run as part of an automated analytical run and shows contamination then the following guidelines may be followed:

12.7.5.1 If the blank levels are > 1/2 DL and no analytes are detected in the samples then the data can be reported without qualification. And the system contamination must be corrected prior to further analysis.

12.7.5.2 If the blank levels are above the DL but the concentration in the sample is greater than 5X the blank level then the results can be reported without qualification.

12.7.5.3 If the blank levels are above the DL and the smaple concentration is < 5X the blank level then the samples should either be re-extracted and reanalyzed or the data must be reported with a qualifier.

12.7.6 Surrogate Standards- If surrogate% recoveries are out of control then the system should be checked for problems and the samples reinjected. If the surrogates are still out of control then the data is reported after presentation on the QA Deviation Form.

APPENDIX F

Methods for Reporting Limits

CONTROL COPY NO. 01

MCP Star ds by Fraction
STL Westfield - Analysis Methods and Reporting Limits

Parameter Group	Suggested Analytical Method	Compound	GW-1 (ug/L)	GW-2 (ug/L)	GW-3 (ug/L)	MMCLs (ug/L)	STL QL (ug/L) (b)	S-1/GW1 (ug/g) (dry)	S-1/GW2 (ug/g) (dry)	S-1/GW3 (ug/g) (dry)	S-2/GW1 (ug/g) (dry)	S-2/GW2 (ug/g) (dry)	S-2/GW3 (ug/g) (dry)	S-3/GW1 (ug/g) (dry)	S-3/GW2 (ug/g) (dry)	S-3/GW3 (ug/g) (dry)	STL QL (ug/g) (dry) (b)
Volatile Organic Compounds	8260B (25 ml Purge Volume)	Benzene	5	2,000	7,000	5	1	10	40	40	10	60	60	10	100	200	0.005
		Bromodichloromethane	5	NA	50,000		1	0.1	20	20	0.1	20	20	0.1	90	90	0.005
		Bromoform	5	800	50,000		1	0.1	20	100	0.1	20	200	0.1	20	700	0.005
		Bromomethane	10	2	50,000	10	2	10	3	50	10	3	200	10	3	700	0.01
		Carbon tetrachloride	5	20	50,000	5	1	1	4	7	1	4	10	1	4	40	0.005
		Chlorobenzene	100	1,000	500	100	1	8	80	40	8	80	40	8	80	40	0.005
		Chloroethane					2										0.01
		2-Chloroethylvinyl ether				5	1										0.005
		Chloroform	5	400	10,000	5*	1	0.1	10	200	0.1	10	200	0.1	10	300	0.005
		Chloromethane					2										0.01
		Dibromochloromethane	5	NA	50,000		1	0.09	10	10	0.09	20	20	0.09	70	70	0.005
		1,2-Dichlorobenzene	600	10,000	8,000	600	1	100	100	100	200	500	500	200	500	500	0.005
		1,3-Dichlorobenzene	600	10,000	8,000		1	100	100	100	200	500	500	200	500	500	0.005
		1,4-Dichlorobenzene	5	30,000	8,000	500	1	2	40	40	2	60	60	2	200	200	0.005
		1,1-Dichloroethane	70	9,000	50,000	70*	1	3	100	100	3	400	500	3	400	500	0.005
		1,2-Dichloroethane	5	20	50,000	5	1	0.05	0.2	10	0.05	0.2	20	0.05	0.2	60	0.005
		1,1-Dichloroethylene	7	1	50,000	7	1	0.7	0.1	2	0.7	0.1	2	0.7	0.1	9	0.005
		cis-1,2-Dichloroethylene	70	30,000	50,000	70	1	2	100	100	2	500	500	2	500	500	0.005
		trans-1,2-Dichloroethylene	100	20,000	50,000	100	1	4	500	500	4	800	1,000	4	2,500	2,000	0.005
		1,2-Dichloropropane	5	9	30,000	5*	1	0.1	0.2	8	0.1	0.2	10	0.1	0.2	40	0.005
		cis-1,3-Dichloropropene	0.5(a)	5(a)	2,000	0.5*(a)	0.5	0.01	0.1	3	0.01	0.1	5	0.01	0.1	20	0.005
		trans-1,3-Dichloropropene	0.5(a)	5(a)	2,000	0.5*(a)	0.5	0.01	0.1	3	0.01	0.1	5	0.01	0.1	20	0.005
		Ethylbenzene	700	30,000	4,000	700	1	80	500	500	80	1,000	500	80	2,500	500	0.005
		Ethylene Dibromide	0.02	3	50,000		1	0.005	0.01	0.01	0.005	0.02	0.02	0.005	0.04	0.07	0.0025
		Methylene chloride	5	50,000	50,000	5	1	0.1	100	100	0.1	200	200	0.1	700	700	0.005
		1,1,2,2-Tetrachloroethane	2	20	20,000		1	0.02	0.2	0.5	0.02	0.2	0.6	0.02	0.2	2	0.005
		Tetrachloroethylene	5	3,000	5,000	5	1	0.5	20	20	0.5	30	30	0.5	100	100	0.005
		Toluene	1,000	6,000	50,000	1,000	1	90	500	500	90	500	1,000	90	500	2,500	0.005
		1,1,1-Trichloroethane	200	4,000	50,000	200	1	30	100	100	30	500	500	30	500	500	0.005
		1,1,2-Trichloroethane	5	20,000	50,000	5	1	0.3	2	2	0.3	3	3	0.3	10	10	0.005
		Trichloroethylene	5	300	20,000	5	1	0.4	20	70	0.4	20	100	0.4	20	500	0.005
		Trichlorofluoromethane					1										0.005
		Vinyl chloride	2	2	40000	2	2	0.3	0.3	0.3	0.4	0.4	0.5	0.4	0.4	2	0.01
		Acetone	3,000	50,000	50,000	3,000*	20	3	60	60	3	80	60	3	80	80	0.06
		2-Butanone	350	50,000	50,000		10	0.3	40	40	0	40	40	0.3	40	40	0.05
		n-Butylbenzene					1										0.006
		s-Butylbenzene					1										0.005
		t-Butylbenzene					1										0.005
		Carbon disulfide					1										0.005
		2-Chlorotoluene					1										0.005
		4-Chlorotoluene					1										0.005
		1,2-Dibromoethane	0.02	3	6,000	0.02	1	5									0.006
		2-Hexanone					10										0.02
		Hexachlorobutadiene	0.6	1	90		0.6	3	3	5	3	3	10	3	3	40	0.005
		Isopropylbenzene					1										0.005
		p-Isopropyltoluene					1										0.005
		4-Methyl-2-pentanone	350	50,000	50,000	350*	10	500			0.5	70	70	0.5	70	70	0.02
		Methyl-t-butyl ether	70	50,000	50,000	700*	1	0.3	100	100	0.3	200	200	0.3	200	200	0.005
		Naphthalene	20	6,000	6,000		10	4	100	100	4	1,000	1,000	4	1,000	1,000	0.05
		n-Propylbenzene					1										0.005
		Styrene	100	900	50,000	100	1	2	20	20	2	20	30	2	20	100	0.005
		1,1,1,2-Tetrachloroethane	5	6	50,000		1	0.4	0.5	4	0.4	0.5	5	0.4	0.5	20	0.005
		1,2,3-Trichlorobenzene					1										0.005
		1,2,4-Trimethylbenzene					1										0.005
		1,3,5-Tnmethlybenzene					1										0.005
		Vinyl acetate					10										0.02
		1,2,4-Trichlorobenzene	70	10,000	500	70	1	100	400	400	100	2,000	800	100	2,000	800	0.005
		Xylenes	10.000	6,000	50,000	10,000	1	500	500	500	800	500	1,000	800	500	2,500	0.005
Semi Volatile Organic Compounds	8270C Modified	Aniline					50										2
		Benzoic acid					50										2
		Benzyl alcohol					20										0.66
		1,1- Biphenyl	400	NA	50,000			1	1.000	100	1	2,500	100	1	3,000	100	
		bis(2-Chloroethoxy)methane					10										0.33
		bis(2-Chloroethyl)ether	30	100	50,000		10	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.33
		bis(2-Chloroisopropyl)ether	30	400	50,000		10	0.7	2	2	0.7	3	3	0.7	4	9	0.33
		bis(2-Ethylhexyl)phthalate	6	50,000	30	6	6	100	200	200	100	300	300	100	1,000	500	0.33
		4-Bromophenyl phenyl ether					10										0.33
		Benzyl butyl phthalate					10										0.33

MCP Stan ds by Fraction
STL Westfield - Analysis Methods and Reporting Limits

Parameter Group	Suggested Analytical Method	Compound	GW-1 (ug/L)	GW-2 (ug/L)	GW-3 (ug/L)	MMCLs (ug/L)	STL QL (ug/L) (b)	S-1/GW1 (ug/g) (dry)	S-1/GW2 (ug/g) (dry)	S-1/GW3 (ug/g) (dry)	S-2/GW1 (ug/g) (dry)	S-2/GW2 (ug/g) (dry)	S-2/GW3 (ug/g) (dry)	S-3/GW1 (ug/g) (dry)	S-3/GW2 (ug/g) (dry)	S-3/GW3 (ug/g) (dry)	STL QL (ug/g) (dry) (b)
		4-Chloroaniline	30	NA	50,000		20	1	100	30	1	400	30	1	400	30	0.66
		2-Chloronaphthalene					10										0.33
		4-Chloro-3-methylphenol					20										0.66
		2-Chlorophenol	10	NA	40,000		10	0.7	100	20	0.7	200	20	0.7	1,000	20	0.33
		4-Chlorophenyl phenyl ether					10										0.33
		Dibenzofuran					10										0.33
		Di-n-butyl phthalate					10										0.33
		1,3-Dichlorobenzene	600	10,000	8,000		10	100	100	100	200	500	600	200	500	600	0.33
		1,4-Dichlorobenzene	5	30,000	8,000		5	2	40	40	2	60	60	2	200	200	0.33
		1,2-Dichlorobenzene	600	10,000	8,000		10	100	100	100	200	500	500	200	500	500	0.33
		1,2-Diphenylhydrazine					10										0.33
		3,3'-Dichlorobenzidine	80	NA	50,000		20	1	1	1	1	1	1	3	3	3	0.66
		2,4-Dichlorophenol	10	NA	4,000		10	10	40	40	10	90	90	10	90	90	0.33
		Diethyl phthalate	6,000	NA	30		10	100	1,000	0.7	100	2,500	0.7	100	5,000	0.7	0.33
		2,4-Dimethylphenol	100	NA	20,000		10	0.7	400	10	0.7	900	10	0.7	4,000	10	0.33
		Dimethyl phthalate	50,000	NA	30		10	30	1,000	0.7	30	2,500	0.7	30	5,000	0.7	0.33
		2-Methyl-4,6-dinitrophenol					50										2
		2,4-Dinitrophenol	200	NA	2,000		50	3	40	6	3	90	6	3	90	6	2
		2,4-Dinitrotoluene	30	NA	2,000		10	0.7	1	1	0.7	2	2	0.7	7	7	0.33
		2,6-Dinitrotoluene					10										0.33
		Di-n-octylphthalate					10										0.33
		Hexachlorobenzene	1	NA	40	1	1	0.7	0.7	0.7	0.8	0.8	0.8	3	3	3	0.33
		Hexachlorobutadiene	0.6	1	90		5	3	3	5	3	3	10	3	3	40	0.33
		Hexachlorocyclopentadiene				50	5										0.33
		Hexachloroethane	8	10	5,000		5	6	6	6	10	10	10	30	30	50	0.33
		Isophorone					10										0.33
		2-Methylnaphthalene	10	10,000	3,000		10	4	500	500	4	1,000	1,000	4	2,000	1,000	0.33
		2-Methylphenol (o-cresol)					10										0.33
		4-Methylphenol (p-cresol)					10										0.33
		2-Nitroaniline					50										2
		3-Nitroaniline					50										2
		4-Nitroaniline					20										2
		Nitrobenzene					10										0.33
		2-Nitrophenol					10										0.33
		4-Nitrophenol					50										2
		N-Nitroso-di-n-propylamine					10										0.33
		N-Nitrosodiphenylamine					10										0.33
		Pentachlorophenol	1	NA	80	1	25	5	7	7	5	10	10	5	40	40	2
		Phenol	4,000	50,000	30,000		10	60	500	500	60	800	500	60	800	500	0.33
		1,2,4-Trichlorobenzene	70	10000	500	70	10	100	400	400	100	2,000	800	100	2,000	800	0.33
		2.4.5-Trichlorophenol	200	NA	100		10	3	1,000	2	3	2,500	2	3	5,000	2	0.33
		2.4.6-Trichlorophenol	10	40.000	10,000		10	3	40	40	3	60	60	3	200	200	0.33
Polynuclear Aromatic Hydrocarbons	8310 (W) 8270C(S)	Naphthalene	20	6,000	6,000		0.2	4	100	100	4	1,000	1,000	4	1,000	1,000	0.33
		Acenaphthylene	300	NA	3,000		0.2	100	100	100	100	2.500	1,000	100	2,500	1,000	0.33
		Acenaphthene	20	NA	5,000		0.2	20	1.000	1,000	20	2,500	2,500	20	5,000	4,000	0.33
		Fluorene	300	NA	3,000		0.2	400	1,000	1,000	400	2,000	2,000	400	5,000	4,000	0.33
		Phenanthrene	300	NA	50		0.2	700	1,000	100	700	2,500	100	700	2,500	100	0.33
		Anthracene	2.000	NA	3,000		0.2	1000.00	1000.00	1000.00	2500.00	2500.00	2500.00	5000.00	5000.00	5,000	0.33
		Fluoranthene	300	NA	200		0.2	1,000	1,000	1,000	2.000	2.000	1.000	2,000	5.000	1,000	0.33
		Pyrene	200	NA	3,000		0.2	700	700	700	1,000	2,000	2,000	1,000	5,000	5,000	0.33
		Chrysene	2	NA	3,000		0.2	7	7	7	10	10	10	40	40	40	0.33
		Benzo(a)anthracene	1	NA	3,000		0.2	0.7	0.7	0.7	1	1	1	4	4	4	0.33
		Benzo(b)fluoranthene	1	NA	3,000		0.2	0.7	0.7	0.7	1	1	1	4	4	4	0.33
		Benzo(k)fluoranthene	1	NA	3.000		0.2	7	7	7	10	10	10	40	40	40	0.33
		Benzo(a)pyrene	0.2	NA	3,000	0.2	0.2	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.33
		Dibenzo(a,h)anthracene	0.5	NA	3,000		0.2	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.33
		Benzo(g,h,i)perylene	300	NA	3,000		0.2	1,000	1,000	1,000	2.500	2,500	2,500	2,500	2,500	2,500	0.33
		Indeno(1,2,3cd)pyrene	0.5	NA	3,000		0.2	0.7	0.7	0.7	1	1	1	4	4	4	0.33
		2-Methylnaphthalene	10	10,000	3,000		0.2	4	500	500	4	1.000	1,000	4	2,000	1,000	0.33
Pesticide PCBs	Modified 8061A	Aldrin	0.5	0.5	10		0.1	0.03	0.03	0.03	0.04	0.04	0.04	0.1	0.1	0.1	0.01
		alpha-BHC					0.1										0.01
		beta-BHC					0.1										0.01
		delta-BHC					0.1										0.01
		gamma-BHC	0.2	NA	0.8		0.1	0.1	0.4	0.4	0.1	0.6	0.5	0.1	2	0.5	0.01
		Chlordane	2	NA	2	2	0.1	1	1	1	2	2	2	5	5	5	0.01
		4,4'-DDD	0.1	NA	6		0.1	2	2	2	3	3	3	10	10	10	0.01
		4.4'-DDE	0.1	NA	100		0.1	2	2	2	2	2	2	9	9	9	0.01

MCP Stan ds by Fraction
STL Westfield - Analysis Methods and Reporting Limits

Parameter Group	Suggested Analytical Method	Compound	GW-1 (ug/L)	GW-2 (ug/L)	GW-3 (ug/L)	MMCLs (ug/L)	STL QL (ug/L) (b)	S-1/GW1 (ug/g) (dry)	S-1/GW2 (ug/g) (dry)	S-1/GW3 (ug/g) (dry)	S-2/GW1 (ug/g) (dry)	S-2/GW2 (ug/g) (dry)	S-2/GW3 (ug/g) (dry)	S-3/GW1 (ug/g) (dry)	S-3/GW2 (ug/g) (dry)	S-3/GW3 (ug/g) (dry)	STL QL (ug/g) (dry) (b)
		4,4'-DDT	0.3	NA	0.3		0.1	2	2	2	2	2	2	9	9	8	0.01
		Dieldrin	0.1	NA	0.1		0.1	0.03	0.03	0.03	0.04	0.04	0.04	0.1	0.2	0.1	0.01
		Endosulfan I	40	NA	0.1		0.1	20	100	0.05	20	400	0.05	20	400	0.05	0.01
		Endorsulfan II	40	NA	0.1		0.1	20	100	0.05	20	400	0.05	20	400	0.05	0.01
		Endosulfan sulfate					0.1										0.01
		Endrin	2	NA	5	2	0.1	0.6	6	1	0.6	10	1	0.6	10	1	0.01
		Endrin Aldehyde					0.1										0.01
		Heptachlor	0.4	NA	1	0.4	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.7	0.7	0.7	0.01
		Heptachlor epoxide	0.2	NA	2	0.2	0.1	0.06	0.06	0.06	0.09	0.09	0.09	0.3	0.3	0.3	0.01
		Methoxychlor	40	NA	2	40	0.2	100	100	30	300	300	30	300	300	30	0.01
		Toxaphene				3	0.3										0.02
	8082A	Aroclor 1016	0.5	NA	0.3	0.5	0.3	2	2	2	2	2	2	2	2	2	0.1
		Aroclor 1221	0.5	NA	0.3	0.5	0.3	2	2	2	2	2	2	2	2	2	0.1
		Aroclor 1232	0.5	NA	0.3	0.5	0.3	2	2	2	2	2	2	2	2	2	0.1
		Aroclor 1242	0.5	NA	0.3	0.5	0.3	2	2	2	2	2	2	2	2	2	0.1
		Aroclor 1248	0.5	NA	0.3	0.5	0.3	2	2	2	2	2	2	2	2	2	0.1
		Aroclor 1254	0.5	NA	0.3	0.5	0.3	2	2	2	2	2	2	2	2	2	0.1
		Aroclor 1260	0.5	NA	0.3	0.5	0.3	2	2	2	2	2	2	2	2	2	0.1
Metals/IO	6010B	Antimony	6	NA	300	8	20	10	10	10	40	40	40	40	40	40	3
	6010B	Arsenic	50	NA	400	50	10	30	30	30	30	30	30	30	30	30	2
	6010B	Beryllium	4	NA	50	4	2	0.7	0.7	0.7	0.8	0.8	0.8	3	3	3	0.3
	6010B	Cadmium	5	NA	10	5	2	30	30	30	80	80	80	80	80	80	0.3
	6010B	Chromium (total)	100	NA	2,000	100	5	1000.00	1000.00	1000.00	2500.00	2500.00	2500.00	5000.00	5000.00	5000.00	2
	Calculation	Chromium III	100	NA	2,000		5	1000.00	1000.00	1000.00	2500.00	2500.00	2500.00	5000.00	5000.00	5000.00	3
	SM183500D	Chromium VI	50	NA	100		5	200.00	200.00	200.00	600.00	600.00	600.00	1000.00	1000.00	1000.00	0.05
	6010B	Lead	15	NA	30	15**	10	300	300	300	600	600	600	600	600	600	2
	7470A	Mercury	2	NA	1	2	0.2	20	20	20	60	60	60	60	60	60	0.05
	6010B	Nickel	100	NA	80	100*	20	300	300	300	700	700	700	700	700	700	3
	6010B	Selenium	50	NA	80	50	10	400	400	400	2,500	2,500	2,500	2,500	2,500	2,500	2
	6010B	Silver	40	NA	7	100*	5	100	100	100	200	200	200	200	200	200	2
	6010B	Vanadium	50	NA	2,000		10	400	400	400	2,000	2,000	2,000	2,000	2,000	2,000	2
	6010B	Zinc	2,000	NA	900	5000*	50	2500.00	2500.00	2500.00	2500.00	2500.00	2500.00	5000.00	5000.00	5000.00	8
	6010B	Thallium	2	NA	400	2	2	8	8	8	30	30	30	100	100	100	2
	6010B	Barium	2,000	NA	30,000	2,000	10	1000.00	1000.00	1000.00	2500.00	2500.00	2500.00	5000.00	5000.00	5000.00	2
	6010B	Copper				1,300**	20										3
	6010B	PAC or Free Cyanide	200	NA	10	200	10	100	100	100	100	100	100	400	400	400	0.5
Petroleum Hydrocarbons	8015M	Total Petroleum Hydrocarbons (GRO/DRO)	1000	NA	50,000		100	200	800	800							3
		Aliphatic Hydrocarbons															
	VPH	C5-C8	400	1,000	4,000		50	100	100	100	500	500	500	500	500	500	2.5
	VPH	C9-C12	4,000	1,000	20,000		50	1,000	1,000	1,000	2,500	2,500	2,500	5,000	5,000	5,000	2.5
	EPH	C9-C18	4,000	1,000	20,000		100	1,000	1,000	1,000	2,500	2,500	2,500	5,000	5,000	5,000	3.8
	EPH	C19-C36	5,000	NA	20,000		100	2,500	2,500	2,500	5,000	5,000	5,000	5,000	5,000	5,000	3.8
		Aromatic Hydrocarbons															
	VPH	C9-C10	200	5,000	4,000		50	100	100	100	100	500	500	100	500	500	2.5
	EPH	C11-C22	200	50,000	30,000		100	200	800	800	200	2,000	2,000	200	5,000	5,000	3.8

Source: Mass. Contingency Plan 310 CMR 40.0974(2), 40.0975(6)(a) and 40 1516(1) 10/31/97
a = MCP Method 1 Standards are for 1,3-dichloropropene
b = STL MA target reporting limits
Blanks = No value is available
NA = Not Applicable
* = Office of research and Standard Guidelines. Annual update May 1996.
** = Action level
MMCL - (Massachusetts Maximum Contaminant Levels) Massachusetts Drinking Water Standards. Annual update, May 1996.

Disclaimer
STL Westfield does not warrant, expressly or impliedly, the completeness accuracy or utility of the information contained herein.
STL Westfield expressly disclaims any responsibility for any action or inaction taken against any person in reliance on the information contained in this document.

CONTROL COPY NO. 01

COMMONWEALTH ANALYTICAL MDL STUDY

MDL Study for : Pb
Analyst: RI
Instrument: XRF-1
Date Analyzed: 10/6/1999
Units: PPM

Approval
QA Coordinator: ____________
Laboratory Director:

Compound	Spike Conc.	MDL1	MDL2	MDL3	MDL4	MDL5	MDL6	MDL7	AVE.	Standard Deviation	MDL	Report Level
Lead	200	281	254	291	275	289	305	267	280.3	16.820	53	100

M:\PEB\MDL\TEMP.XLS

CONTROL COPY NO. 01

SEVERN TRENT LABORATORY MDL STUDY

MDL Study for : Mobile Lab - PCB Soil
Analyst: TDK
Instrument: GC #3
Date Analyzed: 7/11/98
Units: mg/kg

Approval
QA Coordinator: TEB
Laboratory Director:

Compound	Spike Conc.	MDL1	MDL2	MDL3	MDL4	MDL5	MDL6	MDL7	AVE.	Standard Deviation	MDL	Report Level
Aroclor 1242	2 ng/ul	0.102	0.096	0.123	0.109	0.122	0.124	0.123	0.114	0.012	0.037	0.5
Aroclor 1248	2 ng/ul	0.123	0.134	0.159	0.143	0.154	0.166	0.133	0.145	0.016	0.049	0.5
Aroclor 1254	2 ng/ul	0.121	0.141	0.126	0.150	0.146	0.140	0.143	0.138	0.011	0.035	0.5
Aroclor 1260	2 ng/ul	0.126	0.150	0.110	0.148	0.180	0.108	NA	0.137	0.028	0.091	0.5

Mdlpcb98.xls

CONTROL COPY NO. 01

APPENDIX G

Health and Safety Plan

CONTROL COPY NO. 01

J.O. No. 080881100

HEALTH & SAFETY PLAN

FOR

OXFORD PAPER MILL
LAWRENCE, MA

Prepared By: Marilva Mendonca Date: 12-20-00
Marilva Mendonca, Environmental Engineer

Approved By: Claire Doherty Date: 12-20-00
Claire Doherty, Health and Safety Specialist

Approved By: Lm Tyrala Date: 12-20-00
Lester Tyrala, Program Manager

STONE & WEBSTER INC.
245 SUMMER STREET, BOSTON, MA 02210

October 2000

TABLE OF CONTENTS

LIST OF TABLES, FIGURES, AND APPENDICES

CONTROL COPY NO. 01

STONE & WEBSTER

SITE HEALTH AND SAFETY PLAN

1.0 INTRODUCTION

This Site Specific Safety & Health Plan (SSHP), prepared by Stone & Webster Engineering Services, Inc (Stone & Webster), establishes personnel protection standards and mandatory safety practices and procedures in order to prevent accidents, injuries and illnesses during field activities.

2.0 SITE DESCRIPTION

2.1 Location

The former Oxford Paper Mill (OPM) Site (herein known as the Site), is on an approximate 3 acre parcel of land in Lawrence, Massachusetts, immediately northwest of the intersection of Canal Street and the Spicket River (refer to Figure 1 for Locus Plan). A small portion of the site is also located north of Canal Street on the eastern bank of the Spicket River. A raceway, which discharges to the Spicket River, transects the Site.

2.2 Surrounding Population

Properties surrounding the Site are used for residential, commercial, and industrial purposes. GenCorp, Inc. (GenCorp), the Everett Mills property, and Union Street are west of the Site. The Lawrence General Hospital is located beyond the Spicket River to the north. The Everett Mills property is currently used for commercial purposes. The GenCorp facility is currently vacant.

2.3 Topography and Accessibility

The Site can be accessed from the northwest via Canal Street. The general topography of the site consists of paved areas and vacant industrial buildings.

2.4 Site History

The Site is a historic paper mill complex built in the 1800's, that manufactured paper products until 1972. Nine buildings currently occupy the Site; these buildings are south of the raceway. Buildings north of the raceway were demolished in the early 1980's. The City of Lawrence took ownership of the property in 1983.

2.5 Planned Duration of Site Activity

The planned duration of site activities is anticipated to begin in the Summer 2000 and last through the Fall 2000.

2.6 Anticipated Weather Conditions During Activity

Anticipated weather conditions during site activities will be typical for New England weather during Summer and Fall seasons. This may include extreme high and low ambient temperatures, rain, sleet, and wind chills.

2.7 Confined Space Work

Under the scope of work for this project, no confined space work in anticipated to be conducted by Stone & Webster personnel.

2.8 Utility Notifications

At least 72 hours prior to excavation activities, the Contractor is responsible for contacting DIGSAFE in order to identify any underlining utilities in areas where excavation will be performed.

3.0 OBJECTIVES

3.1 Scope of Work

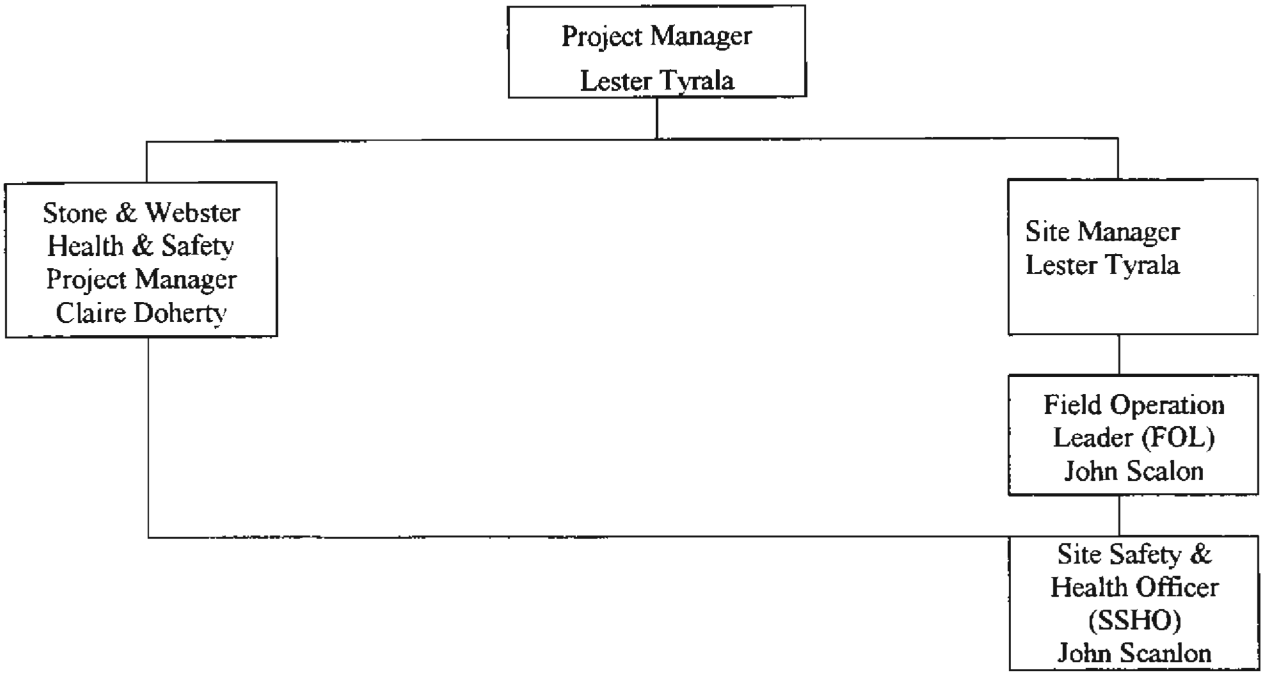
The Scope of Work for this portion of the project involves the oversight of the Contractor to ensure that the Work Plan is being adhered to during construction/demolition activities.

4.0 ON-SITE ORGANIZATION

The success of the health and safety program depends on the establishment of a functional organization made up of the Project Manager, Project Manager for Health and Safety, Site Manager and Field Personnel. The responsibility for health and safety is distributed through all levels of the organization. The goal of the health and safety program is to prevent accidents, injuries, and illnesses while working onsite. This can be achieved through the implementation of this well-thought-out SSHSP. The demonstrable results of the SSHSP will be fewer accidents, fewer lost-time injuries, and healthier employees. The organization responsible for administering and implementing the SSHSP is illustrated in Table 4-1.

The organization responsible for administering and implementing the SSHSP is illustrated in Table 4-1. Responsibilities for these positions are described below.

TABLE 4-1
SAFETY AND HEALTH ORGANIZATION CHART



4.1 Project Manager

The Project Manager has overall responsibility for the development, implementation and administration of the SSHSP. He will promote full support of health and safety by being an enthusiastic advocate of safety and enforcer of rules and discipline. He is responsible for ensuring that Stone & Webster commits adequate resources to health and safety and will maintain a current awareness of the health and safety status of this project by communicating regularly with the FOL and the Stone & Webster Health and Safety Project Manager.

4.2 Stone & Webster Health and Safety Project Manager

The Stone & Webster Health and Safety Project Manager has the responsibility for the review and implementation of the SSHSP. Specific responsibilities of the Stone & Webster Health and Safety Project Manager include:

- Ensuring that appropriate training and medical records are kept up-to-date and generally oversee the administration of the Health and Safety Program.
- Acting as a liaison between the Corporate Health and Safety Department.
- Coordinating health and safety activities with subcontractors.
- Determining what resources are required to address health and safety, and communicating those resource requirements to the Project Manager.

- Reviewing or preparing the SSHSP, providing consultation and technical advice on health and safety matters to the Project Manager and the FOL and providing technical direction to the Site Health and Safety Officers.
- Audit tasks for safety and health and stop work when unacceptable safety or health risks exist.

4.3 Site Manager

The Site Manager is responsible for regulatory compliance and the health and safety of employees working on his projects. Specific responsibilities include:

- Thorough knowledge of the site health and safety requirements and seeking assistance and guidance from the Health and Safety Project Manager, as necessary.
- Ensuring that all project personnel complete or meet project training and medical requirements.
- Continually monitoring the performance of the Field Operations Leader (FOL) and field personnel regarding their participation in and responsibilities toward the implementation of the SSHSP.
- Ensuring that an adequate SSHSP is prepared for the task, enforcing the requirements of the SSHSP and committing adequate resources to ensure effective implementation of the SSHSP.

The Site Manager is also responsible for regulatory compliance and the daily health and safety of employees working on the site. They will coordinate activities with the SSHO and continually monitor the performance of field personnel and subcontractors regarding their participation in and responsibilities toward the implementation of the SSHSP. Site Managers are responsible for enforcing the requirements of the SSHSP and will:

- Ensure that all onsite personnel have received and read a copy of the SSHSP, as well as completed the SSHSP sign-off sheet.
- Ensure that all personnel have attended a briefing apprising them of the SSHSP contents and potential site hazards prior to working on the site.
- Ensure that sufficient personal protective equipment (PPE) and monitoring instrumentation are available, as required by this SSHSP.
- Maintain a high level of health and safety awareness among site personnel.
- Maintain frequent communications with the Site Health and Safety Officer.
- Ensure that all site personnel work according to the procedures outlined in the SSHSP.

4.4 Site Health and Safety Officer

The Site Safety & Health Officer (SSHO) has the responsibility to implement the SSHSP, as directed by the Project Manager for Health and Safety, and to verify compliance at the site. The SHSO has the authority to immediately correct all situations where noncompliance with the SSHSP is noted and to stop work at once in cases where an immediate danger is perceived. Specific responsibilities include:

- Consulting with the Health and Safety Project Manager as required.
- Upgrading or downgrading Levels of PPE, as described in the Section 7.0, or stopping work and ordering personnel to evacuate the site in situations where imminent hazards are identified

(all other modifications to a SSHSP must be approved by the Project Manager and Health and Safety Project Manager).

- Conducting daily inspections of the site.
- Procurement and distribution of PPE, as required.
- Procurement of required air monitoring instrumentation and performing air monitoring, as required.
- Performing personal exposure monitoring where required and deemed necessary to determine the adequacy of the protective measures and PPE specified by the SSHSP.
- Notifying the Site Manager and the Health and Safety Project Manager of all noncompliance and/or unsafe conditions and situations.
- Monitoring the daily safety performance of all personnel to ensure that required safety and health procedures are followed and to ensure any deficiencies are corrected.
- Conducting accident/incident investigations and preparing accident/incident reports.
- Initiating emergency response procedure notifications.
- Conducting pre-entry site specific training and safety briefings to inform personnel of SSHSP contents and site hazards.
- Modifying the SSHSP as dictated by changing site conditions and with approval of the Site Manager and Project Manager for Health and Safety.
- Maintaining a file which documents that the provisions of this SSHSP have been satisfied. This file will contain:
    1. Signed copy of pre-entry briefing attendance sheet
    2. Personnel Injury/Exposure Reports, Incident Reports
    3. Records of safety violations and remedial actions taken
    4. Field logbook containing such information as names of employees onsite, types of protection worn, non-productive times, monitoring results, etc.

4.5 Field Personnel

All Field Personnel are responsible for following the SSHSP and for performing their work in a safe and responsible manner. Specific responsibilities include:

- Reading the SSHSP in its entirety prior to the start of onsite work and signing acknowledgment that they have read and understand the contents of the SSHSP.
- Attending pre-entry briefing regarding SSHSP contents and potential site hazards.
- Voicing questions or concerns regarding SSHSP contents to the Site Manager or SSHO prior to the start of work.
- Reporting unsafe working conditions to the Site Manager or SSHO.
- Immediately reporting accidents and incidents to the SSHO.
- Complying with the SSHSP and requests of the SSHO.
- Using required exposure controls and safety devices, including PPE.

4.6 Subcontractors

Subcontractors that perform work for Stone & Webster under this SSHSP are responsible for the health and safety of their employees. Stone & Webster will take responsibility for the preparation of the SSHSP, however the presence of a SSHO and the implementation of a SSHSP does not relieve the subcontractor of its responsibilities as an employer. Specific responsibilities of subcontractors performing work under this SSHSP include:

- Maintaining a safe and healthy work environment.
- Cooperating and providing assistance when requested in the preparation and implementation of SSHSPs.
- Reviewing this SSHSP to ensure that the health and safety requirements for the operations and scope of work they are contracted to perform are satisfied.
- Performing all work in accordance with the requirements of SSHSPs.
- Meeting all contract/subcontract requirements related to health and safety.

Table 4-2 lists the key personnel for this task and their phone numbers.

TABLE 4-2

KEY HEALTH & SAFETY PERSONNEL

POSITION	NAME	TELEPHONE NO.
Project Manager	Lester Tyrala	617-589-8028
Stone & Webster Health and Safety Project Manager	Claire Doherty	617-589-6750
Site Manager	Lester Tyrala	617-589-8028
Field Operation Leader	John Scanlon	617-589-1046
Health and Safety Officer	John Scanlon	617-589-1046

5.0 HAZARD ANALYSIS

5.1 Chemical Hazards

Based upon knowledge of the background of the Site and anticipated risks posed by the specific on-going operations, there are expected hazards that could be encountered. Table 5-1 lists specific compound materials, along with location and primary hazard that they may cause if contacted without proper PPE.

TABLE 5-1

SPECIFIC COMPOUND MATERIALS AND PRIMARTY HAZARDS

Compound Material	Type (Location)	Primary Hazard
Asbestos	Surface soil near transformer No. 6	Inhalation, ingestion and skin contact
Lead	Soils	Inhalation & Ingestion
PCBs	Transformers and soils	Inhalation, skin contact, and ingestion
Biological Hazards	Insects, Plants, Sewage, Wastes	Inhalation & Ingestion

If additional contaminants are identified during site activities, they will be evaluated for their hazard potential and added to the air sampling scheme. PPE requirements will also be re-evaluated to assure that gloves, suits and respiratory protection are adequate against the new contaminants.

Table 5-2 lists the PELs set by OSHA and the TLVs set by the American Conference of Governmental Industrial Hygienists (ACGIH). Activities will be conducted to protect personnel by maintaining exposure to below the listed OSHA-PEL or ACGIH-TLV.

TABLE 5-2

PUBLISHED EXPOSURE LIMITS FOR POTENTIAL SITE CHEMICALS

Chemical	**OSHA-PEL**	**ACGIH-TLV, 1998**
Asbestos	Dust	Dust
PCBs	0.5 mg/m^3	0.5 mg/m^3
Lead	0.05 mg/m^3	0.05 mg/m^3

S&W personnel shall observe work from an upwind position, where possible. Based on the fact that S&W personnel shall observe work from a safe distance, it is not anticipated that significant exposures to site contaminants shall occur.

5.2 Physical Hazards

The following general physical hazards are associated with the proposed site activities

- Noise

- Slips, trips, and falls hazards from walking and working on uneven terrain
- Crushing injuries from unstable equipment and site structures
- Overhead utilities
- Subsurface hazards such as underground utilities
- Overhead hazards from falling equipment
- Fire and explosion
- Heat stress (while wearing PPE)

5.3 Heat Stress/Cold Stress

Anticipated weather conditions for field activities, which are scheduled between Summer 2000 through Fall 2000, include both summer and fall conditions. This could pose potential for heat stress. Heat stress is particularly prevalent when workers must wear appropriate protective clothing. Heat stress can occur quickly, depending on ambient temperatures, humidity and amount or type of work performed. Exposure to extreme cold conditions can cause the body to experience cold stress. Areas that are highly susceptible to the cold are the fingers, toes, and ears. Additional information on the control methods for both heat and cold stress can be found in Appendix A.

6.0 AIR MONITORING

Air monitoring shall be performed by the Contractor to confirm the level of worker protection required and to verify the efficiency of engineering controls or work practices. Air sampling shall be performed for nuisance dust, asbestos, lead and PCBs. All monitoring equipment shall be calibrated, operated and maintained according to manufacturer's specifications. Air monitoring data shall be provided to the S&W SSHO frequently.

7.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

For the purpose of oversight of construction activities, Level D or modified-D PPE is expected to be required. Oversight will be performed from the Exclusion Zone (see section 8.1). Should site conditions or air sampling data change during construction or excavation activities, levels of protection may change. If entrance into another zone is required, level of protection may be increased to Level C as seen fit by the SSHO.

<u>Level D – General Construction (no contact with hazardous materials)</u>

- Hard hat
- Safety glasses with side shields
- Long pants and work shirt
- Steel-toed work boots
- Gloves (as necessary)
- Ear Plugs/Muffs (where required)
- Additional appropriate outdoor dress as required by weather conditions

<u>Modified Level D (equipment in addition to Level D PPE)</u>

- Full-body Tyvek, with hood, taped at wrists and ankles (splash protection where appropriate)

- Disposable boot covers with ribbed soles over steel-toed boots
- Gloves: outer – cotton work gloves, inner – vinyl surgical
- Chemical splash gloves (where contact is likely)
- Full face shield with chin protector (for operations with high splash potential)

Level C PPE will be required where air monitoring concentrations in the breathing zone meet or exceed the OSHA PEL but are less than the IDLH concentrations or less than the protection factor of the respirator. Although Stone & Webster personnel are performing oversight activities, Level C PPE may be needed if entry into the asbestos or lead contaminated areas is required.

Level C

- Hard hat
- Safety glasses with side shields
- Long pants and work shirt
- Steel-toed work boots
- Gloves: outer – cotton work gloves, inner – vinyl surgical
- Ear Plugs/Muffs (where required)
- Disposable boot covers with ribbed soles over steel-toed boots
- MSHA/NIOSG approved full-face piece air-purifying cartridge respirator (appropriate cartridges for specific hazards)

8.0 SITE CONTROLS

8.1 Work Zones

The containment or Exclusion Zone (EZ), decontamination facility or Contamination Reduction Zone (CRZ), and Support Zone (SZ) are the three general zones that will be established by the Contractor during hazardous remediation inside the building. A brief description of each zone is as follows:

Exclusion Zone (EZ)

This is the area where contamination is either known or likely to be present, or because of activity, will have a potential to cause harm to personnel. Entry into the EZ requires the use of the PPE outlined in part 6.0 of this document.

Contamination Reduction Zone (CRZ)

The CRZ is a series of rooms leading into and out of the containment where workers conduct personal and equipment decontamination on leaving the work area. It is essentially a buffer zone between contaminated work areas and clean area outside the work area.

Support Zone (SZ)

The SZ is the clean area outside the work area where the chance to encounter hazardous materials or conditions is minimal. Clean equipment is stored here, personnel take rest breaks here and personal protective equipment is therefore not required.

8.2 Site Communications

Visual, voice or radio communication must be maintained at all times. At a minimum, the following communications systems will be available during site activities at the site. The Contractor will designate and provide any of the following systems required to adhere to the site HASP protocols.

- Two way radio
- Site telephone or cellular telephone in the support zone
- Compressed air horn
- Hand signals

Signal	Definition
Hands clutching throat	Out of air/cannot breath
Hands on top of head	Need assistance
Thumbs up	OK/I am alright/I understand
Thumbs down	No/negative
Hands waving upright	Send backup support
Grip partners wrist	Exit area immediately

8.3 Work Practices

In addition to the precautions described in each task hazard analysis, the following work practices shall be established and enforced onsite for all activities:

- Maintain safety awareness at all times and obey all instructions from the designated SSHO and the Field Operations Leader;
- Do not violate any posted zones or restricted areas;
- Do not loiter near potentially contaminated areas and avoid direct contact with contaminated soils and ground water;
- Immediately notify the designated Site Health and Safety Officer of any perceived safety concerns, unsafe working conditions, suspicious odors.
- All electrical equipment and tools shall be properly grounded and used with Ground Fault Circuit Interrupters.
- Do not remove any material from the site other than samples and decontaminated equipment/supplies brought to the site;
- When needed, maintain the "Buddy System" at all times and maintain "line-of-sight" contact with the buddy during onsite activities;
- No eating, drinking, smoking, chewing gum or tobacco, or applying of cosmetics shall be allowed except in specifically designated areas for such activities, such as lunch rooms or break areas;
- Maintain the site entry and exit log.

9.0 TRAINING

The Contractor's Site Safety and Health Officer (SSHO) shall provide emergency response training to all "on-site personnel." Stone & Webster employees and subcontractors will attend these training sessions. Topics of training will include, but are not limited to:

- Use of all site emergency equipment such as emergency showers, eyewash facilities, self-contained breathing devices and fire extinguishers
- Location of all site emergency equipment
- Response procedures for fires
- Response procedures for injured workers
- Response procedures for chemical releases
- Response procedures for accidents
- On-site/Off-site response resources
- Emergency site operations shut down procedures
- On-site "chain of command"
- Designated on-site emergency coordinator
- Safe refuge and evacuation locations
- Evacuation signals
- Review of MSDS for PCBs for specific procedures

All Stone & Webster personnel are required to have participated in a 40-hour health and safety training course that complies with OSHA 29 Code of Federal Regulations (CFR) 1910.120. This training should consist of offsite class room instruction and daily exercises to demonstrate the worker's familiarity with PPE, potential hazards to which they may be exposed, and mitigating measures to minimize the potential for exposure.

Refresher training is an integral part of training and is also required for all onsite personnel. Site personnel are required to have participated in a minimum of eight hours of refresher training meeting the requirements of OSHA 29 CFR 1910.120 following the completion of the 40-hour health and safety training requirements described in Section 10.1 of this SSHSP, if the 40-hour training was completed more than 12 months prior to the commencement of work.

Written documentation of 40-hour training and 8-hour refresher training shall be provided by all site personnel prior to the start of work. Refer to Appendix B for copies of certifications.

10.0 DECONTAMINATION

10.1 Personnel Decontamination Procedures

Due to the nature of the work proposed for the oversight on construction activities, minimal, if any, decontamination for Stone & Webster personnel is anticipated. However, if Stone & Webster personnel are required to enter into a contaminated area, the following decontamination procedure will be adhered to.

Station 1: Outer PPE Removal

1. Remove boots and place in segregated area for decontamination.
2. Remove outer gloves and place in marked drums for disposal.

Station 2: Inner PPE Removal

1. Remove inner gloves and place in marked drum for disposal.
2. Wash hands and face.

State 3: Clean Room

1. Dress in street clothes; sign out of the work area.

Note: All electronic monitoring equipment will be wrapped in plastic to eliminate the need for extensive decontamination protocols, which could harm the electronics.

10.2 Equipment Decontamination

Due to the nature of the work proposed for Stone & Webster personnel, minimal, if any, decontamination of equipment will be required. In general, the gross contamination will be removed from the equipment before the equipment leaves the contaminated area. Final cleaning will take place before the equipment leaves the CRZ.

The decontamination procedures for equipment brought into the contaminated work area will vary, depending on the contaminant in question (refer to Appendix C for specific procedures). In order to reduce decontamination and to protect sensitive electronic apparatus, equipment such as monitoring instruments may be wrapped in plastic.

11.0 EMERGENCY RESPONSE

11.1 First Aid

At least one field person onsite will be currently certified in both basic first aid and CPR by the American Red Cross or equivalent organization.

11.2 Emergency Telephone Numbers

Ambulance	911
Lawrence General Hospital	(987) 683-4000
Police	
Emergency	911
Non-Emergency	(978) 681-0333
Fire	
Emergency	911
Non-Emergency	(978) 794-1204
NASDI-General	(617) 254-3140
LFR	(781) 356-7300
EMLO-Asbestos	(781) 830-9444

Compliance Corp, Safety	(781) 899-3510 (781) 899-2766
SSHO (MASSHIGHWAY) Pager	(617) 486-0936
CIH Pager	(617) 486-0936
MASSHIGHWAY Engineers	
Joe D'Angelo	(781) 641-8417
Rich Horgan	(978) 536-9098
Ted Gibson	(978) 774-1757
Mass DEP	(978) 661-7600

11.3 Nearest Hospital

Serious injuries and those requiring treatment beyond first aid will be transported to Lawrence General Hospital for treatment (refer to Figure 2 for map hospital route). Ambulance service can be called by dialing 911.

Lawrence General Hospital
1 General Street
Lawrence, MA
(978) 683-0411

Route to Lawrence General Hospital from Site (see attached map)

Start out going Northeast on Canal Street toward Marston Street. Turn left onto Prospect Street, then turn a slight left onto General Street.

FIGURE 1

CONTROL COPY NO. 01

MA DEP - Bureau of Waste Site Cleanup

Site Scoring Map: 500 feet & 0.5 Mile Radii

ITE NAME:
ford Paper Mill
treet
MA
97 28685ew

Site Location

The information shown on this map is the best available at the date of printing. Please refer to the data source descriptions document.

MASS GIS Massachusetts Geographic Information System

Massachusetts Executive Office of Environmental Affairs - 1999

DEP

Legend: Limited Access, Divided, Major Road, Connector, Street, Track, Trail

Boundaries: Town, County, DEP Region; Train; Powerline; Pipeline; Aqueduct

[illegible] Perennial, Intermittent, Man Made Shore, Dams

EPA Designated Sole Source Aquifer

Public Water Supplies: Ground, Surface, Non Community

Approved Zone2; IWPA; Surface Water Supply Zone A

Hydrography: Water features, Public Surface Water

Wetlands: Fresh, Salt, NHESP Wetland Habitat

Protected Open Space [illegible]

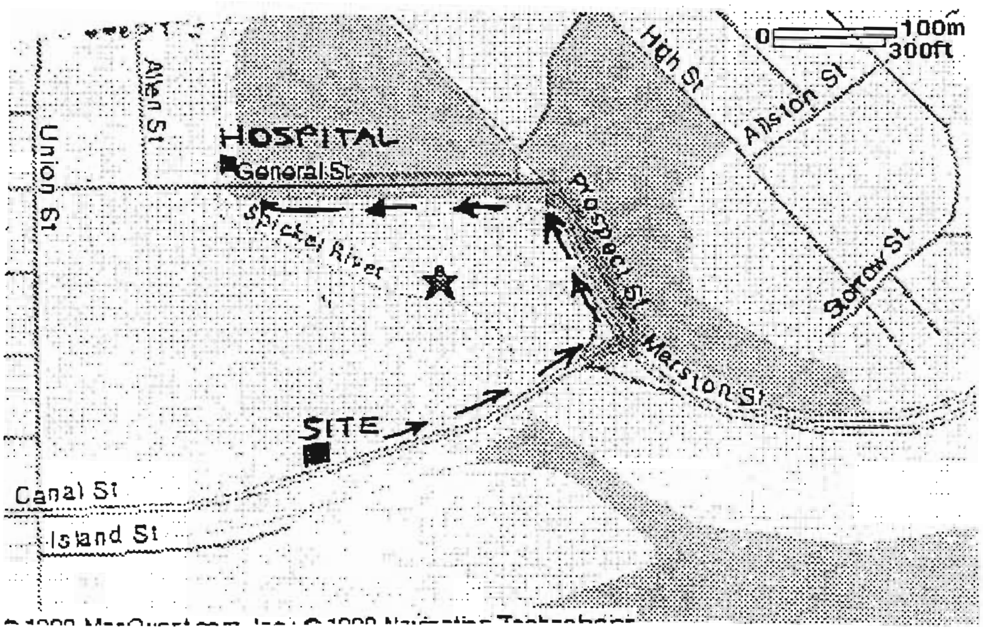
999

FIGURE 2

Lawrence General Hospital
1 General Street
Lawrence, MA
(978) 683-0411

<u>Route to Lawrence General Hospital from Site (see attached map)</u>

Start out going Northeast on Canal Street toward Marston Street. Turn left onto Prospect Street, then turn a slight left onto General Street.



APPENDIX A

HEAT STRESS

■ 07-30-97 ■ Revision 0

1 PURPOSE AND SCOPE

■ **Purpose**

This procedure provides the guidelines for the protection of individuals who work in hot environments.

■ **Scope**

This procedure applies to all Stone & Webster personnel and subcontractors working on projects where heat stress safety requirements are applicable.

2 REFERENCES

NIOSH/OSHA/USCG/EPA *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, 1985.

3 APPENDIXES

■ Appendix A, Suggested Frequency for Monitoring Acclimatized Workers

■ Appendix B, Signs and Symptoms of Heat Stress

4 GENERAL

■ **Definitions**

- *Heat Exhaustion* - Overexposure to heat causing inadequate blood circulation due to cardiovascular insufficiency or dehydration. Symptoms include: pale, cool, moist skin, heavy sweating, nausea.
- *Heat Stroke* - Overexposure to heat causing temperature regulation failure and increased body temperature. Symptoms include red, hot, dry skin, lack of or reduced perspiration, strong rapid pulse.

■ **Responsibilities**

- The *Manager/Supervisor* is responsible for implementing and enforcing this procedure.
- The *Safety Representative* is responsible for monitoring compliance with this procedure.

5 PROCEDURE

■ **Factors Contributing to Heat Stress**

- Wearing Personal Protective Equipment (PPE) can place workers at considerable risk of developing heat stress. Health effects range from transient heat fatigue to serious illness or death. Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and certain individual worker characteristics. Regular monitoring and other preventive precautions shall be employed.
- Individuals vary in their susceptibility to heat stress. Factors that may predispose someone to heat stress include the following:
  - — Lack of physical fitness
  - — Lack of acclimatization
  - — Age
  - — Dehydration
  - — Obesity

- Alcohol and drug use
- Infection
- Sunburn
- Diarrhea
- Chronic disease

- Reduced work tolerance and the increased risk of excessive heat stress is directly influenced by the amount and type of PPE worn. PPE adds weight and bulk, severely reduces the body's access to normal heat exchange mechanisms (evaporation, convection and radiation), and increases energy expenditure. Once PPE is selected, the safe duration of work/rest periods shall be based on the following:
  - Anticipated work rate
  - Ambient temperature and other environmental factors
  - Type of protective ensemble
  - Individual worker characteristics and fitness

■ Monitoring

The following procedures shall be used to monitor field personnel at the site:

- For workers wearing permeable clothing (e.g., standard cotton or synthetic work clothes), recommendations for monitoring requirements and suggested work/rest schedules in the current American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values for Heat Stress shall be followed. If the actual clothing worn differs from the ACGIH standard ensemble in insulation value and/or wind and vapor permeability, the monitoring requirements and work/rest schedules shall be changed accordingly.
- For workers wearing semipermeable or impermeable encapsulating ensembles, the ACGIH standard shall not be used. For these situations, workers shall be monitored when the temperature in the work area is above 70°F (21°C).
- *Heart Rate* shall be monitored. The radial pulse shall be counted during a 30-second period as early as possible in the rest period.

  If the heart rate exceeds 110 beats per minute at the beginning of the rest period, the next work cycle shall be shortened by one-third with the rest period the same.

  If the heart rate still exceeds 110 beats per minute at the next rest period, the following work cycle shall be shortened by one-third.
- *Oral Temperature* shall be monitored. A clinical thermometer shall be used (three minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).

  If oral temperature exceeds 99.6°F (37.6°C) the next work cycle shall be shortened by one-third without changing the rest period.

If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, the following work cycle shall be shortened by one-third.

Workers shall not be permitted to wear semipermeable or impermeable garments when oral temperatures exceed 100.6°F (38.1°C).

- *Body Water Loss shall be monitored*, if possible, by measuring weight on a scale accurate to ±0.25 lb at the beginning and end of each work day to check if enough fluids are being taken to prevent dehydration. Employees shall be weighed while wearing similar clothing or, ideally, nude. *The body water loss should not exceed 1.5 percent total body weight loss in a work day.*
- Initially, the frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work (Appendix A). The length of the work cycle will be governed by the frequency of the required physiological monitoring.

■ **Prevention**

- Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because suffering from heat stroke or heat exhaustion causes a person to be predisposed to additional heat injuries. To avoid heat stress, the following steps shall be used to adjust work schedules:
  - — Modify work/rest schedules according to monitoring requirements.
  - — Mandate work slowdowns as needed.
  - — Rotate personnel. Alternate job functions to minimize overstress or overexertion at one task.
  - — Add additional personnel to work teams.
  - — Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.
- Shelter (air-conditioned, if possible) or shaded areas shall be provided to protect personnel during rest periods.
- Body fluids of workers shall be maintained at normal levels to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat, i.e., 8 fluid ounces (0.23 liters) of water must be ingested for approximately every 8 ounces (0.23 kg) of weight lost. The normal thirst mechanism is not sensitive enough to ensure that enough water will be ingested to replace lost sweat. When heavy sweating occurs, the worker should

increase fluid intake. The following strategies may be useful:

- Maintain water temperature at 50° to 60°F (10° to 15.6°C).
- Provide small disposable cups that hold about 4 ounces (0.1 liter).
- Urge workers to drink 16 ounces (0.5 liters) of fluid (preferably water or dilute drinks) before beginning work
- Urge workers to drink a cup or two of fluid at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid day are recommended, but more may be necessary according to body weight.

- Workers shall be encouraged to maintain an optimal level of physical fitness as follows:
  - Acclimatize workers to site work conditions, i.e., temperature, protective clothing, and workload, as necessary.
  - Urge workers to maintain normal weight levels.
- Cooling devices shall be provided to aid natural body heat exchange during prolonged work or severe heat exposure. Cooling devices include cooling jackets, vests, or suits.
- Workers shall be trained to recognize and treat heat stress, and to identify the signs and symptoms of heat stress (Appendix B).

Appendix A

HEAT STRESS

SHE 8-7

■ 07-30-97 **■ Revision 0**

Suggested Frequency of Physiological Monitoring for Fit and Acclimatized Workers[a]

Adjusted Temperature[b]	Normal Work Ensemble[c]	Impermeable Ensemble
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (225°-253°C)	After each 150 minutes of work	After each 120 minutes of work

[a] For work levels of 250 kilocalories/hour.

[b] Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F = ta °F + (13 X % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine - no cloud cover and a sharp, distinct shadow; 0 percent sunshine - no shadows.)

[c] A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

Signs and Symptoms of Heat Stress

- **Heat rash** may result from continuous exposure to heat or humid air.
- **Heat cramps** are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include:
  - Muscle spasms
  - Pain in the hands, feet, and abdomen
- **Heat exhaustion** occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include:
  - Pale, cool, moist skin
  - Heavy sweating
  - Dizziness
  - Nausea
  - Fainting
- **Heat stroke** is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms include:
  - Red, hot, usually dry skin
  - Lack of or reduced perspiration
  - Nausea
  - Dizziness and confusion
  - Strong, rapid pulse
  - Coma

SHE
8-8

COLD STRESS

■ 07-30-97 ■ Revision 0

1 PURPOSE AND SCOPE

- **Purpose**

  This procedure provides guidelines for the protection of individuals who work in cold environments.

- **Scope**

  This procedure applies to all Stone & Webster personnel and subcontractors working on projects where cold stress requirements are applicable.

2 REFERENCES

- American Conference of Governmental Industrial Hygienists, *Documentation of the Threshold Limit Values and Biological Exposure Indices for Physical Agents in the Work Environment*, Latest Edition.
- Canadian Centre for Occupational Health and Safety. *Cold Stress*. Pamphlet number P87-14E.
- National Safety Council. *Fundamentals of Industrial Hygiene*. Fifth Ed.

3 APPENDIXES

- Appendix A, Wind Chill Index
- Appendix B, Work/Warm-up Schedule for Four Hour Shift

4 GENERAL

Cold weather conditions can be hazardous to the health and safety of employees, endanger the stability of the body system, and cause problems such as hypothermia and frostbite. It is of vital importance that adequate precautions are taken to alleviate the effect of cold environments and to ensure that personnel can work safely and efficiently.

- Definition
  - *Anemometer* - An instrument to measure wind speed.
  - *Cold stress* - The disruption of the body's thermal balance due to exposure to cold.
  - *Core temperature* - The temperature of the inner parts of the body most accurately determined by measuring with a rectal temperature.
  - *Dehydration* - The loss or deficiency of water in body tissues. The condition may result from inadequate water intake and/or excessive removal of water from the body.
- **Responsibilities**
  - The *Manager/Supervisor* is responsible for implementing and enforcing this procedure.
  - The *Safety Representative* is responsible for monitoring compliance with this procedure.

5 PROCEDURE

- **Precautions**
  - The following factors may contribute to a cold injury:
    - — Exposure to humidity
    - — Exposure to high winds
    - — Contact with wetness or metal
    - — Inadequate clothing

COLD STRESS

- — Age
- — General health
- The following physical conditions worsen the effect of cold exposure:
  - — Allergies
  - — Vascular disease
  - — Excessive smoking
  - — Excessive drinking
  - — Specific drugs and medicines
- Workers with blood vessel abnormalities (i.e., Raynauds phenomenon and acrocyanosis) shall take extra precautions to avoid chilling.

■ Requirements

- Alcoholic products, including cough medication containing alcohol, shall not be taken prior to work in cold environments. Alcohol dilates blood vessels near the skin surface which increases heat loss and lowers body temperature.
- Sedative drugs shall not be taken prior to working in cold extremes. Sedative drugs interfere with transmission of impulses to the brain.
- An employee who becomes fatigued while working shall be removed to a warm environment and shall rest. As exhaustion approaches, the body experiences rapid loss of heat and the cooling process begins.
- Double shifts and overtime shall be avoided in cold environments.
- Rest periods in warm environments shall be frequent to prevent cold stress disorders.
- The outer layer of clothing shall be removed when entering the heated shelter. The other layers shall be loosened to allow for sweat evaporation.
- Sitting or standing for prolonged periods of time shall be avoided in cold environments.

■ Windchill Index

- Air temperature alone is not sufficient to assess the cold hazard in certain environments. Therefore, the windchill index along with the air temperature shall be used. Heat loss from convection is the greatest and most deceptive factor in loss of body heat.
- The windchill index is the cooling effect of any combination of temperature and wind velocity or air movement (Appendix A).
- The windchill index takes into account the wind velocity. If there is no anemometer (measures wind speed), the following is a suggested guide for estimating wind speed:
  - — 5 mph : light flag moves
  - — 10 mph : light flag fully extended
  - — 15 mph : raises newspaper sheet
  - — 20 mph : causes blowing and drifting snow

- The windchill index shall be used to evaluate the cold hazard.
- The windchill index does not take into account the body part exposed to cold, the level of activity effect on the body's heat production, and the amount of clothing worn.

■ **Control Measures**

- *Engineering Controls* - Cold stress can be reduced by the following controls:
  - — General or spot heating shall be used to increase temperature at the site.
  - — If work is being performed with bare hands for 10 or more minutes, special provisions must be made to keep the worker's hands warm. Warm air jets, radiant heaters, or contact warm heaters should be supplied.
  - — The work area shall be shielded if the air velocity at the site is increased by the wind, draft, or ventilation equipment.
  - — At temperatures below 40°F, metal handles of tools and control bars shall be covered with thermal insulation.
  - — When necessary, equipment and processes shall be substituted, isolated, relocated, or redesigned to reduce the cold stress.
  - — Power tools, hoists, cranes, and lifting aids shall be used to reduce the metabolic workload.
  - — Heated warming shelters such as tents, cabins, automobiles, or trucks shall be made available if work is performed continuously in an equivalent chill temperature of 30°F or below. Workers shall be encouraged to use them.
- *Administrative Controls* - These controls include the following work practices and rules designed to reduce total cold stress burden on the body.
  - — Scheduling a work rest to reduce the peak of cold stress; enforcing scheduled work breaks.
  - — Urging frequent intake of warm, sweet, caffeine-free, nonalcoholic drinks or soup provided at regular intervals.
  - — Scheduling the coldest work for the warmest part of the day.
  - — Moving work to warmer areas whenever possible; preplanning the activities prior to entering the cold environment.
  - — Assigning extra workers to highly demanding jobs.
  - — Allowing workers to pace themselves, and take extra work breaks when needed.
  - — Providing relief workers for breaktimes.
  - — Teaching workers the basic principles of preventing cold stress and emergency response to cold stress.

- — Maintaining protective supervision or a buddy system for those who work at 20°F or below.
- — Allowing new employees time to adjust to conditions before they work full-time in cold environments.
- — Arranging work to minimize sitting still or standing for long periods at a time.
- — Reorganizing work procedures to ensure as much of a job as possible is performed in a warm environment.
- — Including the weight and bulkiness of clothing when estimating work performance criteria.

- *Personal Protective Equipment* - It is the responsibility of the employee to dress in the clothing appropriate to the expected work conditions. The correct clothing shall be addressed in the following manner:
  - — It is important to preserve the air space between the body and the outer layer of clothing in order to retain body heat.
  - — It is most important to protect the feet, hands, head, and face. The hands and feet are the farthest from the heart and become cooled most easily. Keeping the head covered is important because as much as 40 percent of heat is lost when the head is exposed to the elements.
  - — All clothing and equipment shall be fitted properly and not interfere with circulation.
  - — Clothing shall be made of thin cotton. The cotton helps evaporate sweat by absorbing it and bringing it to the surface.
  - — Clothing shall be of the loose fitting type. Tight clothing of synthetic fabrics interferes with evaporation.
  - — Recommended first layer of clothing shall include a cotton T-shirt and shorts or underpants under cotton and wool thermal underwear. Two-piece long underwear is preferred because the top can be removed and put on as needed.
  - — Socks with high wool content are best. When two pairs are worn, the inside sock should be smaller, and made of cotton. If needed, wool socks can also double for mittens.
  - — Wool or thermal trousers are preferred. The best kind is either quilted or specially lined.
  - — Belts are not recommended because they cut off the circulation at the waist. Suspenders are encouraged.
  - — Trousers shall fit over the top of the boot to prevent snow and ice from entering.

- — Boots shall be felt-lined, rubber-bottomed, and leather-topped with a removable felt insole. Boots shall be waterproofed and socks shall be changed whenever the sock is sweat soaked.
- — Wool sweater over a cotton shirt shall be worn. Tops shall be worn in a layering effect to ensure proper insulation.
- — An anorak or snorkel coat or arctic parka shall fit loosely and have a drawstring at the waist. The sleeves shall fit snugly. A hood prevents the escape of warm air from the neck and also tunnels the warm air past the face to give a slightly warmer breathing air. A wool cap shall also be worn under the hood.
- — When wearing a hard hat, liners shall be worn.
- — A face mask or scarf is vital when working in cold wind. A ski mask gives better visibility than a snorkel hood. Face protectors shall be removed periodically to check to for frostbite.
- — Safety glasses with sideshields shall be worn when out-of-doors. Special safety goggles to protect against ultraviolet light and glare are required when there is snow coverage which could cause a potential eye exposure hazard.

■ **Training**

- The workers shall be instructed in safety and health procedures.
- The training shall include the following instructions:
  - — Proper rewarming procedures and appropriate first aid treatment.
  - — Proper clothing practice.
  - — Recognition of signs and symptoms of impending cold conditions such as hypothermia or excessive cooling of the body (even when shivering does not occur), frostnip, or frostbite. Safe work procedures.

■ **Cold Disorder Symptoms**

- *Frostnip* - This occurs when the face or extremities are exposed to cold wind, causing the skin to turn white.
- *Frostbite* - This disorder entails an excessive drop in tissue temperature resulting in damage. Symptoms of frostbite include: skin discoloration to a white or grayish-yellow, progressing to reddish-violet, and finally black as tissue dies; pain may be felt at first, but subsides; blisters may appear; coldness and numbness of affected part.

  When the outer layer of skin becomes frostbitten, the skin has a waxy or whitish appearance and is firm to the touch (the skin underneath is still resilient). In cases of deep frostbite, the tissues are cold, pale, and solid. Frostbitten skin is highly susceptible to infection, and therefore gangrene.

First symptoms are usually an uncomfortable sensation of coldness, followed by numbness. There may be a tingling, stinging, aching feeling or cramping sensation. The victim is usually unaware of the frostbite.

The three degrees of frostbites are:

- First degree - Freezing without blisters or peeling.
- Second degree - Freezing with blisters or peeling.
- Third degree - Freezing with death to tissues and possibly of the deeper tissues.

- *Immersion Foot* - This occurs when feet have been wet, but not freezing cold, for days or weeks. The primary injury is to the nerve and muscle tissue. Symptoms are numbness, swelling, or even superficial gangrene.
- *Trenchfoot ("wet cold disease")* - This results from exposure to moisture at or near the freezing point for one to several days. Symptoms are similar to immersion foot - swelling and tissue damage.
- *Hypothermia* - This disorder involves the lowering of the body's core temperature. The symptoms include uncontrolled shivering fits, sense of cold, slow heart beat, vague or slow speech, glassy stare, apathy, memory lapses, incoherence, drowsiness, cool skin, slow irregular breathing, sometimes irregular pulse, weakened pulse, apparent exhaustion, and fatigue after rest.

  Pain in extremities can be the first warning of overexposure.

■ **First Aid**

- Frostbite
  - Never rub affected area. Rubbing may cause further damage to soft tissue.
  - Warm area gently by soaking in water. The water should start out cold and warm up about every 5 minutes by adding water that is 5° warmer. Do not immerse affected part in water that is more than 105°F. If a thermometer is not available, test the water temperature with your hand. If the water temperature is uncomfortable, it is too hot.
  - Keep the affected area under water until it looks red and feels warm.
  - Loosely bandage the area with dry, sterile dressing. If fingers and toes are frostbitten, place cotton or gauze between them before the loose bandage.
  - Do not break blisters.
  - Get professional help immediately.

- Hypothermia
  - — Remove any wet clothing and dry the victim.
  - — Warm the body gradually by wrapping the victim in blankets or putting on dry clothing and moving the individual to a warmer place. Do not warm body quickly by immersing the person in hot water. Rapid warming can cause dangerous heart problems. If available, apply heating pads or other heating source to the body. Keep a protective barrier, such as towel, blanket, or clothing between heat source and victim to avoid burning the individual.
  - — If the victim is alert, give warm liquid to drink. Never give liquids to an individual who is unconscious or semi-conscious.
  - — Handle the victim gently.
  - — Get professional help immediately.

Windchill Index

WINDCHILL INDEX	Cooling Power of Wind on Exposed Flesh Expressed as an Equivalent Temperature (under calm conditions)											
Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
Wind speeds greater than 40 mph have little additional effect	**LITTLE DANGER** in < hr. with dry skin. Maximum danger of false sense of security.				**INCREASING DANGER** Danger from freezing of exposed flesh within one minute.				**GREAT DANGER** Flesh may freeze within 30 seconds.			
	Trench foot and immersion foot may occur at any point.											

CONTROL COPY NO. 01

COLD STRESS

■ 07-30-97 ■ Revision 0

Work/Warm-up Schedule for Four-Hour Shift*

Air Temperature - Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx.)	°F	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
1.-26° to -28°	-15° to -19°	(Norm. Breaks)	1	(Norm. Breaks)	1	75 min	2	55 min	3	40 min	4
2.-29° to -31°	-20° to -24°	(Norm. Breaks)	1	75 min	2	55 min	3	40 min	4	30 min	5
3.-32° to -34°	-25° to -29°	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease	
4.-35° to -37°	-30° to -34°	55 min	3	40 min	4	30 min	5	Non-emergency work should cease		Non-emergency work should cease	
5.-38° to -39°	-35° to -39°	40 min	4	30 min	5	Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease	
6.-40° to -42°	-40° to -44°	30 min	5	Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease	
7.-43° & below	-45° & below	Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease	

1. Schedule applies to moderate to heavy work activity with warm-up breaks of ten (10) minutes in a warm location. For light-to-moderate work (limited physical movement), apply the schedule one step lower. For example, at -30°F with no noticeable wind (Step 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4-hour period (Step 5).
2. The following is suggested as a guide for estimating wind velocity. If accurate information is not available:

   5 mph: light flag moves; 10 mph: light flag fully extended; 15 mph: raises newspaper sheet; 20 mph: blowing and drifting snow.
3. If only the Windchill Factor is available, a rough rule of thumb for applying it, rather than the temperature and wind velocity factors given above, would be: 1) special warm-up breaks should be initiated at a wind chill of about 1750 $W/m^2/hr$; 2) all non-emergency work should have ceased at or before a wind chill of 2250 $W/m^2/hr$. In general, the warm-up schedule provided above slightly under-compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly over-compensates for the absolute temperatures in the colder ranges, since windy conditions rarely prevail at extremely low temperatures.

* From Occupational Health & Safety Division, Saskatchewan Dept. of Labor

APPENDIX B

Presented By

CONDOR

JOHN SCANLON

has completed a 40 Hour course in
Hazardous Materials and Site Investigations
required by OSHA 29 CFR 1910.120

Presented this
June 8, 2000

CONDOR GEOTECHNICAL SERVICES, INC

Philip T. Cruz

CONTROL COPY NO. 01

HST

CERTIFICATE OF TRAINING

THIS CERTIFIES THAT

Lester M. Tyrala

has successfully completed 40 hours of instruction in

WASTE SITE WORKER PROTECTION

Prepared and conducted by
Hygiene, Safety and Training Inc.
to comply with 29 CFR 1910.120(e), (2)

June 10, 1993
Date of Completion

Joseph A. Gispanski, Jr.
CET

APPENDIX C

HAZARDOUS WASTE DECONTAMINATION

SHE 9-3

- 07-30-97
- Revision 0

1 PURPOSE AND SCOPE

- **Purpose**

This procedure provides the guidelines for effective decontamination of personnel and equipment.

- **Scope**

This procedure does not cover decontamination of radioactively contaminated personnel or equipment. A health physicist should be consulted if radioactive material is suspected to be present on site. This procedure applies to all Stone & Webster personnel and subcontractors working on projects where hazardous waste requirements are applicable.

2 REFERENCES

- *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, NIOSH, OSHA, USCG, EPA, October 1985.
- *Field Standard Operating Procedures (FSOP)*7, Decontamination of Response Personnel*, USEPA, January 1985.
- Title 29, Code of Federal Regulations, Parts 1910 and 1926, *Occupational Safety and Health Administration* (OSHA), U.S. Department of Labor.

3 APPENDIXES

- Appendix A, Decision Aid for Evaluating Health and Safety Aspects of Decontamination Methods
- Appendix B, Recommended Equipment for Decontamination of Personnel, PPE and Equipment
- Appendix C, Recommended Equipment for Decontamination of Heavy Equipment and Vehicles
- Appendix D, General Guide to Solubility of Contaminants in Four Solvent Types
- Appendix E, Typical Decontamination Methods
- Appendix F, Procedure for Maximum Measures for Level A Decontamination
- Appendix G, Procedure for Maximum Measures for Level B and C Contamination
- Appendix H, Procedure for Minimum Measures for Level A, B, and C Decontamination
- Appendix I, Flowchart for Maximum Measures for Level A Decontamination
- Appendix J, Flowchart for Maximum Measures for Level B Decontamination
- Appendix K, Flowchart for Maximum Measures for Level C Decontamination
- Appendix L, Flowchart for Minimum Measures for Levels A, B, and C Decontamination

4 GENERAL

Decontamination protects workers from hazardous substances that may contaminate and eventually permeate protective clothing, respiratory equipment, tools, vehicles, and other equipment used on site. Decontamination also protects all site personnel by minimizing the transfer of harmful materials into clean areas. It helps prevent mixing of incompatible chemicals and protects the community by preventing uncontrolled transportation of contaminants from the site.

■ Definitions

Decontamination - The removal of hazardous substances from employees and their equipment to the extent necessary to preclude the occurrence of foreseeable adverse health effects.

■ Responsibilities

- The *Manager/Supervisor* is responsible for implementation and enforcement of this procedure.
- The *Safety Representative* is responsible for monitoring compliance with this procedure.

5 PROCEDURE

■ Potential Hazards

While decontamination is performed to protect health and safety, it may pose the following hazards:

- Be incompatible with the hazardous substances being removed (i.e., decontamination method may react with contaminants to produce an explosion, heat, or toxic products).
- Be incompatible with the clothing or equipment being decontaminated (e.g., some organic solvents can permeate and/or degrade protective clothing).
- Be a direct health hazard to workers (e.g., vapors from chemical decontamination solutions may be hazardous if inhaled, or they may be flammable).
- The chemical and physical compatibility of the decontamination solutions or other decontamination materials must be determined before they are used. Any decontamination method that permeates, degrades, damages, or otherwise impairs the safe functioning of the PPE Personal Protective Equipment (PPE) is incompatible with such PPE and should not be used.
- If a decontamination method poses a direct health hazard, measures must be taken to protect both decontamination personnel and workers being decontaminated. Appendix A presents a decision aid for evaluating the health and safety aspects of decontamination methods.

■ Prevention of Contamination

Prevention includes the following methods:

- Follow procedures for proper dressing prior to entry into the Exclusion Zone addressed in Section 9, Personal Protective Equipment. Proper dressing will minimize the potential for contaminants to bypass the PPE and escape decontamination.
- Protect monitoring and sampling instruments by bagging. Make

openings in the bags for sample ports and sensors that must contact site materials. Cover equipment and tools with a strippable coating which can be removed during decontamination.

- Encase the source of contaminants (e.g., plastic sheeting or overpacks). Stress work practices that minimize contact with hazardous substances. Use remote sampling, handling, and container-opening techniques.

■ Decontamination Equipment Selection

In selecting decontamination equipment, consider whether the equipment itself can be decontaminated for reuse or be easily disposed of. Appendix B lists recommended equipment for decontamination of personnel, PPE, and equipment. Appendix C lists recommended equipment for decontamination of heavy equipment and vehicles.

■ Decontamination Facility Design

Decontamination facilities should be located in the Contamination Reduction Zone (CRZ), i.e., the area between the Exclusion Zone (the contaminated area) and the Support Zone (the clean area) as described in the Site Safety and Health Plan.

■ Site-Specific Factors

- Site-specific factors that affect the decontamination facility design must be considered. Typical factors to consider follow:
  - — The chemical, physical, and toxicological properties of the wastes.
  - — The pathogenicity of infectious wastes.
  - — The amount, location, and containment of contaminants.
  - — The potential for, and location of, exposure based on assigned worker duties, activities, and functions.
  - — The potential for wastes to permeate, degrade, or penetrate materials used for personal protective clothing and equipment, vehicles, tools, buildings, and structures.
  - — The proximity of incompatible wastes.
  - — The movement of personnel and/or equipment among different zones.
  - — The emergencies that may arise.
  - — The methods available for protecting workers during decontamination.
  - — The impact of the decontamination process and compounds on worker health and safety.

- Decontamination Line
  - — Decontamination shall be an organized process by which levels of contamination are reduced.
  - — The decontamination process shall consist of a series of steps performed in a specific sequence. For example, outer, more heavily contaminated items shall be decontaminated first, followed by decontamination and removal of inner, less contaminated items.
  - — Each step shall be performed at a separate station to prevent cross contamination. The sequence of stations is called the decontamination line.
  - — Decontamination stations shall be separated physically to prevent cross contamination and shall be arranged in order of decreasing contamination, preferably in a straight line.
  - — Separate flow patterns and stations shall be provided to isolate workers from different contamination zones containing incompatible wastes.
  - — Entry and exit points shall be conspicuously marked, and the entry to the Contamination Reduction Zone (CRZ) from the Exclusion Zone should be separate from the entry to the Exclusion Zone from the CRZ.
  - — Dressing stations for entry to the CRZ shall be separate from redressing areas for exit from the CRZ.
  - — Personnel who wish to enter clean areas of the decontamination facility, such as locker rooms, shall be completely decontaminated.
  - — Examples of decontamination lines and procedures for personnel wearing various levels of protection are provided in the Appendixes of this procedure.

■ Personal Protective Equipment for Decontamination Workers

- The minimum level of PPE worn by decontamination workers shall be one level of protection lower than that required in the Exclusion Zone.
- Site specific cases may require that decontamination personnel wear the same levels of PPE as workers in the Exclusion Zone. Examples of these cases include:
  - — Workers using a steam jet may need a different type of respiratory protection than other decontamination personnel because of the high moisture content of the steam jets.
  - — Cleaning solutions used and wastes removed during decontamination may generate harmful vapors, requiring a

different type of respiratory or clothing protection.

- All decontamination workers shall be decontaminated before entering the clean Support Zone.

■ **Decontamination Methods**

- All personnel, clothing, equipment, and samples leaving the contaminated area of a site shall be decontaminated to remove any harmful chemicals or infectious organisms that may have adhered to them.
- The decontamination methods available are as follows:
  - — Physical removal
  - — Chemical detoxification or disinfection/sterilization
  - — A combination of both physical and chemical methods
- The selected decontamination method shall be effective for the specific substance present. Appendix A provides a decision aid for evaluating the health and safety aspects of decontamination methods.
- The selected decontamination method shall be reviewed for any safety and health hazards. If the selected method poses a direct health hazard, measures shall be taken to protect both the decontamination personnel and the workers to be decontaminated.
- Physical Removal
  - — Physical methods using high pressure and/or heat shall be used only as necessary and with caution.
  - — Loose contaminants shall be removed by using a water or liquid rinse to remove dust and vapors that cling to equipment and workers or that are trapped in small openings, such as clothing or fabric weaving.
  - — Adhering contaminants shall be removed by the following methods:
    - — Scraping, brushing and wiping
    - — Solidifying
    - — Freezing (using dry ice or ice water)
    - — Adsorption or absorption (e.g., kitty litter or powdered lime)
    - — Melting
  - — Volatile liquid contaminants shall be removed from PPE or equipment by evaporation followed by a water rinse. Evaporation may be expedited by the use of steam jets.
- Chemical Removal
  - — Decontamination using chemicals shall be done only if recommended by an industrial

hygienist or other qualified health professional.

- — Any chemical used in the decontamination process shall be chemically compatible with the equipment or clothing being decontaminated. (For example, some personal protective clothing is constructed of organic materials and could be damaged by an organic solvent). Appendix D lists a guide to solubility of contaminants in four solvent types.
- — Halogenated solvents shall only be used for decontamination in extreme cases where other cleaning agents will not remove the contaminant.

- Chemical removal types include the following:
    - — Surface contaminants can be dissolved in a solvent.
    - — Surfactants can be used to aid physical cleaning by reducing adhesion forces between the contaminants and the surface being cleaned and by preventing redeposit of the contaminants (e.g., detergents).
    - — Solidification of liquid or gel contaminants can enhance their physical removal. Typical solidification processes are moisture removal using adsorbents such as grounded clay or powdered lime; and chemical reactions using polymerization chemicals and/or chemical reagents.
    - — Rinsing with water and/or chemicals removes contaminants through dilution, physical attraction and solubility. Multiple rinses enhance the removal of contaminants.
    - — Disinfection/Sterilization is not generally used because the standard available techniques are not practical for PPE and small and large equipment. Disposable PPE is recommended for use with infectious agents.

■ **Personnel Decontamination**

Four levels of personnel protection, as discussed in the PPE procedure, are available for use at any given site. The following is a description of the decontamination process for each level.

- Level D
    - — An area shall be designated for the removal of gloves and boot covers. Paper towels shall be available for removal of this equipment.
    - — A trash barrel at the site shall be provided for all disposable noncontaminated PPE. This material shall be disposed of in a normal trash receptacle at the plant before leaving the site.

- — Laundering of personal clothing shall be completed as soon as possible once offsite.
- — Soap and water shall be used to wash hands before eating, drinking, or smoking, and before using the bathroom facilities.

- Level C
  - — A decontamination line shall be assembled.
  - — The maximum decontamination layout shall contain a 18-step process as shown in Appendix K. The procedure for this layout is listed in Appendix G.
  - — At the discretion of the Safety Representative, the decontamination line shall be modified to a minimum layout as shown in Appendix L after site specific conditions have been evaluated. The procedure for this layout is listed in Appendix H.
  - — The decontamination line shall be located in a shaded area during hot weather.
- Level B
  - — A decontamination line shall be assembled. For decontamination of Level B PPE, the personnel decontamination area shall be typically setup with decontamination tubs filled with decontamination fluids and rinses; boot racks; and equipment storage and disposal facilities located on a wooden platform set on clean gravel and provided with a tarp.
  - — The maximum decontamination layout shall contain a 19-step process as shown in Appendix J. The procedure for this layout is listed in Appendix G.
  - — At the discretion of the Safety Representative, the decontamination line may be modified to a minimum layout as shown in Appendix L after site specific conditions have been evaluated. The procedure for this layout is listed in Appendix H.
  - — Shower facilities (with hot and cold water) or, at a minimum, personal wash sinks shall be provided for all Level B personnel at the site.
  - — Showers or personal wash sinks shall be located in a trailer or other suitable structure equipped with adequate ventilation, and lighting systems. It shall also contain benches, tables, lockers, and racks for clothing.
  - — Personnel shall use the shower facilities or wash sinks prior to changing into street clothes.
  - — Soap, shampoo, towels, and wash cloths shall be provided.
  - — Contaminated clothing shall be left in a designated area.

  - Wastewater from the wash facility shall be piped to a holding tank for sampling and analyses discharge.

- Level A
  - A decontamination line shall be assembled. For decontamination of Level A PPE, the personnel decontamination area shall be typically set up with decontamination tubs filled with decontamination fluids and rinses; boot racks; and equipment storage and disposal facilities located on a wooden platform set on clean gravel and provided with a tarp.
  - The maximum decontamination layout shall contain a 19-step process as shown on Appendix I. The procedure for this layout is listed in Appendix F.
  - At the discretion of the Safety Representative, the decontamination line shall be modified to a minimum layout as shown in Appendix L after site specific conditions have been evaluated. The procedure for this layout is listed in Appendix H.
  - Shower facilities (with hot and cold water) or, at a minimum, personal wash sinks shall be provided for all Level A personnel at the site.
  - Showers or personal wash sinks shall be located in a trailer or other suitable structure equipped with adequate ventilation, and lighting systems. It shall also contain benches, tables, lockers, and racks for clothing.
  - Personnel shall use the shower facilities or wash sinks prior to changing into street clothes.
  - Soap, shampoo, towels, and wash cloths shall be provided.
  - Contaminated clothing shall be left in a designated area.
  - Wastewater from the wash facility shall be piped to a holding tank for sampling and analyses discharge.

■ **Equipment Decontamination**

- The extent of known contamination shall determine to what extent equipment needs to be decontaminated. If the extent of contamination cannot be determined, cleansing should be done assuming that the equipment is highly contaminated until enough data are available to allow assessment of the actual level of contamination.
- Adequate supplies of all materials shall be kept on hand. This includes all rinsing liquids and other required materials.
- The standard procedures shall be considered for full field

decontamination. If different or more elaborate procedures are required for a specific project, they shall be identified in the Site Safety and Health Plan. Such variations in decontamination may include all, part, or an expanded scope of the following decontamination process.

- Standard Procedures
  - — Remove any solid particles from the equipment or material by brushing and then rinsing with available tap water. This initial step is performed to remove gross contamination.
  - — Wash equipment sampler with the soap or detergent solution.
  - — Rinse with tap water.
  - — Rinse with deionized water.
  - — Rinse with methanol.
  - — Repeat entire procedure or any parts of the procedure if necessary.
  - — Allow the equipment or material to air dry before reusing.
  - — Dispose of any soiled materials in the designated disposal container.
- Sanitizing Procedures
  - — Decontaminate and sanitize respirators, reusable clothing, and other personal articles before reuse.
  - — Follow manufacturer's instructions for sanitizing respirator masks.
  - — Machine was reusable protective clothing after a thorough decontamination, if practical. Otherwise, hand wash the clothing.

■ **Quality Assurance**

- The effectiveness of any decontamination method used at a site shall be assessed at the beginning of a project and periodically throughout the life of a project. The Safety Representative shall monitor project procedures to determine their effectiveness.
- If a decontamination method is not considered effective, the decontamination program shall be revised. Visual observation, wipe sampling, cleaning solution analysis, and permeation testing shall be the typical methods to determine the effectiveness of decontamination.
- Visual Observation
  - — Visual observation shall be used to estimate the effectiveness of decontamination.
  - — Natural light shall be used to detect contaminants that have not been removed. Discolorations, stains, corrosive effects, visible dirt, or alterations in clothing

fabric may indicate inadequate decontamination.

- Certain containments may be visible under ultraviolet light. However, a qualified health professional shall assess the benefits and risks associated with ultraviolet light prior to use at a hazardous waste site.

- Wipe Sampling
  - Wipe testing shall be used as an "after-the-fact" procedure to assess decontamination effectiveness.
  - A sample pad shall be wiped over the surface of a potentially contaminated area or object and then analyzed in a laboratory.
  - Inner and outer surfaces of protective clothing shall be tested.
  - Skin shall be tested using wipe samples.
- Cleaning Solution Analysis
  - Analysis of the cleaning solution is used as an "after-the-fact" procedure to determine decontamination effectiveness.
  - Cleaning solutions are analyzed to determine the quantities of contaminants left in the solutions. Elevated levels of contaminants in the final rinse solution may indicate that additional decontamination is required.
- Permeation Testing
  - Permeation testing is used as an "after-the-fact" procedure to assess the effectiveness of decontamination.
  - Testing for permeated chemical contaminants requires that pieces of the protective garments be analyzed in a laboratory.

■ **Disposal Methods**

- All equipment used for decontamination shall be decontaminated and/or disposed of properly.
- Buckets, brushes, clothing, tools, and other contaminated equipment shall be collected, placed in containers, and labeled.
- All spent solutions and wash water shall be collected and disposed of properly. Clothing that is not completely decontaminated shall be placed in plastic bags, pending further decontamination and/or disposal.
- Wastes generated through decontamination activities are governed by RCRA requirements with regard to packaging, labeling, transporting, storing, and record keeping as stated in 40CFR262 ("Standards Applicable to Generators of Hazardous Wastes").
- Potentially hazardous wastes that are accumulated through

decontamination activities shall be staged/stored in a secure and protected area provided onsite.

- Containers used to store the hazardous materials shall be of an approved design and shall be prominently labeled with the words "HAZARDOUS WASTE" or with other words which clearly and accurately identify the contents of the container and the date upon which the period of accumulation of the material began.
- The containers holding the hazardous waste shall be cared for and maintained in a fashion that will prevent leaks or any discharge of the material to the ground surface. Should leaks occur, the materials in the container shall be transferred to a container in good condition or be placed in an overpack drum. The containers, in all cases, shall be compatible with the materials to be stored.
- All containers holding hazardous waste shall remain closed during storage, except when it is necessary to add or remove waste. All containers holding hazardous waste or intended to contain hazardous waste shall not be opened or stored in any way that may rupture the container or allow it to leak.
- Wastes determined to be incompatible shall be separated or protected from each other.
- Decontamination generated contaminated material, once collected and properly stored, shall be subjected to analytical testing to determine the requirements for transportation and ultimate disposal.
- The hazardous nature of materials shall be determined by the methods published in U.S. EPA SW-846.
- Unauthorized employees shall not remove protective clothing or equipment from change rooms.
- Commercial laundries or cleaning establishments that decontaminate protective clothing or equipment shall be informed of the potentially harmful effects of exposure to hazardous substances.

■ **Emergency Decontamination**

- In an emergency, the primary concern is to prevent the loss of life or severe injury to site personnel.
- In the emergency case where immediate medical treatment is required, decontamination shall be delayed until the victim is stabilized.
- Decontamination shall be performed immediately if it will not interfere with essential life saving techniques or first aid.
- If an emergency is due to heat related illness, the victim's protective clothing shall be removed as soon as possible to reduce heat stress.

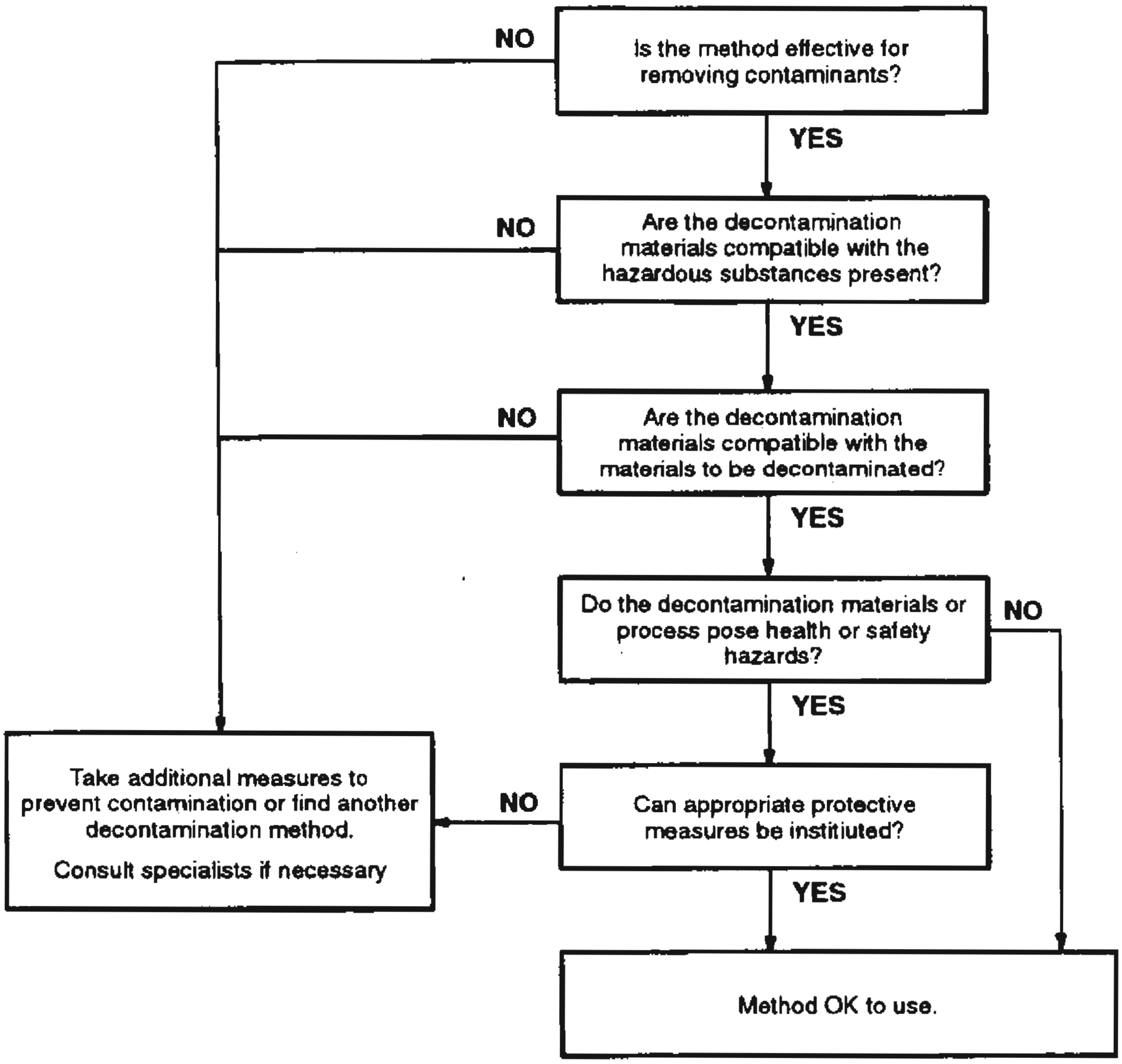
Appendix A

HAZARDOUS WASTE DECONTAMINATION

SHE 9-3

■ 07-30-97 ■ Revision 0

DECISION AID FOR EVALUATING HEALTH AND SAFETY ASPECTS OF DECONTAMINATION METHODS



RECOMMENDED EQUIPMENT FOR DECONTAMINATION OF PERSONNEL, PPE, AND EQUIPMENT

- Drop cloths of plastic or other suitable materials
- Collection containers, such as drums or trash cans
- Lined box with adsorbents
- Large galvanized tubs, stock tanks, or children's wading pools
- Wash solutions appropriate for the contaminants present
- Rinse solutions appropriate for the contaminants present
- Long handled, soft-bristled brushes
- Paper and/or cloth towels
- Lockers and cabinets
- Metal or plastic cans or drums
- Plastic sheeting or sealed pads with drains
- Shower facilities or at a minimum personal wash sinks
- Soap or wash solution, wash cloths, and towels
- Tape
- Traffic cones
- Warning signs
- Hoses
- Rope
- Ladders
- Shovels
- Spare breathing apparatus air cylinders (if used)

RECOMMENDED EQUIPMENT FOR DECONTAMINATION OF HEAVY EQUIPMENT AND VEHICLES

- Storage tanks or appropriate treatment systems
- Drains or pumps
- Long-handled brushes
- Wash solutions appropriate for the contaminants present
- Rinse solutions appropriate for the contaminants present
- Pressurized sprayers for washing and rinsing
- Curtains, enclosures, or spray booths
- Long-handled rods and shovels
- Containers to hold contaminants and contaminated soils
- Wash and rinse buckets
- Brooms
- Containers for storage and disposal of contaminated material

GENERAL GUIDE TO SOLUBILITY OF CONTAMINANTS IN FOUR SOLVENT TYPES

SOLVENT	SOLUBLE CONTAMINANTS
Water	Low-chain hydrocarbons Inorganic compounds Salts Some organic acids and other polar compounds
Dilute Acids	Basic (caustic) compounds Amines Hydrazines
Dilute Bases For example: -detergent -soap	Acidic compounds Phenols Thiols Some nitro and sulfonic compounds
Organic Solvents For example: -alcohols -ethers -ketones -aromatics -straight chain alkanes -common petroleum products	Nonpolar compounds (e.g., some organic compounds)

TYPICAL DECONTAMINATION METHODS

A. PHYSICAL REMOVAL

1. Contaminant Removal

   Water rinse, using pressurized or gravity flow

   Chemical leaching and extraction

   Evaporation/vaporization

   Pressurized air jets

   Scrubbing/scraping

   Steam jets

2. Removal of Contaminated Surfaces

   Disposal of deeply permeated materials, e.g., clothing, floor mats, seats

   Disposal of protective coverings/coatings

B. INACTIVATION

1. Chemical Detoxification

   Halogen stripping

   Neutralization

   Oxidation/reduction

   Thermal degradation

2. Disinfection/Sterilization

   Chemical disinfection

   Dry heat sterilization

   Gas/vapor sterilization

   Irradiation

   Steam sterilization

MAXIMUM MEASURES FOR LEVEL A DECONTAMINATION

Station 1 Segregated Equipment Drop	Deposit equipment used on plastic drop cloths or in different containers with plastic liners. During hot weather, a cool down station may be set up in this area.
Station 2 Outer Glove and Boot Cover Wash	Scrub outer boot covers and gloves with decontamination solution or detergent/water.
Station 3 Boot Cover and Glove Rinse	Rinse off decontamination solution from Station 2 using copious amounts of water.
Station 4 Tape Removal	Remove tape around boots and gloves, and deposit in containers with plastic liner.
Station 5 Boot Cover Removal	Remove boot covers and deposit in container with plastic liner.
Station 6 Outer Glove Removal	Remove outer gloves and deposit in container with plastic liner.
Station 7 Suit/Safety Boot Wash	Wash encapsulating suit and boots using scrub brush and copious amounts of decontamination solution or detergent/water. Wrap SCBA regulator with plastic to keep out water. Wash backpack assembly with sponges or cloths.
Station 8 Suit/SCBA/Glove Rinse	Rinse off decon solution or detergent water using copious amounts of water. Repeat as many times as necessary.

Station 9 Tank Change	If a worker leaves the Exclusion Zone to change an air tank, this is the last step in the decontamination procedure. Worker's air tank is exchanged and new outer gloves and boots donned, and joints taped. Worker returns to duty.
Station 10 Safety Boot Removal	Remove safety boots and deposit in container lined with plastic.
Station 11 Fully Encapsulating Suit and Hard Hat Removal	With assistance, fully encapsulated suit is removed and laid out on a drop cloth or hung up. Hard hat is removed. Hot weather rest station may be setup within this area for personnel returning to the site.
Station 12 SCBA Backpack Removal	While still wearing facepiece remove backpack and place on table. Disconnect hose from regulator valve and proceed to next station.
Station 13 Inner Glove Wash	Wash inner gloves with decon solution or a detergent/water that does not harm skin. Repeat as many times as necessary.
Station 14 Inner Glove Rinse	Rinse inner gloves with water. Repeat as many times as necessary.
Station 15 Face-piece Removal	Remove facepiece. Avoid touching face with gloves. Deposit in container with plastic liner.
Station 16 Inner Glove Removal	Remove inner gloves and deposit in container with plastic liner.

Station 17 Inner Clothing Removal	Remove clothing and place in lined container. Do not wear inner clothing off site since there is a possibility that small amounts of contaminants might have been transferred in removing chemical suits.
Station 18 Field Wash	Shower if highly toxic, skin-corrosive or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available.
Station 19 Redress	Put on clean clothes.

MAXIMUM MEASURES FOR LEVEL B AND C DECONTAMINATION

Station 1 Segregated Equipment Drop	Deposit equipment used on plastic drop cloths or in different containers with plastic liners.
Station 2 Outer Glove and Boot Cover Wash	Scrub outer boot covers and gloves with decontamination solution or detergent/water.
Station 3 Boot Cover and Glove Rinse	Rinse off decontamination solution from Station 2 using copious amounts of water.
Station 4 Tape Removal	Remove tape around boots and gloves, and deposit in containers with plastic liner.
Station 5 Boot Cover Removal	Remove boot covers and deposit in container with plastic liner.
Station 6 Outer Glove Removal	Remove outer gloves and deposit in container with plastic liner.
Station 7 Suit/Safety Boot Wash	Thoroughly wash chemical-resistant splash suit with long-handled, soft-bristle scrub brush, and copious amounts of decontamination solution or detergent/water. Wrap SCBA regulator with plastic to keep out water. Wash backpack assembly with sponges or cloths. (For level C, instructions for SCBA do not apply.)

Station 8 Suit/SCBA/Glove Rinse	Rinse off decon solution or detergent water using copious amounts of water. Repeat as many times as necessary.
Station 9 Tank Change	If a worker leaves the Exclusion Zone to change an air tank, this is the last step in the decontamination procedure. Worker's air tank is exchanged and new outer gloves and boots donned, and joints tapped. Worker returns to duty.
Station 10 Safety Boot Removal	Remove safety boots and deposit in container lined with plastic.
Station 11 SCBA Backpack Removal	While still wearing facepiece remove backpack and place on table. Disconnect hose from regulator valve and proceed to next station.
Station 12 Splash Suit Removal	With assistance, remove splash suit. Deposit in container with plastic liner.
Station 13 Inner Glove Wash	Wash inner gloves with decon solution or a detergent/water that does not harm skin. Repeat as many times as necessary.
Station 14 Inner Glove Rinse	Rinse inner gloves with water. Repeat as many times as necessary.

Station 15 Facepiece Removal	Remove facepiece. Avoid touching face with gloves. Deposit in container with plastic liner.
Station 16 Inner Glove Removal	Remove inner gloves and deposit in container with plastic liner.
Station 17 Inner Clothing Removal	Remove clothing soaked with perspiration. Place in container with plastic liner. Do not wear inner clothing off site since there is a possibility that small amounts of contaminants might have been transferred in removing chemical suits.
Station 18 Field Wash	Wash hands and face thoroughly.
Station 19 Redress	Put on clean clothes.

Appendix H

HAZARDOUS WASTE DECONTAMINATION

SHE 9-3

- **07-30-97**
- **Revision 0**

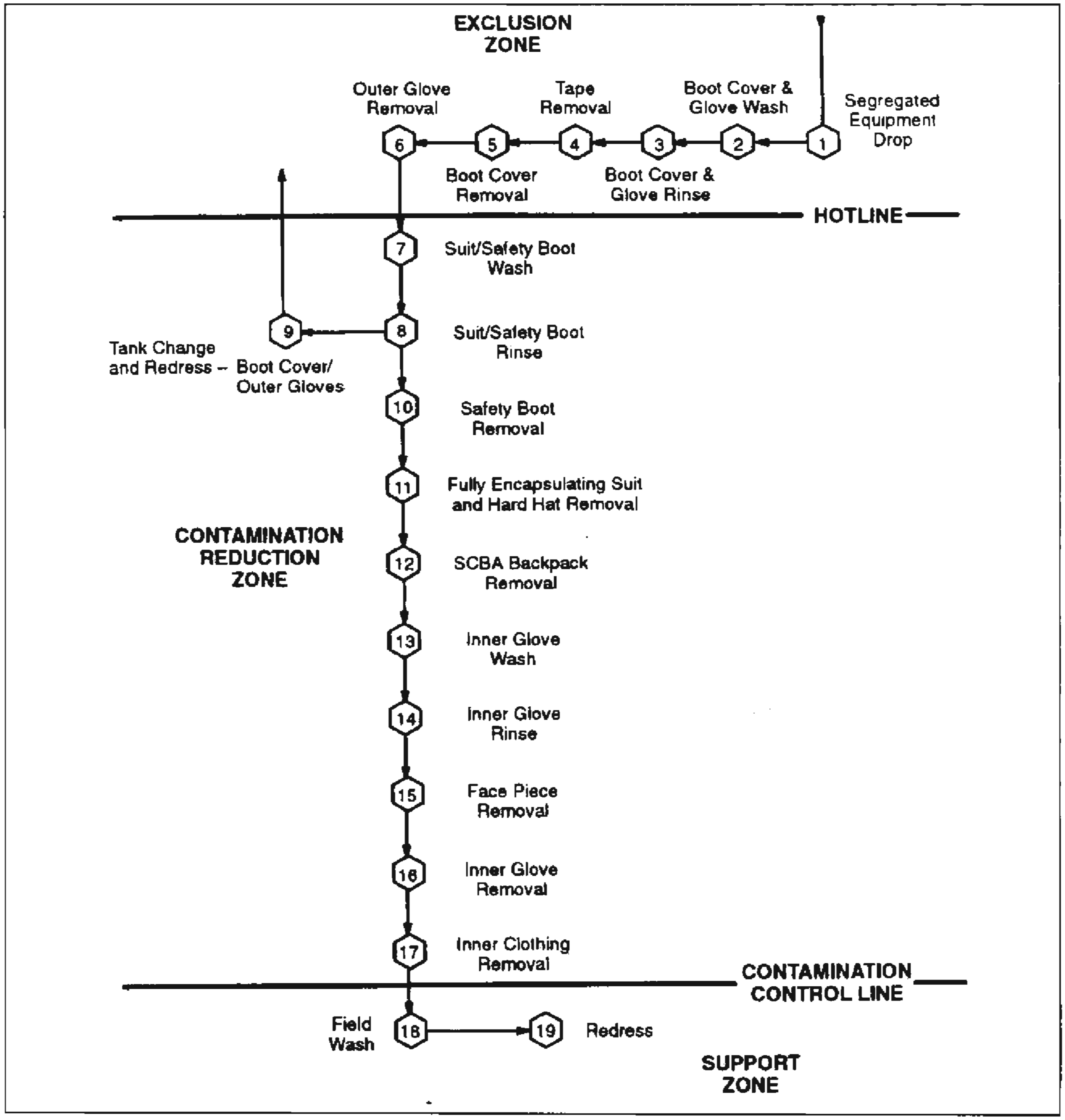
MINIMUM MEASURES FOR LEVEL A, B, AND C DECONTAMINATION

Station 1 Equipment Drop	Deposit equipment used on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather, a cool down station may be setup in this area.
Station 2 Outer Garment, Boots, and Gloves Wash and Rinse	Scrub outer boots, outer gloves and suit with decontamination solution or detergent/water.Rinse off using copious amounts of water.
Station 3 Outer Boot and Glove Removal	Remove outer boots and gloves.Deposit in container with plastic liner.
Station 4 Tank/Air Canister Change	If a worker leaves the Exclusion Zone to change an air tank or an air canister (or mask), this is the last step in the decontamination procedure. Worker's air tank is exchanged and new outer gloves and boots donned, and joints tapped. Worker returns to duty.
Station 5 Boots Gloves and Outer Garment Removal	Remove boots, suit, and inner gloves and deposit in separate containers lined with plastic.
Station 6 SCBA/Respirator Removal	SCBA back pack and face-piece/ respirator is removed (avoid touching face with fingers). SCBA or respirator is deposited on plastic sheets.
Station 7 Field Wash	Shower if highly toxic, skin-corrosive or skin-absorbable materials are known or suspected to be present. Wash hands and face.

HAZARDOUS WASTE DECONTAMINATION

■ **07-30-97** ■ **Revision 0**

MAXIMUM DECONTAMINATION LAYOUT - LEVEL A PROTECTION



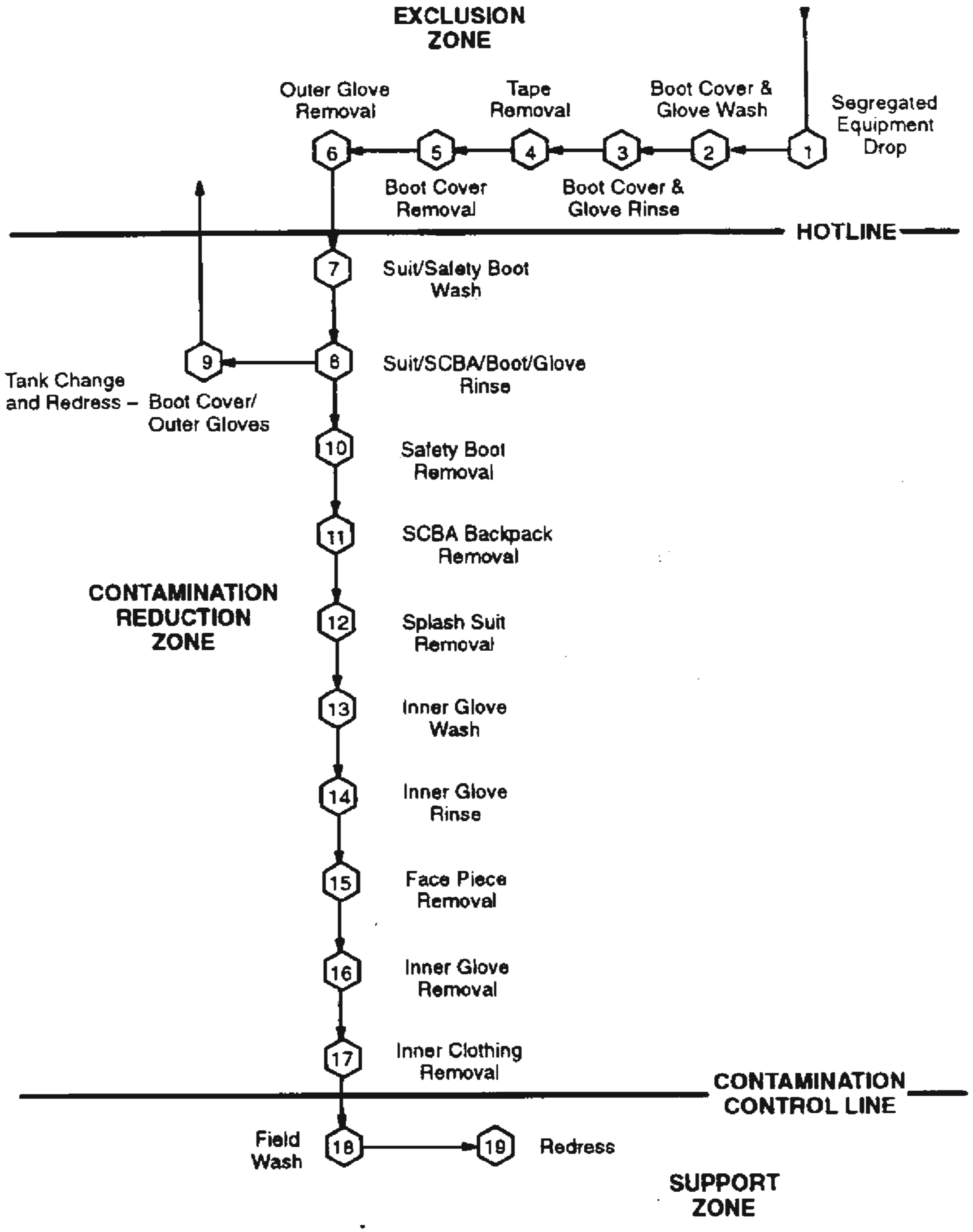
Appendix J

HAZARDOUS WASTE DECONTAMINATION

SHE 9-3

■ **07-30-97** ■ **Revision 0**

MAXIMUM DECONTAMINATION LAYOUT - LEVEL B PROTECTION



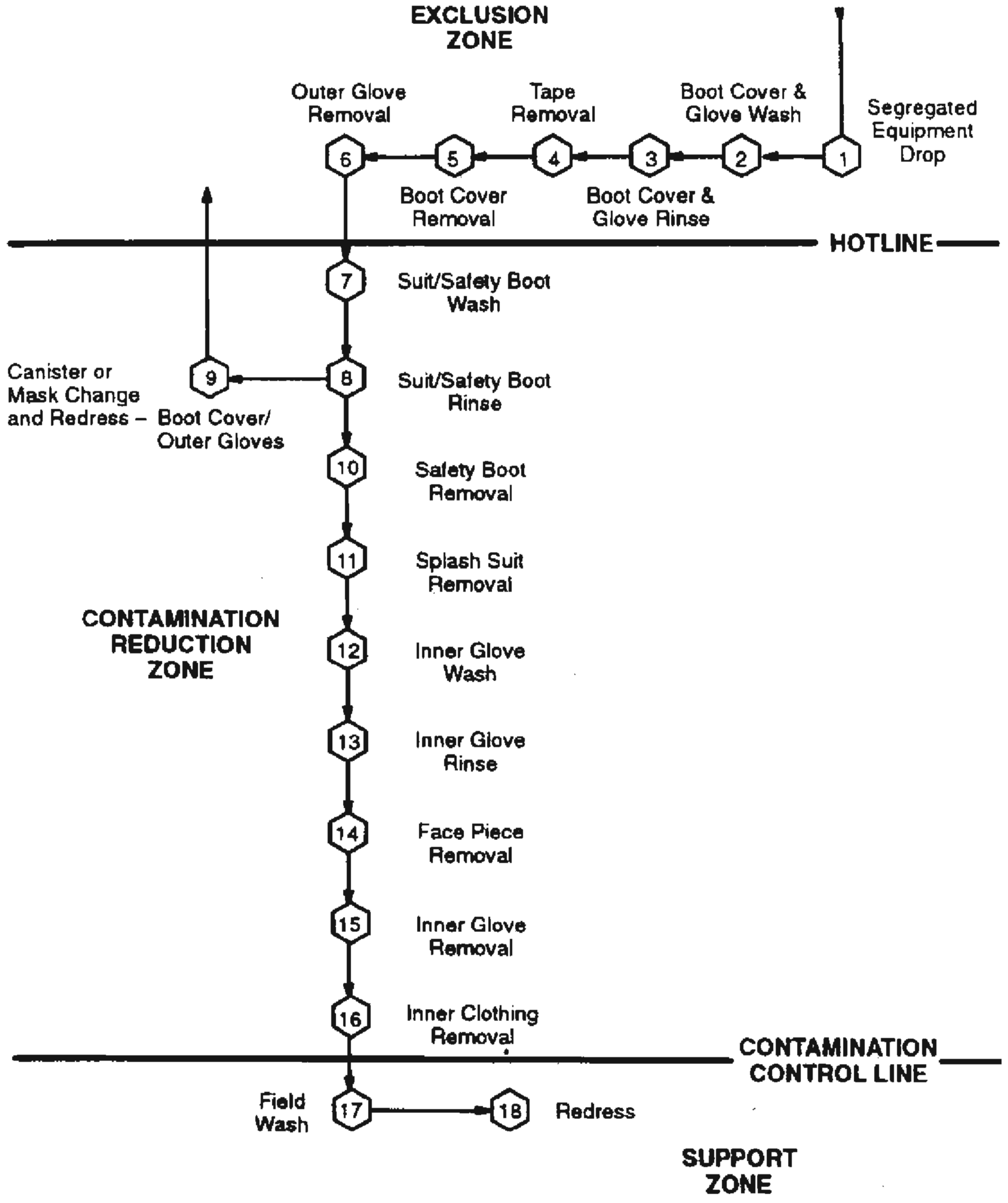
Appendix K

HAZARDOUS WASTE DECONTAMINATION

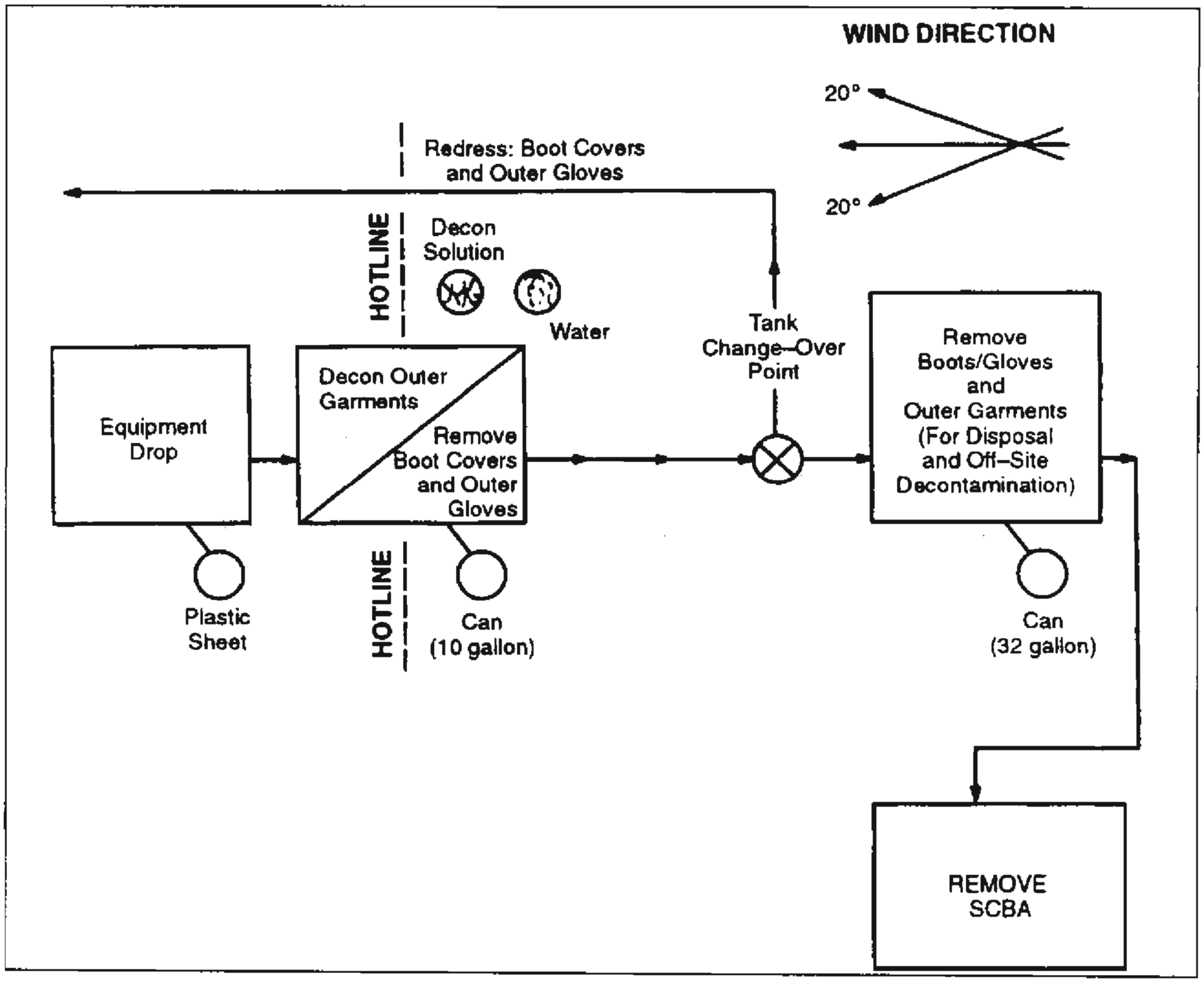
SHE 9-3

■ 07-30-97 ■ Revision 0

MAXIMUM DECONTAMINATION LAYOUT - LEVEL C PROTECTION



MINIMUM DECONTAMINATION LAYOUT - LEVELS A, B, & C PROTECTION



CONTROL COPY NO. 01

QUALITY ASSURANCE PROJECT PLAN
for

SITE CLOSURE
of the
Oxford paper Mill Site
Lawrence, Massachusetts
Release Tracking No. 3-2691

FINAL

April 2001

Prepared for:
Office of Planning and Development
City of Lawrence
225 Essex Street
Lawrence, Massachusetts 01840

Prepared by:
Stone & Webster, Inc.
100 Technology Drive
Stoughton, Ma 02072

TABLE OF CONTENTS

APPENDICES

1.0 Title and Approval Page (Worksheet #1)

Document Title: Oxford Mill Quality Assurance Project Plan

Lead Organization (Agency, State, Tribe, Federal Facility, PRP, or Grantee): City of Lawrence

Preparer's Name and Organizational Affiliation: Ronald Richards, P.E, LSP./ Stone & Webster Inc.

Preparer's Address and Telephone Number: 100 Technology Drive, Stoughton, Ma 02072

Preparation Date (Day/Month/Year): 4/30/01

Investigative Organization's Project Manager: Ronald Richards
Signature/Date Ronald Richards 4/30/01

Printed Name/Organization Ronald Richards 4/30/01

Investigative Organization's Site Quality Manager:
Signature/Date

Printed Name/Organization

Lead Organization's Project Manager: Les Tyrala
Signature/Date Ronald Richards for Les Tyrala 4/30/01

Printed Name/Organization Les Tyrala

Approval Signature: See attached approval letter
Signature/Date

Printed Name/Title

Approval Authority

Other Approval Signatures:
Signature/Date

Printed Name/Title

Document Control Number:

2.0 Document Control Format

This section describes the document control format that will be used in order to identify the most current version of the QAPP and to help ensure that all project participants use the most current version of the QAPP. The following document control format will be included in the upper right-hand corner of each page of the QAPP, starting with the Title and Approval Page:

- The title of the document;
- The original version number or revision number, whichever is applicable, and document status;
- The date of the current revision; and
- The page number in relation to the total number of pages for a discrete section.

2.1 Document Control Numbering System

The document control numbering system helps account for all copies of the QAPP issued and helps to ensure that the most current version is in use. A sequential numbering system will be used to identify controlled copies of the QAPP, which will be given to individuals within the project team. Individuals that receive a controlled copy of the QAPP will be provided with all revisions, addenda and amendments to the QAPP. The individuals in receipt of a controlled copy are responsible for removing all outdated material from circulation. The Document Control Number will be identified in the lower left-hand corner of Worksheet #1.

2.2 EPA-NE QAPP Worksheet #2

Worksheet #2 prefaces the information in the QAPP and places the document in context. Elements listed in Worksheet #2, which are not applicable to this QAPP, are circled and an explanation is provided.

3.0 Distribution List and Project Personnel Sign-off Sheet

The Distribution List (Worksheet #3) documents to whom copies of the approved QAPP and any subsequent revisions will be issued. A complete copy of the original version and all revisions of the QAPP, including addenda and amendments, will be maintained on file by Stone & Webster and will be available to the Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MADEP) upon request.

The Project Personnel Sign-off Sheet (Worksheet #4) documents that project personnel implementing the QAPP have read the QAPP. Applicable project personnel include contractors and subcontractors. Appropriate off-site laboratory and data validation personnel will receive a copy of the QAPP and will sign-off prior to performing services.

4.0 Project Organization

This section of the QAPP summarizes the project organization for the Oxford Mill project. Personnel responsibilities, lines of authority and communication pathways are described, as well as any training requirements.

4.1 Project Organizational Chart

The project organization is delineated in Worksheet #5a.

4.2 Communication Pathways

Communication pathways are delineated in Worksheet #5b. These pathways include the points of contact for resolving field and laboratory problems, and the points of contact for the flow of preliminary, screening and final data to managers, users and the public.

4.2.1 Modifications to Approved QAPP

The MADEP AND EPA will be notified of any deviation from the approved QAPP. Project modifications may include the following:

- Primary project personnel;
- Primary subcontractors;
- Sample analysis procedures; and
- Data assessment and reporting.

All QAPP modifications will be documented and submitted for approval in the same manner as the original QAPP.

4.3 Personnel Responsibilities and Qualifications

The organizational chart shown in Worksheet #5a outlines the management structure that will be used to implement the QAPP. The designated contractor is responsible for conducting site closure at the Site. The assignment of personnel to each position will be based on a combination of (1) experience in the type of work to be performed, (2) a demonstrated commitment to high quality and timely job performance, and (3) staff availability. The primary individuals assigned to these roles and a brief description of their experience is outlined in Worksheet #6.

Analytical laboratory support specific to these investigations will be obtained from an on-site and offsite laboratory. At this time, Severn Trent Laboratories with facilities in Westford, Ma will be the offsite laboratory. Severn Trent Laboratory will also supply the mobile on-site laboratory. Organization charts outlining the key laboratory personnel and organization will be identified in the laboratory QA Plans, which are included as an Appendix 2 of the QAPP.

5.0 Project Planning/Project Definition

5.1 Project Planning Meetings

General project planning meetings were held to plan and coordinate Site Closure. Personnel sign-in sheets and meeting minutes are attached to Worksheet #8a. The project-planning meetings are outlined in Worksheet #8a.

5.2 Problem Definition/Site History and Background

The QAPP is being prepared to support the hazardous materials investigation as part of the Site Closure Plan. The QAPP provides the planning mechanism to support decisions as they relate to evaluating and remediating the known and suspected areas of contamination. It outlines the management approach and objectives, the measurement and assessment procedure, and the oversight plan to provide a defensible assessment of the property to ensure EPA/MADEP approval and meet closure milestones. The Problem Definition/ Site History and Background is found in the Sampling and Analysis Plan.

6.0 Project Description and Schedule

The following sections provide a general overview of the sampling activities that will be performed and how and when they will be performed based upon site history and background information/data, pre-planning site visits, scoping meetings, risk assessments, and the construction schedule.

6.1 Project Overview

6.1.1 Sample Tasks

The number of samples, sample location and type of analysis is outlined in the SAP and was based upon conclusions of previous site assessments and discussions with EPA and MADEP. Based on this information, samples will be taken from the various media within these locations. Contaminants of concern and other target analytes for each applicable medium/matrix are identified in the SAP. The project action limits are based on the MADEP Contingency Plan and EPA criteria.

6.1.2 Analytical Tasks

The analytical services to be performed by the on-site and off-site laboratory are outlined in the SAP.

6.1.3 Data Verification and validation Tasks

Data validation services as described in Sections 18.0 and 19.0 will be subcontracted to Kestral Laboratory.

6.1.4 Quality Assurance Assessments

All laboratory personnel including the laboratory director, laboratory quality assurance manager, and laboratory manager will be responsible for adhering to the laboratory quality assurance management plan.

6.1.5 Data Usability Assessments

Data usability assessments will be as described in Section 20.0.

6.1.6 Records and reports

Records and reports will be managed as outlined in section 15.0.

6.2 Project Schedule

The sampling events described in this QAPP/SAP, if performed consecutively, would take about one month to complete. However, as a result of the long-term construction schedule and other factors, these field investigations will occur in accordance with the project schedule, which ends in 2004. At present, completion of sampling for Building No. 3 is expected to occur in July 2001.

7.0 Project Quality Objectives and Measurement Performance

7.1 Project Quality Objectives

Project Quality Objectives (PQOs) are qualitative and quantitative statements that specify the quality of data required to support decisions made during investigation activities, and are based on the end uses of the data being collected.

The chosen analytical test methods for this project will have Project Quantitation Limits (PQLs) for the chemical analyses lower than the established PQOs to the greatest extent practicable. Such test method pre-selection provides the highest probability that generated data is useful in making project decisions. The PQO process is designed to provide a means to determine what type of data need to be collected, as well as to ensure that the data collected are scientifically sound, legally defensible, and of known, documented quality.

An analytical PQO summary for these investigations is presented in the form of quality control limits, which are summarized in Worksheet #8b. All QC parameters (i.e., percent recoveries) will be adhered to for each chemical listed.

The ability of a data generation process to meet the PQOs is provided through the establishment of data quality criteria, which include precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS) parameters. PQOs are also met by meeting certain goals for the PQL concentrations. Laboratory and field sampling activity documentation will be used to assess the PARCCS parameters. To provide for reliability of field sampling procedures and materials, QC samples will be collected or prepared at a defined frequency for each medium sampled, sample shipment, and each sampling event.

During the sampling in each area, field screening methods and laboratory analytical methods will be used to determine the extent of contamination. Inorganic and organic concentrations will be determined by laboratory analysis. Results from each of these methods will be used to make decisions as to whether an individual work area is remediated or requires remediation. The following guidelines will be used during work area excavation and remediation:

- When all soil sample analytical results from the area show that all accessible soils above the cleanup criteria have been removed, then the work area is considered to be clean.
- When field screening shows levels below the screening level (within the accuracy of the measurement), then no further action is necessary.

7.2 Measurement Performance Criteria

Completeness shall be evaluated both qualitatively and quantitatively. The qualitative determination will be a function of sample handling (in the field and in the lab), labeling, shipping, etc. The quantitative description will depend on the number of sample results that are rejected due to gross exceedances of QC criteria.

The completeness requirement for holding times is 95%. Samples exceeding holding times that comprise greater than 5% of the total number of samples must be resampled and reanalyzed. Results from samples with proven matrix effects will not be used in calculating completeness.

It is the Contractor's responsibility for ensuring that all field samples, including blind duplicates and QA splits, are representative of field conditions and are properly preserved. Samples with results that are rejected due to lack of preservation must be resampled and reanalyzed. The laboratory will measure and record all sample preservation information and notify the contractor of any sample preservation deviations.

The analytical data used as inputs to the data quality objective process must be of known and sufficient quality to support the end use of the data. Analytical data of known and acceptable quality for the intended use are generated by the implementation of carefully chosen (QA/QC) protocols, both in the field and in the laboratory. Worksheet #11b summarizes the measurement performance criteria for each analytical parameter for each medium/matrix (QA/QC) goals are set for:

- each single measurement, and
- the entire data set of which the single measurement is a part.

Each individual measurement should be precise, accurate, representative, and comparable and a part of a data set that should be complete. The PARCC parameters of precision and accuracy can be quantified for a single measurement and for a complete data set. Goals for precision and accuracy can be set for a single measurement and for a complete data set comprising all the data collected during a remedial investigation or action. Representativeness and comparability are not as quantifiable as precision and accuracy, although there is necessarily some overlap between the parameters of representativeness, precision and accuracy. Analytical completeness is assessed by comparing the total number of analytical results expected for a data set (based on the number of samples collected) with the total number of usable (not rejected) analytical results.

The goal for analytical precision and accuracy is that each measurement should be associated with laboratory QC that is within limits. QC limits for chemical parameters are those required by the requested analytical method. Matrix samples including matrix spike (MS) and matrix spike duplicate (MSD) samples (MS/MSD for organics and MS/MD (matrix duplicate) for inorganics), will be used to assess the effect of matrix on the measurement process. Laboratory control samples (LCSs), or blanks spikes, will be used to assess the accuracy and precision of the measurement process in the absence of effects from field samples. Method blanks will be used to assess possible laboratory contamination, and field blanks, such as trip blanks and equipment rinsate blanks will be used to determine sources of contamination from the sampling location, the sample container, the sampling equipment, or sample transport.

Requirements for precision and accuracy to meet data quality goals include the following:

- Completeness of laboratory data;
- Overall data completeness (comparison of planned versus obtained data);
- Precision of field data;
- Precision of laboratory data;
- Accuracy of analytical data;
- Sensitivity
- Representativeness/comparability.

Data quality indicators are precision, accuracy, MDLs, and PQLs. Data indicator objectives are established to ensure the quality of the analytical data produced by the laboratory. A general description of each of the data indicator objectives is given below along with the data assessment procedures. All data must meet or exceed limits for precision and accuracy stated in the individual analytical methods.

Precision

Precision is the degree to which the measurement is reproducible and is frequently determined by comparison of laboratory designated duplicates or designated laboratory MS/MSDs. Precision is important because it represents the ability of the laboratory to produce consistent results. Precision of analyte concentrations in field samples is typically measured by the collection and testing of field duplicate samples. In that case, precision is calculated by the relative percent difference (%D) between the field duplicate results; i.e.,

$$\%RPD = (A - B)/[(A + B)/2] \times 100$$

where :
A = *first sample result, and*
B = *second sample result*

Standard deviation (S) is calculated as follows:

$$S = \left(\sum_{i=1}^{n} \frac{(x_i - \bar{x})^2}{n - 1} \right)^{1/2}$$

x_i = *measured value of the* i^{th} *replicate*

$\bar{x}$ = *average of replicate measurements*

n = *number of replicates*

If more than two samples are collected at the same location and at the same time, precision will be calculated as % relative standard deviation (%RSD). %RSD may be calculated as follows:

$$\%RSD = \frac{S}{\bar{X}} \times 100\%$$

$\bar{X}$ = *average of replicate measurements*

S = *standard deviation*

Accuracy

Accuracy is reported as the percent recovery (%R) of a parameter from a laboratory or field sample spiked with a known value of the parameter for a given analytical procedure. Accuracy is important because it is a measure of the true concentration of a parameter for a given analytical procedure. The determination of the accuracy of a measurement requires knowledge of the true or accepted value for the parameter being measured and the value of the parameter for the unspiked sample. Accuracy is monitored for each matrix type. Percent R recovery may be calculated as follows:

$$\%R = \frac{X_s - X_u}{K} \times 100\%$$

where:
X_s = *measured value for spiked sample*
X_u = *measured value of unspiked sample*
K = *known value of the spike in the sample*

Method Detection Limits and Reporting Limits

Project Quantitation Limits (PQLs) will be based on Method Detection Limits (MDLs), except that the PQLs for samples analyzed under the Toxicity Characteristic Leachate Procedure (TCLP) will be the regulatory limits for individual compounds as listed in 40 CFR, Part 261.24, Table 1. The PQL is typically a factor of 2 to 10 times higher than the MDL.

MDL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The MDL is determined from the analyses of seven blanks, each spiked in an identical fashion with the analytes of interest, so that the final concentration of the spiked solution is approximately two to five times the expected method detection limit. Following analyses, the mean and standard deviation of the seven results is calculated. The MDL may be calculated as follows:

$$MDL = t_{(n-1,\ \alpha = 0.99)} \times S$$

where:

S =*standard deviation of the replicate analyses*
$t_{(n-1,\ \alpha = 0.99)}$ = *one-sided 99 percent t-statistic*
n = *number of measurements of analyte*

It should be recognized that MDLs and PQLs are sample matrix dependent and may be raised due to matrix interferences and/or dilution factors.

Data Completeness

Completeness refers to the amount of valid data obtainable (by the specific method the laboratory used with the instrument to be employed) from a measurement system compared to the expected amount of data, and is usually expressed as a percentage. Completeness may be calculated as follows:

$$Completeness = \frac{amount\ of\ valid\ data}{expected\ amount\ of\ data} X\ 100\ \%$$

Valid data can be defined as either acceptable data or quality data. Quality data are data that passed all QC indicators. Acceptable data are data that are either quality data or data for which corrective actions have been performed. The minimum completeness for acceptable data required for this project is 95 percent. The minimum completeness is 98% for each of the analytical methods employed in the SAP. Completeness for quality data shall be 80%.

Analytical data will be divided into two categories:

- Non-critical measurements and
- Critical measurements

Non-critical measurements are defined as wet chemistry (e.g., anions, alkalinity, Total Kjeldahl Nitrogen (TKN), etc.) soil and water quality parameters, while critical measurements are defined as organics, metals, and TCLP. Non-attainment of QA objectives for non-critical measurements will have a minor impact on project objectives. The most important objective for critical measurements is completeness because it is based on data validity and directly impacts project decisions. Non-attainment of completeness may result in the need for resampling at specific locations. Water quality parameters may be critical if one is considering discharge of stormwater or decontamination water.

8.0 Sampling Process Design

The environmental investigation will be executed within the Oxford Mill Site. Samples will be collected in soil and analyzed for various contaminants of concern based upon the site history and risk considerations contained in the Tier Classification submittal. A summary of the spill history and action parameters for each area is contained in the Site History Report. The sample rationale is based upon this information and is outlined in the SAP.

8.1 Sampling Design Rationale

A sampling rationale is provided for each area and medium/matrix and is outlined in the SAP.

9.0 Sampling Procedures and Requirements

The project SOPs are referenced in Worksheet #13.

9.1 Sampling Procedures

Sampling covers all sampling activities at the Oxford Mill site including screening and sampling of soils. Additionally, it covers air monitoring for industrial hygiene requirements. The SAP describes specific sampling activities and procedures for sampling each medium or matrix, for each analytical parameter, by each type of equipment and technique. The SAP outlines the container requirements, preservation, and holding times to extraction and/or analysis for all analytical parameters and matrices. The project sampling SOPs are attached to the SAP (SOP 4 and 5).

9.2 Sampling SOP Modifications

Any modifications to sampling procedures will be indicated in the SAP and Worksheet #13. EPA and MADEP will be notified of the changes.

9.3 Cleaning and Decontamination of Equipment/Sample Containers-Prior to Use

The goal of decontamination is to eliminate cross-contamination resulting from the use and reuse of sampling equipment. Detailed cleaning and decontamination procedures for equipment, which requiring decontamination is contained in SOP 6 included in the SAP. The laboratory is responsible for providing certified clean sample containers.

9.4 Field Equipment Calibration

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency (and at least annually) and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. The procedures for calibrating field equipment are included in the relevant SOPs for the field sampling equipment (SOP 1,2,4, and 5).

9.5 Field Equipment Maintenance, Testing and Inspection Requirements

Field equipment maintenance, testing, and inspection requirements are outlined in the relevant SOPs in the SAP. Field instruments will be tested and/or calibrated before the manufacturer ships them. Any maintenance conducted on field equipment must be documented in the field logbook and the process documented including the results of any subsequent check/calibration and any adjustments required. Any significant adjustment shall be cause for recalibration by the manufacturer or approved calibration facility. If the instrument cannot be calibrated, it will be returned to the supplier or manufacturer for recalibration, and a back-up instrument will be used in its place.

9.6 Inspection and Acceptance Requirements for Supplies/Sample Containers

The procedure that will be used to ensure that all sampling supplies and sample containers are free of contaminants of concern, other target compounds, or interferences is as follows:

- Certified clean sample containers will be provided by the laboratory;
- Request supplies/containers on an as-needed basis;
- Request supplier/containers in no more than one week;
- Store supplies in a secure on-site storage area;
- Keep supplies/containers in original shipping containers until required for use.

10.0 Sample Handling, Tracking and Custody Requirements

The sampling handling, tracking and custody requirements are outlined in the applicable SOPs in the SAP as identified below.

10.1 Sample Collection Documentation

Sample collection documentation requirements are outlined in SOP 3 "Field Notebook content and Control" contained in the SAP.

10.2 Sample Handling and Tracking System

Sample packaging, coordinating sample shipping to the off-site laboratory, and providing properly maintained shipping containers requirements are outlined in SOP 8 "Labeling, Packing, and Shipping Environmental Samples" contained in the SAP.

10.3 Sample Custody

The program sample custody that will be followed during the sample handling activities from the field to the laboratory is outlined in SOP 8 and is contained in the SAP. The laboratory is responsible for sample receipt from the designated shipping agent, completion of the chain of custody documents, verification of proper sample preservation, recording cooler temperatures, maintaining samples in secure properly designated areas, and maintaining internal chain of custody documents. The laboratory will notify the contractor immediately of any sample receipt issues that impact sample integrity and data quality. The laboratory SOPs are attached in the Appendix E of the SAP.

11.0 Field Analytical Method Requirements

This section describes the screening methods that will be used in the field. Screening will be performed to supplement soil sampling efforts.

11.1 Field Analytical Methods and SOPs

Screening will be performed to determine the extent of contamination when sampling soil. The areas requiring field screening and the field screening methods are provided in the SAP (SOP 1 and 2). The field analytical method and applicable SOP is outlined in Worksheet #16.

11.2 Field Analytical Method/SOP Modifications

The EPA and MADEP will be notified of any significant change in field analytical methods. See Worksheet #16.

11.3 Field Analytical Instrument Calibration

To ensure that the analytical methods and the selected instrumentation meet the project requirements for selective, sensitive, accurate and precise detection and quantitation of the analytes of interest, it will be necessary to calibrate the field instrumentation. Field instrumentation will be calibrated using the applicable procedures outlined in the equipment procedures (SOP 1 and 2) outlined in the SAP and Worksheet #17.

11.3.1 Field Analytical Instrument/Equipment Maintenance, Testing and Inspection Requirements

The applicable field analytical equipment maintenance, testing and inspection requirements are outlined in the equipment procedures (SOP 1 and 2) SAP and listed in Worksheet #18.

12.0 Fixed and Mobile Laboratory Analytical Method Requirements

The following text provides detailed information on analytical procedures. The SAP contains tabular summaries of analyses required for each area. This section describes the number of QC samples to be collected for each method, including field and laboratory QC samples. The actual quality assurance methods and procedures employed in the subcontractor laboratory's daily activities are provided in Worksheet #24a and #24b.

12.1 Fixed and Mobile Laboratory Methods and SOPs

All samples shall be prepared and analyzed in accordance with the methods identified in Worksheet #20. These procedures contain detailed descriptions of the sample preparation and analyte detection steps, including instrumentation and other laboratory apparatus, reagent and standards preparation, and calibration. It also includes discussions of interferences, sample collection including containers and preservation, QC samples, calculations, and reporting of results.

12.1.1 Analytical/Statistical/Control Parameters

Accuracy - Organics

Accuracy shall be evaluated by requiring the laboratory to treat no less than 5% of all Oxford Mill samples (per matrix) as MS/MSD pairs, to analyze at least one blank spike (or LCS) with the entire analyte list for a given method per matrix per sample batch (a sample batch contains a maximum of 20 environmental samples), to add surrogate spikes to all samples as required by the method, and to analyze method blanks every 12 hours of analysis time or every batch, whichever is more frequent. Under no circumstances will trip blanks or equipment rinsate blanks be analyzed as MS/MSD pairs. The sample designated for MS/MSD analyses will have approximately triple the volume of a normal sample (triple volume is required for aqueous samples, not soil samples). MS/MSD samples should be spiked by the laboratory with representative target compounds. These are typically provided in the chosen standard method; e.g., EPA SW-846 (EPA, 1986) Method 8270C for semivolatile organics. Both the MS and MSD samples must be reextracted/reanalyzed if the recoveries are outside of acceptable recovery ranges listed in the Contract Laboratory Program (CLP) Statement of Work for Organic Analyses (OLMO4.2). MS/MSD CLP recoveries listed in OLMO4.2 will be used for all project MS/MSD and MS/MD samples.

Analyses with surrogate recoveries outside acceptable ranges (in-house limits established as per SW-846 guidance (Method 8000, section 8.7)) shall be reextracted/reanalyzed. If method blanks are consistently out of control (see Chapter One of SW-846) for one or more analytes, the laboratory will be required to stop analysis of field samples and find and eliminate the source of contamination. If the source of contamination cannot be found in a timely fashion, another laboratory subcontractor will be procured for those analyses.

LCS samples are clean matrices, such as organic-free water or high purity sodium sulfate spiked with all of the analytes used for the matrix spikes or the analytes of interest for the site. LCS samples will be analyzed with each batch. The LCS provides method performance data for samples free from interferences. As such, they serve as a warning for laboratory methods that are out of control. Like surrogate spikes, control limits must be established for LCS results using SW-846 Method 8000, section 8.7. If a LCS result falls outside QC recovery limits, the LCS should be reanalyzed in real time with respect to sample analyses, to see if the failure represents a transient instrumental condition. A second failure indicates a fundamental problem that must be corrected before sample analysis can restart. All of the sample results associated with that LCS (only for those analytes that failed LCS recovery) need to be reanalyzed after the method performance problem has been corrected. The corrective actions taken by the laboratory must follow the laboratory's corrective action procedures. If a laboratory is in the process of implementing a new method, and LCS recovery limits have not yet been established, the temporary percent recovery limits shall be 80-120% for water and 70-130% for solids.

For Gas Chromatography (GC) methods, QC limits may be established by the laboratory for surrogate, LCS, and MS/MSD recoveries, as appropriate. If not, a default recovery range of 65-135% may be used. The exceptions to this guidance are the MS/MSD limits for pesticides shown in OLMO4.2.

Analytical quality control criteria are presented in the Massachusetts EPH/VPH methods. Sample results not meeting these method specified criteria shall be reextracted/reanlyzed.

In all cases, construction of control charts or QC limit ranges should eliminate outliers, which are defined as those exceeding the mean plus or minus three standard deviations. In addition, reanalysis as a result of QC recovery exceedances as described here, will not be required if the spike signal is obscured by gross contamination. In such cases, the laboratory must substantiate its case for not reanalyzing by providing the proper chromatograms or other pertinent raw data. The final decision as to the acceptability of a laboratory deviating from the requirements of this QAPP will be made by the MADEP.

Accuracy – Inorganics and General Chemistry

Accuracy shall be evaluated by requiring the laboratory to treat no less than 5% of all Oxford Mill samples (per matrix or per batch) as a MS sample, to analyze LCSs with the entire analyte list for a given method, and to analyze method blanks as required by the selected analytical method. Field sample collection will be coordinated with the laboratory so batch size is maximized and the frequency of MS sample designation is not too high. The sample chosen for matrix spiking should be similar to other samples in the batch. Under no circumstances will equipment rinsate blanks be analyzed as MS/MD pairs. The sample designated for MS/MD analyses will have approximately triple the volume of a normal sample (triple volume is required for aqueous samples, not soil samples).

MS samples should be spiked with the complete analyte target list for a given method at a concentration per analyte of about 3 to 5 times the expected background. The percent recovery of the spiked compounds will provide a measure of accuracy. The MS must be redigested/reanalyzed if any of the analyte recoveries are outside of acceptable recovery ranges. The default QC recovery range typically used for inorganics and general chemistry parameters is 75-125%. Prior to any redigestion/reanalysis, sample preparation and test data must be reviewed to see if the cause of the spike recovery exceedance can be determined. If an out-of-control condition is discovered in this process, it must be corrected prior to the redigestion/reanalysis.

Similar to organics, the LCS should be performed for each sample batch up to a maximum of 20 samples per batch. If the aqueous LCS recovery falls outside of the QC criteria (80-120%), the LCS must be reanalyzed for the analyte(s) falling outside criteria. If the LCS recovery fails a second time, corrective action must be taken to improve test measurement performance for the analyte(s) of concern. All samples associated with the faulty LCS must be reanalyzed (only for those analytes that failed LCS recovery) after the problem has been corrected. A solid LCS sample should be digested along with soil/sediment samples when available.

The interference tests (dilution test and post-digest spike addition) described in Section 8.5 of Method 6010B of SW-846 must be performed on one representative sample from a given analytical batch whenever new or unusual matrices are encountered. It is the responsibility of the analyst to look at the samples prior to digestion and select the representative sample in a conservative manner, such that in his or her judgement, the selected sample is the one most likely to contribute interference. If the results of the interference tests are outside the QC limits provided in Section 8.5.1 and 8.5.2 of SW-846 Method 6010B, these results must be discussed in the case narrative. For SW-846 Series 7000 methods, interference checks as described in Section 3.0 of Method 7000 should be conducted. If the results are outside of the QC limits stipulated in Section 8.6.1 of Method 700, the method of standard additions must be employed.

QC criteria for metals analysis will conform to the requirements of SW-846.

Sensitivity

The laboratory will have developed MDLs in accordance with 40 CFR 136 Appendix B. The PQL shall be set at 3 to 5 times the MDL. MDLs should be consistent with the MDLs shown in SW-846 and shall be less than the project action limit. Appendix F of the Sampling and Analysis Plan, as well as SOP 10 and 11 contain the most current Contract Laboratory MDLs and PQLs for all analyses that are expected to be performed. The instrument calibration curves should include the method PQL. All results for dilution runs must be provided. A discussion as to which values are to be reported must also be provided in the case narrative.

Matrix effects caused by highly contaminated samples will be reviewed to assess the laboratory's ability to meet sensitivity requirements. A detailed analysis of all failures to meet sensitivity requirements must be provided in the narrative section of the Format for Comprehensive Certificate of Analysis.

Precision

Precision is defined in PQOs Section 7.2 of this QAPP. It is represented by the Relative Percent Difference (RPD) between duplicate sample results, and the relative standard deviation (RSD) for more than two results. Laboratory control sample results can be used to determine the precision (from the results of many analyses) and accuracy (from the average percent recovery of a given analyte) of a method since there are no matrix effects. For metals, laboratory duplicates (replicates of one field sample) will be analyzed at a rate of at least one in 20 or one per batch, whichever frequency is greater. Laboratory duplicates not meeting QC criteria must be reextracted/reanalyzed once (aqueous ±20% soil/sediment ±35%). For organics, precision may be calculated from spiked and unspiked (if present) analyte results obtained from analysis of MS/MSD samples. Field duplicate results are used for both metals and organics to provide a measure of precision. Field duplicate samples are collected at a frequency of 5% of the total number of samples of a given matrix or site, or one per batch, whichever is more frequent.

12.2 Fixed and Mobile Laboratory Analytical Method/SOP Modifications

Modifications for project work for fixed and mobile laboratory analytical methods are noted on Worksheet #21.

12.3 Fixed and Mobile Laboratory Instrument Calibration

Calibration of laboratory equipment is detailed in Worksheet #20.

12.4 Fixed and Mobile Laboratory Instrument/Equipment Maintenance, Testing and Inspection Requirements

As part of their QA/QC Program, a routine preventive maintenance program will be conducted by the laboratory to minimize the occurrence of instrument failure and other system malfunctions. All laboratory instruments will be maintained in accordance with manufacturers' specifications and the requirements of the specific method employed. This maintenance will be carried out on a regular, scheduled basis and will be documented by the laboratory for each instrument. The laboratory shall maintain an inventory of expendable parts and supplies to minimize downtime. The instrument maintenance, testing and inspection requirements provided by the fixed laboratory, are outlined in Worksheet #20.

12.5 Fixed and Mobile Laboratory Inspection and Acceptance Requirements for Supplies

The QAP (SOP 10 and 11) describe procedures and activities that will be performed by the laboratory to ensure that all supplies used will be available when needed and will be free of contaminants of concern, other target compounds, and interference's.

13.0 Quality Control Requirements

Quality Control (QC) is the system of technical activities, which measures the performance of a process. The following field QC checks and samples will be used to both prevent and identify specific sources of contamination:

- Equipment Blanks;
- Bottle Blanks;
- Trip Blanks;
- Sample Cooler Temperature Blanks;
- Field Duplicates; and
- Performance Evaluation Samples (PES).

13.1 Sampling Quality Control

A field sampling QC table (Worksheet #21a) is provided for each sampling medium/matrix and analytical parameter. The table outlines the frequency, acceptance criteria, and corrective action for each QC check.

13.2 Analytical Quality Control

This section of the QAPP identifies the QC procedures, checks, and sample, and their respective acceptance limits, that will be used during the project to monitor the quality of various preparatory and analytical steps.

13.2.1 Field Analytical QC

The field analytical will be for screening purposes and health and safety monitoring.

13.2.2 Fixed Laboratory QC

The following QC procedures/methods will be used to monitor the quality of laboratory procedures:

- Method Blank;
- Reagent Blank;
- Storage Blank;
- Instrument Blank;
- Laboratory Duplicate;
- Laboratory Matrix Spike;
- Matrix Spike Duplicates;
- Laboratory Control Samples (LCS);
- Laboratory Fortified Blanks (LFB);
- Surrogates;
- Internal Standards (ISs)

The fixed laboratory analytical QC sample table for each medium/matrix, analytical parameter and concentration level is provided in Worksheet #22a. Worksheet #22b outlines the accuracy/bias acceptance criteria for the field laboratory technique for all COCs.

14.0 Data Acquisition Requirements

A Tier Classification was submitted to MADEP, which summarized sampling activities performed for the purposes of a site characterization survey. A Release Abatement Measure (RAM) Plan was submitted to MADEP and recommended areas that require further study and/or remediation. These recommendations were revised during meetings with the MADEP and USEPA. The revised program is summarized in the revised RAM Plan. Previous data collected used as guidance for sample collection rational is referenced in Worksheet #25.

15.0 Documentation, Records and Data Management

This section of the QAPP describes how project data and information will be documented, tracked and managed from their generation in the field to find use and storage in a manner that ensures data integrity and defensibility.

15.1 Project Documentation and Records

The documents and records that will be generated for this project are summarized in Worksheet#26.

15.2 Field Analysis Data Package Deliverables

All field activities and sampling will be recorded in field logbooks as outlined in SOP 3 of the SAP. Entries recorded in the field logbook will include all field analytical screening data, measurement data and a description of the sampling event as required in the SOP. The field logbooks will be filed with project documents.

15.3 Fixed Laboratory Data Package

The Subcontractor shall provide two types of deliverables: (1) hard copies of laboratory data packages for field samples, including data for field QC and laboratory QC samples; and (2) an electronic summary of all laboratory analysis results for field samples, and field QC and laboratory QC samples. The laboratory will also archive the raw data for all sample analyses, in the case that there is a concern with the submitted data. The fixed and on-site laboratories have been notified to archive the data for a minimum of five years.

The Subcontractor shall provide and furnish two complete copies of all hard copy and electronic data packages. The data packages for all media shall be similar to USEPA Level II deliverable requirements and shall contain information and be in sufficient detail to allow for USEPA Tier II data validation, using USEPA New England Region data validation functional guidelines (December 1996) as guidance. The validation for all media except biota will not include: raw data, chart recorder traces, laboratory notebook pages, and calculations. Data packages shall consist of case narratives (including method compliance and overall assessment of data for the SDG including a discussion of all QC criteria exceedances, and any special steps taken such as certain sample cleanup methods), sample results, chromatograms from applicable analyses, and QA/QC summaries (equivalent to CLP Forms I through X for organic analyses, and Forms I through XIV for inorganic analyses), including calibration and internal standard data. In addition, for those parameters for which all QC criteria were met, signed cover sheets indicating the same must be included. One copy of each data package shall be submitted directly to the Contractor, and one copy shall be provided to other (data validation) Subcontractor(s) designated by the Contractor, if required by the project. The hard copy laboratory data packages shall include:

- Sample identification numbers
- Dates of sample collection, extraction/digestion (as appropriate) and analysis
- Analytical results for collected samples
- Analytical results from field QC samples, and all laboratory QC samples specified by the method referenced herein
- "J" qualifiers for results between the MDL and the PQL (for organics)
- Report all pertinent inorganic and organic laboratory qualifiers ("B", "U", etc.) with a descriptive legend
- Tentatively-identified compounds (for organics)(only if requested)
- Chromatograms from appropriate analyses
- Units of measure

- PQLs as required by the project, next to field sample analytical results
- Identification and description of analytical method(s) used
- Dry weight logs, extraction/prep logs, pH logs, and analytical run logs (as appropriate for analyses performed)
- Report the ten (10) highest tentatively identified compounds for each mass spectrometry analysis
- Blank spike laboratory control sample results
- Copy of completed sample and internal chain-of-custody forms
- Certificates of laboratory analysis, with date and initials or signature of responsible person(s)
- Case narrative description of any analytical difficulties encountered, including a discussion of any corrective actions taken for sample results outside QC limits
- Signed and dated QC review by a representative of the Subcontractor who is independent from the analysts and appropriately qualified for the analyses

The Subcontractor shall provide the hard copy data packages in sufficient detail to allow for a USEPA New England Region Tier II data validation of the following (excluding raw data):

Non-CLP Organic Analyses:

- Holding times
- Initial Calibration
- Continuing calibration
- Blanks
- Surrogate recovery
- Internal standard results
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) recovery
- Laboratory Control Sample or Blank Spike recovery
- Field duplicate/laboratory replicate analysis
- Compound identification
- Other laboratory QC results specified by the analytical method

Non-CLP Inorganic and Physical Analyses:

- Holding times
- Initial Calibration
- Blanks (both field and laboratory method)
- Matrix Spike recovery

- Laboratory Control Sample or Blank Spike recovery
- Field duplicate/replicate analysis
- ICP Interference Check Sample results
- ICP Serial Dilution Analysis results (if performed)
- Other laboratory QC results specified by the method

15.4 Data Reporting Formats

Laboratory reports will provide the results of the analyses for parameters along with additional information to identify how the data were produced. The LQAP includes procedures for recording and correcting data.

15.5 Data Handling and Management

Field data will be entered into field notebooks as outlined in SOP 3. The data handling and management procedures within the laboratory are detailed in the LQAP. Data reports will be generated in both hard copy and electronic. Electronic formats include Microsoft Excel, Word and/or Access, email or 31/2 inch DSDD diskettes. The data will be assessed using one of the above formats using spreadsheet/database summary tables. The electronic formats are capable of performing statistical analysis.

15.6 Data Tracking and Control

Laboratory SOPs address the following items:

☐ Data Tracking
☐ Data storing, archival and retrieval
Sample data is saved electronically on tapes. Hardcopies are retained for six months in file cabinets within the laboratory building. After the six-month period, data is shipped in boxes for storage offsite.
☐ Data security

16.0 Assessments and Response Actions

Many projects discover problems associated with the analytical data packages periodically throughout the duration of the project. Such problems may be caused by inadequate communication, different interpretations of work plan (QAPP) requirements, or simply inadequate attention paid to the QC requirements of the QAPP. Many of the problems directly or indirectly adversely impact data quality, and therefore the project's ability to meet PQOs. It is the intention to perform a data quality assessment early in the data production process to eliminate problems and resolve uncertainties in the interpretation of how to carry out certain sampling and testing tasks.

An aggressive oversight program will be maintained. Performance and system assessment of both field and laboratory activities will be conducted to verify that sampling and analysis activities are performed in accordance with the procedures established in the QAPP and SAP. These actions are outlined in Worksheet #27b, which include planned and unplanned assessments.

16.1 Planned Assessments

Field Analytical TSA-A thorough audit of on-site analytical techniques (not performed in a mobile laboratory) will be checked for conformance with the QAPP and will include:

- equipment;
- instrumentation;
- supplies;
- personnel;
- training;
- analytical methods/procedures;
- sampling handling and tracking;
- data reporting;
- data handling and management;
- data tracking and control; and
- data verification procedures.

A Field Analytical TSA can be performed prior to the start of, at the start of, or at any time during field sampling activities. However, it is recommended that at least one Field Analytical TSA be performed prior to the start of the field sampling activities so that effective corrective action measures can be implemented to mitigate the extent and impact of identified non-conformances.

Fixed and Mobile Laboratory TSA-A thorough audit of the fixed and mobile laboratories during which the facility will be checked for conformance with the QAPP and will include:

- equipment;
- instrumentation;
- supplies;
- personnel;
- training;
- analytical methods/procedures;
- laboratory procedures;
- sampling handling and tracking;
- data reporting;
- data handling and management;
- data tracking and control; and
- data verification procedures.

A Fixed Laboratory TSA can be performed prior to the start of, at the start of, or at any time during field sampling activities. However, it is recommended that at least one Fixed Laboratory TSA be performed prior to the start of the field sampling activities so that effective corrective action measures can be implemented to mitigate the extent and impact of identified non-conformances.

The first completed laboratory Data Package TSA, for each analytical method, will be reviewed for completeness and usability. Subsequent data packages will be validated by the contractor or a designated, qualified subcontractor.

Data Validation TSA-A thorough review of the complete Data Validation Report including a review of the associated analytical data package deliverables (tabulated and raw data) to ensure that all required analytical data package deliverables and Data Validation Report components were provided and contain the specified information. The Data Validation TSA also ensures that the data validation procedures and actions specified in the most recent revision of the Region I, EPA-NE Data Validation Functional Guidelines for Evaluation Environmental Analyses are utilized, the data validation criteria in the QAPP are met, and the method and laboratory-specific QC acceptance criteria specified in the QAPP are met and were appropriate for achieving the project measurement performance criteria. The Data Validation TSA also evaluates whether the project-specific measurement performance criteria and data validation criteria were appropriate for meeting the specified PQOs/DQOs and whether there were analytical measurement performance usability issues affecting PQO/DQO achievement.

16.2 Assessment Findings and Corrective Action Responses

If any major findings are discovered with the fixed or mobile laboratory, work of the Contract Laboratory will be suspended until the problem is resolved.

Examples of major findings that would authorize the auditor to suspend work are:

- Incorrect list of analytes
- Incorrect reporting limit
- Method performance not consistent with the requirements of the QAPP
- Absence of current MDL or other studies affecting method performance
- Gross and continual holding time violations

The laboratory QA Manager will address response actions to unsatisfactory conditions.

A data quality assessment will be performed on the first laboratory data package. The data quality assessment will be performed in addition to the data validation and will focus more on adherence of the data package to QAPP requirements. Specifically, it will review the following:

- Consistency of the PQLs with the Contract Laboratory's most recent PQLs submitted just prior to the start of the project.
- Sample custody and sample preservation documentation.
- Validity of calibration curves, especially at low levels.
- Calculation of test results from raw data.

- Proper hardcopy and electronic reporting format
- Reporting criteria for initial and second column confirmation results.
- Adherence to the laboratory QA manual and laboratory SOPs.

Technical staff and project personnel will be responsible for reporting all suspected technical and QA nonconformance or suspected deficiencies of any activity or issued document by reporting the situation to the Project Manager or his/her designee. The Project Manager will be responsible for assessing the suspected problems in consultation with the Laboratory Coordinator to make a decision based on the potential for the situation to impact the quality of the data. When it is determined that the situation warrants a reportable nonconformance and corrective action, then the Project Manager will initiate a Condition Report (CR) in accordance with project procedures. The Project Manager will be responsible for ensuring that corrective actions for nonconformance are initiated by:

- Evaluating all reported nonconformance.
- Controlling additional work on nonconforming items.
- Determining disposition or action to be taken.
- Maintaining a log of nonconformance.
- Reviewing CR's and corrective actions taken.
- Ensuring that CR's are included in the final site documentation project files.

If appropriate, the Project Manager will ensure that no additional work dependent on the nonconforming activity is performed until the corrective actions are completed.

Corrective action for field measurements may include:

- Repeating the measurement to check the error.
- Checking for all proper adjustments for ambient conditions such as temperature.
- Checking the batteries.
- Re-calibrating equipment.
- Checking the calibration.
- Modifying the analytical method including documentation and notification (e.g. standard additions).
- Replacing the instrument or measurement devices.
- Stopping work (if necessary).

The Project Manager or designee is responsible for all site activities. In this role, the Project Manager may at times be required to adjust the site activities to accommodate activity-specific needs. When it becomes necessary to modify an activity, the responsible person notifies the Project Manager of the anticipated change and implements the necessary changes after obtaining the approval of the Program Manager. The Program Manager must approve the change in writing before field implementation. If unacceptable, the action taken during the period of deviation will be evaluated in order to determine the significance of any departure from established program practices and action taken.

The Project Manager for the site is responsible for controlling, tracking, and implementing the identified changes. Reports on all changes will be distributed to all affected parties.

16.3 Additional QAPP Non-conformances

If project personnel identify field sampling and analytical problems that could potentially impact data quality and/or usability, then corrective action will be initiated as outlined in Section 16.2. "Trend" CR's will be generated for continued non-conformance issues.

17.0 QA Management Reports

QA management reports will be prepared as shown in Worksheet #28 and as described below.

Weekly Quality Control Reports (WQCRs)
During the field investigation activities performed for this project, WQCRs will be prepared.

The Severn Trent Laboratory in Westford, Ma shall complete WQCRs for each week of laboratory activities associated with the Oxford Mill project for the fixed and mobile laboratories. The WQCRs shall summarize daily chemical and testing quality control activities and may be limited to out-of-control data events and the actions taken to resolve them. WQCRs completed by the laboratory shall be submitted the following week to the Project Manager. All nonconformance and corrective action reports related to the Oxford Mill Project shall be reported.

Final Project Report
A Final Project Report will be completed at the end of the Project which will summarize all of the data that may have been compromised or influenced by aberrations in the sampling and analytical process and will include all the WQCRs.

18.0 Verification and Validation Requirements

A systematic process for data verification and validation will be performed to ensure that the precision and accuracy of the analytical data are adequate for their intended use. The greatest uncertainty in a measurement is often a result of the sampling process and inherent variability in the environmental media rather than the analytical measurement. Therefore, analytical data validation will be performed only to the level necessary to minimize the potential of using erroneous results in the decision-making process (i.e., to ensure accurate identification and quantitation of target compounds). This approach is consistent with the PQOs for the project, with the analytical methods, and for determining contaminants of concern and calculating risk.

Samples will be analyzed through implementation of definitive analytical methods. Definitive data will be reported consistent with the deliverables identified in the Subcontractor laboratory contract and described in USACE, 1997. The definitive data package should include a cover sheet table of Contents, case narrative, analytical results, sample documentation information, initial and continuing calibration information, and internal laboratory QA/QC information. Laboratory data packages should be comparable to the organic and inorganic US CLP data packages in terms of content. These definitive data will then be validated through the review process presented here. PQOs identified in Section 7.1 and method-specified criteria will be validated. The subcontract laboratory will retain comprehensive analytical information.

Validation will be accomplished by comparing the contents of the data packages and QA/QC results to requirements contained in the requested analytical methods. Validation support staff will be responsible for these activities. A Tier II validation will be completed as defined by Region 1 Tiered Organic and Inorganic Data Validation Guidelines (07/93), following "Region 1 EPA-New England Data Validation Functional Guidelines for Evaluating Environmental Analyses 12/96", "Region 1 Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses 2/89", and method specific QA/QC criteria.

Validation support staff will conduct a systematic review of the data for compliance with the established QC criteria based on the following categories:

- Sample custody documentation.
- Holding times and sample preservation.
- Blanks.
- LCSs.
- Surrogate recovery (organic methods).
- MS/MSD and MS/MD percent recoveries and relative percent differences
- Internal standards (primarily organic methods).
- GC/MS Instrument Performance Check
- Calibration.
- GC PEM Results
- Sample reanalysis.
- Secondary dilutions.
- Laboratory Duplicates
- Field Duplicates
- ICP Interference Check Samples
- Serial Dilution Results
- Secondary dilutions.
- Laboratory case narrative.

Consistent with the data quality requirements as defined in the PQOs, all project data and associated QC will be evaluated on these categories and qualified as per the outcome of the review.

Treatment of Outliers

Outliers are extreme high or low measurements that are set apart from most of the data. They may arise from matrix interferences, errors in transcription, sample preparation, analytical method, or regional variations in the background geochemistry. Apparent outliers may also represent areas with unusually high concentrations.

Outliers that are obvious mistakes should be corrected; otherwise they will disproportionately affect the data set. Outlier statistical tests, however, should only be used to identify potential outliers that require further evaluation (see EPA, 1996). EPA 1996 recommends one of four types of statistical tests: Dixon's Extreme Value test (when sample size is less than or equal to 25), Discordance test, Walsh's test (non-parametric test), or Rosner's test. After identification as a potential outlier, consideration should be given to the magnitude of the observation with respect to the assumed distribution for the data set. It is important to note that no datum should be discarded as an outlier based solely upon the results of these statistical tests. The chosen statistical test should be performed on the original data set and the truncated data set.

Decisions on the use or rejection of outlier data will be aided by the laboratory supplying information justifying an extreme result, especially when associated with QC results that exceed criteria.

19.0 Verification and Validation Procedures

Sample collection, handling, and field analysis procedures will be verified by the site manager, the onsite laboratory, the fixed laboratory, and the data validator. The following QC items will be reviewed as part of the data validation task. These QC items apply to all sample types unless noted otherwise.

Sample Custody Documentation – Verifies the integrity of the samples.

Holding Times - Evaluation of holding times ascertains the validity of results based on the length of time from sample collection to sample preparation or sample analysis. Verification of sample preservation must be confirmed and accounted for in the evaluation of sample holding times. The evaluation of holding times is essential to establishing sample integrity. Concerns regarding physical, chemical, or biochemical alteration of analyte concentrations can be eliminated or qualified through this evaluation.

Blanks - The assessment of blank analyses is performed to determine the existence and magnitude of contamination problems. The criteria for evaluation of blanks apply to any blank associated with the samples, including field, trip, equipment, and method blanks. Contamination during sampling, handling, or analysis, if not discovered, results in false-positive data.

Analytical method blanks should be below PQLs. Field, trip, and equipment rinsate blanks will be evaluated against these levels for most analytes.

Laboratory Control Samples - The LCS serves as a monitor of the overall performance of the analytical process, including sample preparation, for a given set of samples. Evaluation of this standard provides confidence in or allows qualification of results based on a measurement of process control during each sample analysis.

MS/MSD Samples – Matrix spike and matrix spike duplicate (MS/MSD) samples are prepared from an individual field sample that is split into three portions. Two of the three portions are spiked with some or all of the method analytes at concentrations equal to each analyte's cleanup action level. MS/MSDs are analyzed for organic analytes. A matrix spike sample only (and laboratory replicates) are analyzed for inorganic testing. MS/MSD and MS results provide a measure of method accuracy.

Surrogate Recovery - System monitoring/surrogate compounds are added to every sample, blank, matrix spike, MS, MSD, and standard for organic analyses only. They are used to evaluate extraction, cleanup, and analytical efficiency by measuring recovery on a sample-specific basis. Poor system performance as indicated by low surrogate recoveries is one of the most common reasons for data qualification. Evaluation of surrogate recovery is critical to the provision of reliable sample-specific analytical results.

Internal Standards - Internal standards are utilized to evaluate and compensate for sample-specific influences on the analyte quantification. They are evaluated to determine if data require qualification due to excessive variation in acceptable internal standard quantitative or qualitative performance measures. For example, a decrease or increase in internal standard area counts for organics may reflect a change in sensitivity that can be attributed to the sample matrix. Because quantitative determination of analytes is based on the use of internal standards, evaluation is critical to the provision of reliable analytical results. Internal standards are used for organics analyses only.

GC/MS Instrument Performance Check (Tuning) – To verify instrument resolution, identification, and sensitivity. Applies to methods 8260B and 8270C.

ICP or Atomic Absorption QC - Duplicate injections and post-digestion spikes are evaluated to establish precision and accuracy of individual analytical determinations. Because of the nature of the furnace atomic absorption technique and because of the detailed decision tree and analysis scheme required for quantitation of the elements, evaluation of the QC is critical to ensuring reliable analytical results.

Calibration - The purpose of initial and continuing calibration verification analyses is to verify the linear dynamic range and stability of instrument response. Organic and inorganic method calibrations shall follow the method procedures as described in US EPA SW-846 1996. For organics analyses relative instrument response or linear regression is used to quantitate the analyte results. If the relative standard deviation of the average relative response factor (RF) of the initial calibration, or the percent difference between the initial calibration average RF and continuing calibration RF (for organics) is outside acceptable limits, the data quantification is uncertain and requires appropriate qualification. The laboratory is required to meet the minimum relative response factors as defined by the appropriate methods. For inorganics, initial and continuing calibration results for ICP analysis (one standard) must fall within 90-110%. For ICP analyses a standard at two times the PQL should be analyzed for each element of interest. For mercury (five standards and a blank to establish calibration curve), the results must fall within 80 to 120%, and for cyanide (five standards and a blank to establish calibration curve), the results must fall within 85 to 115%. For mercury and cyanide, the correlation coefficient must be greater than 0.995. If these requirements are not met, data must be qualified according to the Region 1 EPA Functional Guidelines.

ICP Interference Check Sample – These standards are analyzed to confirm the interelement and background correction factors.

ICP Serial Dilutions – Verifies the presence or absence of matrix related interferences in the ICP analyses.

Sample Reanalysis - When instrument performance-monitoring standards indicate that an analysis is out of control, the laboratory is required to reanalyze the sample. If the reanalysis does not solve the problem (i.e., surrogate compound recoveries are outside the limits for both analyses), the laboratory is required to submit data from both analyses. An independent review is required to determine which is the appropriate sample result.

Secondary Dilutions - When the concentration of any analyte in any sample exceeds the initial calibration range, a new aliquot of that sample must be diluted and reanalyzed. The laboratory is required to report data from both analyses. When this occurs, an independent review of the data is required to determine the appropriate results to be used for that sample. An evaluation of each analyte exceeding the calibration range must be made, including a review of the dilution analysis performed. Results chosen in this situation may be a combination of both the original results (i.e., analytes within initial calibration range) and the secondary dilution results.

Laboratory Case Narratives - Analytical laboratory case narratives are reviewed for specific information concerning the analytical process. This information is used to direct the data validator to potential problems with the data.

In addition, checks will be made of how results were obtained from the raw data protocols, to verify proper calculation and transcription of results. Data review will verify PQLs to be the same as those agreed upon in the QAPP.

The data validation will review field notes to confirm that correct sampling and excavation decisions were made based on screening and on-site testing data.

20.0 Data Usability/Reconciliation with Project Quality Objectives

The primary criterion for satisfying PQOs is to maximize the number of analyte PQLs that are below applicable cleanup action levels. This will give us confidence that we can detect contaminants of concern below the action levels. Screening levels for chemical contaminants of concern are taken from the MADEP Contingency Plan Method 2 S-1/GW-1/GW-2/GW-3 standards. If standard methods cannot produce PQLs that are less than screening levels, the methods may need to be modified or non-standard methods should be utilized if possible. Even using modified or substitute methods, there may be analytes with screening levels that fall between the PQL and MDL, or below the MDL. For these analytes, there will likely be negotiations with stakeholders and regulators to agree upon a satisfactory approach to test for these analytes.

Sample results will be grouped according to matrix and action level cleanup categories. All test results for samples within a given category will be compared to the appropriate action level. If the results are all below the action level, no further action will be required. If one or more results are above the action level, the mean and standard deviation of the sample grouping will be calculated and compared to the analogous background results. If the comparison, using an appropriate statistical technique, indicates that the two sample populations are indistinguishable, then no further action will be required. If the comparison indicates that the sample grouping is higher than the background population, then remedial action may be required.

The evaluation procedures that will be used to assess overall measurement error associated with the project are outlined in Worksheet #30.

21.0 References

- US Army Corps of Engineers (USACE), *Chemical Quality Assurance for HTRW Projects, EM200-1-6*, October 1997.
- US EPA, *Test Methods for Evaluating Solid Waste SW-846, Update III*, December 1997.
- MADEP, 1998a. *Method for the determination of Extractable Petroleum Hydrocarbons (EPH)*, January 1998.
- MADEP, 1998a. *Method for the determination of Volatile Petroleum Hydrocarbons (VPH)*, January 1998.
- *Region 1, EPA-New England Data Validation Functional Guidelines for Evaluating Environmental Analyses*, 12/96.
- *Region 1, Laboratory Data Validation Functional Guidelines for evaluating Inorganics Analyses,* 02/89.
- *Region 1, EPA-New England Compendium of Quality Assurance Project Plan Guidance 09/98.*

Worksheet #1

Document Title: Oxford Mill Site Quality Assurance Project Plan

Lead Organization (Agency, State, Tribe, Federal Facility, PRP, or Grantee): Massachusetts DEP, City of Lawrence

Preparer's Name and Organizational Affiliation: / Stone & Webster Inc.

Preparer's Address and Telephone Number: 100 Technology Drive, Stoughton, Ma 02072

Preparation Date (Day/Month/Year): March 26, 2001

Investigative Organization's Project Manager: Ronald Richards 4/30/01
Signature/Date
Ronald Richards Stone & Webster
Printed Name/Organization

Investigative Organization's Site Quality Manager:
Signature/Date

Printed Name/Organization

Lead Organization's Project Manager: Ronald Richards for Les Tyrala 4/30/01
Signature/Date
Ronald Richards for Les Tyrala
Printed Name/Organization

Approval Signature:
Signature/Date
See attached approval letter
Printed Name/Title

Approval Authority

Other Approval Signatures:
Signature/Date

Printed Name/Title

Document Control Number:

CONTROL COPY NO. 01

Site Name/Project Name: Oxford Paper Mill
Site Location: Lawrence, Ma
Site Number/Code: 3-2691
Operable Unit:
Contractor Name:
Contractor Number:
Contract Title:
Work Assignment Number:
Anticipated date of QAPP Implementation: Spring 2001

Title: Oxford Mill QAPP
Revision Number: 0
Revision Date: 03/26/01
Page 1 of 1

Worksheet #2

1. Guidance used to prepare QAPP: Region 1, EPA- New England Compendium of Quality Assurance Project Plan Guidance, October 1999 Final

2. Program: Site Closure-Massachusetts Department of Environmental Protection Hazardous Waste regulation's Chapter
310 CMR 40

3. Approval entity:
Massachusetts Department of Environmental Protection/ USEPA

4. The QAPP is a project-specific QAPP.

5. Dates of scoping meetings: 10/26/2000

6. Title of QAPP documents and approval dates written for previous site work, if applicable:
RAM Plan

7. Organizational partners (stakeholders) and connection with EPA and/or State:
Massachusetts Highway Department – constructing bridge on site and remediating a portion of the site

8. Data users: Massachusetts DEP; Massachusetts Highway Department, City of Lawrence, Stone & Webster Engineering (Investigation Organization), EPA

9. Omitted QAPP Elements (1-20), Worksheets and/or Required Information not applicable to the project, are circled on the attached Table. Provide an explanation for their exclusion is below:
Worksheet #7, #19, #22B, #23

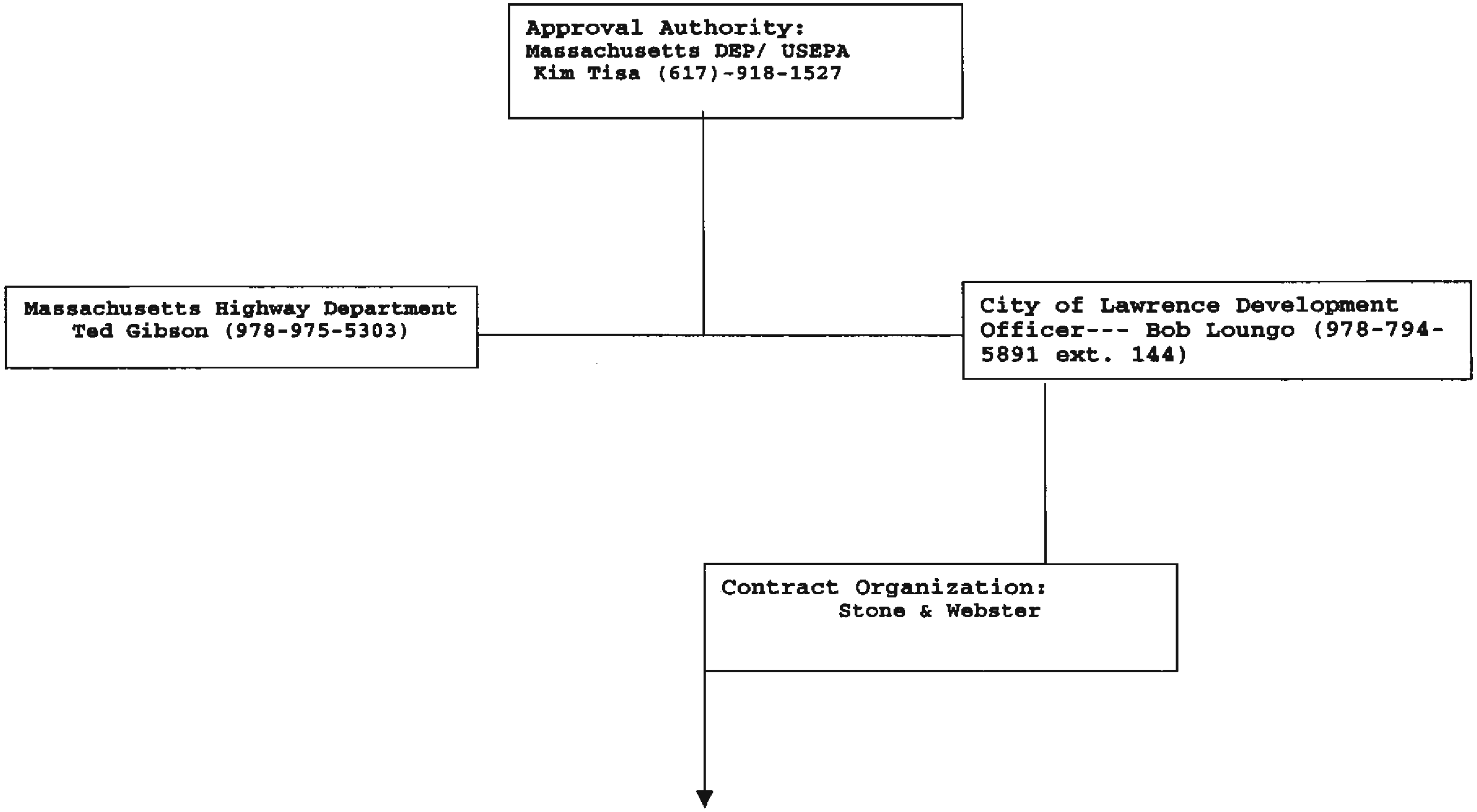
Worksheet #3-Distribution List

QAPP Recipients	Title	Organization	Telephone Number
Robert Luongo	Lawrence Gateway Project Director	City of Lawrence	978-794-5891 ext.: 144
Ann Roache	Hazardous Materials Specialist	Ma Highway Department	781-641-8321
Ron Richards	Project Manager	Stone & Webster Engineering	617-589-5499
Lester Tyrala	Program Manager	Stone & Webster Engineering	617-589-8028
Jim McComiskey	Site Manager	Stone & Webster Engineering	617-589-5810
Brain Tucker	QA Manager	Stone & Webster Engineering	617-589-1101
Mike Wheeler	Laboratory Manager	Severn Trent Laboratories	413-572-4000
Tim Lewis	Data Validator	Kestral	207-865-1256
Thomas Garside	Driller	New Hampshire Boring	603-437-1610
Scott Greene		Massachusetts DEP	978-661-7600
Kim Tisa	PCB Coordinator	USEPA, Office of Ecosystem Protection	617-918-1527
Allen Peterson	Quality Assurance Unit	USEPA, Office of Ecosystem Protection	TBD

Worksheet #4-Project Personnel Sign-Off Sheet

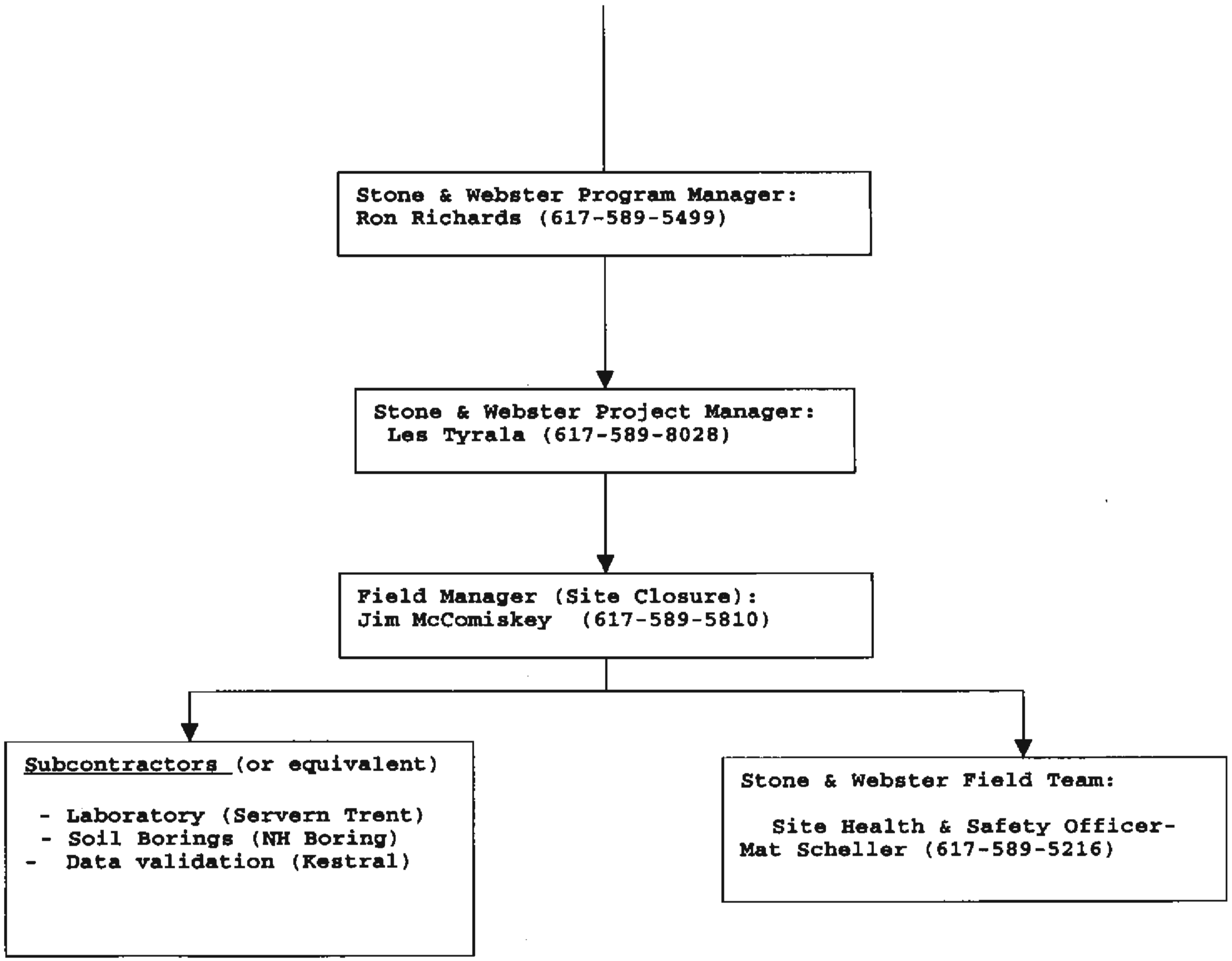
Project Personnel	Organization	Title	Telephone Number	Signature	Date QAPP Read	QAPP Acceptable as Written
Les Tyrala	Stone & Webster	Program Manager	617-589-8028			
Ronald Richards	Stone & Webster	Project Manager	617-589-5499			
Jim McComiskey	Stone & Webster	Field Manager	617-589-5810			
Brian Tucker	Stone & Webster	Project Chemist	617-589-1101			
Mat Scheller	Stone & Webster	Health & Safety Officer	617-589-5216			
Mike Wheeler	Severn Trent	Laboratory Manager	413-572-4000			
Robert Degaetano	Severn Trent	Laboratory QA/QC Manager	413-572-4000			
Tim Lewis	Kestral	Data Validator	207-865-1256			
TBD	NH Boring	Driller	TBD			

Worksheet #5a-Organizational Chart



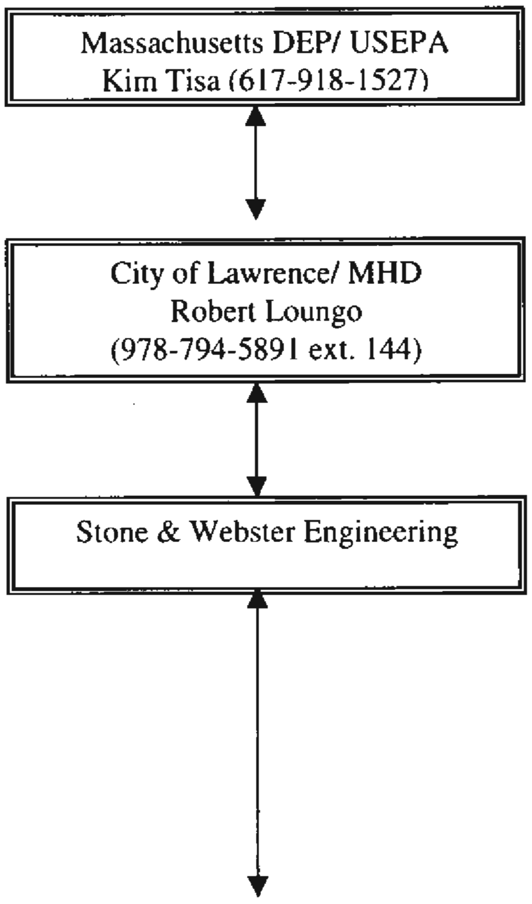
CONTROL COPY NO. 01

Organizational Chart Cont.



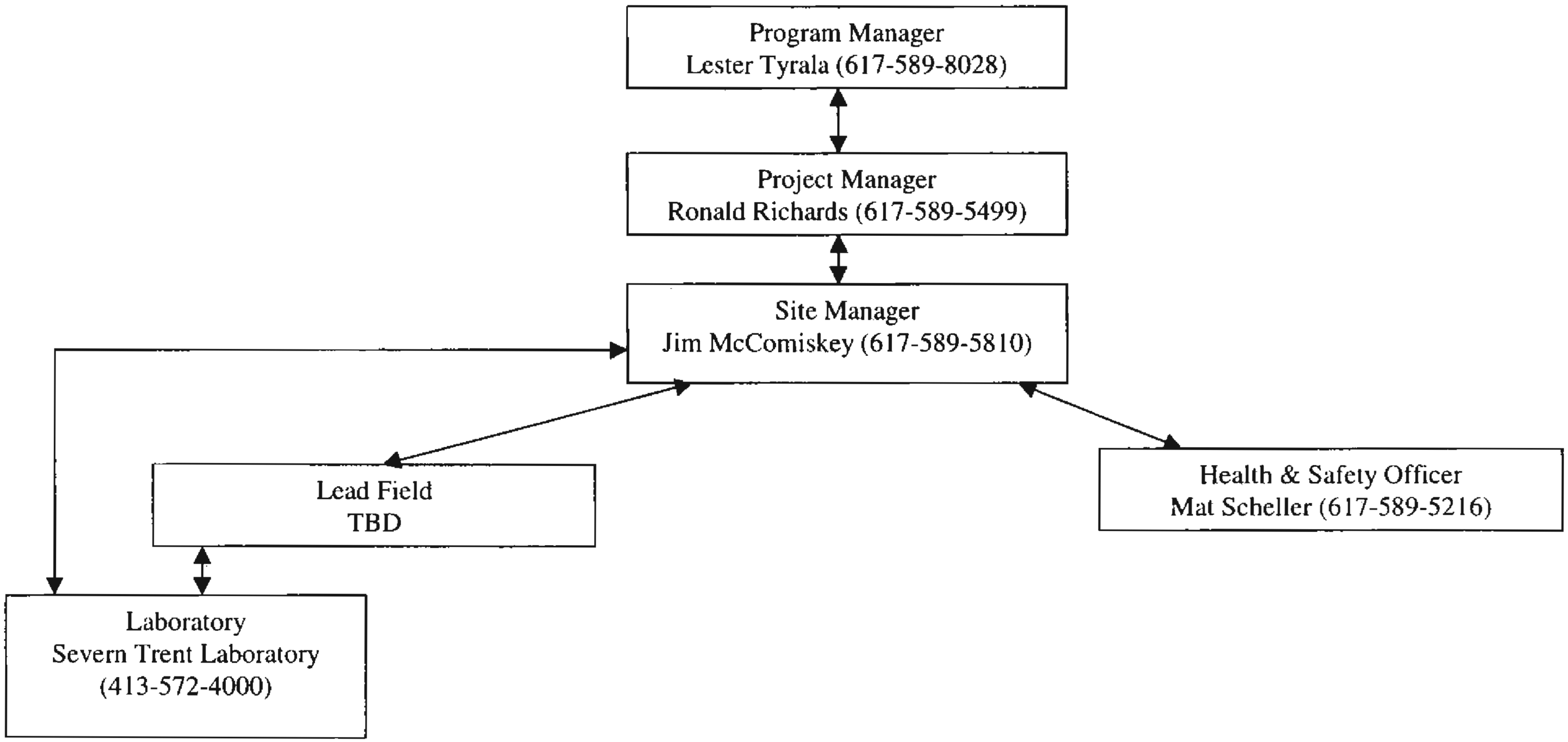
CONTROL COPY NO. 01

Worksheet #5b
Communication Pathways



CONTROL COPY NO. 01

Worksheet #5b
Communication Pathways Cont.



Worksheet #6
Personnel Responsibilities and Qualifications Table

Name	Title	Responsibilities	Organizational Affiliation	Location of Personnel Resumes, if not included	Education and Experience Qualifications
Les Tyrala	Program Manager	Overall manager for site closure program.	Stone & Webster	Stoughton, MA	BS, MS in Geology
Ron Richards	Project Manager	Coordinates and oversees project management for the site closure program. Reviews quality control during work and tracks schedule and budgets.	Stone & Webster	Stoughton, MA	BS, MS in Mechanical Engineering
Brain Tucker	QA Manager	Oversees project QA/QC activities performed by Stone & Webster and its subcontractors.	Stone & Webster	Stoughton, MA	PHD in Chemistry
Jim McComiskey	Field Manager	Direct responsibility for implementing the QAPP and SAP. Coordinates field effort and resources.	Stone & Webster	Stoughton, MA	BS in Engineering Technology

CONTROL COPY NO. 01

Name	Title	Responsibilities	Organizational Affiliation	Location of Personnel Resumes, if not included	Education and Experience Qualifications
Mat Scheller	Health & Safety	Directs health & safety program implementation for project.	Stone & Webster	Stoughton, MA	BS in Geology
Mike Weeler	Lab. Manager	Subcontractor for Stone & Webster. Manages analytical data quality.	Severn Trent Labs	Westfield, Ma	
Robert Degaetano	Lab. QA/QC	Oversees analytical QA/QC activities and identifies necessary corrective actions.	Severn Trent Labs	Westfield, Ma	
Tim Lewis	Data Validator	Subcontractor for Stone & Webster. Verification and validation analytical data.	Kestral	Freeport, Me	

CONTROL COPY NO. 01

Worksheet #8a
Project Scoping Meeting Attendance Sheet

Massachusetts DEP Regulation Program: Site closure	**Site Name**: Oxford Mill
Program (Brownfields, NPDES, etc.): N/A	**Site Location**: Lawrence, Massachusetts
Project Date(s) of Sampling: Spring 2001	**CERCLA Site/Spill Identifier No.**: N/A
Program Manager: Lester Tyrala	**Operable Unit**: N/A
	Other Site Number/Code: N/A
	Phase: ERA SA/SI Pre-RI RI (phase 1, etc.) FS RD RA post-RA (underline one)
	Other phase:

Date of Meeting: October 26, 2000
Meeting Location: Oxford Mill Site

Name	Project Role	Affiliation	Phone #	e-Mail Address
Bob Loungo	Chief Economic Development Officer	City of Lawrence	978-794-5891 ext. 144	r_luongo@cityof lawrence.com
Ed Fitzpatrick		Gencorp	978-683-7123	
Bob Devaney	Director of Environmental Engineering	Gencorp	978-683-7123	
Ann Roche	Hazardous Materials Specialist	Mass. Highway Dept.	781-641-8321	aroche@mediaone.net
Kim Tisa	PCB Coordinator	EPA	617-918-1527	
Ron Richards	Project Manager	Stone & Webster, Inc	617-589-5499	ronald.richards@stoneweb.com

Meeting Purpose: Scoping Meeting

CONTROL COPY NO. 01

Notes of Meeting
10/26/00

Present: Bob Luongo, Ed Fitzpatrick, Ann Roche, Kim Tisa, Ron Richards, Bob Devaney

The meeting started with Ann Roche reviewing the site activities with Kim Tisa – In general it was stated that it was planned to have Buildings 2, 3, 4, and 6 down for winter and continue with the silos and the remainder of the buildings next spring. The results of interior building sampling were reviewed. PCBs up to approximately 225 ppm have been detected. In addition, certain samples showed high levels of PAHs. Up to now all the material had been assumed to be contaminated and was being removed as PCB contaminated. MHD was evaluating the slab and sidewalls of Building 3 and the other buildings. Much discussion occurred on the extent of remediation and who was responsible. At the conclusion, it was determined that MHD would be responsible for all contamination down to the underlying soil of the basements (under the concrete) and they would chase the transformer contamination associated with Building #6. The City of Lawrence would be responsible for contaminated soil beneath the concrete in the basements.

A description of the site elevations was provided, concentrating on Building #3. The fact that the basement floor was about 13 feet below grade was pointed out. However, it was noted that the final grading in the area of the raceway would allow for somewhat less than 13 feet below grade. It was detailed that the plan was for sampling to start December 1st with the last of the buildings available Dec 15th. Subsequent construction activities would commence in March-April. *There was much discussion regarding the overhead clearance in Building #3 in particular. Since major portions of the building would still have the slab at grade in place, overhead clearance of 12-13 feet would be all that would be available for the sampling efforts.*

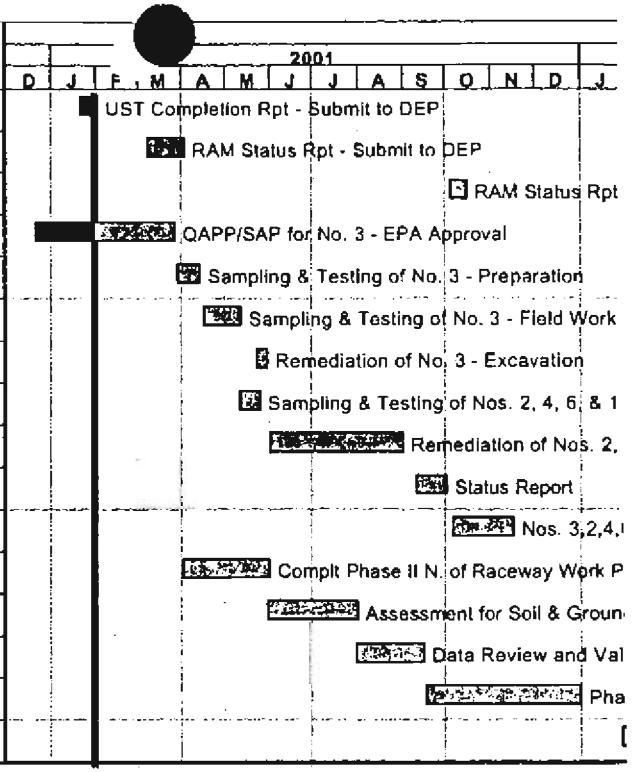
Then the site sampling plan was discussed. Ron Richards described that DEP in their comments on the RAM Plan did not appear to have a problem with the number of borings proposed, but rather commented on the need to define the depth of contamination. Based upon that, it was proposed that 16 borings be conducted for RCRA Metals, EPH/PAH (GC/MS) For PCBs it was proposed to sample with a 25' grid (utilizing the 16 borings described above). After much discussion, it was decided that a hybrid approach would be used with a starting point of the 25' grid. Known hot spots or visual contamination would be cause to focus sampling in an area. Additional discussion occurred with respect to EPA's request to sample the 0-6" level. It was agreed that the 0-2' level would typically be sampled, except where visual contamination was present or a known hot spot was located there, in which case a 0-6" sample would be taken for PCBs. The overall plan on depth of sampling is to continue until the MCP S-3/GW-3 limits are reached.

With the sampling outlined, the discussion focused on the sampling protocol. As a base, it was determined that a QAPP would be required, that the 0-2' screening would require Level III data validation, and that due to site interference's, field screening was probably not applicable. It was discussed that additional sampling may be able to be done with a field lab GC for the PAHs and PCBs sending just a portion to the off to the off-site lab for confirmation. Note that EPA would require copies of the chromatograph from the GC runs from the onsite lab.

At present, remediation goals will be the MCP S-3/GW-3 standards modified wherever direct contact is possible. When results of the site assessment are available, any additional assessment that may be required would be identified and the remediation requirements defined.

CONTROL COPY NO. 01

Activity Description	Orig Dur	Early Start	Early Finish
UST Completion Rpt - Submit to DEP	9*	22JAN01A	01FEB01
RAM Status Rpt - Submit to DEP	17	09MAR01*	02APR01
RAM Status Rpt - Submit to DEP	8	04OCT01*	15OCT01
QAPP/SAP for No. 3 - EPA Approval	68*	21DEC00A	26MAR01
Sampling & Testing of No. 3 - Preparation	12	29MAR01	13APR01
Sampling & Testing of No. 3 - Field Work	20	16APR01	11MAY01
Remediation of No. 3 - Excavation	6	23MAY01*	30MAY01
Sampling & Testing of Nos. 2, 4, 6, & 1	11	11MAY01*	25MAY01
Remediation of Nos. 2, 4, 6, & 1	66	01JUN01*	31AUG01
Status Report	16	10SEP01*	01OCT01
Nos. 3,2,4,6,1 RAM Compl. Rpt-Submit to DEP	31	05OCT01*	16NOV01
Complt Phase II N. of Raceway Work Plan-EPA	44	02APR01*	31MAY01
Assessment for Soil & Groundwater Sampling	43	31MAY01*	30JUL01
Data Review and Validation	35	30JUL01	14SEP01
Phase II Completion Rpt - EPA	77	17SEP01	01JAN02
GW Stdy & Prep of Comp. Phase II & III Rpt w/RAO	262	30JAN02*	30JAN03



Start Date	01DEC00
Finish Date	30JAN03
Data Date	30JAN01
Run Date	07FEB01 12:57

▨ Early Bar
■ Progress Bar

LAWRENCE GATEWAY PROJECT

S&W J.O. 08134

Worksheet #8b
Problem Definition/Site History and Background

[See section 5.2 in the QAPP]

CONTROL COPY NO. 01

Worksheet #9a
Project Description

Sampling Tasks: [Information described in text of QAPP and SAP]

Analysis Tasks:

Quality Control Tasks:

Secondary Data:

Data Management Tasks:

Documentation and Records:

Data Packages:

Assessment/Audit Tasks:

Data Verification and Validation Tasks:

Data Usability Assessment Tasks:

Worksheet #9b
Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Medium/ Matrix: Soil
Concentration Level: Low
PRGS: Industrial Soil (mg/kg)
Field Analytical or Fixed Laboratory Method/SOP[1]: SOP3, 10, or 11
Sampling Areas: Building #3

Analyte	CAS Number	Project Action Res, Soil Limit (mg/kg) (dry weight)	Project Quantitation Limit (mg/kg) (dry weight)	Analytical Method		Achievable Laboratory Limits	
				MDLs[2] (mg/kg)	Method QLs[2] (mg/kg)	MDLs[3] (mg/kg)	QLs[3] (mg/kg)
Antimony	7440-36-0	8.2E+02					
Arsenic	7440-38-2	3.9E-01					
Beryllium	7440-41-7	1.5E+02					
Cadmium	7440-43-9	3.7E+01					
Chromium	18540-29-9	3.0E+01					
Copper	744-50-8	2.9E+03					
Lead	7439-92-1	4.0E+02					
Mercury/ Method 7470,7471		-					
Nickel	7440-02-0	1.6E+03					
Selenium	7782-49-2	3.9E+02					
Zinc	7440-66-6	2.3E+04					

[1] Specify appropriate reference number/letter from the Field and Fixed Laboratory Analytical Method/SOP Reference Tables (EPA-NE QAPP Worksheets #17 and #20).
[2] Analytical method MDLs and QLs are documented in validated methods. QLs are usually 3-10 times higher than the MDLs.
[3] Achievable laboratory limit MDLs are generated by the laboratory. QLs are typically 3-10 times higher than the MDLs.

CONTROL COPY NO. 01

Worksheet #9b
Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Medium/ Matrix: Soil
Concentration Level: Low
PRGS: Industrial Soil (mg/kg)
Field Analytical or Fixed Laboratory Method/SOP[1]: SOP 4, 5, 10, 11
Sampling Areas: Buildings 1-6, 13, 1A, and 28

Analyte	CAS Number	Project Action Limit (mg/kg) (dry weight)	Project Quantitation Limit (mg/kg) (dry weight)	Analytical Method		Achievable Laboratory Limits	
				MDLs[2] (mg/kg)	Method QLs[2] (mg/kg)	MDLs[3] (mg/kg)	QLs[3] (mg/kg)
Acetone	64-67-1	1.6E+03					
Arsenic	7440-38-2	3.9E+01					
Benzene	71-43-2	6.7E-01					
Benzo(a) pyrene (cPAH)	50-32-8	6.2E-02					
Bis(2-ethylhexyl)phthalate	117-81-7	3.5E+01					
Beryllium	7440-50-8	1.5E+02					
Cadmium	7440-43-9	3.7E+01					
Vinyl Chloride	75-1-4	2.2E-02					
Carbon Disulfide	75-15-0	3.6E+02					
Vinyl Acetate	108-05-4	4.3E+02					
Chloroform	67-66-3	2.4E-01					

CONTROL COPY NO. 01

Worksheet #9b
Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (mg/kg) (dry weight)	Project Quantitation Limit (mg/kg) (dry weight)	Analytical Method		Achievable Laboratory Limits	
				MDLs^2 (mg/kg)	Method QLs^2 (mg/kg)	MDLs^3 (mg/kg)	QLs^3 (mg/kg)
Tetrahydrofuran	109-99-9	6.4E+01					
2-Nitropropane	79-46-9	-					
2-Chloroethylvinyl ether	110-75-8	-					
Toluene	108-88-3	5.2E+02					
Chromium (+6)	18540-29-9	3.0E+01					
Copper	7440-50-8	2.9E+03					
Lead	7439-92-1	4.0E+02					
Mercury	7439-97-6	-					
Methyl ethyl Ketone	78-93-3	7.3E+03					
Molybdenum	7439-98-7	3.9E+02					
Naphthalene (PAH)	91-203	5.6E+01					
Nickel	7440-2-0	1.6E+03					
PCBs	1336-36-3	2.2E-01					
Selenium	7782-49-2	3.9E+02					
Silver	7440-22-4	3.9E+02					
Zinc	7440-66-6	2.3E+04					

CONTROL COPY NO. 01

Worksheet #9b
Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (mg/kg) (dry weight)	Project Quantitation Limit (mg/kg) (dry weight)	Analytical Method		Achievable Laboratory Limits	
				MDLs[2] (mg/kg)	Method QLs[2] (mg/kg)	MDLs[3] (mg/kg)	QLs[3] (mg/kg)
Phenol	108-95-2	3.7E+04					
Bis(2-chloroethyl)ether	111-44-4	2.1E-01					
Fluorene	86-73-7	2.6E+03					
Phenanthrene	85-01-8						
Anthracene	120-12-7	2.2E+04					
Di-n-butylphthalate	84-74-2						
Fluoranthene	206-44-0	2.3E+03					
Pyrene	129-00-0	2.3E+03					
Benzo(a)anthracene	56-55-3	6.2E-01					
Chrysene	218-01-9	6.2E+01					
Benzo(b)fluoranthene	205-99-2	6.2E-01					
Benzo(k)fluoranthene	207-08-9	6.2E+00					
Indeno(1,2,3-cd)pyrene	193-39-5	6.2E-01					

[1] Specify appropriate reference number/letter from the Field and Fixed Laboratory Analytical Method/SOP Reference Tables (EPA-NE QAPP Worksheets #17 and #20).

[2] Analytical method MDLs and QLs documented in validated methods. QLs are usually 3-10 times higher than the MDLs.

[3] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

CONTROL COPY NO. 01

Worksheet#9c
Field and Quality Control Sample Summary Table

Medium/ Matrix	Analytical Parameter	Conc. Level	Analytical Method/ SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	Organic		Inorganic		No. of Trip Blanks	No. of Bottle Blanks	No. of Equip. Blanks	No. of PE Samples	Total No. of Samples to Lab
						No. of MS	No. of MSD	No. of Duplicates	No. of MS					
Soil														
Buildings 1-6, 1a, 13, and 28	RCRA 8 +Zn and Be	Low	SOP 4 and 5	74	1	1	1	1	1	1 per cooler of VOCs	1	1	1	TBD
	Selected VOCs	Low	SOP 4 and 5	74	1	1	1	N/A	N/A	1/cooler	1	1	1	TBD
	Pesticides	Low	SOP 4 and 5	74	1	1	1	N/A	N/A	N/A	1	1	1	TBD
	PAH's	Low	SOP 4 and 5	74	1	1	1	N/A	N/A	N/A	1	1	1	TBD
	PCBs	Low	SOP 4 and 5	74	1	1	1	N/A	N/A	N/A	1	1	1	TBD

CONTROL COPY NO. 01

Worksheet #9d
Analytical Services Table

Medium/ Matrix	Analytical Parameter	Concentration Level	Analytical Method/SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address: Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address: Contact Person and Telephone Number)
Soil	Selected VOCs	Low	EPA Method 8260B Preparation Method 5035 SOP 10 and 11	24-72 Hours	Severn Trent Laboratory Mike Wheeler: 413-572-4000	TBD
Soil	PCBs	Low	EPA Method 8082 Preparation Method 3550C SOP 10 and 11	24-72 Hours	Severn Trent Laboratory Mike Wheeler: 413-572-4000	TBD
Soil	PAH's	Low	3350C/ 8100 SOP 10 and 11	24-72 Hours	Severn Trent Laboratory Mike Wheeler: 413-572-4000	TBD
Soil	Pesticides	Low	8081A SOP 10 and 11	24-72 Hours	Severn Trent Laboratory Mike Wheeler: 413-572-4000	TBD
Soil	RCRA 8 + Zn and Be	Low	6010B SOP 10 and 11	24-72 Hours	Severn Trent Laboratory Mike Wheeler: 413-572-4000	TBD

Worksheet #10
Project Schedule Timeline Table

Activities	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
	Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Buildings 1-6 13, 1a, and 28 sample Collection/ Laboratory Analysis	April 2001	2004	See QAPP Section 15.0	
Data Validation			Data Validation Report	
Final Project Report			Final Project Report	

** See attached for the tentative project schedule

CONTROL COPY NO. 01

Worksheet #11a
Projection Quality Objectives/Decision Statements

[Information described in the text of the QAPP]

Worksheet #11b
Measurement Performance Criteria Table

Medium/Matrix	Soil
Analytical Parameter	PCBs
Concentration Level	Low

Sampling Procedure	**Analytical Method/SOP**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
SOP 4 and 5	8082	Precision	Duplicate % DIFF (see 22a), % DIFF between MS and MSD % recoveries	Duplicates, MS/MSD	S+A
		Completeness	90%	NA	NA
		Sensitivity	PQLs ≤ action levels	NA	NA
		Accuracy	% Recovery Limits (see 24a) Surrogate spike RL % (see 24a)	Blank Spikes, MS/MSD	S+A
		Accuracy	Contamination level in blanks	Blanks	S+A

Worksheet #11b
Measurement Performance Criteria Table

Medium/Matrix	Soil
Analytical Parameter	Selected VOC's
Concentration Level	Low

Sampling Procedure	**Analytical Method/SOP**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
SOP 4 and 5	8260B	Precision	Duplicate % DIFF (see 22a), % DIFF between MS and MSD % recoveries	Duplicates, MS/MSD	S+A
		Completeness	90%	NA	NA
		Sensitivity	PQLs ≤ action levels	NA	NA
		Accuracy	% Recovery Limits (see 24a) Surrogate spike RL % (see 24a)	Blank Spikes, MS/MSD	S+A
		Accuracy	Contamination level in blanks	Blanks	S+A

CONTROL COPY NO. 01

Worksheet #11b
Measurement Performance Criteria Table

Medium/Matrix	Soil
Analytical Parameter	PAH
Concentration Level	Low

Sampling Procedure	**Analytical Method/SOP**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
SOP 4 and 5	8100	Precision	Duplicate % DIFF (see 22a), % DIFF between MS and MSD % recoveries	Duplicates, MS/MSD	S+A
		Completeness	90%	NA	NA
		Sensitivity	PQLs ≤ action levels	NA	NA
		Accuracy	% Recovery Limits (see 24a) Surrogate spike RL % (see 24a)	Blank Spikes, MS/MSD	S+A
		Accuracy	Contamination level in blanks	Blanks	S+A

CONTROL COPY NO. 01

Worksheet #11b
Measurement Performance Criteria Table

Medium/Matrix	Soil
Analytical Parameter	RCRA 8 + Zn and Be
Concentration Level	Low

Sampling Procedure	**Analytical Method/SOP**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
SOP 4 and 5	6010B, 7471	Precision	Duplicate % DIFF (see 22a), % DIFF between MS and MSD % recoveries	Duplicates, MS/MSD	S+A
		Completeness	90%	NA	NA
		Sensitivity	PQLs ≤ action levels	NA	NA
		Accuracy	% Recovery Limits (see 24a) Surrogate spike RL % (see 24a)	Blank Spikes, MS/MSD	S+A
		Accuracy	Contamination level in blanks	Blanks	S+A

CONTROL COPY NO. 01

Worksheet #11b
Measurement Performance Criteria Table

Medium/Matrix	Soil
Analytical Parameter	Pesticides
Concentration Level	Low

Sampling Procedure	**Analytical Method/SOP**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
SOP 4 and 5	8081A	Precision	Duplicate % DIFF (see 22a), % DIFF between MS and MSD % recoveries	Duplicates, MS/MSD	S+A
		Completeness	90%	NA	NA
		Sensitivity	PQLs ≤ action levels	NA	NA
		Accuracy	% Recovery Limits (see 24a) Surrogate spike RL % (see 24a)	Blank Spikes, MS/MSD	S+A
		Accuracy	Contamination level in blanks	Blanks	S+A

CONTROL COPY NO. 01

Worksheet #12a
Sampling Design and Rationale

[Information described in text of the QAPP and SAP]

Worksheet#12b
Sampling Locations, Sampling and Analysis Method/SOP Requirements Table

Sampling Location	Location ID Number	Medium/ Matrix	Depth (Units)	Analytical Parameter	Conc. Level	No. of Samples (Identify field duplicates and replicates)	Sampling SOP	Analytical Method/SOP	Sample Volume	Containers (Number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis) in days, unless specified
Buildings 1-6, 13, 1a, and 28		Soil		PAH	Low		SOP 4 SOP 5	8100	4 oz.	4oz. Glass Jar	4°C	7 days
		Soil		RCRA 8 + Zn and Be	Low		SOP 4 SOP 5	6010B, 7471	8 oz. Plus Encores	8 oz. Glass jar + 2 Encores	4°C	Metals – 6 months Mercury – 28 days
		Soil		Pesticides	Low		SOP 4 SOP 5	8081A	8 oz.	8 oz	4°C	14 days
		Soil		Selected VOCs	Low		SOP 4 SOP 5	8260B	Encores	2 Encore samplers	4°C	14 days
		Soil		PCBs	Low		SOP 4 SOP 5	EPA 8082	1-Glass Jar	1-8oz. Glass Jar	4°C	14 days

CONTROL COPY NO. 01

Worksheet #13
Project Sampling SOP Reference Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Identification	Modified for Project Work Y or N	Comments
SOP 1	Onsite Air Monitoring	Stone & Webster Inc.		N	
SOP 2	Onsite Analytical Screening	Stone & Webster Inc.		N	
SOP 3	Field Notebook Content and Control	Stone & Webster Inc.		N	
SOP 4	Surface and Shallow Subsurface Soil Sampling	Stone & Webster Inc.		N	
SOP 5	Geoprobe Soil Sampling Survey	Stone & Webster Inc.		N	
SOP 6	Equipment Decontamination	Stone & Webster Inc.		N	
SOP 7	Cutting and Fluids Management	Stone & Webster Inc.		N	
SOP 8	Labeling, Packing, and shipping Environmental Samples	Stone & Webster Inc.		N	
SOP 9	Personal Protection Equipment	Stone & Webster Inc.		N	
SOP 10	Severn Trent Fixed Laboratory SOPs	Severn Trent Laboratory		N	
SOP 11	Severn Trent Mobile Laboratory SOPs	Severn Trent Laboratory		N	

CONTROL COPY NO. 01

Worksheet #14
Field Sampling Equipment Calibration Table

Equipment	Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Photoionization Detector (PID) Mini RAE	Calibrate using Isobutylene to the benzene equivalent response Factor	Daily	< 10 ppm	Perform maintenance as suggested in the equipment operation manual	Jim McComiskey	SOP 2
LEL meter	Manufacturers Specifications	Daily	~25% of LEL	Perform maintenance as suggested in the equipment operation manual	Jim McComiskey	SOP2
Carcinogenic PAHs RaPID Assay	Manufacturers Specifications	Daily	Provide results to lab if sample is to be analyzed	Perform maintenance as suggested in the equipment operation manual	Jim McComiskey	SOP2
PCB RaPID Assay	Manufacturers Specifications	Daily	Provide results to lab if sample is to be analyzed	Perform maintenance as suggested in the equipment operation manual	Jim McComiskey	SOP2

CONTROL COPY NO. 01

Worksheet #15
Field Equipment Maintenance, Testing and Inspection Table

Sampling Equipment/ Instrument	Maintenance Activity	Testing Activity	Inspection Activity	Responsible Person	Frequency	Acceptance Criteria	Corrective Action	SOP Reference*
Air Monitoring	As suggested by the Manufacturer			Jim McComiskey	4x per day		recalibrate	SOP 2
Analytical Screening	As suggested by the Manufacturer			Jim McComiskey	Each Sample		recalibrate	SOP3

Worksheet #16
Sample Handling System

SAMPLE COLLECTION, PACKAGING AND SHIPMENT		
Sample Collection: Stone & Webster Engineering		
Sample Packing: Stone & Webster Engineering		
Coordination of Shipment: Stone & Webster Engineering		
Type of Shipment (Courier):Overnight, Federal Express/ Courier		
SAMPLE RECEIPT AND ANALYSIS		
Responsible Organization:	Onsite: Severn Trent Mobile Laboratory	Offsite: Severn Trent Laboratory Westfield
Sample Receipt:	Onsite: Severn Trent Mobile Laboratory	Offsite: Severn Trent Laboratory Westfield
Sample Custody and Storage:	Onsite: Severn Trent Mobile Laboratory	Offsite: Severn Trent Laboratory Westfield
Sample Preparation:	Onsite: Severn Trent Mobile Laboratory	Offsite: Severn Trent Laboratory Westfield
Sample Determinative Analysis:	Onsite: Severn Trent Mobile Laboratory	Offsite: Severn Trent Laboratory Westfield
SAMPLE ARCHIVAL		
Field Sample Storage (No. of days from sample collection): 40 days		
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 40 days		
SAMPLE DISPOSAL		
Responsible Organization: Severn Trent Laboratory		
Responsible Personnel:		

CONTROL COPY NO. 01

Worksheet #17
Field Analytical Method/SOP Reference Table

Reference Number	Title, Revision Date and/or Number	Definitive or Screening Data	Region I NESTS Method Code	Originating Organization	Analytical Parameter	Instrument	Organization Performing Field Analysis	Modified for Project Work Y or N
SOP 1	Onsite Air Monitoring	Definitive	N/A	Stone & Webster Engineering	Oxygen/LEL	LEL Meter	Stone & Webster Inc.	N
					Organic Vapors	Mini Rae		
SOP 2	Onsite Analytical Screening	Screening	N/A	Stone & Webster Engineering	Organic Vapors	Mini Rae PID	Stone & Webster Inc.	N

CONTROL COPY NO. 01

Worksheet #18
Field Analytical Instrument Calibration Table

Instrument	Activity	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	Method/SOP Reference*
Oxygen/LEL Meter	As specified	Manufactures Specifications	~25% of LEL	As suggested by the manufacturer	Jim McComiskey	SOP 2
Carcinogenic PAHs RaPID Assay	As specified	Manufactures Specifications	Provide results to lab if samples are to be analyzed	As suggested by the manufacturer	Jim McComiskey	SOP 2
PCB RaPID Assay	As specified	Manufactures Specifications	Provide results to lab if samples are to be analyzed	As suggested by the manufacturer	Jim McComiskey	SOP 2
Mini RAE	As specified	Manufactures Specifications	~10 ppm	As suggested by the manufacturer	Jim McComiskey	SOP 2

Worksheet #20
Fixed Laboratory Analytical Method/SOP Reference Table[1]

Reference Number[2]	Fixed Laboratory Performing Analysis	Title, Revision Date and/or Number	Definitive or Screening Data	Region I NESTS Method Code*	Analytical Parameter	Instrument	Modified for Project Work Y or N
GCS00200.MA	STL Westfield	Test Method for Determination of PCBs in Aqueous and Soil Samples using EPA Method 8082A	Definitive	8082A	PCB	GC	N
MSS00200.MA	STL Westfield	Test Method for Determination of Semi Volatile Organics in Aqueous and Soil Samples using EPA Method 8270C	Definitive	8270C	PAH	GC/MS	N
MES00200.MA	STL Westfield	Test Method for Determination of Metals in Aqueous and Soil Samples using EPA Method 6010B	Definitive	6010B	Metals	ICP	N

CONTROL COPY NO. 01

Worksheet #20
Mobile Laboratory Analytical Method/SOP Reference Table[1]

Reference Number[2]	Mobile Laboratory Performing Analysis	Title, Revision Date and/or Number	Definitive or Screening Data	Region 1 NESTS Method Code*	Analytical Parameter	Instrument	Modified for Project Work Y or N
06-019	STL On-Site Technologies	Operating Procedure for Metals Analysis using Spectrace 9000 XRF, 8/31/95	Screening		Pb	XRF	N
OSS00905.MA	STL On-Site Technologies	Field Screening Analysis of Low-Level PCB's in Soil and Sediment, 03/10/00	Screening		PCB	GC	N
06-026	STL On-Site Technologies	Field Analysis for Polyaromatic Hydrocarbons (PAHs) by Gas Chromatography, EPA SW-846 Method 8015, 04/09/97	Screening		PAH	GC/FID	N

CONTROL COPY NO. 01

Worksheet #21
Fixed Laboratory Instrument Maintenance and Calibration Table[1]

Instrument	Activity	List Maintenance, Testing and Inspection Activities	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	Method/SOP Reference*
GC	PCB	Check connection, replace disposables, bake out instrument, recondition column, and perform leak test	IC-instrument receipt, major instrument change, when CC does not meet criteria	See Section 7.4 of SW-846 Method 8082B	If method criteria is not satisfied then the instrument must be re-calibrated.	Supervisor and Analyst, Steve Hartman and Sandra Mateega	GCS00200.MA SOP 10
			CC-at beginning of each 12 hr shift, daily before use	See Section 7.5 of SW-846 Method 8082B			
ICP	Metals	Check connection, replace Disposables, check the torch, check gas supply, check instrument profile	IC-instrument receipt, Daily, and when CCV fails. CCV after every ten samples	See Section 7.3 and 7.4 of SW-846 Method 6010B. For CC see Section 7.4 of SW846 6010B	If method criteria is not satisfied then the instrument must be re-calibrated	Supervisor and Analyst, Brian Geddes and Kristen Shrout	MES00200.MA SOP 10

CONTROL COPY NO. 01

Worksheet #21
Fixed Laboratory Instrument Maintenance and Calibration Table[1]

Instrument	Activity	List Maintenance, Testing and Inspection Activities	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	Method/SOP Reference*
GC/MS	PAH	Check connection, replace disposables, bake out instrument, recondition column, and perform leak test	IC-instrument receipt, major instrument change, when CC does not meet criteria CC-at beginning of each 12 hr shift, daily before use	See Section 7.3 of SW-846 Method 8720C. For CC see Section 7.4 of SW846 8270C	If method criteria is not satisfied then the instrument must be re-calibrated	Supervisor and Analyst, Steve Hartman and Sandra Mateega	MSS00200.MA SOP 10

Worksheet #21
Mobile Laboratory Instrument Maintenance and Calibration Table[1]

Instrument	Activity	List Maintenance, Testing and Inspection Activities	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	Method/SOP Reference*
HP GC ECD	PCB's	S/A Radiation Leak Test Clip Columns Change Septa Bake out Change Injector sleeve	IC-Instrument receipt Major instrument change When CC fails	R ≥ 0.990 5 point curve	Remake Standards, re-analyze	Analyst	STL SOP OSS00905.MA
			CC-Start of each day Every 10 samples Close of each day	Aroclors 80-120% Surrogates 60-140%			
HP GC FID	PAH's	Clip Columns Change Septa Change injector sleeve H2 leak test	IC-Instrument receipt Major instrument change When CC fails	R ≥ 0.995 3-5 point curve	Remake Standards, re-analyze	Analyst	STL SOP 06-026
			CC-Start of each day Every 10 samples Close of each day	PAH's ± 15% Surrogates 50-150%			
Spectrace 9000 XRF	Metals (Pb)	S/A Radiation Leak Test Clean XRF window	7x check every 10 days	80-120%	Check Fe response check Check Analytical Background check	Analyst	STL SOP 06-019

CONTROL COPY NO. 01

Worksheet #22a
Field Sampling QC Table

Sampling SOP*	SOP 4 and 5
Medium/Matrix	Soil
Analytical Parameter[1]	Selected VOC
Concentration Level	Low
Analytical Method/SOP Reference	8260B
Sampler's Name	
Field Sampling Organization	Stone & Webster
No. of Sample Locations	

Field QC:	**Frequency/Number**	**Method/SOP QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria[3]**
Equipment Blanks/ Rinsate Blanks	1/10 Samples or daily, whichever is more frequent	No target compounds≥ QL	Reclean, retest, and/or qualify data	Stone and Webster Inc.	Accuracy/bias-Contamination	No target compounds≥ QL
Bottle Blanks	1/Lot	No target compounds≥ QL	qualify data, use different lot	Severn Trent Laboratory	Accuracy/bias-Contamination	No target compounds≥ QL
Trip Blanks	1 per Cooler	No target compounds≥ QL	Reclean, retest, and/or qualify data	Severn Trent Laboratory	Accuracy/bias-Contamination	No target compounds≥ QL
Cooler Temperature Blanks	1 per Cooler	4°C. ±2°C	Modify Packing of Cooler	Stone and Webster Inc.	Accuracy/bias-Contamination	4°C. ±2°C

CONTROL COPY NO. 01

Field Sampling QC Table Cont.

Field QC:	Frequency/Number	Method/SOP QC Acceptance Limits[2]	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria[3]
Field Duplicate Pairs (Duplicate Subsamples)	1/10		Assess laboratory precision and resample and/or qualify data	Field Sample and data validator	Precision	RPD ≤50% when VOC detects for both field duplicates are ≥ QL
Collocated Samples	N/A	N/A	N/A	N/A	N/A	N/A
Field Splits	N/A	N/A	N/A	N/A	N/A	N/A
PES sent to Laboratory	1	No false negatives, no false positives, all target compounds within quantitative warning limits	Qualify data and direct laboratory to investigate problem	Data validator and laboratory QA/QC Manager	Accuracy/bias	No false negatives, no false positives, all target compounds within quantitative warning limits
Other:__________						

***Specify appropriate reference number/letter from the Project Sampling SOP Reference Table (EPA-NE QAPP Worksheet #13), Field Analytical Method/SOP Reference Table (EPA-NE QAPP Worksheet #17), and Fixed Laboratory Method/SOP Reference Table (EPA-NE QAPP Worksheet #20).**

Worksheet #22a
Field Sampling QC Table

Sampling SOP*	SOP 4 and 5					
Medium/Matrix	Soil					
Analytical Parameter[1]	PAH's					
Concentration Level	Low					
Analytical Method/SOP Reference	8270					
Sampler's Name						
Field Sampling Organization	Stone & Webster					
No. of Sample Locations						
Field QC:	**Frequency/Number**	**Method/SOP QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria[3]**
Equipment Blanks/ Rinsate Blanks	1/10 Samples or daily, whichever is more frequent	No target compounds≥ QL QL= 1µg/L	Reclean, retest, and/or qualify data	Stone and Webster Inc.	Accuracy/bias-Contamination	No target compounds≥ QL
Bottle Blanks	1/Lot	No target compounds≥ QL	Reclean, retest, and/or qualify data	Severn Trent Laboratory	Accuracy/bias-Contamination	No target compounds≥ QL
Cooler Temperature Blanks	1 per Cooler	4°C. ±2°C	qualify data, modify packing of cooler	Stone and Webster Inc.	Accuracy/bias-Contamination	4°C. ±2°C

CONTROL COPY NO. 01

Field Sampling QC Table Cont.

Field Duplicate Pairs (Duplicate Subsamples)	1		Assess laboratory precision and resample and/or qualify data		Precision	RPD ≤50% when SVOC Detects for both field Duplicates are ≥ QL
Collocated Samples	N/A	N/A	N/A	N/A	N/A	N/A
Field Splits	N/A	N/A	N/A	N/A	N/A	N/A
PES sent to Laboratory	1	No false negatives, no false positives, all target compounds within quantitative warning limits	Qualify data and direct laboratory to investigate problem		Accuracy/bias	No false negatives, no false Positives, all target Compounds within Quantitative warning limits
Other:__________						

***Specify appropriate reference number/letter from the Project Sampling SOP Reference Table (EPA-NE QAPP Worksheet #13), Field Analytical Method/SOP Reference Table (EPA-NE QAPP Worksheet #17), and Fixed Laboratory Method/SOP Reference Table (EPA-NE QAPP Worksheet #20).**

CONTROL COPY NO. 01

Worksheet #22a
Field Sampling QC Table

Sampling SOP*	SOP 4 and 5
Medium/Matrix	Soil
Analytical Parameter[1]	PCBs
Concentration Level	Low
Analytical Method/SOP Reference	8082
Sampler's Name	
Field Sampling Organization	Stone & Webster
No. of Sample Locations	

Field QC:	**Frequency/Number**	**Method/SOP QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria[3]**
Equipment Blanks/ Rinsate Blanks	1/10 Samples or daily, whichever is more frequent	No target compounds≥ QL QL= 1μg/L	Reclean, retest, and/or qualify data	Stone and Webster Inc.	Accuracy/bias-Contamination	No target compounds≥ QL
Bottle Blanks	1/Lot	No target compounds≥ QL	Reclean, retest, and/or qualify data	Severn Trent Laboratory	Accuracy/bias-Contamination	No target compounds≥ QL
Cooler Temperature Blanks	1 per Cooler	4°C. ±2°C	qualify data, modify packing of cooler	Stone and Webster Inc.	Accuracy/bias-Contamination	4°C. ±2°C

Field Sampling QC Table Cont.

Field Duplicate Pairs (Duplicate Subsamples)	I		Assess laboratory precision and resample and/or qualify data	Field Sample and data validator	Precision	RPD ≤50% when PCB Detects for both field Duplicates are ≥ QL
Collocated Samples	N/A	N/A	N/A	N/A	N/A	N/A
Field Splits	N/A	N/A	N/A	N/A	N/A	N/A
PES sent to Laboratory	N/A	No false negatives, no false positives, all target compounds within quantitative warning limits	Qualify data and direct laboratory to investigate problem	Data validator and laboratory QA/QC Manager	Accuracy/bias	No false negatives, no false positives, all target compounds within quantitative warning limits
Other:__________						

***Specify appropriate reference number/letter from the Project Sampling SOP Reference Table (EPA-NE QAPP Worksheet #13), Field Analytical Method/SOP Reference Table (EPA-NE QAPP Worksheet #17), and Fixed Laboratory Method/SOP Reference Table (EPA-NE QAPP Worksheet #20).**

CONTROL COPY NO. 01

Worksheet #22a
Field Sampling QC Table

Sampling SOP*	SOP 4 and 5
Medium/Matrix	Soil
Analytical Parameter[1]	RCRA 8 + Zn & Be
Concentration Level	Low
Analytical Method/SOP Reference	6010B/7471A
Sampler's Name	
Field Sampling Organization	Stone & Webster
No. of Sample Locations	

Field QC:	**Frequency/Number**	**Method/SOP QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria[3]**
Equipment Blanks/ Rinsate Blanks	1/10 Samples or daily, whichever is more frequent	No target compounds≥ QL QL= 1µg/L	Reclean, retest, and/or qualify data	Stone and Webster Inc.	Accuracy/bias-Contamination	No target compounds≥ QL
Bottle Blanks	1/Lot	No target compounds≥ QL	Reclean, retest, and/or qualify data	Severn Trent Laboratory	Accuracy/bias-Contamination	No target compounds≥ QL
Cooler Temperature Blanks	1 per Cooler	4°C. ±2°C	qualify data, modify packing of cooler	Stone and Webster Inc.	Accuracy/bias-Contamination	4°C. ±2°C

Field Sampling QC Table Cont.

Field Duplicate Pairs (Duplicate Subsamples)	1		Assess laboratory precision and resample and/or qualify data	Field Sample and data validator	Precision	RPD ≤30% when VOC detects for both field duplicates are ≥ QL RPD ≤40% when gaseous VOC detects for both field duplicates are≥ QL
Collocated Samples	N/A	N/A	N/A	N/A	N/A	N/A
Field Splits	N/A	N/A	N/A	N/A	N/A	N/A
PES sent to Laboratory	1	No false negatives, no false positives, all target compounds within quantitative warning limits	Qualify data and direct laboratory to investigate problem	Data validator and laboratory QA/QC Manager	Accuracy/bias	No false negatives, no false positives, all target compounds within quantitative warning limits
Other:__________						

***Specify appropriate reference number/letter from the Project Sampling SOP Reference Table (EPA-NE QAPP Worksheet #13), Field Analytical Method/SOP Reference Table (EPA-NE QAPP Worksheet #17), and Fixed Laboratory Method/SOP Reference Table (EPA-NE QAPP Worksheet #20).**

Worksheet #22a
Field Sampling QC Table

Sampling SOP*	SOP 4 and 5					
Medium/Matrix	Soil					
Analytical Parameter[1]	Pesticides					
Concentration Level	Low					
Analytical Method/SOP Reference	8081A					
Sampler's Name						
Field Sampling Organization	Stone & Webster					
No. of Sample Locations						
Field QC:	**Frequency/Number**	**Method/SOP QC Acceptance Limits**[2]	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**[3]
Equipment Blanks/ Rinsate Blanks	1/10 Samples or daily, whichever is more frequent	No target compounds≥ QL QL= 1µg/L	Reclean, retest, and/or qualify data	Stone and Webster Inc.	Accuracy/bias-Contamination	No target compounds≥ QL
Bottle Blanks	1/Lot	No target compounds≥ QL	Reclean, retest, and/or qualify data	Severn Trent Laboratory	Accuracy/bias-Contamination	No target compounds≥ QL
Cooler Temperature Blanks	1 per Cooler	4°C, ±2°C	qualify data, modify packing of cooler	Stone and Webster Inc.	Accuracy/bias-Contamination	4°C, ±2°C

CONTROL COPY NO. 01

Field Sampling QC Table Cont.

Field Duplicate Pairs (Duplicate Subsamples)	1		Assess laboratory precision and resample and/or qualify data	Field Sample and data validator	Precision	RPD ≤30% when VOC detects for both field duplicates are ≥ QL RPD ≤40% when gaseous VOC detects for both field duplicates are≥ QL
Collocated Samples	N/A	N/A	N/A	N/A	N/A	N/A
Field Splits	N/A	N/A	N/A	N/A	N/A	N/A
PES sent to Laboratory	1	No false negatives, no false positives, all target compounds within quantitative warning limits	Qualify data and direct laboratory to investigate problem	Data validator and laboratory QA/QC Manager	Accuracy/bias	No false negatives, no false positives, all target compounds within quantitative warning limits
Other:__________						

***Specify appropriate reference number/letter from the Project Sampling SOP Reference Table (EPA-NE QAPP Worksheet #13), Field Analytical Method/SOP Reference Table (EPA-NE QAPP Worksheet #17), and Fixed Laboratory Method/SOP Reference Table (EPA-NE QAPP Worksheet #20).**

Worksheet #24a
Fixed Laboratory Analytical QC Sample Table

Medium/Matrix	
Sampling SOP	
Analytical Parameter[1]	ICP Metals
Concentration Level	
Analytical Method/ SOP Reference*	
Laboratory Name	STL Westfield
No. of Sample Locations	

Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria[3]**
Method Blank	1/20 or one per batch; whichever is more frequent	½ the reporting limit	If out re-digest the batch	Analyst	contamination	
Reagent Blank	1/20 or one per batch; whichever is more frequent	½ the reporting limit	Check Reagents, re-digest	Analyst	contamination	
Storage Blank	NA					
Instrument Blank	NA					
Laboratory Duplicate	1/20 or one per batch; whichever is more frequent	RPD ≤ 20	Reanalyze, if still out report in case narrative	Analyst	Precision	
Matrix Spike	1/20 or one per batch; whichever is more frequent	% recovery 75-125	Evaluate LCS and MSD. Perform PDS or serial dilution as appropriate	Analyst	Accuracy, matrix	
Matrix Spike Duplicates	1/20 or one per batch; whichever is more frequent	% recovery 75-125, RPD ≤ 20	See above	Analyst	Accuracy/Precision	
LCS	1/20 or one per batch; whichever is more frequent	% recovery 85-115	Reanalyze, if still out bacth should be re-digested	Analyst	Accuracy	

CONTROL COPY NO. 01

Worksheet #24a
Fixed Laboratory Analytical QC Sample Table

Medium/Matrix	
Sampling SOP	
Analytical Parameter[1]	ICP Metals
Concentration Level	
Analytical Method/ SOP Reference*	
Laboratory Name	STL Westfield
No. of Sample Locations	

Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria[3]**
LFB	NA					
Surrogates	NA					
Internal Standards (ISs)	NA					
Other:						

Worksheet #24a
Fixed Laboratory Analytical QC Sample Table

Medium/Matrix	Soil
Sampling SOP	4 and 5
Analytical Parameter[1]	GCMS 8270
Concentration Level	
Analytical Method/ SOP Reference*	SOP 10
Laboratory Name	STL Westfield
No. of Sample Locations	

Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria[3]**
Method Blank	1/20	½ the reporting limit	If out re-prep the batch	Analyst	contamination	
Reagent Blank	See above					
Storage Blank	NA					
Instrument Blank	NA					
Laboratory Duplicate	NA					
Laboratory Matrix Spike	1/20	See Worksheet 24b	Evaluate LCS and MSD.	Analyst	Accuracy, matrix	
Matrix Spike Duplicates	1/20	See Worksheet 24b	See above	Analyst	Accuracy/Precision	
LCS	1/20	See Worksheet 24b	Reanalyze, if still out re-prep	Analyst	Accuracy	
LFB	NA					
Surrogates	1/1	See Worksheet 24b	If out re-analyze, if out re-prep	Analyst	Extraction efficiency	
Internal Standards (ISs)	1/1	See Worksheet 24b	If out re-analyze, if out reprep	Analyst	quantification	
Other:						

CONTROL COPY NO. 01

Worksheet #24a
Fixed Laboratory Analytical QC Sample Table

Medium/Matrix	
Sampling SOP	
Analytical Parameter[1]	GC 8082
Concentration Level	
Analytical Method/ SOP Reference*	
Laboratory Name	STL Westfield
No. of Sample Locations	

Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptance Limits[2]	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria[3]
Method Blank	1/20	½ the reporting limit	If out re-prep the batch	Analyst	contamination	
Reagent Blank	See above					
Storage Blank	NA					
Instrument Blank	NA					
Laboratory Duplicate	NA					
Laboratory Matrix Spike	1/20	See chart	Evaluate LCS and LCSD.	Analyst	Accuracy, matrix	
Matrix Spike Duplicates	NA					
LCS/LCSD	1/20	See chart	Reanalyze, if still out re-prep	Analyst	Accuracy/Precision	
LFB	NA					
Surrogates	1/1	See chart	If out re-analyze, if out re-prep	Analyst	Extraction efficiency	
Internal Standards (ISs)						
Other:						

CONTROL COPY NO. 01

Worksheet #24a
Mobile Laboratory Analytical QC Sample Table

Medium/Matrix	Soil
Sampling SOP	SOP 4 and 5
Analytical Parameter[1]	PAH
Concentration Level	
Analytical Method/ SOP Reference*	06-026 SOP 11
Laboratory Name	STL OST
No. of Sample Locations	

Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria[3]**
Method Blank	1/20 or one per batch, whichever is more frequent	< ½ reporting limit	Clean system, re-analyze or report samples with a "B" flag	Analyst		
Reagent Blank						
Storage Blank						
Instrument Blank						
Laboratory Duplicate						
Matrix Spike	1/20 or one per batch, whichever is more frequent	50-150%R	Check analysis, check LCS, evaluate Method Spikes	Analyst		
Matrix Spike Duplicate	1/20 or one per batch, whichever is more frequent	50-150%R	Check analysis, check LCS, evaluate Method Spikes	Analyst		
LCS	1/20 or one per batch, whichever is more frequent	50-150%R	Correct problem, reinject LCS. If still out, recalibrate or prepare new LCS solution and reinject	Analyst		
LFB						
Surrogates	All samples and QC	OrthoTerphenyl (OTP) 50-150%R	Check analysis then rerun sample.	Analyst		

CONTROL COPY NO. 01

Worksheet #24a
Mobile Laboratory Analytical QC Sample Table

Medium/Matrix	Soil
Sampling SOP	SOP 4 and 5
Analytical Parameter[1]	PAH
Concentration Level	
Analytical Method/ SOP Reference*	06-026 SOP 11
Laboratory Name	STL OST
No. of Sample Locations	

Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria[3]**
Internal Standards (ISs)						
Other: Method Spike/Method Spike Duplicate	1/20 or one per batch; whichever is more frequent.	50-150%R	Reinject, if still out, then evaluate LCS	Analyst		

CONTROL COPY NO. 01

Worksheet #24a
Mobile Laboratory Analytical QC Sample Table

Medium/Matrix	Soil
Sampling SOP	SOP 4 and 5
Analytical Parameter[1]	Pb
Concentration Level	
Analytical Method/ SOP Reference*	SOP 11
Laboratory Name	STL OST
No. of Sample Locations	

Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria[3]**
Method Blank	N/A					
Reagent Blank	N/A					
Storage Blank	N/A					
Instrument Blank	N/A					
Laboratory Duplicate	1/10	RPD ≤40%	Re-analyze the original and duplicate samples and notify laboratory supervisor	Analyst and Supervisor		
Matrix Spike	N/A					
Matrix Spike Duplicate						
LCS						
LFB						
Surrogates						
Internal Standards (ISs)						
Other: Fe Response Check	Beginning of run	Fe intensity >0.96 and the Co and Mn intensity <0.003	Check instrument and re-analyze	Analyst		

CONTROL COPY NO. 01

Worksheet #24a
Mobile Laboratory Analytical QC Sample Table

Medium/Matrix	Soil
Sampling SOP	SOP 4 and 5
Analytical Parameter[1]	Pb
Concentration Level	
Analytical Method/ SOP Reference*	SOP 11
Laboratory Name	STL OST
No. of Sample Locations	

Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria[3]**
Other: Certified Standard	Seven times at the beginning of each 10-day working period.	As, Cd & Pb – 80-120% Cr – 70-130%	Repeat Fe Response Check and Analytical Background Check, consult Spectrace 9000 XRF manual for calibration check procedures	Analyst		
Other: Calibraton Check Standard	Daily, after every 10 samples and at end of run	As, Cd, & Pb – 65-135% Cr – 65-135%	Repeat Fe Response Check and Analytical Background Check and consult Spectrace 9000 XRF manual for calibration check procedures	Analyst		

CONTROL COPY NO. 01

Worksheet #24a
Mobile Laboratory Analytical QC Sample Table

Medium/Matrix	Soil
Sampling SOP	SOP 4 and 5
Analytical Parameter[1]	PCB
Concentration Level	
Analytical Method/ SOP Reference*	OSS00905.MA SOP 11
Laboratory Name	STL OST
No. of Sample Locations	

Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria[3]**
Method Blank	Beginning of each day, and after every calibration check standard	Less than ½ the Minimum Reporting Level for all PCB's	Re-make blank and re-analyze	Analyst		
Reagent Blank						
Storage Blank						
Instrument Blank						
Laboratory Duplicate						
Matrix Spike	1/20 or 1 per batch, whichever is more frequent	75-125%R	Re-extract and re-analyze	Analyst		
Matrix Spike Duplicates	1/20 or 1 per batch, whichever is more frequent	75-125%R, ≤20%RPD	Re-extract and re-analyze	Analyst		
LCS/LCSD	As needed to verify matrix interference in MS/MSD	75-125%R ≤20%RPD	ReExtract and reanalyze; if still out, prepare fresh LCS solution and reextract and reanalyze; if recoveries are still poor, perform instrument maintenance			
LFB						

Worksheet #24a
Mobile Laboratory Analytical QC Sample Table

Medium/Matrix	Soil
Sampling SOP	SOP 4 and 5
Analytical Parameter[1]	PCB
Concentration Level	
Analytical Method/ SOP Reference*	OSS00905.MA SOP 11
Laboratory Name	STL OST
No. of Sample Locations	

Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria[3]**
Surrogates	All samples	TCMX and Decachlorobiphenyl: at least one of the two surrogates meet 60-140%R criteria	Re-analyze sample, if still out, note on report and alert project manager	Analyst		
Internal Standards (ISs)						
Other: PE sample	1 per day	75-125% R	Re-extract and re-analyze. If still out, perform required maintenance and recalibrate	Analyst		

Analytical Method/SOP*:

Worksheet #24b
Fixed Laboratory Method/SOP Precision and Accuracy Table[1]

Analyte	Achievable Laboratory Sensitivity/ Quantitation Limits (ppb)	Analytical Precision (%)	Analytical Accuracy/Bias (% recovery)
PCB 1016	100 ug/kg	50	50-114
PCB 1221	100 ug/kg		
PCB 1232	100 ug/kg		
PCB 1242	100 ug/kg		
PCB 1248	100 ug/kg		
PCB 1254	100 ug/kg		
PCB 1260	100 ug/kg	50	8-127

Analytical Method/SOP*: SW-846, 8270C, SOP 10.

Worksheet #24b
Fixed Laboratory Method/SOP Precision and Accuracy Table[1]

Analyte	Achievable Laboratory Sensitivity/ Quantitation Limits (ppb)	Analytical Precision (%)	Analytical Accuracy/Bias (% recovery)
Acenaphthene	400	50	47-145
Acenaphthylene	400	50	33-145
Anthracene	400	50	27-133
Benzo (a) anthracene	400	50	33-143
Benzo (a) Pyrene	400	50	17-163
Benzo (b) fluoranthene	400	50	24-159
Benzo (k) fluoranthene	400	50	11-162
Benzo (g,h,i) perylene	400	50	1-123
Chrysene	400	50	17-168
Dibenzo (a,h) anthracene	400	50	2-126
Fluoranthene	400	50	26-137
Fluorene	400	50	59-121
Indeno (1,2,3-c,d) pyrene	400	50	D-133
2-Methylnaphthalene	400	50	D-120
Naphthalene	400	50	21-133
Phenanthrene	400	50	54-120
Pyrene	400	50	52-115

Worksheet #24b
Mobile Laboratory Method/SOP Precision and Accuracy Table[1]

Analyte	Achievable Laboratory Sensitivity/ Quantitation Limits (mg/kg)	Analytical Precision (mg/kg)	Analytical Accuracy/Bias (% recovery)
PCB by GC	0.5 mg/kg	≤20% RPD	75-125 % R
PAH by GC	To be determined prior to project	N/A	50-150 % R

EPA-NE QAPP Worksheet #26 - Rev. 10/99
Identify the documents and records that will be generated for all aspects of the project. (Refer to *QAPP Manual* Section 15.1 for guidance.)

Title:
Revision Number:
Revision Date:
Page: of

Project Documentation and Records Table

Sample Collection Records	Field Analysis Records	Fixed Laboratory Records	Data Assessment Records	Other
Field Notebook	Field Notebook	Sample receipt form	Stone and Webster Report	
Chain of Custody		Sample run log	Data Validation Report	
		Sample prep log		
		QA/QC comments		
		Case narative		
		Form I results		

CONTROL COPY NO. 01

EPA-NE QAPP Worksheet #27a - Rev. 10/99
Use this worksheet to plan procedures for identifying and correcting any problems encountered during the project. Provide a detailed discussion of these procedures in Section 16.0 of the QAPP document. (Refer to *QAPP Manual* Sections 16.0-16.3 for guidance.)

Title:
Revision Number:
Revision Date:
Page: of

Assessment and Response Actions

See Attached

CONTROL COPY NO. 01

EPA-NE QAPP Worksheet #27b - Rev. 10/99
Identify the frequency, number and type of planned assessment activities that will be performed for the project. (Refer to *QAPP Manual* Sections 16.0-16.3 for guidance.)

Title: Oxford Paper Mill QAPP
Revision Number:
Revision Date:

Project Assessment Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) responsible for performing assessment, title and organizational affiliation	Person(s) responsible for responding to assessment findings, title and organizational affiliation	Person (s) responsible for identifying and implementing corrective actions (CA), title and organizational affiliation	Person (s) responsible fo monitoring effectiveness of (title and organizational affiliation
Soil Assessment	25 foot grid	External	Stone & Webster	Ronald Richards Project Manager Stone & Webster	Lester Tyrala Program Manager Stone & Webster	Lester Tyrala Program Manager Stone & Webster	Brain Tucker Chemist Stone & Webster
PID MiniRae	25 foot grid	External	Stone & Webster	Field Team Leader TBD	Ronald Richards Project Manager Stone & Webster	Ronald Richards Project Manager Stone & Webster	Field Team Leader TBD
LEL	25 foot grid	External	Stone & Webster	Field Team Leader TBD	Ronald Richards Project Manager Stone & Webster	Ronald Richards Project Manager Stone & Webster	Field Team Leader TBD
PCB RaPID Assay	25 foot grid	External	Stone & Webster	Field Team Leader TBD	Ronald Richards Project Manager Stone & Webster	Ronald Richards Project Manager Stone & Webster	Field Team Leader TBD
Carcinogenic PAHs RaPID Assay	25 foot grid	External	Stone & Webster	Field Team Leader TBD	Ronald Richards Project Manager Stone & Webster	Ronald Richards Project Manager Stone & Webster	Field Team Leader TBD

CONTROL COPY NO. 01

EPA-NE QAPP Worksheet #28 - Rev. 10/99
Identify the frequency and type of planned QA Management Reports, the projected delivery date, the personnel responsible for report preparation and the report recipients. (Refer to *QAPP Manual* Section 17.0 for guidance.)

Title:
Revision Number:
Revision Date:
Page: of

QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation, Title and Organizational Affiliation	Report Recipients, Title and Organizational Affiliation

See Sample and Analysis Plan (SAP)

CONTROL COPY NO. 01

EPA-NE QAPP Worksheet #29a - Rev. 10/99
Describe the process for the collection, organization, and verification of all information and data collected and generated throughout an environmental project. Include in the description how the results will be conveyed to the data user. Indicate, in the appropriate column, if the verification process is performed internally (I) or externally (E) to the data generator, and indicate who will be responsible for performing the verification task. (Refer to *QAPP Manual* Sections 18.0 and 19.0 for guidance.)

Title:
Revision Number:
Revision Date:
Page: of

Data Verification Process

Verification Task	Description	I/E	Responsible for Verification (Name, Organization)
	See section 19.0 of the QAPP		

CONTROL COPY NO. 01

A-NE QAPP Worksheet #29b - Rev. 10/99
List the validation criteria, data validation tier, data validator and person ultimately responsible for validation (by name, title and organizational affiliation) for each matrix, analytical parameter and concentration level. (Refer to *QAPP Manual* Sections 18.0 and 19.0 for guidance.)

Title: Oxford Paper Mill
Revision Number:
Revision Date:

Data Validation Summary Table

Medium/ Matrix	Analytical Parameter	Concentration Level	Validation Criteria[1]	Validation Criteria Modified[2]	Data Validation Tier Level	Modified Tier Level Used[3]	Data Validator (Name, title and organizational affiliation)	Responsibility for Data Validations (Name, title and organizational affiliation)
Soil	8082 – all	The data validator will use the <u>Region 1, EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analysis</u>					Tim Lewis - Kestral	Brian Tucker – Stone & Webster
Soil	8270 – all						Tim Lewis – Kestral	Brian Tucker – Stone & Webster
Soil	8081A – all						Tim Lewis – Kestral	Brian Tucker – Stone & Webster
Soil	8100 - all						Tim Lewis – Kestral	Brian Tucker – Stone & Webster

CONTROL COPY NO. 01

EPA-NE QAPP Worksheet #30 - Rev. 10/99
Use this worksheet to plan the scientific and statistical procedures/methods (not just definitions of DQIs) that will be used to determine whether data are of the right type, quality and quantity to support environmental decision making for the project. Specifically describe how precision, accuracy/bias, representativeness, sensitivity (i.e., achievement of project Quantitation Limits), completeness and comparability data will be used to determine if project quality objectives were achieved in Section 20.0 of the QAPP document. Describe how data quality issues will be addressed, and how limitations on the use of the data will be handled. (Refer to *QAPP Manual* Sections 7.0 and 20.0 for guidance.)

Title: Oxford Paper Mill
Revision Number:
Revision Date:

Data Usability Assessment

The 90% upper confidence limit will have to be < 1 ppm for the area to be declared clean

CONTROL COPY NO. 01

CONTROL COPY NO. 01

RELEASE ABATEMENT MEASURE PLAN
FOR
OXFORD PAPER MILL
LAWRENCE, MASSACHUSETTS
Release Tracking Number: 3-2691

Prepared for:

Office of Planning & Development
City of Lawrence
225 Essex Street
Lawrence, MA 01840

Prepared by:

Stone & Webster, Inc.
100 Technology Drive
Stoughton, Massachusetts 02072

April 2001

TABLE OF CONTENTS

FIGURES

TABLES

This RAM Plan is an updated version of the Oxford Paper Mill RAM Plan, which was submitted on June 12, 2000. No activity has occurred under this RAM plan as of April 6, 2001. At present, work continues under the Massachusetts Highway Department (MHD) RAM Plan, submitted by Levine-Fricke (LFR). It is anticipated that City of Lawrence RAM Plan will be implemented in early May 2001.

SECTION 1.00 CONTACTS

The name, address, telephone number and relationship to the site of the person assuming responsibility for conducting the Release Abatement Measure.

Site Owner:

Robert Luongo
City of Lawrence
Office of Planning and Development
225 Essex Street
Lawrence, Massachusetts 01840
(978) 794-5891 ext. 144
Relationship: Lawrence Gateway Project Director

Project LSP:

Ronald Richards, LSP - No. 4488
Stone & Webster, Inc.
100 Technology Drive
Stoughton, MA 02072
(617) 589-5499

SECTION 2.00 SITE DESCRIPTION

A description of the release or threat of release, site conditions, and surrounding receptors.

2.1 SITE DESCRIPTION AND SURROUNDING RECEPTORS

The former Oxford Paper Mill (OPM) Site (Release Tracking Number 3-2691) is located on approximately 3 acres of land in Lawrence, Massachusetts, immediately northwest of the intersection of Canal Street and the Spicket River (refer to the Locus Plan attached as Figure 1). A small portion of the Site is also located north of Canal Street on the eastern bank of the Spicket River. The Site is transected by a raceway, which discharges to the Spicket River. Nine buildings (Building Nos. 1, 2, 3, 4, 5, 6, 13, 1A, and 28) currently occupy the Site; these buildings are south of the raceway. Buildings north of the raceway were demolished in the early 1980s. The Site is surrounded by either a wooden stockade or chain-linked fence. Oxford Paper ceased operations at the Site in the mid-1970s. The City of Lawrence took ownership of the property in 1983.

Properties surrounding the Site are used for residential, commercial, institutional, and industrial purposes. GenCorp, Inc. (GenCorp), the Everett Mills property, and Union Street are west of the Site. Canal Street and the North Canal are south of the Site beyond which are other historic mill buildings. The Spicket River is north and east of the Site. The Lawrence General Hospital is beyond the Spicket River to the north. The Everett Mills property is currently used for commercial purposes. The GenCorp facility, which was formerly occupied by Bolta Products and used for manufacturing rubber, is currently vacant. The GenCorp facility was used most recently for manufacturing plastics and vinyl coated fabrics; polyvinyl chloride, resins; methyl isobutyl ketone (MIBK), methyl ethyl ketone (MEK), and tetrahydrofuran (THF) were used as part of these manufacturing operations.

Based on a review of the Massachusetts Geographic Information System (GIS) map (Lawrence), the Site is not within an Interim Wellhead Protection Area (IWPA) or Zone II. Mr. Madden at the Lawrence Water Department indicated that the City of Lawrence obtains its water from the Merrimack River. Water is drawn from one well in the Merrimack River; this well is located in the river at the foot of Ames Street (i.e., at the intersection of Ames Street, Water Street, and Riverside Drive), approximately one and one-half miles west of the Site. The city's reservoir is approximately one and one-half miles northeast of the Site on Ames Hill. According to Mr. Madden, several car washes and only one residence have private water supply wells in the city. The closest private well is at a car wash approximately one mile from the Site. Based on a review of Massachusetts Surface Water Quality Standards (314 CMR 4.00), the Spicket and Merrimack Rivers are Class B surface water bodies (i.e., designated as habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation).

According to the Federal Emergency Management Agency, Flood Insurance Rate Map (FIRM) for the City of Lawrence, Massachusetts (Community Panel Number 250087 0002B), the northwestern portion of the Site is within Zone A17 (i.e., an area of 100-year flood) and portions of the north and southeastern areas of the Site are within Zone B (i.e., an area between the limits of the 100-year and 500-year flood).

2.2 DESCRIPTION OF RELEASE/THREAT OF RELEASE AND SITE CONDITIONS

2.2.1 Description of Release/Threat of Release

On April 10, 1989, the Emergency Response Branch of DEP investigated a release of an unknown quantity of petroleum product into the Spicket River. The oil appeared to be released through a sanitary sewer manhole near the former OPM property and the Spicket River. Clean Harbors, Inc. removed oil from this manhole and the impacted area of the Spicket River.

A Notice of Responsibility (NOR) was issued to the City of Lawrence on May 15, 1989; the NOR indicated that contaminant conditions at the former OPM render the Site a "Location To Be Investigated" (LTBI). According to an October 23, 1989 letter from DEP to the City of Lawrence, the Emergency Response Branch concluded that no further emergency response actions at the Site were necessary at the time and the case was referred to the Site Management Branch. The Site was first listed as an LTBI on DEP's "List of Confirmed Disposal Sites and Locations to be Investigated" on January 15, 1990. As a Transition Site under the Massachusetts Contingency Plan (MCP), the August 2, 1996 deadline for submittal of a Licensed Site Professional (LSP) Evaluation Opinion, as specified in the MCP (310 CMR 40.0610(3)(b)), applied to the Site. Neither one of the submittals listed in 310 CMR 40.0610(5)(a) through (c) (i.e., an LSP Evaluation Opinion, statement pursuant to 310 CMR 40.0610(4)(b), or Response Action Outcome Statement) nor a Tier Classification Submittal was submitted to DEP by this deadline. As such, the Site was categorically classified as a Tier IB disposal Site on August 2, 1996.

On November 23, 1999, the Site was Tier Classified by Mr. Kevin Scully, LSP of Stone & Webster. The numerical ranking for the Site was 558, and a Tier 1A Permit Application Submittal was sent to DEP on November 29, 1999 for administrative and technical review. A Site visit was conducted by MADEP on February 3, 2000. During this meeting and subsequence discussions with Mr. Kevin Scully and Ms. Ann Roche of MHD, Mr. Larry Mach of MADEP indicated that the Site would be classified Tier 1B. On March 3, 2000, MADEP classified the Site as a Tier 1B.

2.2.2 Site Conditions

Currently, there is no evidence of soil contamination beneath Site buildings. Upon completion of building demolition (Nos. 1-6, 13 and 28) predetermined soil sampling locations will be sampled and analyzed for PCBs, PAH, RCRA 8+ Be and Zn. Once all soil laboratory data has been received and undergone QA/QC protocols, basement slabs will be either removed and undergone soil remediation or leveled to grade.

2.2.2.1 Previous Studies

The following sections presents information regarding the contaminant conditions at the Site, which was gathered as part of environmental investigations prior to and after the Site, entered the MCP process. Also, provided is information on the status of; (1) existing transformers, (2) drums, storage tanks, or containers of oil and/or hazardous material which remain at the Site, (3) locations of the Site known to be contaminated with asbestos, and (4) potentially contaminated PCB materials. Investigation locations referred to are shown on Figure 3.

Prior to the 1989 emergency response incident described above, environmental investigations of the Site were conducted by Briggs Associates, Inc., Camp, Dresser & McKee, Earth Tech (HMM) and Eckenfelder, Inc. The scope and results of each of these studies are presented below.

Briggs Associates, Inc., 1984

In December 1984, Briggs Associates, Inc. (Briggs) completed an Environmental Site Investigation of the former OPM property in accordance with Massachusetts General Laws (M.G.L.) Chapter 21E. The study consisted of a Site reconnaissance, a review of information at the Lawrence Fire Department regarding storage tanks on the property, excavation of five shallow (to a maximum depth of 7 feet below ground surface) test pits (TP-1B thorough TP-5B), and collection and analysis of soil samples for volatile organic compounds (VOCs), RCRA-8 metals, and oil and grease. Briggs concluded that, "RCRA metals, oil and grease, and volatile organics concentration were all within limits not to represent a problem," and "all factors indicate that the area is environmentally acceptable."

Camp, Dresser & McKee, 1985

In 1985, Camp, Dresser & McKee (CDM) conducted an evaluation of conditions surrounding a transformer at the southeastern corner of Building No. 6. Soil samples collected at various locations and depths around the transformer indicated the presence of PCBs at levels up to 6,000 parts per million (ppm), which exceeds the MCP limit of 2 ppm.

As part of CDM's study, two samples were collected from an oil-stained area on the surface of the western most portion of the south-exterior wall of the former OPM Building No. 22; this wall borders the north raceway (Figure 2). The former Building No. 22 is located north of the raceway, above Building No. 3. The two samples were submitted for PCB analysis. Analytical results indicated the presence of PCBs at levels of 4,300 mg/m^2 and 4,800 mg/m^2.

Since the Site was first listed as an LTBI in 1990, further environmental investigations of the Site have been conducted by HMM Associates, Inc. of Concord, Massachusetts; Eckenfelder, Inc. of Mahwah, New Jersey; and EARTH TECH (formerly HMM Associates, Inc.). The work conducted as part of these studies is summarized below.

Eckenfelder, Inc. 1984 through 1992

Eckenfelder, Inc. conducted investigations of the GenCorp, Inc. Site between 1984 and 1992 in order to assess and monitor the mobility of contaminants from the GenCorp property. These studies were conducted in phases (i.e., Phase I-A, Phase I-B, Phase II, Phase III-A, Phase III-B, Phase IV-A, Phase IV-B, and Phase IV-C). Eckenfelder's Phase IV investigations, which were completed between September 1990 and December 1992, included sampling and analysis of soil and groundwater on the former OPM Site. The scope and results of their work on the former OPM Site are presented below.

Eckenfelder's Phase IV groundwater investigation program included: installation of monitoring wells on both the GenCorp, Inc. and former OPM property; collection of two rounds of groundwater samples from existing and newly installed wells; collection of a third round of groundwater samples from a limited number of wells; and collection of surface and subsurface soil samples. The following paragraphs summarize soil and groundwater analytical results for the Oxford Paper property.

Soil

With the exception of 0.12 ppm of methylene chloride in surface soil sample G-19, no VOCs were detected in soil. Low levels of SVOCs (i.e., benzo(a)anthracene, benzo(b)fluoranthene, bis-(2-ethylhexyl) phthalate, di-n-butyl phthalate, chrysene, fluoranthene, and pyrene) were detected in soil at various depths. PHCs were detected in three subsurface soil samples (B-16XD, B-22, and B-18) at concentrations ranging from 13 to 1720 ppm. PCBs (Aroclor 1254) were detected in two surface soil samples, G-19 and G-22 at 0.165 ppm and 0.34 ppm, respectively. Mercury was detected in surface soil at one location (B-19) at a concentration of 43 ppm. Lead and zinc were detected in surface soil sample G-18 at 230 ppm and 200 ppm, respectively. Phenols were also detected in soil sample G-18 at 59.5 ppm.

Groundwater

VOCs (i.e., benzene, chloroform, ethylbenzene, toluene, 2-chloro-ethyl vinyl ether, MIBK, MEK, acetone, THF) were detected at low concentrations in groundwater during Eckenfelder's Phase IV investigation.

Analytical results indicated the presence of low levels of PCBs (Aroclor 1242) in three wells (B-18D, B-20D, and B-22D) on the former OPM Site at concentrations close to the detection limit (concentrations ranged from 0.5 to 2.9 ppb). No PCBs were detected in deep bedrock wells or in wells along the downgradient perimeter of the former OPM Site.

Elevated levels of several metals (arsenic, chromium, mercury, and lead) were detected in groundwater. Arsenic was detected in wells B-16D and B-22D at 212 ppb and 370 ppb, respectively. Analytical results indicated the presence of mercury in monitoring well B-19 at 440 ppb and lead in monitoring well B-16D at 16 ppb.

Phenanthrene was detected in groundwater collected from monitoring well B-22S at a concentration of 70 ppb. Pesticides (beta BHC) were detected in B-22D at a concentration of 0.09 ppb.

Based on the results of this study, Eckenfelder, Inc. concluded that the shallow VOC plume emanating from the GenCorp, Inc. property had decreased in size and no longer extends on to the former OPM property.

HMM Associates, Inc., 1992

In February 1992, HMM Associates, Inc. (HMM) completed a Preliminary Site Assessment of the former OPM Site. The study included a Site reconnaissance, a review of Site history, and a summary of available analytical data. Potential migration pathways and routes of exposure were also identified as part of this study. No environmental sampling or laboratory testing was conducted during this investigation. HMM concluded that, "due to the evidence of a release of several hazardous materials in soil, groundwater, sediment, and building structures at the Oxford Paper Site, the completion of additional assessment is recommended." HMM also prepared a draft Release Abatement Plan (RAM) to address PCBs in soil near Building No. 6.

EARTH TECH, 1994

In October 1994, EARTH TECH conducted additional investigations in the area of the transformer at the southeastern corner of Building No. 6. Soil samples were collected at depths up to 6.5 feet below ground surface. The samples were analyzed in the laboratory for PCBs via U.S. EPA Method 8080. Selected samples were also analyzed for pH, flashpoint, cyanide (reactive), sulfide (reactive), and TCLP (metals, VOCs, SVOCs, pesticides, and herbicides). Analytical results indicated the presence of PCBs in soil at levels up to 23,000 ppm. Data analysis was not Aroclor specific. A TCLP lead concentration of 12 mg/l was detected in soil sample SS-6 at 2.5 feet below ground surface.

Eckenfelder, Inc., 1994

In October 1994, Eckenfelder, Inc. collected groundwater samples from 20 monitoring wells located on and around the Oxford Site in order to assess and monitor the mobility of contaminants on the GenCorp property. The samples were analyzed for VOCs, PCBs, arsenic, chromium, mercury, and zinc. Low to non-detectable levels of VOCs were present in groundwater. PCBs were not detected in any of the groundwater samples. Concentrations of arsenic, chromium, mercury, and zinc were consistent with previous sampling results.

Eckenfelder, Inc., 1995

In May 1995, Eckenfelder, Inc. collected surface water samples from locations within the Spicket River, North Canal, and raceway. The samples were analyzed for VOCs via U.S. EPA Method 8240 and tetrahydrofuran (THF). With the exception of 1.1 ug/l of 1,2-dichloroethene (1,2-DCE) in the Spicket River at General Street (SW-1) and 2.7 ug/l of carbon disulfide in the raceway (SW-11), no VOCs were detected in the surface water samples collected.

Transformers

Based on available information, one of the previous three transformers remains on Site. The existing transformer (referred to as transformer No. 6) is located at the southeastern corner of Building No. 6. The transformers formerly located between Building Nos. 1, 2, and 4 (referred to as transformer No. 2) and in Building No. 3 (referred to as transformer No. 3) were disposed of in the raceway. According to Mr. Edward Fitzpatrick of GenCorp, GenCorp assisted the Lawrence Fire Department in removing and disposing these two transformers from the raceway between 1981 and 1982.

Although soil near existing transformer No. 6 has been sampled and analyzed, no soil sampling has been conducted to assess contaminant conditions in the vicinity of transformers No. 2 or No. 3 that were previously removed. Therefore, as part of Massachusetts Highway Department (MHD) Release Abatement Plan (RAM) submitted by Levine-Fricke (LFR), samples will be collected from these areas to assess the soil conditions and determine whether additional PCB-contaminated material should be removed. Sampling will occur in the area of former transformer No. 2, which is now accessible. Samples will be collected and submitted for PCB analysis (U.S. EPA Method 8082) prior to demolition activities in this area. Soil sampling in the previous location of transformer No. 3, within in Building 3 is currently not accessible for soil sampling. Demolition will be required in this area before samples can be collected and submitted for analysis. There has been no update in the status of sampling for PCBs in the vicinity of the transformers. Transformer 6 should be removed in May of 2001 and sampling should occur soon after that.

Storage Tanks, Drums, and Containers

Information on the status of storage tanks, drums and containers is provided in various letters and reports regarding the former OPM Site and is summarized below.

According to a review of City of Lawrence Fire Department records by Briggs Associates, Inc. personnel during their 1984 study, no aboveground storage tanks were present at the Site. However, the records indicated that one 20,000-gallon and three-30,000-gallon underground storage tanks (USTs) were present at the Site. The license for these tanks was issued on July 6, 1953. Fire Department records also indicated that gasoline was stored in two 300-gallon USTs. One tank was installed in 1921 and the other one was installed in 1928; both were removed on July 23, 1968.

A March 19, 1992 letter from Mr. Robert J. Devaney, Jr., Director of Environmental Engineering at GenCorp to the City of Lawrence Community Development Department summarizes the results of CDM's December 1985 report titled "Final Technical Memo Report #3 - Oxford Paper Site." The letter indicates that the presence of three 30,000-gallon tanks at the Site was confirmed in April 1989.

The May 15, 1989 NOR letter from DEP to the City of Lawrence indicates that based on DEP's review of a July 25, 1967 plan of the Site, seven fuel oil storage tanks were located on the property (three 30,000-gallon, one 20,000-gallon, one 10,000-gallon, and two 1,000-gallon tanks). The letter indicates that these tanks were abandoned in 1976. According to the letter, two of the tanks (one 20,000-gallon and one 1,000-gallon) were located on April 19, 1989 and were scheduled to be removed; no leakage was observed from the 20,000-gallon tank.

A Commonwealth of Massachusetts, Department of Public Safety, Division of Fire Prevention, Permit for Removal and Transportation to Approved Tank Yard was obtained for the 20,000-gallon tank on April 18, 1989. The tank was removed on April 19, 1989 and transported off-Site to John C. Tombarello & Sons of Lawrence, Massachusetts. The permit indicates that the tank was accepted at this location on June 9, 1989.

The 1,000-gallon tank was excavated on April 20, 1989. This 1,000-gallon tank was removed from the location of a supposed 10,000-gallon fuel oil tank shown on a historical map of the Site. According to a Commonwealth of Massachusetts, Department of Public Safety, Division of Fire Prevention, Permit for Removal and Transportation to Approved Tank Yard, the tank was transported off-Site to John C. Tombarello & Sons of Lawrence, Massachusetts. The permit indicates that the tank was accepted at this location on June 9, 1989.

An April 23, 1991 letter from Eckenfelder, Inc. to Mr. Robert J. Devaney, Jr., Director of Environmental Engineering at GenCorp indicates that GenCorp responded to the 1988 oil release to the Spicket River by assisting with UST location, identification, and removal on the former OPM property. The letter also indicates that subsequent excavations conducted by the City of Lawrence confirmed the presence of several large diameter USTs which contained petroleum residuals of unknown composition.

According to information gathered, as part of HMM's Preliminary Site Assessment in 1992, five underground storage tanks were identified on the Site to the north of the raceway. Two of these tanks (one 500-gallon and one 1,000-gallon) were removed by Clean Harbors in 1988. Records maintained by the City of Lawrence Fire Department indicate that one 1,000-gallon tank was removed in 1989. The remaining USTs are each 30,000-gallons. The contents of the tanks were sampled by Clean Harbors in 1988; analytical results indicated that petroleum was stored in the tanks. Clean Harbors reportedly removed the contents of two of the USTs. According to records at the City of Lawrence Fire Department, the contents of the third tank had solidified.

Observations made by HMM during the Site reconnaissance indicated the presence of five 30-gallon cardboard containers of a dry, purple substance in Building No. 3. Several of the containers had leaked onto the floor surrounding them. Several 55-gallon drums of unknown contents were observed by HMM throughout the basement level of Building No. 3; based on their weight, the drums appeared to be essentially empty. Several drums of unknown contents were also observed in the basement of Building No. 2; these drums also appeared to be essentially empty. Three approximately 500-gallon above ground storage tanks were observed in the basement of Building No. 6; they appeared to be essentially empty. The use and contents of these tanks is unknown.

The three 30,000-gallon fuel oil UST's were removed in November of 2000. Analytical data showed no exceedances at reportable levels. Based on the above information, it appears that there are no remaining underground storage tanks at the former OPM Site.

As indicated above, sampling performed by CDM in 1985 within an oil-stained area on the surface of the south exterior wall of former OPM Building No. 22 indicated the presence of

PCBs at levels of 4,300 mg/m^2 and 4,800 mg/m^2. PCBs may also be present in soil behind the wall.

Locations Known to be Contaminated with Asbestos

Visual observations made by GZA and others near transformer No. 6 indicate the likely presence of asbestos and/or asbestos containing materials on the surface soil within this area.

Potentially Contaminated PCB Materials

As indicated above, sampling performed by CDM in 1985 within an oil-stained area on the surface of the south exterior wall of former OPM Building No. 22 indicated the presence of PCBs at levels of 4,300 mg/m^2 and 4,800 mg/m^2. PCBs may also be present in soil behind the wall.

SECTION 3.00 OBJECTIVES

The objective(s), specific plan(s) and proposed implementation schedule for the Release Abatement Measure including, as appropriate, plans and/or sketches of the Site and any proposed investigative and/or remedial installations.

3.1 OBJECTIVES AND SPECIFIC PLANS

3.1.1 Objective of RAM

The objective of this RAM is to:

1. To determine the presence or absence of site Contaminants of Concern in the soil beneath site buildings.

2. If necessary and feasible, perform site remediation activities under this RAM to allow the achievement of a Class A Response Action Outcome (RAO) for the Oxford Paper Mill site.

3.1.2 Roles and Responsibilities

In order to prepare the Site for construction of a relocated Canal Street and bridge over the Spickett River, MHD has assumed the responsibility to conduct the following activities under a MCP Release Abatement Measure (RAM). The following actions will be performed (through their Subcontractor, North American Site Developers, Inc.) at the OPM Site.

- Demolition Site Buildings
- Disposal of contaminated demolition debris (not meeting Beneficial Reuse Requirements or the requirements of City to support its intended site use as passive open space)
- Disposal of uncontaminated demolition debris that does not meet structural requirements for Site backfill.
- Decontamination of the basements of Site buildings and backfill with structural material in anticipation of bridge construction.
- Removal of PCB-contaminated transformers and all soils contaminated by PCBs released from these transformers within the designated construction area.
- Grading of the southern portion of the Site in anticipation of bridge construction. All soils handled during Site grading activities will be tested, and if found to be contaminated will be disposed of by MHD in compliance with MCP standards.
- Grading of the Site along the northern edge of the Raceway. All soils handled during Site grading activities will be tested, and if found to be contaminated will be disposed of by MHD.

GenCorp, which owns the abutting property, has taken responsibility for the remediation of PCB contaminated sediments that are found in the Raceway which transects the OPM property.

As property owner, the City Of Lawrence (COL) has the responsibility to ensure that the property is sufficiently remediated to satisfy regulatory requirements and allow for the intended use (passive open space). This includes conducting all necessary environmental assessment and remediation activities that are not dealt with by the MHD and GenCorp

The activities described in the remained of this section are those actions to be performed by the City Of Lawrence under this RAM.

3.2 Soil Characterization

The environmental investigation will be completed within the three acres of land in Lawrence, Massachusetts, immediately northwest of the intersection of Canal Street and the Spicket River (refer to the Locus Plan attached as Figure 1). A small portion of the Site is also located north of Canal Street on the eastern bank of the Spicket River. The Site is transected by a raceway, which discharges to the Spicket River.

The sampling provided herein is intended to define the extent and characteristics of contamination on the south side of the raceway. The sampling is designed to meet the requirements of the MCP and Toxic Substances Control Act (TSCA) regulations. Table 3 is provided to outline the target analytes.

After the buildings are removed, the basement floor (concrete pad) will be penetrated at predetermined sample locations and direct push samples will be collected. Proposed sample locations are shown on Figure 3.

For MCP purposes:

- Building No. 1 – samples will be collected from five locations;
- Building No. 2 – samples will be collected from four locations;
- Building No. 3 – samples will be collected from sixteen locations;
- Building No. 4 – samples will be collected from two locations;
- Building No. 5 – samples will be collected from one location;
- Building No. 6 – samples will be collected from six locations;
- Building No. 13 – samples will be collected from four locations;
- Building No. 28 – samples will be collected from six locations

The aforementioned mentioned sampling points are deemed sufficient to characterize the soil conditions beneath each building for MCP purposes. These samples will be analyzed for VOC's, Priority Pollutants 13, PAHs, and Pesticides. The actual number of sample locations and analytical parameters may vary based on the conditions found in each building basement including the number of floor drains observed and the competency of the basement floor as well as the results of waste stream analysis of materials found in each basement. Sample locations are general for MCP compliance.

To address TSCA PCB requirements, a 25-foot sampling grid is proposed for building basements. Since the soil under the concrete basement floors is geologically similar, pathways of PCB contamination could be seepage of the oil through the thick concrete floor or seepage through any cracks and holes that may exist. Since the permeability of concrete with respect to PCB oils is relatively high, it would be anticipated that any PCB materials that seeped through the floor would spread out in a widely dispersed pattern over a period of time (as opposed to a point source). Any holes or cracks would be potential point or line sources. Based upon this analysis and the geostatistical analysis done by GenCorp (Phase II Demolition Main Buildings Project, Supplemental Sampling and Analysis Program," Camp, Dresser & McKee (March 1996)), it is proposed to implement a sampling program that focuses on both seepage and "point sources". To this end, it is proposed to sample areas where a visible hole or crack existed and locations where known breaks had been present in the floor. At least 10% of the samples will be selected based on this focus. To detect any seepage through the concrete, the sampling program will focus on a grid 25 feet on center to detect any seepage that may have occurred through the concrete. This grid is sufficient to detect any seepage that would have occurred through the floor since the seepage would be diffuse and spread out due to the long time periods involved. Using this sampling grid, an estimated 44 samples shall be collected for PCBs from beneath the Building #3 basement pad. Sixteen of these locations will also be used for MCP sampling as previously discussed. At a minimum, an additional 10% of the number of grid samples described above will be utilized to delineate any potential hotspots, such as floor drains, cracks in the basement floor, and location of concern, stemming from concrete coring analysis.

This process provides a general framework for characterizing contamination that may exist under the basements. The following is a detailed description of the sampling methodology for Building #3. It is anticipated that the other buildings will be addressed in a similar fashion.

3.2.1 Building No. 3 Sub-Basement Characterization

Building No.3 is the largest single building on the Oxford Paper Mill Site with an approximate dimension of 150 feet by 350 feet. A mobile laboratory may be used on-site to expedite soil characterization of the Building No.3 sub-basement. The feasibility of using the mobile lab will be determined based on preliminary data from the basement concrete sampling, logistics, and cost effectiveness.

Samples will be collected from 0 to 0.5 (ft.) below the basement floor (bbf), 0.5 to 2 (ft.) bbf, and 2-4 (ft.) bbf. A discrete sample will be taken from the first six inches of soil, followed by composite samples taken from the subsequent 2-foot intervals. Sampling within each 2-foot depth interval will be biased toward visually stained soil. Dependent upon the PCB concentration, the individual intervals may then need to be analyzed, if the PCB result exceeded the TSCA required cleanup standards. If contaminants of concern (COC) are not present above S-3/GW-3 levels of the MCP (Table 3) in the 0 to 0.5 (ft.) sample at a given location, then samples collected below that depth interval will not be analyzed. If one or more COC is above its respective MCP S-3/GW-3 standard, then both the 0.5 to 2 ft. and 2-4 ft bbf intervals will be analyzed. If the 4-6 ft bbf sample has one or more COC above its respective MCP S-3/GW-3 standard (except for background PAHs), then the next six-foot depth interval (6-12 ft bbf) will be sampled and analyzed. At the twelve foot level, if contamination still exists above the S-3/GW-3 level (but below the TSCA action level), based upon the LSP's judgement, due to decreasing contamination levels, if the soil is well characterized and no additional actions will be necessary. If COCs are not present at concentrations of concern then sample intervals collected below the depth interval would not be analyzed, unless observations indicate otherwise. This process will be repeated until all COCs in a sample are less than their respective MCP S-3/GW-3 standard.

All samples collected will be field screened for VOCs using a Photo Ionization Detector (PID). Samples with PID readings greater than 10 parts per million (ppm) will be analyzed for COCs by the mobile laboratory (if utilized) and will be submitted to the fixed laboratory for VOC analysis by EPA Method 8260.

Samples will be sent to the fixed laboratory at a frequency of 100% for the 0-0.5 (ft) bbf samples. If the use of the on-site laboratory is deemed necessary, the first interval of samples will provide the comparability criteria, which will determine the percent of samples that will be sent to the fixed laboratory for analysis. Based on the comparability criteria, samples from following intervals will be analyzed at the mobile laboratory (if utilized) and the pre-determined percent will be sent fixed laboratory. At the depth which contamination ceases in a sampling location, that sample will be sent to the fixed laboratory for confirmatory analysis. Soil samples will be submitted to a fixed laboratory (in accordance with Appendix A) for analysis within a 48-hour turnaround time. Confirmatory samples will be analyzed for PCBs by EPA extraction Method 3500/3550B and modified EPA Method 8082, RCRA 8 + Zn & Be using EPA Method 6010B/7471A, selected VOC's using EPA Method 8260B, and PAHs by EPA Method 8270 (See SOP 10). Quality Assurance/Quality Control (QA/QC) samples will be collected as follows for the parameters:

1. Sample Duplicates will be collected at a frequency of 10%
2. Rinsate Blanks will be collected at a frequency of 5% or daily, whichever is the higher frequency
3. Matrix spike/matrix spike duplicates (MS/MSD) will be collected at a frequency of 5%.
4. One trip blank will be included in each cooler containing VOC and VPH samples
5. One water and methanol trip blank.

3.2.2 Remaining Buildings – Sub-basements Characterization

Characterization of the sub-basements beneath the remaining buildings will be identical to the Building No. 3 process with the possible exception that samples characterized by the rapid analysis methods may be done at a fixed base laboratory rather than in an onsite mobile lab. This decision will be based on the cost effectiveness of bringing an onsite mobile lab for the number of sampling points that can be accessed at the time of each characterization mobilization.

3.3 Equipment Decontamination

All downhole sampling equipment will be decontaminated prior to initial use and after each use. Large pieces of equipment such as auger flights will be decontaminated in the onsite decontamination facility. For smaller sampling equipment such as trowels and mixing bowls, equipment decontamination will be performed in accordance with the Stone & Webster Equipment Decontamination SOP included in Appendix A.

3.4 Investigation/Remediation Dewatering

Any groundwater or stormwater runoff encountered in basement area that would interfere with required investigation and/or remediation work will be pumped into the onsite water treatment system for treatment and disposal under the NPDES permit for this site.

3.5 Site Remediation

If site remediation for sub-basements soil conditions is deemed to be warranted, remedial actions will only be conducted under this RAM if they can be conducted within the timeframe agreed upon the City of Lawrence and the MHD for sub-basements assessment and remedation. If characterization activities demonstrate that no remediation is necessary then the City will inform MHD that backfill can begin immediately. Should remediation be deemed to be warranted, an assessment of the length of time needed to complete the necessary activities will be made. If it is determined that remediation cannot be performed or if it is determined that the City has insufficient funds in the Remedation Force Account with MHD to complete needed remedial activities, the City will inform the MHD and deal with sub-basements remediation at a later time as part of a comprehensive site solution.

3.5.1 Remedial Approach under RAM

Sample results will be compared against the MCP S3/GW3 Standards and the UCLs. Figure 4 presents a characterization/remediation decision tree, which shows the concentrations of COCs and the corresponding remedial action. Soil with concentrations less than the MCP S-3/GW-3 will remain in place. Before COPC above the MCP S-3/GW-3 standard can be left in place, a

MCP evaluation of risk must be conducted. Soil exceeding the MCP S-3/GW-3 will be excavated, if technically feasible. If it is not technically feasible to remove the contaminated soil, then an activity use limitation will be placed on the Site.

Upon completion of the RAM activities that can be completed, the site will then be backfilled with clean materials by MHD up to the finish grade of the site. A Feasibility Evaluation as prescribed by 310 CMR 40.0860 will be performed, if required at a later date as part of a comprehensive site evaluation to be performed upon completion of site Phase II investigation activities.
In areas where removal of soil containing upper concentration limit (UCL) exceedances above 15 ft bfg is not technically feasible, an RAO Class C will be proposed for that portion of the Site.

3.5.1.1 Removal and Disposal of Contaminated Soil

All investigative work beneath the building basement shall be conducted by Stone & Webster and its subcontractors. Excavation, should it be deemed necessary and feasible, will be conducted by NASDI under Contract Agreement #8855 with the City of Lawrence.

Excavated soil will be temporarily stockpiled on-site and then transported by NASDI to an approved facility. Transportation of the non-TSCA waste will be conducted via Logano Trucking. The contact information is provided below:

Logano Trucking (A Waste Management Company)
P.O. Box 144
Portland, CT 06480
(860) 342-0867
Contact: Kimberly Johnson

Transportation of the TSCA PCB and asbestos waste will be conducted by NASDI via a hazardous waste transporter. The following list of hazardous materials transporters may be used:

Buffalo Fuel Corp.
344 Vulcan Street
Buffalo, NY 14027-1327
(715) 873-7196
Contact: Salvatore Santarosa
EPA ID No. NYD051809952

Tonawanda Tank Transport Services, Inc.
P.O. Box H
Buffalo, NY 14217
(716) 874-0400
Contact: Carl J. Andrews
EPA ID No. NYD097644801

US Bulk Transport, Inc.
6286 Sterrettania Road
Fairview, PA 16415
(814) 838-2558
Contact: R E Caputo
EPA ID No. PAD98737515

Page E.T.C., Inc.
1290 2758 Trombley Road
Weedsport, NY 13166-9991
(315) 834-6681
Contact: Donna Mahaney

The City of Lawrence is the generator of these materials. MHD Contractor (NASDI) will make a log of all trucks arriving to the Site, amount of time on site and the departure time. Each truck will be recorded according to the license plate number. These daily logs will be signed by the Engineer, Stone & Webster, and NASDI. Copies of the load log will be provided to the Stone & Webster Engineer daily. Stone & Webster will receive, within 30 days of receipt of material at the accepting disposal facility, facility signed manifests, and certificates of disposal.

The proposed non-TSCA disposal facilities, which may be utilized, for this project are listed below:

Valley Landfill (A Waste Management Co.)
RD #2, P. O. Box 782A
Pleasant Valley Road
Irwin, PA 15642
(724) 744-7446

Waste Mgt., Inc. (2 sites)
WMNH – Turnkey Landfill
P.O. Box 7065
Rochester, NH 03839
OR
357 Mercer Road
P.O. Box 629
Norridge Wock, ME 04957

The approved TSCA disposal facilities, which may be utilized, for this project are listed below:

Primary PCB/TSCA Waste:

CWM Chemical Services
LLC Model City Facility
1550 Balmer Road, P.O. Box 200
Model City, New York 14107
EPA ID No. NYD049836679
(716) 754-0299
Contact: Lawrence M. Grasso

Secondary PCB/TSCA Waste:

EQ Michigan Disposal Waste Treatment Plant
Wayne Disposal Inc.
4935 North I-94 Service Drive

Belleville, Michigan 48111
EPA ID No. MID048090633
(800) 592-5489
Contact: Sean Conley

Additionally, hazardous and non-hazardous solid and liquid residues from decontamination and erosion control measures will be separately contained and profiled for disposal at appropriately permitted facilities. Shipping records or manifest will be prepared for these materials.

3.6 PROPOSED IMPLEMENTATION SCHEDULE

The OPM Site has been Tier classified as 1B by MADEP, therefore MADEP pre-approval of the RAM is not required. The City of Lawrence will perform all characterization and remediation beneath each building in a 30-day period after completion of MHD demolition activities at each building. After this period, the MHD will backfill up to grade and compact each basement area in preparation for bridge construction.

Although not required, we have provided you with a copy of this RAM Plan so that your comments, if any, can be incorporated before the RAM activities begin. It is anticipated that the RAM will begin in early August and will conclude in late November. A proposed project schedule is included in Appendix B. This schedule is based on the construction schedule. After completion of the RAM, the existing data and new data developed as part of the RAM will be evaluated to determine if an RAO can be achieved.

SECTION 4.00 SOIL DISPOSAL

A statement as to whether Remediation Waste, Remediation Wastewater and/or Remedial Activities will be excavated, collected, stored, treated, discharged, applied, reused, or otherwise managed.

PCB and asbestos contaminated soils will be handled as a Toxic Substance Control Act (TSCA) waste. Soil with contaminants in excess of the UCLs will be excavated and temporarily stockpiled on-site until an approved project disposal facility has reviewed characterization data and has accepted delivery. Material excavated as part of the RAM and not suitable for reuse will be transported off-site to an approved facility for disposal.

SECTION 5.00 HEALTH AND SAFETY MATTERS

Where appropriate, a proposed environmental monitoring plan, for implementation during and/or after the Release Abatement Measure.

A worker health and safety plan will be developed for and implemented during this RAM. Provisions for fugitive emissions control will be included in this plan.

If excavation is conducted, confirmatory samples will be collected from the bottom and sidewalls of each Site excavation. Depending on the size of an excavation these samples will either be a single grab sample from each wall or a composite sample from each wall. Confirmatory samples will be sent to an off site laboratory for analysis. Samples will be analyzed for the COC(s) identified during pre-characterization activities using the analytical methods listed in Section 3.2.1.

No environmental monitoring program is anticipated as being required at this site for the area of investigation/remediation under this RAM.

SECTION 6.00 PERMITS

A listing of federal, state and/or local permits likely to be needed to conduct the Release Abatement Measure.

The federal, state, and/or local permits likely to be required to conduct the RAM are listed below:

- Since the Site is within the 100 year floodplain of the Spicket River (i.e., it is considered to be Bordering Land Subject to Flooding), a Notice of Intent (a written notice filed by any person intending to remove, fill, dredge, or alter an Area Subject to Protection under the Wetlands Protection Act) has be filed by MHD with the Lawrence Conservation Commission.

- MHD has been awarded a National Pollutant Discharge Elimination system (NPDES) permit as part of the Erosion Control/Treatment Plan for the Building No. 3. However, since groundwater exists at 27-32 feet below grade on-site, it is not expected to be collected or treated as part of this work.

- Remediation Wastes will be managed off-site under the Bill of Lading prepared by the LSP, a Uniform Hazardous Waste Manifest process or asbestos manifest as appropriate.

SECTION 7.00 LSP CERTIFICATION

The seal and signature of the Licensed Site Professional who prepared the Release Abatement Measure Plan.

The seal and signature of the LSP who prepared the RAM Plan is provided in Item I of the RAM Plan Transmittal Form.

SECTION 8.00 REMOVAL CERTIFICATION

The certification required at 310 CMR 40.0442(4), if greater than 1500 cubic yards of Remediation Wastes are to be excavated and managed at the disposal site.

Not required. Based on available analytical data, we do not anticipate excavation and/or management of greater than 1500 cubic yards of Remediation Waste.